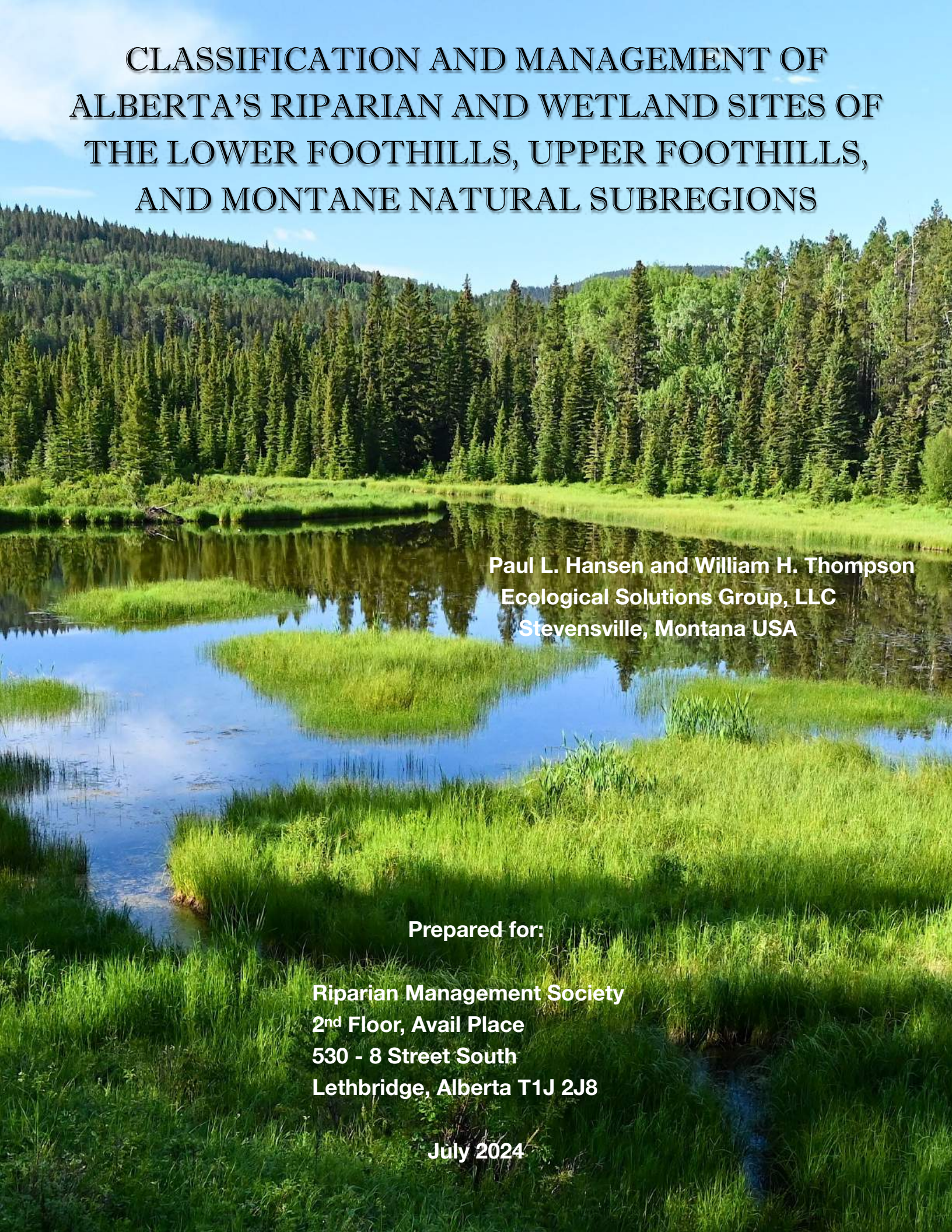
CLASSIFICATION AND MANAGEMENT OF ALBERTA'S RIPARIAN AND WETLAND SITES OF THE LOWER FOOTHILLS, UPPER FOOTHILLS, AND MONTANE NATURAL SUBREGIONS



Paul L. Hansen and William H. Thompson
Ecological Solutions Group, LLC
Stevensville, Montana USA

Prepared for:

Riparian Management Society
2nd Floor, Avail Place
530 - 8 Street South
Lethbridge, Alberta T1J 2J8

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About Cows and Fish

Riparian areas are those areas along rivers, streams, lakes, wetlands, springs, and ponds that are strongly influenced by water and are recognized by water-loving vegetation. Cows and Fish is striving to foster a better understanding of how riparian areas function and how improvements in management strategies in riparian areas can enhance landscape health and productivity for the benefit of livestock producers, their communities, and others who value these landscapes.

Cows and Fish Supporters and Members: Producers and community groups, Alberta Beef Producers, Trout Unlimited Canada, Canadian Cattle Association, Alberta Agriculture and Irrigation, Alberta Forestry and Parks, Alberta Environment and Protected Areas, Association of Alberta Agricultural Fieldman, Rural Municipalities of Alberta.

COWS &FISH
RIPARIAN MANAGEMENT SOCIETY

Front Cover Photo: Alan Dodd
Back Cover Photo: Hilary Baker

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INTRODUCTION

This work focuses within the natural landscape on riparian and wetland areas in the Lower and Upper Foothills and the Montane Natural Subregions of Alberta. The riparian and wetland areas represent the wetter terrestrial (lowland) component of a mosaic comprised also of uplands, open water bodies, and areas of human development that are altered from the natural (e.g., agriculture, roadways, cities, etc.). Within the natural landscape, much work has already been done to classify forested areas, which constitute the majority of the land area within the scope of this study. Most of these forested areas are uplands (non-riparian, non-wetland). The authors intend that this work be consistent with prior work to classify community types in Alberta (in particular: Baker and others 2020, France and others 2020, Lawrence and others 2005, and Willoughby and others 2021). Although there is not always a one-to-one match between a riparian and wetland type and a community type, we include a section in the description of each type to identify the community type(s) into which it most closely fits.

Riparian and wetland areas[1] in the Lower and Upper Foothills and the Montane Natural Subregions of Alberta are areas supplied with more available moisture than are the surrounding uplands. This extra moisture is supplied by topographic collection of surface runoff, by contact with near surface ground water tables, and by proximity to bodies of surface water, such as streams, ponds, lakes, and rivers. This extra water is reflected by the presence of hydrophytic vegetation bordering lakes, sloughs, and ephemeral, intermittent, or perennial streams; and that comprise fens, peatlands, springs and seeps, and wet meadows. The threshold between wetland and upland is not universally defined. In this work, we do not attempt to draw the line with distinction, but rather to describe those vegetation types that we perceive in this study area to be influenced by the additional water. It can be thought of as water in excess of the incident precipitation received on the site.

In many cases, the riparian zone is the interface, or linkage, between the upland zone and the deep water (aquatic) zone. It may be covered by water with emergent plants, or it may by quite dry with only some facultative wetland plants present (plants that have the ability to adapt to either wetland or upland conditions). A given riparian or wetland site may or may not have either an upland or any aquatic habitat immediately present. It may be a part of an extensive wetland complex, or it may be only a small slough, amid extensive uplands, completely vegetated and lacking open water.

Riparian and wetland ecosystems often are important islands and/or corridors of diversity and higher productivity within extensive upland systems. They provide a functional link between the aquatic and terrestrial systems. These sites are of prime importance to setting conditions of water quality, water quantity, stream stability, and fish habitat. The associated abundance of water, forage, and habitat attracts proportionately greater levels of use and conflict than usually occur on nearby uplands. Riparian and wetland areas are vital to the livestock grazing industry; many of them contain important mineral concentrations; and many become developed into highly productive farmland. Most riparian and wetland sites provide critical habitat for many wildlife species. They support greater concentrations of wildlife and human recreational activities than any other kind of natural site on the landscape.

The structure, function, and management requirements of riparian and wetland plant communities are generally less understood than are those of most other areas. They have often been overlooked, ignored, or considered only as minor inclusions of larger systems, terrestrial or aquatic. Grazing, timber harvest, transportation corridors, energy, mining, farming, residential development, recreation, and other human activities can drastically alter these communities. Consequently, management of riparian and wetland areas has become—and will continue as—a major issue of concern. Multi-resource opportunities, multi-disciplinary concerns, and multi-ownership patterns

[1] The terms riparian areas and wetland areas are not synonyms, and usage varies greatly. In this work, we use the terms in combination when speaking of general situations that include both.

within riparian and wetland areas demand a high level of coordination and cooperation among users to meet society's needs from these sites.

Historical Overview of Riparian and Wetland Areas

The first lands settled by European immigrants were frequently in or near the riparian zone. Riparian and wetland areas provided an abundance of game, fish, and other natural resources needed by settlers until they could bring uplands into production. Watercourses often provided the primary means of transporting supplies and goods. Waterpower was harnessed to mill grain, saw wood, and perform other tasks. The fertile, alluvial soils that provided excellent wildlife habitat also became excellent farmlands after being drained and cleared. Water from the streams, rivers, lakes, or ponds was diverted to irrigate cropland. Trees in the riparian zone became fence posts, railroad ties, building materials, and fuel for the home.

Increased environmental awareness in recent decades has raised major concerns about the loss of wetlands to development, over use, pollution, and hydrologic alteration. Agricultural expansion has been the major cause of wetland conversion in Canada. It is estimated that by 1976 a total of 1.2 million hectares (3 million aces) of wetland had been converted to agriculture, representing a loss of over 70 percent of prairie wetlands in Canada (Environment Canada 1986).

In addition to drainage of wetlands, many other human activities have greatly changed the structure and function of these important sites. Improper timber harvesting and mining techniques have caused severe impacts on the riparian zone in many regions. Livestock have often been grazed in riparian zones almost year-round year after year. Many wetlands and aquatic systems near farmsteads have become highly eutrophic from barnyard and feedlot runoff. Fires have been suppressed whenever possible, allowing dead vegetation to accumulate, resulting in catastrophic fires that burn the organic matter from even the wetland soils. Many bottomlands of ephemeral depressions and riparian areas have been drained and cultivated. Hay is mowed in many wetlands as often as possible. Some wetlands have been burned in the fall to reduce the amount of snow trapped or to discourage the spread of weeds. Ploughing for row crops, cultivation of steeper slopes, and summer fallowing have accelerated mobilization of upland top soils down into riparian areas, altering their vegetation potential and changing species composition and abundance (Kantrud 1986). Dissolved salts and residues from agricultural chemicals have migrated into many wetland and riparian areas, while irrigation water removal has altered the hydrology and vegetation of many others.

Why is There Suddenly a Problem?

Research over the past few decades has demonstrated many economic and social values that are enhanced by the proper function of riparian and wetland systems. We have learned some of the ways that impacts are made on these systems, and how difficult restoration can sometimes be. It is in our best interest as managers and landowners to make use of the growing body of knowledge at hand. Some such assets are *Caring for Shoreline Properties* (Valastin 2000), a guidebook for cottagers and users of lands adjacent to lakeshores, *Caring for the Green Zone, Third Edition* (Fitch and others 2003), a guidebook for ranchers and livestock producers on how to manage most effectively the riparian areas within their rangelands.

Benefits of a Healthy and Productive Riparian Area

Background—In a broad sense, the health of a riparian or wetland area may be defined as its ability to perform its normal functions. These functions include sediment filtering, streambank building, storing water, aquifer recharge, providing fish and wildlife habitat, and dissipating stream energy (Fitch and Ambrose 2003). An excellent ecological measuring stick for assessing the state of health of a riparian or wetland site is *Riparian Health Assessment for Streams and Small Rivers* (Fitch and others 2001). Evaluating a stream's health requires consideration of upstream and adjacent management. For example, although noxious weeds such as *Cirsium arvense* (Canada thistle) or *Sonchus arvense* (perennial sow-thistle) along a streambank may help to trap sediment

and bind the soil to a small extent, their presence would be a management concern and an indication of compromised health.

Many wetlands in Alberta occur on sites not associated with a river or stream floodplain, but do occur on rangeland utilized for livestock production. Another useful tool currently being developed for assessing rangeland health on sites that may include wetland and riparian vegetation communities is the Range/Pasture Health Assessment Short Form (Adams and others 2000).

Vegetation—The condition of vegetation along streams is a major component of the health of riparian ecosystems. Healthy riparian vegetation stabilizes streambanks making them less likely to erode during high flows, influences bank morphology, and aids in reducing streambank damage from ice and animal trampling (Karr and Schlosser 1978, Platts 1979, Marlow and Pogacnik 1985). The roots of trees, shrubs, and herbaceous plants stabilize the streambanks and support overhangs, which provide cover for aquatic animals (Fitch and others 2003). Much of a stream's sediment load, particularly during high flows, can result from bank erosion. Schlosser and Karr (1981) found that levels of suspended solids increased quickly during storms where the streambanks lacked vegetation. On more stable channel sections having well-developed riparian vegetation, they found levels of suspended solids increased at a slower rate. Vegetation along streams provides flow resistance, which reduces velocity and therefore the erosive energy of overbank floods (Schumm and Meyer 1979).

Riparian vegetation provides shade, lowering water temperatures, which can prevent harm to native aquatic life (Meehan and others 1977). Lower temperature increases the water's oxygen-carrying capacity. Vegetation removal can cause water temperature to increase, adversely affecting the stream biota, such as the many species of trout that require well-oxygenated water.

Water Quality and Quantity—Riparian areas can filter nutrients thereby improving water quality. In agricultural watersheds, nutrient filtering in riparian areas can help control agricultural nonpoint-source pollution (Lowrance and others 1985). Sediment deposition is a natural process that occurs during flooding; therefore, upland erosion can increase the sediment load and deposition in riparian areas and wetlands. Such deposition can alter surface soils, the hydrology, and the vegetation community in these low-lying sites (Fitch and others 2003, Lowrance and others 1985). Riparian vegetation also reduces sediment and nutrient transport in a number of ways. Roots, especially those of woody vegetation, help stabilize streambanks by holding soil intact. Vegetation also increases hydraulic resistance to flow, thereby lowering flow velocities and causing sediment deposition.

Another important role of wetland vegetation is uptake and storage of nutrients. Wetland areas are more productive because of the nutrient and water subsidies provided by periodic flooding (Brinson and others 1980). Nutrient uptake into leaves and other deciduous plant parts provides short-term storage. However, because deciduous plant parts drop each year, these nutrients are soon available again. High litterfall and moist conditions in riparian and wetland areas result in soils higher in organic matter than soils on upland sites.

Riparian and wetland areas are also important in dissipating the energy of runoff from agricultural land. In general, surface runoff slows as it flows through the riparian zone, causing sediment deposition and diminishing the water's erosive potential. Loss of wetlands has contributed to the change from perennial to intermittent flow in some streams. Some alluvial aquifers are maintained by infiltration of upland runoff through the stream channel or alluvial deposits. These aquifers provide an important source of water for human use.

Fisheries and Aquatics—Riparian areas are important to in-stream ecosystems. Streambanks provide habitat edge with high diversity, hiding cover, and shading for fish (Fitch and others 2003). Riparian vegetation produces most of the detritus that provides as much as 90 percent of the organic matter necessary to support stream (aquatic) communities (Campbell and Franklin 1979). In forested ecosystems, up to 99 percent of the stream

biological energy input may come from bordering riparian vegetation with only 1 percent coming from in stream photosynthesis by aquatic vegetation (Cummins 1974).

Wildlife Uses—The riparian and wetland ecosystems are likely the most productive wildlife habitats, benefiting the greatest number of species (Ames 1977, Hubbard 1977, Patton 1977). Population densities of birds in upland habitat adjacent to the riparian or wetland zones are influenced by the presence of riparian or wetland areas (Carothers 1977). When a riparian or wetland area is destroyed or changed by humans, not only are the riparian and wetland species of the area adversely influenced, but wildlife productivity in the adjacent uplands suffers as well.

Livestock Grazing—Riparian and wetland areas are vitally important to the livestock industry. Livestock tend to congregate in riparian and wetland areas and utilize this vegetation much more intensively than that of adjacent uplands (Kauffman and Krueger 1984). In many parts of the western North America rangeland, the landscape has been so altered by more than a century of livestock grazing that it is now difficult to visualize what it looked like in the mid nineteenth century, particularly its riparian segments (Ehrhart and Hansen 1997). Cattle tend to prefer riparian and wetland areas for the same reasons other animals do: availability of water, shade, and the quality and variety of forage (Ames 1977, Severson and Boldt 1978). Concerning forage quality, many of the various sedge species retain relatively constant crude protein levels until the first killing frost. Several *Carex* (sedges) found in riparian and wetland zones of the Pacific Northwestern United States exceed key upland forage species in sustained protein and energy content (Kauffman and Krueger 1984).

Grazing can have a considerable effect on vegetation, resulting in decreased vigor and biomass and an alteration of species composition and diversity (Ames 1977, Bryant and others 1972). Improper livestock use of riparian areas can affect the wetland environment by changing, reducing, or eliminating streambank or shoreline vegetation. Excessive livestock presence can cause alteration of the shore or channel morphology (Fitch and others 2003). Depending on soils and substrate composition, the channel can become wider and shallower, entrenched, or braided (Marcuson 1977, Platts 1979). Water quality can be altered by increasing water temperatures, nutrients, suspended sediments, and bacterial counts.

Knopf and Cannon (1982) found that excessive livestock grazing significantly altered the size, shape, and quantity of *Salix* (willow) stems. Livestock use also was found to increase the spacing of shrubs and to decrease the width of the riparian or wetland zone. Marcuson (1977) found shrub production to be 13 times greater in an ungrazed area than in a severely overgrazed area. Shrub canopy cover was 82 percent greater in the ungrazed area. However, researchers have found that management changes can dramatically restore lost shrub canopy cover (Fitch and others 2003, Davis 1982, Kauffman and Krueger 1984, Hansen 1985).

Improper grazing management can adversely affect riparian and wetland sites for wildlife, significantly reducing bird species composition and foraging guilds, as well as small mammal density and diversity (Kauffman and Krueger 1984). Furthermore, Alderfer and Robinson (1949), Bryant and others (1972), and Rauzi and Hanson (1966) all found soil compaction increased linearly with increases in grazing intensity.

While the list of detrimental effects of mismanagement is long and well-documented, recent advancements in systematic grazing practices have successfully rehabilitated many degraded riparian and wetland areas. Specialized grazing schemes hold promise for rehabilitating riparian and wetland areas without excluding cattle for long periods (Fitch and others 2003, Ehrhart and Hansen 1997, Kauffman and Krueger 1984). In a study in northeastern Oregon, Bryant (1985) found herbage production increased one- to four-fold through proper timing and intensity of grazing.

Summary—Having greater soil moisture than surrounding uplands, riparian and wetland areas are more productive than those areas; they add to the overall diversity of the landscape; and they attract livestock and wildlife for the forage, thermal and other cover, nesting habitat, water, and browse species they afford (Ames 1977, Severson and Boldt 1978). Because of this, riparian and wetland areas are focal points for both livestock and wildlife. Management strategies that recognize all these functions can be designed to maintain or restore the integrity of riparian and wetland communities.

Proper stewardship of a riparian or wetland area is money-in-the-bank for the land manager. Proper management of riparian and wetland areas means decreased streambank erosion and floodplain losses (Gunderson 1968, Marcuson 1977), increased forage production for livestock (Pond 1961, Kauffman and Krueger 1984), an increase in wildlife and fisheries resource values (Duff 1979, Van Velson 1979), increased water quantity, improved water quality, and greater recreational opportunities. Some changes to a landscape, even those with human causes, occur so slowly that individuals fail to perceive the change happening (Fitch and others 2003). *Salix* (willows) or *Carex* (sedges) are eliminated from a stream reach, or it ceases to flow all summer more years than it once did. These are changes that we can often prevent, or processes that we can improve upon.

Areas of rich, dark soil where groves of *Populus tremuloides* (aspen) and *Salix* (willow) were once found around every depressional wetland have been greatly reduced in favor of agricultural development. Across much of the Parkland Natural Region, the land once occupied by *Populus tremuloides* (aspen) and *Salix* (willow) carried a far greater immediate monetary value when put into commodity production. This conversion has reduced the riparian and wetland function of those areas cleared. The loss of soil to fluvial and wind erosion, the loss of soil moisture and the soil building processes beneath woody plant canopies, the introduction of non-native species, and the loss of wildlife habitat are among the impacts of this land clearing on riparian and wetland areas. Such losses must be counted in the benefit balance sheet when consideration is made for further clearing of forested wetlands.

Wetland Definitions

Background—The earliest definition of wetlands was intended for managers and scientists, particularly those concerned with waterfowl and wildlife (Shaw and Fredine 1956):

The term wetlands . . . refers to lowlands covered with shallow and sometimes temporary or intermittent waters. They are referred to by such names as marshes, swamps, bogs, wet meadows, potholes, sloughs, and river overflow lands. Shallow lakes and ponds, usually with emergent vegetation as a conspicuous feature, are included in the definition, but the permanent water of streams, reservoirs, and deep lakes are not included. Neither are water areas that are so temporary as to have little or no effect on the development of moist-soil vegetation.

The definition of Shaw and Fredine (1956) established two parameters necessary for a habitat to be considered a wetland: 1) the presence of surface water, and 2) the development of moist-soil vegetation (Kent 1994). Twenty-three years later at a workshop of the Canadian National Wetlands Working Group, a definition evolved which recognized hydric soils as a third parameter, and which noted the functional attributes of wetlands (Tarnocai 1979). In addition, it expanded the previous definition of wetlands to include not only those habitats with surface water, but also those having saturated soils:

Wetland is defined as land having the water table at, near, or above the land surface or which is saturated for a long enough period to promote wetland or aquatic processes as indicated by hydric soils, hydrophilic vegetation, and various kinds of biological activity which are adapted to the wet environment.

The term wetland is a catchall that includes units on the landscape such as marshes, swamps, bogs, fens, and lowlands covered with shallow and sometimes ephemeral or intermittent waters. The term wetland also includes wet meadows, potholes, sloughs, the riparian zone, and river-overflow areas. Shallow lakes and ponds, usually

with emergent vegetation as a conspicuous feature, are included in the wetland definition. Permanent waters deeper than 2 m are not included.

Formal classification systems provide a means to clarify definitions. Such documents as *Wetland classification in western Canada* (Millar 1976) satisfy certain purposes well, while leaving other needs unmet. This work focuses on depressional wetlands and was done because of waterfowl habitat concerns that arose across North America around the middle of this century. The primary objective of *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin and others 1979) was "to impose boundaries on natural ecosystems for the purposes of inventory, evaluation, and management." The classification provides a major contribution for upper levels of a taxonomic hierarchy. However, it did not resolve the need for a single acceptable definition for lower levels in the hierarchy—a level of primary concern for practical on-the-ground management applications.

Defining wetlands has become more difficult as greater economic stakes have increased the involvement of more politics and less science. A universally accepted wetland definition satisfactory to all users has not yet been developed because the definition depends on the objectives and the field of interest. However, wetland scientists generally agree that wetlands are characterized by one or more of the following features: 1) ***wetland hydrology,*** the driving factor common to all wetlands, 2) ***hydric soils,*** an indicator of the absence of oxygen, and 3) ***hydrophytic vegetation,*** as indicator(s) of wetland site conditions. The problem is how to define and obtain consensus on thresholds of these three criteria or various combinations of them.

The Concept of *Riparian/Wetland* Site, as Used in This Study—The working definition of the term riparian and wetland used for this project is somewhat arbitrary in that a line had to be drawn separating the land into wetland and upland site categories. There is no distinct, visible boundary on the landscape dividing upland and wetland sites. Since the purpose of this project is to classify riparian and wetland sites, and not ***all*** sites, the line had to be drawn. The authors hope it was drawn in a way that makes sense and is usefully placed. While we may have initiated its placement, the final location may still be debated. For example, the important tree species *Picea glauca* (white spruce) and *Populus tremuloides* (aspen) are both adapted to a range of moisture conditions spanning from quite moist to quite dry. Understory or associated species had to be selected as indicators to separate upland from wetland sites having a canopy of these trees. We attempted to include as riparian and wetland sites in the classification all those areas within the study area having vegetation characterized by presence of threshold amounts of plant species requiring extra moisture beyond that provided by the incident precipitation in the area. Generally, it is the topographic relief that concentrates this water into depressions or channels, and in turn defines where the wetlands occur. During dry season, the green zones in low areas and green ribbons adjacent to streams will generally be the riparian zone or wetland (Fitch and others 2003).

Wetland Soils

Riparian and wetland areas are ecosystems that occupy the transition between upland and aquatic ecosystems. Within an ecosystem, soils may have a strong influence on the vegetation. These influences are often seen as differences in species composition, species coverage, or growth form, but the soil effects are often subtle compared to the primary influence of water. Most wetland scientists interpret water regimes as the timing, duration, depth, and extent of flooding (Heitmeyer and others 1991). However, this can be misleading as some riparian and wetland areas never experience inundation by floodwaters. Rather, they can remain saturated for prolonged periods by ground water.

Soil Forming Factors—Soils are dynamic natural bodies having properties derived from the combined effects of ***climate*** and ***biotic activities*** as modified by ***topography,*** acting on ***parent materials*** over ***time***. Soil forming events include both complicated reactions and comparatively simple rearrangements of material. Numerous events that enhance or negate each other may take place simultaneously or sequentially. It is important to emphasize the

interdependency of all five factors on soil development. The following discussion of these five soil-forming factors have in part been expanded or modified from Brady (1984).

Parent materials of riparian and wetland soils are predominantly transported sediments. The exceptions are those seeps, springs, and occasional bogs where residual soils have developed. In most all other instances, the soils of a riparian or wetland area have developed from the lateral or vertical accretion of sediments by alluvial, colluvial, glacial, lacustrine, or, less commonly, aeolian processes. The most common, the alluvial deposits are often stratified by particle size. The size of particles of a deposit is a direct function of the velocity of the water at the time of deposition.

All other factors being held constant, the mineralogical composition of the parent material determines the rate of weathering. Soil particle size (texture) is highly correlated to mineralogical composition. Sands are largely made up of the highly weather resistant mineral quartz, whereas the vast majority of clay sized particles are dominated by secondary silicate minerals (the silicate clays). The unique electro-chemical properties and tremendous surface area of these clays serve to increase the concentration of plant available nutrients and potential rate of physical and chemical processes.

Climate is perhaps the most influential of the five soil forming factors. Climate regulates the amount of water a site receives through precipitation and evaporation. In turn, moisture content of the soil influences the rate of the physical and chemical processes involved in soil development. Water affects soil in a number of ways.

Wet soils warm more slowly in spring and cool more slowly in autumn. Water adds weight to the soil and acts as a lubricant between soil particles, making wet soils more susceptible to damage. When soils are saturated, the spaces between particles are filled with water instead of air. Saturated soils are commonly oxygen deficient. Since air (oxygen) is essential to most lifeforms, saturated soil contains fewer lifeforms than unsaturated soils. Microorganisms are the most abundant lifeforms in the soil. They feed primarily on dead plant and animal remains. Wetlands produce comparatively higher amount of plant material than adjacent upland areas, which commonly results in an accumulation of organic material at the mineral soil surface. Other common characteristics of wet soils are the presence of redox depletions (gleyed soil) and redox concentrations (mottles). Redox depletions result from a state of total lack of oxygen in the soil. This state is also called a reduced condition. Iron in a reduced state (ferrous iron or soluble iron, Fe^{+2}), appears blue or gray in color. These saturated blue or gray soils are often called gleyed soils and the reduction process in the soil is called gleization. Redox concentrations are often an indication of poorly drained soils. Redox concentrations are segregations of the remaining oxidized iron (ferric iron, Fe^{+3}), in the soil when all other iron is reduced or has been removed by leaching. They appear as red or brown soft speckles, hardened nodules, or may line the inside of pores in the soil. They vary in size, shape, and differ in color from the dominant soil. A description of characteristics of wet soils (redoximorphic features) is given in the document *The Canadian System of Soil Classification* (Canada Soil Survey Committee 1978).

Air and soil temperatures are directly related to climate and can affect soil formation. Seasonal and diurnal temperature fluctuations (freeze and thaw) dictate the rate of physical weathering of soil particles. Cold temperatures restrict distributions of biotic communities, reduce biomass production, and retard decomposition rates. Typically, higher elevations are cooler. However, cold air ponding is common in areas where relief is great. In the absence of wind, colder air pools and valley soil and air temperatures are lower than adjacent sites at higher elevations. Cold air ponding can be indicated by dramatic differences in spatial distribution of vegetation.

Organic matter accumulation and decomposition, nutrient cycling, development of soil structure, soil mixing and many other processes are all enhanced or diminished by both the flora and fauna living on or within the soil.

The amount of organic matter, in either the surface horizon or accumulating at the soil surface, is greater in riparian and wetland soils than in adjacent upland soils. Much of this organic matter is intimately mixed into the soil through biological activity. This increase in organic matter gives the soil a darker color (a higher Munsell color value), greater fertility, and higher moisture holding capacity.

Human activities can also affect soil formation. Cutting of trees, overgrazing, cultivation, irrigation, draining, road construction, and other developments remove the natural vegetation and may affect the depth of water tables. Irrigation obviously increases the amount of water a site receives directly, while road construction, or any construction that covers or seals the soil surface, will concentrate the amount of water a site receives into a smaller area of infiltration.

Topography can enhance or diminish the effects of climate on soil formation. The most common of these effects are higher precipitation rates and lower air temperatures at higher elevations. Excess water in soils of headwater areas and V-shaped canyons is drained far more rapidly than in soils of flat alluvial terraces, broad-valley positions, glacial depressions, and lacustrine systems. Soils on steep gradients are more susceptible to natural erosion by over-land flow than flatter areas, possibly preventing formation of a deep soil. Landform gradient also tends to produce lateral soil water movement. This water may carry salts, oxides, suspended material, or solutes to landscape depressions. In arid environments, potential evaporation rates exceed precipitation, thereby removing the water and concentrating these salts, often producing saline or alkaline soils.

The length of time parent materials are exposed to weathering directly affects the degree of soil development. Riparian soils are commonly formed in alluvium and are typically younger than adjacent upland soils, but can be of any age. The time required for the development of a soil horizon is uniquely related to all five soil-forming factors.

ALBERTA NATURAL REGIONS AND SUBREGIONS WITHIN THE STUDY AREA

The following descriptions and map of Alberta Natural Regions and Subregions within the study area (Figure 1) are taken from Alberta Parks (2015).

The study area for this project covers the entire Foothills Natural Region (containing two Natural Subregions: the Lower Foothills Natural Subregion and the Upper Foothills Natural Subregion) and the Montane Natural Subregion of the Rocky Mountain Natural Region (Figure 1).

The Foothills Natural Region has a generally moist, cool climate. Gently undulating to rolling hills and plateaus with deciduous and mixedwood forests are typical at lower elevations. Strongly rolling to steeply sloping hills with coniferous forests are widespread at higher elevations. This natural region extends along the eastern side of the Rocky Mountains north from the Bow River Valley to just south of Grande Prairie. It also includes the Swan Hills and Pelican Mountain outliers to the east and the Saddle Hills outlier north of Grande Prairie.

The topography of the Foothills Natural Region varies from sharp, bedrock-dominated ridges near the mountains to rolling terrain in the north and east. Elevations range from 700 m in the most northerly areas to about 1,700 m in the south. Mixed forests of aspen, lodgepole pine, white spruce, and balsam poplar with understories containing a variety of vegetation are commonly found at lower elevations. Lodgepole pine forests with less diverse understory vegetation are typical at higher elevations. Both Natural Subregions in this Natural Region, the Lower and Upper Foothills Natural Subregions, receive a relatively high annual precipitation. Their average July precipitation is higher than in any other Natural Subregion in the province.

Water bodies cover less than 1 percent of the total area within the natural region, with the Athabasca and North Saskatchewan being the primary rivers. Wetlands occur throughout the region, but are less common in the steep-sided valleys typical of the Upper Foothills than in the gentler terrain of the Lower Foothills. This natural region contains a wide range of habitat types owing to its varying topography, surface and groundwater flow patterns, and diverse plant communities. In the southern and eastern parts of the natural region, wetland habitats are more diverse and have a richer variety of species. Lodgepole pine stands are considered a good marker of the Foothills Natural Region/Boreal Forest Natural Region boundary as they are abundant in the former but scarce in the latter.

Also included in the study area for this project is the Montane Natural Subregion of the Rocky Mountain Natural Region. The Rocky Mountain Natural Region, as its name implies, extends uphill from the Foothills Natural Region to the top of the mountain, and the Montane Natural Subregion is the lowest Subregion of the Rocky Mountain Natural Region. The Rocky Mountain Natural Region lies along the Continental Divide and consists of the Alpine, Subalpine and Montane Natural Subregion. On average, the Rocky Mountain Natural Region has the coolest summers, shortest growing season, highest average annual precipitation and snowiest winters of any Region. Wetlands are uncommon to rare in all three Subregions of this Natural Region: the Alpine, Subalpine, and Montane.

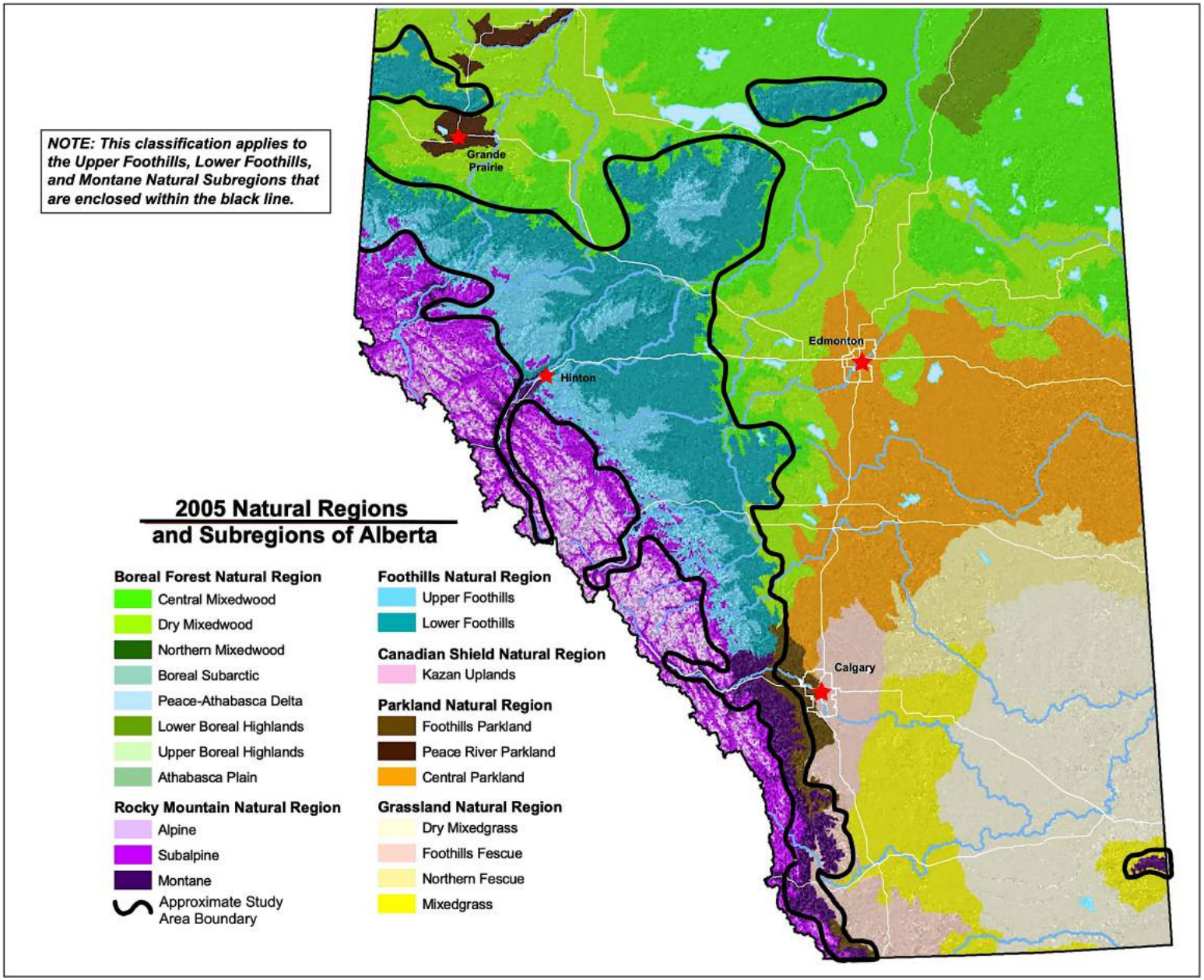


Figure 1. Natural regions and subregions of Alberta (Alberta Parks 2015) showing the study area enclosed with a black line (***NOTE:*** Map does not include the northern 1/3 of Alberta)

Lower Foothills Natural Subregion

The Lower Foothills Natural Subregion is a transition area, with cold winters typical of boreal climates and high winter snowfalls typical of more mountainous climates. The topography of the Foothills Natural Region varies from sharp, bedrock-dominated ridges near the mountains to rolling terrain in the north and east. Elevations range from 700 m in the most northerly areas to about 1,700 m in the south. The rolling plateaus are forested with dense mixed stands of aspen, lodgepole pine, white spruce, and balsam poplar. The Lower Foothills Natural Subregion covers a broad northwest-to- southeast belt between the Bow River Valley to the south and Grande Prairie to the north, with outliers in the Swan Hills and Pelican Mountains to the east, and the Saddle Hills to the north (Alberta Parks 2015).

Geology and Physiography of the Lower Foothills Natural Subregion

- The Lower Foothills Natural Subregion is a broad northwest-to-southeast belt between the Bow River Valley to the south and Grande Prairie to the north, with outliers in the Swan Hills and Pelican Mountains to the east, and the Saddle Hills to the north (Lawrence and others 2005);
- Elevationally, this Subregion is below the Upper Foothills and above the Boreal Mixedwood Natural Subregions;
- Wetlands are not usually found on the steep valley sides, although areas of seepage are common on the middle to lower slopes. Wetlands are, however, common in valley bottoms, and overall make up about 20 percent of the Subregion. In this Natural Subregion, the wetlands are characterized by peat accumulations up to 3 m thick;
- Little standing water is present aside from the man-made Brazeau Reservoir. Several major rivers, including the North Saskatchewan, Macleod, Athabasca, Smoky, and Wapiti Rivers, run eastward and northward through the Subregion (Alberta Parks 2015).

Soils of the Lower Foothills Natural Subregion

- The soils of the Lower Foothills Natural Subregion reflect a transition from a cold, dry continental climate to a milder, moister montane climate (Alberta Parks 2015).

Climate of the Lower Foothills Natural Subregion

- The climate of the Lower Foothills Natural Subregion reflects a transition from a cold, dry continental climate to a milder, moister montane climate;
- This Subregion has a continental climate with a wide amplitude between summer and winter temperatures. The average annual precipitation is 464 mm, two thirds of which falls during the summer months. Summer temperatures average 12.8 ˚C and winter temperatures average -7.8 ˚C (Alberta Parks 2015).

Vegetation of the Lower Foothills Natural Subregion

- A significant deciduous tree cover on mesic sites aids in differentiating this Subregion from adjacent Upper Foothills areas;
- This Subregion is the most diverse in Alberta in terms of forest types and tree species. Aspen, balsam poplar, white birch, lodgepole pine, black spruce, white spruce, balsam fir, and tamarack grow as pure stands or as mixtures on a variety of slopes and exposures;
- Lodgepole pine tends to dominate on drier sites, often with bearberry, bog cranberry, or hairy wild rye in the understory;
- Aspen stands may be common on somewhat moister sites, usually with an understory of bearberry, blueberry, or Canada buffaloberry;
- Forests on mesic sites are commonly a mixture of lodgepole pine, white spruce, and aspen, although pure stands of any of these species also occur;
- These mesic forests commonly have understory species that are usually considered boreal such as low-bush cranberry, green alder, prickly rose, wild sarsaparilla, dewberry, and marsh reedgrass;

- Stands of lodgepole pine and black spruce with Labrador tea are common on nutrient- poor sites;
- Moister sites support pure stands and mixtures of aspen, lodgepole pine, and white spruce as well, but the understory species are often lush with bracted honeysuckle, willows, wild currants, and, occasionally, devil's club. Fern species become more abundant;
- Black spruce and tamarack occur on poorly drained sites with bog and fen understory species;
- A significant presence of lodgepole pine on mesic sites helps distinguish this Subregion from adjacent Central Mixedwood areas (Alberta Parks 2015).

Upper Foothills Natural Subregion

The Upper Foothills Natural Subregion is situated within the Foothills Natural Region and occurs along the high elevation plateaus of foothills of the Rocky Mountains Front Ranges. The Subregion covers approximately 34 percent of the Foothills Natural Region as a narrow belt between the Lower Foothills Natural Subregion at lower elevations and the Subalpine Natural Subregion at higher elevations. An outlier of this Subregion occurs at high elevations along the Swan Hills. (Alberta Parks 2015).

Geology and Physiography of the Upper Foothills Natural Subregion

- The landscape this Subregion is dominated by strongly rolling to steep higher-elevation foothills, typically with a cover of coniferous forests;
- The Subregion is characterized by strongly rolling to steep terrain with glacial deposits and exposed bedrock;
- Wetlands occur in the major valleys and cover about 10 percent of the Subregion;
- There is very little standing water, although several major rivers, including the North Saskatchewan, Macleod, Athabasca, Smoky, and Wapiti Rivers run eastward and northward through the Subregion (Alberta Parks 2015).

Soils of the Upper Foothills Natural Subregion

- The Upper Foothills Natural Subregion is characterized by very hilly terrain associated with the foothills and high-elevation dissected plateaus of west-central Alberta. The bedrock is composed mainly of sandstones and mudstones of Tertiary and Upper Cretaceous origin;
- Orthic Gray Luvisols are associated with moderately well drained sites, and are usually associated with stands having a deciduous component. Wetlands are a complex of Terric and Typic Mesisols along with Peaty and Orthic Gleysols (France and others 2020).

Climate of the Upper Foothills Natural Subregion

- The Upper Foothills Natural Subregion is influenced by short, wet summers and snowy, cold winters;
- The climate, soils, and vegetation patterns of the Upper Foothills Natural Subregion indicate a shift from the drier, somewhat warmer conditions of the Lower Foothills Natural Subregion to the cooler, wetter conditions of the Subalpine Natural Subregion of the Rocky Mountain Natural Region (Alberta Parks 2015).

Vegetation of the Upper Foothills Natural Subregion

- The Upper Foothills Natural Subregion is distinguished from the Subalpine Natural Subregion by its lack of subalpine understory species such as white rhododendron, false azalea, and grouseberry;
- Lodgepole pine dominates the forests in the south; however, in the north the forests are usually a mix of lodgepole pine and black spruce;
- Forest understory shrubs on mesic sites include Labrador tea, bog cranberry, green alder, and tall bilberry;
- Drier lodgepole pine forests typically have Canada buffaloberry, juniper, bearberry, or hairy wild rye in the understory;
- White and black spruce are the dominant trees of older stands, often with subalpine fir in the understory and a ground cover of feathermosses;

- Wetlands in lower valley locations are dominated by open and closed black spruce communities with Labrador tea, cloudberry, and peat mosses in the understory;
- White spruce stands occur along river valleys and on lower slopes;
- One of the main differences between the Upper and the Lower Foothills Natural Subregions is that lodgepole pine forms the dominant pioneer forest in the Upper Foothills Natural Subregion rather than aspen (Alberta Parks 2015).

Montane Natural Subregion

The Montane Natural Subregion includes the rolling and hilly foothills of southwestern Alberta and outliers on the Porcupine Hills and Cypress Hills as well as the valley floors and lower slopes of the Crowsnest, Bow, North Saskatchewan, Athabasca, and Smoky Rivers that flow from west to east through the Front Ranges. The foothills area is composed of non-marine Cretaceous sandstones, siltstones and shales, while the Porcupine and Cypress Hills are underlain by non-marine Tertiary sandstones and siltstones. Glacial and river erosion has carved major valleys through Mesozoic and Paleozoic dolomitic and limestone formations and Cretaceous sediments (Willoughby and others 2021).

The Montane Natural Subregion comprises only 0.9 percent of the province and is found in an area south of Chain Lakes to the Montana border, portions of the Bow and Athabasca river valleys and isolated areas near Ya Ha Tinda and Grande Cache (Strong and Leggat 1992). The Montane Natural Subregion is distinguished from the other Subregions by the presence of Douglas-fir, limber pine, and lodgepole pine. Elevationally, the Montane occurs below the Subalpine and Upper Foothills Natural Subregions in the mountains, and above the Foothills Fescue Grass and Foothills Parkland Natural Subregions in southern Alberta (Willoughby and others 2021).

North of the Bow River Valley, the Montane Natural Subregion is a series of separate units. Each stretches from the foothills west into the Main Ranges along one of the major east-west river valleys which include the North Saskatchewan, Athabasca, and Smoky Rivers. These montane units are associated with warm air masses that move through the mountain passes. There is a small isolated outlier on the Red Deer River at the Ya Ha Tinda Ranch. The Subregion's upper boundary forms the lower limit of the Subalpine Natural Subregion (Alberta Parks 2015).

Geology and Physiography of the Montane Natural Subregion

- Regional and local climate influences have led to a highly varied collection of plant groupings or communities and soil types that change rapidly over very short distances;
- Lodgepole pine and aspen stands occur on easterly and northerly exposures, with grasslands growing on southerly and westerly exposures at lower elevations. Closed mixedwood and coniferous forests dominated by lodgepole pine occur at higher elevations;
- About 3 percent of the total area of the Montane Natural Subregion is covered by water, largely accounted for by major rivers including the Smoky, Athabasca, North Saskatchewan, and Bow rivers and five standing water bodies (Waterton, Minnewanka, Abraham, and Brule Lakes and the Ghost Reservoir);
- On the Canadian landscape, the Cypress Hills are the highest geographic feature between Labrador and the Rocky Mountains. On their northerly slopes at higher elevations conditions are cool and moist enough to support forest and grassland communities like those found in the Rocky Mountains several hundred kilometers to the west. This is why the Cypress Hills plateau is classified as an outlier of the Montane Natural Subregion (Willoughby and others 2021).

Soils of the Montane Natural Subregion

- Surficial materials in the foothills are mainly medium textured, weakly calcareous tills. However, these deposits can be quite thin in steeper areas where textures tend to be more variable. In major river valleys, fluvial and glaciofluvial sands and gravels form level to gently undulating terraces on valley bottoms; till and

colluvial deposits of variable textures occur on lower slopes. Bedrock exposures occur both in the foothills and in the valleys. Extremely calcareous loessal materials occur at the eastern extension of the Athabasca valley in the Brule Lake area;
- In the foothills and outlying Montane areas of southern and southwestern Alberta, Orthic Black Chernozems are typical under grasslands with Orthic Dark Gray Chernozems becoming dominant in the wooded areas. On moister northern slopes and higher elevations, Gray Luvisols become significant. Bedrock exposures (non-soils) also occur. In the valleys, Eutric Brunisols are the dominant soil on fluvial and glaciofluvial deposits;
- Regosols are typical of both fluvial terraces adjacent to the rivers and side slopes where erosion or slope movement has recently occurred. Valley side soils may also include Luvisols and Dystric Brunisols where slopes are stable enough to allow soil development to occur. Gleysols and Organic soils are typically associated with fens (Willoughby and others 2021).

Climate of the Montane Natural Subregion
- This is the driest and warmest of the three Natural Subregions in the Rocky Mountain Natural Region, and regional and local climatic influences produce a highly diverse array of plant communities and soil types that change rapidly over very short distances. Mild summers, a summer-high precipitation pattern, frequent Chinook winds, and warm winters are characteristics of the Montane Natural Subregion;
- Owing to warm Pacific air masses and frequent Chinooks, winters in the Montane Natural Subregion are warmer than anywhere else in Alberta except the Foothills Fescue and Foothills Parkland Natural Subregions (Willoughby and others 2021);
- Annual precipitation ranges from 308 mm to 1,279 mm, with two precipitation peaks occurring in May-June and again in August-September. Summer monthly temperatures average 11.9 °C and are 2 °C warmer than the Subalpine and 2 °C cooler than the Foothills Fescue Natural Subregions. The Montane has the warmest winter temperatures of any forested region in Alberta because of chinook activity and reduced influence of Arctic air (Willoughby and others 2021).

Vegetation of the Montane Natural Subregion
- Aspen forests occur on fluvial fans and terraces, while balsam poplar or black cottonwood stands occupy the floodplains;
- Ericaceous shrubs (except bearberry and some Vaccinium species) are notably absent, in contrast to the Subalpine Natural Subregion, which is dominated by ericaceous species;
- The Montane Natural Subregion is characterized by forest and grassland complexes with grasslands occurring on dry and exposed sites;
- Closed forest communities are a mixture of lodgepole pine, aspen, and white spruce, although pure stands of any of these species can occur. From the Athabasca valley south, Douglas fir is also a member of this mix;
- Understory shrubs are variable, with Canada buffaloberry, white meadowsweet, thimbleberry, snowberry, and saskatoon all common on mesic sites. Grasses including pine grass and hairy wild rye are common in the understory as well;
- Creeping mahonia is a common understory species from the Crowsnest Pass south;
- Open limber pine stands occur on ridgetops and eroding valley slopes in the southern Montane and as far north as the North Saskatchewan River valley (Alberta Parks 2015).

DEVELOPMENT OF A VEGETATION BASED ECOLOGICAL SITE CLASSIFICATION

Background

This classification of riparian and wetland sites in the Upper Foothills, Lower Foothills, and Montane Natural Subregions of Alberta is a continuation of work previously done to classify riparian and wetland sites in the Grassland Natural Region, the Parkland Natural Region, and the Dry Mixedwood Subregion of the Boreal Natural Region, while working at the Riparian and Wetland Research Program at the University of Montana, then with Bitterroot Restoration, Inc. (Corvallis, Montana) (BRI) from 2001 through 2005, and finally as Ecological Solutions Group LLC from 2006, where the work has continued until the present.

We use the ***habitat type*** approach as outlined by Daubenmire (1952, 1968, 1970, 1978) in classifying riparian and wetland sites. We have adopted the ***habitat type*** approach for three main reasons:

1. While the habitat type is based on a climax plant association said to represent long-term biotic potential on the site, it also includes a series of seral stage communities, any one of which may occupy the site at some time in its history—even repeatedly following disturbance. Therefore, a site can be quite thoroughly described by naming its climax vegetation, as well as its current vegetation community. For example, a site may be described as being a *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type presently occupied by the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type consisting of a mixed stand of aging *Populus balsamifera* (balsam poplar) and mature *Populus tremuloides* (aspen), with a few young spruce saplings establishing through a dense tall shrub understory.

   In order to further emphasize the point of seral progression, consider a dense, relatively undisturbed stand of willow shrubs, such that quite often will include sufficient small, young conifer trees (i.e., greater than 25 per hectare) that indicate the site potential for a conifer tree-dominated habitat type, that currently supports an early seral willow-dominated community type. For example, a stand of the *Salix bebbiana* (beaked willow) community type dominated by a vigorous stand of tall willows can have an easily overlooked scattering of small *Picea glauca* (white spruce) seedlings and saplings that indicate the actual potential of the site as the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type.

   In both examples, the reader is given a clear idea of the kind of site it is, the potential vegetation, and the current seral vegetation.
2. The habitat type approach is primarily a vegetation-based, ecological site classification that does not directly incorporate soils data in the development of the classification. A given habitat type may include a variety of soils types. A description of soils is included in a description of the habitat type, and soils information may be used to help characterize lower levels in the classification such as phases. Therefore, the habitat type approach uses vegetation is as an integrator of the landscape and climatic conditions. This is especially appropriate in riparian zones where soils are commonly young and the pedogenic process is susceptible to frequent disruption by fluvial processes. Daubenmire noted that soil is a critical important ecological factor. However, he felt that vegetation responds to differences in moisture, fertility, temperature, and aeration rather than to parameters such as color, texture, structure, depth, sequence of horizons, and other soil features that are easily observed by the human eye.
3. The dynamics of edaphic and hydrologic conditions on river and stream floodplains typically cause the formation of complex mosaics of vegetation communities as intermixes of all stages of stand maturity and seral stage. We believe that the habitat type system of classifying sites offers the best presently available means for developing a working terminology for these natural places.

METHODS

Vegetation Cover Criteria (Canopy Cover vs. Foliar Cover)

Abundance of a plant species can be measured in numerous ways, but the standard measure for potential natural vegetation classification purposes is percent cover. Cover is a meaningful attribute for nearly all plant lifeforms, which allows their abundances to be evaluated in comparable terms (Daubenmire 1968, Mueller-Dombois and Ellenberg 1974). Percent cover can be defined as "the vertical projection of the crown or shoot area to the ground surface expressed as … a percent of the reference area" (Mueller-Dombois and Ellenberg 1974). The use of crown or shoot area results in two definitions of cover as follows:

> ***Canopy cover*** is "*the percentage of ground covered by a vertical projection of the outermost perimeter of the natural spread of foliage of plants. Small openings within the canopy are included."* (Daubenmire 1959, Society for Range Management 1989, USDA Natural Resources Conservation Service 1997)
>
> ***Foliar cover*** is "*the percentage of ground covered by the vertical projection of the aerial portion of plants. Small openings in the canopy and intraspecific overlap are excluded*" (Society for Range Management 1989). Foliar cover is the vertical projection of stems and leaves.

NOTE: Foliar cover is usually less than, and never greater than, canopy cover (Daubenmire 1968, Society for Range Management 1989). Neither can exceed 100 percent for a single species, but both can total over 100 percent for all the species in a plot or stand due to overlap between species (Daubenmire 1968).

Foliar cover and canopy cover are not necessarily correlated (Daubenmire 1968) for either a species or a plant community. We have chosen to use canopy cover for this work for the following reasons:

- Canopy cover better estimates the area that is directly influenced by the individuals of each species (Daubenmire 1968).
- Canopy cover is easier to estimate from aerial photos than foliar cover. A classification based on canopy cover is better suited for mapping vegetation than one based on foliar cover.
- The majority of legacy data for habitat type classifications uses canopy cover rather than foliar cover.

NOTE: All foliar cover data sets used in the development of this document were converted to canopy cover. For example, a number of data sets used in this document were originally collected using foliar cover. These data sets were converted from foliar cover to canopy cover. All tables and discussions in this document are based on canopy cover values.

Use of Canopy Cover Data Classes (Ranges and Midpoints) for Data Analysis

Most sets of quantitative data brought together for consideration to be used in this project were collected using discrete classes of numerical data categories (Table 1), rather than continuous numerical data. Other data sets considered were collected using continuous numerical data. Before being used, these continuous data were converted to the discrete categories shown in Table 1. These data classes, known as canopy cover classes, and their ranges are taken from the USDA Forest Service Northern Regions ECODATA (1989) program. The canopy cover class midpoint values were then used in all calculations throughout the computer data analysis process.

Table 1. The 12 canopy cover classes of discrete data ranges that together span from greater than zero to 100 percent, showing the percent range of each class and its numerical midpoint

Canopy Cover Class Range	Canopy Cover Class Midpoint	Canopy Cover Class Range	Canopy Cover Class Midpoint	Canopy Cover Class Range	Canopy Cover Class Midpoint
>0<1%	0.5%	1<5%	3.0%	5<15%	10.0%
15<25%	20.0%	25<35%	30.0%	35<45%	40.0%
45<55%	50.0%	55<65%	60.0%	65<75%	70.0%
75<85%	80.0%	85<95%	90.0%	95-100%	97.5%

Data Sets Analyzed for Developing the Habitat Type Classification

A large body of vegetation stand data was obtained from the Alberta Government Ecological Information System (ECOSYS) open data repository (Alberta Government 2016). Vegetative data collection for this data was based on inventory protocol established for Alberta's Ecological Land Description program (Resource Data Branch 2003), and rangeland inventories (Alberta Environment and Parks 2021). Of this large body of stand data, 9,852 plot records were provided to Ecological Solutions Group (ESG) as representing the area including and surrounding the study area for this classification project.

The pool of data sets considered for use in developing this classification originally contained a total of 16,198 stands. Included in the pool were data sets from the following sources:

- Alberta Government Ecological Information System (ECOSYS) data = 9,852 stands;
- Data used in the *Classification and Management of Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002) = 1,321 stands;
- Data used in the *Classification and Management of Riparian and Wetland Sites of Alberta's Parkland Natural Region & Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003) = 707 stands;
- Data used in the *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995) = 2,681 stands;
- Data used in the *Forest Habitat Types of Montana* (Pfister and others 1977) = 1,496 stands;
- Bunchgrass Consulting (Baker 2021) = 114 stands; and
- Longview Ecological (Dodd 2022) = 27 stands.

Data Analysis Steps Used to Select the Stands for this Classification (N = 1,569)

The original starting data set included 16,198 stands. This data set was reduced by the following steps:

- Higher elevation Alberta Government Ecological Information System (ECOSYS) data sets (e.g., the Alpine and Subalpine Natural Subregions), as well as those located in drier site moisture regimes (xeric, sub-xeric, sub-mesic, etc.) were eliminated from the data set. Therefore, the remaining stands represent the portions of the Lower Foothills, Upper Foothills, and Montane Natural Subregions that comprise the study area for this classification, and that also represent the wetter moisture regimes most likely to support riparian and wetland vegetation;
- Stands were eliminated that lacked critical species identification beyond the genus level for plants critical to wetlands (e.g., *Carex* species., *Salix* species, etc.) ***NOTE:*** A large number of the Alberta Government Ecological Information System (ECOSYS) data sets were eliminated due to this lack of critical species identification;
- Stands were eliminated for which unreasonably high, or low, total plant canopy cover was recorded (i.e., some stands had over 400 percent total canopy cover, while others had total canopy cover as low as 2 percent);

- Stands were eliminated for which an unreasonably high total number of species were listed due to the plot crossing one or more ecotones and for not being situated within one homogeneous stand of vegetation;
- Stands were eliminated when the species list contained a large number of both extremely dry upland vegetation and extremely moist wetland vegetation and, both sets of species (i.e., dry vs. wet) having a very high canopy cover (indicating the stand was not in one relatively homogenous moisture regime);
- For types that occur commonly across the landscape, in some cases we identified a large number of stands that were deemed to be more than sufficient to adequately describe the type, and therefore did not continue to add additional stands to the data set for that type; and
- A plant community that is abundant in another region may have extremely limited occurrence in this study area. In other words, the plant community may be at the edge of its range of distribution. If the pool of data available for analysis only had one or two stands to represent a type, we did not include it in the classification data set, because the low number stands was inadequate to describe a habitat type. ***NOTE:*** In developing habitat type classifications, a rule of thumb is that "a habitat type can not be described using only one stand."

In this document, 1,569 stands were included in the analysis, resulting in 66 habitat types/major seral community types. These 66 types averaged 23.8 stands per type. The types ranged from a low of 4 stands describing a type, to a high of 98 stands describing a type. The median value is 17 stands.

Additional Data Considerations

The following represent additional consideration taken for data analysis:

- All plant species data sets from Montana were converted from 6-letter code format to the 7-letter code format commonly used in Alberta for data analysis (***NOTE:*** this was time consuming process due to the different taxonomic authorities used in Alberta vs. Montana. For example, one taxonomic authority may only have the plant to the genus/species level while the other authority may have three different varieties of the same plant. Another problem is nomenclature and name changes that are significantly different between the two taxonomic authorities);
- All data that was originally collected using foliar cover (i.e., Alberta Government Ecological Information System (ECOSYS) data sets) was converted to canopy cover using a process that involved using approx. 50 different values for converting the foliar cover various species, and/or classes of species, to canopy cover;
- All data sets prior to analysis were run through a 7-letter Code checker to clean the data;
- Some of the species in the 7-letter code dictionary did not have a common name, and we had to use a variety of Canadian documents to come up with an acceptable common name for various plant species.

Development of the Site Classification Document

Development of this site classification followed the general procedures outlined below.

1. Stand data was entered into a database for analysis, using modules designed to sort the plot vegetation data into stand/species abundance tables.
2. Using the stand/species abundance tables, plots were grouped into types by stepwise successive approximations to develop the classification (Pfister and Arno 1980).
3. Preliminary association tables are created using plot species and canopy cover values. Stands are then rearranged several times to group them into sets having the greatest vegetation similarities. Plot-to-plot similarity relations, plot-to-set similarity relations, and set-to-set similarity relations were analyzed using a modified Sorensen's Index. The final placement of each sample plot into a set is based on both floristic and environmental relationships.
4. Average canopy cover, canopy cover range, and constancy tables are created for each group. ***Average canopy cover*** is the average value of cover of a species in those plots where it was recorded, ***AND NOT*** the statistical mean of cover of the species on all plots in the sample. ***Canopy cover range*** is the lowest and highest canopy cover value recorded for a species. ***Constancy*** is the percentage of plots with the species present (sometimes called presence value). If constancy is less than 100 percent, then the lower value of the canopy cover range is

zero. To aid interpretation of the distribution and importance of a species in a type, it is given a ***prominence index*** value and ***origin status.*** The ***prominence index*** value is useful for ranking species importance within a type. ***Prominence index*** is the product of average canopy cover and constancy (frequency) values. ***Origin status*** refers to whether a plant is native to pre-Columbian North America, or is introduced by post-Columbian human immigrants.

5. A dichotomous key to the preliminary types is developed based on the presence or abundance of diagnostic plant species that indicate the presence of certain environmental conditions (indicator species). The key was then applied to all plots, and revisions were made to accommodate variations in the data.
6. A description was written for each habitat type and major seral community type, including a general discussion of where sites of the type might be found, successional relationships, vegetation, physical site characteristics, and management information.
7. This final draft classification of riparian and wetland sites in the Upper Foothills, Lower Foothills, and Montane Natural Subregions of Alberta incorporates reviewers comments.

Taxonomic Considerations

Taxonomic nomenclature follows Moss (1983), as revised by John G. Packer.

Ecological Equivalents

We have grouped several species together in the key due to similarities in morphology, environmental conditions, and management concerns. Stands comprised of the following combinations of species were grouped together:

1. The *Calamagrostis canadensis* (marsh reed grass) habitat types/community types includes all combinations of *Calamagrostis canadensis* (marsh reed grass), *Calamagrostis inexpansa* (northern reed grass), and *Calamagrostis stricta* (narrow reed grass).
2. The *Picea glauca* (white spruce) habitat types includes all combinations of *Picea glauca* (white spruce) and *Picea engelmannii* (Engelmann spruce).
3. The *Rosa acicularis* (prickly rose) community type includes all combinations of *Rosa acicularis* (prickly rose) and *Rosa woodsii* (common wild rose).
4. The *Scirpus acutus* (great bulrush) habitat type includes all combinations of *Scirpus acutus* (great bulrush) and *Scirpus validus* (common great bulrush).
5. The *Typha latifolia* (common cattail) habitat type includes all combinations of *Typha latifolia* (common cattail) and *Typha angustifolia* (narrow-leaved cattail).

Natural hybridization between species of *Picea* (spruce) is common. *Picea engelmannii* (Engelmann spruce) x *Picea glauca* (white spruce) hybrids are common where the ranges of these species overlap (Uchytil 1991d). Pure *Picea engelmannii* (Engelmann spruce) tends to dominate at higher elevations, and trees at low elevations closely resemble pure *Picea glauca* (white spruce) (Uchytil 1991d). Most populations in Montana are the result of *Picea engelmannii* (Engelmann spruce) x *Picea glauca* (white spruce) hybridization (Pfister and others 1977).

Both primary and secondary vegetative succession occurs in riparian/wetland and upland environments. However, primary succession is more prevalent in riparian and wetland situations than in upland sites. Primary succession represents the initial invasion of vegetation on barren sites lacking soil or pedogenic processes. Primary succession may be evident on previously unoccupied bedrock, on recent colluvial or alluvial deposits, or in areas where severe fire or flood has removed surface soil layers. Primary succession usually develops slowly, especially in the early stages as pioneer species gradually colonize and modify infertile sites over time (Clements 1920). However, in riparian zones this process may be much more rapid. Locally adapted pioneer species usually abound ready to establish on alluvial deposits of fine materials with good moisture supply. Secondary succession generally proceeds after disturbances resulting in the loss of the vegetation component, but where the soil layer remains intact. Revegetation may occur rapidly since the growth medium and nutrients remain primarily in place (Clements 1920). The result of succession in either context is climax vegetation, defined by self-replicating populations of vegetation that, barring disturbance, will persist on a site (Daubenmire 1968).

The following classification of climax vegetation was first proposed by Tansley (1935) and later modified by Daubenmire (1952). A ***climax community*** is a final or steady-state plant community which is self-perpetuating and in dynamic equilibrium with its environment. ***Climatic climax*** vegetation develops on normal topography with fairly deep loamy soil. Where topography or soil exert sufficient influence to produce a self-perpetuating, steady-state vegetation distinct from the climatic climax, the terms ***topographic climax*** or ***edaphic climax*** respectively are used. Where special topographic conditions also favor the development of edaphic conditions distinct from the normal, and the climax vegetation is distinct from the climatic climax, the term ***topoedaphic climax*** is used. Where recurring disturbances, such as grazing or fire, exert the predominant influence in maintaining the structure and composition of the steady-state vegetation, the term ***disclimax*** is used. A ***zootic climax*** is stable vegetation which is distinct as a result of heavy use by animals. ***Fire climax*** is apparently stable vegetation which is distinctive as a result of periodic burning. ***Disclimaxes,*** such as the ***zootic climax*** or ***fire climax, are not the basis for recognizing habitat types.*** A ***seral community*** is a vegetation community that has theoretically not attained a steady state; seral communities successively occupy and replace others of a particular environment over time. In our work, we used the time frame of 200-500 years for determining stability (e.g., climax vegetation), as outlined by Daubenmire (1952, 1968, 1970, 1978).

Daubenmire (1968) defines a stand as an array of vegetation that is predominantly homogeneous in all layers and that is separate from adjacent vegetation arrangements due to differences in qualitative or quantitative characteristics. The assemblage of all climax stands, in which, for all practical purposes, the collective dominant species in each of the apparent layers is similar, is termed a ***plant association.*** No two stands within an association are identical in every facet. All stands bear a high degree of vegetative similarity. Kovalchik (1987) coined the term ***riparian association*** to represent those collections of vegetation in equilibrium with their environment (climax) on sites influenced by specific hydrologic regimes.

These concepts and terminology carry information concerning site potential and temporal status of the present vegetation community. They are consistent with usage proposed by Daubenmire (1952, 1968, 1978) and used in numerous studies of vegetation-based ecological site classification (habitat types) (Daubenmire 1952, Daubenmire and Daubenmire 1968, Daubenmire 1970, Cooper 1975, Hoffman and Alexander 1976, Hoffman and Alexander 1980, Hoffman and Alexander 1983, Hoffman and Alexander 1987, Pfister and others 1977, Moir and Ludwig 1979, Jorgensen 1979, Mueggler and Stewart 1980, Pfister and Arno 1980, Steele and others 1981, Hironaka and others 1983, Hanks and others 1983, Steele and others 1983, Alexander and others 1984a, Alexander and others 1984b, Alexander and others 1986, Alexander 1985, Cooper 1981, Cooper and Pfister 1985, Hansen and others 1984, Hansen and Hoffman 1988a, Mauk and Henderson 1984, Alexander 1985, Youngblood and Mauk 1985, DeVelice and others 1986, Cooper and others 1991, Kovalchik 1987, Steele and Geier-Hayes

1987, Tiedeman and others 1987, Hansen and others 1995, Thompson and Hansen 2001, Hansen and Hall 2002, Thompson and Hansen 2002, Thompson and Hansen 2003, Kovalchik and Clausnitzer 2004, Hansen and others 2008). For a review of vegetation-based ecological site classifications (habitat types), see Ferguson and others (1989) and Pfister (1989).

A ***habitat type*** is defined as the land area that supports, or has the potential of supporting, the same climax vegetation type (association). A ***phase*** is a finer subdivision of a habitat type representing a minor variation in climax vegetation. Each habitat type represents a relatively narrow segment of environmental variation having a certain potential for vegetation development. Although any given habitat type may support a wide variety of disturbance-caused or seral vegetation, the ultimate product of vegetational succession anywhere within that habitat type will be a similar plant community. Therefore, the habitat type is a vegetation-based ecological site classification that uses the plant community as an indicator of integrated environmental factors as they affect species reproduction and plant community development.

Changes in site conditions such as drying and filling of potholes or sufficient deposition of alluvium on floodplains to create a drier site over time can change the habitat type. Cyclical changes that do not change long-term site conditions will remain the same habitat type. Habitat types have been used extensively to classify grasslands, shrublands, woodlands, and forests throughout the western United States and to some areas in the central and eastern United States.

The term ***plant association*** is used to group together all those stands of climax vegetation which occur in environments so similar that there is much floristic similarity throughout all layers of the vegetation. For our work, we have chosen to follow the lead of Kovalchik (1987) in the development of a vegetation based ecological site classification for riparian and wetland areas. Kovalchik (1987) uses the term ***riparian association*** as a vegetation type representing the latest successional stage attainable on a specific hydrologically influenced surface. Because the riparian association is the end result of plant succession, it reflects the most meaningful integration of environmental factors affecting vegetation. (The association, or climax plant community type is essentially equivalent to “potential natural community [type]” and climax vegetation is essentially equivalent to “potential natural vegetation” for purposes of developing a vegetation-based site classification system.)

Naming of the plant association follows the frequently used system of a binomial set with the dominant overstory species separated from the dominant or most diagnostic indicator of the undergrowth union by a slash (/). For example, numerous stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) association occur. The units of land on which these occur (currently or potentially) represent the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type. Some climax communities consist of only a single layer of vegetation; we consider this the overstory and ignore all references to additional layers (e.g., the *Carex utriculata* [beaked sedge] habitat type).

In addition to habitat types, we also describe several major seral plant communities that are stable for time frames relevant to land management decision-making. These are called ***community types.*** A ***community type*** is an aggregation of all plant communities distinguished by floristic and structural similarities in both overstory and undergrowth layers. A ***community type only represents a seral community or a disclimax community.*** Like a habitat type, a community type is an aggregation of all plant communities distinguished by floristic and structural similarities in both overstory and undergrowth layers. Examples are the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type and the *Alnus tenuifolia* (river alder) community type. A community type does not specify the vegetation potential of the site supporting it, although it does infer a great deal of information about the site. Many seral community types (e.g., the *Alnus tenuifolia* [river alder]) occur on sites with differing potentials, especially depending on geographic location. A recent alluvial bar with a dense stand of *Alnus tenuifolia* (river alder) may be pioneering to an *Picea glauca/Equisetum arvense* (white spruce/

common horsetail) habitat type, a *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type, or a *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type.

Our goal is to communicate some understanding of plant communities as they relate to factors of time, physical environment (site), and managerial treatment through a taxonomic classification. The concepts and terminology are illustrated in Figure 2 for further clarification. The upper cell is the ***plant association*** (climax vegetation type or most mature successional stage attainable). After we identify and describe the plant associations, we write a taxonomic key to identify the column (physical environment or site) that represents the ***habitat type.*** This key allows identification of the habitat type in most stages of successional development. In some instances, the successional relationships are more evident than others. For example, community types A-2, A-3, and A-4 represent specific and clearly identifiable successional stages within association A. On the other hand, major seral community type B/C-2 represents a disclimax that extends over two or more habitat types, occurring on sites currently providing insufficient evidence to distinguish between two or more habitat types (columns), and usually caused by grazing pressure displacement of later seral species. An example of a B/C-2 disclimax community type is the Disturbed Herbaceous community type, which may contain stands of *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (timothy), and/or *Bromus inermis* (smooth brome).

In association D, our present knowledge of the site only allows us to identify one seral stage, identified as community type D-2. Finally, association E represents the case in which the successional path is brief, and the most mature successional stage (riparian/wetland plant association) is reached directly and quickly. There are many examples of association E in the study area. For example, stands of nearly mono-specific communities as *Carex utriculata* (beaked sedge) and *Typha latifolia* (common cattail) where the pioneering species is an ecologically strong native colonizer species with the ability to also be climax vegetation for the site.

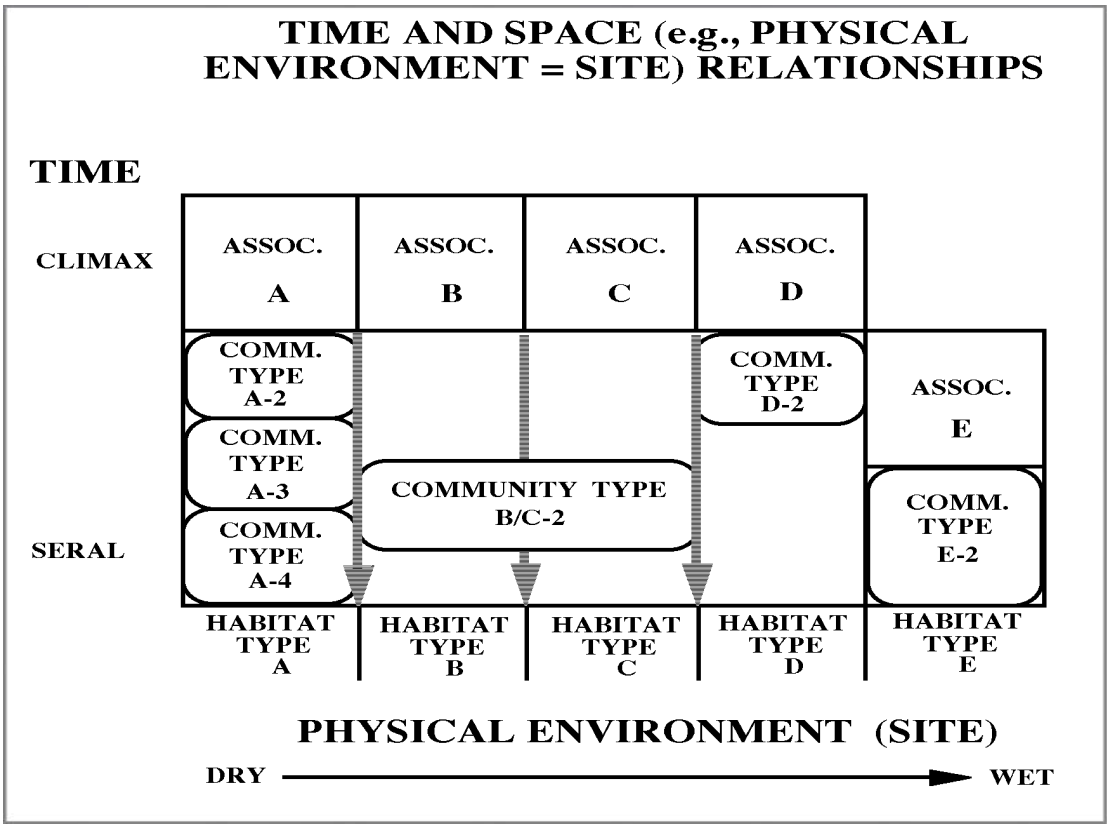


Figure 2. Illustration of the terminology as it relates to time and space (e.g., physical environment)

The time frame for site-successional processes varies greatly, depending upon the type, location, and origin of an area. As an example, beaver ponds may silt-in within a few years or hundreds of years. In contrast, analysis of a few mountain meadows has shown them to be stable for the last 6,900 years (Windell and others 1986). In the Madison Range, Montana, Patten (1963) considered that the vegetation was still adjusting to the post-Pleistocene climate, but that vegetation patterns, including mountain meadows, are relatively stable.

The long-term product of vegetative succession is the climax or steady-state community. Theoretically this community, free of major disturbance, is self perpetuating and represents a meaningful integration of its total environment. It is from this assumption that climax vegetation is useful in the recognition of habitat types.

The climax plant community (plant association), as the theoretical end result of succession, is an expression of the biotic potential of that site. Each habitat type is a relatively narrow segment of environmental variation and is defined by a certain potential for vegetational development. Although one habitat type may support a variety of disturbance-caused (seral) plant communities, the potential product of vegetational succession anywhere within one habitat type will be a similar climax community. Therefore, the habitat type classification uses the plant community as an integrated expression of the environmental factors affecting species reproduction and plant community development.

Some ecologists dispute the existence of successional end points in the form of climax communities. This argument has developed primarily from the study of global climate change, which indicates that plant communities do progress along successional pathways, but are continually adapting to changes in climate and natural disturbance and thus never truly reach an end point in succession. This argument may have particular relevance to the highly dynamic environment of the riparian zone where hydrological influences are often quite dramatic and may fluctuate significantly both seasonally and annually. These fluctuations coupled with natural disturbances may result in an ever-changing environment, making it difficult to predict vegetation potential. Nevertheless, current understanding of successional pathways and of the relative temporal persistence of major seral plant communities that reflect current site differences, make possible this tool for applying names on landscape types in a manner relevant to resource management needs.

RELATIONSHIP OF POTENTIAL NATURAL VEGETATION (PNV) AND HABITAT TYPES

Potential natural vegetation (PNV) is defined as the vegetation that would become established if all successional sequences were completed without major natural disturbances or direct human activities under present climatic, edaphic, and topographic conditions (adapted from Tuxen [1956], as translated by Mueller-Dombois and Ellenberg [1974], and from Kuchler [1964]). A major disturbance is an event (such as fire, flood, etc.) or an ongoing process (such as heavy grazing) that results in stand replacement or selectively reduces the abundance of some plant species. Direct human activities are those that alter or manipulate the vegetation itself rather than the environment. In the event of significant changes in climate, soils, or topography, a change in PNV type would be the logical outcome.

PNV provides a strong conceptual foundation for understanding and describing:
- The variation of vegetation over time; and
- The relationships of vegetation with the controlling physical environment.

Classifications provide defined “reference points“ to study systems that vary in multiple dimensions. Classification of formal PNV types provides a taxonomic system to describe the kinds of plant communities that are relatively stable and self-reproducing, thereby representing the probable latest stage of successional development for that physical environment. A key to taxonomic PNV types can be used on existing vegetation

(EV) to identify the predicted PNV type, thereby leading to understanding how vegetation changes with successional development over time.

A PNV type also serves as a “phytometer“ or integrated expression of the biological potential of a site (Kuchler 1964 and 1967, Daubenmire 1952, 1968, 1978, Mueller-Dombois and Ellenberg 1974). PNV type classification provides a system that strengthens the ecological foundation of land management and is essential for predicting land capability. Consequently, PNV types provide a practical vegetation-based biophysical site (and land) classification system—useful as either a stand-alone classification or as a component of multiple-factor ecosystem classification systems (Ferguson and others 1989, Kimmins 1997). PNV mapping, as a “stand-alone“ land classification, is used to represent the area of land than would potentially support unique PNV types over time.

Uses of Potential Natural Vegetation (PNV) Information

PNV classification and PNV mapping serve several purposes at many levels of natural resource management. Two uses are policy development and land management. Policy development requires aggregation of data to formulate programs and allocate funds. Standardization of classification provides uniformity and credibility to the information aggregated for policy decision-making. A single hierarchical classification works well for the aggregation process. Implementing land management policy requires place-specific knowledge that can be obtained through the mapping process. A hierarchical, linked classification and mapping system can serve both purposes well. Using hierarchical classification and multi-level mapping of PNV provides the appropriate level of detail for each intended use.

The PNV classification system provides a consistent framework for cataloging, describing, and communicating information about potential natural plant communities. The PNV types provide a consistent reference point for interpretation of earlier successional stages of vegetation for many ecological and land management questions. This facilitates interpretation of disturbance effects, outcomes of management activities, site capabilities, and ecosystem health.

PNV types are often used in combination with knowledge of existing vegetation (EV) to identify management objectives, alternatives, and desired future condition. Using PNV types also provides a reference point for comparison with historic vegetation. PNV types may be used as desired future condition goals for conservation and/or restoration strategies for specific sites. Where the PNV type is not the desired future condition, management activities can be prescribed to maintain or attain a desired condition other than PNV (such as earlier successional stages). To maintain ecological diversity at landscape levels, a representative diversity of ***all*** successional stages is generally considered the appropriate desired future condition for a landscape and region (Kimmins 1997, Floyd 2002, Haufler and others 1996, Pfister and Sweet 2000).

Researchers from many disciplines have utilized PNV types to stratify research data and have found good correlation with a large number of factors. These published summaries have been called “managed implications“ of habitat types. (Habitat types are directly related to the PNV associations.) Daubenmire (1976) provided an extensive review of these practical values:

- Rate of tree growth;
- Appropriate silviculture;
- Biological hazards;
- Susceptibility to wind-throw;
- Tree form and anatomy;
- Reproductive habits;
- Game management;
- Ecotype distribution; and
- Hydrologic cycles.

Thomas and others (1979) used a matrix framework of PNV and successional stages to summarize wildlife habitat knowledge for the Blue Mountains of Eastern Oregon. Many other examples are included in the proceedings of a 1987 symposium (Ferguson and others 1989).

By holding time relatively constant, PNV classification also provides a reflection of the physical environment. Mapping of PNV types therefore provides a vegetation-based land classification system for land and resource management planning (Ferguson and others 1989). Knowledge is developed and stored in reference to the PNV taxonomic types; knowledge is extrapolated to the landscape by a mapping system that is directly linked to the classification.

Relationship Between Potential Natural Vegetation (PNV) and Historical Vegetation

Historical vegetation is often used by land managers to provide a reference point upon which to base vegetation management strategies. Historical vegetation can be defined as the vegetation that developed during a reference period prior to Euro-American settlement. The time of Euro-American settlement varies throughout Canada, from east to west and south to north. More importantly, this reference period also includes the prevalent disturbance regimes that drove succession on the landscape historically. On many landscapes, this included fire, both natural and that caused by Indigenous peoples burning.

Historical vegetation patterns were the result of the interaction of both the disturbance regime and the successional response of the vegetation. In the case of fire, as well as other disturbances, the successional response can often be predicted by knowing the site's PNV. However, the occurrence and behavior of fire on vegetation is often governed by other factors, such as terrain, broad scale climatic patterns, and features on the landscape more prone to lightning. These factors are often independent from PNV, and their patterns on the landscape cannot be characterized solely with PNV classifications and concepts. Thus, in order to characterize historical vegetation patterns on the landscape, it is not enough to just know the PNV. We need to know both the PNV and the historical disturbance regime.

In areas lacking data on natural, late successional plant communities, historic vegetation recorded in old land surveys may be useful to help define a preliminary classification of PNV at the series level of classification. However, historic vegetation data does not exist at the plant community level; only dominant species were documented. Furthermore, Kuchler (1964) and Mueller-Dombois and Ellenberg (1974) present a strong case that PNV is not equal to the "original" vegetation for a variety of reasons including varying amounts of human disturbance and different climatic conditions over time.

Potential Natural Vegetation (PNV) Taxonomic Units

A ***PNV type*** is a named category of PNV defined on the basis of selected shared floristic, physiognomic, and successional characteristics, which distinguishes it from other PNV types.

PNV types are taxonomic units developed through the scientific classification process described above. Definition of PNV types makes meaningful generalization about each type possible, thus reducing complexity and furthering communication while maintaining meaningful differences among types (Pfister and Arno 1980). Members of a PNV type (e.g., plots or stands) should be more similar to each other (in aggregate) than they are to members of other PNV types.

Four levels, from coarsest to finest, of PNV taxonomy are specified by this protocol: PNV series, PNV association group (or subseries), PNV association, and PNV association phase. These levels are defined below.

PNV series is a taxonomic unit of PNV classification that aggregates PNV associations that share the same climax species in the dominant layer. In forested vegetation this is typically the most shade-tolerant tree species capable

of occupying a site. For areas lacking defined PNV associations, a preliminary or provisional classification of PNV series (e.g., Layser and Schubert 1974) can be developed based on general knowledge of existing vegetation combined with knowledge of the relative autecological characteristics of dominant species.

PNV association group (or subseries) is an aggregation of similar PNV associations within a PNV series. The PNV association group is an intermediate hierarchical classification level between the two basic taxonomic levels of PNV association and PNV series. This is not to be confused with *plant association groups* and *habitat type groups* that contain members from different series; these do not meet the strict rules of hierarchical classification and should be described as *technical classification groups.*

PNV association is a potential climax plant community type (following Daubenmire's stricter definition) based on similar floristics, physiognomy, and inferred equivalent habitat conditions. The PNV association represents a relatively stable, self-reproducing, apparent climax stage of secondary succession based on data from existing late-successional natural plant communities. PNV associations are typically named after indicated potential climax overstory dominants and diagnostic undergrowth species. The PNV association can be considered a special case of the general definition of "association," just as Daubenmire (1952) used "climax association." Habitat types of the same name as the climax association have been used to represent the potential land area capable of supporting a given climax plant community type or PNV association (Daubenmire 1952, Bailey and others 1978, Pfister and Arno 1980).

PNV association phase is a taxonomic subdivision of a PNV association, typically based on minor floristic differences. This is usually based on floristic differences and thus is different from subdivision of a PNV association into "ecological types" based on unique abiotic factors as discussed in Section 3.2.1 of the Terrestrial Ecological Unit Inventory (TEUI) Technical Guide (Winthers and others 2005).

The series, association, and association phase levels of the PNV hierarchy have become fairly well established through much of North America where formal taxonomies of PNV have been developed (Bailey and others 1978, Layser and Schubert 1974, Pfister and Arno 1980, Pfister 1989). These taxonomies have generally been developed at the plant association level with grouping of associations to a series level and often subdividing associations to a phase level, generally based on floristic composition characteristics. These three levels are strictly hierarchical when the first part of the PNV association name is identical with the PNV series level, the second part of the name specifies the PNV association, and the third part is the PNV phase name. (e.g., *Abies lasiocarpa/Clintonia uniflora* PNV association, *Menziesia ferruginea* phase).

USE OF THIS CLASSIFICATION

Overview

No two vegetation communities are exactly alike due to differences in climate, parent material, topography, elevation, disturbance regimes and a host of other variables. The ecological site classification concept used in this study is based on the premise that vegetation on a site reflects the culmination of all the elements at work there. Those species present on site best reflect the principal forces acting there.

This approach results in a classification that establishes baseline information for riparian and wetland sites within the study area. It provides land managers with information enabling them to develop appropriate management strategies and policies. Two features of this classification that increase its utility for land managers are the dichotomous key and the successional hierarchy established in the habitat type framework. The dichotomous key offers a simple approach to identifying vegetation types. Users, with some knowledge of the local flora, need only to identify the dominant overstory and understory species, and some indicator species, to use the classification. Type descriptions provide species lists, summarize physical parameters, outline successional trends, and present viable management strategies.

Another useful feature of the classification is the successional framework inherent within the habitat type concept. A habitat type represents the land area that supports, or has the potential to support, the same climax vegetation wherever it occurs (Daubenmire 1968). The climax vegetation, or plant association, represents the endpoint of succession on a site. Community types (intermediate, seral plant communities with similar floristic components in all structural layers) represent intermediate stages of succession. They can be organized within the framework of a habitat type system to form successional paths useful in predicting the pattern of community replacement from the pioneer to climax stages. Projection of potential, future vegetation communities in an area provides land managers with a tool for developing strategies and realistic goals.

Management Interpretations

Habitat type classifications provide a relatively permanent and ecologically-based system of land stratification in terms of vegetational potential (Daubenmire 1976). The habitat type is the basic unit in classifying land units or sites based on biotic potential, it emphasizes similarities in ecosystems which carry implications for a variety of land management objectives (Daubenmire 1984). Some of the practical implications of habitat type classification are in predicting livestock and wildlife forage production and wildlife habitat values, inventory, land type mapping, timber production, species selection for regeneration and/or rehabilitation, development of best management practices, growth rates of trees and shrubs, susceptibility of trees and shrubs to insects and disease, depth of soil moisture penetration, potential for producing browse after fire, soil management criteria, impacts of recreational uses, natural areas for preservation, downed woody fuels on the forest floor, and successional trends following disturbance. In addition, habitat types offer a basis of comparison and evaluation useful in designing and carrying out field experiments in ecology or applied natural resource disciplines.

There are typically three misconceptions about the use of a habitat type classification:

1. The expectation of an abundance of climax vegetation to be present on the current landscape;
2. Natural resource managers need to manage solely for climax vegetation; and
3. The use of a habitat type classification requires climax or near-climax vegetation.

For the first two misconceptions, the opposite is true. A very high percentage of our landscape has experienced disturbance resulting in domination by various seral stages. In the second case, preferred management strategies quite often favor seral, instead of climax potential species, regardless of habitat type. In the third misconception, comparing the relative reproductive success of certain plant species present, having known successional process, generally permits identification of the habitat type. In general, succession is more rapid for undergrowth species,

providing insight into the habitat type for the site. Where stands have been severely disturbed, are in an early seral stage, or have a closed canopy resulting in a depauperate understory, comparison of the stand with nearby stands on physically similar sites can assist in habitat type identification.

Habitat type classification and management systems provide a critical part of the information needed to:

- Describe the variety of vegetation communities potentially occupying an area;
- Characterize the effect of disturbances or management on plant community distributions, threatened and endangered species, and other entities of conservation concern;
- Identify realistic objectives and related management opportunities;
- Provide a framework to document successional relationships and seral communities;
- Streamline monitoring design and facilitate extrapolation of monitoring interpretations;
- Assess multi-resource potentials, capability, and suitability of management alternatives;
- Provide a framework to help evaluate upland (i.e., forests and rangelands), riparian sites, and wetland health;
- Assess risks for invasive species, fire, insects, disease, and flooding;
- Conduct project planning and watershed analysis, and predict activity outcomes for a project or for land and resource management planning;
- Allows planning of disturbed site vegetation rehabilitation/restoration to be based on site potential; and
- More effectively communicate with all stakeholders.

Successional Relationships

The process of change by which biotic communities replace each other, and by which the physical environment becomes altered over time is referred to as succession (Kimmins 1997). As discussed earlier in the Ecological Terms and Concepts Section, two types of succession characterize vegetation development: 1) primary succession, and 2) secondary succession. Development of vegetation on newly created soil surfaces, such as filling in a lake or a newly formed alluvial bar, is primary succession. This slow process may require many centuries to reach a stable or climax community. Secondary succession occurs after disturbance, such as a fire, alters or destroys the vegetation cover, but not the soil. Revegetation usually happens quickly. Extreme disturbance (such as soil erosion or fire consumption of organics in the substrate) may alter the site so drastically that succession becomes primary.

Secondary succession may proceed in either of two directions: toward or away from the climax community or potential natural vegetation. For example, the establishment of *Betula glandulosa* (bog birch) individuals in a stand of *Carex aquatilis* (water sedge) would represent progressive succession toward the *Betula glandulosa/ Carex aquatilis* (bog birch/water sedge) habitat type. The elimination of *Carex aquatilis* (water sedge) and the resulting domination of undesirable herbaceous species due to overgrazing would represent regressive succession away from potential climax. Plant communities that represent steps along the successional pathways toward or away from the potential climax association are called seral stages or seral communities. Major, relatively stable, seral or disclimax plant communities are formally defined as community types in this publication. Descriptions of seral stages and successional pathways are included in the habitat type descriptions.

In upland sites, ecologists and land managers have typically only had to deal with secondary succession. However, in many riparian and wetland situations, primary succession is just as important in explaining vegetational development. One of the most important characteristics of riparian and wetland areas is their dynamic nature. Not only does vegetation change with time and disturbance within a habitat type, but the site itself may also be altered by changes in the hydrology or soil. Alluvial depositions can alter the available water on a floodplain site. Rapid accumulations of organic materials can occur on fens, bogs, and wet meadows, altering water holding capacity and nutrient availability of the soil. Site potential may change when the water table is lowered by draining or heavy livestock impacts. Permanent flooding by human (dams) or wildlife activity

(beavers) will also change site potential. Any site that has changed significantly will undergo change in potential climax community (and habitat type).

Developing Reasonable and Attainable Management Goals and Objectives

After riparian and wetland habitat types and community types have been identified on a site, there are several uses for the information. Understanding of the information available in this document will increase over time with use. Some examples of the uses of the information are discussed below.

Land management plans sometimes call for attaining certain vegetation communities. Using this document, an understanding of what vegetation is feasible for a site can be gained. For example, on a degraded site with only a scattering of *Salix glauca* (smooth willow), the potential canopy cover can be learned from the canopy cover tables in the text. Specific objectives can then be written to increase the canopy cover on the site of *Salix glauca* (smooth willow) from 3 percent to 20 percent. The canopy cover tables can be used to write species lists for site rehabilitation/restoration projects. For example, in a burned area, there may be extremely limited vegetation remaining. The canopy cover tables for types identified on similar nearby sites provide a list of species that could be on the site. The species that are most desirable, available for planting, and easiest to obtain or establish can be selected.

If the goal is to provide winter range for wildlife species, the tables will provide a list of plant species that will grow on a type, so that informed decisions can be made to avoid planting species unsuited for the purpose. Long-term planning, land use decisions, threatened and endangered species consultations, and environmental documents can be guided by successional information present in each habitat type or major seral community type described.

Therefore, habitat type classification systems are useful to land and resource managers by providing:

- A permanent and ecologically based system of site classification that is referenced to vegetation potential (Daubenmire 1976);
- A vegetational classification for near-climax to climax communities;
- A way in which successional stages can be identified and described, thereby increasing our knowledge and ability to predict change on the landscape; and
- A basis for predicting results of management decisions or expected trends resulting from natural disturbances.

COMPARISON TO EARLIER HABITAT TYPE CLASSIFICATION WORK IN ALBERTA

Background

This document represents the third classification work, using the habitat type classification approach, for Alberta. The three documents are as follows:

- *Classification and Management of Riparian and Wetland Sites of the Alberta Grassland Natural Region and Adjacent Subregions* (Thompson and Hansen 2002);
- *Classification and Management of Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003); and
- *Classification and Management of Alberta's Riparian and Wetland Sites of the Lower Foothills, Upper Foothills, and Montane Natural Subregions* (Hansen and Thompson 2024).

Individual Alberta Habitat Type Classification Summaries

Table 2 shows the distribution of the 66 habitat types and community types described in this classification among the different vegetation lifeform categories. To describe those 66 types, 1,569 stands were analyzed for their species composition and amount of canopy cover, as indication for their assignment among the 66 types.

Table 2. Number of categories of types, number of stands, and data sets used for the [1]Lower Foothills, Upper Foothills and Montane Riparian and Wetland Sites Classification

Lifeform Category	Number of Types	Number of Sampled Stands	Alberta Forestry and Parks Data Sets	Other Data Sets
Coniferous Forest	15	649 (41.4%)	574 (88.4%)	75 (11.6%)
Deciduous Forest	6	277 (17.7%)	101 (36.5%)	176 (63.5%)
Willow Shrub	25	307 (19.6%)	147 (47.9%)	160 (52.1%)
Non-Willow Shrub	10	105 (6.7%)	48 (45.7%)	57 (54.3%)
Sedge	3	72 (4.6%)	29 (40.3%)	43 (59.7%)
Non-Sedge	7	159 (10.1%)	72 (45.3%)	87 (54.7%)
TOTAL	***66***	***1,569 (100.0%)***	***971 (61.9%)***	***598 (38.1%)***

[1]Lower Foothills, Upper Foothills and Montane Sites Classification = *Classification and Management of Riparian and Wetland Sites of the Lower Foothills, Upper Foothills, and Montane Natural Subregions* (Ecological Solutions Group 2024)

Table 3 shows the distribution of the 1,569 sampled stands in this classification among the different vegetation lifeform categories, and also the average number of sampled stands per type. The coniferous and deciduous forest types averaged far more stands per type described than did any of the other lifeform categories. This difference is likely due to a combination of two factors: the actual distribution of plant species abundance across the landscape in the study area, and a possible forestry skew in the overall selection of sample strand sites. Given the realities of the Alberta Government Ecological Information System (ECOSYS) data sets, determination of the degree of influence of either of these factors is not practical.

Table 3. Number of category types, number of stands per type, and average number of stands per type for the [1]Lower Foothills, Upper Foothills and Montane Riparian and Wetland Sites Classification

Lifeform Category	Number of Types Per Category	Total Number of Sampled Stands Per Category	Average Number of Sampled Stands Per Type
Coniferous Forest	15	649	43.3
Deciduous Forest	6	277	46.2
Willow Shrub	25	307	12.3
Non-Willow Shrub	10	105	10.5
Sedge	3	72	24.0
Non-Sedge	7	159	22.7
TOTAL	***66***	***1,569***	***23.8***

[1]Lower Foothills, Upper Foothills and Montane Ecological Sites Classification = *Classification and Management of Alberta's Riparian and Wetland Sites of the Lower Foothills, Upper Foothills, and Montane Natural Subregions* (Hansen and Thompson 2024)

Table 4 shows the distribution of the 707 sampled stands among the different vegetation lifeform categories, and also the average number of sampled stands per type for the *Classification and Management of Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003). The coniferous and deciduous forest types averaged more stands per type described than did any of the other categories of types. This condition reflects the fact that this document is focussed in the Parkland Natural Region and adjacent Dry Mixedwood Natural Subregion, both areas with only one conifer tree species commonly occurring.

Table 4. Number of category types, number of stands per type, and average number of stands per type for the [1]Parkland and Dry Mixedwood Riparian and Wetland Sites Classification

Lifeform Category	Number of Types	Total Number of Sampled Stands Per Category	Average Number of Sampled Stands Per Type
Coniferous Forest	2	50	25.0
Deciduous Forest	6	211	35.2
Willow Shrub	14	197	14.1
Non-Willow Shrub	4	35	8.8
Sedge	4	79	19.8
Non-Sedge	13	135	10.4
TOTAL	***43***	***707***	***16.4***

[1]Parkland and Dry Mixedwood Sites Classification = *Classification and Management of Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003)

Table 5 shows the distribution of the 1,321 sampled stands among the vegetation lifeform categories, and also the average and total number of sampled stands per type for the *Classification and Management of Riparian and Wetland Sites of the Alberta Grassland Natural Region and Adjacent Subregions* (Thompson and Hansen 2002). The average number of sampled stands per type is much more balanced among the lifeform categories here than in the Parkland Natural Region and the Dry Mixedwood Natural Subregion, or in the present document. The main reason for this balanced distribution is due to the overall great diversity of vegetation across the Grassland Natural Region of Alberta. Notably scarce here are the conifer types and their sampled stands. Also few are sedge types, but these occur commonly across the region.

Table 5. Number of category types, number of stands per type, and average number of stands per type for the [1]Grassland Riparian and Wetland Sites Classification

Lifeform Category	Number of Types	Total Number of Sampled Stands Per Category	Average Number of Sampled Stands Per Type
Coniferous Forest	2	24	12.0
Deciduous Forest	16	304	19.0
Willow Shrub	12	247	20.6
Non-Willow Shrub	10	224	22.4
Sedge	4	130	32.5
Non-Sedge	18	392	21.8
TOTAL	***62***	***1,321***	***21.3***

[1]Grassland Sites Classification= *Classification and Management of Riparian and Wetland Sites of the Alberta Grassland Natural Region and Adjacent Subregions* (Thompson and Hansen 2002)

OVERALL COMPARISON OF THREE ALBERTA HABITAT TYPE CLASSIFICATION DOCUMENTS

Coniferous forest types and willow shrub types are far more predominant in the Lower Foothills, Upper Foothills, and Montane Natural Subregion sites than they are in either the Parkland Natural Region and the Dry Mixedwood Natural Subregion, or in the Grassland Natural Region (Table 6). The sharply increased number of deciduous forest types in the Grassland Natural Region is explained by the presence in this region of three riverine poplar (cottonwood) species, only one of which (*Populus balsamifera* [balsam poplar]) is found on Lower Foothills, Upper Foothills, and Montane Natural Subregion sites.

Table 6. Comparison of the three regional riparian and wetland habitat type and major seral community type documents for Alberta, along with the number of various types per lifeform and number of stands per each habitat type or major seral community type

Alberta Classification Document	Coniferous Forest Types (# Stands)	Deciduous Forest Types (# Stands)	Willow Shrub Types (# Stands)	Non-Willow Shrub Types (# Stands)	Sedge Types (# Stands)	Non-Sedge Types (# Stands)	**TOTAL TYPES (# Stands)**
[1]Lower Foothills, Upper Foothills and Montane Sites	15 (649)	6 (277)	25 (307)	10 (105)	3 (72)	7 (159)	**66 (1,569)**
[2]Parkland and Dry Mixedwood Sites	2 (50)	6 (211)	14 (197)	4 (35)	4 (79)	13 (135)	**43 (707)**
[3]Grassland Sites	2 (24)	16 (304)	12 (247)	10 (224)	4 (130)	18 (392)	**62 (1,321)**

[1]Lower Foothills, Upper Foothills and Montane Sites—*Classification and Management of Alberta's Riparian and Wetland Sites of the Lower Foothills, Upper Foothills, and Montane Natural Subregions* (Hansen and Thompson 2024)

[2]Parkland and Dry Mixedwood Sites —*Classification and Management of Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003)

[3]Grassland Sites—*Classification and Management of Riparian and Wetland Sites of the Alberta Grassland Natural Region and Adjacent Subregions* (Thompson and Hansen 2002)

The Lower Foothills, Upper Foothills, and Montane Natural Subregion group of sites, with four unique conifer tree species, is the only group with more than a single conifer tree species used in a type name (Table 7). Grassland sites have the most deciduous tree species used in type names, with five. The Lower Foothills, Upper Foothills, and Montane Natural Subregion group also has the greatest number of willow shrub species.

Table 7. Comparison of the three regional riparian and wetland habitat type and major seral community type documents for Alberta, with the number of various types per lifeform and number of unique plant species (i.e., indicator species) used in the name of each habitat type and community type

Alberta Classification Document	Coniferous Forest Types (# of Unique) (Coniferous) (Tree Species)	Deciduous Forest Types (# of Unique) (Deciduous) (Tree Species)	Willow Shrub Types (# of Unique) (Willow) (Shrub Species)	Non-Willow Shrub Types (# of Unique) Non-Willow (Shrub Species)	Sedge Types (# of Unique) (Sedge Species)	Non-Sedge Types (# of Unique) (Non-Sedge Species)
[1]Lower Foothills, Upper Foothills and Montane Sites	15 (4)	6 (3)	25 (10)	10 (7)	3 (3)	7 (7)
[2]Parkland and Dry Mixedwood Sites	2 (1)	6 (3)	14 (7)	4 (4)	4 (4)	13 (13)
[3]Grassland Sites	2 (1)	16 (5)	12 (6)	10 (10)	4 (4)	18 (18)

[1]Lower Foothills, Upper Foothills and Montane Sites—*Classification and Management of Alberta's Riparian and Wetland Sites of the Lower Foothills, Upper Foothills, and Montane Natural Subregions* (Hansen and Thompson 2024)

[2]Parkland and Dry Mixedwood Sites—*Classification and Management of Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003)

[3]Grassland Sites—*Classification and Management of Riparian and Wetland Sites of the Alberta Grassland Natural Region and Adjacent Subregions* (Thompson and Hansen 2002)

COMPARISON TO OTHER REGIONAL HABITAT TYPE CLASSIFICATION DOCUMENTS

The great discrepancy in the total number of stands analyzed for developing the classification document between Alberta's Lower Foothills, Upper Foothills, and Montane Natural Subregion and the other listed documents is due to differing sources of data. The large number of stands in the Alberta's Lower Foothills, Upper Foothills, and Montane data set (Table 8) were collected over many years, for a variety of unknown purposes, by various unknown workers; whereas the other documents listed with lower numbers of stands analyzed were developed using a majority of stand data collected by the document authors with focused intent on fulfilling the purpose at hand. The average number of stands per type described for Alberta's Lower Foothills, Upper Foothills, and Montane Sites (23.8) is well within the mid range of the regional documents listed (Table 8).

Table 8. Number of habitat types, major seral community types, total number of types, total number of stands analyzed for developing the classification, number of stands actually used in classification, and number of stands per type for adjacent regional riparian and wetland habitat type classification documents

Document	Number of Habitat Types	Number of Community Types	Total Number of Types	Total Number of Stands Analyzed for Developing Classification	Number of Stands Used in Classification	Average Number of Stands per Type
[1]Alberta's Lower Foothills, Upper Foothills and Montane Sites	39	27	66	16,198	1,569	23.8
[2]Alberta's Parkland and Dry Mixedwood Sites	24	19	43	814	707	16.4
[3]Alberta's Grassland Sites	26	36	62	1,517	1,321	21.3
[4]Montana Riparian/Wetland Sites	62	44	106	approx. 5,500	2,681	25.3
[5]Montana Forest Types	34	1	35	1,496	1,496	42.7

[1]Alberta's Lower Foothills, Upper Foothills and Montane Sites—*Classification and Management of Alberta's Riparian and Wetland Sites of the Lower Foothills, Upper Foothills, and Montane Natural Subregions* (Hansen and Thompson 2024)

[2]Alberta's Parkland and Dry Mixedwood Sites—*Classification and Management of Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003)

[3]Alberta's Grassland Sites—*Classification and Management of Riparian and Wetland Sites of the Alberta Grassland Natural Region and Adjacent Subregions* (Thompson and Hansen 2002)

[4]Montana Riparian/Wetland Sites—*Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995)

[5]Montana Forest Types = *Forest Habitat Types of Montana* (Pfister and others 1977)

COMPARISON TO ALBERTA PLANT COMMUNITY GUIDES/ECOLOGICAL SITES

The average number of stands analyzed per community types described ranges from 4.5 to 21.4 (Table 9). The Montane Natural Subregion was broken into three separate ecosections to isolate the differences found as the result of disjunct location, differing geologic formation, and other variables. The Cypress Hills Ecosection and the Montane North Ecosection are both relatively small outlier units with correspondingly small numbers of stands analyzed.

Table 9. Number of community types, number of plots, and number of plots per community type for the four Alberta plant community guides/ecological site documents covering the study area ***(NOTE: These documents include both upland and riparian/wetland sites)***

Location	Number of Community Types	Number of Stands	Average Number of Stands per Community Type
[1]Lower Foothills Range Plant Community Guide (Lawrence and others 2005)	123	1,205	9.8
[2]Upper Foothills Range Plant Community Guide (France and others 2020)	106	2,264	21.4
[3]Southern Montane Range Plant Community Guide (Baker and others 2020)	139	2,918	21.0
[4]Montane Subregion Ecological Sites (Willoughby and others 2021)			
Montane North Ecosection	70	512	7.3
Montane South Ecosection	163	3,145	19.3
Montane Cypress Hills Ecosection	43	195	4.5

[1]Lower Foothills Range Plant Community Guide—*Range Plant Community Types and Carrying Capacity for the Lower Foothills Subregion of Alberta. Fourth Approximation* (Lawrence and others 2005)

[2]Upper Foothills Range Plant Community Guide—*Rangeland Plant Communities and Range Health Assessment Guidelines for the Upper Foothills Natural Region of Alberta. Seventh Approximation* (France and others 2020)

[3]Southern Montane Range Plant Community Guide—*Range Plant Communities and Range Health Assessment Guidelines for the South Ecosection of the Montane Natural Subregion of Alberta. Eighth Approximation* (Baker and others 2020)

[4]Montane Subregion Ecological Sites—*Guide to Ecological Sites of the Montane Subregion. Fourth Approximation* (Willoughby and others 2021)

GEOGRAPHIC DISTRIBUTION OF TYPES

Table 10 lists the geographic distribution and relative abundance of riparian and wetland habitat types and community types in the southern portion of the Lower Foothills, Upper Foothills, and Montane Natural Subregions:

- Major—occupies extensive acreages in at least some portion of the riparian or wetland zone;
- Minor—seldom occupies large acreages but may be common on smaller areas within the riparian or wetland zone;
- Incidental—rarely occurs within the region, or is limited to narrow site conditions and/or very localized occurrence within the riparian or wetland zone;
- Restricted—small, isolated stands may occur within the riparian or wetland zone.

Alberta Natural Regions and Subregions follows Alberta Parks 2015 publication.

Table 10. Geographic distribution and abundance of habitat types and major seral community types in riparian and wetland sites of the Lower Foothills, Upper Foothills, and Montane Natural Subregions (number of sampled stands used in classification = 1,569)

Habitat Type/Community Type	Stands Sampled	Lower Foothills	Upper Foothills	Montane
Coniferous Tree Types (N = 15; Number of Stands Sampled = 649)				
Abies lasiocarpa/Calamagrostis canadensis habitat type (subalpine fir/marsh reed grass habitat type)	50	Minor	Minor	Minor
Abies lasiocarpa/Cornus canadensis habitat type (subalpine fir/bunchberry habitat type)	20	Minor	Minor	Incidental
Abies lasiocarpa/Ledum groenlandicum habitat type (subalpine fir/common Labrador tea habitat type)	31	Minor	Minor	Minor
Abies lasiocarpa/Oplopanax horridum habitat type (subalpine fir/devil's-club habitat type)	7	Incidental	Restricted	Restricted
Picea glauca/Calamagrostis canadensis habitat type (white spruce/marsh reed grass habitat type)	98	Major	Major	Major
Picea glauca/Equisetum arvense habitat type (white spruce/common horsetail habitat type)	45	Minor	Minor	Minor
Picea glauca/Ledum groenlandicum habitat type (white spruce/common Labrador tea habitat type)	22	Minor	Minor	Minor
Picea glauca/Viburnum edule habitat type (white spruce/low-bush cranberry habitat type)	28	Minor	Minor	Incidental

Table 10. (cont.)

Habitat Type/Community Type	Stands Sampled	Lower Foothills	Upper Foothills	Montane
Picea mariana/Calamagrostis canadensis habitat type				
black spruce/marsh reed grass habitat type	60	Major	Major	Major
Picea mariana/Carex aquatilis habitat type				
(black spruce/water sedge habitat type)	37	Minor	Minor	Minor
Picea mariana/Ledum groenlandicum habitat type				
(black spruce/common Labrador tea habitat type)	75	Major	Minor	Minor
Picea mariana/Lonicera involucrata habitat type				
(black spruce/bracted honeysuckle habitat type)	19	Minor	Incidental	Restricted
Pinus contorta/Alnus crispa community type				
(lodgepole pine/green alder community type)	42	Minor	Minor	Minor
Pinus contorta/Calamagrostis canadensis community type				
(lodgepole pine/marsh reed grass community type)	93	Major	Major	Major
Pinus contorta/Ledum groenlandicum community type				
(lodgepole pine/common Labrador tea community type)	22	Minor	Minor	Minor
Deciduous Tree Types (N = 6; Number of Stands Sampled = 277)				
Betula papyrifera community type				
(white birch community type)	20	Incidental	Restricted	Restricted
Populus balsamifera/Cornus stolonifera community type				
(balsam poplar/red-osier dogwood community type)	81	Major	Major	Major
Populus balsamifera community type				
(balsam poplar community type)	29	Minor	Minor	Minor
Populus tremuloides/Calamagrostis canadensis community type				
(aspen/marsh reed grass community type)	73	Major	Major	Major
Populus tremuloides/Viburnum edule community type				
(aspen/low-bush cranberry community type)	54	Minor	Minor	Minor
Populus tremuloides community type				
(aspen community type)	20	Minor	Minor	Minor

Table 10. (cont.)

Habitat Type/Community Type	Stands Sampled	Lower Foothills	Upper Foothills	Montane
Willow Shrub Types (N = 25; Number of Stands Sampled = 307)				
Salix barclayi/Deschampsia cespitosa habitat type (Barclay's willow/tufted hair grass habitat type)	10	Incidental	Incidental	Incidental
Salix barclayi community type (Barclay's willow community type)	12	Incidental	Incidental	Incidental
Salix bebbiana/Calamagrostis canadensis habitat type (beaked willow/marsh reed grass habitat type)	18	Major	Major	Major
Salix bebbiana/Carex aquatilis habitat type (beaked willow/water sedge habitat type)	10	Major	Major	Major
Salix bebbiana/Carex atherodes habitat type (beaked willow/awned sedge habitat type)	7	Minor	Minor	Incidental
Salix bebbiana/Carex utriculata habitat type (beaked willow/beaked sedge habitat type)	9	Major	Major	Major
Salix bebbiana community type (beaked willow community type)	36	Minor	Minor	Minor
Salix drummondiana/Carex utriculata habitat type (Drummond's willow/beaked sedge habitat type)	6	Incidental	Incidental	Incidental
Salix drummondiana community type (Drummond's willow community type)	10	Incidental	Incidental	Incidental
Salix exigua community type (sandbar willow community type)	23	Minor	Minor	Incidental
Salix glauca/Carex aquatilis habitat type (smooth willow/water sedge habitat type)	15	Incidental	Minor	Minor
Salix glauca community type (smooth willow community type)	17	Incidental	Minor	Minor
Salix myrtillifolia/Carex aquatilis habitat type (myrtle-leaved willow/water sedge habitat type)	14	Incidental	Minor	Minor
Salix myrtillifolia community type (myrtle-leaved willow community type)	7	Incidental	Minor	Minor
Salix pedicellaris/Carex aquatilis habitat type (bog willow/water sedge habitat type)	7	Incidental	Incidental	Incidental

Table 10. (cont.)

Habitat Type/Community Type	Stands Sampled	Lower Foothills	Upper Foothills	Montane
Salix pedicellaris/Potentilla palustris habitat type (bog willow/marsh cinquefoil habitat type)	7	Incidental	Incidental	Incidental
Salix pedicellaris community type (bog willow community type)	6	Incidental	Incidental	Incidental
Salix petiolaris/Carex atherodes habitat type (basket willow/awned sedge habitat type)	12	Minor	Minor	Minor
Salix petiolaris/Cornus stolonifera habitat type (basket willow/red-osier dogwood habitat type)	4	Minor	Minor	Minor
Salix petiolaris community type (basket willow community type)	5	Minor	Minor	Minor
Salix planifolia/Carex aquatilis habitat type (flat-leaved willow/water sedge habitat type)	15	Major	Major	Major
Salix planifolia/Carex atherodes habitat type (flat-leaved willow/awned sedge habitat type)	6	Minor	Minor	Incidental
Salix planifolia/Carex utriculata habitat type (flat-leaved willow/beaked sedge habitat type)	12	Major	Major	Major
Salix planifolia community type (flat-leaved willow community type)	16	Minor	Minor	Minor
Salix scouleriana community type (Scouler's willow community type)	23	Incidental	Incidental	Incidental
Non-Willow Shrub Types (N = 10; Number of Stands Sampled = 105)				
Alnus crispa community type (green alder community type)	5	Incidental	Incidental	Incidental
Alnus tenuifolia community type (river alder community type)	15	Incidental	Incidental	Incidental
Betula glandulosa/Carex aquatilis habitat type (bog birch/water sedge habitat type)	14	Incidental	Minor	Minor
Betula glandulosa/Deschampsia cespitosa habitat type (bog birch/tufted hair grass habitat type)	4	Incidental	Incidental	Incidental

Table 10. (cont.)

Habitat Type/Community Type	Stands Sampled	Lower Foothills	Upper Foothills	Montane
Betula glandulosa community type (bog birch community type)	6	Incidental	Minor	Minor
Betula pumila/Carex aquatilis habitat type (dwarf birch/water sedge habitat type)	6	Incidental	Incidental	Incidental
Betula pumila community type (dwarf birch community type)	4	Incidental	Incidental	Incidental
Elaeagnus commutata community type (silverberry community type)	19	Minor	Minor	Minor
Rosa acicularis community type (prickly rose community type)	20	Incidental	Incidental	Incidental
Symphoricarpos occidentalis community type (buckbrush community type)	12	Incidental	Incidental	Incidental
Sedge Types (N = 3; Number of Stands Sampled = 72)				
Carex aquatilis habitat type (water sedge habitat type)	25	Minor	Minor	Minor
Carex atherodes habitat type (awned sedge habitat type)	17	Minor	Minor	Incidental
Carex utriculata habitat type (beaked sedge habitat type)	30	Minor	Minor	Minor
Non-Sedge Types (N = 7; Number of Stands Sampled = 159)				
Calamagrostis canadensis habitat type (marsh reed grass habitat type)	18	Minor	Minor	Minor
Deschampsia cespitosa habitat type (tufted hair grass habitat type)	23	Incidental	Incidental	Incidental
Disturbed Herbaceous community type	53	Minor	Minor	Minor
Equisetum fluviatile habitat type (swamp horsetail habitat type)	14	Incidental	Incidental	Incidental

Table 10. (cont.)

Habitat Type/Community Type	Stands Sampled	Lower Foothills	Upper Foothills	Montane
Phalaris arundinacea habitat type (reed canary grass habitat type)	12	Incidental	Restricted	Restricted
Scirpus acutus habitat type (great bulrush habitat type)	15	Minor	Minor	Incidental
Typha latifolia habitat type (common cattail habitat type)	24	Minor	Minor	Minor

KEY TO THE RIPARIAN AND WETLAND HABITAT TYPES AND MAJOR SERAL COMMUNITY TYPES OF THE LOWER FOOTHILLS, UPPER FOOTHILLS, AND MONTANE NATURAL SUBREGIONS

Figure 3 is a map of the study area.

INSTRUCTIONS

1. ***Warning! The key is not the classification! Validate your determination by comparing the site characteristics with the written description of the type. Be aware that the environmental conditions described in the text are from both sampled sites and personal observations and may not include all the sites on the landscape in which the type is found.***
2. Accurately identify and record the canopy cover for all indicator species. The indicator species are those species used in the key. We have included an indicator handbook to aid in the identification of species used in the key.
3. The plot being classified must be representative of the stand as a whole. If not, take another plot. Environmental or vegetation uniformity is a primary consideration in plot selection.
4. Identify the potential lifeform using the ***Lifeform Group Key.*** Generally a tree species is considered successfully reproducing if 10 or more individuals per acre (25/ha) occupy ***or will occupy*** the site.
5. Within the correct lifeform group, key to the ***Habitat Type or Community Type*** by following the key literally. ***All*** conditions stipulated for each couplet must be satisfied in order to make a correct determination. The first set of conditions to satisfy the site characteristics should supply the correct classification.
6. In sites where the vegetation is obviously depauperate (unusually sparse) because of heavy grazing or browsing pressure, dense shading, or duff accumulations, or shows evidence of past fire, ***adjust the key downward*** to reflect the reduced canopy cover. For example, when the key refers to a plant with at least 5 percent canopy cover, the amount would be reduced to needing only 1 percent canopy cover. Extrapolation from the nearest non-depauperate condition occurring on a comparable site will assist in the correct determination of the type on an altered site.
   In addition, when classifying a site, be aware of and avoid ***microsites. Microsites*** are small areas that are atypical for the stand as a whole. Examples include windthrow pockets filled with colluvium/alluvium or raised hummocks of willows growing on either active or abandon beaver dams comprised of woody materials.
7. In sites that are heavily impacted by grazing or browsing pressures, look around to see if you see ***ANY*** shrub or tree growth or remnants (stumps). In extreme situations, the potential natural community (such as a willow habitat type) may be present only in the form of dwarf-looking, widely scattered individuals. If this is the case, again adjust the key downward to reflect the reduced canopy cover. Once again, extrapolation from the nearest non-grazed or non-browsed condition occurring on a comparable site will assist in the correct determination of the type.
8. Habitat type or community type can generally be projected for a site in an early seral stage by examining the closest site(s) having the same site conditions (soils, hydrologic characteristics, position on the landscape, etc.).
9. ***Caution!*** The potential of a site may change if there is a change in the soil and/or water characteristics of the site. Riparian and wetland sites can change site potential due to changes in the hydrology on a site. For example, a rather sudden change in site hydrology can occur with the draining of a beaver pond, causing vegetation potential to change from open water to willows and sedges. Slower and subtler hydrologic changes can result from accumulation of overbank alluvial deposits on a river floodplain terrace, causing vegetation potential to change over several decades from willows to drier tree and shrub species.
10. Throughout the key we have included an “Unclassified Site” couplet. This is intended to give the user the option of using this name for a site instead of “dropping” the user into an inappropriate type.

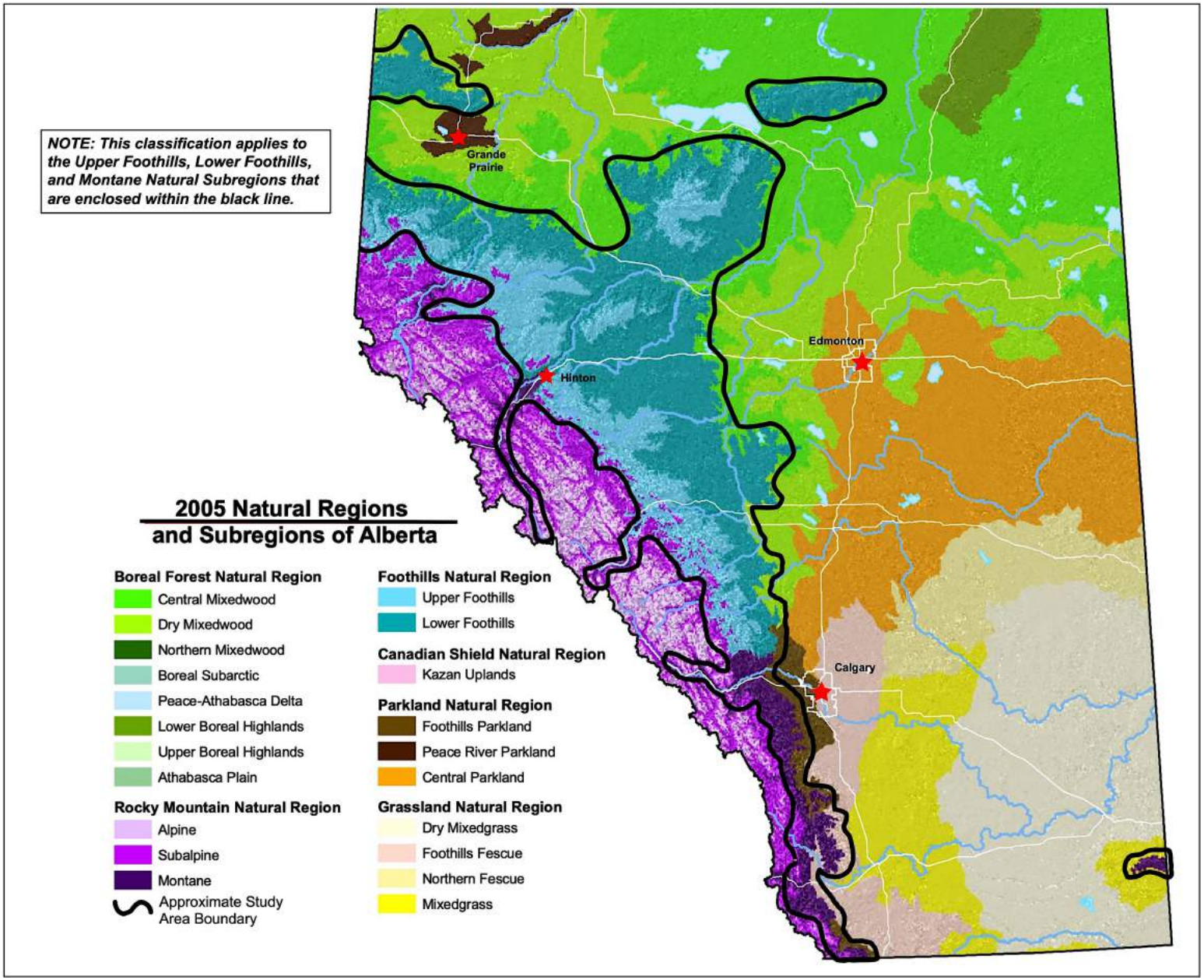


Figure 3. Natural regions and subregions of Alberta (Alberta Parks 2015) showing the study area enclosed with a black line (***NOTE:*** Map does not include the northern 1/3 of Alberta)

IMPORTANT NOTE: **As one progresses into the Upper and Lower Foothills Natural Regions, and on into the Montane Natural Subregion in Alberta, conifer tree diversity and abundance increases. (Essentially you are transitioning from the grassland zone [i.e., low elevation] to the alpine zone [i.e., upper elevation].) In these natural subregions, the total *Salix* (willow) canopy cover may occupy extensive areas along many riparian and wetland areas, but many of these communities may be seral to eventual conifer tree dominance, as indicated by conifer tree seedlings and saplings becoming established among the willows. This trend is also found all along the Rocky Mountain Front in the United States, including neighboring Montana.**

KEY TO THE LIFEFORM GROUPS

1. Coniferous trees present ***AND*** successfully reproducing (i.e., 25 or more trees per hectare, including seedlings and saplings) ***AND NOT*** restricted to microsites .....**Coniferous Forest Types (p. 46)**

1. Coniferous trees absent ***OR*** if present, restricted to microsites ***AND NOT*** successfully reproducing **2**

    2. Deciduous trees present ***AND*** successfully reproducing ***AND NOT*** restricted to microsites ....**Deciduous Forest Types (p. 51)**

    2. Deciduous trees absent ***OR*** if present, restricted to microsites ***AND NOT*** successfully reproducing.....**3**

3. Shrubs present with a combined canopy cover of at least 10 percent.....**Shrub Types (p. 53)**

3. Shrubs with a combined canopy cover of less than 10 percent; herbaceous species present with a combined canopy cover of at least 15 percent, or emergent herbaceous species with at least 5 percent canopy cover ....**Herbaceous Types (p. 61)**

KEY TO THE CONIFEROUS FOREST TYPES

NOTE: **Coniferous trees present *AND* successfully reproducing (i.e., 25 or more trees per hectare, including seedlings and saplings) *AND NOT* restricted to microsites.**

1. *Abies lasiocarpa* (subalpine fir) or *Abies balsamea* (balsam fir), individually or in combination, with at least 5 percent canopy cover and successfully reproducing.....***Abies lasiocarpa* (subalpine fir) Series (p. 47)**

1. *Abies lasiocarpa* (subalpine fir) or *Abies balsamea* (balsam fir) absent; if present, with a lesser canopy cover than other conifers ***AND*** not successfully reproducing.....**2**

    2. *Picea* species (spruce) present with at least 5 percent canopy cover and successfully reproducing.....**3**

    2. *Picea* species (spruce) absent; if present, with a lesser canopy cover than other conifers and not successfully reproducing **4**

3. *Picea mariana* (black spruce) with a greater canopy cover than the combined canopy cover of *Picea glauca* (white spruce) and *Picea engelmannii* (Engelmann spruce) ....***Picea mariana* (black spruce) Series (p. 48)**

3. *Picea glauca* (white spruce) and *Picea engelmannii* (Engelmann spruce) with a combined canopy cover greater than *Picea mariana* (black spruce).....***Picea glauca* (white spruce) Series (p. 49)**

    4. *Pinus contorta* (lodgepole pine) with at least 5 percent canopy cover..... .....***Pinus contorta* (lodgepole pine) Series (p. 50)**

    4. *Pinus contorta* (lodgepole pine) with less than 5 percent canopy cover.....**5**

5. The site has at least one of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology .....**Unclassified Riparian or Wetland Site**

    When the site does not fit any of the classification key, name the site in terms of a dominance type (cover type), using the species with the greatest canopy cover over 25 percent in the overstory, or tallest vegetation layer.

5. The site has none of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology .....**Upland Site**

    NOTE: Refer to the following Alberta plant community guides for possible site description:
    - *Range Plant Community Types and Carrying Capacity for the Lower Foothills Subregion of Alberta (Fourth Approximation)* (Lawrence and others 2005);
    - *Rangeland Plant Communities and Range Health Assessment Guidelines for the Upper Foothills Natural Region of Alberta (Seventh Approximation)* (France and others 2020);
    - *Range Plant Communities and Range Health Assessment Guidelines for the South Ecosection of the Montane Natural Subregion of Alberta (Eighth Approximation)* (Baker and others 2020; and
    - *Guide to ecological sites of the montane subregion (Fourth Approximation)* (Willoughby and others 2021).

ABIES LASIOCARPA (SUBALPINE FIR) SERIES
Key to the Types

1. *Calamagrostis canadensis* (marsh reed grass), *C. inexpansa* (northern reed grass), or *C. stricta* (narrow reed grass), individually or in combination, with at least 5 percent canopy cover ..... ***Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) Habitat Type (p. 65)**

1. *Calamagrostis canadensis* (marsh reed grass), *C. inexpansa* (northern reed grass), or *C. stricta* (narrow reed grass), individually or in combination, with less than 5 percent canopy cover..... **2**

    2. *Ledum groenlandicum* (common Labrador tea) with at least 5 percent canopy cover..... ***Abies lasiocarpa/Ledum groenlandicum*** **(subalpine fir/common Labrador tea) Habitat Type (p. 107)**

    2. *Ledum groenlandicum* (common Labrador tea) with less than 5 percent canopy cover..... **3**

3. *Oplopanax horridum* (devil's club) with at least 1 percent canopy cover ..... ***Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's club) Habitat Type (p. 124)**

3. *Oplopanax horridum* (devil's club) with less then 1 percent canopy cover..... **4**

    4. *Cornus canadensis* (bunchberry) or *Linnaea borealis* (twinflower) present ..... ***Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) Habitat Type (p. 87)**

    4. *Cornus canadensis* (bunchberry) or *Linnaea borealis* (twinflower) absent..... **5**

5. The site has at least one of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology ..... **Unclassified Riparian or Wetland Site**

    When the site does not fit any of the classification key, name the site in terms of a dominance type (cover type), using the species with the greatest canopy cover over 25 percent in the overstory, or tallest vegetation layer.

5. The site has none of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology ..... **Upland Site**

    NOTE: Refer to the following Alberta plant community guides for possible site description:
    - *Range Plant Community Types and Carrying Capacity for the Lower Foothills Subregion of Alberta (Fourth Approximation)* (Lawrence and others 2005);
    - *Rangeland Plant Communities and Range Health Assessment Guidelines for the Upper Foothills Natural Region of Alberta (Seventh Approximation)* (France and others 2020);
    - *Range Plant Communities and Range Health Assessment Guidelines for the South Ecosection of the Montane Natural Subregion of Alberta (Eighth Approximation)* (Baker and others 2020; and
    - *Guide to ecological sites of the montane subregion (Fourth Approximation)* (Willoughby and others 2021).

PICEA MARIANA (BLACK SPRUCE) SERIES
Key to the Types

1. *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), or *Carex atherodes* (awned sedge), individually or in combination, with at least 5 percent canopy cover ..... ***Picea mariana/Carex aquatilis* (black spruce/water sedge) Habitat Type (p. 261)**

1. *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), or *Carex atherodes* (awned sedge), individually or in combination, with less than 5 percent canopy cover **2**

    2. *Calamagrostis canadensis* (marsh reed grass), *C. inexpansa* (northern reed grass), or *C. stricta* (narrow reed grass), individually or in combination, with at least 5 percent canopy cover ..... ***Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) Habitat Type (p. 239)**

    2. *Calamagrostis canadensis* (marsh reed grass), *C. inexpansa* (northern reed grass), or *C. stricta* (narrow reed grass), individually or in combination, with less than 5 percent canopy cover..... **3**

3. *Ledum groenlandicum* (common Labrador tea) with at least 5 percent canopy cover..... ***Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) Habitat Type (p. 282)**

3. *Ledum groenlandicum* (common Labrador tea) with less than 5 percent canopy cover **4**

    4. *Lonicera involucrata* (bracted honeysuckle) with at least 1 percent canopy cover ..... ***Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) Habitat Type (p. 301)**

    4. *Lonicera involucrata* (bracted honeysuckle) with less than 1 percent canopy cover..... **5**

5. The site has at least one of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology ..... **Unclassified Riparian or Wetland Site**

    When the site does not fit any of the classification key, name the site in terms of a dominance type (cover type), using the species with the greatest canopy cover over 25 percent in the overstory, or tallest vegetation layer.

5. The site has none of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology ..... **Upland Site**

    NOTE: Refer to the following Alberta plant community guides for possible site description:
    - *Range Plant Community Types and Carrying Capacity for the Lower Foothills Subregion of Alberta (Fourth Approximation)* (Lawrence and others 2005);
    - *Rangeland Plant Communities and Range Health Assessment Guidelines for the Upper Foothills Natural Region of Alberta (Seventh Approximation)* (France and others 2020);
    - *Range Plant Communities and Range Health Assessment Guidelines for the South Ecosection of the Montane Natural Subregion of Alberta (Eighth Approximation)* (Baker and others 2020; and
    - *Guide to ecological sites of the montane subregion (Fourth Approximation)* (Willoughby and others 2021).

PICEA GLAUCA (WHITE SPRUCE) SERIES
Key to the Types

1. *Calamagrostis canadensis* (marsh reed grass), *C. inexpansa* (northern reed grass), or *C. stricta* (narrow reed grass), individually or in combination, with at least 5 percent canopy cover ....***Picea glauca/Calamagrostis canadensis*** **(white spruce/marsh reed grass) Habitat Type (p. 142)**

1. *Calamagrostis canadensis* (marsh reed grass), *C. inexpansa* (northern reed grass), or *C. stricta* (narrow reed grass), individually or in combination, with less than 5 percent canopy cover.....**2**

    2. *Equisetum arvense* (common horsetail), *Equisetum pratense* (meadow horsetail), or *Equisetum sylvaticum* (woodland horsetail) with a combined canopy cover of at least 25 percent ....***Picea glauca/Equisetum arvense*** **(white spruce/common horsetail) Habitat Type (p. 171)**

    2. *Equisetum arvense* (common horsetail), *Equisetum pratense* (meadow horsetail), or *Equisetum sylvaticum* (woodland horsetail) with a combined canopy cover of less than 25 percent.....**3**

3. *Ledum groenlandicum* (common Labrador tea) with at least 5 percent canopy cover..... .....***Picea glauca/Ledum groenlandicum*** .....**(white spruce/common Labrador tea) Habitat Type (p. 195)**

3. *Ledum groenlandicum* (common Labrador tea) with less than 5 percent canopy cover.....**4**

    4. *Viburnum edule* (low-bush cranberry), *Cornus stolonifera* (red-osier dogwood), or *Salix* species (willows) with a combined canopy cover of at least 1 percent ....***Picea glauca/Viburnum edule*** **(white spruce/low-bush cranberry) Habitat Type (p. 214)**

    4. *Viburnum edule* (low-bush cranberry), *Cornus stolonifera* (red-osier dogwood), or *Salix* species (willows) with a combined canopy cover of less than 1 percent.....**5**

5. The site has at least one of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology .....**Unclassified Riparian or Wetland Site**

    When the site does not fit any of the classification key, name the site in terms of a dominance type (cover type), using the species with the greatest canopy cover over 25 percent in the overstory, or tallest vegetation layer.

5. The site has none of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology .....**Upland Site**

    NOTE: Refer to the following Alberta plant community guides for possible site description:
    - *Range Plant Community Types and Carrying Capacity for the Lower Foothills Subregion of Alberta (Fourth Approximation)* (Lawrence and others 2005);
    - *Rangeland Plant Communities and Range Health Assessment Guidelines for the Upper Foothills Natural Region of Alberta (Seventh Approximation)* (France and others 2020);
    - *Range Plant Communities and Range Health Assessment Guidelines for the South Ecosection of the Montane Natural Subregion of Alberta (Eighth Approximation)* (Baker and others 2020; and
    - *Guide to ecological sites of the montane subregion (Fourth Approximation)* (Willoughby and others 2021).

PINUS CONTORTA (LODGEPOLE PINE) SERIES
Key to the Community Types

1. *Calamagrostis canadensis* (marsh reed grass), *C. inexpansa* (northern reed grass), or *C. stricta* (narrow reed grass), individually or in combination, with at least 5 percent canopy cover ..... ***Pinus contorta/Calamagrostis canadensis*** **(lodgepole pine/marsh reed grass) Community Type (p. 332)**

1. *Calamagrostis canadensis* (marsh reed grass), *C. inexpansa* (northern reed grass), or *C. stricta* (narrow reed grass), individually or in combination, with less than 5 percent canopy cover..... **2**

    2. *Ledum groenlandicum* (common Labrador tea) with at least 5 percent canopy cover..... ***Pinus contorta/Ledum groenlandicum*** **(lodgepole pine/common Labrador tea) Community Type (p. 347)**

    2. *Ledum groenlandicum* (common Labrador tea) with less than 5 percent canopy cover..... **3**

3. *Alnus crispa* (green alder) or *Alnus tenuifolia* (river alder) with a combined canopy cover of at least 5 percent..... ***Pinus contorta/Alnus crispa*** **(lodgepole pine/green alder) Community Type (p. 319)**

3. *Alnus crispa* (green alder) or *Alnus tenuifolia* (river alder) with a combined canopy cover of less than 5 percent **4**

    4. The site has at least one of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology ..... **Unclassified Riparian or Wetland Site**

        When the site does not fit any of the classification key, name the site in terms of a dominance type (cover type), using the species with the greatest canopy cover over 25 percent in the overstory, or tallest vegetation layer.

    4. The site has none of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology..... **Upland Site**

NOTE: Refer to the following Alberta plant community guides for possible site description:

- *Range Plant Community Types and Carrying Capacity for the Lower Foothills Subregion of Alberta (Fourth Approximation)* (Lawrence and others 2005);
- *Rangeland Plant Communities and Range Health Assessment Guidelines for the Upper Foothills Natural Region of Alberta (Seventh Approximation)* (France and others 2020);
- *Range Plant Communities and Range Health Assessment Guidelines for the South Ecosection of the Montane Natural Subregion of Alberta (Eighth Approximation)* (Baker and others 2020; and
- *Guide to ecological sites of the montane subregion (Fourth Approximation)* (Willoughby and others 2021).

KEY TO THE DECIDUOUS FOREST TYPES

NOTE: **Deciduous trees present *AND* successfully reproducing *AND NOT* restricted to microsites.**

1. *Populus tremuloides* (aspen) with at least 5 percent canopy cover **2**

1. *Populus tremuloides* (aspen) with less than 5 percent canopy cover **4**

    2. *Calamagrostis canadensis* (marsh reed grass), *C. inexpansa* (northern reed grass), or *C. stricta* (narrow reed grass), individually or in combination, with at least 5 percent canopy cover ..... ***Populus tremuloides*/*Calamagrostis canadensis*** **(aspen/marsh reed grass) Community Type (p. 403)**

    2. *Calamagrostis canadensis* (marsh reed grass), *C. inexpansa* (northern reed grass), or *C. stricta* (narrow reed grass), individually or in combination, with less than 5 percent canopy cover..... **3**

3. *Viburnum edule* (low-bush cranberry), *Cornus stolonifera* (red-osier dogwood), or *Salix* species (willows), individually or in combination, with at least 1 percent canopy cover, ***OR*** *Populus balsamifera* (balsam poplar) with at least 15 percent canopy cover ..... ***Populus tremuloides*/*Viburnum edule*** **(aspen/low-bush cranberry) Community Type (p. 422)**

3. *Viburnum edule* (low-bush cranberry), *Cornus stolonifera* (red-osier dogwood), or *Salix* species (willows), in combination, with less than 1 percent canopy cover, ***AND*** *Populus balsamifera* (balsam poplar) with less than 15 percent canopy cover ..... ***Populus tremuloides*** **(aspen) Community Type (p. 441)**

    4. *Betula papyrifera* (white birch) with at least 5 percent canopy cover, and greater canopy cover than *Populus balsamifera* (balsam poplar)..... ***Betula papyrifera*** **(white birch) Community Type (p. 358)**

    4. *Populus balsamifera* (balsam poplar) with at least 5 percent canopy cover, and greater canopy cover than *Betula papyrifera* (white birch) **5**

5. Shrub species with at least 25 percent canopy cover, ***AND*** *Cornus stolonifera* (red-osier dogwood), *Viburnum edule* (low-bush cranberry), or *Salix* species (willows), individually or in combination, with at least 1 percent canopy cover ..... ***Populus balsamifera*/*Cornus stolonifera*** **(balsam poplar/red-osier dogwood) Community Type (p. 370)**

5. Shrub species with less than 25 percent canopy cover, ***OR*** *Cornus stolonifera* (red-osier dogwood), *Viburnum edule* (low-bush cranberry), or *Salix* species (willows), individually or in combination, with less than 1 percent canopy cover **6**

    6. *Populus balsamifera* (balsam poplar) with at least 5 percent canopy cover ..... ***Populus balsamifera*** **(balsam poplar) Community Type (p. 388)**

    6. *Populus balsamifera* (balsam poplar) with less than 5 percent canopy cover **7**

7. The site has at least one of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology .....**Unclassified Riparian or Wetland Site**

   When the site does not fit any of the classification key, name the site in terms of a dominance type (cover type), using the species with the greatest canopy cover over 25 percent in the overstory, or tallest vegetation layer.

7. The site has none of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology .....**Upland Site**

   NOTE: Refer to the following Alberta plant community guides for possible site description:
   - *Range Plant Community Types and Carrying Capacity for the Lower Foothills Subregion of Alberta (Fourth Approximation)* (Lawrence and others 2005);
   - *Rangeland Plant Communities and Range Health Assessment Guidelines for the Upper Foothills Natural Region of Alberta (Seventh Approximation)* (France and others 2020);
   - *Range Plant Communities and Range Health Assessment Guidelines for the South Ecosection of the Montane Natural Subregion of Alberta (Eighth Approximation)* (Baker and others 2020; and
   - *Guide to ecological sites of the montane subregion (Fourth Approximation)* (Willoughby and others 2021).

KEY TO THE SHRUB TYPES

NOTE: **Shrubs present with a combined canopy cover of at least 10 percent.**

1. *Salix* species (willows) present with at least 5 percent combined canopy cover ..... **Willow Shrub Key (p. 53)**

1. *Salix* species (willows) absent ***OR*** if present, with less than 5 percent canopy cover ..... **Non-Willow Shrub Key (p. 59)**

WILLOW SHRUB KEY

***NOTE 1: Salix* species (willows) are present with at least 5 percent combined canopy cover.**

NOTE 2: Many willow-dominated stands may have 25 or more conifer trees per hectare (including conifer seedlings and saplings). These stands are actually conifer habitat types that are currently dominated by seral willow species. If the stand you are assessing is characterized by this appearance, go back to the KEY TO THE LIFEFORM GROUPS to key out the appropriate conifer habitat type.

1. *Salix pedicellaris* (bog willow) with the greatest canopy cover..... ***Salix pedicellaris* (bog willow) Series (p. 55)**

1. *Salix pedicellaris* (bog willow) absent ***OR*** if present, with a lesser canopy cover than other individual willow species **2**

    2. *Salix planifolia* (flat-leaved willow) with the greatest canopy cover..... ***Salix planifolia* (flat-leaved willow) Series (p. 55)**

    2. *Salix planifolia* (flat-leaved willow) absent ***OR*** if present, with a lesser canopy cover than other individual willow species **3**

3. *Salix bebbiana* (beaked willow) with the greatest canopy cover ..... ***Salix bebbiana* (beaked willow) Series (p. 56)**

3. *Salix bebbiana* (beaked willow) absent ***OR*** if present, with a lesser canopy cover than other individual willow species **4**

    4. *Salix drummondiana* (Drummond's willow) with the greatest canopy cover ..... ***Salix drummondiana* (Drummond's willow) Series (p. 57)**

    4. *Salix drummondiana* (Drummond's willow) absent ***OR*** if present, with a lesser canopy cover than other individual willow species **5**

5. *Salix glauca* (smooth willow) with the greatest canopy cover ..... ***Salix glauca* (smooth willow) Series (p. 57)**

5. *Salix glauca* (smooth willow) absent ***OR*** if present, with a lesser canopy cover than other individual willow species **6**

    6. *Salix myrtillifolia* (myrtle-leaved willow) with the greatest canopy cover ..... ***Salix myrtillifolia* (myrtle-leaved willow) Series (p. 57)**

    6. *Salix myrtillifolia* (myrtle-leaved willow) absent ***OR*** if present, with a lesser canopy cover than other individual willow species **7**

7. *Salix petiolaris* (basket willow) with the greatest canopy cover ..... ***Salix petiolaris* (basket willow) Series (p. 58)**

7. *Salix petiolaris* (basket willow) absent ***OR*** if present, with a lesser canopy cover than other individual willow species **8**

    8. *Salix barclayi* (Barclay's willow) with the greatest canopy cover ..... ***Salix barclayi* (Barclay's willow) Series (p. 58)**

    8. Individual willow species, not mentioned earlier in the key, with greater canopy cover than *Salix barclayi* (Barclay's willow) **9**

9. Individual ***NON-WILLOW*** shrub species with greater canopy cover than any individual ***WILLOW*** shrub species not mentioned previously in the key. ..... **Go to the Non-Willow Key (p. 59)**

9. Individual ***WILLOW*** shrub species, not mentioned earlier in the key, with greater canopy cover than any individual ***NON-WILLOW*** shrub species **10**

    10. *Salix exigua* (sandbar willow) with the greatest canopy cover ..... ***Salix exigua* (sandbar willow) Community Type (p. 603)**

    10. *Salix exigua* (sandbar willow) absent ***OR*** if present, with a lesser canopy cover than other individual willow species **11**

11. *Salix scouleriana* (Scouler's willow) with the greatest canopy cover ..... ***Salix scouleriana* (Scouler's willow) Community Type (p. 828)**

11. *Salix scouleriana* (Scouler's willow) absent ***OR*** if present, with a lesser canopy cover than other individual willow species **12**

12. The site has at least one of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology .....**Unclassified Riparian or Wetland Site**

    When the site does not fit any of the classification key, name the site in terms of a dominance type (cover type), using the species with the greatest canopy cover over 25 percent in the overstory, or tallest vegetation layer.

12. The site has none of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology .....**Upland Site**

NOTE: Refer to the following Alberta plant community guides for possible site description:

- *Range Plant Community Types and Carrying Capacity for the Lower Foothills Subregion of Alberta (Fourth Approximation)* (Lawrence and others 2005);
- *Rangeland Plant Communities and Range Health Assessment Guidelines for the Upper Foothills Natural Region of Alberta (Seventh Approximation)* (France and others 2020);
- *Range Plant Communities and Range Health Assessment Guidelines for the South Ecosection of the Montane Natural Subregion of Alberta (Eighth Approximation)* (Baker and others 2020; and
- *Guide to ecological sites of the montane subregion (Fourth Approximation)* (Willoughby and others 2021).

SALIX PEDICELLARIS (BOG WILLOW) SERIES
Key to the Types

1. *Carex aquatilis* (water sedge), *C. utriculata* (beaked sedge), or *C. atherodes* (awned sedge), individually or in combination, with at least 5 percent canopy cover .....
.....***Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) Habitat Type (p. 681)**

1. *Carex aquatilis* (water sedge), *C. utriculata* (beaked sedge), or *C. atherodes* (awned sedge), individually or in combination, with less than 5 percent canopy cover.....**2**

    2. *Potentilla palustris* (bog willow/marsh cinquefoil) with at least 1 percent canopy cover.....
    .....***Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) Habitat Type (p. 697)**

    2. *Potentilla palustris* (bog willow/marsh cinquefoil) with less than 1 percent canopy cover .....
    .....***Salix pedicellaris* (bog willow) Community Type (p. 712)**

SALIX PLANIFOLIA (FLAT-LEAVED WILLOW) SERIES
Key to the Types

1. *Carex utriculata* (beaked sedge) with at least 5 percent canopy cover ***AND*** a greater canopy cover than either *C. aquatilis* (water sedge) or *C. atherodes* (awned sedge).....
.....***Salix planifolia*/*Carex utriculata* (flat-leaved willow/beaked sedge) Habitat Type (p. 798)**

1. *Carex utriculata* (beaked sedge) with less than 5 percent canopy cover ***AND WITHOUT*** a greater canopy cover than either *C. aquatilis* (water sedge) or *C. atherodes* (awned sedge).....**2**

2. *Carex aquatilis* (water sedge) with at least 5 percent canopy cover ***AND*** a greater canopy cover than *C. atherodes* (awned sedge) ..... ***Salix planifolia*/*Carex aquatilis* (flat-leaved willow/water sedge) Habitat Type (p. 763)**

2. *Carex aquatilis* (water sedge) with less than 5 percent canopy cover ***AND WITHOUT*** a greater canopy cover than *C. atherodes* (awned sedge) **3**

3. *Carex atherodes* (awned sedge) with at least 5 percent canopy cover ..... ***Salix planifolia*/*Carex atherodes* (flat-leaved willow/awned sedge) Habitat Type (p. 781)**

3. *Carex atherodes* (awned sedge) with less than 5 percent canopy cover ..... ***Salix planifolia* (flat-leaved willow) Community Type (p. 815)**

SALIX BEBBIANA (BEAKED WILLOW) SERIES
Key to the Types

1. *Carex utriculata* (beaked sedge) with at least 5 percent canopy cover ***AND*** a greater canopy cover than either *C. aquatilis* (water sedge) or *C. atherodes* (awned sedge) ..... ***Salix bebbiana*/*Carex utriculata* (beaked willow/beaked sedge) Habitat Type (p. 541)**

1. *Carex utriculata* (beaked sedge) with less than 5 percent canopy cover ***AND WITHOUT*** a greater canopy cover than either *C. aquatilis* (water sedge) or *C. atherodes* (awned sedge) **2**

2. *Carex aquatilis* (water sedge) with at least 5 percent canopy cover ***AND*** a greater canopy cover than *C. atherodes* (awned sedge) ..... ***Salix bebbiana*/*Carex aquatilis* (beaked willow/water sedge) Habitat Type (p. 505)**

2. *Carex aquatilis* (water sedge) with less than 5 percent canopy cover ***AND WITHOUT*** a greater canopy cover than *C. atherodes* (awned sedge) **3**

3. *Carex atherodes* (awned sedge) with at least 5 percent canopy cover ..... ***Salix bebbiana*/*Carex atherodes* (beaked willow/awned sedge) Habitat Type (p. 523)**

3. *Carex atherodes* (awned sedge) with less than 5 percent canopy cover **4**

4. *Calamagrostis canadensis* (marsh reed grass), *C. inexpansa* (northern reed grass), or *C. stricta* (narrow reed grass), individually or in combination, with at least 10 percent canopy cover ..... ***Salix bebbiana*/*Calamagrostis canadensis* (beaked willow/marsh reed grass) Habitat Type (p. 484)**

4. *Calamagrostis canadensis* (marsh reed grass), *C. inexpansa* (northern reed grass), or *C. stricta* (narrow reed grass), individually or in combination, with less than 10 percent canopy cover ..... ***Salix bebbiana* (beaked willow) Community Type (p. 559)**

SALIX DRUMMONDIANA (DRUMMOND'S WILLOW) SERIES
Key to the Types

1. *Carex utriculata* (beaked sedge), *C. aquatilis* (water sedge), or *C. atherodes* (awned sedge), individually or in combination, with at least 5 percent canopy cover ..... ***Salix drummondiana*/*Carex utriculata*** **(Drummond's willow/beaked sedge) Habitat Type (p. 574)**

1. *Carex utriculata* (beaked sedge), *C. aquatilis* (water sedge), or *C. atherodes* (awned sedge), individually or in combination, with less than 5 percent canopy cover..... ***Salix drummondiana*** **(Drummond's willow) Community Type (p. 592)**

SALIX GLAUCA (SMOOTH WILLOW) SERIES
Key to the Types

1. *Carex aquatilis* (water sedge), *C. utriculata* (beaked sedge), or *C. atherodes* (awned sedge), individually or in combination, with at least 5 percent canopy cover ..... ***Salix glauca*/*Carex aquatilis*** **(smooth willow/water sedge) Habitat Type (p. 617)**

1. *Carex aquatilis* (water sedge), *C. utriculata* (beaked sedge), or *C. atherodes* (awned sedge), individually or in combination, with less than 5 percent canopy cover..... ***Salix glauca*** **(smooth willow) Community Type (p. 636)**

SALIX MYRTILLIFOLIA (MYRTLE-LEAVED WILLOW) SERIES
Key to the Types

1. *Carex aquatilis* (water sedge), *C. utriculata* (beaked sedge), or *C. atherodes* (awned sedge), individually or in combination, with at least 5 percent canopy cover ..... ***Salix myrtillifolia*/*Carex aquatilis*** **(myrtle-leaved willow/water sedge) Habitat Type (p. 649)**

1. *Carex aquatilis* (water sedge), *C. utriculata* (beaked sedge), or *C. atherodes* (awned sedge), individually or in combination, with less than 5 percent canopy cover..... ***Salix myrtillifolia*** **(myrtle-leaved willow) Community Type (p. 669)**

SALIX PETIOLARIS (BASKET WILLOW) SERIES
Key to the Types

1. *Carex atherodes* (awned sedge), *C. aquatilis* (water sedge), or *C. utriculata* (beaked sedge), individually or in combination, with at least 5 percent canopy cover ..... ***Salix petiolaris/Carex atherodes* (basket willow/awned sedge) Habitat Type (p. 720)**

1. *Carex atherodes* (awned sedge), *C. aquatilis* (water sedge), or *C. utriculata* (beaked sedge), individually or in combination, with less than 5 percent canopy cover **2**

    2. *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover ..... ***Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) Habitat Type (p. 739)**

    2. *Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover ..... ***Salix petiolaris* (basket willow) Community Type (p. 753)**

SALIX BARCLAYI (BARCLAY'S WILLOW) SERIES
Key to the Types

1. *Deschampsia cespitosa* (tufted hair grass) with at least 5 percent canopy cover ..... ***Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) Habitat Type (p. 456)**

1. *Deschampsia cespitosa* (tufted hair grass) with less than 5 percent canopy cover ..... ***Salix barclayi* (Barclay's willow) Community Type (p. 473)**

NON-WILLOW SHRUB KEY

***NOTE: Salix* species (willows) absent *OR* if present, with less than 5 percent canopy cover; other shrub species present.**

1. *Betula glandulosa* (bog birch) with at least 5 percent canopy cover **2**

1. *Betula glandulosa* (bog birch) with less than 5 percent canopy cover **4**

    2. *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), or *Carex atherodes* (awned sedge), individually or in combination, with at least 5 percent canopy cover ..... ***Betula glandulosa*/*Carex aquatilis* (bog birch/water sedge) Habitat Type (p. 864)**

    2. *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), or *Carex atherodes* (awned sedge), individually or in combination, with less than 5 percent canopy cover **3**

3. *Deschampsia cespitosa* (tufted hair grass) with at least 5 percent canopy cover ..... ***Betula glandulosa*/*Deschampsia cespitosa* (bog birch/water sedge) Habitat Type (p. 884)**

3. *Deschampsia cespitosa* (tufted hair grass) with less than 5 percent canopy cover ..... ***Betula glandulosa* (bog birch) Community Type (p. 899)**

    4. *Betula pumila* (dwarf birch) with at least 5 percent canopy cover **5**

    4. *Betula pumila* (dwarf birch) with less than 5 percent canopy cover **6**

5. *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), or *Carex atherodes* (awned sedge), individually or in combination, with at least 5 percent canopy cover ..... ***Betula pumila*/*Carex aquatilis* (dwarf birch/water sedge) Habitat Type (p. 910)**

5. *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), or *Carex atherodes* (awned sedge), individually or in combination, with less than 5 percent canopy cover ..... ***Betula pumila* (dwarf birch) Community Type (p. 927)**

    6. *Alnus crispa* (green alder) with at least 5 percent canopy cover ***AND*** the greatest canopy cover in the tallest layer ..... ***Alnus crispa* (green alder) Community Type (p. 841)**

    6. *Alnus crispa* (green alder) with less than 5 percent canopy cover ***OR*** does not have the greatest canopy cover in the tallest layer **7**

7. *Alnus tenuifolia* (river alder) with at least 5 percent canopy cover ***AND*** the greatest canopy cover in the tallest layer ..... ***Alnus tenuifolia* (river alder) Community Type (p. 851)**

7. *Alnus tenuifolia* (river alder) with less than 5 percent canopy cover ***OR*** does not have the greatest canopy cover in the tallest layer **8**

8. *Elaeagnus commutata* (silverberry) with at least 5 percent canopy cover ***AND*** the greatest canopy cover in the tallest layer .....***Elaeagnus commutata* (silverberry) Community Type (p. 937)**

8. *Elaeagnus commutata* (silverberry) with less than 5 percent canopy cover ***OR*** does not have the greatest canopy cover in the tallest layer **9**

9. *Rosa acicularis* (prickly rose) or *R. woodsii* (woods rose), individually or in combination, with at least 15 percent canopy cover ***AND*** the greatest canopy cover in the tallest layer ....***Rosa acicularis* (prickly rose) Community Type (p. 951)**

9. *Rosa acicularis* (prickly rose) or *R. woodsii* (woods rose), individually or in combination, with less than 15 percent canopy cover ***AND*** do not have the greatest canopy cover in the tallest layer **10**

10. *Symphoricarpos occidentalis* (buckbrush) or *S. albus* (snowberry), individually or in combination, with at least 5 percent canopy cover ***AND*** the greatest canopy cover in the tallest layer..... .....***Symphoricarpos occidentalis* (buckbrush) Community Type (p. 965)**

10. *Symphoricarpos occidentalis* (buckbrush) or *S. albus* (snowberry) with a combined canopy cover of less than 5 percent canopy cover ***OR*** do not have the greatest canopy cover in the tallest layer.....**11**

11. The site has at least one of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology .....**Unclassified Riparian or Wetland Site**

When the site does not fit any of the classification key, name the site in terms of a dominance type (cover type), using the species with the greatest canopy cover over 25 percent in the overstory, or tallest vegetation layer.

11. The site has none of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology.....**Upland Site**

NOTE: Refer to the following Alberta plant community guides for possible site description:

- *Range Plant Community Types and Carrying Capacity for the Lower Foothills Subregion of Alberta (Fourth Approximation)* (Lawrence and others 2005);
- *Rangeland Plant Communities and Range Health Assessment Guidelines for the Upper Foothills Natural Region of Alberta (Seventh Approximation)* (France and others 2020);
- *Range Plant Communities and Range Health Assessment Guidelines for the South Ecosection of the Montane Natural Subregion of Alberta (Eighth Approximation)* (Baker and others 2020; and
- *Guide to ecological sites of the montane subregion (Fourth Approximation)* (Willoughby and others 2021).

KEY TO THE HERBACEOUS TYPES

NOTE: **Herbaceous species present with a combined canopy cover of at least 15 percent, or emergent herbaceous species with at least 5 percent canopy cover; shrubs with a combined canopy cover of less than 10 percent.**

1. *Carex* species (sedges) ***WITH*** a combined canopy cover of at least 25 percent.....**Sedge Key (p. 61)**

1. *Carex* species (sedges) ***WITHOUT*** a combined canopy cover of at least 25 percent .....**Non-Sedge Key (p. 63)**

SEDGE KEY

NOTE: Carex **species (sedges)** ***WITH*** **a combined canopy cover of at least 25 percent.**

1. *Carex utriculata* (beaked sedge) with at least 25 percent canopy cover, ***AND*** a greater canopy cover than the combined canopy cover of *Carex aquatilis* (water sedge) and *Carex atherodes* (awned sedge).....***Carex utriculata*** **(beaked sedge) Habitat Type (p. 1008)**

1. *Carex utriculata* (beaked sedge) with less than 25 percent canopy cover, ***OR*** with a canopy cover less than the combined canopy cover of *Carex aquatilis* (water sedge) and *Carex atherodes* (awned sedge).....**2**

    2. *Carex aquatilis* (water sedge) with at least 25 percent canopy cover ***AND*** a greater canopy cover than the combined canopy cover of *Carex utriculata* (beaked sedge) and *Carex atherodes* (awned sedge).....***Carex aquatilis*** **(water sedge) Habitat Type (p. 977)**

    2. *Carex aquatilis* (water sedge) with less than 25 percent canopy cover ***OR*** with a canopy cover less than the combined canopy cover of *Carex utriculata* (beaked sedge) and *Carex atherodes* (awned sedge).....**3**

3. *Carex atherodes* (awned sedge) with at least 25 percent canopy cover ***AND*** a greater canopy cover than the combined canopy cover of *Carex utriculata* (beaked sedge) and *Carex aquatilis* (water sedge).....***Carex atherodes*** **(awned sedge) Habitat Type (p. 994)**

3. *Carex atherodes* (awned sedge) with less than 25 percent canopy cover **4**

4. The site has at least one of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology .....**Unclassified Riparian or Wetland Site**

   When the site does not fit any of the classification key, name the site in terms of a dominance type (cover type), using the species with the greatest canopy cover over 25 percent in the overstory, or tallest vegetation layer.

4. The site has none of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology.....**Upland Site**

NOTE: Refer to the following Alberta plant community guides for possible site description:

- *Range Plant Community Types and Carrying Capacity for the Lower Foothills Subregion of Alberta (Fourth Approximation)* (Lawrence and others 2005);
- *Rangeland Plant Communities and Range Health Assessment Guidelines for the Upper Foothills Natural Region of Alberta (Seventh Approximation)* (France and others 2020);
- *Range Plant Communities and Range Health Assessment Guidelines for the South Ecosection of the Montane Natural Subregion of Alberta (Eighth Approximation)* (Baker and others 2020; and
- *Guide to ecological sites of the montane subregion (Fourth Approximation)* (Willoughby and others 2021).

NON-SEDGE KEY

***NOTE: Carex* species (sedges) *WITHOUT* a combined canopy cover of at least 25 percent; other herbaceous species present.**

1. *Typha latifolia* (common cattail) or *T. angustifolia* (narrow-leaved cattail), individually or in combination, with at least 25 percent canopy cover ..... ***Typha latifolia* (common cattail) Habitat Type (p. 1109)**

1. *Typha latifolia* (common cattail) or *T. angustifolia* (narrow-leaved cattail), individually or in combination, with less than 25 percent canopy cover **2**

    2. *Scirpus acutus* (great bulrush) or *S. validus* (common great bulrush), individually or in combination, with at least 25 percent canopy cover ..... ***Scirpus acutus* (great bulrush) Habitat Type (p. 1096)**

    2. *Scirpus acutus* (great bulrush) or *S. validus* (common great bulrush), individually or in combination, with less than 25 percent canopy cover **3**

3. *Equisetum fluviatile* (swamp horsetail) with at least 25 percent canopy cover ..... ***Equisetum fluviatile* (swamp horsetail) Habitat Type (p. 1071)**

3. *Equisetum fluviatile* (swamp horsetail) with less than 25 percent canopy cover **4**

    4. *Calamagrostis canadensis* (marsh reed grass), *C. inexpansa* (northern reed grass), or *C. stricta* (narrow reed grass), individually or in combination, with at least 25 percent canopy cover ..... ***Calamagrostis canadensis* (marsh reed grass) Habitat Type (p. 1024)**

    4. *Calamagrostis canadensis* (marsh reed grass), *C. inexpansa* (northern reed grass), or *C. stricta* (narrow reed grass), individually or in combination, with less than 25 percent canopy cover **5**

5. *Phalaris arundinacea* (reed canary grass) with at least 25 percent canopy cover ..... ***Phalaris arundinacea* (reed canary grass) Habitat Type (p. 1083)**

5. *Phalaris arundinacea* (reed canary grass) with less than 25 percent canopy cover **6**

    6. *Deschampsia cespitosa* (tufted hair grass) with at least 25 percent canopy cover ..... ***Deschampsia cespitosa* (tufted hair grass) Habitat Type (p. 1040)**

    6. *Deschampsia cespitosa* (tufted hair grass) with less than 25 percent canopy cover **7**

7. The stand is dominated by non-native herbaceous species (i.e., non-native herbaceous species have a combined canopy cover of greater than 50 percent) ..... **DISTURBED HERBACEOUS Community Type (p. 1056)**

7. The stand is not dominated by non-native herbaceous species (i.e., non-native herbaceous species have a combined canopy cover of less than 50 percent) **8**

8. The site has at least one of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology .....**Unclassified Riparian or Wetland Site**

   When the site does not fit any of the classification key, name the site in terms of a dominance type (cover type), using the species with the greatest canopy cover over 25 percent in the overstory, or tallest vegetation layer.

8. The site has none of the following wetland attributes: hydric soils, hydrophytic vegetation, or wetland hydrology.....**Upland Site**

NOTE: Refer to the following Alberta plant community guides for possible site description:

- *Range Plant Community Types and Carrying Capacity for the Lower Foothills Subregion of Alberta (Fourth Approximation)* (Lawrence and others 2005);
- *Rangeland Plant Communities and Range Health Assessment Guidelines for the Upper Foothills Natural Region of Alberta (Seventh Approximation)* (France and others 2020);
- *Range Plant Communities and Range Health Assessment Guidelines for the South Ecosection of the Montane Natural Subregion of Alberta (Eighth Approximation)* (Baker and others 2020; and
- *Guide to ecological sites of the montane subregion (Fourth Approximation)* (Willoughby and others 2021).

DESCRIPTION OF CONIFEROUS FOREST TYPES

Abies lasiocarpa/Calamagrostis canadensis Habitat Type
(subalpine fir/marsh reed grass Habitat Type)

ABIELAS/CALACAN Habitat Type
Number of Stands = 50 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 45; Other Data Sets = 5)

LOCATION AND ASSOCIATED LANDFORMS

The *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This habitat type is restricted to sites having the fairly narrow range of conditions required for *Abies lasiocarpa* (subalpine fir). These conditions are most commonly met in smaller pockets in the montane and upper foothills natural subregions on sites with cold, humid habitats. Cool summers, cold winters, and deep winter snowpacks are more important than total precipitation in determining where *Abies lasiocarpa* (subalpine fir) grows. Site conditions required by *Calamagrostis canadensis* (marsh reed grass) are broader and less restrictive of where the habitat type is found.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 11 lists the five most prominent plant species among the four lifeforms for species recorded in stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type. This habitat type has a forest/woodland character dominated by an upper canopy of conifer trees, primarily by the late seral *Abies lasiocarpa* (subalpine fir). The sample set of 50 stands contains all stands sampled of the type, which includes

early seral and disturbed stands along with late seral and undisturbed stands. Three conifer tree species dominate this habitat type. There are moderately prominent shrub and forb species in the understory, but no single species is particularly prominent. The understory is dominated by the graminoid, *Calamagrostis canadensis* (marsh reed grass).

Table 11. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type (number = 50 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Abies lasiocarpa (subalpine fir)	32.52	Native
Pinus contorta (lodgepole pine)	17.97	Native
Picea glauca (white spruce)	10.06	Native
Populus tremuloides (aspen)	5.58	Native
Populus balsamifera (balsam poplar)	4.06	Native
Shrubs		
Alnus crispa (green alder)	6.08	Native
Linnaea borealis (twinflower)	3.59	Native
Ledum groenlandicum (common Labrador tea)	2.46	Native
Viburnum edule (low-bush cranberry)	2.26	Native
Rubus pubescens (dewberry)	2.02	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	18.20	Native
Calamagrostis stricta (narrow reed grass)	0.60	Native
Elymus innovatus (hairy wild rye)	0.38	Native
Bromus vulgaris (woodland brome)	0.08	Native
Elymus glaucus (smooth wild rye)	0.07	Native
Forbs		
Cornus canadensis (bunchberry)	4.86	Native
Aralia nudicaulis (wild sarsaparilla)	3.69	Native
Arnica latifolia (broad-leaved arnica)	2.13	Native
Lycopodium annotinum (stiff club-moss)	1.47	Native
Arnica cordifolia (heart-leaved arnica)	1.38	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 12 through Table 15, break out the vegetation recorded in all 50 stands sampled of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized

into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species rich, forested habitat type of minor occurrence in the study area.

Table 12 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type. For the 50 stands comprising the habitat type, the number of unique species was 193 with 189 (97.9 percent) of them being native species.

Table 12. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type (number = 50 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	10	10	0	0
Shrubs	49	48	0	1
Graminoids	19	19	0	0
Forbs	115	112	1	2
TOTAL	***193 (100.0%)***	***189 (97.9%)***	***1 (0.5%)***	***3 (1.6%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 13 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type. The average number of species per stand is 26.3, with native species comprising 26.2 species per stand or 99.6 percent.

Table 13. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type (number = 50 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3.3	3.3	0.0	0.0
Shrubs	7.9	7.8	0.0	0.1
Graminoids	1.6	1.6	0.0	0.0
Forbs	13.5	13.5	0.0	0.0
TOTAL	***26.3 (100.0%)***	***26.2 (99.6%)***	***0.0 (0.0%)***	***0.1 (0.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 14 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type. The average canopy cover per stand is 159.8 percent, with native species comprising 159.7 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 14. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type (number = 50 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	75.2%	75.2%	0.0%	0.0%
Shrubs	34.7%	34.6%	0.0%	0.0%
Graminoids	19.7%	19.7%	0.0%	0.0%
Forbs	30.2%	30.2%	0.0%	0.0%
TOTAL	***159.8% (100.0%)***	***159.7% (100.0%)***	***0.0% (0.0%)***	***0.1% (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 15 shows the average number of species and average canopy cover by lifeform in stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type. The average number of species per stand was 26.3 with an average canopy cover of 159.8 percent.

Table 15. Average number of species and average canopy cover by lifeform in stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type (number = 50 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	3.3	75.2%
Shrubs	7.9	34.7%
Graminoids	1.6	19.7%
Forbs	13.5	30.2%
TOTAL	***26.3***	***159.8%***

Sampled Stands Plant Species List

The *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type described here is based on 50 sampled stands. In addition to the type indicator *Abies lasiocarpa* (subalpine fir), nine other tree species were recorded, of which *Pinus contorta* (lodgepole pine) and *Picea glauca* (white spruce) are prominent associate tree species (Table 16). Of the 49 individual shrub species recorded on at least one of the 50 stands, none stand out as especially prominent. A few, like *Linnaea borealis* (twinflower), are fairly constantly present, but in

small amounts. Of the 19 total graminoid species recorded, only the type understory indicator, *Calamagrostis canadensis* (marsh reed grass), is especially prominent; and among the 115 forb species recorded, none stand out as especially prominent, although *Cornus canadensis* (bunchberry) occurred on 84 percent of plots sampled.

Table 16. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Abies lasiocarpa/ Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type (number = 50 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 10)					
Abies balsamea (balsam fir)	10.0	0-10	4	0.40	N
Abies lasiocarpa (subalpine fir)	33.9	0-80	96	32.52	N
Betula papyrifera (white birch)	1.7	0-10	16	0.27	N
Picea engelmannii (Engelmann spruce)	9.0	0-20	20	1.80	N
Picea engelmannii x glauca (Engelmann x white spruce)	20.0	0-30	6	1.20	N
Picea glauca (white spruce)	15.7	0-60	64	10.06	N
Picea mariana (black spruce)	7.5	0-20	18	1.35	N
Pinus contorta (lodgepole pine)	27.2	0-60	66	17.97	N
Populus balsamifera (balsam poplar)	29.0	0-50	14	4.06	N
Populus tremuloides (aspen)	23.3	0-70	24	5.58	N
Shrubs (N = 49)					
Alnus crispa (green alder)	15.2	0-50	40	6.08	N
Alnus tenuifolia (river alder)	14.3	0-20	6	0.86	N
Amelanchier alnifolia (Saskatoon)	0.9	0-3	14	0.12	N
Betula pumila (dwarf birch)	3.0	0-3	2	0.06	N
Chimaphila umbellata (prince's-pine)	0.5	0-0.5	2	0.01	N
Cornus stolonifera (red-osier dogwood)	10.0	0-10	2	0.20	N
Empetrum nigrum (crowberry)	10.3	0-20	4	0.41	N
Gaultheria hispidula (creeping snowberry)	1.8	0-3	4	0.07	N
Gaultheria humifusa (alpine wintergreen)	0.5	0-0.5	2	0.01	N
Juniperus communis (ground juniper)	0.5	0-0.5	2	0.01	N
Ledum glandulosum (glandular Labrador tea)	3.0	0-3	2	0.06	N
Ledum groenlandicum (common Labrador tea)	8.2	0-50	30	2.46	N
Linnaea borealis (twinflower)	4.7	0-30	76	3.59	N
Lonicera dioica (twining honeysuckle)	0.5	0-0.5	4	0.02	N
Lonicera involucrata (bracted honeysuckle)	3.1	0-20	62	1.95	N
Lonicera utahensis (red twinberry)	0.5	0-0.5	6	0.03	N
Luetkea pectinata (partridgefoot)	0.5	0-0.5	2	0.01	N
Menziesia ferruginea (false azalea)	0.8	0-3	16	0.13	N
Oplopanax horridum (devil's-club)	3.7	0-10	6	0.22	N
Rhododendron albiflorum (white-flowered rhododendron)	0.5	0-0.5	2	0.01	N
Ribes hudsonianum (northern black currant)	0.5	0-0.5	2	0.01	N
Ribes lacustre (bristly black currant)	1.3	0-3	44	0.57	N
Ribes laxiflorum (mountain currant)	0.5	0-0.5	2	0.01	N
Ribes oxyacanthoides (northern gooseberry)	2.5	0-10	12	0.30	N

Table 16. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Ribes triste (wild red currant)	1.1	0-3	8	0.09	N
Rosa acicularis (prickly rose)	1.6	0-10	68	1.07	N
Rosa woodsii (common wild rose)	1.8	0-3	4	0.07	N
Rubus idaeus (wild red raspberry)	3.8	0-10	22	0.83	N
Rubus parviflorus (thimbleberry)	1.0	0-3	10	0.10	N
Rubus pedatus (dwarf bramble)	5.1	0-30	36	1.84	N
Rubus pubescens (dewberry)	4.4	0-30	46	2.02	N
Salix bebbiana (beaked willow)	9.0	0-20	8	0.72	N
Salix brachycarpa (short-capsuled willow)	20.0	0-20	2	0.40	N
Salix drummondiana (Drummond's willow)	26.5	0-50	4	1.06	N
Salix glauca (smooth willow)	3.0	0-3	2	0.06	N
Salix myrtillifolia (myrtle-leaved willow)	20.0	0-20	2	0.40	N
Salix spp. (willow)	0.5	0-0.5	8	0.04	B
Salix vestita (rock willow)	10.0	0-10	2	0.20	N
Sambucus racemosa (red elderberry)	0.5	0-0.5	8	0.04	N
Shepherdia canadensis (Canada buffaloberry)	3.0	0-3	2	0.06	N
Sorbus scopulina (western mountain-ash)	1.8	0-3	32	0.56	N
Spiraea betulifolia (white meadowsweet)	1.1	0-3	24	0.27	N
Vaccinium caespitosum (dwarf bilberry)	3.5	0-20	20	0.69	N
Vaccinium membranaceum (tall bilberry)	6.8	0-30	24	1.64	N
Vaccinium myrtilloides (common blueberry)	3.7	0-20	20	0.74	N
Vaccinium myrtillus (low bilberry)	10.0	0-10	2	0.20	N
Vaccinium scoparium (grouseberry)	10.3	0-20	8	0.82	N
Vaccinium vitis-idaea (bog cranberry)	4.6	0-20	28	1.30	N
Viburnum edule (low-bush cranberry)	3.9	0-10	58	2.26	N
Graminoids (N = 19)					
Bromus vulgaris (woodland brome)	1.3	0-3	6	0.08	N
Calamagrostis canadensis (marsh reed grass)	19.4	0-60	94	18.20	N
Calamagrostis rubescens (pine reed grass)	3.0	0-3	2	0.06	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	6	0.60	N
Carex albo-nigra (black-and-white sedge)	0.5	0-0.5	2	0.01	N
Carex concinnoides (low northern sedge)	0.5	0-0.5	2	0.01	N
Carex disperma (two-seeded sedge)	0.5	0-0.5	2	0.01	N
Carex spp. (sedge)	0.5	0-0.5	4	0.02	N
Cinna latifolia (drooping wood-reed)	0.5	0-0.5	2	0.01	N
Deschampsia cespitosa (tufted hair grass)	0.5	0-0.5	2	0.01	N
Elymus glaucus (smooth wild rye)	1.8	0-3	4	0.07	N
Elymus innovatus (hairy wild rye)	2.1	0-10	18	0.38	N
Juncus drummondii (Drummond's rush)	3.0	0-3	2	0.06	N
Juncus spp. (rush)	0.5	0-0.5	2	0.01	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	2	0.01	N
Melica subulata (Alaska onion grass)	0.5	0-0.5	2	0.01	N
Phleum commutatum (mountain timothy)	1.8	0-3	4	0.07	N
Poa sandbergii (Sandberg bluegrass)	0.5	0-0.5	2	0.01	N

Table 16. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Schizachne purpurascens (purple oat grass)	0.5	0-0.5	4	0.02	N
Forbs (N = 115)					
Achillea millefolium (common yarrow)	1.1	0-3	8	0.09	N
Actaea rubra (red and white baneberry)	2.7	0-10	22	0.60	N
Angelica arguta (white angelica)	0.5	0-0.5	2	0.01	N
Angelica dawsonii (yellow angelica)	0.5	0-0.5	2	0.01	N
Antennaria alpina (alpine everlasting)	0.5	0-0.5	2	0.01	N
Antennaria parvifolia (small-leaved everlasting)	0.5	0-0.5	2	0.01	N
Aquilegia formosa (Sitka columbine)	0.5	0-0.5	2	0.01	N
Aralia nudicaulis (wild sarsaparilla)	8.4	0-50	44	3.69	N
Arnica cordifolia (heart-leaved arnica)	2.8	0-20	50	1.38	N
Arnica diversifolia (lawless arnica)	0.5	0-0.5	2	0.01	N
Arnica latifolia (broad-leaved arnica)	17.8	0-60	12	2.13	N
Arnica rydbergii (narrow-leaved arnica)	0.5	0-0.5	2	0.01	N
Artemisia norvegica (mountain sagewort)	0.5	0-0.5	2	0.01	N
Aster ciliolatus (Lindley's aster)	1.0	0-3	10	0.10	N
Aster conspicuus (showy aster)	1.3	0-3	20	0.25	N
Aster spp. (aster)	1.8	0-3	4	0.07	N
Aster subspicatus (leafy-bracted aster)	0.5	0-0.5	2	0.01	N
Athyrium filix-femina (lady fern)	1.6	0-3	18	0.29	N
Calypso bulbosa (Venus'-slipper)	0.5	0-0.5	4	0.02	N
Campanula lasiocarpa (Alaska harebell)	0.5	0-0.5	2	0.01	N
Campanula rotundifolia (harebell)	0.5	0-0.5	2	0.01	N
Castilleja miniata (common red paintbrush)	0.5	0-0.5	2	0.01	N
Cerastium spp. (mouse-ear chickweed)	0.5	0-0.5	2	0.01	B
Circaea alpina (small enchanter's nightshade)	1.8	0-3	4	0.07	N
Clintonia uniflora (corn lily)	0.5	0-0.5	2	0.01	N
Coptis trifolia (goldthread)	0.5	0-0.5	2	0.01	N
Corallorhiza striata (striped coralroot)	0.5	0-0.5	2	0.01	N
Corallorhiza trifida (pale coralroot)	0.5	0-0.5	4	0.02	N
Cornus canadensis (bunchberry)	5.8	0-20	84	4.86	N
Cystopteris fragilis (fragile bladder fern)	0.5	0-0.5	2	0.01	N
Delphinium glaucum (tall larkspur)	1.1	0-3	18	0.19	N
Disporum trachycarpum (fairybells)	0.5	0-0.5	4	0.02	N
Dryopteris assimilis (broad spinulose shield fern)	1.3	0-3	18	0.24	N
Epilobium angustifolium (common fireweed)	1.3	0-3	58	0.74	N
Equisetum arvense (common horsetail)	3.6	0-30	24	0.86	N
Equisetum pratense (meadow horsetail)	4.0	0-20	14	0.56	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	4	0.02	N
Equisetum sylvaticum (woodland horsetail)	1.7	0-10	42	0.70	N
Erigeron acris (northern daisy fleabane)	0.5	0-0.5	2	0.01	N
Erythronium grandiflorum (glacier lily)	1.8	0-3	4	0.07	N
Fragaria virginiana (wild strawberry)	1.7	0-10	28	0.48	N
Galium boreale (northern bedstraw)	1.3	0-3	12	0.16	N

Table 16. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Galium trifidum (small bedstraw)	0.5	0-0.5	2	0.01	N
Galium triflorum (sweet-scented bedstraw)	0.8	0-3	32	0.26	N
Geranium richardsonii (wild white geranium)	0.5	0-0.5	2	0.01	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	2	0.01	N
Geum rivale (purple avens)	0.5	0-0.5	2	0.01	N
Geum spp. (avens)	0.5	0-0.5	2	0.01	N
Goodyera oblongifolia (rattlesnake plantain)	0.5	0-0.5	6	0.03	N
Goodyera repens (lesser rattlesnake plantain)	1.3	0-3	6	0.08	N
Gymnocarpium dryopteris (oak fern)	3.2	0-20	40	1.27	N
Habenaria obtusata (blunt-leaved bog orchid)	1.5	0-3	10	0.15	N
Habenaria orbiculata (round-leaved bog orchid)	0.5	0-0.5	2	0.01	N
Habenaria viridis (bracted bog orchid)	0.5	0-0.5	2	0.01	N
Heracleum lanatum (cow parsnip)	0.5	0-0.5	26	0.13	N
Heuchera glabra (alpine alumroot)	0.5	0-0.5	2	0.01	N
Hieracium albiflorum (white hawkweed)	0.5	0-0.5	2	0.01	N
Hieracium triste (slender hawkweed)	0.5	0-0.5	2	0.01	N
Lathyrus ochroleucus (cream-colored vetchling)	1.8	0-3	24	0.42	N
Lathyrus venosus (purple peavine)	3.0	0-3	2	0.06	N
Lilium philadelphicum (western wood lily)	0.5	0-0.5	2	0.01	N
Listera borealis (northern twayblade)	3.0	0-3	2	0.06	N
Listera cordata (heart-leaved twayblade)	0.8	0-3	18	0.14	N
Lycopodium annotinum (stiff club-moss)	2.8	0-10	52	1.47	N
Lycopodium complanatum (ground-cedar)	0.5	0-0.5	2	0.01	N
Lycopodium obscurum (ground-pine)	1.8	0-3	4	0.07	N
Maianthemum canadense (wild lily-of-the-valley)	1.1	0-3	40	0.45	N
Mertensia paniculata (tall lungwort)	1.9	0-10	56	1.06	N
Mitella nuda (bishop's-cap)	2.1	0-20	58	1.22	N
Mitella pentandra (bishop's-cap)	0.5	0-0.5	4	0.02	N
Moneses uniflora (one-flowered wintergreen)	0.5	0-0.5	6	0.03	N
Orthilia secunda (one-sided wintergreen)	1.4	0-3	38	0.54	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	0.5	0-0.5	6	0.03	N
Osmorhiza depauperata (spreading sweet cicely)	1.1	0-3	8	0.09	N
Osmorhiza longistylis (smooth sweet cicely)	0.5	0-0.5	4	0.02	N
Osmorhiza occidentalis (western sweet cicely)	0.5	0-0.5	6	0.03	N
Osmorhiza purpurea (purple sweet cicely)	0.5	0-0.5	2	0.01	N
Oxyria digyna (mountain sorrel)	0.5	0-0.5	2	0.01	N
Parnassia fimbriata (fringed grass-of-parnassus)	0.5	0-0.5	2	0.01	N
Pedicularis bracteosa (western lousewort)	0.5	0-0.5	4	0.02	N
Petasites frigidus (arctic sweet coltsfoot)	0.5	0-0.5	2	0.01	N
Petasites palmatus (palmate-leaved coltsfoot)	1.9	0-10	64	1.21	N
Pyrola asarifolia (common pink wintergreen)	1.6	0-10	48	0.78	N
Pyrola chlorantha (greenish-flowered wintergreen)	1.8	0-3	8	0.14	N
Pyrola spp. (wintergreen)	3.0	0-3	2	0.06	N
Ranunculus eschscholtzii (mountain buttercup)	0.5	0-0.5	2	0.01	N

Table 16. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Ranunculus inamoenus (graceful buttercup)	0.5	0-0.5	2	0.01	N
Ranunculus spp. (ranunculus)	0.5	0-0.5	2	0.01	B
Rumex acetosa (green sorrel)	0.5	0-0.5	2	0.01	N
Senecio triangularis (brook ragwort)	0.5	0-0.5	4	0.02	N
Smilacina racemosa (false Solomon's-seal)	1.0	0-3	22	0.21	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	6	0.03	N
Spirodela polyrhiza (larger duckweed)	0.5	0-0.5	2	0.01	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	2	0.01	N
Stenanthium occidentale (bronzebells)	0.5	0-0.5	6	0.03	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1.6	0-3	50	0.80	N
Streptopus roseus (rose mandarin)	0.5	0-0.5	4	0.02	N
Taraxacum officinale (common dandelion)	0.5	0-0.5	2	0.01	I
Thalictrum occidentale (western meadow rue)	1.8	0-3	8	0.14	N
Thalictrum venulosum (veiny meadow rue)	1.8	0-3	8	0.14	N
Tiarella trifoliata (laceflower)	1.3	0-3	6	0.08	N
Tiarella unifoliata (sugarscoop)	0.5	0-0.5	2	0.01	N
Trillium ovatum (western wakerobin)	0.5	0-0.5	2	0.01	N
Urtica dioica (common nettle)	0.5	0-0.5	4	0.02	N
Valeriana dioica (northern valerian)	0.5	0-0.5	2	0.01	N
Valeriana sitchensis (mountain valerian)	0.5	0-0.5	4	0.02	N
Veratrum eschscholtzii (green false hellebore)	1.3	0-3	12	0.16	N
Vicia americana (wild vetch)	0.5	0-0.5	2	0.01	N
Viola adunca (early blue violet)	1.8	0-3	4	0.07	N
Viola canadensis (western Canada violet)	1.0	0-3	10	0.10	N
Viola glabella (yellow wood violet)	3.0	0-3	2	0.06	N
Viola orbiculata (evergreen violet)	1.1	0-3	8	0.09	N
Viola palustris (marsh violet)	0.5	0-0.5	2	0.01	N
Viola renifolia (kidney-leaved violet)	0.9	0-3	12	0.11	N
Xerophyllum tenax (bear-grass)	3.7	0-10	6	0.22	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 17 shows the five most prominent plant species among the four lifeforms for species recorded in all 10 relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type. This habitat type has a forest/woodland character dominated by an upper canopy of conifer trees, with the late seral *Abies lasiocarpa* (subalpine fir) by far most prominent. This sample set of 10 stands includes only late seral and relatively undisturbed stands sampled of the habitat type. There are moderately prominent shrub and forb species in the understory, but no single one is very prominent. The entire understory is dominated by one graminoid, *Calamagrostis canadensis* (marsh reed grass).

Table 17. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type (number = 10 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Abies lasiocarpa (subalpine fir)	51.00	Native
Picea glauca (white spruce)	7.65	Native
Picea engelmannii (Engelmann spruce)	3.05	Native
Pinus contorta (lodgepole pine)	3.05	Native
Picea engelmannii x glauca (Engelmann x white spruce)	2.00	Native
Shrubs		
Linnaea borealis (twinflower)	7.15	Native
Ledum groenlandicum (common Labrador tea)	6.30	Native
Alnus crispa (green alder)	3.60	Native
Viburnum edule (low-bush cranberry)	2.35	Native
Salix brachycarpa (short-capsuled willow)	2.00	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	18.00	Native
Elymus innovatus (hairy wild rye)	0.45	Native
Juncus drummondii (Drummond's rush)	0.30	Native
Phleum commutatum (mountain timothy)	0.30	Native
Forbs		
Cornus canadensis (bunchberry)	5.75	Native
Equisetum arvense (common horsetail)	3.45	Native
Pyrola asarifolia (common pink wintergreen)	1.15	Native
Gymnocarpium dryopteris (oak fern)	1.05	Native
Mitella nuda (bishop's-cap)	1.00	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 18 through Table 21, break out the vegetation recorded in 10 relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species rich, forested habitat type of minor occurrence in the study area.

Table 18 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type. For the 10 stands comprising the habitat type, the number of unique species was 100 with 98 (98.0 percent) of them being native species.

Table 18. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type (number = 10 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	7	7	0	0
Shrubs	31	30	0	1
Graminoids	4	4	0	0
Forbs	58	57	0	1
TOTAL	***100 (100.0%)***	***98 (98.0%)***	***0 (0.0%)***	***2 (2.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 19 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type. The average number of species per stand is 22.6, with native species comprising 22.4 species per stand or 99.1 percent.

Table 19. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type (number = 10 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.4	2.4	0.0	0.0
Shrubs	7.0	6.9	0.0	0.1
Graminoids	1.6	1.6	0.0	0.0
Forbs	11.6	11.5	0.0	0.1
TOTAL	***22.6 (100.0%)***	***22.4 (99.1%)***	***0.0 (0.0%)***	***0.2 (0.9%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 20 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type. The average canopy cover per stand is 143.8 percent, with native species comprising 143.7 percent or 99.9 percent of the total amount of average canopy cover per stand.

Table 20. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type (number = 10 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	69.1%	69.1%	0.0%	0.0%
Shrubs	32.7%	32.7%	0.0%	0.1%
Graminoids	19.1%	19.1%	0.0%	0.0%
Forbs	23.0%	22.9%	0.0%	0.0%
TOTAL	***143.8% (100.0%)***	***143.7% (99.9%)***	***0.0% (0.0%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 21 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type. The average number of species per stand was 22.6 with an average canopy cover of 143.8 percent.

Table 21. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type (number = 10 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.4	69.1%
Shrubs	7.0	32.7%
Graminoids	1.6	19.1%
Forbs	11.6	23.0%
TOTAL	***22.6***	***143.8%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

On 10 relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type, seven tree species were recorded, dominated by the type overstory indicator, *Abies lasiocarpa* (subalpine fir) (Table 22). Only *Picea glauca* (white spruce) occurred in more than half of stands sampled. Among the 31 shrub species recorded on sampled stands, *Linnaea borealis* (twinflower) and *Ledum groenlandicum* (common Labrador tea) were most prominent. *Calamagrostis canadensis* (marsh reed grass) was by far most prominent among the graminoids, and *Cornus canadensis* (bunchberry) was most prominent among the graminoids.

Table 22. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type (number = 10 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 7)					
Abies lasiocarpa (subalpine fir)	51.0	40-80	100	51.00	N
Picea engelmannii (Engelmann spruce)	10.2	0-20	30	3.05	N
Picea engelmannii x glauca (Engelmann x white spruce)	20.0	0-20	10	2.00	N
Picea glauca (white spruce)	12.8	0-30	60	7.65	N
Picea mariana (black spruce)	20.0	0-20	10	2.00	N
Pinus contorta (lodgepole pine)	15.3	0-30	20	3.05	N
Populus tremuloides (aspen)	3.0	0-3	10	0.30	N
Shrubs (N = 31)					
Alnus crispa (green alder)	9.0	0-20	40	3.60	N
Chimaphila umbellata (prince's-pine)	0.5	0-0.5	10	0.05	N
Empetrum nigrum (crowberry)	0.5	0-0.5	10	0.05	N
Ledum groenlandicum (common Labrador tea)	21.0	0-50	30	6.30	N

Table 22. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Lonicera involucrata (bracted honeysuckle)	1.5	0-3	50	0.75	N
Lonicera utahensis (red twinberry)	0.5	0-0.5	10	0.05	N
Luetkea pectinata (partridgefoot)	0.5	0-0.5	10	0.05	N
Menziesia ferruginea (false azalea)	0.5	0-0.5	30	0.15	N
Ribes lacustre (bristly black currant)	1.8	0-3	40	0.70	N
Ribes triste (wild red currant)	0.5	0-0.5	10	0.05	N
Rosa acicularis (prickly rose)	2.9	0-10	60	1.75	N
Rubus idaeus (wild red raspberry)	5.3	0-10	20	1.05	N
Rubus parviflorus (thimbleberry)	3.0	0-3	10	0.30	N
Rubus pedatus (dwarf bramble)	1.3	0-3	30	0.40	N
Rubus pubescens (dewberry)	6.5	0-10	20	1.30	N
Salix bebbiana (beaked willow)	3.0	0-3	10	0.30	N
Salix brachycarpa (short-capsuled willow)	20.0	0-20	10	2.00	N
Salix drummondiana (Drummond's willow)	3.0	0-3	10	0.30	N
Salix spp. (willow)	0.5	0-0.5	10	0.05	B
Salix vestita (rock willow)	10.0	0-10	10	1.00	N
Sambucus racemosa (red elderberry)	0.5	0-0.5	10	0.05	N
Sorbus scopulina (western mountain-ash)	3.0	0-3	20	0.60	N
Spiraea betulifolia (white meadowsweet)	0.5	0-0.5	20	0.10	N
Vaccinium caespitosum (dwarf bilberry)	0.5	0-0.5	30	0.15	N
Vaccinium membranaceum (tall bilberry)	2.2	0-3	30	0.65	N
Vaccinium myrtilloides (common blueberry)	0.5	0-0.5	10	0.05	N
Vaccinium myrtillus (low bilberry)	10.0	0-10	10	1.00	N
Vaccinium scoparium (grouseberry)	0.5	0-0.5	10	0.05	N
Vaccinium vitis-idaea (bog cranberry)	1.8	0-3	20	0.35	N
Viburnum edule (low-bush cranberry)	5.9	0-10	40	2.35	N
Graminoids (N = 4)					
Calamagrostis canadensis (marsh reed grass)	18.0	10-40	100	18.00	N
Elymus innovatus (hairy wild rye)	1.1	0-3	40	0.45	N
Juncus drummondii (Drummond's rush)	3.0	0-3	10	0.30	N
Phleum commutatum (mountain timothy)	3.0	0-3	10	0.30	N
Forbs (N = 58)					
Achillea millefolium (common yarrow)	3.0	0-3	10	0.30	N
Angelica dawsonii (yellow angelica)	0.5	0-0.5	10	0.05	N
Aquilegia formosa (Sitka columbine)	0.5	0-0.5	10	0.05	N
Aralia nudicaulis (wild sarsaparilla)	2.4	0-3	40	0.95	N
Arnica cordifolia (heart-leaved arnica)	1.8	0-3	40	0.70	N
Arnica diversifolia (lawless arnica)	0.5	0-0.5	10	0.05	N
Arnica latifolia (broad-leaved arnica)	0.5	0-0.5	10	0.05	N
Artemisia norvegica (mountain sagewort)	0.5	0-0.5	10	0.05	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	30	0.15	N
Aster conspicuus (showy aster)	0.5	0-0.5	30	0.15	N
Aster spp. (aster)	3.0	0-3	10	0.30	N
Athyrium filix-femina (lady fern)	0.5	0-0.5	10	0.05	N

Table 22. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Campanula rotundifolia (harebell)	0.5	0-0.5	10	0.05	N
Cerastium spp. (mouse-ear chickweed)	0.5	0-0.5	10	0.05	B
Clintonia uniflora (corn lily)	0.5	0-0.5	10	0.05	N
Cornus canadensis (bunchberry)	6.4	0-20	90	5.75	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	10	0.05	N
Dryopteris assimilis (broad spinulose shield fern)	3.0	0-3	10	0.30	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	20	0.10	N
Equisetum arvense (common horsetail)	6.9	0-30	50	3.45	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	10	0.05	N
Equisetum sylvaticum (woodland horsetail)	1.1	0-3	40	0.45	N
Fragaria virginiana (wild strawberry)	2.2	0-3	30	0.65	N
Galium triflorum (sweet-scented bedstraw)	0.5	0-0.5	20	0.10	N
Goodyera oblongifolia (rattlesnake plantain)	0.5	0-0.5	10	0.05	N
Gymnocarpium dryopteris (oak fern)	5.3	0-10	20	1.05	N
Habenaria obtusata (blunt-leaved bog orchid)	0.5	0-0.5	10	0.05	N
Heracleum lanatum (cow parsnip)	0.5	0-0.5	20	0.10	N
Lathyrus ochroleucus (cream-colored vetchling)	2.2	0-3	30	0.65	N
Listera borealis (northern twayblade)	3.0	0-3	10	0.30	N
Listera cordata (heart-leaved twayblade)	0.5	0-0.5	10	0.05	N
Lycopodium annotinum (stiff club-moss)	1.8	0-3	40	0.70	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	20	0.10	N
Mertensia paniculata (tall lungwort)	1.0	0-3	50	0.50	N
Mitella nuda (bishop's-cap)	2.0	0-3	50	1.00	N
Mitella pentandra (bishop's-cap)	0.5	0-0.5	10	0.05	N
Moneses uniflora (one-flowered wintergreen)	0.5	0-0.5	10	0.05	N
Orthilia secunda (one-sided wintergreen)	1.3	0-3	30	0.40	N
Osmorhiza depauperata (spreading sweet cicely)	0.5	0-0.5	20	0.10	N
Osmorhiza purpurea (purple sweet cicely)	0.5	0-0.5	10	0.05	N
Oxyria digyna (mountain sorrel)	0.5	0-0.5	10	0.05	N
Parnassia fimbriata (fringed grass-of-parnassus)	0.5	0-0.5	10	0.05	N
Pedicularis bracteosa (western lousewort)	0.5	0-0.5	10	0.05	N
Petasites frigidus (arctic sweet coltsfoot)	0.5	0-0.5	10	0.05	N
Petasites palmatus (palmate-leaved coltsfoot)	2.0	0-3	50	1.00	N
Pyrola asarifolia (common pink wintergreen)	2.9	0-10	40	1.15	N
Ranunculus eschscholtzii (mountain buttercup)	0.5	0-0.5	10	0.05	N
Rumex acetosa (green sorrel)	0.5	0-0.5	10	0.05	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	20	0.10	N
Stenanthium occidentale (bronzebells)	0.5	0-0.5	10	0.05	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1.3	0-3	30	0.40	N
Streptopus roseus (rose mandarin)	0.5	0-0.5	10	0.05	N
Thalictrum occidentale (western meadow rue)	3.0	0-3	10	0.30	N
Thalictrum venulosum (veiny meadow rue)	3.0	0-3	10	0.30	N
Tiarella unifoliata (sugarscoop)	0.5	0-0.5	10	0.05	N

Table 22. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Valeriana dioica (northern valerian)	0.5	0-0.5	10	0.05	N
Veratrum eschscholtzii (green false hellebore)	0.5	0-0.5	10	0.05	N
Viola canadensis (western Canada violet)	0.5	0-0.5	10	0.05	N

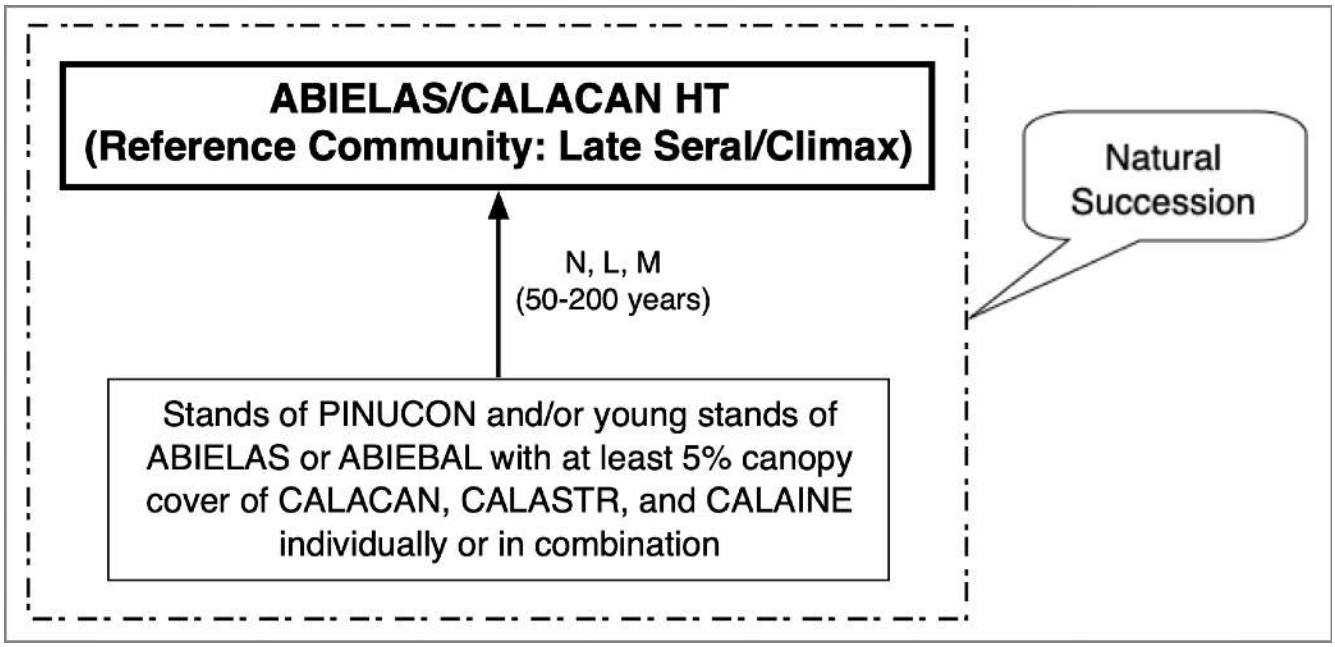
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Abies lasiocarpa (subalpine fir) is a shade-tolerant climax species favored by a long fire-free interval. Maturity and extended age of stands of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type depend mostly on freedom from wildfire. Reestablishment of stands after a burn depends of availability of nearby sources of *Abies lasiocarpa* (subalpine fir) seed and on the level of competition from the fire adapted seral species, such as *Pinus contorta* (lodgepole pine) and *Populus tremuloides* (aspen).

Figure 4 shows a schematic diagram of vegetation successional pathways on sites of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type.



Successional Pathway of *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
ABIEBAL—*Abies balsamea* (balsam fir)
ABIELAS—*Abies lasiocarpa* (subalpine fir)
ABIELAS/CALACAN HT—*Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type
CALACAN—*Calamagrostis canadensis* (marsh reed grass)
CALAINE—*Calamagrostis inexpansa* (northern reed grass)
CALASTR—*Calamagrostis stricta* (narrow reed grass)
PINUCON—*Pinus contorta* (lodgepole pine)

Figure 4. Successional pathway for sites of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 5 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

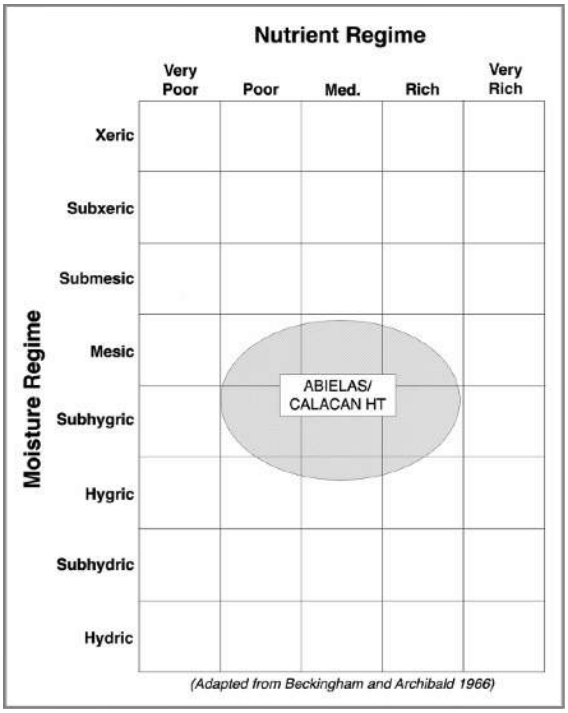


Figure 5. Edatope grid position for the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type (ABIELAS/CALACAN HT)

SOILS

Parent material on sites supporting the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type is usually morainal, and soils are mostly gleysols and brunisols. Soil drainage ranges from moderately well drained to well drained, with surface texture ranging from sandy loam to clay loam. Organic thickness is mostly 0 cm to 5 cm thick (France and others 2020).

ADJACENT COMMUNITIES

Wetter adjacent sites are likely to be dominated by *Alnus* (alder) species, *Betula* (birch) shrub species, *Salix* (willow) species, or *Carex* (sedge) species, often in a bog or fen setting. Adjacent drier sites may have types such as the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type or the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) occurs frequently in the southern Rocky Mountain and Boreal Forest natural regions of Alberta in forested stands from low elevation up to the subalpine zone (Tannas 1997a).

This is a middle to upper elevation mountain conifer tree species. It generally occupies sites having a short growing season with cold winters, cool summers, frequent summer frosts, and heavy winter snowpack. In the Rocky Mountains, *Abies lasiocarpa* (subalpine fir) is a shade-tolerant late seral/climax species that is favored by sites with long intervals free of fire-(Uchytil 1991b).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—*Calamagrostis stricta* (narrow reed grass) is common across Alberta, except in the prairies. It occurs farther north than *Calamagrostis inexpansa* (northern reed grass). It grows in swamps, around edges of wetlands, in moist woods, and on many moister upland sites (Tannas 1997a).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) is a late seral to climax conifer tree species, commonly replacing stand associates, *Betula* species (birch), *Populus* species (poplar), and *Pinus* species (pine), as succession progresses (Tannas 1997a).

This species typically grows in regions having long, cold winters and short, cool summers. It may be found on floodplains, upland slopes, and a variety of other landscape positions. Although it has a wide elevational range, *Picea glauca* (white spruce) is often confined to stream bottoms and lower river benches (Abrahamson 2015). It

typically grows best on warm, moderately-to-well drained, upland or floodplain soils; and grows poorly on sites with stagnant water or a high water table (Abrahamson 2015).

Picea glauca (white spruce) co-dominates with *Populus tremuloides* (aspen), *Betula papyrifera* (white birch), and *Picea mariana* (black spruce) over large areas of mid seral forest (Abrahamson 2015).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is found in all natural regions of Alberta, except the Dry Mixedgrass. It is the most common tree species at middle and lower altitudes along the eastern slopes of the Rocky Mountains, forming nearly pure stands on some sites in the foothills and montane areas (Tannas 1997a).

Pinus contorta (lodgepole pine) grows at low to high elevations, in dry to wet conditions, warm to cold temperatures, and on nearly every soil type found in western North America, except on saline sites. The species is not shade tolerant, and grows best on non-calcareous soil. It is primarily an aggressive pioneer on disturbed sites, and fire perpetuates or renews the stands (Anderson 2003). As these pine stands mature, they give way to shade-tolerant conifers at ages from 50 to 100 years in mesic habitats, and 100 to 200 years on warmer and drier sites (Anderson 2003).

Pinus contorta (lodgepole pine) may establish alongside later seral, more shade-tolerant species, and its rapid growth may enable the pines to remain competitive in the canopy for several years. However, these trees do not regenerate under a canopy, and are eliminated from the stand as mortality occurs. The *Pinus contorta* (lodgepole pine) is generally replaced within 50 to 100 years by the more shade-tolerant associates (Anderson 2003).

Livestock

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) is unpalatable and its forage value is poor for both livestock and wild ungulates (Tannas 1997a). Stands dominated by it generally do not produce enough forage for livestock, but do provide browse and cover for large and small wildlife species (Uchytil 1991b).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—*Calamagrostis stricta* (narrow reed grass) has moderate nutritional value in early spring, but which declines as the season advances. The forage is most palatable in spring, but is avoided later in the season unless other forage is unavailable (Tannas 1997a). In general, *Calamagrostis* species (reed grass) are mostly palatable and nutritious for livestock and wildlife, but are considered to be of poor quality because their foliage becomes very rough as it matures (Johnson and others 1995). Protein content is 17 percent to 19 percent in spring, but drops to 7 percent by late summer (Tannas 1997a).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) has poor value as forage for both livestock and wild ungulates, although it is occasionally used where better quality forage is lacking (Tannas 1997a). Herbage production is moderate to low, decreasing as seral succession progresses, and the upper canopy closes. These sites have little value as livestock range, other than shading. Lane and others (2000) recommend non-use for stands of *Picea glauca* (white spruce) on moist sites in the Lower Foothills Subregion. The moist soils are sensitive to disturbance, and cattle can easily churn the wet soil and destroy plant cover, as well as limiting tree seedling establishment.

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) offers poor forage value, and is seldom eaten by livestock (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) wood is soft, brittle, and quick to decay. It is used for rough construction and boxes, doors, frames, poles, and fuel. Small trees are extensively used as Christmas trees (USDA National Resources Conservation Service 2023).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) timber is used primarily for pulpwood, construction lumber, furniture, boxes, crates, and pallets (USDA National Resources Conservation Service 2023). Productivity is moderate to high on these moist, rich sites (Beckingham and others 1996). However, they offer only limited potential due to the extremely fragile site conditions, generally accessible only during winter. Due to high water tables, the trees are extremely susceptible to windthrow and soil loss may follow all forms of timber harvesting. Subsequent to harvest, water tables can rise, causing problems for regeneration of trees on the site.

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) timber is used extensively for construction lumber, pulpwood, heating fuel, posts and poles, and plywood veneer (USDA National Resources Conservation Service 2023).

Wildlife

***Abies lasiocarpa* (subalpine fir)**—Mule deer, elk, moose, woodland caribou, black bear, and grizzly bear often use *Abies lasiocarpa* (subalpine fir) habitats as summer range, but these forest sites are generally not suitable winter range for deer and elk because of heavy snowpack. Mule deer, elk, moose, woodland caribou, black bear, and grizzly bear often use these habitats as summer range (Uchytil 1991b).

Abies lasiocarpa (subalpine fir) seeds are eaten by several species of small mammals and birds. Red squirrels, chipmunks, and mice eat seeds from cached cones. Several birds, including chickadees, nuthatches, crossbills, pine siskins, and Clark's nutcrackers eat seeds from the cones. Because subalpine fir seeds are large, comprising about 26 percent of a cone's weight, they can provide an energy-efficient food source (Uchytil 1991b).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—Elk may make moderate summer use of *Calamagrostis* species (reed grass) (Kufeld 1973).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) provides important wildlife habitat values, and is browsed to some extent by small mammals, especially by snowshoe hares (Tannas 1997a). The cones of this species are a choice food for red squirrels (Tannas 1997a).

Picea glauca (white spruce) provides good thermal and hiding cover for moose, white-tailed deer, and ruffed grouse. In southwestern Alberta, ruffed grouse preferentially select drumming sites with young *Picea glauca* (white spruce) cover (Abrahamson 2015).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) also offers poor forage value for wildlife, and is eaten by deer and elk only when better forage is lacking (Tannas 1997a). Stands of the species provide cover for big game animals, upland game birds, small non-game birds, and small mammals (Anderson 2003).

Fisheries

***Calamagrostis stricta* (narrow reed grass)**—The rhizomatous nature of *Calamagrostis* species (reed grass) will help provide bank stability for sites adjacent to streams (Thompson and Hansen 2003).

***Picea glauca* (white spruce)**—Stands of *Picea glauca* (white spruce) adjacent to streams provide hiding, thermal cover, debris recruitment, and streambank stability for fish habitat (Thompson and Hansen 2003).

Fire

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) is very fire sensitive, and it generally suffers high mortality from even low intensity fires. To colonize burned areas, it relies on wind-dispersed seeds, which readily germinate on seedbeds that are prepared by fire (Uchytil 1991b).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

***Calamagrostis stricta* (narrow reed grass)**—Fires reducing the abundance of other associated species tend to cause dramatic increase in *Calamagrostis stricta* (narrow reed grass) and other rhizomatous species (Haeussler and Coates 1986).

***Picea glauca* (white spruce)**— *Picea glauca* (white spruce) is easily killed by fire (Fischer and Bradley 1987). The species is poorly adapted to survive fire due to the trees have thin bark and shallow roots (Abrahamson 2015). Fires in *Picea glauca* (white spruce) communities are often stand-replacing, and post-fire succession generally progresses through stages of herbaceous plants, shrubs, and deciduous trees before finally succeeding to the late seral *Picea glauca* (white spruce). On sites where fire is frequent, the same species that initially colonized the stand after fire may dominate until the next stand-replacing fire. This leads to the persistence of shade intolerant species such as *Populus tremuloides* (aspen) and *Betula papyrifera* (white birch). Alternatively, when fire is not frequent, stands eventually become dominated by shade tolerant species, such as the *Picea glauca* (white spruce) (Abrahamson 2015).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) thrives under the influence of fire, and on many sites fire is required to maintain its dominance. Producing serotinous cones is one adaptation to stand-replacing fire, and the seed supply is nearly always available on the tree (Anderson 2003).

The propensity of *Pinus contorta* (lodgepole pine) to form stands with high seedling density, initial rapid growth that slows with age, high susceptibility to snow breakage and wind-throw, infestation by dwarf-mistletoe and mountain pine beetles, all result in large buildups of fuel (Anderson 2003).

Rehabilitation/Restoration Considerations

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) can be planted on disturbed sites within forest vegetation types where it naturally occurs. The species is generally recommended for cool and moist sites in subalpine areas. Because this wide-ranging tree exhibits a great degree of genetic variation, seed or nursery stock for rehabilitation projects should come from a local, site adapted. source. Transplanting rooted nursery stock is generally more successful than direct seeding of the species (Uchytil 1991b).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—Roads and trails should be located on adjacent uplands. *Calamagrostis stricta* (narrow reed grass) propagates by both seeds and rhizomes, making it a valuable species for stabilizing or rehabilitating suitable disturbed sites (Thompson and Hansen 2003).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) is useful for long-term revegetation of coal mine overburden. In Alberta, it is considered one of the best conifers for this purpose (Abrahamson 2015). Road construction and development severely degrade riparian and wetland sites with high water tables, poor drainage, or organic soils. Therefore, roads and trails should be located on adjacent uplands.

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is often used in reforestation projects, especially for revegetation on sites of mining disturbance. Though it grows well on nutrient poor soils, addition of nitrogen fertilizer will likely enhance growth of the plantings (Anderson 2003).

Recreational Uses and Consideration

***Picea glauca* (white spruce)**—Because of high water tables and the problems associated with road construction, campgrounds should not be located in stands of *Picea glauca* (white spruce).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Pl/Bracted honeysuckle/Fern/Feather moss
- Sw/Green alder/Fern/Feather moss

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type was previously described in the region for the following geographic location(s):

- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995);
- *Forest Habitat Types of Montana* (Pfister and others 1977); and
- *Forest Habitat Types of Northern Idaho: A Second Approximation* (Cooper and others 1991).

Abies lasiocarpa/Cornus canadensis Habitat Type (subalpine fir/bunchberry Habitat Type)

ABIELAS/CORNCAN Habitat Type
Number of Stands = 20 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 18; Other Data Sets = 2)

LOCATION AND ASSOCIATED LANDFORMS

The *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. This habitat type is restricted to sites having the fairly narrow range of conditions required for *Abies lasiocarpa* (subalpine fir). These conditions are most commonly met in smaller pockets in the montane and upper foothills natural subregions on sites with cold, humid habitats. Cool summers, cold winters, and deep winter snowpacks are more important than total precipitation in determining where *Abies lasiocarpa* (subalpine fir) grows. Site conditions required by *Cornus canadensis* (bunchberry) are broader and less restrictive of where the habitat type is found.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 23 shows the five most prominent plant species among the four lifeforms for species recorded in all 20 stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type. This habitat type has a forest/woodland character by being dominated by an upper canopy of conifer trees, primarily by the late seral *Abies lasiocarpa* (subalpine fir). The sample set of 20 stands includes all the stands sampled of the habitat type, which has early seral and disturbed stands along with late seral and undisturbed stands. Three conifer tree species dominate stands of this habitat type. There are moderately prominent shrub and forb species in the understory, but only one shrub, *Alnus crispa* (green alder), is particularly prominent.

Table 23. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type (number = 20 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Abies lasiocarpa (subalpine fir)	29.65	Native
Picea glauca (white spruce)	16.18	Native
Pinus contorta (lodgepole pine)	14.00	Native
Picea mariana (black spruce)	4.18	Native
Picea engelmannii (Engelmann spruce)	3.50	Native
Shrubs		
Alnus crispa (green alder)	9.53	Native
Salix bebbiana (beaked willow)	4.65	Native
Linnaea borealis (twinflower)	3.35	Native
Alnus tenuifolia (river alder)	3.00	Native
Menziesia ferruginea (false azalea)	1.68	Native
Graminoids		
Elymus innovatus (hairy wild rye)	2.30	Native
Cinna latifolia (drooping wood-reed)	1.00	Native
Calamagrostis rubescens (pine reed grass)	0.50	Native
Calamagrostis canadensis (marsh reed grass)	0.30	Native
Carex spp. (sedge)	0.15	Native
Forbs		
Cornus canadensis (bunchberry)	3.65	Native
Arnica cordifolia (heart-leaved arnica)	2.75	Native
Gymnocarpium dryopteris (oak fern)	2.53	Native
Aralia nudicaulis (wild sarsaparilla)	2.03	Native
Pyrola asarifolia (common pink wintergreen)	1.18	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 24 through Table 27, break out the vegetation recorded in all 20 stands sampled of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species rich, forested habitat type of minor-to-incidental occurrence in the study area.

Table 24 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/

bunchberry) habitat type. For the 20 stands comprising the habitat type, the number of unique species was 133 with 128 (96.2 percent) of them being native species.

Table 24. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type (number = 20 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	13	13	0	0
Shrubs	43	42	0	1
Graminoids	10	8	0	2
Forbs	67	65	0	2
TOTAL	***133 (100.0%)***	***128 (96.2%)***	***0 (0.0%)***	***5 (3.8%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 25 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type. The average number of species per stand is 22.9, with native species comprising 22.6 species per stand or 98.7 percent.

Table 25. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type (number = 20 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3.4	3.4	0.0	0.0
Shrubs	8.2	8.1	0.0	0.1
Graminoids	1.0	0.9	0.0	0.1
Forbs	10.3	10.2	0.0	0.1
TOTAL	***22.9 (100.0%)***	***22.6 (98.7%)***	***0.0 (0.0%)***	***0.3 (1.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 26 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type. The

average canopy cover per stand is 144.1 percent, with native species comprising 144.0 percent or 99.9 percent of the total amount of average canopy cover per stand.

Table 26. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type (number = 20 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	75.3%	75.3%	0.0%	0.0%
Shrubs	40.1%	40.1%	0.0%	0.0%
Graminoids	4.4%	4.3%	0.0%	0.1%
Forbs	24.4%	24.3%	0.0%	0.1%
TOTAL	***144.1% (100.0%)***	***144.0% (99.9%)***	***0.0% (0.0%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 27 shows the average number of species and average canopy cover by lifeform in stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type. The average number of species per stand was 22.9 with an average canopy cover of 144.1 percent.

Table 27. Average number of species and average canopy cover by lifeform in stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type (number = 20 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	3.4	75.3%
Shrubs	8.2	40.1%
Graminoids	1.0	4.4%
Forbs	10.3	24.4%
TOTAL	***22.9***	***144.1%***

Sampled Stands Plant Species List

The *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type described here is based on 20 sampled stands. In addition to the type indicator *Abies lasiocarpa* (subalpine fir), 12 other tree species were recorded, of which *Pinus contorta* (lodgepole pine) and *Picea glauca* (white spruce) are prominent associate tree species (Table 28). Of the 43 individual shrub species recorded on at least one of the 20 stands, *Alnus crispa* (green alder) was prominent. A few, like *Linnaea borealis* (twinflower), are fairly constantly present, but in small amounts. Of the 10 total graminoid species recorded, none is especially prominent; while among the 67 forb species recorded, the type indicator *Cornus canadensis* (bunchberry) is most prominent.

Table 28. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type (number = 20 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 13)					
Abies balsamea (balsam fir)	10.0	0-10	15	1.50	N
Abies lasiocarpa (subalpine fir)	34.9	0-90	85	29.65	N
Betula papyrifera (white birch)	10.3	0-30	15	1.55	N
Picea engelmannii (Engelmann spruce)	35.0	0-40	10	3.50	N
Picea engelmannii x glauca (Engelmann x white spruce)	15.0	0-20	10	1.50	N
Picea glauca (white spruce)	23.1	0-70	70	16.17	N
Picea mariana (black spruce)	16.7	0-40	25	4.18	N
Pinus banksiana (jack pine)	0.5	0-0.5	5	0.03	N
Pinus contorta (lodgepole pine)	20.0	0-70	70	14.00	N
Populus balsamifera (balsam poplar)	10.0	0-10	5	0.50	N
Populus tremuloides (aspen)	10.9	0-30	20	2.18	N
Pseudotsuga menziesii (Douglas-fir)	10.0	0-10	5	0.50	N
Thuja plicata (western red cedar)	0.5	0-0.5	5	0.03	N
Shrubs (N = 43)					
Acer glabrum (mountain maple)	20.0	0-20	5	1.00	N
Alnus crispa (green alder)	19.1	0-50	50	9.53	N
Alnus tenuifolia (river alder)	15.0	0-30	20	3.00	N
Amelanchier alnifolia (Saskatoon)	0.5	0-0.5	5	0.03	N
Arctostaphylos uva-ursi (common bearberry)	0.5	0-0.5	10	0.05	N
Betula pumila (dwarf birch)	0.5	0-0.5	10	0.05	N
Chimaphila umbellata (prince's-pine)	0.5	0-0.5	5	0.03	N
Clematis occidentalis (purple clematis)	3.0	0-3	5	0.15	N
Cornus stolonifera (red-osier dogwood)	5.3	0-10	15	0.80	N
Gaultheria hispidula (creeping snowberry)	3.0	0-3	5	0.15	N
Juniperus communis (ground juniper)	2.2	0-3	15	0.33	N
Ledum groenlandicum (common Labrador tea)	1.3	0-3	45	0.60	N
Linnaea borealis (twinflower)	3.7	0-20	90	3.35	N
Lonicera involucrata (bracted honeysuckle)	2.6	0-10	40	1.05	N
Menziesia ferruginea (false azalea)	11.2	0-30	15	1.68	N
Oxycoccus microcarpus (small bog cranberry)	0.5	0-0.5	5	0.03	N
Rhododendron albiflorum (white-flowered rhododendron)	0.5	0-0.5	5	0.03	N
Ribes lacustre (bristly black currant)	1.3	0-3	50	0.63	N
Ribes triste (wild red currant)	0.5	0-0.5	20	0.10	N
Rosa acicularis (prickly rose)	2.5	0-10	65	1.65	N
Rosa woodsii (common wild rose)	1.8	0-3	10	0.18	N
Rubus idaeus (wild red raspberry)	3.0	0-3	10	0.30	N
Rubus parviflorus (thimbleberry)	1.8	0-3	10	0.18	N
Rubus pedatus (dwarf bramble)	1.8	0-3	10	0.18	N
Rubus pubescens (dewberry)	2.3	0-10	55	1.25	N

Table 28. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Salix bebbiana (beaked willow)	18.6	0-60	25	4.65	N
Salix glauca (smooth willow)	30.0	0-30	5	1.50	N
Salix pedicellaris (bog willow)	10.0	0-10	5	0.50	N
Salix scouleriana (Scouler's willow)	10.0	0-10	5	0.50	N
Salix spp. (willow)	0.5	0-0.5	5	0.03	B
Sambucus racemosa (red elderberry)	0.5	0-0.5	10	0.05	N
Shepherdia canadensis (Canada buffaloberry)	3.0	0-3	5	0.15	N
Sorbus scopulina (western mountain-ash)	0.5	0-0.5	20	0.10	N
Spiraea betulifolia (white meadowsweet)	5.3	0-10	15	0.80	N
Symphoricarpos albus (snowberry)	10.0	0-10	5	0.50	N
Symphoricarpos occidentalis (buckbrush)	0.5	0-0.5	5	0.03	N
Vaccinium caespitosum (dwarf bilberry)	0.5	0-0.5	15	0.08	N
Vaccinium membranaceum (tall bilberry)	5.3	0-20	30	1.60	N
Vaccinium myrtilloides (common blueberry)	7.7	0-10	15	1.15	N
Vaccinium myrtillus (low bilberry)	0.5	0-0.5	5	0.03	N
Vaccinium scoparium (grouseberry)	3.0	0-3	5	0.15	N
Vaccinium vitis-idaea (bog cranberry)	3.8	0-10	30	1.13	N
Viburnum edule (low-bush cranberry)	2.6	0-10	35	0.90	N
Graminoids (N = 10)					
Bromus spp. (brome grass)	0.5	0-0.5	5	0.03	B
Calamagrostis canadensis (marsh reed grass)	3.0	0-3	10	0.30	N
Calamagrostis rubescens (pine reed grass)	10.0	0-10	5	0.50	N
Carex lanuginosa (woolly sedge)	0.5	0-0.5	5	0.03	N
Carex spp. (sedge)	3.0	0-3	5	0.15	N
Cinna latifolia (drooping wood-reed)	20.0	0-20	5	1.00	N
Elymus glaucus (smooth wild rye)	0.5	0-0.5	5	0.03	N
Elymus innovatus (hairy wild rye)	5.1	0-30	45	2.30	N
Festuca rubra (red fescue)	0.5	0-0.5	5	0.03	B
Glyceria elata (tufted tall manna grass)	0.5	0-0.5	5	0.03	N
Forbs (N = 67)					
Achillea millefolium (common yarrow)	1.3	0-3	15	0.20	N
Actaea rubra (red and white baneberry)	2.2	0-3	15	0.33	N
Adenocaulon bicolor (pathfinder)	0.5	0-0.5	5	0.03	N
Antennaria spp. (everlastings)	0.5	0-0.5	5	0.03	N
Aralia nudicaulis (wild sarsaparilla)	10.1	0-20	20	2.03	N
Arnica cordifolia (heart-leaved arnica)	4.6	0-30	60	2.75	N
Arnica latifolia (broad-leaved arnica)	0.5	0-0.5	5	0.03	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	15	0.08	N
Aster conspicuus (showy aster)	1.5	0-3	25	0.38	N
Aster spp. (aster)	0.5	0-0.5	5	0.03	N
Aster subspicatus (leafy-bracted aster)	3.0	0-3	5	0.15	N
Athyrium filix-femina (lady fern)	10.0	0-10	5	0.50	N
Calypso bulbosa (Venus'-slipper)	2.2	0-3	15	0.33	N
Campanula rotundifolia (harebell)	0.5	0-0.5	5	0.03	N

Table 28. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Castilleja spp. (paintbrush)	0.5	0-0.5	5	0.03	N
Circaea alpina (small enchanter's nightshade)	10.0	0-10	5	0.50	N
Clintonia uniflora (corn lily)	3.0	0-3	5	0.15	N
Cornus canadensis (bunchberry)	3.7	0.5-20	100	3.65	N
Delphinium glaucum (tall larkspur)	1.8	0-3	10	0.18	N
Epilobium angustifolium (common fireweed)	1.8	0-10	55	1.00	N
Equisetum arvense (common horsetail)	1.8	0-3	20	0.35	N
Equisetum laevigatum (smooth scouring-rush)	0.5	0-0.5	5	0.03	N
Equisetum pratense (meadow horsetail)	2.4	0-3	20	0.48	N
Equisetum scirpoides (dwarf scouring-rush)	1.8	0-3	10	0.18	N
Equisetum sylvaticum (woodland horsetail)	1.0	0-3	25	0.25	N
Fragaria virginiana (wild strawberry)	1.8	0-3	20	0.35	N
Galium boreale (northern bedstraw)	3.0	0-3	5	0.15	N
Galium triflorum (sweet-scented bedstraw)	0.5	0-0.5	15	0.08	N
Goodyera oblongifolia (rattlesnake plantain)	0.5	0-0.5	5	0.03	N
Gymnocarpium dryopteris (oak fern)	16.8	0-30	15	2.52	N
Habenaria spp. (bog orchid)	0.5	0-0.5	5	0.03	B
Hedysarum sulphurescens (yellow hedysarum)	3.0	0-3	5	0.15	N
Heracleum lanatum (cow parsnip)	10.3	0-20	10	1.03	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	5	0.03	N
Listera borealis (northern twayblade)	0.5	0-0.5	5	0.03	N
Listera cordata (heart-leaved twayblade)	1.8	0-3	10	0.18	N
Lycopodium annotinum (stiff club-moss)	1.0	0-3	25	0.25	N
Maianthemum canadense (wild lily-of-the-valley)	0.9	0-3	35	0.30	N
Mertensia paniculata (tall lungwort)	1.2	0-3	35	0.43	N
Mitella nuda (bishop's-cap)	1.7	0-10	40	0.68	N
Moneses uniflora (one-flowered wintergreen)	0.5	0-0.5	15	0.08	N
Orthilia secunda (one-sided wintergreen)	1.4	0-3	55	0.78	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	0.5	0-0.5	5	0.03	N
Osmorhiza depauperata (spreading sweet cicely)	0.5	0-0.5	10	0.05	N
Osmorhiza occidentalis (western sweet cicely)	0.5	0-0.5	5	0.03	N
Pedicularis labradorica (Labrador lousewort)	0.5	0-0.5	5	0.03	N
Petasites palmatus (palmate-leaved coltsfoot)	0.9	0-3	35	0.30	N
Petasites sagittatus (arrow-leaved coltsfoot)	3.0	0-3	5	0.15	N
Pyrola asarifolia (common pink wintergreen)	2.9	0-10	40	1.18	N
Pyrola chlorantha (greenish-flowered wintergreen)	1.8	0-3	20	0.35	N
Senecio pseudaureus (thin-leaved ragwort)	1.8	0-3	10	0.18	N
Senecio triangularis (brook ragwort)	0.5	0-0.5	5	0.03	N
Smilacina racemosa (false Solomon's-seal)	1.8	0-3	10	0.18	N
Smilacina stellata (star-flowered Solomon's-seal)	1.8	0-3	10	0.18	N
Solidago multiradiata (alpine goldenrod)	0.5	0-0.5	5	0.03	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	5	0.03	N
Stenanthium occidentale (bronzebells)	0.5	0-0.5	5	0.03	N

Table 28. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.5	0-0.5	35	0.18	N
Thalictrum occidentale (western meadow rue)	3.0	0-3	5	0.15	N
Thalictrum venulosum (veiny meadow rue)	3.0	0-3	5	0.15	N
Tiarella trifoliata (laceflower)	0.5	0-0.5	10	0.05	N
Townsendia parryi (Parry's townsendia)	0.5	0-0.5	5	0.03	N
Veratrum eschscholtzii (green false hellebore)	0.5	0-0.5	5	0.03	N
Viola canadensis (western Canada violet)	0.5	0-0.5	5	0.03	N
Viola orbiculata (evergreen violet)	0.5	0-0.5	5	0.03	N
Viola renifolia (kidney-leaved violet)	3.0	0-3	10	0.30	N
Viola spp. (violet)	0.5	0-0.5	5	0.03	B

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 29 shows the five most prominent plant species among the four lifeforms for species recorded in all four relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type. This habitat type has a forest/woodland character dominated by an upper canopy of conifer trees, heavily dominated by the late seral *Abies lasiocarpa* (subalpine fir). This sample set of four stands includes only late seral and relatively undisturbed stands sampled of the habitat type. There are moderately prominent shrub and forb species in the understory, but only a small amount of one graminoid species was recorded on these four stands.

Table 29. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type (number = 4 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Abies lasiocarpa (subalpine fir)	62.50	Native
Picea glauca (white spruce)	7.50	Native
Pinus contorta (lodgepole pine)	5.75	Native
Picea engelmannii x glauca (Engelmann x white spruce)	5.00	Native
Picea mariana (black spruce)	0.75	Native
Shrubs		
Menziesia ferruginea (false azalea)	7.50	Native
Alnus crispa (green alder)	5.00	Native
Alnus tenuifolia (river alder)	5.00	Native
Vaccinium membranaceum (tall bilberry)	2.75	Native
Linnaea borealis (twinflower)	1.75	Native
Graminoids		
Elymus innovatus (hairy wild rye)	0.13	Native
Forbs		
Cornus canadensis (bunchberry)	4.13	Native
Orthilia secunda (one-sided wintergreen)	1.63	Native
Arnica cordifolia (heart-leaved arnica)	0.88	Native
Epilobium angustifolium (common fireweed)	0.25	Native
Mitella nuda (bishop's-cap)	0.25	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 30 through Table 33, break out the vegetation recorded in all four relatively undisturbed late seral to climax stands sampled of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species rich, forested habitat type of minor-to-incidental occurrence across the study area.

Table 30 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type. For the 4 stands comprising the habitat type, the number of unique species was 46 with 45 (97.8 percent) of them being native species.

Table 30. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type (number = 4 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	6	6	0	0
Shrubs	20	19	0	1
Graminoids	1	1	0	0
Forbs	19	19	0	0
TOTAL	***46 (100.0%)***	***45 (97.8%)***	***0 (0.0%)***	***1 (2.2%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 31 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type. The average number of species per stand is 19.1, with native species comprising 18.8 species per stand or 98.4 percent.

Table 31. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type (number = 4 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3.0	3.0	0.0	0.0
Shrubs	8.8	8.5	0.0	0.3
Graminoids	0.3	0.3	0.0	0.0
Forbs	7.0	7.0	0.0	0.0
TOTAL	***19.1 (100.0%)***	***18.8 (98.4%)***	***0.0 (0.0%)***	***0.3 (1.6%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 32 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type. The average canopy cover per stand is 119.4 percent, with native species comprising 119.3 percent or 99.9 percent of the total amount of average canopy cover per stand.

Table 32. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type (number = 4 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	81.6%	81.6%	0.0%	0.0%
Shrubs	28.6%	28.5%	0.0%	0.1%
Graminoids	0.1%	0.1%	0.0%	0.0%
Forbs	9.0%	9.0%	0.0%	0.0%
TOTAL	***119.4% (100.0%)***	***119.3% (99.9%)***	***0.0% (0.0%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 33 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type. The average number of species per stand was 19.1 with an average canopy cover of 119.4 percent.

Table 33. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type (number = 4 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	3.0	81.6%
Shrubs	8.8	28.6%
Graminoids	0.3	0.1%
Forbs	7.0	9.0%
TOTAL	***19.1***	***119.4%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

On four relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type, six tree species were recorded, led by the type overstory indicator, *Abies lasiocarpa* (subalpine fir) (Table 34). Twenty shrub species also were recorded, but none had high prominence, and only *Linnaea borealis* (twinflower) occurred in all stands. This habitat type is not a grassy community; *Elymus innovatus* (hairy wild rye) was the only graminoid recorded on any of the four stands. Of the total 19 forb species recorded in these four later seral stands, only the type understory indicator, *Cornus canadensis* (bunchberry), occurred on every stand.

Table 34. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type (number = 4 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 6)					
Abies lasiocarpa (subalpine fir)	62.5	50-90	100	62.50	N
Picea engelmannii x glauca (Engelmann x white spruce)	20.0	0-20	25	5.00	N
Picea glauca (white spruce)	15.0	0-20	50	7.50	N
Picea mariana (black spruce)	3.0	0-3	25	0.75	N
Pinus banksiana (jack pine)	0.5	0-0.5	25	0.13	N
Pinus contorta (lodgepole pine)	7.7	0-10	75	5.75	N
Shrubs (N = 20)					
Alnus crispa (green alder)	10.0	0-10	50	5.00	N
Alnus tenuifolia (river alder)	10.0	0-10	50	5.00	N
Arctostaphylos uva-ursi (common bearberry)	0.5	0-0.5	25	0.13	N
Ledum groenlandicum (common Labrador tea)	1.3	0-3	75	1.00	N
Linnaea borealis (twinflower)	1.8	0.5-3	100	1.75	N
Lonicera involucrata (bracted honeysuckle)	0.5	0-0.5	25	0.13	N
Menziesia ferruginea (false azalea)	30.0	0-30	25	7.50	N
Rhododendron albiflorum (white-flowered rhododendron)	0.5	0-0.5	25	0.13	N
Ribes lacustre (bristly black currant)	0.5	0-0.5	75	0.38	N
Ribes triste (wild red currant)	0.5	0-0.5	25	0.13	N
Rosa acicularis (prickly rose)	1.3	0-3	75	1.00	N
Rubus idaeus (wild red raspberry)	3.0	0-3	25	0.75	N
Rubus pedatus (dwarf bramble)	1.8	0-3	50	0.88	N
Rubus pubescens (dewberry)	0.5	0-0.5	50	0.25	N
Salix spp. (willow)	0.5	0-0.5	25	0.13	B
Sorbus scopulina (western mountain-ash)	0.5	0-0.5	25	0.13	N
Spiraea betulifolia (white meadowsweet)	3.0	0-3	25	0.75	N
Vaccinium membranaceum (tall bilberry)	3.7	0-10	75	2.75	N
Vaccinium vitis-idaea (bog cranberry)	3.0	0-3	25	0.75	N
Viburnum edule (low-bush cranberry)	0.5	0-0.5	25	0.13	N
Graminoids (N = 1)					
Elymus innovatus (hairy wild rye)	0.5	0-0.5	25	0.13	N
Forbs (N = 19)					
Achillea millefolium (common yarrow)	0.5	0-0.5	25	0.13	N
Arnica cordifolia (heart-leaved arnica)	1.8	0-3	50	0.88	N
Aster conspicuus (showy aster)	0.5	0-0.5	25	0.13	N
Cornus canadensis (bunchberry)	4.1	0.5-10	100	4.13	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	50	0.25	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	25	0.13	N
Listera borealis (northern twayblade)	0.5	0-0.5	25	0.13	N
Listera cordata (heart-leaved twayblade)	0.5	0-0.5	25	0.13	N
Lycopodium annotinum (stiff club-moss)	0.5	0-0.5	25	0.13	N

Table 34. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	25	0.13	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	25	0.13	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	50	0.25	N
Moneses uniflora (one-flowered wintergreen)	0.5	0-0.5	25	0.13	N
Orthilia secunda (one-sided wintergreen)	2.2	0-3	75	1.63	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	25	0.13	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	25	0.13	N
Pyrola chlorantha (greenish-flowered wintergreen)	0.5	0-0.5	25	0.13	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	25	0.13	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.5	0-0.5	50	0.25	N

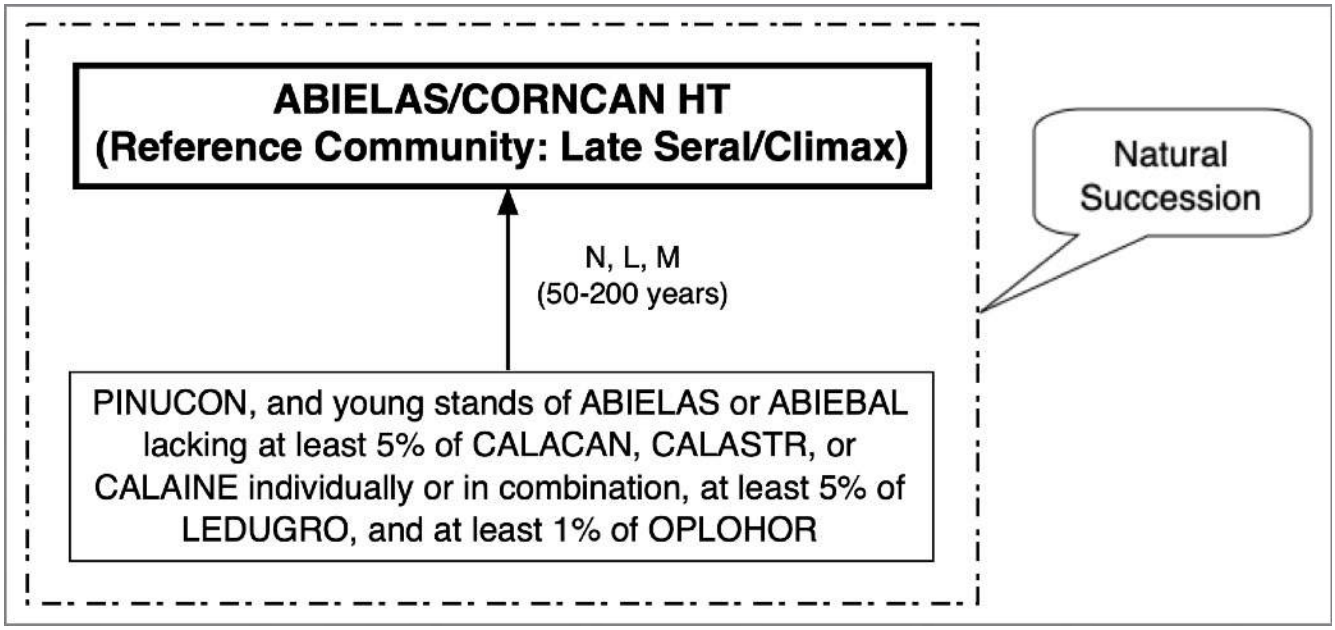
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Abies lasiocarpa (subalpine fir) is a shade-tolerant climax species favored by a long fire-free interval. Maturity and extended age of stands of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type depend largely on freedom from wildfire. Reestablishment of stands after a burn depends of availability of nearby sources of *Abies lasiocarpa* (subalpine fir) seed and on the level of competition from the fire adapted seral species, such as *Pinus contorta* (lodgepole pine) and *Populus tremuloides* (aspen).

Figure 6 shows a schematic diagram of vegetation successional pathways on sites of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type.



Successional Pathway of *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
ABIEBAL—*Abies balsamea* (balsam fir)
ABIELAS—*Abies lasiocarpa* (subalpine fir)
ABIELAS/CORNCAN HT—*Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type
CALACAN—*Calamagrostis canadensis* (marsh reed grass)
CALAINE—*Calamagrostis inexpansa* (northern reed grass)
CALASTR—*Calamagrostis stricta* (narrow reed grass)
LEDUGRO—*Ledum groenlandicum* (common Labrador tea)
OPLOHOR—*Oplopanax horridum* (devil's-club)
PINUCON—*Pinus contorta* (lodgepole pine)

Figure 6. Successional pathway for sites of the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 7 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Abies lasiocarpa/Cornus canadensis*

(subalpine fir/bunchberry) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

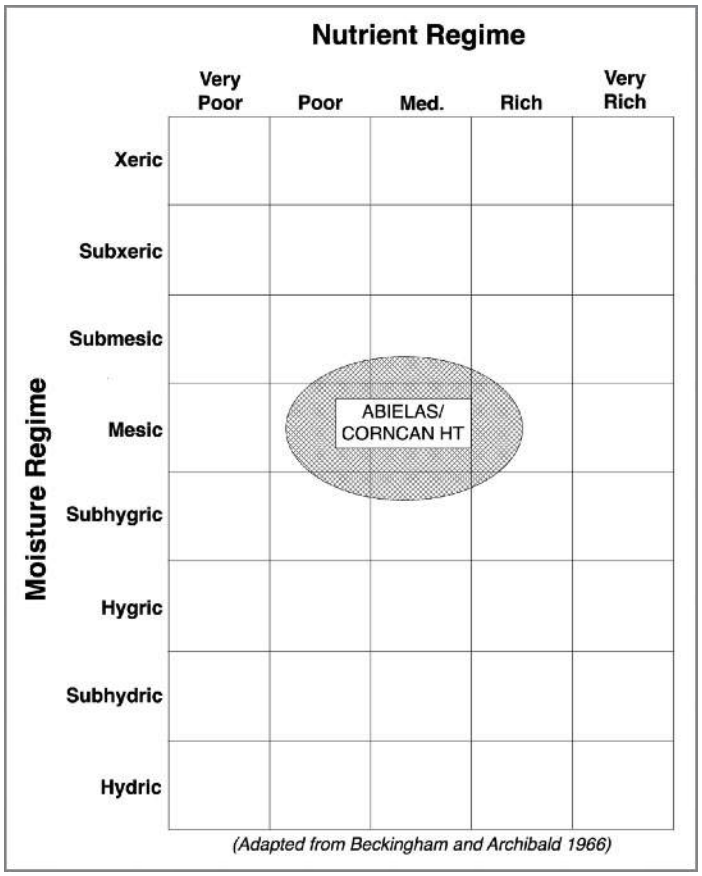


Figure 7. Edatope grid position for the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type (ABIELAS/CORNCAN HT)

SOILS

Parent material on sites supporting the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type is typically morainal or glaciofluvial, and soils are mostly luvisols and brunisols. Soil drainage ranges from moderately drained to well drained, with surface texture ranging from silt loam to clay loam. Organic thickness is mostly 0 cm to 5 cm thick (France and others 2020, Baker and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites will likely be dominated by either the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/marsh reed grass) habitat type or the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/ common Labrador tea) habitat type. Drier adjacent sites will often have communities dominated by *Picea glauca* (white spruce) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) occurs frequently in the southern Rocky Mountain and Boreal Forest natural regions of Alberta in forested stands from low elevation up to the subalpine zone (Tannas 1997a).

This is a middle to upper elevation mountain conifer tree species. It generally occupies sites having a short growing season with cold winters, cool summers, frequent summer frosts, and heavy winter snowpack. In the Rocky Mountains, *Abies lasiocarpa* (subalpine fir) is a shade-tolerant late seral/climax species that is favored by sites with long intervals free of fire-(Uchytil 1991b).

***Cornus canadensis* (bunchberry)**—*Cornus canadensis* (bunchberry) is a low forb species common in moist, shaded woodlands and forests throughout most natural regions in Alberta (Tannas 1997a).

Cornus canadensis (bunchberry) sites are typically in cool and moist habitats. The species tolerates a wide range of soil types and moisture and nutrient conditions. In west-central Alberta, it is found on sites ranging from wet to dry and from nutrient poor to nutrient rich (Gucker 2012a).

Cornus canadensis (bunchberry) occurs in all stages of forest seral succession. It tolerates the range of conditions spanning forest succession stages from early to late seral, and its abundance can be greater under an open canopy than under closed canopies. However, the species still persists on densely shaded forest sites (Gucker 2012a).

***Linnaea borealis* (twinflower)**—*Linnaea borealis* (twinflower) is found in most natural regions of Alberta, growing in moist woodlands, often forming large mats (Tannas 1997a). The species grows in recently disturbed, seral stands, as well as in climax plant communities. It tolerates a wide spectrum of light intensity, ranging from fully sunlit openings to a closed forest canopy. It has a creeping or trailing growth form, with numerous short aerial stems rising from the stolon (Howard 1993a).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) is found in woodlands and thickets, in moist or boggy woods, along streams, in coniferous forests, and sometimes in sandy woods (Tannas 1997a). The species is a valuable understory component, protecting the soil along water courses and as a pioneer species on disturbed mineral soil. It improves the soil by adding organic matter and by fixing nitrogen (Tannas 1997a).

Alnus crispa (green alder) is a semi-shade tolerant pioneer, or seral, species. It invades and inhabits terraces above the floodplain that are subject to occasional flooding (Matthews 1992).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) is a late seral to climax conifer tree species, commonly replacing stand associates, *Betula* species (birch), *Populus* species (poplar), and *Pinus* species (pine), as succession progresses (Tannas 1997a).

This species typically grows in regions having long, cold winters and short, cool summers. It may be found on floodplains, upland slopes, and a variety of other landscape positions. Although it has a wide elevational range, *Picea glauca* (white spruce) is often confined to stream bottoms and lower river benches (Abrahamson 2015). It typically grows best on warm, moderately-to-well drained, upland or floodplain soils; and grows poorly on sites with stagnant water or a high water table (Abrahamson 2015).

Picea glauca (white spruce) co-dominates with *Populus tremuloides* (aspen), *Betula papyrifera* (white birch), and *Picea mariana* (black spruce) over large areas of mid seral forest (Abrahamson 2015).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is found in all natural regions of Alberta, except the Dry Mixedgrass Region. It is the most common tree species at middle and lower altitudes along the eastern slopes of the Rocky Mountains, forming nearly pure stands on some sites in the foothills and montane areas (Tannas 1997a).

Pinus contorta (lodgepole pine) grows at low to high elevations, in dry to wet conditions, warm to cold temperatures, and on nearly every soil type found in western North America, except on saline sites. The species is not shade tolerant, and grows best on non-calcareous soil. It is primarily an aggressive pioneer on disturbed sites, and fire perpetuates or renews the stands (Anderson 2003). As these pine stands mature, they give way to shade-tolerant conifers at ages from 50 to 100 years in mesic habitats, and 100 to 200 years on warmer and drier sites (Anderson 2003).

Pinus contorta (lodgepole pine) may establish alongside later seral, more shade-tolerant species, and its rapid growth may enable the pines to remain competitive in the canopy for several years. However, these trees do not regenerate under a canopy, and are eliminated from the stand as mortality occurs. The *Pinus contorta* (lodgepole pine) is generally replaced within 50 to 100 years by the more shade-tolerant associates (Anderson 2003).

Livestock

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) is unpalatable and its forage value is poor for both livestock and wild ungulates (Tannas 1997a). Stands dominated by it generally do not produce enough forage for livestock, but do provide browse and cover for large and small wildlife species (Uchytil 1991b).

***Cornus canadensis* (bunchberry)**—*Cornus canadensis* (bunchberry) appears not to be a significant food source for livestock (Gucker 2012a).

***Linnaea borealis* (twinflower)**—*Linnaea borealis* (twinflower) provides little, poor quality, forage. *Linnaea borealis* (twinflower) is considered to be an increaser in response to grazing, but does not spread aggressively (Tannas 1997a).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) provides fair to poor forage value. Although the leaves and twigs are thought to be nutritious and to have a fairly high protein content, the species ranks quite low in palatability, and is used only sparingly by both livestock and wild ungulates (Tannas 1997a). *Alnus crispa* (green alder) is considered an increaser in response to grazing, reproducing rapidly by both rhizomes and seed, while being fairly resistant to browsing (Tannas 1997a).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) has poor value as forage for both livestock and wild ungulates, although it is occasionally used where better quality forage is lacking (Tannas 1997a). Herbage production is moderate to low, decreasing as seral succession progresses, and the upper canopy closes. These sites have little value as livestock range, other than shading. Lane and others (2000) recommend non-use for stands of *Picea glauca* (white spruce) on moist sites in the Lower Foothills Subregion. The moist soils are sensitive to disturbance, and cattle can easily churn the wet soil and destroy plant cover, as well as limiting tree seedling establishment.

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) offers poor forage value, and is seldom eaten by livestock (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) wood is soft, brittle, and quick to decay. It is used for rough construction and boxes, doors, frames, poles, and fuel. Small trees are extensively used as Christmas trees (USDA National Resources Conservation Service 2023).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) timber is used primarily for pulpwood, construction lumber, furniture, boxes, crates, and pallets (USDA National Resources Conservation Service 2023). Productivity is moderate to high on these moist, rich sites (Beckingham and others 1996). However, they offer only limited potential due to the extremely fragile site conditions, generally accessible only during winter. Due to high water tables, the trees are extremely susceptible to windthrow and soil loss may follow all forms of timber harvesting. Subsequent to harvest, water tables can rise, causing problems for regeneration of trees on the site.

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) timber is used extensively for construction lumber, pulpwood, heating fuel, posts and poles, and plywood veneer (USDA National Resources Conservation Service 2023).

Wildlife

***Abies lasiocarpa* (subalpine fir)**—Mule deer, elk, moose, woodland caribou, black bear, and grizzly bear often use *Abies lasiocarpa* (subalpine fir) habitats as summer range, but these forest sites are generally not suitable winter range for deer and elk because of heavy snowpack. Mule deer, elk, moose, woodland caribou, black bear, and grizzly bear often use these habitats as summer range (Uchytil 1991b).

Abies lasiocarpa (subalpine fir) seeds are eaten by several species of small mammals and birds. Red squirrels, chipmunks, and mice eat seeds from cached cones. Several birds, including chickadees, nuthatches, crossbills, pine siskins, and Clark's nutcrackers eat seeds from the cones. Because subalpine fir seeds are large, comprising about 26 percent of a cone's weight, they can provide an energy-efficient food source (Uchytil 1991b).

***Cornus canadensis* (bunchberry)**—*Cornus canadensis* (bunchberry) can be an important forage species for caribou, moose, elk, and deer. The fruits are eaten by bears, small mammals, and many bird species. Deer use of the species can be extensive and is considered highly preferred by mule deer. Chipmunks, martens, cottontails, and snowshoe hares feed on the stems and fruits. *Cornus canadensis* (bunchberry) fruits are eaten by song and game birds such as thrushes, veeries, vireos, and grouse (Gucker 2012a).

***Linnaea borealis* (twinflower)**—*Linnaea borealis* (twinflower) is used in northern Canada and Alaska by bighorn sheep and caribou as incidental forage. Elk use the species in British Columbia and Washington state, and ruffed grouse are known to consume it in Idaho (Howard 1993a).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) leaves and young growth are readily eaten in severe weather and when other food supplies are scarce, primarily on elk and moose winter range in the upper foothills. Furthermore, the species provides important cover and habitat for wildlife, and is an important source of food for beaver (Tannas 1997a). Muskrat, beaver, cottontail, and snowshoe hares feed on alder twigs and foliage (Matthews 1992). Many birds eat alder seeds, buds, and catkins. The species is also an important component of white-tailed ptarmigan winter forage (Matthews 1992).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) provides important wildlife habitat values, and is browsed to some extent by small mammals, especially by snowshoe hares (Tannas 1997a). The cones of this species are a choice food for red squirrels (Tannas 1997a).

Picea glauca (white spruce) provides good thermal and hiding cover for moose, white-tailed deer, and ruffed grouse. In southwestern Alberta, ruffed grouse preferentially select drumming sites with young *Picea glauca* (white spruce) cover (Abrahamson 2015).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) also offers poor forage value for wildlife, and is eaten by deer and elk only when better forage is lacking (Tannas 1997a). Stands of the species provide cover for big game animals, upland game birds, small non-game birds, and small mammals (Anderson 2003).

Fisheries

***Picea glauca* (white spruce)**—Stands of *Picea glauca* (white spruce) adjacent to streams provide hiding, thermal cover, debris recruitment, and streambank stability for fish habitat (Thompson and Hansen 2003).

Fire

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) is very fire sensitive, and it generally suffers high mortality from even low intensity fires. To colonize burned areas, it relies on wind-dispersed seeds, which readily germinate on seedbeds that are prepared by fire (Uchytil 1991b).

***Cornus canadensis* (bunchberry)**—*Cornus canadensis* (bunchberry) is typically only top-killed by fire, and post fire sprouting is common. It survives most fires by sprouting from the rhizomes (Gucker 2012a).

***Linnaea borealis* (twinflower)**—Following fire, *Linnaea borealis* (twinflower) sprouts from the root crowns and establishes by seed from plants in adjacent unburned areas. The bare mineral soil created by fire provides prime sites for *Linnaea borealis* (twinflower) establishment. These shrubs provide shade that reduce soil temperatures, allowing spruce and other conifer tree genera to become established (Howard 1993a).

***Alnus crispa* (green alder)**—Following fire, *Alnus crispa* (green alder) resprouts from the root crowns and establishes by seed from plants in nearby unburned areas. The bare mineral soil created by fire provides prime sites for *Alnus crispa* (green alder) establishment. The species does not burn easily, and dense stands can sometimes prevent fire spread. These shrubs provide shade that reduces soil temperatures, allowing spruce and other conifer trees to become established (Matthews 1992).

***Picea glauca* (white spruce)**— *Picea glauca* (white spruce) is easily killed by fire (Fischer and Bradley 1987). The species is poorly adapted to survive fire due to the trees have thin bark and shallow roots (Abrahamson 2015). Fires in *Picea glauca* (white spruce) communities are often stand-replacing, and post-fire succession generally progresses through stages of herbaceous plants, shrubs, and deciduous trees before finally succeeding to the late seral *Picea glauca* (white spruce). On sites where fire is frequent, the same species that initially colonized the stand after fire may dominate until the next stand-replacing fire. This leads to the persistence of shade intolerant species such as *Populus tremuloides* (aspen) and *Betula papyrifera* (white birch). Alternatively, when fire is not frequent, stands eventually become dominated by shade tolerant species, such as the *Picea glauca* (white spruce) (Abrahamson 2015).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) thrives under the influence of fire, and on many sites fire is required to maintain its dominance. Producing serotinous cones is one adaptation to stand-replacing fire, and the seed supply is nearly always available on the tree (Anderson 2003).

Rehabilitation/Restoration Considerations

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) can be planted on disturbed sites within forest vegetation types where it naturally occurs. The species is generally recommended for cool and moist sites in subalpine areas. Because this wide-ranging tree exhibits a great degree of genetic variation, seed or nursery stock

for rehabilitation projects should come from a local, site adapted. source. Transplanting rooted nursery stock is generally more successful than direct seeding of the species (Uchytil 1991b).

***Alnus crispa* (green alder)**—The major value of *Alnus crispa* (green alder) in rehabilitation is its ability to invade sterile soil, thereby increasing the organic matter content and by nitrogen fixation (Matthews 1992). The species was noted for its ability to colonize tailings at the Discovery Mine in Northwest Territories (Matthews 1992).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) is useful for long-term revegetation of coal mine overburden. In Alberta, it is considered one of the best conifers for this purpose (Abrahamson 2015). Road construction and development severely degrade riparian and wetland sites with high water tables, poor drainage, or organic soils. Therefore, roads and trails should be located on adjacent uplands.

Recreational Uses and Consideration

***Picea glauca* (white spruce)**—Because of high water tables and the problems associated with road construction, campgrounds should not be located in stands of *Picea glauca* (white spruce).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Fa/Feather moss
- Sw/Hairy wild rye/Feather moss (harvested)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Sw/Thimbleberry

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Mse16 Sw/Thimbleberry (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type has not been described in the region.

Abies lasiocarpa/Ledum groenlandicum Habitat Type (subalpine fir/common Labrador tea Habitat Type)

ABIELAS/LEDUGRO Habitat Type
Number of Stands = 31 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 31; Other Data Sets = 0)

LOCATION AND ASSOCIATED LANDFORMS

The *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This habitat type is restricted to sites having the fairly narrow range of conditions required for *Abies lasiocarpa* (subalpine fir). These conditions are most commonly met in smaller pockets in the montane and upper foothills natural subregions on sites with cold, humid habitats. Cool summers, cold winters, and deep winter snowpacks are more important than total precipitation in determining where *Abies lasiocarpa* (subalpine fir) grows. Site conditions required by *Ledum groenlandicum* (common Labrador tea) may be somewhat more restrictive of the habitat type to boggy, nutrient poor, poorly drained, acidic soils.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 35 shows the five most prominent plant species among the four lifeforms for species recorded in all 31 stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type. This habitat type has a forest/woodland character dominated by an upper canopy of conifer trees, primarily by the late seral *Abies lasiocarpa* (subalpine fir). The sample set of 31 stands includes all stands sampled of the habitat type, which includes early seral and disturbed stands along with late seral and undisturbed stands. Two conifer tree species dominate stands of this habitat type. The shrub layer is dominated by *Ledum groenlandicum* (common Labrador tea), while the graminoids have no particularly prominent species in this type, while among the forbs, only *Cornus canadensis* (bunchberry) is moderately prominent.

Table 35. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type (number = 31 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Abies lasiocarpa (subalpine fir)	30.97	Native
Pinus contorta (lodgepole pine)	18.45	Native
Picea engelmannii (Engelmann spruce)	8.07	Native
Picea mariana (black spruce)	6.82	Native
Picea glauca (white spruce)	5.48	Native
Shrubs		
Ledum groenlandicum (common Labrador tea)	23.55	Native
Menziesia ferruginea (false azalea)	6.21	Native
Vaccinium membranaceum (tall bilberry)	5.44	Native
Vaccinium vitis-idaea (bog cranberry)	4.94	Native
Linnaea borealis (twinflower)	3.60	Native
Graminoids		
Elymus innovatus (hairy wild rye)	0.66	Native
Calamagrostis canadensis (marsh reed grass)	0.39	Native
Calamagrostis rubescens (pine reed grass)	0.21	Native
Carex concinnoides (low northern sedge)	0.02	Native
Schizachne purpurascens (purple oat grass)	0.02	Native
Forbs		
Cornus canadensis (bunchberry)	5.05	Native
Lycopodium annotinum (stiff club-moss)	0.97	Native
Orthilia secunda (one-sided wintergreen)	0.61	Native
Arnica cordifolia (heart-leaved arnica)	0.57	Native
Petasites palmatus (palmate-leaved coltsfoot)	0.47	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 36 through Table 39, break out the vegetation recorded in all 31 stands sampled of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, forested habitat type of minor occurrence across the study area.

Table 36 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/

common Labrador tea) habitat type. For the 31 stands comprising the habitat type, the number of unique species was 84 with 83 (98.8 percent) of them being native species.

Table 36. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type (number = 31 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	10	10	0	0
Shrubs	33	32	0	1
Graminoids	5	5	0	0
Forbs	36	36	0	0
TOTAL	***84 (100.0%)***	***83 (98.8%)***	***0 (0.0%)***	***1 (1.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 37 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type. The average number of species per stand is 15.3, with native species comprising 15.2 species per stand or 99.3 percent.

Table 37. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type (number = 31 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3.0	3.0	0.0	0.0
Shrubs	6.6	6.5	0.0	0.1
Graminoids	0.7	0.7	0.0	0.0
Forbs	5.0	5.0	0.0	0.0
TOTAL	***15.3 (100.0%)***	***15.2 (99.3%)***	***0.0 (0.0%)***	***0.1 (0.7%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 38 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea)

habitat type. The average canopy cover per stand is 146.1 percent, with native species comprising 145.9 percent or 99.9 percent of the total amount of average canopy cover per stand.

Table 38. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type (number = 31 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	74.5%	74.5%	0.0%	0.0%
Shrubs	60.2%	60.0%	0.0%	0.1%
Graminoids	1.3%	1.3%	0.0%	0.0%
Forbs	10.1%	10.1%	0.0%	0.0%
TOTAL	***146.1% (100.0%)***	***145.9% (99.9%)***	***0.0% (0.0%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 39 shows the average number of species and average canopy cover by lifeform in stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type. The average number of species per stand was 15.3 with an average canopy cover of 146.1 percent.

Table 39. Average number of species and average canopy cover by lifeform in stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type (number = 31 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	3.0	74.5%
Shrubs	6.6	60.2%
Graminoids	0.7	1.3%
Forbs	5.0	10.1%
TOTAL	***15.3***	***146.1%***

Sampled Stands Plant Species List

The *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type described here is based on 31 stands with 10 tree species occurring in at least one stand each, of which *Abies lasiocarpa* (subalpine fir) is most prominent, although the earlier seral associate, *Pinus contorta* (lodgepole pine), is also quite prominent (Table 40). Thirty-three shrub species were recorded, with only *Ledum groenlandicum* (common Labrador tea) having very high prominence. Only five graminoid species were present, and these were all in small amounts. Of the 36 forb species recorded, none had high prominence, and only *Cornus canadensis* (bunchberry) occurred on all stands sampled.

Table 40. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type (number = 31 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 10)					
Abies balsamea (balsam fir)	25.0	0-40	6	1.61	N
Abies lasiocarpa (subalpine fir)	32.0	0-80	97	30.97	N
Betula papyrifera (white birch)	3.0	0-3	3	0.10	N
Picea engelmannii (Engelmann spruce)	35.7	0-60	23	8.06	N
Picea engelmannii x glauca (Engelmann x white spruce)	20.0	0-20	13	2.58	N
Picea glauca (white spruce)	21.3	0-40	26	5.48	N
Picea mariana (black spruce)	19.2	0-40	35	6.82	N
Pinus contorta (lodgepole pine)	21.2	0-60	87	18.45	N
Populus tremuloides (aspen)	4.5	0-10	10	0.44	N
Pseudotsuga menziesii (Douglas-fir)	0.5	0-0.5	3	0.02	N
Shrubs (N = 33)					
Alnus crispa (green alder)	1.8	0-3	6	0.11	N
Amelanchier alnifolia (Saskatoon)	0.5	0-0.5	3	0.02	N
Empetrum nigrum (crowberry)	10.6	0-20	16	1.71	N
Gaultheria hispidula (creeping snowberry)	0.5	0-0.5	3	0.02	N
Juniperus communis (ground juniper)	1.8	0-3	6	0.11	N
Ledum glandulosum (glandular Labrador tea)	0.5	0-0.5	3	0.02	N
Ledum groenlandicum (common Labrador tea)	23.5	10-50	100	23.55	N
Linnaea borealis (twinflower)	4.3	0-40	84	3.60	N
Lonicera dioica (twining honeysuckle)	10.0	0-10	3	0.32	N
Lonicera involucrata (bracted honeysuckle)	1.8	0-3	6	0.11	N
Menziesia ferruginea (false azalea)	19.3	0-60	32	6.21	N
Phyllodoce empetriformis (red heather)	10.0	0-10	3	0.32	N
Rhododendron albiflorum (white-flowered rhododendron)	10.7	0-40	23	2.42	N
Ribes lacustre (bristly black currant)	1.3	0-3	10	0.13	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	3	0.02	N
Rosa acicularis (prickly rose)	2.9	0-10	42	1.23	N
Rubus arcticus (dwarf raspberry)	3.0	0-3	3	0.10	N
Rubus pedatus (dwarf bramble)	9.0	0-20	39	3.48	N
Rubus pubescens (dewberry)	0.5	0-0.5	10	0.05	N
Salix bebbiana (beaked willow)	6.5	0-10	13	0.84	N
Salix glauca (smooth willow)	8.3	0-10	13	1.06	N
Salix pyrifolia (balsam willow)	3.0	0-3	3	0.10	N
Salix spp. (willow)	1.1	0-3	13	0.15	B
Shepherdia canadensis (Canada buffaloberry)	0.5	0-0.5	6	0.03	N
Sorbus scopulina (western mountain-ash)	1.0	0-3	16	0.16	N
Spiraea betulifolia (white meadowsweet)	3.0	0-3	3	0.10	N
Vaccinium caespitosum (dwarf bilberry)	2.9	0-10	26	0.76	N
Vaccinium membranaceum (tall bilberry)	12.0	0-40	45	5.44	N

Table 40. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Vaccinium myrtilloides (common blueberry)	3.3	0-10	19	0.65	N
Vaccinium myrtillus (low bilberry)	1.3	0-3	10	0.13	N
Vaccinium scoparium (grouseberry)	11.1	0-30	19	2.15	N
Vaccinium vitis-idaea (bog cranberry)	8.1	0-30	61	4.94	N
Viburnum edule (low-bush cranberry)	1.0	0-3	16	0.16	N
Graminoids (N = 5)					
Calamagrostis canadensis (marsh reed grass)	3.0	0-3	13	0.39	N
Calamagrostis rubescens (pine reed grass)	2.2	0-3	10	0.21	N
Carex concinnoides (low northern sedge)	0.5	0-0.5	3	0.02	N
Elymus innovatus (hairy wild rye)	1.7	0-10	39	0.66	N
Schizachne purpurascens (purple oat grass)	0.5	0-0.5	3	0.02	N
Forbs (N = 36)					
Achillea millefolium (common yarrow)	0.5	0-0.5	3	0.02	N
Aralia nudicaulis (wild sarsaparilla)	0.5	0-0.5	3	0.02	N
Arnica cordifolia (heart-leaved arnica)	1.2	0-3	48	0.56	N
Arnica latifolia (broad-leaved arnica)	0.5	0-0.5	6	0.03	N
Arnica rydbergii (narrow-leaved arnica)	1.8	0-3	6	0.11	N
Cornus canadensis (bunchberry)	5.0	0.5-20	100	5.05	N
Disporum trachycarpum (fairybells)	0.5	0-0.5	3	0.02	N
Dryopteris assimilis (broad spinulose shield fern)	3.0	0-3	3	0.10	N
Epilobium angustifolium (common fireweed)	0.9	0-3	19	0.18	N
Equisetum arvense (common horsetail)	0.5	0-0.5	3	0.02	N
Equisetum pratense (meadow horsetail)	0.5	0-0.5	3	0.02	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	10	0.05	N
Equisetum sylvaticum (woodland horsetail)	1.0	0-3	16	0.16	N
Galium triflorum (sweet-scented bedstraw)	0.5	0-0.5	3	0.02	N
Goodyera repens (lesser rattlesnake plantain)	3.0	0-3	3	0.10	N
Gymnocarpium dryopteris (oak fern)	0.5	0-0.5	3	0.02	N
Hedysarum boreale (northern hedysarum)	0.5	0-0.5	3	0.02	N
Hedysarum sulphurescens (yellow hedysarum)	0.5	0-0.5	3	0.02	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	3	0.02	N
Listera cordata (heart-leaved twayblade)	1.1	0-3	13	0.15	N
Lycopodium annotinum (stiff club-moss)	1.9	0-10	52	0.97	N
Lycopodium clavatum (running club-moss)	0.5	0-0.5	6	0.03	N
Lycopodium obscurum (ground-pine)	0.5	0-0.5	3	0.02	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	13	0.06	N
Mertensia paniculata (tall lungwort)	0.9	0-3	19	0.18	N
Mitella nuda (bishop's-cap)	1.0	0-3	16	0.16	N
Orthilia secunda (one-sided wintergreen)	1.5	0-3	42	0.61	N
Pedicularis labradorica (Labrador lousewort)	0.5	0-0.5	3	0.02	N
Petasites palmatus (palmate-leaved coltsfoot)	1.6	0-3	29	0.47	N
Pyrola chlorantha (greenish-flowered wintergreen)	3.0	0-3	3	0.10	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	3	0.02	N
Solidago multiradiata (alpine goldenrod)	0.5	0-0.5	3	0.02	N

Table 40. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Stenanthium occidentale (bronzebells)	2.0	0-3	16	0.32	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1.6	0-3	23	0.35	N
Streptopus roseus (rose mandarin)	0.5	0-0.5	3	0.02	N
Veratrum eschscholtzii (green false hellebore)	3.0	0-3	3	0.10	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 41 shows the five most prominent plant species among the four lifeforms for species recorded in all eight relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type. The upper canopy in these stands is heavily dominated by the late seral *Abies lasiocarpa* (subalpine fir), although *Pinus contorta* (lodgepole pine) is also fairly prominent. The shrub layer is dominated by *Ledum groenlandicum* (common Labrador tea), while graminoids are essentially absent from this habitat type, and *Cornus canadensis* (bunchberry) is the only moderately prominent forb species present.

Table 41. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type (number = 8 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Abies lasiocarpa (subalpine fir)	56.25	Native
Pinus contorta (lodgepole pine)	15.44	Native
Picea engelmannii (Engelmann spruce)	6.25	Native
Picea glauca (white spruce)	6.25	Native
Abies balsamea (balsam fir)	5.00	Native
Shrubs		
Ledum groenlandicum (common Labrador tea)	18.75	Native
Vaccinium membranaceum (tall bilberry)	5.75	Native
Vaccinium vitis-idaea (bog cranberry)	5.19	Native
Linnaea borealis (twinflower)	5.00	Native
Rubus pedatus (dwarf bramble)	2.69	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	0.75	Native
Elymus innovatus (hairy wild rye)	0.25	Native
Forbs		
Cornus canadensis (bunchberry)	3.88	Native
Orthilia secunda (one-sided wintergreen)	0.81	Native
Petasites palmatus (palmate-leaved coltsfoot)	0.81	Native
Lycopodium annotinum (stiff club-moss)	0.63	Native
Mitella nuda (bishop's-cap)	0.44	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 42 through Table 45, break out the vegetation recorded in 8 relatively undisturbed late seral to climax stands sampled of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, forested habitat type of minor occurrence across the study area.

Table 42 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type. For the 8 stands comprising the habitat type, the number of unique species was 50 with 49 (98.0 percent) of them being native species.

Table 42. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/ Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type (number = 8 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	8	8	0	0
Shrubs	20	19	0	1
Graminoids	2	2	0	0
Forbs	20	20	0	0
TOTAL	***50 (100.0%)***	***49 (98.0%)***	***0 (0.0%)***	***1 (2.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 43 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type. The average number of species per stand is 15.7, with native species comprising 15.6 species per stand or 99.4 percent.

Table 43. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type (number = 8 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3.1	3.1	0.0	0.0
Shrubs	6.4	6.3	0.0	0.1
Graminoids	0.8	0.8	0.0	0.0
Forbs	5.4	5.4	0.0	0.0
TOTAL	***15.7 (100.0%)***	***15.6 (99.4%)***	***0.0 (0.0%)***	***0.1 (0.6%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 44 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type. The average canopy cover per stand is 157.7 percent, with native species comprising 157.6 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 44. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type (number = 8 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	96.8%	96.8%	0.0%	0.0%
Shrubs	51.0%	50.9%	0.0%	0.1%
Graminoids	1.0%	1.0%	0.0%	0.0%
Forbs	8.9%	8.9%	0.0%	0.0%
TOTAL	***157.7% (100.0%)***	***157.6% (100.0%)***	***0.0% (0.0%)***	***0.1% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 45 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type. The average number of species per stand was 15.7 with an average canopy cover of 157.7 percent.

Table 45. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type (number = 8 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	3.1	96.8%
Shrubs	6.4	51.0%
Graminoids	0.8	1.0%
Forbs	5.4	8.9%
TOTAL	***15.7***	***157.7%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

Eight relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type were identified (Table 46). Eight tree species were recorded on these later seral stands, of which *Abies lasiocarpa* (subalpine fir) is most prominent, although the earlier seral associate, *Pinus contorta* (lodgepole pine), is also quite prominent. Twenty shrub species were recorded, with *Ledum groenlandicum* (common Labrador tea) being the only highly prominent species. Only two graminoid species in very small amounts were found on these stands; and of the 20 forb species recorded, none was very prominent, and only *Cornus canadensis* (bunchberry) occurred on every stand.

Table 46. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type (number = 8 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 8)					
Abies balsamea (balsam fir)	40.0	0-40	13	5.00	N
Abies lasiocarpa (subalpine fir)	56.3	20-80	100	56.25	N
Picea engelmannii (Engelmann spruce)	50.0	0-50	13	6.25	N
Picea engelmannii x glauca (Engelmann x white spruce)	20.0	0-20	25	5.00	N
Picea glauca (white spruce)	16.7	0-20	38	6.25	N
Picea mariana (black spruce)	10.3	0-20	25	2.56	N
Pinus contorta (lodgepole pine)	17.6	0-30	88	15.44	N
Populus tremuloides (aspen)	0.5	0-0.5	13	0.06	N
Shrubs (N = 20)					
Empetrum nigrum (crowberry)	20.0	0-20	13	2.50	N
Juniperus communis (ground juniper)	0.5	0-0.5	13	0.06	N
Ledum groenlandicum (common Labrador tea)	18.8	10-40	100	18.75	N
Linnaea borealis (twinflower)	5.7	0-20	88	5.00	N
Menziesia ferruginea (false azalea)	5.3	0-10	25	1.31	N
Rhododendron albiflorum (white-flowered rhododendron)	3.0	0-3	38	1.13	N
Ribes lacustre (bristly black currant)	1.8	0-3	25	0.44	N
Rosa acicularis (prickly rose)	5.3	0-10	50	2.63	N
Rubus pedatus (dwarf bramble)	5.4	0-20	50	2.69	N
Salix bebbiana (beaked willow)	3.0	0-3	13	0.38	N
Salix spp. (willow)	0.5	0-0.5	13	0.06	B
Shepherdia canadensis (Canada buffaloberry)	0.5	0-0.5	13	0.06	N
Sorbus scopulina (western mountain-ash)	0.5	0-0.5	13	0.06	N
Spiraea betulifolia (white meadowsweet)	3.0	0-3	13	0.38	N
Vaccinium caespitosum (dwarf bilberry)	1.8	0-3	25	0.44	N
Vaccinium membranaceum (tall bilberry)	15.3	0-40	38	5.75	N
Vaccinium myrtilloides (common blueberry)	10.0	0-10	13	1.25	N
Vaccinium scoparium (grouseberry)	20.0	0-20	13	2.50	N
Vaccinium vitis-idaea (bog cranberry)	8.3	0-30	63	5.19	N
*Viburnum edul*e (low-bush cranberry)	1.8	0-3	25	0.44	N
Graminoids (N = 2)					
Calamagrostis canadensis (marsh reed grass)	3.0	0-3	25	0.75	N
Elymus innovatus (hairy wild rye)	0.5	0-0.5	50	0.25	N
Forbs (N = 20)					
Arnica cordifolia (heart-leaved arnica)	0.5	0-0.5	50	0.25	N
Arnica latifolia (broad-leaved arnica)	0.5	0-0.5	13	0.06	N
Arnica rydbergii (narrow-leaved arnica)	0.5	0-0.5	13	0.06	N
Cornus canadensis (bunchberry)	3.9	0.5-20	100	3.88	N
Dryopteris assimilis (broad spinulose shield fern)	3.0	0-3	13	0.38	N

Table 46. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Epilobium angustifolium (common fireweed)	0.5	0-0.5	25	0.13	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	13	0.06	N
Equisetum sylvaticum (woodland horsetail)	0.5	0-0.5	13	0.06	N
Galium triflorum (sweet-scented bedstraw)	0.5	0-0.5	13	0.06	N
Goodyera repens (lesser rattlesnake plantain)	3.0	0-3	13	0.38	N
Lycopodium annotinum (stiff club-moss)	1.0	0-3	63	0.63	N
Lycopodium clavatum (running club-moss)	0.5	0-0.5	13	0.06	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	25	0.13	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	25	0.13	N
Mitella nuda (bishop's-cap)	1.8	0-3	25	0.44	N
Orthilia secunda (one-sided wintergreen)	2.2	0-3	38	0.81	N
Petasites palmatus (palmate-leaved coltsfoot)	2.2	0-3	38	0.81	N
Stenanthium occidentale (bronzebells)	0.5	0-0.5	13	0.06	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1.8	0-3	25	0.44	N
Streptopus roseus (rose mandarin)	0.5	0-0.5	13	0.06	N

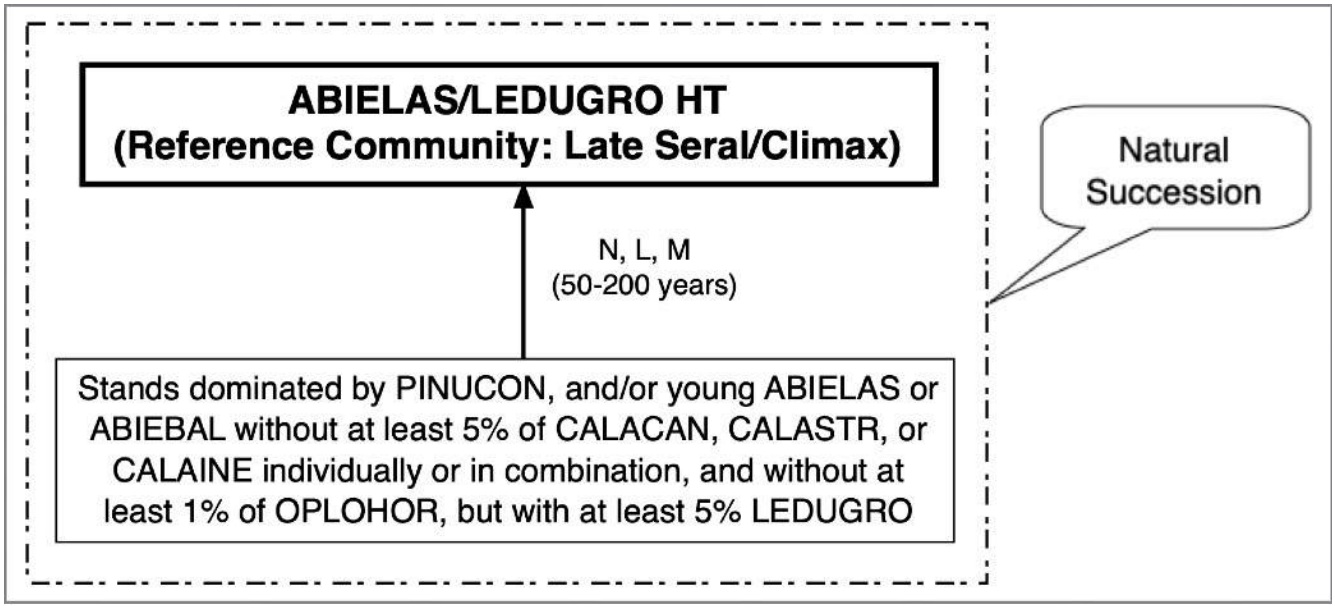
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Abies lasiocarpa (subalpine fir) is a shade-tolerant climax species favored by a long fire-free interval. Maturity and extended age of stands of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type depend largely on freedom from wildfire. Reestablishment of stands after a burn depends of availability of nearby sources of *Abies lasiocarpa* (subalpine fir) seed and on the level of competition from the fire adapted seral species, such as *Pinus contorta* (lodgepole pine) and *Populus tremuloides* (aspen).

Figure 8 shows a schematic diagram of vegetation successional pathways on sites of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type.



Successional Pathway of *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
ABIEBAL—*Abies balsamea* (balsam fir)
ABIELAS—*Abies lasiocarpa* (subalpine fir)
ABIELAS/LEDUGRO HT—*Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type
CALACAN—*Calamagrostis canadensis* (marsh reed grass)
CALAINE—*Calamagrostis inexpansa* (northern reed grass)
CALASTR—*Calamagrostis stricta* (narrow reed grass)
LEDUGRO—*Ledum groenlandicum* (common Labrador tea)
OPLOHOR—*Oplopanax horridum* (devil's-club)
PINUCON—*Pinus contorta* (lodgepole pine)

Figure 8. Successional pathway for sites of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 9 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

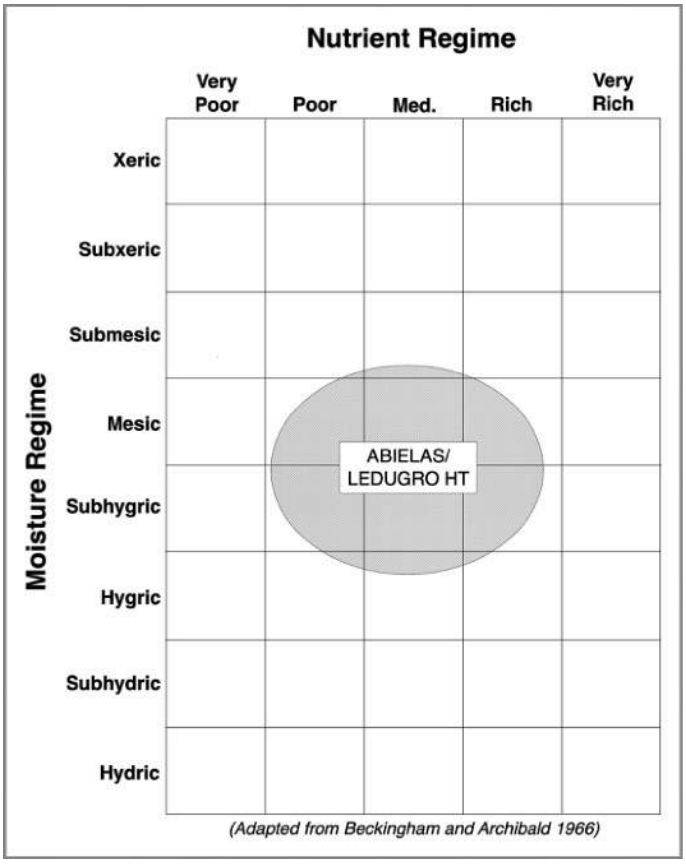


Figure 9. Edatope grid position for the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type (ABIELAS/LEDUGRO HT)

SOILS

Parent material on sites supporting the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type is predominantly morainal, and soils are mostly brunisols and gleysols. Soil drainage ranges from moderately well drained to well drained, with surface texture ranging from sandy loam to clay loam. Organic thickness is mostly 0 cm to 5 cm thick (France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites will likely be dominated by the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/ marsh reed grass) habitat type or by such wetland shrubs as *Alnus* (alder) species, *Betula* (birch) species, and *Salix* (willow) species. Drier adjacent sites will often have the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/ bunchberry) habitat type or communities dominated by *Picea glauca* (white spruce) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) occurs frequently in the southern Rocky Mountain and Boreal Forest natural regions of Alberta in forested stands from low elevation up to the subalpine zone (Tannas 1997a).

This is a middle to upper elevation mountain conifer tree species. It generally occupies sites having a short growing season with cold winters, cool summers, frequent summer frosts, and heavy winter snowpack. In the Rocky Mountains, *Abies lasiocarpa* (subalpine fir) is a shade-tolerant late seral/climax species that is favored by sites with long intervals free of fire-(Uchytil 1991b).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) is commonly found in Alberta in swampy, wet, coniferous wooded areas in bogs (especially peat), commonly on acidic, infertile soils and associated with *Picea mariana* (black spruce) and *Larix laricina* (tamarack) (Tannas 1997a). This species is typical of poorly drained habitats in boreal forests, open conifer treed bogs, treeless bogs, wooded swamps, wet barrens, and peatlands throughout its range (Gucker 2006).

The soils typical of *Ledum groenlandicum* (common Labrador tea) habitats are commonly described as moist to wet, acidic, nutrient-poor organics (Gucker 2006). The species is typically present in late seral communities that result from primary succession. However, following disturbances on sites where *Ledum groenlandicum* (common Labrador tea) was established, it often recolonizes the sites rapidly (Gucker 2006).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is found in all natural regions of Alberta, except the Dry Mixedgrass Region. It is the most common tree species at middle and lower altitudes along the eastern slopes of the Rocky Mountains, forming nearly pure stands on some sites in the foothills and montane areas (Tannas 1997a).

Pinus contorta (lodgepole pine) grows at low to high elevations, in dry to wet conditions, warm to cold temperatures, and on nearly every soil type found in western North America, except on saline sites. The species is not shade tolerant, and grows best on non-calcareous soil. It is primarily an aggressive pioneer on disturbed sites, and fire perpetuates or renews the stands (Anderson 2003). As these pine stands mature, they give way to shade-tolerant conifers at ages from 50 to 100 years in mesic habitats, and 100 to 200 years on warmer and drier sites (Anderson 2003).

Pinus contorta (lodgepole pine) may establish alongside later seral, more shade-tolerant species, and its rapid growth may enable the pines to remain competitive in the canopy for several years. However, these trees do not regenerate under a canopy, and are eliminated from the stand as mortality occurs. The *Pinus contorta* (lodgepole pine) is generally replaced within 50 to 100 years by the more shade-tolerant associates (Anderson 2003).

Livestock

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) is unpalatable and its forage value is poor for both livestock and wild ungulates (Tannas 1997a). Stands dominated by it generally do not produce enough forage for livestock, but do provide browse and cover for large and small wildlife species (Uchytil 1991b).

***Ledum groenlandicum* (common Labrador tea)**—Forage value of *Ledum groenlandicum* (common Labrador tea) is poor for livestock, and the habitats occupied by it represent marginal rangeland that is seldom used by livestock (Tannas 1997a).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) offers poor forage value, and is seldom eaten by livestock (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) wood is soft, brittle, and quick to decay. It is used for rough construction and boxes, doors, frames, poles, and fuel. Small trees are extensively used as Christmas trees (USDA National Resources Conservation Service 2023).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) timber is used extensively for construction lumber, pulpwood, heating fuel, posts and poles, and plywood veneer (USDA National Resources Conservation Service 2023).

Wildlife

***Abies lasiocarpa* (subalpine fir)**—Mule deer, elk, moose, woodland caribou, black bear, and grizzly bear often use *Abies lasiocarpa* (subalpine fir) habitats as summer range, but these forest sites are generally not suitable winter range for deer and elk because of heavy snowpack. Mule deer, elk, moose, woodland caribou, black bear, and grizzly bear often use these habitats as summer range (Uchytil 1991b).

Abies lasiocarpa (subalpine fir) seeds are eaten by several species of small mammals and birds. Red squirrels, chipmunks, and mice eat seeds from cached cones. Several birds, including chickadees, nuthatches, crossbills, pine siskins, and Clark's nutcrackers eat seeds from the cones. Because subalpine fir seeds are large, comprising about 26 percent of a cone's weight, they can provide an energy-efficient food source (Uchytil 1991b).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) forage is used to some extent by wild ungulates, especially deer, but only when other forage is scarce (Tannas 1997a). The species may provide important cover for many wildlife species, as it is a typical component species in many important wildlife habitats (Gucker 2006). The leaves and twigs are browsed by caribou and moose (Anderson 2011).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) also offers poor forage value for wildlife, and is eaten by deer and elk only when better forage is lacking (Tannas 1997a). Stands of the species provide cover for big game animals, upland game birds, small non-game birds, and small mammals (Anderson 2003).

Fire

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) is very fire sensitive, and it generally suffers high mortality from even low intensity fires. To colonize burned areas, it relies on wind-dispersed seeds, which readily germinate on seedbeds that are prepared by fire (Uchytil 1991b).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) underground structures often survive and rapidly sprout after fire. When burned lightly, such that some above ground stem material survives, *Ledum groenlandicum* (common Labrador tea) may sprout from stems, but when completely top-killed, sprouting occurs from the root crown or rhizomes (Gucker 2006). Provided that a seed source is present, the species' abundant seed production and easily wind-dispersed seed suggests a high likelihood of burned site recolonization (Gucker 2006).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) thrives under the influence of fire, and on many sites fire is required to maintain its dominance. Producing serotinous cones is one adaptation to stand-replacing fire, and the seed supply is nearly always available on the tree (Anderson 2003).

The propensity of *Pinus contorta* (lodgepole pine) to form stands with high seedling density, initial rapid growth that slows with age, high susceptibility to snow breakage and wind-throw, infestation by dwarf-mistletoe and mountain pine beetles, all result in large buildups of fuel (Anderson 2003).

Rehabilitation/Restoration Considerations

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) can be planted on disturbed sites within forest vegetation types where it naturally occurs. The species is generally recommended for cool and moist sites in subalpine areas. Because this wide-ranging tree exhibits a great degree of genetic variation, seed or nursery stock for rehabilitation projects should come from a local, site adapted. source. Transplanting rooted nursery stock is generally more successful than direct seeding of the species (Uchytil 1991b).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) may be useful in revegetating disturbed sites, and may be a valuable indicator of contaminated sites and easily reforested sites (Gucker 2006). Plants can be started from seed or root-crown division. Collect seeds from dry capsules and plant them in fall or spring in moist peaty soil in a sunny spot. Water them thoroughly after planting and keep moist. Suckers with roots can be split off from the base of the plant in mid-December and transplanted during spring (Anderson 2011).

Many of the fens and bogs that provide important habitat for *Ledum groenlandicum* (common Labrador tea) in North America were created by glaciation. These wetlands have been disappearing over thousands of years, due to a decrease in native ungulates that graze the bogs, and encroachment by conifers and hardwoods (Anderson 2011).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is often used in reforestation projects, especially for revegetation on sites of mining disturbance. Though it grows well on nutrient poor soils, addition of nitrogen fertilizer will likely enhance growth of the plantings (Anderson 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Fa/Tall bilberry-Bog cranberry/Feather moss

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type has not been described in the region.

Abies lasiocarpa/Oplopanax horridum Habitat Type
(subalpine fir/devil's-club Habitat Type)

ABIELAS/OPLOHOR Habitat Type
Number of Stands = 7 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 4; Other Data Sets = 3)

LOCATION AND ASSOCIATED LANDFORMS

The *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type is an incidental type in the Lower Foothills Natural Subregion, a restricted type in the Upper Foothills Natural Subregion, and a restricted type in the Montane Natural Subregion of Alberta. This habitat type is restricted to sites having the fairly narrow range of conditions required for *Abies lasiocarpa* (subalpine fir). These conditions are most commonly met in smaller pockets in the montane and upper foothills natural subregions on sites with cold, humid habitats. Cool summers, cold winters, and deep winter snowpacks are more important than total precipitation in determining where *Abies lasiocarpa* (subalpine fir) grows. Site conditions required by *Oplopanax horridum* (devil's-club) may be slightly more restrictive of the habitat type to shaded, poorly drained, wet soils around seeps and springs, along streams and wet bottom areas.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 47 shows the five most prominent plant species among the four lifeforms for species recorded in all seven stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type. This habitat type has a forest/woodland character dominated by an upper canopy of conifer trees, primarily by the late seral *Abies lasiocarpa* (subalpine fir). The sample set of seven stands includes all stands sampled of the habitat type, which includes early seral and disturbed stands along with late seral and undisturbed stands. Three conifer tree species dominate stands of this habitat type, though *Abies lasiocarpa* (subalpine fir) is by far most prominent. The shrub layer is dominated by *Oplopanax horridum* (devil's-club), while the graminoids have no particularly prominent species in this habitat type, while among the forbs *Gymnocarpium dryopteris* (oak fern) is most prominent.

Table 47. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type (number = 7 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Abies lasiocarpa (subalpine fir)	38.57	Native
Picea engelmannii (Engelmann spruce)	10.00	Native
Picea glauca (white spruce)	10.00	Native
Pinus contorta (lodgepole pine)	5.79	Native
Larix occidentalis (western larch)	1.86	Native
Shrubs		
Oplopanax horridum (devil's-club)	24.71	Native
Taxus brevifolia (western yew)	3.71	Native
Lonicera involucrata (bracted honeysuckle)	3.29	Native
Viburnum edule (low-bush cranberry)	3.00	Native
Linnaea borealis (twinflower)	2.43	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	1.29	Native
Calamagrostis stricta (narrow reed grass)	0.43	Native
Bromus vulgaris (woodland brome)	0.14	Native
Elymus glaucus (smooth wild rye)	0.07	Native
Melica subulata (Alaska onion grass)	0.07	Native
Forbs		
Gymnocarpium dryopteris (oak fern)	8.00	Native
Athyrium filix-femina (lady fern)	5.86	Native
Aralia nudicaulis (wild sarsaparilla)	5.57	Native
Tiarella trifoliata (laceflower)	4.21	Native
Dryopteris assimilis (broad spinulose shield fern)	2.93	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 48 through Table 51, break out the vegetation recorded in all seven stands sampled of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, but species rich, forested habitat type of incidental-to-restricted occurrence across the study area.

Table 48 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/

devil's-club) habitat type. For the 7 stands comprising the habitat type, the number of unique species was 80 with 79 (98.8 percent) of them being native species.

Table 48. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type (number = 7 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	8	8	0	0
Shrubs	27	27	0	0
Graminoids	5	5	0	0
Forbs	40	39	0	1
TOTAL	***80 (100.0%)***	***79 (98.8%)***	***0 (0.0%)***	***1 (1.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 49 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type. The average number of species per stand is 30.0, with native species comprising 29.8 species per stand or 99.3 percent.

Table 49. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type (number = 7 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3.4	3.4	0.0	0.0
Shrubs	10.6	10.6	0.0	0.0
Graminoids	1.1	1.1	0.0	0.0
Forbs	14.9	14.7	0.0	0.1
TOTAL	***30.0 (100.0%)***	***29.8 (99.3%)***	***0.0 (0.0%)***	***0.1 (0.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 50 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type.

The average canopy cover per stand is 167.4 percent, with native species comprising 167.3 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 50. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type (number = 7 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	68.7%	68.7%	0.0%	0.0%
Shrubs	51.6%	51.6%	0.0%	0.0%
Graminoids	2.0%	2.0%	0.0%	0.0%
Forbs	45.1%	45.0%	0.0%	0.1%
TOTAL	***167.4% (100.0%)***	***167.3% (100.0%)***	***0.0% (0.0%)***	***0.1% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 51 shows the average number of species and average canopy cover by lifeform in stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type. The average number of species per stand was 30.0 with an average canopy cover of 167.4 percent.

Table 51. Average number of species and average canopy cover by lifeform in stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type (number = 7 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	3.4	68.7%
Shrubs	10.6	51.6%
Graminoids	1.1	2.0%
Forbs	14.9	45.1%
TOTAL	***30.0***	***167.4%***

Sampled Stands Plant Species List

The *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type is described here using plot data from seven stands. Eight tree species were recorded in these stands, of which *Abies lasiocarpa* (subalpine fir) was by far most prominent, but with *Picea glauca* (white spruce) and *Picea engelmannii* (Engelmann spruce) as moderately prominent associates on several stands (Table 52). Of the total 27 shrub species recorded, *Oplopanax horridum* (devil's-club) was the only highly prominent species. Five graminoid species were recorded, all in small amounts. A total of 40 forb species were recorded, but none had high prominence, and only *Gymnocarpium dryopteris* (oak fern) occurred in all stands.

Table 52. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type (number = 7 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 8)					
Abies lasiocarpa (subalpine fir)	38.6	20-60	100	38.57	N
Betula papyrifera (white birch)	1.3	0-3	43	0.57	N
Larix occidentalis (western larch)	6.5	0-10	29	1.86	N
Picea engelmannii (Engelmann spruce)	23.3	0-30	43	10.00	N
Picea glauca (white spruce)	17.5	0-30	57	10.00	N
Pinus contorta (lodgepole pine)	20.3	0-40	29	5.79	N
Pinus monticola (western white pine)	0.5	0-0.5	14	0.07	N
Pseudotsuga menziesii (Douglas-fir)	6.5	0-10	29	1.86	N
Shrubs (N = 27)					
Acer glabrum (mountain maple)	4.5	0-10	43	1.93	N
Alnus crispa (green alder)	0.5	0-0.5	14	0.07	N
Alnus tenuifolia (river alder)	0.5	0-0.5	14	0.07	N
Betula occidentalis (water birch)	3.0	0-3	14	0.43	N
Cornus stolonifera (red-osier dogwood)	0.5	0-0.5	29	0.14	N
Linnaea borealis (twinflower)	3.4	0-10	71	2.43	N
Lonicera involucrata (bracted honeysuckle)	7.7	0-10	43	3.29	N
Lonicera utahensis (red twinberry)	0.5	0-0.5	29	0.14	N
Menziesia ferruginea (false azalea)	5.3	0-10	29	1.50	N
Oplopanax horridum (devil's-club)	24.7	3-40	100	24.71	N
Pachistima myrsinites (mountain-lover)	0.5	0-0.5	14	0.07	N
Ribes lacustre (bristly black currant)	1.5	0-3	71	1.07	N
Rosa acicularis (prickly rose)	1.8	0-3	29	0.50	N
Rubus idaeus (wild red raspberry)	0.5	0-0.5	57	0.29	N
Rubus parviflorus (thimbleberry)	0.5	0-0.5	43	0.21	N
Rubus pedatus (dwarf bramble)	3.7	0-10	43	1.57	N
Rubus pubescens (dewberry)	0.5	0-0.5	43	0.21	N
Salix bebbiana (beaked willow)	10.0	0-10	14	1.43	N
Sambucus racemosa (red elderberry)	1.8	0-3	29	0.50	N
Sorbus scopulina (western mountain-ash)	0.5	0-0.5	43	0.21	N
Spiraea betulifolia (white meadowsweet)	2.2	0-3	43	0.93	N
Symphoricarpos albus (snowberry)	5.3	0-10	29	1.50	N
Taxus brevifolia (western yew)	8.7	0-20	43	3.71	N
Vaccinium membranaceum (tall bilberry)	1.8	0-3	86	1.50	N
Vaccinium myrtilloides (common blueberry)	0.5	0-0.5	14	0.07	N
Vaccinium scoparium (grouseberry)	0.5	0-0.5	14	0.07	N
Viburnum edule (low-bush cranberry)	5.3	0-10	57	3.00	N
Graminoids (N = 5)					
Bromus vulgaris (woodland brome)	0.5	0-0.5	29	0.14	N
Calamagrostis canadensis (marsh reed grass)	3.0	0-3	43	1.29	N
Calamagrostis stricta (narrow reed grass)	3.0	0-3	14	0.43	N
Elymus glaucus (smooth wild rye)	0.5	0-0.5	14	0.07	N

Table 52. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Melica subulata (Alaska onion grass)	0.5	0-0.5	14	0.07	N
Forbs (N = 40)					
Actaea rubra (red and white baneberry)	0.5	0-0.5	43	0.21	N
Adenocaulon bicolor (pathfinder)	3.0	0-3	14	0.43	N
Aralia nudicaulis (wild sarsaparilla)	6.5	0-10	86	5.57	N
Arnica latifolia (broad-leaved arnica)	6.5	0-10	29	1.86	N
Athyrium filix-femina (lady fern)	10.3	0-20	57	5.86	N
Circaea alpina (small enchanter's nightshade)	0.5	0-0.5	14	0.07	N
Clintonia uniflora (corn lily)	5.3	0-10	43	2.29	N
Cornus canadensis (bunchberry)	4.1	0-10	57	2.36	N
Disporum hookeri (Oregon fairybells)	0.5	0-0.5	14	0.07	N
Disporum spp. (fairybells)	0.5	0-0.5	14	0.07	B
Dryopteris assimilis (broad spinulose shield fern)	10.3	0-20	29	2.93	N
Dryopteris carthusiana (narrow spinulose shield fern)	10.0	0-10	14	1.43	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	14	0.07	N
Equisetum sylvaticum (woodland horsetail)	2.2	0-3	43	0.93	N
Galium triflorum (sweet-scented bedstraw)	1.3	0-3	43	0.57	N
Goodyera oblongifolia (rattlesnake plantain)	0.5	0-0.5	29	0.14	N
Goodyera repens (lesser rattlesnake plantain)	0.5	0-0.5	14	0.07	N
Gymnocarpium dryopteris (oak fern)	8.0	3-10	100	8.00	N
Hieracium albiflorum (white hawkweed)	0.5	0-0.5	29	0.14	N
Listera cordata (heart-leaved twayblade)	0.5	0-0.5	14	0.07	N
Lycopodium annotinum (stiff club-moss)	1.0	0-3	71	0.71	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	43	0.21	N
Mertensia paniculata (tall lungwort)	3.0	0-3	14	0.43	N
Mitella nuda (bishop's-cap)	1.3	0-3	43	0.57	N
Orthilia secunda (one-sided wintergreen)	0.5	0-0.5	43	0.21	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	0.5	0-0.5	29	0.14	N
Osmorhiza occidentalis (western sweet cicely)	0.5	0-0.5	14	0.07	N
Petasites palmatus (palmate-leaved coltsfoot)	1.1	0-3	57	0.64	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	29	0.14	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	43	0.21	N
Smilacina stellata (star-flowered Solomon's-seal)	4.5	0-10	43	1.93	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1.1	0-3	57	0.64	N
Thalictrum occidentale (western meadow rue)	0.5	0-0.5	43	0.21	N
Tiarella trifoliata (laceflower)	4.9	0-10	86	4.21	N
Trillium ovatum (western wakerobin)	0.5	0-0.5	14	0.07	N
Veratrum eschscholtzii (green false hellebore)	0.5	0-0.5	43	0.21	N
Viola canadensis (western Canada violet)	1.8	0-3	29	0.50	N
Viola orbiculata (evergreen violet)	1.3	0-3	43	0.57	N
Viola renifolia (kidney-leaved violet)	0.5	0-0.5	29	0.14	N

Table 52. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Xerophyllum tenax (bear-grass)	0.5	0-0.5	14	0.07	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 53 shows the five most prominent plant species among the four lifeforms for species recorded in all three relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type. The overstory in stands of this habitat type is heavily dominated by the late seral *Abies lasiocarpa* (subalpine fir); while the shrub layer is dominated by *Oplopanax horridum* (devil's-club). The graminoids are poorly represented in this habitat type. but the forbs have moderate prominence, led by *Gymnocarpium dryopteris* (oak fern).

Table 53. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type (number = 3 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Abies lasiocarpa (subalpine fir)	50.00	Native
Picea glauca (white spruce)	10.00	Native
Picea engelmannii (Engelmann spruce)	6.67	Native
Larix occidentalis (western larch)	3.33	Native
Betula papyrifera (white birch)	0.17	Native
Shrubs		
Oplopanax horridum (devil's-club)	23.33	Native
Viburnum edule (low-bush cranberry)	3.50	Native
Lonicera involucrata (bracted honeysuckle)	3.33	Native
Salix bebbiana (beaked willow)	3.33	Native
Symphoricarpos albus (snowberry)	3.33	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	2.00	Native
Bromus vulgaris (woodland brome)	0.17	Native
Elymus glaucus (smooth wild rye)	0.17	Native
Forbs		
Gymnocarpium dryopteris (oak fern)	10.00	Native
Athyrium filix-femina (lady fern)	6.83	Native
Tiarella trifoliata (laceflower)	6.83	Native
Clintonia uniflora (corn lily)	3.33	Native
Dryopteris carthusiana (narrow spinulose shield fern)	3.33	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 54 through Table 57, break out the vegetation recorded in three relatively undisturbed late seral to climax stands sampled of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, but species rich, forested habitat type of incidental-to-restricted occurrence across the study area.

Table 54 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies*

lasiocarpa/Oplopanax horridum (subalpine fir/devil's-club) habitat type. For the 3 stands comprising the habitat type, the number of unique species was 58 with 58 (100.0 percent) of them being native species.

Table 54. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type (number = 3 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	5	5	0	0
Shrubs	19	19	0	0
Graminoids	3	3	0	0
Forbs	31	31	0	0
TOTAL	***58 (100.0%)***	***58 (100.0%)***	***0 (0.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 55 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type. The average number of species per stand is 29.0, with native species comprising 29.0 species per stand or 100.0 percent.

Table 55. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type (number = 3 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.7	2.7	0.0	0.0
Shrubs	10.3	10.3	0.0	0.0
Graminoids	1.3	1.3	0.0	0.0
Forbs	14.7	14.7	0.0	0.0
TOTAL	***29.0 (100.0%)***	***29.0 (100.0%)***	***0.0 (0.0%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 56 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Oplopanax horridum*

(subalpine fir/devil's-club) habitat type. The average canopy cover per stand is 165.7 percent, with native species comprising 165.7 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 56. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type (number = 3 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	70.2%	70.2%	0.0%	0.0%
Shrubs	46.5%	46.5%	0.0%	0.0%
Graminoids	2.3%	2.3%	0.0%	0.0%
Forbs	46.7%	46.7%	0.0%	0.0%
TOTAL	***165.7% (100.0%)***	***165.7% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 57 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type. The average number of species per stand was 29.0 with an average canopy cover of 165.7 percent.

Table 57. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type (number = 3 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.7	70.2%
Shrubs	10.3	46.5%
Graminoids	1.3	2.3%
Forbs	14.7	46.7%
TOTAL	***29.0***	***165.7%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

On the three relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type, five tree species were recorded on at least one stand each, of which *Abies lasiocarpa* (subalpine fir) was by far most prominent and the only one to occur on every plot (Table 58). Of 19 shrub species recorded, only *Oplopanax horridum* (devil's-club) was highly prominent, although several others occurred in all three stands sampled. Three graminoid species were recorded, all in small amounts: and there were 31 forb species recorded, none very prominent.

Table 58. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type (number = 3 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 5)					
Abies lasiocarpa (subalpine fir)	50.0	40-60	100	50.00	N
Betula papyrifera (white birch)	0.5	0-0.5	33	0.17	N
Larix occidentalis (western larch)	10.0	0-10	33	3.33	N
Picea engelmannii (Engelmann spruce)	20.0	0-20	33	6.67	N
Picea glauca (white spruce)	15.0	0-20	67	10.00	N
Shrubs (N = 19)					
Acer glabrum (mountain maple)	0.5	0-0.5	33	0.17	N
Cornus stolonifera (red-osier dogwood)	0.5	0-0.5	33	0.17	N
Linnaea borealis (twinflower)	3.0	0-3	67	2.00	N
Lonicera involucrata (bracted honeysuckle)	10.0	0-10	33	3.33	N
Lonicera utahensis (red twinberry)	0.5	0-0.5	33	0.17	N
Menziesia ferruginea (false azalea)	0.5	0-0.5	33	0.17	N
Oplopanax horridum (devil's-club)	23.3	10-40	100	23.33	N
Ribes lacustre (bristly black currant)	1.3	0.5-3	100	1.33	N
Rubus idaeus (wild red raspberry)	0.5	0.5-0.5	100	0.50	N
Rubus parviflorus (thimbleberry)	0.5	0-0.5	33	0.17	N
Rubus pedatus (dwarf bramble)	0.5	0-0.5	67	0.33	N
Rubus pubescens (dewberry)	0.5	0-0.5	33	0.17	N
Salix bebbiana (beaked willow)	10.0	0-10	33	3.33	N
Sambucus racemosa (red elderberry)	1.8	0-3	67	1.17	N
Sorbus scopulina (western mountain-ash)	0.5	0-0.5	33	0.17	N
Symphoricarpos albus (snowberry)	10.0	0-10	33	3.33	N
Taxus brevifolia (western yew)	3.0	0-3	33	1.00	N
Vaccinium membranaceum (tall bilberry)	2.2	0.5-3	100	2.17	N
Viburnum edule (low-bush cranberry)	5.3	0-10	67	3.50	N
Graminoids (N = 3)					
Bromus vulgaris (woodland brome)	0.5	0-0.5	33	0.17	N
Calamagrostis canadensis (marsh reed grass)	3.0	0-3	67	2.00	N
Elymus glaucus (smooth wild rye)	0.5	0-0.5	33	0.17	N
Forbs (N = 31)					
Actaea rubra (red and white baneberry)	0.5	0-0.5	33	0.17	N
Aralia nudicaulis (wild sarsaparilla)	3.0	3-3	100	3.00	N
Athyrium filix-femina (lady fern)	10.3	0-20	67	6.83	N
Circaea alpina (small enchanter's nightshade)	0.5	0-0.5	33	0.17	N
Clintonia uniflora (corn lily)	10.0	0-10	33	3.33	N
Cornus canadensis (bunchberry)	3.0	0-3	33	1.00	N
Disporum hookeri (Oregon fairybells)	0.5	0-0.5	33	0.17	N
Dryopteris assimilis (broad spinulose shield fern)	0.5	0-0.5	33	0.17	N
Dryopteris carthusiana (narrow spinulose shield fern)	10.0	0-10	33	3.33	N
Equisetum sylvaticum (woodland horsetail)	3.0	0-3	33	1.00	N

Table 58. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Galium triflorum (sweet-scented bedstraw)	0.5	0-0.5	67	0.33	N
Goodyera oblongifolia (rattlesnake plantain)	0.5	0-0.5	33	0.17	N
Goodyera repens (lesser rattlesnake plantain)	0.5	0-0.5	33	0.17	N
Gymnocarpium dryopteris (oak fern)	10.0	10-10	100	10.00	N
Hieracium albiflorum (white hawkweed)	0.5	0-0.5	33	0.17	N
Lycopodium annotinum (stiff club-moss)	0.5	0-0.5	67	0.33	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	67	0.33	N
Mertensia paniculata (tall lungwort)	3.0	0-3	33	1.00	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	67	0.33	N
Osmorhiza occidentalis (western sweet cicely)	0.5	0-0.5	33	0.17	N
Petasites palmatus (palmate-leaved coltsfoot)	1.8	0-3	67	1.17	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	33	0.17	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	33	0.17	N
Smilacina stellata (star-flowered Solomon's-seal)	10.0	0-10	33	3.33	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1.8	0-3	67	1.17	N
Thalictrum occidentale (western meadow rue)	0.5	0-0.5	33	0.17	N
Tiarella trifoliata (laceflower)	6.8	0.5-10	100	6.83	N
Veratrum eschscholtzii (green false hellebore)	0.5	0-0.5	33	0.17	N
Viola canadensis (western Canada violet)	3.0	0-3	33	1.00	N
Viola orbiculata (evergreen violet)	0.5	0-0.5	33	0.17	N
Viola renifolia (kidney-leaved violet)	0.5	0-0.5	33	0.17	N

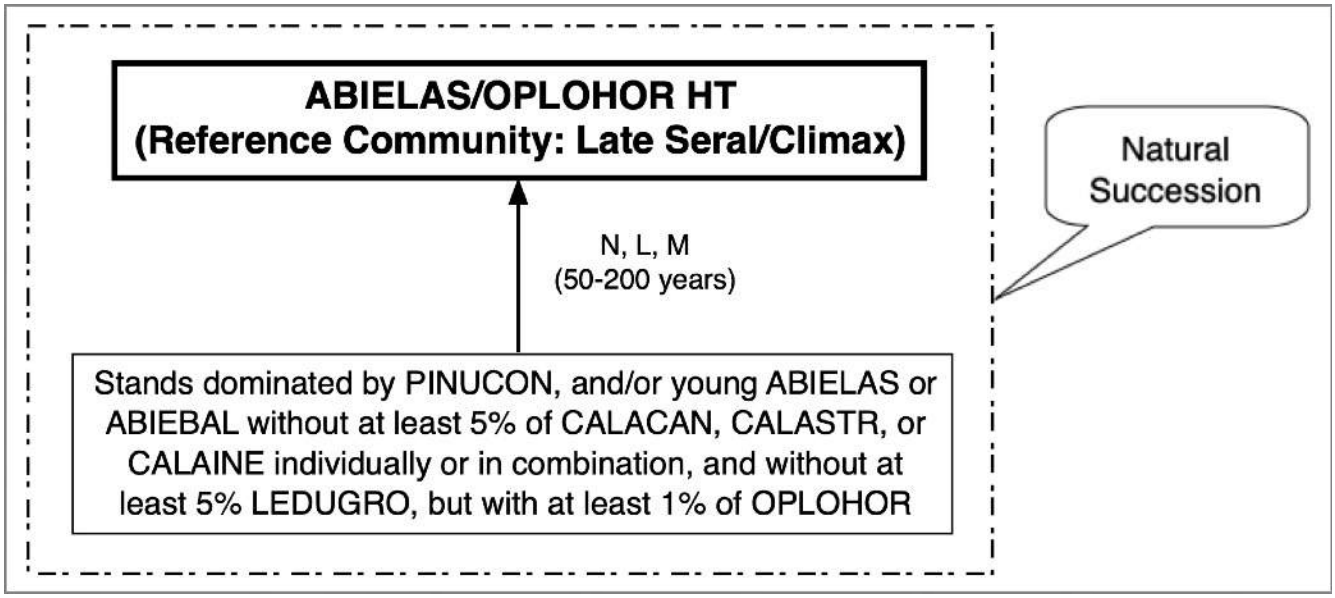
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Abies lasiocarpa (subalpine fir) is a shade-tolerant climax species favored by a long fire-free interval. Maturity and extended age of stands of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type depend largely on freedom from wildfire. Reestablishment of stands after a burn depends of availability of nearby sources of *Abies lasiocarpa* (subalpine fir) seed and on the level of competition from the fire adapted seral species, such as *Pinus contorta* (lodgepole pine) and *Populus tremuloides* (aspen).

Figure 10 shows a schematic diagram of vegetation successional pathways on sites of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type.



Successional Pathway of *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
ABIEBAL—*Abies balsamea* (balsam fir)
ABIELAS—*Abies lasiocarpa* (subalpine fir)
ABIELAS/OPLOHOR HT—*Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type
CALACAN—*Calamagrostis canadensis* (marsh reed grass)
CALAINE—*Calamagrostis inexpansa* (northern reed grass)
CALASTR—*Calamagrostis stricta* (narrow reed grass)
LEDUGRO—*Ledum groenlandicum* (common Labrador tea)
OPLOHOR—*Oplopanax horridum* (devil's-club)
PINUCON—*Pinus contorta* (lodgepole pine)

Figure 10. Successional pathway for sites of the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 11 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Abies lasiocarpa/Oplopanax horridum*

(subalpine fir/devil's-club) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

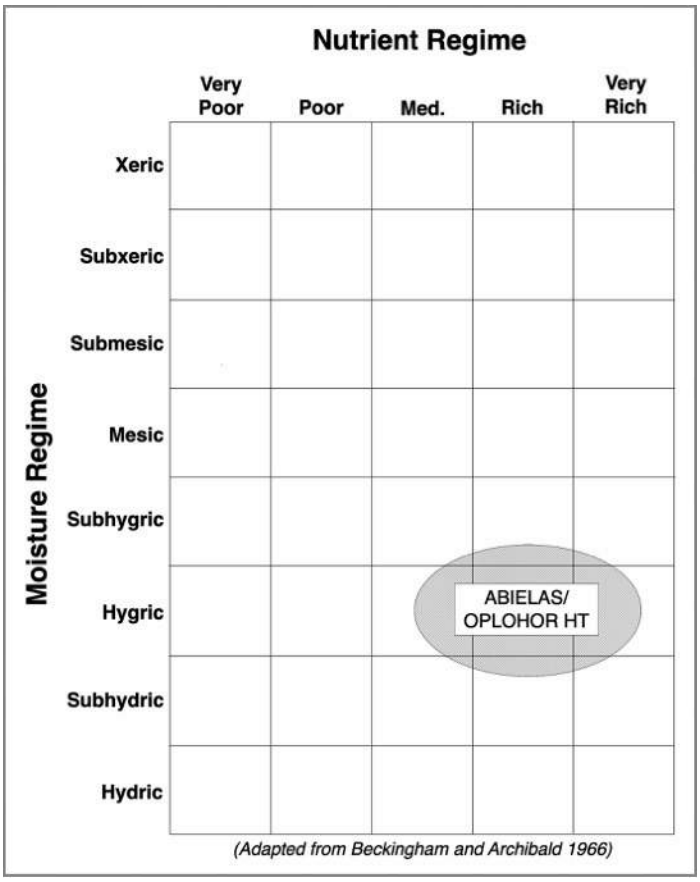


Figure 11. Edatope grid position for the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type (ABIELAS/OPLOHOR HT)

SOILS

Soils information is currently unavailable for sites supporting the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites are likely to be dominated by types such as the *Abies lasiocarpa/Ledum groenlandicum* (subalpine fir/common Labrador tea) habitat type, the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/ marsh reed grass) habitat type, or by *Alnus* (alder) species, *Betula* (birch) shrub species, *Salix* (willow) species. Drier adjacent sites will often have the *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) habitat type or communities dominated by *Picea glauca* (white spruce) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) occurs frequently in the southern Rocky Mountain and Boreal Forest natural regions of Alberta in forested stands from low elevation up to the subalpine zone (Tannas 1997a).

This is a middle to upper elevation mountain conifer tree species. It generally occupies sites having a short growing season with cold winters, cool summers, frequent summer frosts, and heavy winter snowpack. In the Rocky Mountains, *Abies lasiocarpa* (subalpine fir) is a shade-tolerant late seral/climax species that is favored by sites with long intervals free of fire-(Uchytil 1991b).

***Oplopanax horridum* (devil's club)**—*Oplopanax horridum* (devil's club) is a native, erect to slightly spreading, deciduous shrub from 1 m to 3 m tall. It is sparsely branched with sharp, dense prickles on stems and prominent leaf veins. The species is distributed from south-central Alaska south along the Pacific Coast and the western slope of the Cascade Range to southern Oregon and east to southwestern Yukon Territory, Idaho, and western Montana (Howard 1993). The species has limited occurrence in Alberta, typically found in moist *Abies* species (fir) and *Picea* species (spruce) forested sites.

Oplopanax horridum (devil's club) grows on moderately well-drained to poorly drained, shaded sites. It is commonly found near springs and streams and in drainage, seepage, and wet bottom areas. It is moderately shade tolerant and is primarily found in the understories of late seral, climax, and old-growth forests (Howard 1993).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is a late seral to climax conifer species, commonly replacing stand associates *Betula* species (birch), *Populus* species (poplar), and *Pinus* species (pine) as succession progresses (Tannas 1997a). This species in Alberta is restricted to the montane and subalpine natural subregions (Tannas 1997a).

Picea engelmannii (Engelmann spruce) is found in some of the highest and coldest forest environments that are characterized by long, cold winters with heavy snowpack and short, cool summers. The species is generally found on moist, cool sites extending down to lower elevations along stream bottoms where cold air flows down the valley and collects in localized frost pockets (Uchytil 1991d). *Picea engelmannii* (Engelmann spruce) often forms pure stands, but is more commonly associated with *Abies lasiocarpa* (subalpine fir). These two species frequently occur as codominants, forming widespread subalpine forests (Uchytil 1991d).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) is a late seral to climax conifer tree species, commonly replacing stand associates, *Betula* species (birch), *Populus* species (poplar), and *Pinus* species (pine), as succession progresses (Tannas 1997a).

This species typically grows in regions having long, cold winters and short, cool summers. It may be found on floodplains, upland slopes, and a variety of other landscape positions. Although it has a wide elevational range, *Picea glauca* (white spruce) is often confined to stream bottoms and lower river benches (Abrahamson 2015). It typically grows best on warm, moderately-to-well drained, upland or floodplain soils; and grows poorly on sites with stagnant water or a high water table (Abrahamson 2015).

Picea glauca (white spruce) co-dominates with *Populus tremuloides* (aspen), *Betula papyrifera* (white birch), and *Picea mariana* (black spruce) over large areas of mid seral forest (Abrahamson 2015).

Livestock

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) is unpalatable and its forage value is poor for both livestock and wild ungulates (Tannas 1997a). Stands dominated by it generally do not produce enough forage for livestock, but do provide browse and cover for large and small wildlife species (Uchytil 1991b).

***Oplopanax horridum* (devil's club)**— *Oplopanax horridum* (devil's club) is generally not preferred by browsing animals and is considered unpalatable for livestock (Howard 1993).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) palatability is poor, and it is seldom browsed by livestock (Tannas 1997a, Uchytil 1991d).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) has poor value as forage for both livestock and wild ungulates, although it is occasionally used where better quality forage is lacking (Tannas 1997a). Herbage production is moderate to low, decreasing as seral succession progresses, and the upper canopy closes. These sites have little value as livestock range, other than shading. Lane and others (2000) recommend non-use for stands of *Picea glauca* (white spruce) on moist sites in the Lower Foothills Subregion. The moist soils are sensitive to disturbance, and cattle can easily churn the wet soil and destroy plant cover, as well as limiting tree seedling establishment.

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) wood is soft, brittle, and quick to decay. It is used for rough construction and boxes, doors, frames, poles, and fuel. Small trees are extensively used as Christmas trees (USDA National Resources Conservation Service 2023).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is an important commercial wood producing species. The wood is white, straight grained, soft, and stiff. It is primarily used for construction lumber, but also for specialty items such as food containers and musical instruments (Uchytil 1991d).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) timber is used primarily for pulpwood, construction lumber, furniture, boxes, crates, and pallets (USDA National Resources Conservation Service 2023). Productivity is moderate to high on these moist, rich sites (Beckingham and others 1996). However, they offer only limited potential due to the extremely fragile site conditions, generally accessible only during winter. Due to high water tables, the trees are extremely susceptible to windthrow and soil loss may follow all forms of timber harvesting. Subsequent to harvest, water tables can rise, causing problems for regeneration of trees on the site.

Wildlife

***Abies lasiocarpa* (subalpine fir)**—Mule deer, elk, moose, woodland caribou, black bear, and grizzly bear often use *Abies lasiocarpa* (subalpine fir) habitats as summer range, but these forest sites are generally not suitable winter range for deer and elk because of heavy snowpack. Mule deer, elk, moose, woodland caribou, black bear, and grizzly bear often use these habitats as summer range (Uchytil 1991b).

Abies lasiocarpa (subalpine fir) seeds are eaten by several species of small mammals and birds. Red squirrels, chipmunks, and mice eat seeds from cached cones. Several birds, including chickadees, nuthatches, crossbills, pine siskins, and Clark's nutcrackers eat seeds from the cones. Because subalpine fir seeds are large, comprising about 26 percent of a cone's weight, they can provide an energy-efficient food source (Uchytil 1991b).

***Oplopanax horridum* (devil's club)**—Black-tailed deer, white-tailed deer, and elk may utilize *Oplopanax horridum* (devil's club) lightly in spring and summer (Howard 1993). The species provides hiding, escape, and thermal cover for various birds and small mammals (Howard 1993).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) stands provide forage and habitat for a wide variety of small and large wildlife species. However, these properties are characteristic of where spruce grows and the associated understory species, rather than to the tree species itself. Animals that inhabit these stands include moose, elk, mule deer, woodland caribou, porcupine, snowshoe hare, red squirrel, and chipmunks. A partial list of birds that nest and feed in *Picea engelmannii* (Engelmann spruce) includes mountain chickadee, Williamson's sapsucker, red-breasted nuthatch, brown creeper, owls, and woodpeckers (Uchytil 1991d).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) provides important wildlife habitat values, and is browsed to some extent by small mammals, especially by snowshoe hares (Tannas 1997a). The cones of this species are a choice food for red squirrels (Tannas 1997a).

Picea glauca (white spruce) provides good thermal and hiding cover for moose, white-tailed deer, and ruffed grouse. In southwestern Alberta, ruffed grouse preferentially select drumming sites with young *Picea glauca* (white spruce) cover (Abrahamson 2015).

Fisheries

***Picea glauca* (white spruce)**—Stands of *Picea glauca* (white spruce) adjacent to streams provide hiding, thermal cover, debris recruitment, and streambank stability for fish habitat (Thompson and Hansen 2003).

Fire

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) is very fire sensitive, and it generally suffers high mortality from even low intensity fires. To colonize burned areas, it relies on wind-dispersed seeds, which readily germinate on seedbeds that are prepared by fire (Uchytil 1991b).

***Oplopanax horridum* (devil's club)**—Sites supporting *Oplopanax horridum* (devil's club) burn infrequently. Typically, the moist ravines and stream side areas serve as a fire break to low and moderate severity ground fires (Howard 1993).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) spruce is very fire sensitive and is generally killed even by low-intensity fires. Post fire reestablishment is via wind-dispersed seeds, which readily germinate on fire-prepared seedbeds. The occasional mature tree that survives fire, those trees in unburned pockets, and live trees adjacent to burned areas provide the seeds for colonizing burned areas (Uchytil 1991d).

Scattered individuals or pockets of *Picea engelmannii* (Engelmann spruce) trees commonly escape fire by occurring on wetter sites where fire spread is limited. Scattered spruce trees may escape fire by occurring on sites with discontinuous fuels, broken and rocky terrain, and/or a moist and cool environment (Uchytil 1991d).

***Picea glauca* (white spruce)**— *Picea glauca* (white spruce) is easily killed by fire (Fischer and Bradley 1987). The species is poorly adapted to survive fire due to the trees have thin bark and shallow roots (Abrahamson 2015). Fires in *Picea glauca* (white spruce) communities are often stand-replacing, and post-fire succession generally progresses through stages of herbaceous plants, shrubs, and deciduous trees before finally succeeding to the late seral *Picea glauca* (white spruce). On sites where fire is frequent, the same species that initially colonized the stand after fire may dominate until the next stand-replacing fire. This leads to the persistence of shade intolerant species such as *Populus tremuloides* (aspen) and *Betula papyrifera* (white birch). Alternatively, when

fire is not frequent, stands eventually become dominated by shade tolerant species, such as the *Picea glauca* (white spruce) (Abrahamson 2015).

Rehabilitation/Restoration Considerations

***Abies lasiocarpa* (subalpine fir)**—*Abies lasiocarpa* (subalpine fir) can be planted on disturbed sites within forest vegetation types where it naturally occurs. The species is generally recommended for cool and moist sites in subalpine areas. Because this wide-ranging tree exhibits a great degree of genetic variation, seed or nursery stock for rehabilitation projects should come from a local, site adapted. source. Transplanting rooted nursery stock is generally more successful than direct seeding of the species (Uchytil 1991b).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is suitable for restoration and revegetation applications in Alberta ranging from the montane natural subregion and above to the lower reaches of the alpine natural subregion (Hardy BBT Limited 1989).

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) is useful for long-term revegetation of coal mine overburden. In Alberta, it is considered one of the best conifers for this purpose (Abrahamson 2015). Road construction and development severely degrade riparian and wetland sites with high water tables, poor drainage, or organic soils. Therefore, roads and trails should be located on adjacent uplands.

Recreational Uses and Consideration

***Picea engelmannii* (Engelmann spruce)**—Because of high water tables and the problems associated with road construction, campgrounds should not be located in stands of *Picea engelmannii* (Engelmann spruce).

***Picea glauca* (white spruce)**—Because of high water tables and the problems associated with road construction, campgrounds should not be located in stands of *Picea glauca* (white spruce).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's-club) habitat type was previously described in the region for the following geographic location(s):

- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995); and
- *Forest Habitat Types of Montana* (Pfister and others 1977).

Picea glauca/Calamagrostis canadensis Habitat Type
(white spruce/marsh reed grass Habitat Type)

PICEGLA/CALACAN Habitat Type
Number of Stands = 98 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 87; Other Data Sets = 11)

LOCATION AND ASSOCIATED LANDFORMS

The *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type is a major type in the Lower Foothills Natural Subregion, a major type in the Upper Foothills Natural Subregion, and a major type in the Montane Natural Subregion of Alberta. This habitat type characteristically occurs on gentle toe slopes, seep areas, stream terraces, and along low gradient meandering streams—on sites representing the broad middle of the moisture and nutrient spectrum of conditions required by *Picea glauca* (white spruce), limited on the drier side of the moisture spectrum by the requirements of the understory indicator species, *Calamagrostis canadensis* (marsh reed grass).

Photo 1 shows a typical stand of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type.

Photo 1. A stand of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type (photo provided by Alan Dodd)

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 59 shows the five most prominent plant species among the four lifeforms for species recorded in all 98 stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type. This sample set contains a mix of late seral relatively undisturbed stands and early seral and disturbed stands. For this reason several early seral species, such as the *Populus tremuloides* (aspen), are highly prominent. Among the shrubs, graminoids, and forbs in this habitat type, only *Calamagrostis canadensis* (marsh reed grass), is highly prominent.

Table 59. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type (number = 98 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus tremuloides (aspen)	25.23	Native
Picea glauca (white spruce)	24.06	Native
Populus balsamifera (balsam poplar)	7.68	Native
Pinus contorta (lodgepole pine)	7.46	Native
Betula papyrifera (white birch)	3.45	Native
Shrubs		
Alnus crispa (green alder)	5.47	Native
Viburnum edule (low-bush cranberry)	4.21	Native
Salix bebbiana (beaked willow)	4.01	Native
Rosa acicularis (prickly rose)	3.35	Native
Lonicera involucrata (bracted honeysuckle)	3.16	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	24.18	Native
Elymus innovatus (hairy wild rye)	2.70	Native
Deschampsia cespitosa (tufted hair grass)	0.83	Native
Carex aquatilis (water sedge)	0.51	Native
Bromus ciliatus (fringed brome)	0.21	Native

Table 59. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Cornus canadensis (bunchberry)	4.97	Native
Aralia nudicaulis (wild sarsaparilla)	4.53	Native
Equisetum arvense (common horsetail)	4.33	Native
Epilobium angustifolium (common fireweed)	3.76	Native
Equisetum pratense (meadow horsetail)	3.35	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 60 through Table 63, break out the vegetation recorded in all 98 stands sampled of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, species rich, forested habitat type of major occurrence across the study area.

Table 60 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type. For the 98 stands comprising the habitat type, the number of unique species was 253 with 233 (92.1 percent) of them being native species.

Table 60. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type (number = 98 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	12	12	0	0
Shrubs	60	57	0	3
Graminoids	41	34	6	1
Forbs	140	130	6	4
TOTAL	***253 (100.0%)***	***233 (92.1%)***	***12 (4.7%)***	***8 (3.2%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 61 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type. The average number of species per stand is 27.9, with native species comprising 27.5 species per stand or 98.6 percent.

Table 61. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type (number = 98 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.8	2.8	0.0	0.0
Shrubs	8.3	8.3	0.0	0.1
Graminoids	2.4	2.3	0.1	0.0
Forbs	14.4	14.1	0.3	0.0
TOTAL	***27.9 (100.0%)***	***27.5 (98.6%)***	***0.4 (1.4%)***	***0.1 (0.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 62 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type. The average canopy cover per stand is 182.2 percent, with native species comprising 180.6 percent or 99.2 percent of the total amount of average canopy cover per stand.

Table 62. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type (number = 98 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	69.5%	69.5%	0.0%	0.0%
Shrubs	38.4%	37.9%	0.0%	0.5%
Graminoids	30.4%	30.0%	0.4%	0.0%
Forbs	43.9%	43.2%	0.7%	0.0%
TOTAL	***182.2% (100.0%)***	***180.6% (99.2%)***	***1.0% (0.6%)***	***0.5% (0.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 63 shows the average number of species and average canopy cover by lifeform in stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type. The average number of species per stand was 27.9 with an average canopy cover of 182.2 percent.

Table 63. Average number of species and average canopy cover by lifeform in stands of the *Picea glauca/ Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type (number = 98 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.8	69.5%
Shrubs	8.3	38.4%
Graminoids	2.4	30.4%
Forbs	14.4	43.9%
TOTAL	***27.9***	***182.2%***

Sampled Stands Plant Species List

The *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type is one of the most common types in the study area. On the 98 stands sampled, a total of 12 tree species were recorded on at least one stand each (Table 64). The early-to-mid seral *Populus tremuloides* (aspen) was the most prominent tree, with slightly higher prominence that the overstory indicator species, *Picea glauca* (white spruce). This is because the *Populus tremuloides* (aspen) is an early seral species, and only 17 of the 98 stands are in late seral stage of development. None of the 60 shrub species recorded is highly prominent. Of 41 graminoid species, only *Calamagrostis canadensis* (marsh reed grass) is very prominent or occurs on more than a few of the plots. Of the total 140 forb species recorded, none was highly prominent or occurred on every plot.

Table 64. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type (number = 98 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 12)					
Abies balsamea (balsam fir)	0.5	0-0.5	6	0.03	N
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	7	0.04	N
Betula neoalaskana (Alaska birch)	0.5	0-0.5	1	0.01	N
Betula papyrifera (white birch)	12.5	0-50	28	3.45	N
Picea engelmannii (Engelmann spruce)	40.0	0-40	1	0.41	N
Picea engelmannii x glauca (Engelmann x white spruce)	40.0	0-60	2	0.82	N
Picea glauca (white spruce)	24.8	0-80	97	24.06	N
Picea mariana (black spruce)	1.8	0-3	2	0.04	N
Pinus contorta (lodgepole pine)	20.3	0-60	37	7.46	N
Populus balsamifera (balsam poplar)	20.3	0-90	38	7.68	N
Populus tremuloides (aspen)	39.2	0-90	64	25.23	N
Pseudotsuga menziesii (Douglas-fir)	30.0	0-30	1	0.31	N

Table 64. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Shrubs (N = 60)					
Alnus crispa (green alder)	15.3	0-70	36	5.47	N
Alnus tenuifolia (river alder)	11.1	0-20	6	0.68	N
Amelanchier alnifolia (Saskatoon)	2.0	0-10	26	0.50	N
Arctostaphylos uva-ursi (common bearberry)	5.3	0-10	5	0.27	N
Betula glandulosa (bog birch)	0.5	0-0.5	4	0.02	N
Betula occidentalis (water birch)	1.8	0-3	2	0.04	N
Betula pumila (dwarf birch)	0.5	0-0.5	2	0.01	N
Clematis occidentalis (purple clematis)	0.5	0-0.5	1	0.01	N
Cornus stolonifera (red-osier dogwood)	3.0	0-3	6	0.18	N
Corylus cornuta (beaked hazelnut)	0.5	0-0.5	1	0.01	N
Elaeagnus commutata (silverberry)	10.0	0-10	1	0.10	N
Juniperus communis (ground juniper)	0.5	0-0.5	2	0.01	N
Ledum groenlandicum (common Labrador tea)	3.6	0-30	20	0.73	N
Linnaea borealis (twinflower)	3.8	0-20	66	2.53	N
Lonicera dioica (twining honeysuckle)	1.2	0-3	22	0.27	N
Lonicera involucrata (bracted honeysuckle)	5.3	0-20	59	3.16	N
Oplopanax horridum (devil's-club)	10.3	0-30	3	0.32	N
Potentilla fruticosa (shrubby cinquefoil)	0.5	0-0.5	1	0.01	N
Ribes hudsonianum (northern black currant)	1.8	0-3	2	0.04	N
Ribes lacustre (bristly black currant)	1.2	0-3	26	0.31	N
Ribes oxyacanthoides (northern gooseberry)	1.1	0-10	28	0.31	N
Ribes spp. (currant)	0.5	0-0.5	1	0.01	B
Ribes triste (wild red currant)	1.2	0-10	24	0.30	N
Rosa acicularis (prickly rose)	4.0	0-30	84	3.35	N
Rosa spp. (rose)	8.7	0-20	5	0.44	B
Rosa woodsii (common wild rose)	25.0	0-30	2	0.51	N
Rubus arcticus (dwarf raspberry)	0.8	0-3	8	0.07	N
Rubus chamaemorus (cloudberry)	0.5	0-0.5	1	0.01	N
Rubus idaeus (wild red raspberry)	2.3	0-10	38	0.86	N
Rubus parviflorus (thimbleberry)	2.5	0-10	6	0.15	N
Rubus pedatus (dwarf bramble)	2.5	0-10	6	0.15	N
Rubus pubescens (dewberry)	3.8	0-20	74	2.82	N
Salix barclayi (Barclay's willow)	10.0	0-10	1	0.10	N
Salix bebbiana (beaked willow)	13.6	0-60	30	4.01	N
Salix boothii (Booth's willow)	5.3	0-10	2	0.11	N
Salix discolor (pussy willow)	2.2	0-3	3	0.07	N
Salix exigua (sandbar willow)	0.5	0-0.5	1	0.01	N
Salix glauca (smooth willow)	18.7	0-50	3	0.57	N
Salix maccalliana (velvet-fruited willow)	1.8	0-3	2	0.04	N
Salix myrtillifolia (myrtle-leaved willow)	1.8	0-3	2	0.04	N
Salix petiolaris (basket willow)	1.8	0-3	2	0.04	N
Salix planifolia (flat-leaved willow)	15.3	0-30	2	0.31	N
Salix prolixa (Mackenzie's willow)	3.0	0-3	1	0.03	N

Table 64. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Salix pseudomyrsinites (firm leaf willow)	3.0	0-3	1	0.03	N
Salix scouleriana (Scouler's willow)	20.0	0-30	2	0.41	N
Salix spp. (willow)	0.5	0-0.5	3	0.02	B
Sambucus racemosa (red elderberry)	0.5	0-0.5	2	0.01	N
Shepherdia canadensis (Canada buffaloberry)	6.6	0-40	22	1.48	N
Sorbus scopulina (western mountain-ash)	1.8	0-3	6	0.11	N
Spiraea betulifolia (white meadowsweet)	2.2	0-10	20	0.45	N
Spiraea densiflora (pink meadowsweet)	0.5	0-0.5	1	0.01	N
Symphoricarpos albus (snowberry)	1.0	0-3	5	0.05	N
Symphoricarpos occidentalis (buckbrush)	4.1	0-10	12	0.50	N
Symphoricarpos spp. (snowberry)	3.0	0-3	1	0.03	N
Vaccinium caespitosum (dwarf bilberry)	2.9	0-20	24	0.71	N
Vaccinium membranaceum (tall bilberry)	1.3	0-3	3	0.04	N
Vaccinium myrtilloides (common blueberry)	2.7	0-10	21	0.58	N
Vaccinium scoparium (grouseberry)	3.0	0-3	1	0.03	N
Vaccinium vitis-idaea (bog cranberry)	3.1	0-30	26	0.80	N
Viburnum edule (low-bush cranberry)	6.6	0-40	64	4.21	N
Graminoids (N = 41)					
Agropyron repens (quack grass)	3.0	0-3	1	0.03	I
Agropyron trachycaulum (slender wheat grass)	0.8	0-3	8	0.07	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	2	0.01	N
Agrostis stolonifera (redtop)	10.0	0-10	1	0.10	I
Alopecurus occidentalis (alpine foxtail)	0.5	0-0.5	2	0.01	N
Bromus ciliatus (fringed brome)	6.8	0-10	3	0.21	N
Bromus inermis (smooth brome)	3.0	0-3	1	0.03	I
Bromus vulgaris (woodland brome)	0.5	0-0.5	1	0.01	N
Calamagrostis canadensis (marsh reed grass)	24.4	0-90	99	24.18	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	1	0.10	N
Carex aquatilis (water sedge)	12.5	0-20	4	0.51	N
Carex atherodes (awned sedge)	10.0	0-10	1	0.10	N
Carex canescens (hoary sedge)	0.5	0-0.5	1	0.01	N
Carex concinna (beautiful sedge)	5.3	0-10	2	0.11	N
Carex disperma (two-seeded sedge)	2.4	0-3	4	0.10	N
Carex limosa (mud sedge)	20.0	0-20	1	0.20	N
Carex loliacea (rye-grass sedge)	10.0	0-10	1	0.10	N
Carex norvegica (Norway sedge)	2.2	0-3	3	0.07	N
Carex praegracilis (graceful sedge)	0.5	0-0.5	2	0.01	N
Carex praticola (meadow sedge)	0.5	0-0.5	1	0.01	N
Carex preslii (Presl sedge)	5.3	0-10	2	0.11	N
Carex siccata (hay sedge)	0.5	0-0.5	2	0.01	N
Carex spp. (sedge)	0.9	0-3	6	0.06	N
Carex vaginata (sheathed sedge)	0.5	0-0.5	4	0.02	N
Deschampsia cespitosa (tufted hair grass)	13.6	0-50	6	0.83	N
Deschampsia elongata (slender hair grass)	0.5	0-0.5	1	0.01	N

Table 64. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Elymus glaucus (smooth wild rye)	3.0	0-3	1	0.03	N
Elymus innovatus (hairy wild rye)	6.8	0-30	40	2.70	N
Festuca saximontana (Rocky Mountain fescue)	0.5	0-0.5	1	0.01	N
Glyceria striata (fowl manna grass)	0.5	0-0.5	1	0.01	N
Hierochloe odorata (sweet grass)	0.5	0-0.5	1	0.01	N
Juncus balticus (wire rush)	5.3	0-10	2	0.11	N
Luzula acuminata (wood-rush)	3.0	0-3	1	0.03	N
Luzula multiflora (field wood-rush)	3.0	0-3	1	0.03	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	1	0.01	N
Oryzopsis asperifolia (white-grained mountain rice grass)	1.0	0-3	5	0.05	N
Phleum pratense (timothy)	2.9	0-10	5	0.15	I
Poa palustris (fowl bluegrass)	0.9	0-3	6	0.06	N
Poa pratensis (Kentucky bluegrass)	1.3	0-3	3	0.04	I
Schizachne purpurascens (purple oat grass)	2.1	0-10	9	0.19	N
X Agroelymus spp. (Agropyron-Elymus hybrid)	0.5	0-0.5	1	0.01	B
Forbs (N = 140)					
Achillea millefolium (common yarrow)	1.2	0-10	20	0.25	N
Aconitum delphinifolium (monkshood)	0.5	0-0.5	1	0.01	N
Actaea rubra (red and white baneberry)	1.4	0-3	27	0.36	N
Agoseris glauca (yellow false dandelion)	0.5	0-0.5	1	0.01	N
Agrimonia striata (agrimony)	0.5	0-0.5	1	0.01	N
Antennaria anaphaloides (tall everlasting)	3.0	0-3	1	0.03	N
Antennaria racemosa (racemose everlasting)	0.5	0-0.5	1	0.01	N
Aquilegia spp. (columbine)	0.5	0-0.5	1	0.01	N
Aralia nudicaulis (wild sarsaparilla)	12.0	0-60	38	4.53	N
Arnica chamissonis (leafy arnica)	0.5	0-0.5	2	0.01	N
Arnica cordifolia (heart-leaved arnica)	2.3	0-10	38	0.88	N
Arnica longifolia (long-leaved arnica)	0.5	0-0.5	1	0.01	N
Aster ciliolatus (Lindley's aster)	2.9	0-20	45	1.31	N
Aster conspicuus (showy aster)	1.9	0-20	30	0.58	N
Aster laevis (smooth aster)	1.1	0-3	4	0.05	N
Aster spp. (aster)	1.1	0-3	4	0.05	N
Aster subspicatus (leafy-bracted aster)	0.5	0-0.5	1	0.01	N
Astragalus americanus (American milk vetch)	2.2	0-3	3	0.07	N
Astragalus spp. (milk vetch)	0.5	0-0.5	1	0.01	B
Athyrium filix-femina (lady fern)	2.2	0-3	3	0.07	N
Callitriche verna (vernal water-starwort)	0.5	0-0.5	1	0.01	N
Caltha palustris (marsh-marigold)	0.5	0-0.5	4	0.02	N
Calypso bulbosa (Venus'-slipper)	0.5	0-0.5	1	0.01	N
Campanula lasiocarpa (Alaska harebell)	0.5	0-0.5	1	0.01	N
Campanula rotundifolia (harebell)	0.9	0-3	6	0.06	N
Castilleja miniata (common red paintbrush)	2.2	0-10	7	0.16	N
Chrysanthemum leucanthemum (ox-eye daisy)	0.5	0-0.5	1	0.01	I

Table 64. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Chrysosplenium iowense (golden saxifrage)	3.0	0-3	1	0.03	N
Circaea alpina (small enchanter's nightshade)	3.0	0-3	1	0.03	N
Cirsium spp. (thistle)	0.5	0-0.5	1	0.01	B
Cirsium undulatum (wavy-leaved thistle)	0.5	0-0.5	1	0.01	N
Coptis trifolia (goldthread)	0.5	0-0.5	1	0.01	N
Corallorhiza spp. (coralroot)	0.5	0-0.5	1	0.01	B
Corallorhiza trifida (pale coralroot)	0.5	0-0.5	3	0.02	N
Cornus canadensis (bunchberry)	6.1	0-30	82	4.97	N
Delphinium glaucum (tall larkspur)	1.6	0-10	13	0.21	N
Disporum trachycarpum (fairybells)	1.0	0-3	5	0.05	N
Dryopteris assimilis (broad spinulose shield fern)	1.3	0-3	3	0.04	N
Dryopteris carthusiana (narrow spinulose shield fern)	0.5	0-0.5	1	0.01	N
Dryopteris cristata (crested shield fern)	0.5	0-0.5	1	0.01	N
Epilobium angustifolium (common fireweed)	4.4	0-60	85	3.76	N
Equisetum arvense (common horsetail)	14.1	0-50	31	4.33	N
Equisetum hyemale (common scouring-rush)	0.5	0-0.5	2	0.01	N
Equisetum pratense (meadow horsetail)	20.5	0-60	16	3.35	N
Equisetum scirpoides (dwarf scouring-rush)	1.0	0-3	5	0.05	N
Equisetum spp. (horsetail)	0.5	0-0.5	1	0.01	N
Equisetum sylvaticum (woodland horsetail)	7.9	0-40	30	2.35	N
Fragaria vesca (woodland strawberry)	0.5	0-0.5	1	0.01	N
Fragaria virginiana (wild strawberry)	1.8	0-10	68	1.26	N
Galeopsis tetrahit (hemp-nettle)	0.5	0-0.5	1	0.01	I
Galium boreale (northern bedstraw)	1.1	0-10	53	0.57	N
Galium triflorum (sweet-scented bedstraw)	0.8	0-3	31	0.26	N
Geranium bicknellii (Bicknell's geranium)	0.5	0-0.5	1	0.01	N
Geranium richardsonii (wild white geranium)	2.6	0-10	14	0.37	N
Geranium viscosissimum (sticky purple geranium)	3.0	0-3	1	0.03	N
Geum aleppicum (yellow avens)	1.0	0-3	5	0.05	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	4	0.02	N
Geum rivale (purple avens)	1.3	0-3	6	0.08	N
Geum triflorum (three-flowered avens)	0.5	0-0.5	1	0.01	N
Goodyera oblongifolia (rattlesnake plantain)	0.5	0-0.5	1	0.01	N
Goodyera repens (lesser rattlesnake plantain)	3.0	0-3	1	0.03	N
Gymnocarpium dryopteris (oak fern)	4.0	0-20	16	0.66	N
Habenaria hyperborea (northern green bog orchid)	0.5	0-0.5	1	0.01	N
Habenaria obtusata (blunt-leaved bog orchid)	0.5	0-0.5	5	0.03	N
Habenaria orbiculata (round-leaved bog orchid)	1.8	0-3	2	0.04	N
Habenaria spp. (bog orchid)	0.5	0-0.5	1	0.01	B
Halenia deflexa (spurred gentian)	1.8	0-3	2	0.04	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	2	0.01	N
Hedysarum sulphurescens (yellow hedysarum)	0.5	0-0.5	1	0.01	N
Heracleum lanatum (cow parsnip)	2.5	0-10	18	0.46	N

Table 64. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Hieracium umbellatum (narrow-leaved hawkweed)	0.5	0-0.5	3	0.02	N
Lathyrus ochroleucus (cream-colored vetchling)	2.5	0-20	59	1.46	N
Lathyrus venosus (purple peavine)	3.0	0-3	1	0.03	N
Leptarrhena pyrolifolia (leather-leaved saxifrage)	0.5	0-0.5	1	0.01	N
Lilium philadelphicum (western wood lily)	1.1	0-3	4	0.05	N
Listera cordata (heart-leaved twayblade)	0.5	0-0.5	2	0.01	N
Lycopodium annotinum (stiff club-moss)	4.9	0-40	21	1.06	N
Lycopodium complanatum (ground-cedar)	0.5	0-0.5	1	0.01	N
Lycopodium sitchense (ground-fir)	3.0	0-3	1	0.03	N
Maianthemum canadense (wild lily-of-the-valley)	0.8	0-3	52	0.44	N
Mentha arvensis (wild mint)	0.5	0-0.5	1	0.01	N
Mertensia paniculata (tall lungwort)	1.9	0-10	74	1.43	N
Mitella breweri (Brewer's bishop's-cap)	3.0	0-3	1	0.03	N
Mitella nuda (bishop's-cap)	2.2	0-40	61	1.33	N
Moehringia lateriflora (blunt-leaved sandwort)	0.5	0-0.5	2	0.01	N
Moneses uniflora (one-flowered wintergreen)	1.3	0-3	3	0.04	N
Orthilia secunda (one-sided wintergreen)	1.5	0-3	13	0.19	N
Osmorhiza depauperata (spreading sweet cicely)	0.8	0-3	8	0.07	N
Osmorhiza occidentalis (western sweet cicely)	1.1	0-3	4	0.05	N
Osmorhiza purpurea (purple sweet cicely)	0.5	0-0.5	2	0.01	N
Osmorhiza spp. (sweet cicely)	0.5	0-0.5	1	0.01	N
Parnassia palustris (northern grass-of-parnassus)	0.5	0-0.5	1	0.01	N
Pedicularis bracteosa (western lousewort)	1.8	0-3	2	0.04	N
Pedicularis labradorica (Labrador lousewort)	0.5	0-0.5	1	0.01	N
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	1	0.01	N
Penstemon spp. (beardtongue)	10.0	0-10	1	0.10	N
Petasites frigidus (arctic sweet coltsfoot)	2.0	0-3	5	0.10	N
Petasites nivalis (sweet coltsfoot)	0.5	0-0.5	1	0.01	N
Petasites palmatus (palmate-leaved coltsfoot)	1.3	0-10	69	0.88	N
Petasites sagittatus (arrow-leaved coltsfoot)	1.0	0-3	5	0.05	N
Petasites vitifolius (vine-leaved coltsfoot)	0.5	0-0.5	2	0.01	N
Polemonium pulcherrimum (showy Jacob's-ladder)	0.5	0-0.5	1	0.01	N
Polygonum viviparum (alpine bistort)	3.0	0-3	1	0.03	N
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	4	0.02	N
Pyrola asarifolia (common pink wintergreen)	2.0	0-30	61	1.21	N
Pyrola chlorantha (greenish-flowered wintergreen)	3.0	0-3	1	0.03	N
Ranunculus abortivus (small-flowered buttercup)	0.5	0-0.5	1	0.01	N
Ranunculus macounii (Macoun's buttercup)	0.5	0-0.5	1	0.01	N
Rumex acetosa (green sorrel)	3.0	0-3	1	0.03	N
Rumex britannica (water dock)	0.5	0-0.5	1	0.01	N
Sanicula marilandica (snakeroot)	1.8	0-3	2	0.04	N
Senecio indecorus (rayless ragwort)	10.0	0-10	1	0.10	N
Senecio pauciflorus (few-flowered ragwort)	0.5	0-0.5	2	0.01	N
Senecio triangularis (brook ragwort)	10.0	0-10	1	0.10	N

Table 64. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Smilacina racemosa (false Solomon's-seal)	2.0	0-10	20	0.40	N
Smilacina stellata (star-flowered Solomon's-seal)	1.0	0-3	14	0.15	N
Smilacina trifolia (three-leaved Solomon's-seal)	1.3	0-3	3	0.04	N
Solidago canadensis (Canada goldenrod)	4.5	0-10	3	0.14	N
Solidago mollis (velvety goldenrod)	0.5	0-0.5	1	0.01	N
Solidago multiradiata (alpine goldenrod)	3.0	0-3	1	0.03	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	1	0.01	N
Stenanthium occidentale (bronzebells)	0.5	0-0.5	1	0.01	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1.8	0-10	26	0.45	N
Streptopus roseus (rose mandarin)	0.5	0-0.5	1	0.01	N
Taraxacum officinale (common dandelion)	1.0	0-3	14	0.15	I
Thalictrum occidentale (western meadow rue)	0.5	0-0.5	1	0.01	N
Thalictrum venulosum (veiny meadow rue)	2.0	0-10	10	0.20	N
Tiarella unifoliata (sugarscoop)	0.5	0-0.5	1	0.01	N
Trifolium hybridum (alsike clover)	0.5	0-0.5	2	0.01	I
Trifolium pratense (red clover)	1.1	0-3	4	0.05	I
Trifolium repens (white clover)	8.8	0-20	5	0.45	I
Urtica dioica (common nettle)	0.5	0-0.5	3	0.02	N
Vicia americana (wild vetch)	1.2	0-3	42	0.49	N
Viola adunca (early blue violet)	3.0	0-3	1	0.03	N
Viola canadensis (western Canada violet)	1.3	0-3	16	0.21	N
Viola nephrophylla (bog violet)	0.5	0-0.5	1	0.01	N
Viola orbiculata (evergreen violet)	0.5	0-0.5	1	0.01	N
Viola palustris (marsh violet)	0.5	0-0.5	1	0.01	N
Viola renifolia (kidney-leaved violet)	2.1	0-10	14	0.30	N
Zigadenus elegans (white camas)	0.5	0-0.5	3	0.02	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and

low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 65 shows the five most prominent plant species among the four lifeforms for species recorded in all 17 relatively undisturbed late seral to climax stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type. *Picea glauca* (white spruce) is the only highly prominent tree species in later seral stands of this habitat type. No shrub species is highly prominent, *Calamagrostis canadensis* (marsh reed grass) is the only prominent graminoid, and three *Equisetum* (horsetail) species lead the forb layer.

Table 65. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type (number = 17 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	57.06	Native
Picea engelmannii x glauca (Engelmann x white spruce)	3.53	Native
Populus balsamifera (balsam poplar)	2.12	Native
Pseudotsuga menziesii (Douglas-fir)	1.77	Native
Betula papyrifera (white birch)	1.21	Native
Shrubs		
Salix glauca (smooth willow)	3.12	Native
Linnaea borealis (twinflower)	2.27	Native
Lonicera involucrata (bracted honeysuckle)	1.79	Native
Rubus pubescens (dewberry)	1.74	Native
Salix bebbiana (beaked willow)	1.56	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	16.47	Native
Elymus innovatus (hairy wild rye)	0.97	Native
Bromus ciliatus (fringed brome)	0.59	Native
Calamagrostis stricta (narrow reed grass)	0.59	Native
Carex aquatilis (water sedge)	0.59	Native
Forbs		
Equisetum pratense (meadow horsetail)	18.27	Native
Equisetum arvense (common horsetail)	14.35	Native
Equisetum sylvaticum (woodland horsetail)	6.24	Native
Cornus canadensis (bunchberry)	3.94	Native
Mitella nuda (bishop's-cap)	1.71	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 66 through Table 69, break out the vegetation recorded in 17 relatively undisturbed late seral to climax stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, species rich, forested habitat type of major occurrence across the study area.

Table 66 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/ Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type. For the 17 stands comprising the habitat type, the number of unique species was 147 with 142 (96.6 percent) of them being native species.

Table 66. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/ Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type (number = 17 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	9	9	0	0
Shrubs	38	36	0	2
Graminoids	20	18	2	0
Forbs	80	79	1	0
TOTAL	***147 (100.0%)***	***142 (96.6%)***	***3 (2.0%)***	***2 (1.4%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 67 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type. The average number of species per stand is 28.4, with native species comprising 28.0 species per stand or 98.6 percent.

Table 67. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type (number = 17 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.9	1.9	0.0	0.0
Shrubs	7.6	7.4	0.0	0.2
Graminoids	2.7	2.6	0.1	0.0
Forbs	16.2	16.1	0.1	0.0
TOTAL	***28.4 (100.0%)***	***28.0 (98.6%)***	***0.2 (0.7%)***	***0.2 (0.7%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 68 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type. The average canopy cover per stand is 167.4 percent, with native species comprising 167.2 percent or 99.9 percent of the total amount of average canopy cover per stand.

Table 68. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type (number = 17 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	66.4%	66.4%	0.0%	0.0%
Shrubs	19.6%	19.5%	0.0%	0.1%
Graminoids	21.2%	21.1%	0.1%	0.0%
Forbs	60.3%	60.2%	0.1%	0.0%
TOTAL	***167.4% (100.0%)***	***167.2% (99.9%)***	***0.1% (0.1%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 69 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type. The average number of species per stand was 28.4 with an average canopy cover of 167.4 percent.

Table 69. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type (number = 17 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	1.9	66.4%
Shrubs	7.6	19.6%
Graminoids	2.7	21.2%
Forbs	16.2	60.3%
TOTAL	***28.4***	***167.4%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

On the 17 relatively undisturbed late seral to climax stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type, nine tree species were recorded on at least one of the plots, but *Picea glauca* (white spruce) is the only highly prominent species (Table 70). Thirty-eight shrub species were recorded on these 17 relatively late seral stands, but none are highly prominent. Among the graminoids, *Calamagrostis canadensis* (marsh reed grass) was the only one of 20 species recorded with high prominence. Eighty forb species were recorded, but only *Equisetum arvense* (common horsetail) and *Equisetum pratense* (meadow horsetail) are especially prominent.

Table 70. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type (number = 17 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 9)					
Abies balsamea (balsam fir)	0.5	0-0.5	6	0.03	N
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	12	0.06	N
Betula papyrifera (white birch)	10.3	0-20	12	1.21	N
Picea engelmannii x glauca (Engelmann x white spruce)	60.0	0-60	6	3.53	N
Picea glauca (white spruce)	60.6	0-80	94	57.06	N
Pinus contorta (lodgepole pine)	1.3	0-3	18	0.24	N
Populus balsamifera (balsam poplar)	9.0	0-20	24	2.12	N
Populus tremuloides (aspen)	3.0	0-3	12	0.35	N
Pseudotsuga menziesii (Douglas-fir)	30.0	0-30	6	1.76	N
Shrubs (N = 38)					
Alnus crispa (green alder)	1.8	0-3	24	0.41	N
Alnus tenuifolia (river alder)	3.0	0-3	6	0.18	N

Table 70. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Amelanchier alnifolia (Saskatoon)	0.5	0-0.5	6	0.03	N
Betula glandulosa (bog birch)	0.5	0-0.5	12	0.06	N
Betula occidentalis (water birch)	3.0	0-3	6	0.18	N
Clematis occidentalis (purple clematis)	0.5	0-0.5	6	0.03	N
Cornus stolonifera (red-osier dogwood)	3.0	0-3	12	0.35	N
Ledum groenlandicum (common Labrador tea)	10.0	0-10	6	0.59	N
Linnaea borealis (twinflower)	3.0	0-20	76	2.26	N
Lonicera dioica (twining honeysuckle)	1.3	0-3	18	0.24	N
Lonicera involucrata (bracted honeysuckle)	2.5	0-10	71	1.79	N
Ribes hudsonianum (northern black currant)	3.0	0-3	6	0.18	N
Ribes lacustre (bristly black currant)	1.1	0-3	53	0.56	N
Ribes oxyacanthoides (northern gooseberry)	1.0	0-3	29	0.29	N
Ribes triste (wild red currant)	0.5	0-0.5	29	0.15	N
Rosa acicularis (prickly rose)	1.3	0-3	88	1.18	N
Rosa spp. (rose)	0.5	0-0.5	6	0.03	B
Rubus arcticus (dwarf raspberry)	1.8	0-3	12	0.21	N
Rubus chamaemorus (cloudberry)	0.5	0-0.5	6	0.03	N
Rubus idaeus (wild red raspberry)	3.4	0-10	29	1.00	N
Rubus pedatus (dwarf bramble)	0.5	0-0.5	6	0.03	N
Rubus pubescens (dewberry)	3.0	0-10	59	1.74	N
Salix bebbiana (beaked willow)	6.6	0-20	24	1.56	N
Salix boothii (Booth's willow)	0.5	0-0.5	6	0.03	N
Salix discolor (pussy willow)	3.0	0-3	6	0.18	N
Salix glauca (smooth willow)	26.5	0-50	12	3.12	N
Salix maccalliana (velvet-fruited willow)	0.5	0-0.5	6	0.03	N
Salix prolixa (Mackenzie's willow)	3.0	0-3	6	0.18	N
Salix spp. (willow)	0.5	0-0.5	18	0.09	B
Shepherdia canadensis (Canada buffaloberry)	1.1	0-3	24	0.26	N
Sorbus scopulina (western mountain-ash)	0.5	0-0.5	6	0.03	N
Spiraea betulifolia (white meadowsweet)	1.8	0-3	12	0.21	N
Symphoricarpos albus (snowberry)	0.5	0-0.5	6	0.03	N
Symphoricarpos occidentalis (buckbrush)	10.0	0-10	6	0.59	N
Vaccinium caespitosum (dwarf bilberry)	0.5	0-0.5	12	0.06	N
Vaccinium scoparium (grouseberry)	3.0	0-3	6	0.18	N
Vaccinium vitis-idaea (bog cranberry)	0.5	0-0.5	12	0.06	N
Viburnum edule (low-bush cranberry)	3.6	0-20	41	1.50	N
Graminoids (N = 20)					
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	18	0.09	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	6	0.03	N
Alopecurus occidentalis (alpine foxtail)	0.5	0-0.5	6	0.03	N
Bromus ciliatus (fringed brome)	10.0	0-10	6	0.59	N
Bromus vulgaris (woodland brome)	0.5	0-0.5	6	0.03	N
Calamagrostis canadensis (marsh reed grass)	17.5	0-50	94	16.47	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	6	0.59	N

Table 70. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex aquatilis (water sedge)	10.0	0-10	6	0.59	N
Carex atherodes (awned sedge)	10.0	0-10	6	0.59	N
Carex disperma (two-seeded sedge)	3.0	0-3	18	0.53	N
Carex norvegica (Norway sedge)	1.8	0-3	12	0.21	N
Carex praegracilis (graceful sedge)	0.5	0-0.5	6	0.03	N
Carex spp. (sedge)	1.8	0-3	12	0.21	N
Carex vaginata (sheathed sedge)	0.5	0-0.5	12	0.06	N
Deschampsia cespitosa (tufted hair grass)	0.5	0-0.5	12	0.06	N
Elymus innovatus (hairy wild rye)	4.1	0-10	24	0.97	N
Phleum pratense (timothy)	0.5	0-0.5	6	0.03	I
Poa palustris (fowl bluegrass)	0.5	0-0.5	6	0.03	N
Poa pratensis (Kentucky bluegrass)	0.5	0-0.5	6	0.03	I
Schizachne purpurascens (purple oat grass)	0.5	0-0.5	6	0.03	N
Forbs (N = 80)					
Achillea millefolium (common yarrow)	1.8	0-3	24	0.41	N
Aconitum delphinifolium (monkshood)	0.5	0-0.5	6	0.03	N
Actaea rubra (red and white baneberry)	1.0	0-3	29	0.29	N
Agrimonia striata (agrimony)	0.5	0-0.5	6	0.03	N
Antennaria racemosa (racemose everlasting)	0.5	0-0.5	6	0.03	N
Aquilegia spp. (columbine)	0.5	0-0.5	6	0.03	N
Aralia nudicaulis (wild sarsaparilla)	0.5	0-0.5	24	0.12	N
Arnica chamissonis (leafy arnica)	0.5	0-0.5	6	0.03	N
Arnica cordifolia (heart-leaved arnica)	1.1	0-3	24	0.26	N
Aster ciliolatus (Lindley's aster)	1.8	0-3	47	0.82	N
Aster conspicuus (showy aster)	1.8	0-3	12	0.21	N
Aster laevis (smooth aster)	0.5	0-0.5	6	0.03	N
Aster spp. (aster)	0.5	0-0.5	6	0.03	N
Astragalus americanus (American milk vetch)	1.8	0-3	12	0.21	N
Callitriche verna (vernal water-starwort)	0.5	0-0.5	6	0.03	N
Calypso bulbosa (Venus'-slipper)	0.5	0-0.5	6	0.03	N
Campanula rotundifolia (harebell)	0.5	0-0.5	6	0.03	N
Chrysosplenium iowense (golden saxifrage)	3.0	0-3	6	0.18	N
Circaea alpina (small enchanter's nightshade)	3.0	0-3	6	0.18	N
Cirsium undulatum (wavy-leaved thistle)	0.5	0-0.5	6	0.03	N
Corallorhiza trifida (pale coralroot)	0.5	0-0.5	6	0.03	N
Cornus canadensis (bunchberry)	5.2	0-20	76	3.94	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	29	0.15	N
Disporum trachycarpum (fairybells)	0.5	0-0.5	6	0.03	N
Dryopteris assimilis (broad spinulose shield fern)	0.5	0-0.5	6	0.03	N
Epilobium angustifolium (common fireweed)	1.7	0-10	82	1.41	N
Equisetum arvense (common horsetail)	24.4	0-50	59	14.35	N
Equisetum pratense (meadow horsetail)	31.1	0-60	59	18.26	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	18	0.09	N
Equisetum sylvaticum (woodland horsetail)	15.1	0-40	41	6.24	N

Table 70. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Fragaria virginiana (wild strawberry)	0.9	0-3	82	0.71	N
Galium boreale (northern bedstraw)	0.7	0-3	65	0.47	N
Galium triflorum (sweet-scented bedstraw)	1.3	0-3	18	0.24	N
Geranium richardsonii (wild white geranium)	1.8	0-3	24	0.41	N
Geranium viscosissimum (sticky purple geranium)	3.0	0-3	6	0.18	N
Geum aleppicum (yellow avens)	1.8	0-3	12	0.21	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	12	0.06	N
Geum rivale (purple avens)	0.5	0-0.5	12	0.06	N
Goodyera repens (lesser rattlesnake plantain)	3.0	0-3	6	0.18	N
Gymnocarpium dryopteris (oak fern)	0.5	0-0.5	6	0.03	N
Habenaria obtusata (blunt-leaved bog orchid)	0.5	0-0.5	18	0.09	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	6	0.03	N
Heracleum lanatum (cow parsnip)	0.5	0-0.5	24	0.12	N
Lathyrus ochroleucus (cream-colored vetchling)	1.1	0-3	47	0.53	N
Leptarrhena pyrolifolia (leather-leaved saxifrage)	0.5	0-0.5	6	0.03	N
Listera cordata (heart-leaved twayblade)	0.5	0-0.5	6	0.03	N
Lycopodium annotinum (stiff club-moss)	2.2	0-3	18	0.38	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	18	0.09	N
Mertensia paniculata (tall lungwort)	1.9	0-10	82	1.56	N
Mitella nuda (bishop's-cap)	1.9	0-10	88	1.71	N
Moneses uniflora (one-flowered wintergreen)	0.5	0-0.5	12	0.06	N
Orthilia secunda (one-sided wintergreen)	2.5	0-3	29	0.74	N
Osmorhiza depauperata (spreading sweet cicely)	3.0	0-3	6	0.18	N
Osmorhiza occidentalis (western sweet cicely)	0.5	0-0.5	6	0.03	N
Osmorhiza purpurea (purple sweet cicely)	0.5	0-0.5	6	0.03	N
Parnassia palustris (northern grass-of-parnassus)	0.5	0-0.5	6	0.03	N
Pedicularis bracteosa (western lousewort)	0.5	0-0.5	6	0.03	N
Petasites frigidus (arctic sweet coltsfoot)	3.0	0-3	6	0.18	N
Petasites nivalis (sweet coltsfoot)	0.5	0-0.5	6	0.03	N
Petasites palmatus (palmate-leaved coltsfoot)	1.0	0-3	65	0.62	N
Petasites sagittatus (arrow-leaved coltsfoot)	1.3	0-3	18	0.24	N
Polygonum viviparum (alpine bistort)	3.0	0-3	6	0.18	N
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	6	0.03	N
Pyrola asarifolia (common pink wintergreen)	0.8	0-3	47	0.38	N
Pyrola chlorantha (greenish-flowered wintergreen)	3.0	0-3	6	0.18	N
Ranunculus abortivus (small-flowered buttercup)	0.5	0-0.5	6	0.03	N
Senecio indecorus (rayless ragwort)	10.0	0-10	6	0.59	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	6	0.03	N
Smilacina stellata (star-flowered Solomon's-seal)	1.0	0-3	29	0.29	N
Smilacina trifolia (three-leaved Solomon's-seal)	1.3	0-3	18	0.24	N
Solidago canadensis (Canada goldenrod)	3.0	0-3	6	0.18	N
Stenanthium occidentale (bronzebells)	0.5	0-0.5	6	0.03	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.5	0-0.5	24	0.12	N

Table 70. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Streptopus roseus (rose mandarin)	0.5	0-0.5	6	0.03	N
Taraxacum officinale (common dandelion)	0.5	0-0.5	12	0.06	I
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	18	0.09	N
Vicia americana (wild vetch)	1.3	0-3	35	0.47	N
Viola canadensis (western Canada violet)	1.8	0-3	24	0.41	N
Viola nephrophylla (bog violet)	0.5	0-0.5	6	0.03	N
Viola renifolia (kidney-leaved violet)	3.0	0-3	6	0.18	N

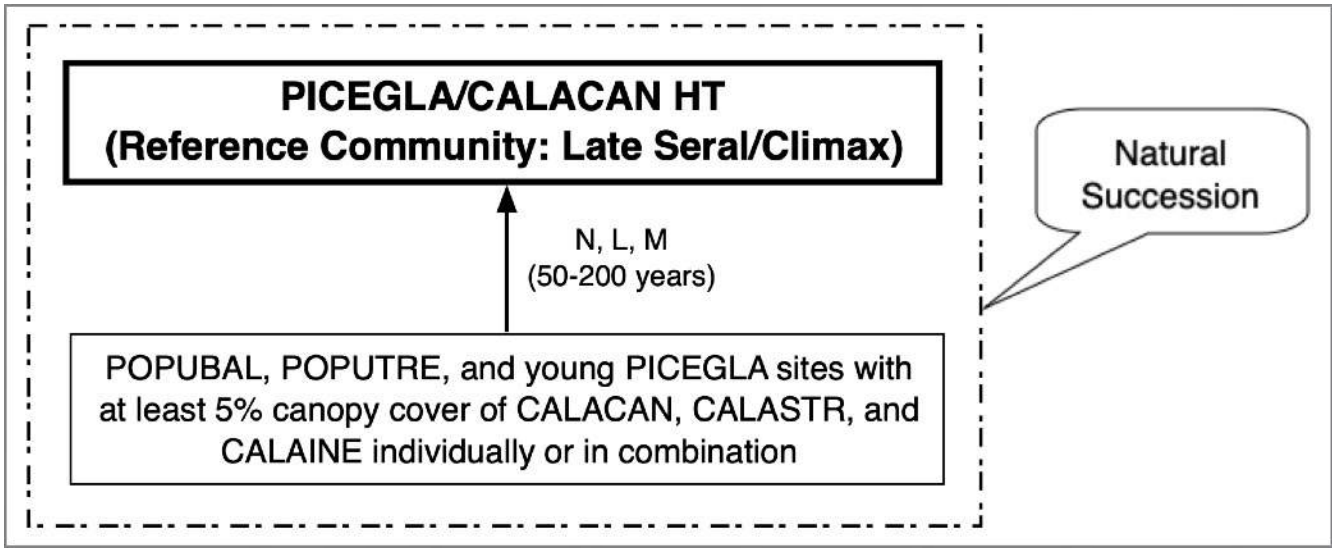
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Fluvial processes (e.g., channel migration, flooding, and deposition) are the principal origins of sites for new forest stands in riparian settings. Natural firebreaks of moist floodplains, wide channels, oxbows, and low fuel loadings on dark forest floors inhibit fire. Therefore, old-growth riparian forests of *Picea glauca* (white spruce) in western Canada are restricted to terraces of the major river valleys where primary succession has been allowed to proceed undisturbed for more than 200 years (Timoney and others 1997). New fluvial deposits become vegetated with pioneer species of *Alnus tenuifolia* (river alder), *Salix* (willows), *Populus balsamifera* (balsam poplar), and herbaceous hydrophytes, which collect additional sediment buildup from successive flood events. This process creates a new fluvial terrace, elevating it and effectively drying it as it becomes better drained and less accessible to the more common flooding levels. This process provides sites for new stands of the *Picea glauca/ Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type.

Figure 12 shows a schematic diagram of vegetation successional pathways on sites of the *Picea glauca/ Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type.



Successional Pathway of *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CALACAN—*Calamagrostis canadensis* (marsh reed grass)
CALAINE—*Calamagrostis inexpansa* (northern reed grass)
CALASTR—*Calamagrostis stricta* (narrow reed grass)
PICEGLA—*Picea glauca* (white spruce)
PICEGLA/CALACAN HT—*Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUTRE—*Populus tremuloides* (aspen)

Figure 12. Successional pathway for sites of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 13 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

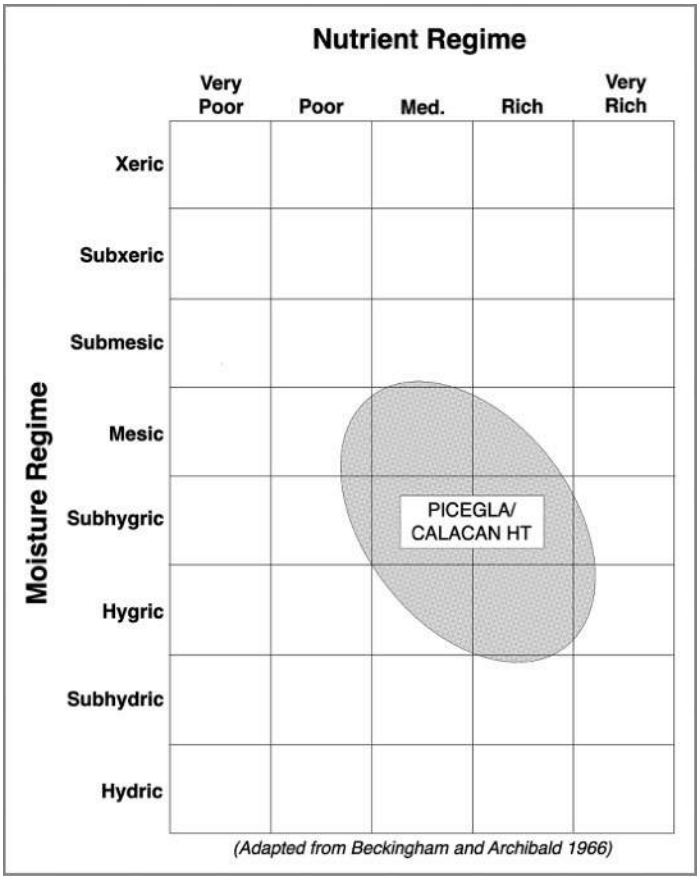


Figure 13. Edatope grid position for the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type (PICEGLA/CALACAN HT)

SOILS

Parent material on sites supporting the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type is predominantly morainal and alluvial, and soils are mostly brunisols and luvisols. Soil drainage ranges from moderately well drained to well drained, with surface texture ranging from sandy loam to silty clay. Organic thickness is mostly 0 cm to 5 cm thick (France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites will likely be dominated by *Alnus* (alder) species, *Betula* (birch) shrub species, *Salix* (willow) species, or *Carex* (sedge) species, often in a bog or fen setting. Drier adjacent sites may have the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type or the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) is a late seral to climax conifer tree species, commonly replacing stand associates, *Betula* species (birch), *Populus* species (poplar), and *Pinus* species (pine), as succession progresses (Tannas 1997a).

This species typically grows in regions having long, cold winters and short, cool summers. It may be found on floodplains, upland slopes, and a variety of other landscape positions. Although it has a wide elevational range, *Picea glauca* (white spruce) is often confined to stream bottoms and lower river benches (Abrahamson 2015). It typically grows best on warm, moderately-to-well drained, upland or floodplain soils; and grows poorly on sites with stagnant water or a high water table (Abrahamson 2015).

Picea glauca (white spruce) co-dominates with *Populus tremuloides* (aspen), *Betula papyrifera* (white birch), and *Picea mariana* (black spruce) over large areas of mid seral forest (Abrahamson 2015).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is a late seral to climax conifer species, commonly replacing stand associates *Betula* species (birch), *Populus* species (poplar), and *Pinus* species (pine) as succession progresses (Tannas 1997a). This species in Alberta is restricted to the montane and subalpine natural subregions (Tannas 1997a).

Picea engelmannii (Engelmann spruce) is found in some of the highest and coldest forest environments that are characterized by long, cold winters with heavy snowpack and short, cool summers. The species is generally found on moist, cool sites extending down to lower elevations along stream bottoms where cold air flows down the valley and collects in localized frost pockets (Uchytil 1991d). *Picea engelmannii* (Engelmann spruce) often forms pure stands, but is more commonly associated with *Abies lasiocarpa* (subalpine fir). These two species frequently occur as codominants, forming widespread subalpine forests (Uchytil 1991d).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—*Calamagrostis stricta* (narrow reed grass) is common across Alberta, except in the prairies. It occurs farther north than *Calamagrostis inexpansa* (northern reed grass). It grows in swamps, around edges of wetlands, in moist woods, and on many moister upland sites (Tannas 1997a).

***Equisetum pratense* (meadow horsetail)**—*Equisetum pratense* (meadow horsetail) is a feathery, native, perennial plant with delicate, thin branches spreading horizontally outward in perfect whorls, occurring usually in scattered colonies on sites ranging from moist, sunny meadows to cool, moist woodlands (Cobb and others 2005).

Equisetum pratense (meadow horsetail) produces slender, black, horizontally creeping rhizomes that are deep in the soil (Cobb and others 2005).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is found in all natural regions of Alberta, except the Dry Mixedgrass Region. It is the most common tree species at middle and lower altitudes along the eastern slopes of the Rocky Mountains, forming nearly pure stands on some sites in the foothills and montane areas (Tannas 1997a).

Pinus contorta (lodgepole pine) grows at low to high elevations, in dry to wet conditions, warm to cold temperatures, and on nearly every soil type found in western North America, except on saline sites. The species is not shade tolerant, and grows best on non-calcareous soil. It is primarily an aggressive pioneer on disturbed sites, and fire perpetuates or renews the stands (Anderson 2003). As these pine stands mature, they give way to shade-tolerant conifers at ages from 50 to 100 years in mesic habitats, and 100 to 200 years on warmer and drier sites (Anderson 2003).

Pinus contorta (lodgepole pine) may establish alongside later seral, more shade-tolerant species, and its rapid growth may enable the pines to remain competitive in the canopy for several years. However, these trees do not regenerate under a canopy, and are eliminated from the stand as mortality occurs. The *Pinus contorta* (lodgepole pine) is generally replaced within 50 to 100 years by the more shade-tolerant associates (Anderson 2003).

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) is common and widely distributed across Alberta, often forming large groves. However, in dry areas, it is restricted to moist depression sites (Tannas 1997a). The species occurs on a wide variety of sites, such as moist uplands, dry mountainsides, avalanche chutes, talus slopes, parklands, valley bottoms, alluvial terraces, and along streams and lake shorelines (Howard 1996). It grows on soils ranging from shallow and rocky to deep loamy sands and heavy clays. The best *Populus tremuloides* (aspen) sites are usually well drained, loamy, and high in both organic matter and nutrients (Howard 1996).

Populus tremuloides (aspen) is shade intolerant and cannot reproduce new seedlings beneath its own canopy, which means that the species is seral to conifer trees in most of its range in western North America (Howard 1996). Although, on sites where it is seral, it usually persists as a minor component well into later seral stages of the stand (Howard 1996).

Livestock

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) has poor value as forage for both livestock and wild ungulates, although it is occasionally used where better quality forage is lacking (Tannas 1997a). Herbage production is moderate to low, decreasing as seral succession progresses, and the upper canopy closes. These sites have little value as livestock range, other than shading. Lane and others (2000) recommend non-use for stands of *Picea glauca* (white spruce) on moist sites in the Lower Foothills Subregion. The moist soils are sensitive to disturbance, and cattle can easily churn the wet soil and destroy plant cover, as well as limiting tree seedling establishment.

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) palatability is poor, and it is seldom browsed by livestock (Tannas 1997a, Uchytil 1991d).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—*Calamagrostis stricta* (narrow reed grass) has moderate nutritional value in early spring, but which declines as the season advances. The forage is most palatable in spring, but is avoided later in the season unless other forage is unavailable (Tannas 1997a). In general, *Calamagrostis* species (reed grass) are mostly palatable and nutritious for livestock and wildlife, but are considered to be of poor quality because their foliage becomes very rough as it matures (Johnson and others 1995). Protein content is 17 percent to 19 percent in spring, but drops to 7 percent by late summer (Tannas 1997a).

***Equisetum pratense* (meadow horsetail)**—*Equisetum pratense* (meadow horsetail) herbage production is low. However, livestock seldom graze *Equisetum pratense* (meadow horsetail) due to its low palatability. In wild hay, if in excessive quantities, *Equisetum* species (horsetails) are known to cause scours, paralysis, and occasionally death. Hay containing around 20 percent or more *Equisetum* species (horsetails) can produce poisoning symptoms in horses. Symptoms appear in 2-5 weeks, beginning with weight loss, loss of muscular control, and followed by falling, exhaustion, and possibly death. Cattle, sheep, and goats are rarely affected (Hansen and others 1995).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) offers poor forage value, and is seldom eaten by livestock (Tannas 1997a).

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) has fair forage value, with high protein and phosphorous levels. Both its leaves and twigs are highly palatable throughout the season for livestock and wild ungulates. It is highly tolerant of heavy browsing, and is considered an increaser species and an invader of native rangeland. Clipping of its leaders stimulates growth of new suckers, as well as growth of new wood on the clipped stem (Tannas 1997a). Forage production in stands dominated by *Populus tremuloides* (aspen) varies from low to moderate, depending on stand density. Palatability of the various herbaceous species associated with this type is often high, and cattle utilization may be high as upland vegetation cures and the animals spend more time in shade that these stands provide. Livestock browse young suckers; and this, combined with trampling and soil compaction, can alter both the age structure and understory composition of stands (Thompson and Hansen 2003).

Stands of *Populus tremuloides* (aspen) are often subjected to high levels of grazing pressure because of their gentle topography and ease of access. With moderate to high, prolonged grazing pressure, palatable shrubs will be decreased relative to such species as *Symphoricarpos* species (buckbrush), *Rosa* species (rose), and *Lonicera* species (honeysuckle) in the understory. With continued long-term intense usage, a stand can be converted to the *Populus tremuloides* (aspen) community type by reduction of total shrub canopy cover to less than 25 percent (Thompson and Hansen 2003).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) timber is used primarily for pulpwood, construction lumber, furniture, boxes, crates, and pallets (USDA National Resources Conservation Service 2023). Productivity is moderate to high on these moist, rich sites (Beckingham and others 1996). However, they offer only limited potential due to the extremely fragile site conditions, generally accessible only during winter. Due to high water tables, the trees are extremely susceptible to windthrow and soil loss may follow all forms of timber harvesting. Subsequent to harvest, water tables can rise, causing problems for regeneration of trees on the site.

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is an important commercial wood producing species. The wood is white, straight grained, soft, and stiff. It is primarily used for construction lumber, but also for specialty items such as food containers and musical instruments (Uchytil 1991d).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) timber is used extensively for construction lumber, pulpwood, heating fuel, posts and poles, and plywood veneer (USDA National Resources Conservation Service 2023).

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) timber is an important source of fiber used for pulpwood, flake-board, and other composite products. It is also used for making pallets, boxes, veneer and plywood. Higher grades are used for solid wood products such as paneling, furniture components, and flooring (USDA National Resources Conservation Service 2023).

Wildlife

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) provides important wildlife habitat values, and is browsed to some extent by small mammals, especially by snowshoe hares (Tannas 1997a). The cones of this species are a choice food for red squirrels (Tannas 1997a).

Picea glauca (white spruce) provides good thermal and hiding cover for moose, white-tailed deer, and ruffed grouse. In southwestern Alberta, ruffed grouse preferentially select drumming sites with young *Picea glauca* (white spruce) cover (Abrahamson 2015).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) stands provide forage and habitat for a wide variety of small and large wildlife species. However, these properties are characteristic of where spruce grows and the associated understory species, rather than to the tree species itself. Animals that inhabit these stands include moose, elk, mule deer, woodland caribou, porcupine, snowshoe hare, red squirrel, and chipmunks. A partial list of birds that nest and feed in *Picea engelmannii* (Engelmann spruce) includes mountain chickadee, Williamson's sapsucker, red-breasted nuthatch, brown creeper, owls, and woodpeckers (Uchytil 1991d).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—Elk may make moderate summer use of *Calamagrostis* species (reed grass) (Kufeld 1973).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) also offers poor forage value for wildlife, and is eaten by deer and elk only when better forage is lacking (Tannas 1997a). Stands of the species provide cover for big game animals, upland game birds, small non-game birds, and small mammals (Anderson 2003).

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) forests provide important breeding, foraging, and resting habitat for a variety of birds and mammals. Elk browse it year-round, feeding on bark, new leaders, and sprouts. The species also provides important forage for moose, mule deer, and white-tailed deer (Howard 1996). Wildlife utilization of *Populus tremuloides* (aspen) communities varies with composition of the understory and relative age of the *Populus tremuloides* (aspen) stand. Young stands generally provide more browse. *Populus tremuloides* (aspen) crowns can grow out of reach of large ungulates in 6 to 8 years. Although many animals browse *Populus tremuloides* (aspen) year-round, it is especially valuable during fall and winter, when protein levels are high relative to other browse species (Howard 1996).

Elk browse *Populus tremuloides* (aspen) year-round, feeding on bark, buds, twigs, and sprouts. The species is important forage for mule and white-tailed deer. The deer consume leaves, buds, twigs, bark, and sprouts. New growth on burned sites or clearcuts is especially palatable to deer. Sprouts provide key summer forage for deer

after herbaceous species have cured. *Populus tremuloides* (aspen) is valuable moose browse for much of the year, utilizing it on summer and winter ranges (Howard 1996).

Lagomorphs feed on *Populus tremuloides* (aspen) in summer and winter. They may girdle suckers or even mature trees, and in some parts of Canada, fairly high *Populus tremuloides* (aspen) mortality has been attributed to rabbits and hares (Howard 1996). Small rodents such as squirrels, pocket gophers, mice, and voles feed on *Populus tremuloides* (aspen) during at least part of the year. Mice and voles frequently consume *Populus tremuloides* (aspen) bark below snow level, and can girdle suckers and small trees (Howard 1996).

Beaver consume the leaves, bark, twigs, and all diameters of *Populus tremuloides* (aspen) branches. They use the stems for constructing dams and lodges, and at least temporarily, beaver can eliminate *Populus tremuloides* (aspen) from as far as 122 m from the water body. A beaver can consume 1-2 kg of aspen bark per day, and it is estimated that as many as 200 *Populus tremuloides* (aspen) trees are required to support one beaver for a year (Howard 1996).

Fisheries

***Picea glauca* (white spruce)**—Stands of *Picea glauca* (white spruce) adjacent to streams provide hiding, thermal cover, debris recruitment, and streambank stability for fish habitat (Thompson and Hansen 2003).

***Calamagrostis stricta* (narrow reed grass)**—The rhizomatous nature of *Calamagrostis* species (reed grass) will help provide bank stability for sites adjacent to streams (Thompson and Hansen 2003).

***Populus tremuloides* (aspen)**—Where adjacent to streams, stands of *Populus tremuloides* (aspen) enhance fisheries by stabilizing streambanks and providing overhanging shade cover. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible (Hansen and others 1995).

Fire

***Picea glauca* (white spruce)**— *Picea glauca* (white spruce) is easily killed by fire (Fischer and Bradley 1987). The species is poorly adapted to survive fire due to the trees have thin bark and shallow roots (Abrahamson 2015). Fires in *Picea glauca* (white spruce) communities are often stand-replacing, and post-fire succession generally progresses through stages of herbaceous plants, shrubs, and deciduous trees before finally succeeding to the late seral *Picea glauca* (white spruce). On sites where fire is frequent, the same species that initially colonized the stand after fire may dominate until the next stand-replacing fire. This leads to the persistence of shade intolerant species such as *Populus tremuloides* (aspen) and *Betula papyrifera* (white birch). Alternatively, when fire is not frequent, stands eventually become dominated by shade tolerant species, such as the *Picea glauca* (white spruce) (Abrahamson 2015).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) spruce is very fire sensitive and is generally killed even by low-intensity fires. Post fire reestablishment is via wind-dispersed seeds, which readily germinate on fire-prepared seedbeds. The occasional mature tree that survives fire, those trees in unburned pockets, and live trees adjacent to burned areas provide the seeds for colonizing burned areas (Uchytil 1991d).

Scattered individuals or pockets of *Picea engelmannii* (Engelmann spruce) trees commonly escape fire by occurring on wetter sites where fire spread is limited. Scattered *Picea engelmannii* (Engelmann spruce) trees may escape fire by occurring on sites with discontinuous fuels, broken and rocky terrain, and/or a moist and cool environment (Uchytil 1991d).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts

vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

***Calamagrostis stricta* (narrow reed grass)**—Fires reducing the abundance of other associated species tend to cause dramatic increase in *Calamagrostis stricta* (narrow reed grass) and other rhizomatous species (Haeussler and Coates 1986).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) thrives under the influence of fire, and on many sites fire is required to maintain its dominance. Producing serotinous cones is one adaptation to stand-replacing fire, and the seed supply is nearly always available on the tree (Anderson 2003).

The propensity of *Pinus contorta* (lodgepole pine) to form stands with high seedling density, initial rapid growth that slows with age, high susceptibility to snow breakage and wind-throw, infestation by dwarf-mistletoe and mountain pine beetles, all result in large buildups of fuel (Anderson 2003).

***Populus tremuloides* (aspen)**—Prescribed fire is recommended to rejuvenate *Populus tremuloides* (aspen) stands. With the recent history of fire suppression, there has been a general aging of *Populus tremuloides* (aspen) stands across western North America. While conifers may replace seral *Populus tremuloides* (aspen) stands, stable stands may become less productive. In many areas stands now live longer than they did prior to fire exclusion, and many are in decline (Howard 1996). However, wet conditions in spring and summer may limit prescribed burning to the drier fall season. Fire, sometimes in combination with cutting, can be an important tool in regenerating decadent stands (Hansen and others 1995). Brown (1984) provides information for using prescribed fire in *Populus tremuloides* (aspen) stands. Protection of newly burned or cleared sites from beaver and grazing animals may be necessary for successful stand reestablishment.

Prescribed fire is often difficult to apply in *Populus tremuloides* (aspen) stands because of the abundance of live trees and sparse distribution of fine dead fuels. Even if fuels are plentiful, they are often too moist to burn easily. Prescribed fire may be possible, however, when live vegetation cures enough to contribute to fire spread, rather than to hinder it. The optimum combination of dry weather and cured fuels occurs mostly in early spring, late summer, and fall (Howard 1996). In Alberta, these moderately severe, early season burning conditions can persist from snowmelt until the first week in June (Quintilo and others 1991). In the northern forest of Alberta, Bailey (1978) found that prescribed burning in *Populus tremuloides* (aspen) forests in spring was usually not successful at relative humidity above 35 to 40 percent. He recommended that prescribed burning be conducted 8 to 10 drying days after snowmelt, when air temperature is at least 18 degrees C, relative humidity is less than 30 percent, and winds are 9-35 km/hr.

Populus tremuloides (aspen) is the classic soboliferous species: a plant that sprouts from carbohydrate-storing lateral roots (sobols). The species generally sprouts vigorously after burning. Moderately severe fire generally results in dense sprouting, and fewer sprouts may be produced after severe fire. A low severity surface fire may leave standing live trees that locally suppress sprouting, resulting in an uneven-aged stand. *Populus tremuloides* (aspen) burned in spring generally sprout later in the growing season and again the following year. Stands burned in late summer or fall usually sprout the next spring (Howard 1996).

Populus tremuloides (aspen) readily colonizes sites after fire, timber harvest, or other disturbance (Howard 1996). Even in stands where it was only a small component of the vegetation prior to burning, the aspen often gains dominance after a fire. The species is easily top-killed by fire, but root systems of top-killed stems continue to send up a profusion of sprouts for several years after burning. After a fire, a new, even-aged stand can develop within one decade (Howard 1996).

Rehabilitation/Restoration Considerations

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) is useful for long-term revegetation of coal mine overburden. In Alberta, it is considered one of the best conifers for this purpose (Abrahamson 2015). Road construction and development severely degrade riparian and wetland sites with high water tables, poor drainage, or organic soils. Therefore, roads and trails should be located on adjacent uplands.

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is suitable for restoration and revegetation applications in Alberta ranging from the Montane Natural Subregion and above to the lower reaches of the Alpine Natural Subregion (Hardy BBT Limited 1989).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—Roads and trails should be located on adjacent uplands. *Calamagrostis stricta* (narrow reed grass) propagates by both seeds and rhizomes, making it a valuable species for stabilizing or rehabilitating suitable disturbed sites (Thompson and Hansen 2003).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is often used in reforestation projects, especially for revegetation on sites of mining disturbance. Though it grows well on nutrient poor soils, addition of nitrogen fertilizer will likely enhance growth of the plantings (Anderson 2003).

***Populus tremuloides* (aspen)**—The wide adaptability of *Populus tremuloides* (aspen) makes it well-suited for restoration and rehabilitation on a wide range of sites. Stands of this species are unique in their ability to stabilize soil and watersheds on burned and otherwise disturbed sites. The trees produce abundant litter that contains more nitrogen, phosphorus, potassium, and calcium than does the leaf litter of most other deciduous trees. This litter decays rapidly, forming a nutrient-rich humus that reduces runoff and aids in percolation of surface water. Compared to conifer stands, more snow accumulates under aspen, and snowmelt begins earlier in the spring, allowing the soil to thaw more quickly than soil under conifer trees (Howard 1996).

Populus tremuloides (aspen) can be useful in revegetating disturbed sites having moist, well-drained soils. Best results are obtained using rooted cuttings or nursery-grown stock. Once established, growth rates are rapid. The quickly spreading aspen roots effectively stabilize exposed soils. Rooted cuttings or nursery grown seedlings are easily established on moist, well-drained soils. Growth rates are rapid and the roots of established seedlings are effective stabilizers of alluvial soil deposits (Thompson and Hansen 2003).

Populus tremuloides (aspen) seedlings transplanted onto disturbed sites have shown good establishment and are more economical to grow than vegetative cuttings. Seedlings grow a taproot and secondary roots quickly, while cuttings can be slow to establish an adequate root system. In addition, genetic diversity is greater among seedlings than cuttings. The major advantage of using cuttings is that clones with desirable traits can be selected as parent stock. Stem cuttings are especially difficult to root unless taken from young sprouts. Root cuttings taken from young sprouts are generally more successful (Howard 1996).

Recreational Uses and Consideration

***Picea glauca* (white spruce)**—Because of high water tables and the problems associated with road construction, campgrounds should not be located in stands of *Picea glauca* (white spruce).

***Picea engelmannii* (Engelmann spruce)**—Because of high water tables and the problems associated with road construction, campgrounds should not be located in stands of *Picea engelmannii* (Engelmann spruce).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- F8. Aspen-white birch/alder-bracted honeysuckle
- L15. White spruce/willow/marsh reed grass

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Aw-Pl-Sw/Green alder/Feather moss
- Aw-Pl-Sw/Rose/Marsh reed grass
- Pb-Aw-Sw-Pl/Green alder/Fern

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Aw/Marsh reed grass-Kentucky bluegrass
- Aw-Pl/Marsh reed grass
- Pb-Sw/Rose/Forbs

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msg9a Aw-Pb/Marsh reed grass (Montane Southern Ecosection)
- Msf8a Aw-Pl/Marsh reed grass (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type was previously described in the region for the following geographic location(s):

- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995).

Picea glauca/Equisetum arvense Habitat Type
(white spruce/common horsetail Habitat Type)

PICEGLA/EQUIARV Habitat Type
Number of Stands = 45 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 21; Other Data Sets = 24)

LOCATION AND ASSOCIATED LANDFORMS

The *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This habitat type characteristically occurs on flat, low lying sites with poor drainage, representing the wetter end of the moisture spectrum of sites supporting *Picea glauca* (white spruce). It also occurs on gentle toe slopes, seeps, stream terraces, and along low gradient meandering streams. Boundaries with adjacent types are often distinct, defined by readily visible topographic discontinuity.

Photo 2 shows a typical stand of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type.

Photo 2. A stand of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type (photo provided by Alan Dodd)

Sampled Stands Characteristics

Picea engelmannii (Engelmann spruce) x *Picea glauca* (white spruce) hybrids are common where the ranges of these species overlap. Pure *Picea engelmannii* (Engelmann spruce) tends to dominate at higher elevations, and trees at low elevations closely resemble pure *Picea glauca* (white spruce) (Uchytil 1991d).

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 71 shows the five most prominent plant species among the four lifeforms for species recorded in all 45 stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type. Although this sample set contains a mix of late seral, relatively undisturbed stands and early seral disturbed stands; the type is heavily dominated by only two species: *Picea glauca* (white spruce) among the trees and *Equisetum arvense* (common horsetail) among the forbs. No shrub or graminoid species present is more than moderately prominent.

Table 71. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type (number = 45 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	40.89	Native
Populus balsamifera (balsam poplar)	9.86	Native
Picea engelmannii (Engelmann spruce)	7.78	Native
Betula papyrifera (white birch)	1.32	Native
Picea engelmannii x glauca (Engelmann x white spruce)	0.89	Native
Shrubs		
Salix bebbiana (beaked willow)	4.78	Native
Alnus tenuifolia (river alder)	4.73	Native
Rosa acicularis (prickly rose)	3.59	Native
Cornus stolonifera (red-osier dogwood)	2.44	Native
Linnaea borealis (twinflower)	1.61	Native
Graminoids		
Elymus innovatus (hairy wild rye)	2.09	Native
Bromus inermis (smooth brome)	1.20	Introduced
Carex disperma (two-seeded sedge)	0.91	Native

Table 71. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Poa pratensis (Kentucky bluegrass)	0.71	Introduced
Agrostis stolonifera (redtop)	0.68	Introduced
Forbs		
Equisetum arvense (common horsetail)	44.56	Native
Equisetum pratense (meadow horsetail)	4.11	Native
Taraxacum officinale (common dandelion)	2.02	Introduced
Cornus canadensis (bunchberry)	1.50	Native
Heracleum lanatum (cow parsnip)	1.44	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 72 through Table 75, break out the vegetation recorded in all 45 stands sampled of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species rich, forested habitat type of minor occurrence across the study area.

Table 72 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type. For the 45 stands comprising the habitat type, the number of unique species was 248 with 217 (87.5 percent) of them being native species.

Table 72. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type (number = 45 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	10	10	0	0
Shrubs	53	50	0	3
Graminoids	49	38	7	4
Forbs	136	119	12	5
TOTAL	***248 (100.0%)***	***217 (87.5%)***	***19 (7.7%)***	***12 (4.8%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 73 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type. The average number of species per stand is 25.6, with native species comprising 23.6 species per stand or 92.2 percent.

Table 73. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type (number = 45 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.0	2.0	0.0	0.0
Shrubs	6.5	6.3	0.0	0.2
Graminoids	2.8	2.1	0.6	0.2
Forbs	14.3	13.2	1.0	0.2
TOTAL	***25.6 (100.0%)***	***23.6 (92.2%)***	***1.6 (6.3%)***	***0.6 (2.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 74 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type. The average canopy cover per stand is 175.5 percent, with native species comprising 168.9 percent or 96.2 percent of the total amount of average canopy cover per stand.

Table 74. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type (number = 45 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	61.9%	61.9%	0.0%	0.0%
Shrubs	29.7%	29.4%	0.0%	0.3%
Graminoids	11.3%	7.9%	3.2%	0.2%
Forbs	72.7%	69.7%	2.7%	0.4%
TOTAL	***175.5% (100.0%)***	***168.9% (96.2%)***	***5.8% (3.3%)***	***0.8% (0.5%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 75 shows the average number of species and average canopy cover by lifeform in stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type. The average number of species per stand was 25.6 with an average canopy cover of 175.5 percent.

Table 75. Average number of species and average canopy cover by lifeform in stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type (number = 45 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.0	61.9%
Shrubs	6.5	29.7%
Graminoids	2.8	11.3%
Forbs	14.3	72.7%
TOTAL	***25.6***	***175.5%***

Sampled Stands Plant Species List

In 45 stands sampled of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type, 10 tree species were recorded, with only *Picea glauca* (white spruce) being very highly prominent. The early seral *Populus balsamifera* (balsam poplar) was moderately prominent, reflecting the inclusion of several early seral stands (Table 76). Fifty-three shrub species were recorded, but none were highly prominent, and the same holds for the 49 graminoid species recorded. The understory indicator species, *Equisetum arvense* (common horsetail) is the only one of 136 forb species recorded with high prominence.

Table 76. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type (number = 45 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 10)					
Abies lasiocarpa (subalpine fir)	3.0	0-3	2	0.07	N
Betula papyrifera (white birch)	9.9	0-40	13	1.32	N
Larix occidentalis (western larch)	0.5	0-0.5	2	0.01	N
Picea engelmannii (Engelmann spruce)	58.3	0-80	13	7.78	N
Picea engelmannii x glauca (Engelmann x white spruce)	40.0	0-40	2	0.89	N
Picea glauca (white spruce)	48.4	0-90	84	40.89	N
Picea mariana (black spruce)	3.0	0-3	2	0.07	N
Pinus contorta (lodgepole pine)	7.3	0-20	9	0.64	N
Populus balsamifera (balsam poplar)	17.7	0-50	56	9.86	N
Populus tremuloides (aspen)	2.1	0-3	18	0.37	N
Shrubs (N = 53)					
Alnus crispa (green alder)	10.0	0-10	2	0.22	N
Alnus tenuifolia (river alder)	19.4	0-40	24	4.73	N
Amelanchier alnifolia (Saskatoon)	1.1	0-3	18	0.20	N
Berberis repens (creeping mahonia)	0.5	0-0.5	4	0.02	N

Table 76. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Betula occidentalis (water birch)	20.0	0-20	2	0.44	N
Clematis ligusticifolia (western clematis)	0.5	0-0.5	2	0.01	N
Cornus stolonifera (red-osier dogwood)	5.2	0-20	47	2.44	N
Elaeagnus commutata (silverberry)	35.0	0-40	4	1.56	N
Juniperus communis (ground juniper)	0.5	0-0.5	4	0.02	N
Ledum groenlandicum (common Labrador tea)	0.5	0-0.5	7	0.03	N
Linnaea borealis (twinflower)	3.8	0-20	42	1.61	N
Lonicera dioica (twining honeysuckle)	0.9	0-3	31	0.27	N
Lonicera involucrata (bracted honeysuckle)	1.4	0-3	24	0.34	N
Menziesia ferruginea (false azalea)	3.0	0-3	2	0.07	N
Pachistima myrsinites (mountain-lover)	3.0	0-3	2	0.07	N
Potentilla fruticosa (shrubby cinquefoil)	0.5	0-0.5	2	0.01	N
Prunus virginiana (choke cherry)	0.5	0-0.5	2	0.01	N
Rhamnus alnifolia (alder-leaved buckthorn)	1.8	0-3	4	0.08	N
Ribes americanum (wild black currant)	10.0	0-10	2	0.22	N
Ribes hudsonianum (northern black currant)	0.5	0-0.5	2	0.01	N
Ribes lacustre (bristly black currant)	1.9	0-10	16	0.29	N
Ribes oxyacanthoides (northern gooseberry)	1.6	0-3	16	0.24	N
Ribes triste (wild red currant)	1.1	0-3	9	0.10	N
Rosa acicularis (prickly rose)	5.8	0-40	62	3.59	N
Rosa spp. (rose)	0.5	0-0.5	9	0.04	B
Rosa woodsii (common wild rose)	8.2	0-40	18	1.46	N
Rubus arcticus (dwarf raspberry)	1.8	0-3	9	0.16	N
Rubus idaeus (wild red raspberry)	0.5	0-0.5	13	0.07	N
Rubus parviflorus (thimbleberry)	0.5	0-0.5	2	0.01	N
Rubus pubescens (dewberry)	2.5	0-10	49	1.21	N
Rubus spp. (raspberry)	0.5	0-0.5	2	0.01	B
Salix barclayi (Barclay's willow)	1.8	0-3	4	0.08	N
Salix bebbiana (beaked willow)	14.3	0-60	33	4.78	N
Salix boothii (Booth's willow)	0.5	0-0.5	4	0.02	N
Salix discolor (pussy willow)	30.0	0-30	2	0.67	N
Salix drummondiana (Drummond's willow)	0.5	0-0.5	2	0.01	N
Salix glauca (smooth willow)	3.0	0-3	7	0.20	N
Salix lutea (yellow willow)	0.5	0-0.5	2	0.01	N
Salix maccalliana (velvet-fruited willow)	5.9	0-10	9	0.52	N
Salix myrtillifolia (myrtle-leaved willow)	5.3	0-10	4	0.23	N
Salix pseudomonticola (false mountain willow)	12.3	0-40	9	1.09	N
Salix scouleriana (Scouler's willow)	6.1	0-10	13	0.81	N
Salix spp. (willow)	1.8	0-3	13	0.23	B
Shepherdia canadensis (Canada buffaloberry)	1.6	0-10	36	0.56	N
Spiraea betulifolia (white meadowsweet)	0.5	0-0.5	2	0.01	N
Symphoricarpos albus (snowberry)	1.3	0-3	13	0.18	N
Symphoricarpos occidentalis (buckbrush)	1.1	0-3	20	0.21	N
Vaccinium caespitosum (dwarf bilberry)	0.5	0-0.5	4	0.02	N

Table 76. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Vaccinium myrtillus (low bilberry)	0.5	0-0.5	4	0.02	N
Vaccinium scoparium (grouseberry)	3.0	0-3	2	0.07	N
Vaccinium vitis-idaea (bog cranberry)	0.5	0-0.5	2	0.01	N
Viburnum edule (low-bush cranberry)	1.5	0-3	27	0.41	N
Viburnum opulus (high-bush cranberry)	0.5	0-0.5	2	0.01	N
Graminoids (N = 49)					
Agropyron intermedium (intermediate wheatgrass)	0.5	0-0.5	2	0.01	I
Agropyron repens (quack grass)	4.5	0-10	7	0.30	I
Agropyron spp. (wheat grass)	3.0	0-3	2	0.07	B
Agropyron trachycaulum (slender wheat grass)	3.7	0-10	7	0.24	N
Agrostis scabra (rough hair grass)	10.0	0-10	2	0.22	N
Agrostis stolonifera (redtop)	15.3	0-30	4	0.68	I
Alopecurus occidentalis (alpine foxtail)	0.5	0-0.5	2	0.01	N
Bromus ciliatus (fringed brome)	6.8	0-10	7	0.46	N
Bromus inermis (smooth brome)	10.8	0-40	11	1.20	I
Bromus mollis (soft chess)	0.5	0-0.5	2	0.01	I
Bromus spp. (brome grass)	3.0	0-3	2	0.07	B
Bromus vulgaris (woodland brome)	0.5	0-0.5	4	0.02	N
Calamagrostis canadensis (marsh reed grass)	1.6	0-3	16	0.24	N
Calamagrostis rubescens (pine reed grass)	0.5	0-0.5	4	0.02	N
Carex aquatilis (water sedge)	15.0	0-20	4	0.67	N
Carex capillaris (hair-like sedge)	3.0	0-3	2	0.07	N
Carex concinna (beautiful sedge)	3.2	0-10	16	0.50	N
Carex concinnoides (low northern sedge)	0.5	0-0.5	2	0.01	N
Carex deweyana (Dewey's sedge)	0.5	0-0.5	2	0.01	N
Carex disperma (two-seeded sedge)	8.2	0-20	11	0.91	N
Carex eburnea (bristle-leaved sedge)	0.5	0-0.5	4	0.02	N
Carex hoodii (Hood's sedge)	0.5	0-0.5	2	0.01	N
Carex microglochin (short-awned sedge)	0.5	0-0.5	2	0.01	N
Carex microptera (small-winged sedge)	0.5	0-0.5	2	0.01	N
Carex praticola (meadow sedge)	0.5	0-0.5	4	0.02	N
Carex rossii (Ross' sedge)	0.5	0-0.5	2	0.01	N
Carex simulata (analogue sedge)	0.5	0-0.5	2	0.01	N
Carex spp. (sedge)	0.5	0-0.5	7	0.03	N
Carex sprengelii (Sprengel's sedge)	0.5	0-0.5	2	0.01	N
Carex torreyi (Torrey's sedge)	0.5	0-0.5	2	0.01	N
Carex utriculata (beaked sedge)	10.3	0-20	4	0.46	N
Carex vaginata (sheathed sedge)	1.3	0-3	13	0.18	N
Cinna latifolia (drooping wood-reed)	1.3	0-3	7	0.09	N
Deschampsia cespitosa (tufted hair grass)	5.3	0-10	4	0.23	N
Elymus glaucus (smooth wild rye)	10.0	0-10	2	0.22	N
Elymus innovatus (hairy wild rye)	6.7	0-20	31	2.09	N
Elymus virginicus (Virginia wild rye)	0.5	0-0.5	2	0.01	N
Festuca rubra (red fescue)	0.5	0-0.5	7	0.03	B

Table 76. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Glyceria elata (tufted tall manna grass)	0.5	0-0.5	2	0.01	N
Glyceria striata (fowl manna grass)	0.5	0-0.5	2	0.01	N
Juncus balticus (wire rush)	20.0	0-20	2	0.44	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	2	0.01	N
Phleum pratense (timothy)	2.9	0-10	9	0.26	I
Poa palustris (fowl bluegrass)	2.4	0-10	11	0.27	N
Poa pratensis (Kentucky bluegrass)	2.9	0-10	24	0.71	I
Poa spp. (bluegrass)	0.5	0-0.5	4	0.02	B
Schizachne purpurascens (purple oat grass)	3.7	0-10	7	0.24	N
Stipa columbiana (Columbia needle grass)	3.0	0-3	2	0.07	N
Trisetum cernuum (nodding trisetum)	0.5	0-0.5	4	0.02	N
Forbs (N = 136)					
Achillea millefolium (common yarrow)	2.0	0-10	18	0.36	N
Achillea sibirica (many-flowered yarrow)	0.5	0-0.5	2	0.01	N
Actaea rubra (red and white baneberry)	2.0	0-10	22	0.43	N
Anaphalis margaritacea (pearly everlasting)	0.5	0-0.5	2	0.01	N
Anemone parviflora (small wood anemone)	0.5	0-0.5	2	0.01	N
Angelica arguta (white angelica)	3.0	0-3	4	0.13	N
Antennaria pulcherrima (showy everlasting)	3.0	0-3	2	0.07	N
Aralia nudicaulis (wild sarsaparilla)	11.0	0-20	7	0.73	N
Arnica cordifolia (heart-leaved arnica)	10.0	0-10	2	0.22	N
Arnica latifolia (broad-leaved arnica)	1.8	0-3	4	0.08	N
Aster ciliolatus (Lindley's aster)	1.8	0-3	27	0.47	N
Aster conspicuus (showy aster)	2.3	0-10	18	0.41	N
Aster laevis (smooth aster)	1.3	0-3	7	0.09	N
Aster modestus (large northern aster)	10.0	0-10	2	0.22	N
Aster sibiricus (Arctic aster)	0.5	0-0.5	2	0.01	N
Aster spp. (aster)	0.5	0-0.5	4	0.02	N
Aster subspicatus (leafy-bracted aster)	0.5	0-0.5	2	0.01	N
Astragalus americanus (American milk vetch)	1.8	0-3	4	0.08	N
Astragalus cicer (cicer milk vetch)	0.5	0-0.5	2	0.01	I
Astragalus spp. (milk vetch)	0.5	0-0.5	7	0.03	B
Callitriche verna (vernal water-starwort)	0.5	0-0.5	2	0.01	N
Calypso bulbosa (Venus'-slipper)	0.5	0-0.5	2	0.01	N
Campanula rotundifolia (harebell)	0.5	0-0.5	7	0.03	N
*Castilleja miniat*a (common red paintbrush)	0.5	0-0.5	4	0.02	N
Cirsium arvense (Canada thistle)	1.1	0-3	9	0.10	I
Cirsium hookerianum (white thistle)	0.5	0-0.5	2	0.01	N
Cirsium vulgare (bull thistle)	0.5	0-0.5	2	0.01	I
Clintonia uniflora (corn lily)	3.0	0-3	2	0.07	N
Corallorhiza trifida (pale coralroot)	3.0	0-3	2	0.07	N
Cornus canadensis (bunchberry)	3.6	0-20	42	1.50	N
Cypripedium calceolus (yellow lady's-slipper)	0.5	0-0.5	2	0.01	N

Table 76. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Cypripedium passerinum (sparrow's-egg lady's-slipper)	0.5	0-0.5	2	0.01	N
Cypripedium spp. (lady's slipper)	0.5	0-0.5	2	0.01	N
Delphinium glaucum (tall larkspur)	1.1	0-3	9	0.10	N
Disporum trachycarpum (fairybells)	0.5	0-0.5	4	0.02	N
Epilobium anagallidifolium (alpine willowherb)	1.8	0-3	4	0.08	N
Epilobium angustifolium (common fireweed)	1.4	0-10	42	0.59	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	2	0.01	N
Epilobium latifolium (broad-leaved fireweed)	0.5	0-0.5	2	0.01	N
Equisetum arvense (common horsetail)	47.7	0-97.5	93	44.56	N
Equisetum hyemale (common scouring-rush)	0.5	0-0.5	2	0.01	N
Equisetum pratense (meadow horsetail)	15.4	0-40	27	4.11	N
Equisetum scirpoides (dwarf scouring-rush)	2.7	0-10	20	0.53	N
Equisetum variegatum (variegated horsetail)	3.0	0-3	2	0.07	N
Erigeron peregrinus (wandering daisy)	0.5	0-0.5	2	0.01	N
Erigeron speciosus (showy fleabane)	0.5	0-0.5	2	0.01	N
Fragaria vesca (woodland strawberry)	0.5	0-0.5	2	0.01	N
Fragaria virginiana (wild strawberry)	1.6	0-10	51	0.80	N
Galium boreale (northern bedstraw)	0.8	0-3	36	0.29	N
Galium triflorum (sweet-scented bedstraw)	1.2	0-3	31	0.38	N
Geocaulon lividum (northern bastard toadflax)	1.2	0-3	16	0.19	N
Geranium richardsonii (wild white geranium)	1.3	0-10	36	0.44	N
Geum aleppicum (yellow avens)	1.2	0-3	16	0.19	N
Geum macrophyllum (large-leaved yellow avens)	1.1	0-3	20	0.21	N
Geum rivale (purple avens)	0.5	0-0.5	2	0.01	N
Goodyera repens (lesser rattlesnake plantain)	0.5	0-0.5	2	0.01	N
Habenaria dilatata (tall white bog orchid)	0.5	0-0.5	4	0.02	N
Habenaria hyperborea (northern green bog orchid)	2.2	0-3	7	0.14	N
Habenaria obtusata (blunt-leaved bog orchid)	1.1	0-3	18	0.20	N
Hedysarum alpinum (alpine hedysarum)	5.3	0-20	13	0.71	N
Heracleum lanatum (cow parsnip)	5.4	0-40	27	1.44	N
Hieracium umbellatum (narrow-leaved hawkweed)	0.5	0-0.5	2	0.01	N
Lathyrus ochroleucus (cream-colored vetchling)	0.9	0-3	29	0.26	N
Lilium philadelphicum (western wood lily)	0.5	0-0.5	4	0.02	N
Lomatium macrocarpum (long-fruited wild parsley)	0.5	0-0.5	2	0.01	N
Maianthemum canadense (wild lily-of-the-valley)	1.5	0-3	11	0.17	N
Melilotus alba (white sweet-clover)	0.5	0-0.5	2	0.01	I
Mentha arvensis (wild mint)	0.5	0-0.5	2	0.01	N
Mertensia paniculata (tall lungwort)	2.1	0-10	42	0.87	N
Mitella nuda (bishop's-cap)	1.5	0-10	47	0.72	N
Mitella pentandra (bishop's-cap)	3.0	0-3	2	0.07	N
Mitella spp. (miterwort)	0.5	0-0.5	2	0.01	N
Moehringia lateriflora (blunt-leaved sandwort)	0.5	0-0.5	2	0.01	N
Moneses uniflora (one-flowered wintergreen)	0.8	0-3	20	0.16	N

Table 76. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Moss spp. (moss)	10.0	0-10	2	0.22	B
Orchis rotundifolia (round-leaved orchid)	1.1	0-3	9	0.10	N
Orthilia secunda (one-sided wintergreen)	1.0	0-3	24	0.23	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	0.5	0-0.5	9	0.04	N
Osmorhiza depauperata (spreading sweet cicely)	0.8	0-3	18	0.14	N
Osmorhiza spp. (sweet cicely)	1.8	0-3	4	0.08	N
Oxytropis monticola (late yellow locoweed)	0.5	0-0.5	2	0.01	N
Parnassia fimbriata (fringed grass-of-parnassus)	0.5	0-0.5	4	0.02	N
Petasites frigidus (arctic sweet coltsfoot)	3.3	0-10	16	0.51	N
Petasites palmatus (palmate-leaved coltsfoot)	2.6	0-10	31	0.80	N
Petasites sagittatus (arrow-leaved coltsfoot)	1.2	0-3	16	0.19	N
Petasites vitifolius (vine-leaved coltsfoot)	1.0	0-3	11	0.11	N
Plantago major (common plantain)	0.5	0-0.5	2	0.01	I
Polemonium pulcherrimum (showy Jacob's-ladder)	0.5	0-0.5	2	0.01	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	2	0.01	N
Potentilla rivalis (brook cinquefoil)	0.5	0-0.5	2	0.01	N
Pyrola asarifolia (common pink wintergreen)	0.7	0-3	24	0.18	N
Pyrola chlorantha (greenish-flowered wintergreen)	0.5	0-0.5	7	0.03	N
Pyrola elliptica (white wintergreen)	0.5	0-0.5	2	0.01	N
Pyrola spp. (wintergreen)	0.5	0-0.5	2	0.01	N
Ranunculus abortivus (small-flowered buttercup)	1.8	0-3	4	0.08	N
Ranunculus acris (tall buttercup)	0.5	0-0.5	9	0.04	I
Ranunculus uncinatus (hairy buttercup)	0.5	0-0.5	4	0.02	N
Rorippa palustris (marsh yellow cress)	0.5	0-0.5	2	0.01	N
Sanicula marilandica (snakeroot)	0.5	0-0.5	2	0.01	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	2	0.01	N
Senecio indecorus (rayless ragwort)	0.5	0-0.5	2	0.01	N
Senecio lugens (black-tipped groundsel)	0.5	0-0.5	2	0.01	N
Senecio pauciflorus (few-flowered ragwort)	0.5	0-0.5	2	0.01	N
Senecio pauperculus (balsam groundsel)	1.3	0-3	7	0.09	N
Senecio pseudaureus (thin-leaved ragwort)	0.5	0-0.5	7	0.03	N
Senecio spp. (senecio)	0.5	0-0.5	2	0.01	B
Senecio triangularis (brook ragwort)	0.5	0-0.5	2	0.01	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	7	0.03	N
Smilacina stellata (star-flowered Solomon's-seal)	2.9	0-40	49	1.40	N
Smilacina trifolia (three-leaved Solomon's-seal)	0.5	0-0.5	2	0.01	N
Solidago canadensis (Canada goldenrod)	1.3	0-3	7	0.09	N
Spiranthes romanzoffiana (hooded ladies'-tresses)	0.5	0-0.5	4	0.02	N
Stellaria media (common chickweed)	0.5	0-0.5	2	0.01	I
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.9	0-3	13	0.12	N
Tanacetum vulgare (common tansy)	0.5	0-0.5	2	0.01	I
Taraxacum officinale (common dandelion)	4.6	0-30	44	2.02	I
Thalictrum occidentale (western meadow rue)	2.2	0-10	16	0.34	N

Table 76. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Thalictrum venulosum (veiny meadow rue)	1.6	0-3	16	0.24	N
Tiarella trifoliata (laceflower)	0.5	0-0.5	2	0.01	N
Trifolium hybridum (alsike clover)	0.5	0-0.5	2	0.01	I
Trifolium pratense (red clover)	0.5	0-0.5	7	0.03	I
Trifolium repens (white clover)	2.9	0-10	13	0.39	I
Trillium ovatum (western wakerobin)	0.5	0-0.5	2	0.01	N
Urtica dioica (common nettle)	0.5	0-0.5	11	0.06	N
Valeriana dioica (northern valerian)	0.5	0-0.5	4	0.02	N
Valeriana sitchensis (mountain valerian)	3.0	0-3	2	0.07	N
Veronica americana (American brooklime)	0.5	0-0.5	2	0.01	N
Vicia americana (wild vetch)	0.9	0-3	29	0.26	N
Vicia spp. (vetch)	0.5	0-0.5	2	0.01	B
Viola adunca (early blue violet)	1.3	0-3	7	0.09	N
Viola canadensis (western Canada violet)	4.6	0-30	20	0.92	N
Viola orbiculata (evergreen violet)	5.3	0-10	4	0.23	N
Viola renifolia (kidney-leaved violet)	1.1	0-3	18	0.20	N
Viola spp. (violet)	1.8	0-3	4	0.08	B
Zigadenus elegans (white camas)	1.3	0-3	7	0.09	N
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	4	0.02	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 77 shows the five most prominent plant species among the four lifeforms for species recorded in all 17 relatively undisturbed late seral to climax stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type. Late seral stands of this habitat type are heavily dominated by only two species: *Picea*

glauca (white spruce) among the trees and *Equisetum arvense* (common horsetail) among the forbs. The shrubs and the graminoids present all have low prominence.

Table 77. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type (number = 17 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	58.24	Native
Picea engelmannii (Engelmann spruce)	9.41	Native
Populus balsamifera (balsam poplar)	3.53	Native
Betula papyrifera (white birch)	0.35	Native
Populus tremuloides (aspen)	0.24	Native
Shrubs		
Cornus stolonifera (red-osier dogwood)	1.53	Native
Alnus tenuifolia (river alder)	1.35	Native
Linnaea borealis (twinflower)	0.82	Native
Rosa acicularis (prickly rose)	0.82	Native
Salix scouleriana (Scouler's willow)	0.79	Native
Graminoids		
Carex disperma (two-seeded sedge)	1.21	Native
Schizachne purpurascens (purple oat grass)	0.62	Native
Poa pratensis (Kentucky bluegrass)	0.27	Introduced
Stipa columbiana (Columbia needle grass)	0.18	Native
Bromus vulgaris (woodland brome)	0.06	Native
Forbs		
Equisetum arvense (common horsetail)	45.74	Native
Equisetum pratense (meadow horsetail)	4.71	Native
Viola canadensis (western Canada violet)	2.41	Native
Mitella nuda (bishop's-cap)	1.21	Native
Petasites frigidus (arctic sweet coltsfoot)	1.12	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 78 through Table 81, break out the vegetation recorded in 17 relatively undisturbed late seral to climax stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy

cover in each group. This is a fairly common, species rich, forested habitat type of minor occurrence across the study area.

Table 78 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/ Equisetum arvense* (white spruce/common horsetail) habitat type. For the 17 stands comprising the habitat type, the number of unique species was 127 with 115 (90.6 percent) of them being native species.

Table 78. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/ Equisetum arvense* (white spruce/common horsetail) habitat type (number = 17 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	5	5	0	0
Shrubs	31	29	0	2
Graminoids	22	18	4	0
Forbs	69	63	4	2
TOTAL	***127 (100.0%)***	***115 (90.6%)***	***8 (6.3%)***	***4 (3.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 79 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type. The average number of species per stand is 22.4, with native species comprising 21.0 species per stand or 93.8 percent.

Table 79. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type (number = 17 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.8	1.8	0.0	0.0
Shrubs	5.8	5.6	0.0	0.2
Graminoids	1.9	1.5	0.4	0.0
Forbs	12.9	12.1	0.6	0.2
TOTAL	***22.4 (100.0%)***	***21.0 (93.8%)***	***1.0 (4.5%)***	***0.4 (1.8%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 80 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type. The average canopy cover per stand is 153.3 percent, with native species comprising 151.3 percent or 98.7 percent of the total amount of average canopy cover per stand.

Table 80. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type (number = 17 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	71.8%	71.8%	0.0%	0.0%
Shrubs	10.4%	10.3%	0.0%	0.1%
Graminoids	2.9%	2.6%	0.4%	0.0%
Forbs	68.2%	66.6%	0.9%	0.6%
TOTAL	***153.3% (100.0%)***	***151.3% (98.7%)***	***1.3% (0.8%)***	***0.7% (0.5%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 81 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type. The average number of species per stand was 22.4 with an average canopy cover of 152.3 percent.

Table 81. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type (number = 17 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	1.8	71.8%
Shrubs	5.8	10.4%
Graminoids	1.9	2.9%
Forbs	12.9	68.2%
TOTAL	***22.4***	***152.3%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

On 17 relatively undisturbed late seral to climax stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type, five tree species were recorded, with *Picea glauca* (white spruce) and *Picea engelmannii* (Engelmann spruce) being most prominent (Table 82). Among the 31 shrubs and the 22 graminoids

recorded, none were highly prominent. Of 69 forbs recorded, only *Equisetum arvense* (common horsetail) is highly prominence.

Table 82. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type (number = 17 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 5)					
Betula papyrifera (white birch)	3.0	0-3	12	0.35	N
Picea engelmannii (Engelmann spruce)	80.0	0-80	12	9.41	N
Picea glauca (white spruce)	66.0	0-90	88	58.24	N
Populus balsamifera (balsam poplar)	7.5	0-30	47	3.53	N
Populus tremuloides (aspen)	1.3	0-3	18	0.24	N
Shrubs (N = 31)					
Alnus tenuifolia (river alder)	7.7	0-10	18	1.35	N
Amelanchier alnifolia (Saskatoon)	0.9	0-3	35	0.32	N
Berberis repens (creeping mahonia)	0.5	0-0.5	12	0.06	N
Cornus stolonifera (red-osier dogwood)	3.3	0-10	47	1.53	N
Linnaea borealis (twinflower)	1.8	0-3	47	0.82	N
Lonicera dioica (twining honeysuckle)	1.3	0-3	18	0.24	N
Lonicera involucrata (bracted honeysuckle)	0.5	0-0.5	35	0.18	N
Menziesia ferruginea (false azalea)	3.0	0-3	6	0.18	N
Rhamnus alnifolia (alder-leaved buckthorn)	3.0	0-3	6	0.18	N
Ribes hudsonianum (northern black currant)	0.5	0-0.5	6	0.03	N
Ribes lacustre (bristly black currant)	0.5	0-0.5	6	0.03	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	6	0.03	N
Ribes triste (wild red currant)	0.5	0-0.5	6	0.03	N
Rosa acicularis (prickly rose)	1.8	0-3	47	0.82	N
Rosa spp. (rose)	0.5	0-0.5	12	0.06	B
Rosa woodsii (common wild rose)	2.5	0-3	29	0.74	N
Rubus arcticus (dwarf raspberry)	1.8	0-3	12	0.21	N
Rubus idaeus (wild red raspberry)	0.5	0-0.5	6	0.03	N
Rubus pubescens (dewberry)	1.0	0-3	59	0.59	N
Salix bebbiana (beaked willow)	2.9	0-10	24	0.68	N
Salix boothii (Booth's willow)	0.5	0-0.5	6	0.03	N
Salix myrtillifolia (myrtle-leaved willow)	0.5	0-0.5	6	0.03	N
Salix pseudomonticola (false mountain willow)	3.0	0-3	12	0.35	N
Salix scouleriana (Scouler's willow)	4.5	0-10	18	0.79	N
Salix spp. (willow)	0.5	0-0.5	6	0.03	B
Shepherdia canadensis (Canada buffaloberry)	1.0	0-3	29	0.29	N
Symphoricarpos albus (snowberry)	1.3	0-3	18	0.24	N
Symphoricarpos occidentalis (buckbrush)	0.9	0-3	35	0.32	N
Vaccinium myrtillus (low bilberry)	0.5	0-0.5	6	0.03	N
Viburnum edule (low-bush cranberry)	3.0	0-3	6	0.18	N
Viburnum opulus (high-bush cranberry)	0.5	0-0.5	6	0.03	N

Table 82. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Graminoids (N = 22)					
Agropyron repens (quack grass)	0.5	0-0.5	6	0.03	I
Bromus inermis (smooth brome)	0.5	0-0.5	6	0.03	I
Bromus vulgaris (woodland brome)	0.5	0-0.5	12	0.06	N
Calamagrostis canadensis (marsh reed grass)	0.5	0-0.5	12	0.06	N
Calamagrostis rubescens (pine reed grass)	0.5	0-0.5	6	0.03	N
Carex concinna (beautiful sedge)	0.5	0-0.5	12	0.06	N
Carex concinnoides (low northern sedge)	0.5	0-0.5	6	0.03	N
Carex deweyana (Dewey's sedge)	0.5	0-0.5	6	0.03	N
Carex disperma (two-seeded sedge)	6.8	0-10	18	1.21	N
Carex microptera (small-winged sedge)	0.5	0-0.5	6	0.03	N
Carex praticola (meadow sedge)	0.5	0-0.5	6	0.03	N
Carex rossii (Ross' sedge)	0.5	0-0.5	6	0.03	N
Carex spp. (sedge)	0.5	0-0.5	6	0.03	N
Carex sprengelii (Sprengel's sedge)	0.5	0-0.5	6	0.03	N
Cinna latifolia (drooping wood-reed)	0.5	0-0.5	12	0.06	N
Elymus virginicus (Virginia wild rye)	0.5	0-0.5	6	0.03	N
Phleum pratense (timothy)	0.5	0-0.5	6	0.03	I
Poa palustris (fowl bluegrass)	0.5	0-0.5	6	0.03	N
Poa pratensis (Kentucky bluegrass)	1.1	0-3	24	0.26	I
Schizachne purpurascens (purple oat grass)	5.3	0-10	12	0.62	N
Stipa columbiana (Columbia needle grass)	3.0	0-3	6	0.18	N
Trisetum cernuum (nodding trisetum)	0.5	0-0.5	12	0.06	N
Forbs (N = 69)					
Achillea millefolium (common yarrow)	0.5	0-0.5	6	0.03	N
Actaea rubra (red and white baneberry)	1.5	0-3	29	0.44	N
Aralia nudicaulis (wild sarsaparilla)	3.0	0-3	6	0.18	N
Arnica latifolia (broad-leaved arnica)	3.0	0-3	6	0.18	N
Aster ciliolatus (Lindley's aster)	1.3	0-3	18	0.24	N
Aster conspicuus (showy aster)	5.3	0-10	12	0.62	N
Aster laevis (smooth aster)	0.5	0-0.5	6	0.03	N
Astragalus spp. (milk vetch)	0.5	0-0.5	12	0.06	B
Campanula rotundifolia (harebell)	0.5	0-0.5	6	0.03	N
Cirsium arvense (Canada thistle)	0.5	0-0.5	6	0.03	I
Cirsium hookerianum (white thistle)	0.5	0-0.5	6	0.03	N
Cornus canadensis (bunchberry)	2.9	0-10	35	1.03	N
Cypripedium spp. (lady's slipper)	0.5	0-0.5	6	0.03	N
Disporum trachycarpum (fairybells)	0.5	0-0.5	12	0.06	N
Epilobium anagallidifolium (alpine willowherb)	0.5	0-0.5	6	0.03	N
Epilobium angustifolium (common fireweed)	0.8	0-3	47	0.38	N
Equisetum arvense (common horsetail)	51.8	0-97.5	88	45.74	N
Equisetum pratense (meadow horsetail)	40.0	0-40	12	4.71	N
Equisetum scirpoides (dwarf scouring-rush)	6.5	0-10	12	0.76	N
Erigeron peregrinus (wandering daisy)	0.5	0-0.5	6	0.03	N

Table 82. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Erigeron speciosus (showy fleabane)	0.5	0-0.5	6	0.03	N
Fragaria virginiana (wild strawberry)	0.9	0-3	35	0.32	N
Galium boreale (northern bedstraw)	0.5	0-0.5	41	0.21	N
Galium triflorum (sweet-scented bedstraw)	1.3	0-3	53	0.71	N
Geranium richardsonii (wild white geranium)	1.8	0-10	53	0.97	N
Geum aleppicum (yellow avens)	2.2	0-3	18	0.38	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	24	0.12	N
Habenaria obtusata (blunt-leaved bog orchid)	0.5	0-0.5	12	0.06	N
Heracleum lanatum (cow parsnip)	0.5	0-0.5	29	0.15	N
Lathyrus ochroleucus (cream-colored vetchling)	1.2	0-3	41	0.50	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	6	0.03	N
Mertensia paniculata (tall lungwort)	0.9	0-3	35	0.32	N
Mitella nuda (bishop's-cap)	2.9	0-10	41	1.21	N
Moehringia lateriflora (blunt-leaved sandwort)	0.5	0-0.5	6	0.03	N
Moneses uniflora (one-flowered wintergreen)	0.5	0-0.5	18	0.09	N
Moss spp. (moss)	10.0	0-10	6	0.59	B
Orthilia secunda (one-sided wintergreen)	0.5	0-0.5	12	0.06	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	0.5	0-0.5	18	0.09	N
Osmorhiza depauperata (spreading sweet cicely)	0.9	0-3	35	0.32	N
Osmorhiza spp. (sweet cicely)	0.5	0-0.5	6	0.03	N
Petasites frigidus (arctic sweet coltsfoot)	4.8	0-10	24	1.12	N
Petasites palmatus (palmate-leaved coltsfoot)	1.8	0-3	12	0.21	N
Petasites sagittatus (arrow-leaved coltsfoot)	1.8	0-3	12	0.21	N
Pyrola asarifolia (common pink wintergreen)	1.0	0-3	29	0.29	N
Pyrola chlorantha (greenish-flowered wintergreen)	0.5	0-0.5	12	0.06	N
Ranunculus abortivus (small-flowered buttercup)	0.5	0-0.5	6	0.03	N
Ranunculus acris (tall buttercup)	0.5	0-0.5	6	0.03	I
Ranunculus uncinatus (hairy buttercup)	0.5	0-0.5	6	0.03	N
Sanicula marilandica (snakeroot)	0.5	0-0.5	6	0.03	N
Senecio pauperculus (balsam groundsel)	1.3	0-3	18	0.24	N
Senecio pseudaureus (thin-leaved ragwort)	0.5	0-0.5	12	0.06	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	18	0.09	N
Smilacina stellata (star-flowered Solomon's-seal)	1.1	0-3	47	0.53	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	6	0.03	N
Spiranthes romanzoffiana (hooded ladies'-tresses)	0.5	0-0.5	12	0.06	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.5	0-0.5	6	0.03	N
Taraxacum officinale (common dandelion)	1.4	0-3	47	0.68	I
Thalictrum occidentale (western meadow rue)	1.1	0-3	24	0.26	N
Thalictrum venulosum (veiny meadow rue)	2.2	0-3	18	0.38	N
Trifolium repens (white clover)	3.0	0-3	6	0.18	I
Urtica dioica (common nettle)	0.5	0-0.5	12	0.06	N
Valeriana dioica (northern valerian)	0.5	0-0.5	12	0.06	N
Veronica americana (American brooklime)	0.5	0-0.5	6	0.03	N

Table 82. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Vicia americana (wild vetch)	0.5	0-0.5	24	0.12	N
Viola adunca (early blue violet)	0.5	0-0.5	12	0.06	N
Viola canadensis (western Canada violet)	5.1	0-30	47	2.41	N
Viola orbiculata (evergreen violet)	0.5	0-0.5	6	0.03	N
Viola renifolia (kidney-leaved violet)	0.5	0-0.5	12	0.06	N
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	6	0.03	N

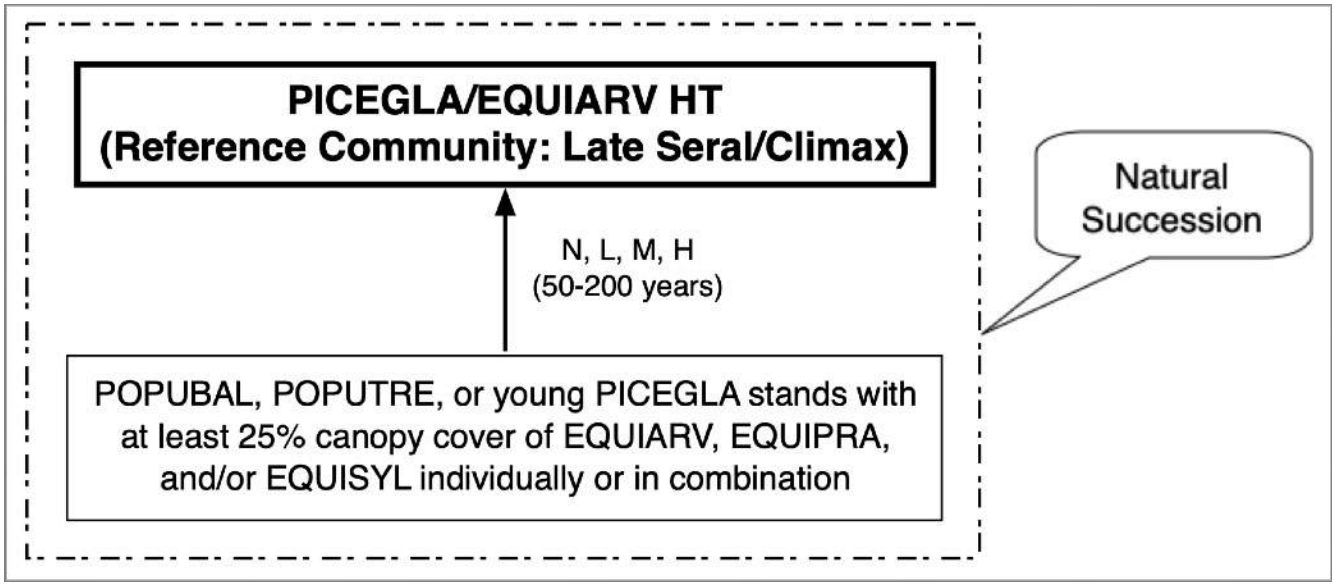
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Fluvial processes (e.g., channel migration, flooding, and deposition) are the principal origins of sites for new forest stands in riparian settings. Natural firebreaks of moist floodplains, wide channels, oxbows, and low fuel loadings on dark forest floors inhibit fire. The *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type characteristically occurs on flat, low lying sites with poor drainage, representing the wetter end of the moisture gradient of sites supporting *Picea glauca* (white spruce). New stands typically develop on sites where aging stands of *Populus balsamifera* (balsam poplar) or *Populus tremuloides* (aspen) yield the site to the shade tolerant, young *Picea glauca* (white spruce) trees.

Figure 14 shows a schematic diagram of vegetation successional pathways on sites of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type.



Successional Pathway of *Picea glauca/Equisetum arvense* (white spruce/common horsetail)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
EQUIARV—*Equisetum arvense* (common horsetail)
EQUIPRA—*Equisetum pratense* (meadow horsetail)
EQUISYL—*Equisetum sylvaticum* (woodland horsetail)
PICEGLA—*Picea glauca* (white spruce)
PICEGLA/EQUIARV HT—*Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUTRE—*Populus tremuloides* (aspen)

Figure 14. Successional pathway for sites of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 15 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

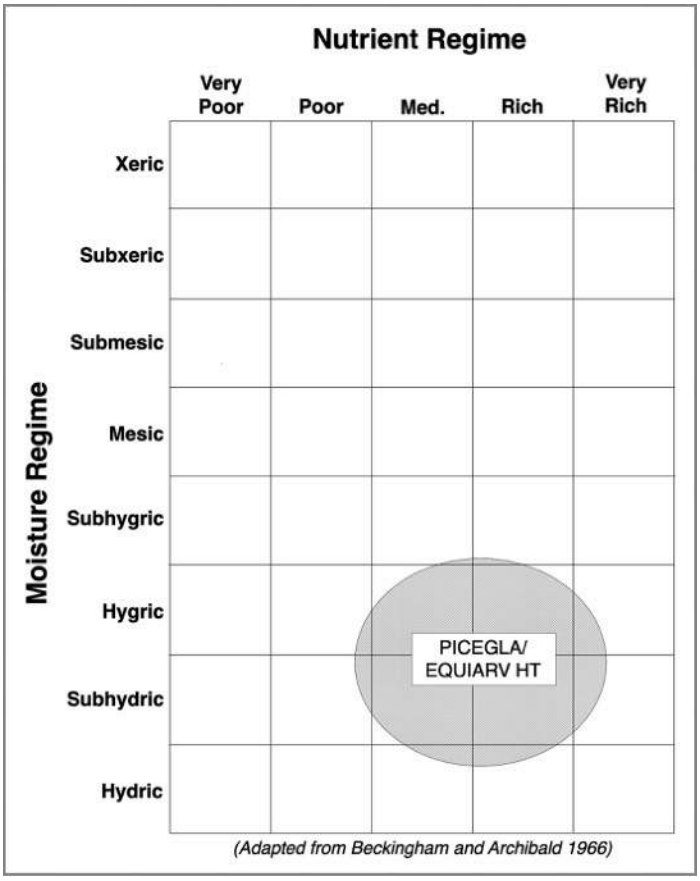


Figure 15. Edatope grid position for the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type (PICEGLA/EQUIARV HT)

SOILS

Parent material on sites supporting the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type is usually alluvium, and soils are generally Brunisols or Regosols, often with Histic and Aquic characteristics (e.g., high organic matter accumulations, redox depletions [gleyed soil], redox concentrations [mottling] and high water tables). Sites of this habitat type typically have an organic (mor) layer with thickness ranging from 0 cm to 5 cm, imperfectly to poorly drained mineral soils with texture ranging from sandy silt loam to sandy clay, and moisture regimes from subhygric to hygric (France and others 2020, Beckingham and Archibald 1996).

ADJACENT COMMUNITIES

Adjacent wetter sites will likely have the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type. Drier adjacent sites often have the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type or the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) is a late seral to climax conifer tree species, commonly replacing stand associates, *Betula* species (birch), *Populus* species (poplar), and *Pinus* species (pine), as succession progresses (Tannas 1997a).

This species typically grows in regions having long, cold winters and short, cool summers. It may be found on floodplains, upland slopes, and a variety of other landscape positions. Although it has a wide elevational range, *Picea glauca* (white spruce) is often confined to stream bottoms and lower river benches (Abrahamson 2015). It typically grows best on warm, moderately-to-well drained, upland or floodplain soils; and grows poorly on sites with stagnant water or a high water table (Abrahamson 2015).

Picea glauca (white spruce) co-dominates with *Populus tremuloides* (aspen), *Betula papyrifera* (white birch), and *Picea mariana* (black spruce) over large areas of mid seral forest (Abrahamson 2015).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is a late seral to climax conifer species, commonly replacing stand associates *Betula* species (birch), *Populus* species (poplar), and *Pinus* species (pine) as succession progresses (Tannas 1997a). This species in Alberta is restricted to the montane and subalpine natural subregions (Tannas 1997a).

Picea engelmannii (Engelmann spruce) is found in some of the highest and coldest forest environments that are characterized by long, cold winters with heavy snowpack and short, cool summers. The species is generally found on moist, cool sites extending down to lower elevations along stream bottoms where cold air flows down the valley and collects in localized frost pockets (Uchytil 1991d). *Picea engelmannii* (Engelmann spruce) often forms pure stands, but is more commonly associated with *Abies lasiocarpa* (subalpine fir). These two species frequently occur as codominants, forming widespread subalpine forests (Uchytil 1991d).

***Equisetum arvense* (common horsetail)**—*Equisetum arvense* (common horsetail) is a native, perennial, rhizomatous cryptogam (Sullivan 1993). The species is very common throughout all natural regions of Alberta. It is found on a variety of sites, including roadsides, gravelly banks, sandy areas, moist woods, low areas, cultivated fields, and disturbed sites (Tannas 1997b).

Equisetum arvense (common horsetail) is present in both early seral and climax communities; its presence largely dictated by edaphic conditions instead of shade or other factors. It is an early colonizer on alluvial deposits and persists through succession, occurring in later seral communities as an herbaceous dominant (Sullivan 1993).

***Equisetum pratense* (meadow horsetail)**—*Equisetum pratense* (meadow horsetail) is a feathery, native, perennial plant with delicate, thin branches spreading horizontally outward in perfect whorls, occurring usually in scattered colonies on sites ranging from moist, sunny meadows to cool, moist woodlands (Cobb and others 2005).

Equisetum pratense (meadow horsetail) produces slender, black, horizontally creeping rhizomes that are deep in the soil (Cobb and others 2005).

Livestock

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) has poor value as forage for both livestock and wild ungulates, although it is occasionally used where better quality forage is lacking (Tannas 1997a). Herbage production is moderate to low, decreasing as seral succession progresses, and the upper canopy closes. These sites have little value as livestock range, other than shading. Lane and others (2000) recommend non-use for stands of

Picea glauca (white spruce) on moist sites in the Lower Foothills Subregion. The moist soils are sensitive to disturbance, and cattle can easily churn the wet soil and destroy plant cover, as well as limiting tree seedling establishment.

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) palatability is poor, and it is seldom browsed by livestock (Tannas 1997a, Uchytil 1991d).

***Equisetum arvense* (common horsetail)**—*Equisetum arvense* (common horsetail) has poor forage value, and is a grazing increaser, especially on sandy and gravelly soils (Tannas 1997b). In wild hay, if in excessive quantities, *Equisetum* species (horsetails) are known to cause scours, paralysis, and occasionally death. Hay containing around 20 percent or more *Equisetum* species (horsetails) can produce poisoning symptoms in horses. Symptoms appear in 2-5 weeks, beginning with weight loss, loss of muscular control, and followed by falling, exhaustion, and possibly death. Cattle, sheep, and goats are rarely affected (Hansen and others 1995).

***Equisetum pratense* (meadow horsetail)**—*Equisetum pratense* (meadow horsetail) herbage production is low. However, livestock seldom graze *Equisetum pratense* (meadow horsetail) due to its low palatability. In wild hay, if in excessive quantities, *Equisetum* species (horsetails) are known to cause scours, paralysis, and occasionally death. Hay containing around 20 percent or more *Equisetum* species (horsetails) can produce poisoning symptoms in horses. Symptoms appear in 2-5 weeks, beginning with weight loss, loss of muscular control, and followed by falling, exhaustion, and possibly death. Cattle, sheep, and goats are rarely affected (Hansen and others 1995).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) timber is used primarily for pulpwood, construction lumber, furniture, boxes, crates, and pallets (USDA National Resources Conservation Service 2023). Productivity is moderate to high on these moist, rich sites (Beckingham and others 1996). However, they offer only limited potential due to the extremely fragile site conditions, generally accessible only during winter. Due to high water tables, the trees are extremely susceptible to windthrow and soil loss may follow all forms of timber harvesting. Subsequent to harvest, water tables can rise, causing problems for regeneration of trees on the site.

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is an important commercial wood producing species. The wood is white, straight grained, soft, and stiff. It is primarily used for construction lumber, but also for specialty items such as food containers and musical instruments (Uchytil 1991d).

Wildlife

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) provides important wildlife habitat values, and is browsed to some extent by small mammals, especially by snowshoe hares (Tannas 1997a). The cones of this species are a choice food for red squirrels (Tannas 1997a).

Picea glauca (white spruce) provides good thermal and hiding cover for moose, white-tailed deer, and ruffed grouse. In southwestern Alberta, ruffed grouse preferentially select drumming sites with young *Picea glauca* (white spruce) cover (Abrahamson 2015).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) stands provide forage and habitat for a wide variety of small and large wildlife species. However, these properties are characteristic of where spruce grows and the associated understory species, rather than to the tree species itself. Animals that inhabit

these stands include moose, elk, mule deer, woodland caribou, porcupine, snowshoe hare, red squirrel, and chipmunks. A partial list of birds that nest and feed in *Picea engelmannii* (Engelmann spruce) includes mountain chickadee, Williamson's sapsucker, red-breasted nuthatch, brown creeper, owls, and woodpeckers (Uchytil 1991d).

***Equisetum arvense* (common horsetail)**—*Equisetum arvense* (common horsetail) is a common food item for grizzly bears, and is a minor to important component of the spring and early summer diet of black bears (Sullivan 1993). Caribou, moose, sheep and grizzly bear all eat *Equisetum arvense* (common horsetail), and it is also a favorite food of geese and other waterfowl (CYSIP 2023).

Fisheries

***Picea glauca* (white spruce)**—Stands of *Picea glauca* (white spruce) adjacent to streams provide hiding, thermal cover, debris recruitment, and streambank stability for fish habitat (Thompson and Hansen 2003).

Fire

***Picea glauca* (white spruce)**— *Picea glauca* (white spruce) is easily killed by fire (Fischer and Bradley 1987). The species is poorly adapted to survive fire due to the trees have thin bark and shallow roots (Abrahamson 2015). Fires in *Picea glauca* (white spruce) communities are often stand-replacing, and post-fire succession generally progresses through stages of herbaceous plants, shrubs, and deciduous trees before finally succeeding to the late seral *Picea glauca* (white spruce). On sites where fire is frequent, the same species that initially colonized the stand after fire may dominate until the next stand-replacing fire. This leads to the persistence of shade intolerant species such as *Populus tremuloides* (aspen) and *Betula papyrifera* (white birch). Alternatively, when fire is not frequent, stands eventually become dominated by shade tolerant species, such as the *Picea glauca* (white spruce) (Abrahamson 2015).

***Equisetum arvense* (common horsetail)**—*Equisetum arvense* (common horsetail) usually occurs in moist habitats that do not undergo frequent fire. However when it does burn, it is top-killed by most fires. The rhizomes are particularly resistant to fire because they are buried deep in the mineral soil, so it regenerates rapidly after a fire (Sullivan 1993).

Rehabilitation/Restoration Considerations

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) is useful for long-term revegetation of coal mine overburden. In Alberta, it is considered one of the best conifers for this purpose (Abrahamson 2015). Road construction and development severely degrade riparian and wetland sites with high water tables, poor drainage, or organic soils. Therefore, roads and trails should be located on adjacent uplands.

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is suitable for restoration and revegetation applications in Alberta ranging from the Montane Natural Subregion and above to the lower reaches of the Alpine Natural Subregion (Hardy BBT Limited 1989).

Recreational Uses and Consideration

***Picea glauca* (white spruce)**—Because of high water tables and the problems associated with road construction, campgrounds should not be located in stands of *Picea glauca* (white spruce).

***Picea engelmannii* (Engelmann spruce)**—Because of high water tables and the problems associated with road construction, campgrounds should not be located in stands of *Picea engelmannii* (Engelmann spruce).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- J17. White spruce/Horsetail/moss

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Sw/Horsetail/Feather moss
- Sb-Sw/Labrador tea/Horsetail

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Sw/Horsetail
- Sw-Pb/Horsetail

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msg19 SW-Pb/Horsetail Montane Southern Ecosection)
- Mse12a Sw/Horsetail (Montane Southern Ecosection)
- Mne22 Sw/Horsetail (Montane Northern Ecosection)
- Mce5 Sw/Horsetail (Montane Cypress Hills Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995); and
- *Forest Habitat Types of Montana* (Pfister and others 1977).

Picea glauca/Ledum groenlandicum Habitat Type
(white spruce/common Labrador tea Habitat Type)

PICEGLA/LEDUGRO Habitat Type
Number of Stands = 22 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 21; Other Data Sets = 1)

LOCATION AND ASSOCIATED LANDFORMS

The *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This habitat type characteristically occurs on flat, low lying sites on the wetter end of the moisture gradient of sites supporting *Picea glauca* (white spruce). Conditions required by *Ledum groenlandicum* (common Labrador tea) further limit the habitat type to sites with boggy, nutrient poor, poorly drained, acidic soils.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 83 shows the five most prominent plant species among the four lifeforms for species recorded in all 22 stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type. This sample set contains a mix of late seral, relatively undisturbed stands, as well as early seral, disturbed stands. For this reason the early seral tree, *Pinus contorta* (lodgepole pine), is more highly prominent than the late seral *Picea glauca* (white spruce). *Ledum groenlandicum* (common Labrador tea is the only species among the shrubs, graminoids, and forbs that is more than moderately prominent.

Table 83. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type (number = 22 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Pinus contorta (lodgepole pine)	26.64	Native
Picea glauca (white spruce)	19.82	Native
Populus tremuloides (aspen)	4.43	Native
Populus balsamifera (balsam poplar)	4.09	Native
Betula papyrifera (white birch)	2.30	Native
Shrubs		
Ledum groenlandicum (common Labrador tea)	23.18	Native
Vaccinium vitis-idaea (bog cranberry)	8.43	Native
Vaccinium myrtilloides (common blueberry)	4.73	Native
Salix bebbiana (beaked willow)	4.39	Native
Betula pumila (dwarf birch)	3.64	Native
Graminoids		
Elymus innovatus (hairy wild rye)	2.05	Native
Calamagrostis canadensis (marsh reed grass)	1.68	Native
Carex capillaris (hair-like sedge)	1.38	Native
Carex aquatilis (water sedge)	0.91	Native
Carex vaginata (sheathed sedge)	0.91	Native
Forbs		
Cornus canadensis (bunchberry)	6.09	Native
Epilobium angustifolium (common fireweed)	2.14	Native
*Lathyrus ochroleucu*s (cream-colored vetchling)	0.57	Native
Arnica cordifolia (heart-leaved arnica)	0.55	Native
Maianthemum canadense (wild lily-of-the-valley)	0.50	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 84 through Table 87, break out the vegetation recorded in all 22 stands sampled of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, forested habitat type of minor occurrence across the study area.

Table 84 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea glauca/Ledum groenlandicum* (white spruce/

common Labrador tea) habitat type. For the 22 stands comprising the habitat type, the number of unique species was 91 with 90 (98.9 percent) of them being native species.

Table 84. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type (number = 22 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	8	8	0	0
Shrubs	31	30	0	1
Graminoids	8	8	0	0
Forbs	44	44	0	0
TOTAL	***91 (100.0%)***	***90 (98.9%)***	***0 (0.0%)***	***1 (1.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 85 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type. The average number of species per stand is 19.0, with native species comprising 19.0 species per stand or 100.0 percent.

Table 85. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type (number = 22 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3.3	3.3	0.0	0.0
Shrubs	7.3	7.3	0.0	0.0
Graminoids	1.3	1.3	0.0	0.0
Forbs	7.1	0.0	0.0	0.0
TOTAL	***19.0 (100.0%)***	***19.0 (100.0%)***	***0.0 (0.0%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 86 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat

type. The average canopy cover per stand is 139.7 percent, with native species comprising 139.6 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 86. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type (number = 22 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	60.2%	60.2%	0.0%	0.0%
Shrubs	57.2%	57.2%	0.0%	0.0%
Graminoids	7.5%	7.5%	0.0%	0.0%
Forbs	14.8%	14.8%	0.0%	0.0%
TOTAL	***139.7% (100.0%)***	***139.6% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 87 shows the average number of species and average canopy cover by lifeform in stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type. The average number of species per stand was 19.0 with an average canopy cover of 139.7 percent.

Table 87. Average number of species and average canopy cover by lifeform in stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type (number = 22 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	3.3	60.2%
Shrubs	7.3	57.2%
Graminoids	1.3	7.5%
Forbs	7.1	14.8%
TOTAL	***19.0***	***139.7%***

Sampled Stands Plant Species List

On 22 stands sampled of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type, eight tree species were recorded, with the overstory indicator species, *Picea glauca* (white spruce), having the second highest prominence behind the early seral, *Pinus contorta* (lodgepole pine) (Table 88). Thirty-one shrub species were recorded on at least one plot, with *Ledum groenlandicum* (common Labrador tea) having by far the greatest prominence, while occurring on all 22 plots. Eight graminoid species were recorded, all with low prominence, and *Cornus canadensis* (bunchberry) is the most prominent of 44 forbs recorded, occurring on 20 of the 22 plots.

Table 88. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type (number = 22 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 8)					
Abies lasiocarpa (subalpine fir)	1.3	0-3	14	0.18	N
Betula papyrifera (white birch)	16.8	0-40	14	2.30	N
Larix laricina (tamarack)	6.5	0-10	9	0.59	N
Picea glauca (white spruce)	19.8	3-50	100	19.82	N
Picea mariana (black spruce)	11.6	0-40	18	2.11	N
Pinus contorta (lodgepole pine)	30.8	0-70	86	26.64	N
Populus balsamifera (balsam poplar)	18.0	0-30	23	4.09	N
Populus tremuloides (aspen)	6.5	0-40	68	4.43	N
Shrubs (N = 31)					
Alnus crispa (green alder)	5.3	0-10	23	1.20	N
Arctostaphylos rubra (alpine bearberry)	10.0	0-10	5	0.45	N
Arctostaphylos uva-ursi (common bearberry)	5.3	0-10	9	0.48	N
Betula glandulosa (bog birch)	3.0	0-3	5	0.14	N
Betula pumila (dwarf birch)	80.0	0-80	5	3.64	N
Empetrum nigrum (crowberry)	0.5	0-0.5	5	0.02	N
Juniperus communis (ground juniper)	2.2	0-3	14	0.30	N
Ledum groenlandicum (common Labrador tea)	23.2	10-60	100	23.18	N
Linnaea borealis (twinflower)	2.7	0-10	91	2.45	N
Lonicera dioica (twining honeysuckle)	3.0	0-3	5	0.14	N
Lonicera involucrata (bracted honeysuckle)	1.6	0-3	32	0.50	N
Oxycoccus microcarpus (small bog cranberry)	0.5	0-0.5	5	0.02	N
Prunus virginiana (choke cherry)	0.5	0-0.5	5	0.02	N
Ribes hudsonianum (northern black currant)	0.5	0-0.5	5	0.02	N
Ribes lacustre (bristly black currant)	0.5	0-0.5	5	0.02	N
Rosa acicularis (prickly rose)	2.3	0-10	86	1.98	N
Rubus idaeus (wild red raspberry)	3.0	0-3	9	0.27	N
Rubus pedatus (dwarf bramble)	0.5	0-0.5	5	0.02	N
Rubus pubescens (dewberry)	0.5	0-0.5	14	0.07	N
Salix bebbiana (beaked willow)	9.7	0-20	45	4.39	N
Salix glauca (smooth willow)	3.0	0-3	5	0.14	N
Salix myrtillifolia (myrtle-leaved willow)	30.0	0-30	5	1.36	N
Salix serissima (autumn willow)	0.5	0-0.5	5	0.02	N
Salix spp. (willow)	0.5	0-0.5	5	0.02	B
Shepherdia canadensis (Canada buffaloberry)	3.4	0-10	23	0.77	N
Spiraea betulifolia (white meadowsweet)	4.5	0-10	14	0.61	N
Vaccinium caespitosum (dwarf bilberry)	2.5	0-10	27	0.68	N
Vaccinium membranaceum (tall bilberry)	6.5	0-10	9	0.59	N
Vaccinium myrtilloides (common blueberry)	6.9	0-20	68	4.73	N
Vaccinium vitis-idaea (bog cranberry)	9.8	0-30	86	8.43	N
Viburnum edule (low-bush cranberry)	2.9	0-10	18	0.52	N

Table 88. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Graminoids (N = 8)					
Calamagrostis canadensis (marsh reed grass)	2.6	0-3	64	1.68	N
Carex aquatilis (water sedge)	20.0	0-20	5	0.91	N
Carex capillaris (hair-like sedge)	30.0	0-30	5	1.36	N
Carex gynocrates (northern bog sedge)	0.5	0-0.5	5	0.02	N
Carex vaginata (sheathed sedge)	20.0	0-20	5	0.91	N
Elymus glaucus (smooth wild rye)	10.0	0-10	5	0.45	N
Elymus innovatus (hairy wild rye)	5.0	0-10	41	2.05	N
Oryzopsis asperifolia (white-grained mountain rice grass)	3.0	0-3	5	0.14	N
Forbs (N = 44)					
Achillea millefolium (common yarrow)	1.0	0-3	23	0.23	N
Arnica cordifolia (heart-leaved arnica)	1.3	0-3	41	0.55	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	9	0.05	N
Caltha palustris (marsh-marigold)	0.5	0-0.5	5	0.02	N
Calypso bulbosa (Venus'-slipper)	3.0	0-3	5	0.14	N
Comandra umbellata (bastard toadflax)	0.5	0-0.5	5	0.02	N
Cornus canadensis (bunchberry)	6.7	0-20	91	6.09	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	5	0.02	N
Dryopteris assimilis (broad spinulose shield fern)	3.0	0-3	5	0.14	N
Epilobium angustifolium (common fireweed)	2.9	0-20	73	2.14	N
Epilobium ciliatum (northern willowherb)	3.0	0-3	5	0.14	N
Equisetum arvense (common horsetail)	1.1	0-3	18	0.20	N
Equisetum laevigatum (smooth scouring-rush)	0.5	0-0.5	5	0.02	N
Equisetum scirpoides (dwarf scouring-rush)	1.3	0-3	14	0.18	N
Equisetum sylvaticum (woodland horsetail)	0.5	0-0.5	14	0.07	N
Equisetum variegatum (variegated horsetail)	0.5	0-0.5	5	0.02	N
Erigeron peregrinus (wandering daisy)	0.5	0-0.5	5	0.02	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	45	0.23	N
*Galium boreal*e (northern bedstraw)	1.8	0-3	18	0.32	N
Geocaulon lividum (northern bastard toadflax)	1.8	0-3	9	0.16	N
Habenaria obtusata (blunt-leaved bog orchid)	0.5	0-0.5	5	0.02	N
Habenaria orbiculata (round-leaved bog orchid)	0.5	0-0.5	5	0.02	N
*Lathyrus ochroleucu*s (cream-colored vetchling)	1.3	0-3	45	0.57	N
Listera cordata (heart-leaved twayblade)	0.5	0-0.5	5	0.02	N
Lycopodium annotinum (stiff club-moss)	0.5	0-0.5	18	0.09	N
Lycopodium complanatum (ground-cedar)	5.3	0-10	9	0.48	N
Lycopodium obscurum (ground-pine)	0.5	0-0.5	5	0.02	N
Maianthemum canadense (wild lily-of-the-valley)	0.9	0-3	55	0.50	N
Mertensia paniculata (tall lungwort)	2.0	0-3	23	0.45	N
Mitella nuda (bishop's-cap)	3.0	0-3	9	0.27	N
Orthilia secunda (one-sided wintergreen)	0.5	0-0.5	14	0.07	N
Parnassia palustris (northern grass-of-parnassus)	3.0	0-3	5	0.14	N
Pedicularis bracteosa (western lousewort)	0.5	0-0.5	5	0.02	N

Table 88. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Petasites palmatus (palmate-leaved coltsfoot)	0.7	0-3	50	0.36	N
Polygonum bistortoides (western bistort)	0.5	0-0.5	5	0.02	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	5	0.02	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	18	0.09	N
Pyrola chlorantha (greenish-flowered wintergreen)	0.5	0-0.5	5	0.02	N
Ranunculus lapponicus (Lapland buttercup)	3.0	0-3	5	0.14	N
Smilacina trifolia (three-leaved Solomon's-seal)	10.0	0-10	5	0.45	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.5	0-0.5	9	0.05	N
Vicia americana (wild vetch)	0.5	0-0.5	5	0.02	N
Viola renifolia (kidney-leaved violet)	0.5	0-0.5	5	0.02	N
Zigadenus elegans (white camas)	3.0	0-3	5	0.14	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 89 shows the five most prominent plant species among the four lifeforms for species recorded in all five relatively undisturbed late seral to climax stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type. While the late seral *Picea glauca* (white spruce) is heavily dominant, the fairly long lived, early seral *Pinus contorta* (lodgepole pine) remains prominent in these later seral stands. Among the shrubs *Ledum groenlandicum* (common Labrador tea) is most prominent, followed by *Vaccinium vitis-idaea* (bog cranberry), while no graminoid or forb species is more than moderately prominent.

Table 89. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type (number = 5 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	36.00	Native
Pinus contorta (lodgepole pine)	14.00	Native
Picea mariana (black spruce)	8.70	Native
Larix laricina (tamarack)	2.00	Native
Populus tremuloides (aspen)	0.60	Native
Shrubs		
Ledum groenlandicum (common Labrador tea)	30.00	Native
Vaccinium vitis-idaea (bog cranberry)	12.70	Native
Salix myrtillifolia (myrtle-leaved willow)	6.00	Native
Rosa acicularis (prickly rose)	3.40	Native
Shepherdia canadensis (Canada buffaloberry)	2.10	Native
Graminoids		
Carex capillaris (hair-like sedge)	6.00	Native
Carex vaginata (sheathed sedge)	4.00	Native
Elymus innovatus (hairy wild rye)	2.60	Native
Elymus glaucus (smooth wild rye)	2.00	Native
Forbs		
Cornus canadensis (bunchberry)	3.30	Native
Equisetum scirpoides (dwarf scouring-rush)	0.70	Native
Achillea millefolium (common yarrow)	0.60	Native
Parnassia palustris (northern grass-of-parnassus)	0.60	Native
Zigadenus elegans (white camas)	0.60	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 90 through Table 93, break out the vegetation recorded in five relatively undisturbed late seral to climax stands sampled of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, forested habitat type of minor occurrence across the study area.

Table 90 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/*

Ledum groenlandicum (white spruce/common Labrador tea) habitat type. For the 5 stands comprising the habitat type, the number of unique species was 37 with 37 (100.0 percent) of them being native species.

Table 90. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type (number = 5 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	6	6	0	0
Shrubs	12	12	0	0
Graminoids	4	4	0	0
Forbs	15	15	0	0
TOTAL	***37 (100.0%)***	***37 (100.0%)***	***0 (0.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 91 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type. The average number of species per stand is 14.2, with native species comprising 14.2 species per stand or 100.0 percent.

Table 91. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type (number = 5 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3.0	3.0	0.0	0.0
Shrubs	5.6	5.6	0.0	0.0
Graminoids	1.0	1.0	0.0	0.0
Forbs	4.6	4.6	0.0	0.0
TOTAL	***14.2 (100.0%)***	***14.2 (100.0%)***	***0.0 (0.0%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 92 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Ledum groenlandicum*

(white spruce/common Labrador tea) habitat type. The average canopy cover per stand is 142.9 percent, with native species comprising 142.9 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 92. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type (number = 5 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	61.4%	61.4%	0.0%	0.0%
Shrubs	59.7%	59.7%	0.0%	0.0%
Graminoids	14.6%	14.6%	0.0%	0.0%
Forbs	7.2%	7.2%	0.0%	0.0%
TOTAL	***142.9% (100.0%)***	***142.9% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 93 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type. The average number of species per stand was 14.2 with an average canopy cover of 142.9 percent.

Table 93. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type (number = 5 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	3.0	61.4%
Shrubs	5.6	59.7%
Graminoids	1.0	14.6%
Forbs	4.6	7.2%
TOTAL	***14.2***	***142.9%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

In five relatively undisturbed late seral to climax stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type, six tree species were recorded, led by *Picea glauca* (white spruce), but with the early seral associate, *Pinus contorta* (lodgepole pine) also having a significant presence (Table 94). Twelve shrubs were recorded on at least one plot, led by *Ledum groenlandicum* (common Labrador tea), but also with significant presence of *Vaccinium vitis-idaea* (bog cranberry). Four graminoid and 15 forb species were recorded, all with low to moderate prominence.

Table 94. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type (number = 5 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 6)					
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	20	0.10	N
Larix laricina (tamarack)	10.0	0-10	20	2.00	N
Picea glauca (white spruce)	36.0	20-50	100	36.00	N
Picea mariana (black spruce)	14.5	0-40	60	8.70	N
Pinus contorta (lodgepole pine)	17.5	0-20	80	14.00	N
Populus tremuloides (aspen)	3.0	0-3	20	0.60	N
Shrubs (N = 12)					
Arctostaphylos rubra (alpine bearberry)	10.0	0-10	20	2.00	N
Betula glandulosa (bog birch)	3.0	0-3	20	0.60	N
Juniperus communis (ground juniper)	3.0	0-3	40	1.20	N
Ledum groenlandicum (common Labrador tea)	30.0	10-60	100	30.00	N
Linnaea borealis (twinflower)	1.8	0-3	80	1.40	N
Lonicera involucrata (bracted honeysuckle)	0.5	0-0.5	20	0.10	N
Rosa acicularis (prickly rose)	3.4	0.5-10	100	3.40	N
Salix myrtillifolia (myrtle-leaved willow)	30.0	0-30	20	6.00	N
Shepherdia canadensis (Canada buffaloberry)	5.3	0-10	40	2.10	N
Vaccinium caespitosum (dwarf bilberry)	0.5	0-0.5	20	0.10	N
Vaccinium myrtilloides (common blueberry)	0.5	0-0.5	20	0.10	N
Vaccinium vitis-idaea (bog cranberry)	15.9	0-30	80	12.70	N
Graminoids (N = 4)					
Carex capillaris (hair-like sedge)	30.0	0-30	20	6.00	N
Carex vaginata (sheathed sedge)	20.0	0-20	20	4.00	N
Elymus glaucus (smooth wild rye)	10.0	0-10	20	2.00	N
Elymus innovatus (hairy wild rye)	6.5	0-10	40	2.60	N
Forbs (N = 15)					
Achillea millefolium (common yarrow)	3.0	0-3	20	0.60	N
Arnica cordifolia (heart-leaved arnica)	0.5	0-0.5	20	0.10	N
Cornus canadensis (bunchberry)	4.1	0-10	80	3.30	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	60	0.30	N
Equisetum arvense (common horsetail)	0.5	0-0.5	20	0.10	N
Equisetum scirpoides (dwarf scouring-rush)	1.8	0-3	40	0.70	N
Equisetum variegatum (variegated horsetail)	0.5	0-0.5	20	0.10	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	20	0.10	N
Geocaulon lividum (northern bastard toadflax)	0.5	0-0.5	20	0.10	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	40	0.20	N
Parnassia palustris (northern grass-of-parnassus)	3.0	0-3	20	0.60	N
Pedicularis bracteosa (western lousewort)	0.5	0-0.5	20	0.10	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	20	0.10	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	40	0.20	N

Table 94. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Zigadenus elegans (white camas)	3.0	0-3	20	0.60	N

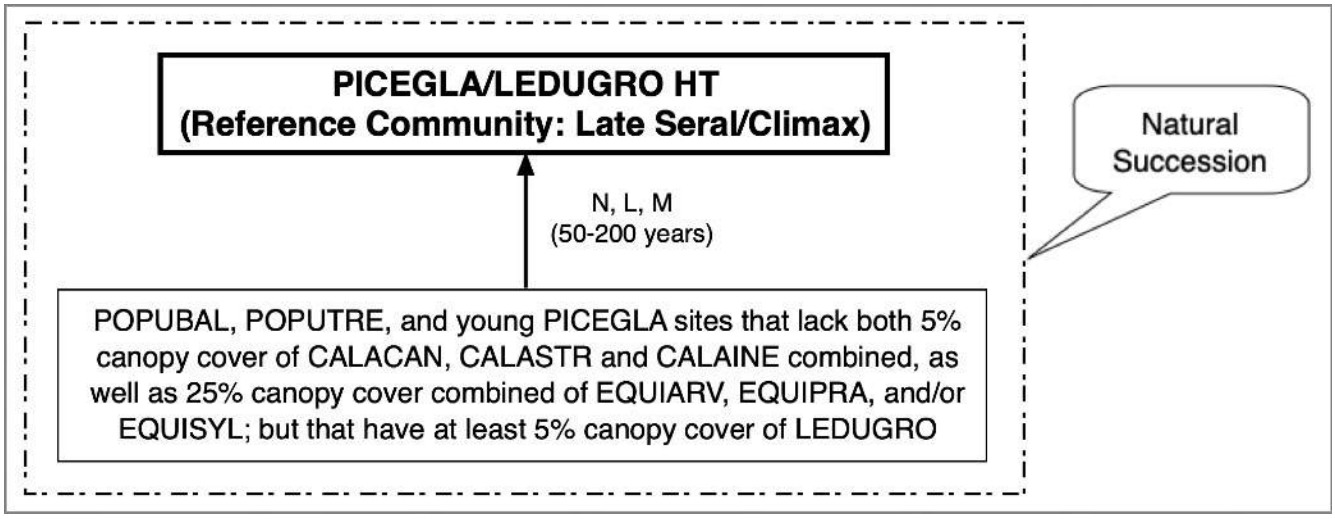
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Fluvial processes (e.g., channel migration, flooding, and deposition) are the principal origins of sites for new forest stands in riparian settings. Natural firebreaks of moist floodplains, wide channels, oxbows, and low fuel loadings on dark forest floors inhibit fire. The *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type characteristically occurs on flat, low lying sites with poor drainage, representing the wetter end of the moisture gradient of sites supporting *Picea glauca* (white spruce). New stands typically develop on sites where aging stands of *Populus balsamifera* (balsam poplar) or *Populus tremuloides* (aspen) yield the site to the shade tolerant, young *Picea glauca* (white spruce) trees.

Figure 16 shows a schematic diagram of vegetation successional pathways on sites of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type.



Successional Pathway of *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CALACAN—*Calamagrostis canadensis* (marsh reed grass)
CALAINE—*Calamagrostis inexpansa* (northern reed grass)
CALASTR—*Calamagrostis stricta* (narrow reed grass)
EQUIARV—*Equisetum arvense* (common horsetail)
EQUIPRA—*Equisetum pratense* (meadow horsetail)
EQUISYL—*Equisetum sylvaticum* (woodland horsetail)
LEDUGRO—*Ledum groenlandicum* (common Labrador tea)
PICEGLA—*Picea glauca* (white spruce)
PICEGLA/LEDUGRO HT—*Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUTRE—*Populus tremuloides* (aspen)

Figure 16. Successional pathway for sites of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 17 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

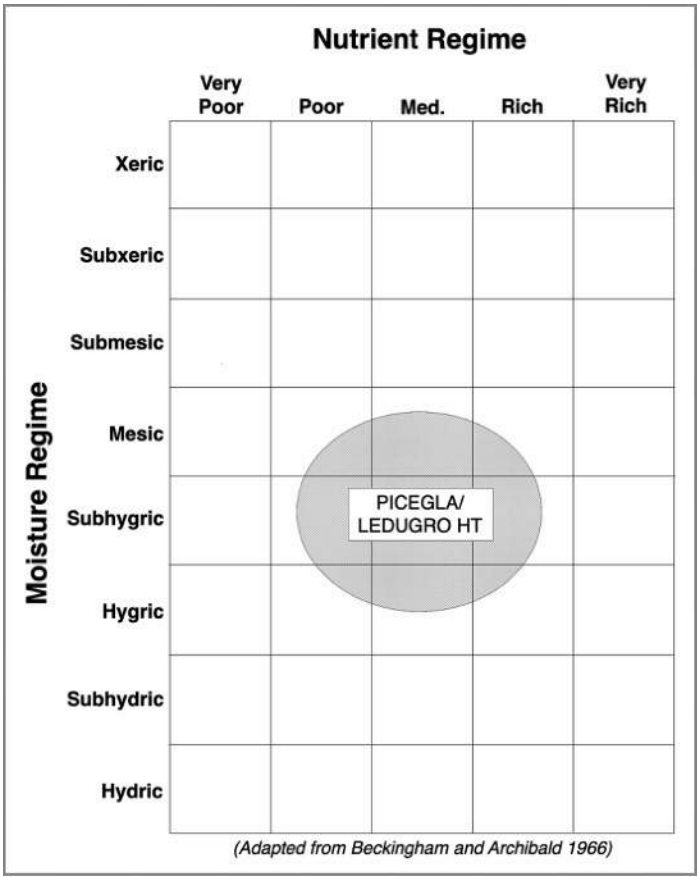


Figure 17. Edatope grid position for the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type (PICEGLA/LEDUGRO HT)

SOILS

Parent material on sites supporting the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type may be colluvial, alluvial, or morainal. Soil drainage ranges from imperfectly drained to well drained. Soil subgroups may include brunisols, luvisols, gleysols, and chernozems. Soil texture may range from sandy loam silty clay, and organic layer thickness may range from 0 cm to 5 cm (France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites are likely to be dominated by the *Picea glauca/Calamagrostis canadensis* (white spruce/ marsh reed grass) habitat type or the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type. Drier adjacent sites are likely to have the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) is a late seral to climax conifer tree species, commonly replacing stand associates, *Betula* species (birch), *Populus* species (poplar), and *Pinus* species (pine), as succession progresses (Tannas 1997a).

This species typically grows in regions having long, cold winters and short, cool summers. It may be found on floodplains, upland slopes, and a variety of other landscape positions. Although it has a wide elevational range, *Picea glauca* (white spruce) is often confined to stream bottoms and lower river benches (Abrahamson 2015). It typically grows best on warm, moderately-to-well drained, upland or floodplain soils; and grows poorly on sites with stagnant water or a high water table (Abrahamson 2015).

Picea glauca (white spruce) co-dominates with *Populus tremuloides* (aspen), *Betula papyrifera* (white birch), and *Picea mariana* (black spruce) over large areas of mid seral forest (Abrahamson 2015).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is a late seral to climax conifer species, commonly replacing stand associates *Betula* species (birch), *Populus* species (poplar), and *Pinus* species (pine) as succession progresses (Tannas 1997a). This species in Alberta is restricted to the montane and subalpine natural subregions (Tannas 1997a).

Picea engelmannii (Engelmann spruce) is found in some of the highest and coldest forest environments that are characterized by long, cold winters with heavy snowpack and short, cool summers. The species is generally found on moist, cool sites extending down to lower elevations along stream bottoms where cold air flows down the valley and collects in localized frost pockets (Uchytil 1991d). *Picea engelmannii* (Engelmann spruce) often forms pure stands, but is more commonly associated with *Abies lasiocarpa* (subalpine fir). These two species frequently occur as codominants, forming widespread subalpine forests (Uchytil 1991d).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) is commonly found in Alberta in swampy, wet, coniferous wooded areas in bogs (especially peat), commonly on acidic, infertile soils and associated with *Picea mariana* (black spruce) and *Larix laricina* (tamarack) (Tannas 1997a). This species is typical of poorly drained habitats in boreal forests, open conifer treed bogs, treeless bogs, wooded swamps, wet barrens, and peatlands throughout its range (Gucker 2006).

The soils typical of *Ledum groenlandicum* (common Labrador tea) habitats are commonly described as moist to wet, acidic, nutrient-poor organics (Gucker 2006). The species is typically present in late seral communities that result from primary succession. However, following disturbances on sites where *Ledum groenlandicum* (common Labrador tea) was established, it often recolonizes the sites rapidly (Gucker 2006).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is found in all natural regions of Alberta, except the Dry Mixedgrass Region. It is the most common tree species at middle and lower altitudes along the eastern slopes of the Rocky Mountains, forming nearly pure stands on some sites in the foothills and montane areas (Tannas 1997a).

Pinus contorta (lodgepole pine) grows at low to high elevations, in dry to wet conditions, warm to cold temperatures, and on nearly every soil type found in western North America, except on saline sites. The species is not shade tolerant, and grows best on non-calcareous soil. It is primarily an aggressive pioneer on disturbed sites, and fire perpetuates or renews the stands (Anderson 2003). As these pine stands mature, they give way to shade-

tolerant conifers at ages from 50 to 100 years in mesic habitats, and 100 to 200 years on warmer and drier sites (Anderson 2003).

Pinus contorta (lodgepole pine) may establish alongside later seral, more shade-tolerant species, and its rapid growth may enable the pines to remain competitive in the canopy for several years. However, these trees do not regenerate under a canopy, and are eliminated from the stand as mortality occurs. The *Pinus contorta* (lodgepole pine) is generally replaced within 50 to 100 years by the more shade-tolerant associates (Anderson 2003).

***Vaccinium vitis-idaea* (bog cranberry)**—*Vaccinium vitis-idaea* (bog cranberry) grows as an understory dominant or co-dominant in a variety of forest communities, including many dominated by *Pinus contorta* (lodgepole pine), as well as in bog and muskeg communities (Tannas 1997a). It also occurs as a dominant or indicator in dwarf shrub and shrub tundra communities (Tirmenstein 1991). This species is a low, creeping, evergreen subshrub that commonly reaches only 5 cm to 15 cm in height. It typically grows in dense rhizomatous colonies and frequently forms mats (Tirmenstein 1991).

Livestock

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) has poor value as forage for both livestock and wild ungulates, although it is occasionally used where better quality forage is lacking (Tannas 1997a). Herbage production is moderate to low, decreasing as seral succession progresses, and the upper canopy closes. These sites have little value as livestock range, other than shading. Lane and others (2000) recommend non-use for stands of *Picea glauca* (white spruce) on moist sites in the Lower Foothills Subregion. The moist soils are sensitive to disturbance, and cattle can easily churn the wet soil and destroy plant cover, as well as limiting tree seedling establishment.

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) palatability is poor, and it is seldom browsed by livestock (Tannas 1997a, Uchytil 1991d).

***Ledum groenlandicum* (common Labrador tea)**—Forage value of *Ledum groenlandicum* (common Labrador tea) is poor for livestock, and the habitats occupied by it represent marginal rangeland that is seldom used by livestock (Tannas 1997a).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) offers poor forage value, and is seldom eaten by livestock (Tannas 1997a).

***Vaccinium vitis-idaea* (bog cranberry)**—*Vaccinium vitis-idaea* (bog cranberry) browse is of little value to domestic livestock, but provides some winter browse for caribou. It is not eaten by domestic sheep if more preferred forage is available (Tirmenstein 1991). Forage value for livestock is poor (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) timber is used primarily for pulpwood, construction lumber, furniture, boxes, crates, and pallets (USDA National Resources Conservation Service 2023). Productivity is moderate to high on these moist, rich sites (Beckingham and others 1996). However, they offer only limited potential due to the extremely fragile site conditions, generally accessible only during winter. Due to high water tables, the trees are extremely susceptible to windthrow and soil loss may follow all forms of timber harvesting. Subsequent to harvest, water tables can rise, causing problems for regeneration of trees on the site.

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is an important commercial wood producing species. The wood is white, straight grained, soft, and stiff. It is primarily used for construction lumber, but also for specialty items such as food containers and musical instruments (Uchytil 1991d).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) timber is used extensively for construction lumber, pulpwood, heating fuel, posts and poles, and plywood veneer (USDA National Resources Conservation Service 2023).

Wildlife

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) provides important wildlife habitat values, and is browsed to some extent by small mammals, especially by snowshoe hares (Tannas 1997a). The cones of this species are a choice food for red squirrels (Tannas 1997a).

Picea glauca (white spruce) provides good thermal and hiding cover for moose, white-tailed deer, and ruffed grouse. In southwestern Alberta, ruffed grouse preferentially select drumming sites with young *Picea glauca* (white spruce) cover (Abrahamson 2015).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) stands provide forage and habitat for a wide variety of small and large wildlife species. However, these properties are characteristic of where spruce grows and the associated understory species, rather than to the tree species itself. Animals that inhabit these stands include moose, elk, mule deer, woodland caribou, porcupine, snowshoe hare, red squirrel, and chipmunks. A partial list of birds that nest and feed in *Picea engelmannii* (Engelmann spruce) includes mountain chickadee, Williamson's sapsucker, red-breasted nuthatch, brown creeper, owls, and woodpeckers (Uchytil 1991d).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) forage is used to some extent by wild ungulates, especially deer, but only when other forage is scarce (Tannas 1997a). The species may provide important cover for many wildlife species, as it is a typical component species in many important wildlife habitats (Gucker 2006). The leaves and twigs are browsed by caribou and moose (Anderson 2011).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) also offers poor forage value for wildlife, and is eaten by deer and elk only when better forage is lacking (Tannas 1997a). Stands of the species provide cover for big game animals, upland game birds, small non-game birds, and small mammals (Anderson 2003).

***Vaccinium vitis-idaea* (bog cranberry)**—*Vaccinium vitis-idaea* (bog cranberry) browse is readily eaten by barren-ground caribou, black bear, moose, arctic hare, and snowshoe hare. In some parts of Canada, *Vaccinium vitis-idaea* (bog cranberry) browse is a primary food of barren-ground caribou. The evergreen leaves are an important item in their winter diet. The berries are an important food source for many species of birds and mammals. The fruits are an important spruce grouse food during spring, summer, and fall (Tirmenstein 1991).

Fisheries

***Picea glauca* (white spruce)**—Stands of *Picea glauca* (white spruce) adjacent to streams provide hiding, thermal cover, debris recruitment, and streambank stability for fish habitat (Thompson and Hansen 2003).

Fire

***Picea glauca* (white spruce)**— *Picea glauca* (white spruce) is easily killed by fire (Fischer and Bradley 1987). The species is poorly adapted to survive fire due to the trees have thin bark and shallow roots (Abrahamson 2015). Fires in *Picea glauca* (white spruce) communities are often stand-replacing, and post-fire succession

generally progresses through stages of herbaceous plants, shrubs, and deciduous trees before finally succeeding to the late seral *Picea glauca* (white spruce). On sites where fire is frequent, the same species that initially colonized the stand after fire may dominate until the next stand-replacing fire. This leads to the persistence of shade intolerant species such as *Populus tremuloides* (aspen) and *Betula papyrifera* (white birch). Alternatively, when fire is not frequent, stands eventually become dominated by shade tolerant species, such as the *Picea glauca* (white spruce) (Abrahamson 2015).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) spruce is very fire sensitive and is generally killed even by low-intensity fires. Post fire reestablishment is via wind-dispersed seeds, which readily germinate on fire-prepared seedbeds. The occasional mature tree that survives fire, those trees in unburned pockets, and live trees adjacent to burned areas provide the seeds for colonizing burned areas (Uchytil 1991d).

Scattered individuals or pockets of *Picea engelmannii* (Engelmann spruce) trees commonly escape fire by occurring on wetter sites where fire spread is limited. Scattered *Picea engelmannii* (Engelmann spruce) trees may escape fire by occurring on sites with discontinuous fuels, broken and rocky terrain, and/or a moist and cool environment (Uchytil 1991d).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) underground structures often survive and rapidly sprout after fire. When burned lightly, such that some above ground stem material survives, *Ledum groenlandicum* (common Labrador tea) may sprout from stems, but when completely top-killed, sprouting occurs from the root crown or rhizomes (Gucker 2006). Provided that a seed source is present, the species' abundant seed production and easily wind-dispersed seed suggests a high likelihood of burned site recolonization (Gucker 2006).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) thrives under the influence of fire, and on many sites fire is required to maintain its dominance. Producing serotinous cones is one adaptation to stand-replacing fire, and the seed supply is nearly always available on the tree (Anderson 2003).

The propensity of *Pinus contorta* (lodgepole pine) to form stands with high seedling density, initial rapid growth that slows with age, high susceptibility to snow breakage and wind-throw, infestation by dwarf-mistletoe and mountain pine beetles, all result in large buildups of fuel (Anderson 2003).

***Vaccinium vitis-idaea* (bog cranberry)**—Underground regenerative structures of *Vaccinium vitis-idaea* (bog cranberry) generally survive light fires. Plants often survive, even when aerial portions are killed by the fire. However, the entire plant may be killed by moderate to heavy, duff-consuming fires. Survivability is related to soil moisture levels, season of burn, fire severity and intensity, and rhizome depth (Tirmenstein 1991).

Rehabilitation/Restoration Considerations

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) is useful for long-term revegetation of coal mine overburden. In Alberta, it is considered one of the best conifers for this purpose (Abrahamson 2015). Road construction and development severely degrade riparian and wetland sites with high water tables, poor drainage, or organic soils. Therefore, roads and trails should be located on adjacent uplands.

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is suitable for restoration and revegetation applications in Alberta ranging from the Montane Natural Subregion and above to the lower reaches of the Alpine Natural Subregion (Hardy BBT Limited 1989).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) may be useful in revegetating disturbed sites, and may be a valuable indicator of contaminated sites and easily reforested sites

(Gucker 2006). Plants can be started from seed or root-crown division. Collect seeds from dry capsules and plant them in fall or spring in moist peaty soil in a sunny spot. Water them thoroughly after planting and keep moist. Suckers with roots can be split off from the base of the plant in mid-December and transplanted during spring (Anderson 2011).

Many of the fens and bogs that provide important habitat for *Ledum groenlandicum* (common Labrador tea) in North America were created by glaciation. These wetlands have been disappearing over thousands of years, due to a decrease in native ungulates that graze the bogs, and encroachment by conifers and hardwoods (Anderson 2011).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is often used in reforestation projects, especially for revegetation on sites of mining disturbance. Though it grows well on nutrient poor soils, addition of nitrogen fertilizer will likely enhance growth of the plantings (Anderson 2003).

***Vaccinium vitis-idaea* (bog cranberry)**—Potential rehabilitation value of *Vaccinium vitis-idaea* (bog cranberry) has not been well documented. The plants are able to survive on extremely harsh sites, and some rehabilitation potential is possible. The species can be readily propagated from seed, as well as from stem or rhizome cuttings (Tirmenstein 1991).

Recreational Uses and Consideration

***Picea glauca* (white spruce)**—Because of high water tables and the problems associated with road construction, campgrounds should not be located in stands of *Picea glauca* (white spruce).

***Picea engelmannii* (Engelmann spruce)**—Because of high water tables and the problems associated with road construction, campgrounds should not be located in stands of *Picea engelmannii* (Engelmann spruce).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- H3. Pl-Sw-Aw/Labrador tea/feather moss

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Pl/Bracted honeysuckle/Fern/Feather moss
- Sw/Labrador tea-Tall bilberry/Feather moss

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Mnb7 Water birch/Bearberry/Bog sedge (Montane Northern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type has not been described in the region.

Picea glauca/Viburnum edule Habitat Type
(white spruce/low-bush cranberry Habitat Type)

PICEGLA/VIBUEDU Habitat Type
Number of Stands = 28 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 2; Other Data Sets = 26)

LOCATION AND ASSOCIATED LANDFORMS

The *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. This habitat type characteristically occurs on sites with mesic moisture regimes associated with lakes and sloughs, on floodplain terraces bordering streams, and in steep wooded draws leading into river valleys. These sites occupy the drier side of the moisture gradient of sites supporting *Picea glauca* (white spruce). Late seral mature and old growth stands of this type are rare because stands usually burn before they reach advanced maturity.

Photo 3 shows a typical stand of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type.

Photo 3. A stand of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type (photo provided by Alan Dodd)

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 95 shows the five most prominent plant species among the four lifeforms for species recorded in all 28 stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type. This sample set contains a mix of late seral, relatively undisturbed stands, along with early seral, disturbed stands. For this reason the early seral tree species, *Populus tremuloides* (aspen) and *Populus balsamifera* (balsam poplar) are fairly prominent behind the late seral *Picea glauca* (white spruce). No other species in any of the lifeform groups is more than moderately prominent in this type.

Table 95. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type (number = 28 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	30.93	Native
Populus tremuloides (aspen)	14.20	Native
Populus balsamifera (balsam poplar)	9.30	Native
Betula papyrifera (white birch)	2.11	Native
Abies lasiocarpa (subalpine fir)	0.71	Native
Shrubs		
Betula pumila (dwarf birch)	6.91	Native
Salix myrtillifolia (myrtle-leaved willow)	4.64	Native
Cornus stolonifera (red-osier dogwood)	4.34	Native
Rosa spp. (rose)	3.75	Both
Alnus tenuifolia (river alder)	2.71	Native
Graminoids		
Carex aquatilis (water sedge)	4.30	Native
Elymus innovatus (hairy wild rye)	1.52	Native
Calamagrostis canadensis (marsh reed grass)	1.27	Native
Poa pratensis (Kentucky bluegrass)	0.75	Introduced
Carex sartwellii (Sartwell's sedge)	0.71	Native

Table 95. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Cornus canadensis (bunchberry)	5.02	Native
Aralia nudicaulis (wild sarsaparilla)	2.52	Native
Fragaria virginiana (wild strawberry)	1.73	Native
Aster conspicuus (showy aster	0.95	Native
Geum rivale (purple avens)	0.95	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 96 through Table 99, break out the vegetation recorded in all 28 stands sampled of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species rich, forested habitat type of minor-to-incidental occurrence across the study area.

Table 96 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type. For the 28 stands comprising the habitat type, the number of unique species was 200 with 180 (90.0 percent) of them being native species.

Table 96. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type (number = 28 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	8	8	0	0
Shrubs	51	50	0	1
Graminoids	39	32	6	1
Forbs	102	90	9	3
TOTAL	***200 (100.0%)***	***180 (90.0%)***	***15 (7.5%)***	***5 (2.5%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 97 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type. The average number of species per stand is 31.8, with native species comprising 29.4 species per stand or 92.5 percent.

Table 97. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type (number = 28 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.5	2.5	0.0	0.0
Shrubs	10.0	9.6	0.0	0.4
Graminoids	4.6	3.8	0.8	0.1
Forbs	14.7	13.5	1.1	0.1
TOTAL	***31.8 (100.0%)***	***29.4 (92.5%)***	***1.9 (6.0%)***	***0.6 (1.9%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 98 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type. The average canopy cover per stand is 153.5 percent, with native species comprising 144.8 percent or 94.3 percent of the total amount of average canopy cover per stand.

Table 98. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type (number = 28 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	57.5%	57.5%	0.0%	0.0%
Shrubs	54.5%	50.7%	0.0%	3.8%
Graminoids	15.4%	12.8%	2.5%	0.0%
Forbs	26.2%	23.7%	2.3%	0.1%
TOTAL	***153.5% (100.0%)***	***144.8% (94.3%)***	***4.8% (3.2%)***	***3.9% (2.6%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 99 shows the average number of species and average canopy cover by lifeform in stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type. The average number of species per stand was 31.8 with an average canopy cover of 153.5 percent.

Table 99. Average number of species and average canopy cover by lifeform in stands of the *Picea glauca/ Viburnum edule* (white spruce/low-bush cranberry) habitat type (number = 28 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.5	57.5%
Shrubs	10.0	54.5%
Graminoids	4.6	15.4%
Forbs	14.7	26.2%
TOTAL	***31.8***	***153.5%***

Sampled Stands Plant Species List

On 28 stands sampled of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, eight tree species were recorded on at least one of the plots (Table 100). The type overstory indicator, *Picea glauca* (white spruce), occurred on all 28 plots and is by far the most prominent species of this habitat type. The shrub, graminoid, and forb lifeforms are all very diverse, but with no single species standing out as being much more prominent that the others. Of the total 102 forb species recorded, 50 of them occurred on only on one of the 28 plots.

Table 100. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type (number = 28 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 8)					
Abies lasiocarpa (subalpine fir)	20.0	0-20	4	0.71	N
Betula papyrifera (white birch)	9.8	0-20	21	2.11	N
Picea glauca (white spruce)	30.9	3-80	100	30.93	N
Picea mariana (black spruce)	3.0	0-3	4	0.11	N
Pinus contorta (lodgepole pine)	1.8	0-3	7	0.13	N
Populus angustifolia (narrow-leaf cottonwood)	0.5	0-0.5	4	0.02	N
Populus balsamifera (balsam poplar)	16.3	0-60	57	9.30	N
Populus tremuloides (aspen)	24.8	0-80	57	14.20	N
Shrubs (N = 51)					
Alnus crispa (green alder)	50.0	0-50	4	1.79	N
Alnus tenuifolia (river alder)	6.9	0-30	39	2.71	N
Amelanchier alnifolia (Saskatoon)	3.1	0-10	46	1.45	N
Arctostaphylos uva-ursi (common bearberry)	8.5	0-30	14	1.21	N
Betula occidentalis (water birch)	30.0	0-30	4	1.07	N
Betula pumila (dwarf birch)	27.6	0-60	25	6.91	N
Clematis ligusticifolia (western clematis)	0.5	0-0.5	4	0.02	N

Table 100. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Cornus stolonifera (red-osier dogwood)	7.6	0-20	57	4.34	N
Corylus cornuta (beaked hazelnut)	12.0	0-30	11	1.29	N
Dryas drummondii (yellow mountain avens)	10.0	0-10	4	0.36	N
Elaeagnus commutata (silverberry)	6.3	0-20	18	1.12	N
Juniperus communis (ground juniper)	0.5	0-0.5	4	0.02	N
Ledum groenlandicum (common Labrador tea)	2.2	0-3	11	0.23	N
Linnaea borealis (twinflower)	4.0	0-10	64	2.55	N
Lonicera dioica (twining honeysuckle)	0.9	0-3	46	0.41	N
Lonicera involucrata (bracted honeysuckle)	3.0	0-10	57	1.70	N
Lonicera utahensis (red twinberry)	3.0	0-3	4	0.11	N
Potentilla fruticosa (shrubby cinquefoil)	2.2	0-3	11	0.23	N
Prunus virginiana (choke cherry)	2.2	0-3	21	0.46	N
Ribes hirtellum (wild gooseberry)	0.5	0-0.5	4	0.02	N
Ribes lacustre (bristly black currant)	0.5	0-0.5	4	0.02	N
Ribes oxyacanthoides (northern gooseberry)	5.1	0-30	25	1.27	N
Ribes triste (wild red currant)	3.0	0-3	7	0.21	N
Rosa acicularis (prickly rose)	5.1	0-20	43	2.20	N
Rosa spp. (rose)	9.5	0-30	39	3.75	B
Rubus arcticus (dwarf raspberry)	0.9	0-3	21	0.20	N
Rubus idaeus (wild red raspberry)	7.3	0-40	29	2.07	N
Rubus pubescens (dewberry)	1.7	0-3	54	0.89	N
Salix bebbiana (beaked willow)	2.6	0-10	29	0.75	N
Salix candida (hoary willow)	15.3	0-40	11	1.64	N
Salix drummondiana (Drummond's willow)	0.5	0-0.5	4	0.02	N
Salix exigua (sandbar willow)	3.0	0-3	4	0.11	N
Salix glauca (smooth willow)	8.4	0-20	14	1.20	N
Salix lutea (yellow willow)	1.8	0-3	7	0.13	N
Salix myrtillifolia (myrtle-leaved willow)	43.3	0-60	11	4.64	N
Salix pedicellaris (bog willow)	0.5	0-0.5	4	0.02	N
Salix planifolia (flat-leaved willow)	2.9	0-10	21	0.62	N
Salix pseudomonticola (false mountain willow)	0.5	0-0.5	7	0.04	N
Salix pseudomyrsinites (firm leaf willow)	5.3	0-10	11	0.57	N
Salix pyrifolia (balsam willow)	3.0	0-3	4	0.11	N
Salix scouleriana (Scouler's willow)	2.2	0-3	11	0.23	N
Salix serissima (autumn willow)	3.0	0-3	4	0.11	N
Shepherdia canadensis (Canada buffaloberry)	1.5	0-10	43	0.64	N
Sorbus scopulina (western mountain-ash)	0.5	0-0.5	4	0.02	N
Spiraea betulifolia (white meadowsweet)	1.8	0-3	7	0.13	N
Symphoricarpos occidentalis (buckbrush)	3.0	0-10	43	1.27	N
Symphoricarpos spp. (snowberry)	1.8	0-3	14	0.25	N
Vaccinium caespitosum (dwarf bilberry)	3.0	0-3	7	0.21	N
Vaccinium myrtillus (low bilberry)	1.8	0-3	7	0.13	N
Vaccinium vitis-idaea (bog cranberry)	10.3	0-20	7	0.73	N
Viburnum edule (low-bush cranberry)	3.6	0-10	64	2.30	N

Table 100. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Graminoids (N = 39)					
Agropyron repens (quack grass)	1.8	0-3	14	0.25	I
Agropyron trachycaulum (slender wheat grass)	1.0	0-3	18	0.18	N
Agrostis stolonifera (redtop)	4.8	0-10	14	0.68	I
Bromus ciliatus (fringed brome)	0.5	0-0.5	21	0.11	N
Bromus inermis (smooth brome)	4.5	0-10	11	0.48	I
Bromus inermis subsp. *pumpellianus* (northern awnless brome)	0.5	0-0.5	4	0.02	N
Calamagrostis canadensis (marsh reed grass)	2.2	0-3	57	1.27	N
Carex aquatilis (water sedge)	24.1	0-40	18	4.30	N
Carex atherodes (awned sedge)	0.5	0-0.5	4	0.02	N
Carex aurea (golden sedge)	0.5	0-0.5	4	0.02	N
Carex capillaris (hair-like sedge)	0.5	0-0.5	7	0.04	N
Carex disperma (two-seeded sedge)	2.9	0-10	21	0.62	N
Carex eburnea (bristle-leaved sedge)	0.5	0-0.5	4	0.02	N
Carex gynocrates (northern bog sedge)	0.5	0-0.5	4	0.02	N
Carex leptalea (bristle-stalked sedge)	1.8	0-3	21	0.38	N
Carex limosa (mud sedge)	0.5	0-0.5	4	0.02	N
Carex raymondii (Raymond's sedge)	3.0	0-3	4	0.11	N
Carex sartwellii (Sartwell's sedge)	20.0	0-20	4	0.71	N
Carex siccata (hay sedge)	5.3	0-10	7	0.38	N
Carex utriculata (beaked sedge)	0.5	0-0.5	4	0.02	N
Carex vaginata (sheathed sedge)	0.5	0-0.5	11	0.05	N
Carex viridula (green sedge)	0.5	0-0.5	4	0.02	N
Cinna latifolia (drooping wood-reed)	10.0	0-10	4	0.36	N
Deschampsia cespitosa (tufted hair grass)	1.3	0-3	11	0.14	N
Elymus glaucus (smooth wild rye)	2.0	0-3	18	0.36	N
Elymus innovatus (hairy wild rye)	6.1	0-20	25	1.52	N
Festuca scabrella (rough fescue)	0.5	0-0.5	4	0.02	N
Festuca spp. (fescue)	0.5	0-0.5	7	0.04	B
Juncus balticus (wire rush)	2.4	0-3	14	0.34	N
Luzula multiflora (field wood-rush)	10.0	0-10	4	0.36	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	4	0.02	N
Muhlenbergia glomerata (bog muhly)	0.5	0-0.5	4	0.02	N
Oryzopsis asperifolia (white-grained mountain rice grass)	1.1	0-3	14	0.16	N
Phleum pratense (timothy)	0.5	0-0.5	4	0.02	I
Poa alpina (alpine bluegrass)	0.5	0-0.5	4	0.02	N
Poa palustris (fowl bluegrass)	0.9	0-3	21	0.20	N
Poa pratensis (Kentucky bluegrass)	2.6	0-10	29	0.75	I
Schizachne purpurascens (purple oat grass)	2.1	0-10	32	0.68	N
Scirpus cespitosus (tufted bulrush)	20.0	0-20	4	0.71	N
Forbs (N = 102)					
Achillea millefolium (common yarrow)	0.5	0-0.5	32	0.16	N

Table 100. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Actaea rubra (red and white baneberry)	0.5	0-0.5	11	0.05	N
Androsace chamaejasme (sweet-flowered androsace)	0.5	0-0.5	4	0.02	N
Anemone cylindrica (long-fruited anemone)	0.5	0-0.5	4	0.02	N
Anemone multifida (cut-leaved anemone)	0.5	0-0.5	4	0.02	N
Antennaria parvifolia (small-leaved everlasting)	0.5	0-0.5	4	0.02	N
Antennaria pulcherrima (showy everlasting)	0.5	0-0.5	7	0.04	N
Apocynum androsaemifolium (spreading dogbane)	10.0	0-10	4	0.36	N
Aralia nudicaulis (wild sarsaparilla)	6.4	0-20	39	2.52	N
Arnica cordifolia (heart-leaved arnica)	3.0	0-3	4	0.11	N
Artemisia biennis (biennial sagewort)	0.5	0-0.5	4	0.02	N
Aster ciliolatus (Lindley's aster)	1.1	0-3	14	0.16	N
Aster conspicuus (showy aster)	2.0	0-3	46	0.95	N
Aster hesperius (western willow aster)	0.5	0-0.5	11	0.05	N
Aster laevis (smooth aster)	2.2	0-3	32	0.70	N
Aster modestus (large northern aster)	3.0	0-3	4	0.11	N
Astragalus eucosmus (milk vetch)	0.5	0-0.5	4	0.02	N
Astragalus spp. (milk vetch)	0.5	0-0.5	4	0.02	B
Astragalus vexilliflexus (few-flowered milk vetch)	0.5	0-0.5	4	0.02	N
Campanula rotundifolia (harebell)	0.5	0-0.5	18	0.09	N
Castilleja miniata (common red paintbrush)	0.5	0-0.5	7	0.04	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	7	0.04	N
Chenopodium gigantospermum (maple-leaved goosefoot)	0.5	0-0.5	4	0.02	N
Cirsium arvense (Canada thistle)	0.5	0-0.5	4	0.02	I
Cornus canadensis (bunchberry)	8.3	0-40	61	5.02	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	7	0.04	N
Disporum trachycarpum (fairybells)	0.5	0-0.5	29	0.14	N
Dodecatheon pulchellum (saline shooting star)	0.5	0-0.5	4	0.02	N
Epilobium angustifolium (common fireweed)	1.7	0-3	46	0.77	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	4	0.02	N
Equisetum arvense (common horsetail)	2.0	0-10	46	0.93	N
Equisetum laevigatum (smooth scouring-rush)	0.5	0-0.5	4	0.02	N
Equisetum pratense (meadow horsetail)	0.5	0-0.5	7	0.04	N
Equisetum scirpoides (dwarf scouring-rush)	1.8	0-3	14	0.25	N
Equisetum sylvaticum (woodland horsetail)	1.8	0-3	7	0.13	N
Eriogonum androsaceum (cushion umbrella-plant)	0.5	0-0.5	4	0.02	N
Fragaria virginiana (wild strawberry)	2.6	0-10	68	1.73	N
Galeopsis tetrahit (hemp-nettle)	10.0	0-10	4	0.36	I
Galium boreale (northern bedstraw)	0.6	0-3	68	0.43	N
Galium labradoricum (Labrador bedstraw)	0.5	0-0.5	4	0.02	N
Galium triflorum (sweet-scented bedstraw)	1.3	0-3	36	0.45	N
Geranium richardsonii (wild white geranium)	0.5	0-0.5	11	0.05	N
Geum aleppicum (yellow avens)	0.5	0-0.5	4	0.02	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	4	0.02	N

Table 100. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Geum rivale (purple avens)	6.6	0-20	14	0.95	N
Goodyera repens (lesser rattlesnake plantain)	3.0	0-3	4	0.11	N
Habenaria hyperborea (northern green bog orchid)	0.5	0-0.5	7	0.04	N
Habenaria spp. (bog orchid)	0.5	0-0.5	4	0.02	B
Hackelia floribunda (large-flowered stickseed)	0.5	0-0.5	4	0.02	N
Hedysarum alpinum (alpine hedysarum)	3.0	0-3	4	0.11	N
Hedysarum sulphurescens (yellow hedysarum)	0.5	0-0.5	4	0.02	N
Heracleum lanatum (cow parsnip)	1.3	0-3	11	0.14	N
Hieracium umbellatum (narrow-leaved hawkweed)	0.5	0-0.5	14	0.07	N
Lathyrus ochroleucus (cream-colored vetchling)	0.8	0-3	61	0.48	N
Lysimachia ciliata (fringed loosestrife)	0.5	0-0.5	4	0.02	N
Maianthemum canadense (wild lily-of-the-valley)	0.7	0-3	43	0.30	N
Melilotus officinalis (yellow sweet-clover)	0.5	0-0.5	4	0.02	I
Mertensia paniculata (tall lungwort)	1.9	0-10	50	0.95	N
Mitella nuda (bishop's-cap)	1.3	0-3	46	0.59	N
Monarda fistulosa (wild bergamot)	0.5	0-0.5	4	0.02	N
Moneses uniflora (one-flowered wintergreen)	0.5	0-0.5	4	0.02	N
Moss spp. (moss)	3.0	0-3	4	0.11	B
Orthilia secunda (one-sided wintergreen)	0.5	0-0.5	18	0.09	N
Osmorhiza depauperata (spreading sweet cicely)	0.5	0-0.5	4	0.02	N
Oxytropis cusickii (alpine locoweed)	0.5	0-0.5	4	0.02	N
Oxytropis deflexa (reflexed locoweed)	0.5	0-0.5	4	0.02	N
Oxytropis monticola (late yellow locoweed)	3.0	0-3	4	0.11	N
Oxytropis sericea (early yellow locoweed)	0.5	0-0.5	4	0.02	N
*Parnassia palustri*s (northern grass-of-parnassus)	0.5	0-0.5	7	0.04	N
Parnassia parviflora (small northern grass-of-parnassus)	0.5	0-0.5	4	0.02	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	7	0.04	N
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	4	0.02	N
Petasites frigidus (arctic sweet coltsfoot)	2.3	0-3	39	0.91	N
Petasites palmatus (palmate-leaved coltsfoot)	2.2	0-3	11	0.23	N
Petasites sagittatus (arrow-leaved coltsfoot)	10.0	0-10	4	0.36	N
Plantago major (common plantain)	0.5	0-0.5	11	0.05	I
Polemonium acutiflorum (tall Jacob's-ladder)	0.5	0-0.5	4	0.02	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	4	0.02	N
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	4	0.02	N
Pyrola asarifolia (common pink wintergreen)	0.7	0-3	46	0.32	N
Ranunculus pedatifidus (northern buttercup)	0.5	0-0.5	4	0.02	N
Rumex occidentalis (western dock)	0.5	0-0.5	4	0.02	N
Sanicula marilandica (snakeroot)	3.0	0-3	4	0.11	N
Senecio integerrimus (entire-leaved groundsel)	0.5	0-0.5	4	0.02	N
Senecio pauciflorus (few-flowered ragwort)	0.5	0-0.5	11	0.05	N
Smilacina stellata (star-flowered Solomon's-seal)	1.0	0-3	39	0.37	N
Solidago canadensis (Canada goldenrod)	1.5	0-3	18	0.27	N

Table 100. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.5	0-0.5	4	0.02	N
Taraxacum officinale (common dandelion)	2.0	0-3	43	0.84	I
Thalictrum venulosum (veiny meadow rue)	0.9	0-3	21	0.20	N
Trifolium hybridum (alsike clover)	0.5	0-0.5	18	0.09	I
Trifolium pratense (red clover)	0.5	0-0.5	7	0.04	I
Trifolium repens (white clover)	4.1	0-10	21	0.87	I
Triglochin maritima (seaside arrow-grass)	3.0	0-3	4	0.11	N
Urtica dioica (common nettle)	0.5	0-0.5	4	0.02	N
Valeriana dioica (northern valerian)	0.5	0-0.5	7	0.04	N
Vicia americana (wild vetch)	0.8	0-3	54	0.45	N
Viola canadensis (western Canada violet)	0.9	0-3	21	0.20	N
Viola nephrophylla (bog violet)	3.0	0-3	4	0.11	N
Viola renifolia (kidney-leaved violet)	0.5	0-0.5	7	0.04	N
Zigadenus elegans (white camas)	0.5	0-0.5	7	0.04	N
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	7	0.04	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 101 shows the five most prominent plant species among the four lifeforms for species recorded in all six relatively undisturbed late seral to climax stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type. *Picea glauca* (white spruce) is the only plant species more than moderately prominent in later seral stands of this habitat type.

Table 101. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type (number = 6 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	60.00	Native
Populus balsamifera (balsam poplar)	8.92	Native
Abies lasiocarpa (subalpine fir)	3.33	Native
Betula papyrifera (white birch)	0.50	Native
Populus tremuloides (aspen)	0.17	Native
Shrubs		
Linnaea borealis (twinflower)	4.00	Native
Rosa acicularis (prickly rose)	3.58	Native
Alnus tenuifolia (river alder)	2.83	Native
Cornus stolonifera (red-osier dogwood)	2.50	Native
Viburnum edule (low-bush cranberry)	2.50	Native
Graminoids		
Carex disperma (two-seeded sedge)	2.25	Native
Cinna latifolia (drooping wood-reed)	1.67	Native
Calamagrostis canadensis (marsh reed grass)	1.08	Native
Carex leptalea (bristle-stalked sedge)	1.08	Native
Agrostis stolonifera (redtop)	1.00	Introduced
Forbs		
Cornus canadensis (bunchberry)	4.50	Native
Aralia nudicaulis (wild sarsaparilla)	2.25	Native
Taraxacum officinale (common dandelion)	1.50	Introduced
Mertensia paniculata (tall lungwort)	1.17	Native
Mitella nuda (bishop's-cap)	1.17	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 102 through Table 105, break out the vegetation recorded in six relatively undisturbed late seral to climax stands sampled of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species rich, forested habitat type of minor-to-incidental occurrence across the study area.

Table 102 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/ Viburnum edule* (white spruce/low-bush cranberry) habitat type. For the 6 stands comprising the habitat type, the number of unique species was 78 with 69 (88.5 percent) of them being native species.

Table 102. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type (number = 6 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	5	5	0	0
Shrubs	21	20	0	1
Graminoids	15	12	2	1
Forbs	37	32	3	2
TOTAL	***78 (100.0%)***	***69 (88.5%)***	***5 (6.4%)***	***4 (5.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 103 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type. The average number of species per stand is 31.4, with native species comprising 29.2 species per stand or 93.0 percent.

Table 103. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Viburnum edule* (white spruce/ low-bush cranberry) habitat type (number = 6 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.5	2.5	0.0	0.0
Shrubs	9.8	9.7	0.0	0.2
Graminoids	4.3	3.5	0.7	0.2
Forbs	14.8	13.5	1.0	0.3
TOTAL	***31.4 (100.0%)***	***29.2 (93.0%)***	***1.7 (5.4%)***	***0.7 (2.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 104 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type. The average canopy cover per stand is 128.2 percent, with native species comprising 123.7 percent or 96.5 percent of the total amount of average canopy cover per stand.

Table 104. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type (number = 6 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	72.9%	72.9%	0.0%	0.0%
Shrubs	23.2%	22.7%	0.0%	0.5%
Graminoids	9.5%	8.3%	1.2%	0.1%
Forbs	22.6%	19.8%	2.2%	0.6%
TOTAL	***128.2% (100.0%)***	***123.7% (96.5%)***	***3.3% (2.6%)***	***1.2% (0.9%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 105 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type. The average number of species per stand was 31.4 with an average canopy cover of 128.2 percent.

Table 105. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type (number = 6 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.5	72.9%
Shrubs	9.8	23.2%
Graminoids	4.3	9.5%
Forbs	14.8	22.6%
TOTAL	***31.4***	***128.2%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

In six relatively undisturbed late seral to climax stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, five tree species were recorded, led by *Picea glauca* (white spruce), but with the early seral associate, *Populus balsamifera* (balsam poplar) also with moderate presence (Table 106). Twenty-one shrubs were recorded on at least one plot, but none had more than low to moderate presence. This is due to the

nearly closed canopy of *Picea glauca* (white spruce) blocking most light from reaching the understory of these stands. Fifteen graminoid and 37 forb species were recorded, all with low to moderate prominence.

Table 106. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type (number = 6 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 5)					
Abies lasiocarpa (subalpine fir)	20.0	0-20	17	3.33	N
Betula papyrifera (white birch)	3.0	0-3	17	0.50	N
Picea glauca (white spruce)	60.0	40-80	100	60.00	N
Populus balsamifera (balsam poplar)	10.7	0-20	83	8.92	N
Populus tremuloides (aspen)	0.5	0-0.5	33	0.17	N
Shrubs (N = 21)					
Alnus tenuifolia (river alder)	3.4	0-10	83	2.83	N
Amelanchier alnifolia (Saskatoon)	0.5	0-0.5	33	0.17	N
Cornus stolonifera (red-osier dogwood)	3.0	0-3	83	2.50	N
Linnaea borealis (twinflower)	4.8	0-10	83	4.00	N
Lonicera dioica (twining honeysuckle)	0.5	0-0.5	50	0.25	N
Lonicera involucrata (bracted honeysuckle)	2.5	0-3	83	2.08	N
Prunus virginiana (choke cherry)	0.5	0-0.5	17	0.08	N
Ribes lacustre (bristly black currant)	0.5	0-0.5	17	0.08	N
Ribes oxyacanthoides (northern gooseberry)	3.0	0-3	17	0.50	N
Ribes triste (wild red currant)	3.0	0-3	17	0.50	N
Rosa acicularis (prickly rose)	4.3	0-10	83	3.58	N
Rosa spp. (rose)	3.0	0-3	17	0.50	B
Rubus idaeus (wild red raspberry)	2.2	0-3	50	1.08	N
Rubus pubescens (dewberry)	1.5	0-3	83	1.25	N
Salix bebbiana (beaked willow)	0.5	0-0.5	17	0.08	N
Salix planifolia (flat-leaved willow)	0.5	0-0.5	17	0.08	N
Shepherdia canadensis (Canada buffaloberry)	0.5	0-0.5	50	0.25	N
Sorbus scopulina (western mountain-ash)	0.5	0-0.5	17	0.08	N
Symphoricarpos occidentalis (buckbrush)	0.5	0-0.5	33	0.17	N
Symphoricarpos spp. (snowberry)	1.8	0-3	33	0.58	N
Viburnum edule (low-bush cranberry)	2.5	0.5-10	100	2.50	N
Graminoids (N = 15)					
Agrostis stolonifera (redtop)	3.0	0-3	33	1.00	I
Bromus ciliatus (fringed brome)	0.5	0-0.5	17	0.08	N
Calamagrostis canadensis (marsh reed grass)	2.2	0-3	50	1.08	N
Carex aurea (golden sedge)	0.5	0-0.5	17	0.08	N
Carex disperma (two-seeded sedge)	4.5	0-10	50	2.25	N
Carex eburnea (bristle-leaved sedge)	0.5	0-0.5	17	0.08	N
Carex leptalea (bristle-stalked sedge)	2.2	0-3	50	1.08	N
Carex vaginata (sheathed sedge)	0.5	0-0.5	17	0.08	N
Cinna latifolia (drooping wood-reed)	10.0	0-10	17	1.67	N
Elymus glaucus (smooth wild rye)	1.8	0-3	33	0.58	N

Table 106. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Elymus innovatus (hairy wild rye)	3.0	0-3	17	0.50	N
Festuca spp. (fescue)	0.5	0-0.5	17	0.08	B
Oryzopsis asperifolia (white-grained mountain rice grass)	0.5	0-0.5	17	0.08	N
Poa pratensis (Kentucky bluegrass)	0.5	0-0.5	33	0.17	I
Schizachne purpurascens (purple oat grass)	1.3	0-3	50	0.67	N
Forbs (N = 37)					
Achillea millefolium (common yarrow)	0.5	0-0.5	17	0.08	N
Aralia nudicaulis (wild sarsaparilla)	4.5	0-10	50	2.25	N
Aster conspicuus (showy aster)	0.5	0-0.5	33	0.17	N
Aster laevis (smooth aster)	2.2	0-3	50	1.08	N
Campanula rotundifolia (harebell)	0.5	0-0.5	33	0.17	N
Cornus canadensis (bunchberry)	4.5	0.5-10	100	4.50	N
Disporum trachycarpum (fairybells)	0.5	0-0.5	50	0.25	N
Epilobium angustifolium (common fireweed)	1.8	0-3	33	0.58	N
Equisetum arvense (common horsetail)	1.0	0-3	83	0.83	N
Equisetum laevigatum (smooth scouring-rush)	0.5	0-0.5	17	0.08	N
Equisetum pratense (meadow horsetail)	0.5	0-0.5	33	0.17	N
Equisetum scirpoides (dwarf scouring-rush)	2.2	0-3	50	1.08	N
Equisetum sylvaticum (woodland horsetail)	0.5	0-0.5	17	0.08	N
Fragaria virginiana (wild strawberry)	2.2	0-3	50	1.08	N
Galium boreale (northern bedstraw)	0.5	0-0.5	50	0.25	N
Galium triflorum (sweet-scented bedstraw)	1.1	0-3	67	0.75	N
Geranium richardsonii (wild white geranium)	0.5	0-0.5	17	0.08	N
Goodyera repens (lesser rattlesnake plantain)	3.0	0-3	17	0.50	N
Habenaria spp. (bog orchid)	0.5	0-0.5	17	0.08	B
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	50	0.25	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	67	0.33	N
Mertensia paniculata (tall lungwort)	1.8	0-3	67	1.17	N
Mitella nuda (bishop's-cap)	1.8	0-3	67	1.17	N
Moss spp. (moss)	3.0	0-3	17	0.50	B
Orthilia secunda (one-sided wintergreen)	0.5	0-0.5	50	0.25	N
Osmorhiza depauperata (spreading sweet cicely)	0.5	0-0.5	17	0.08	N
Petasites frigidus (arctic sweet coltsfoot)	1.3	0-3	50	0.67	N
Petasites palmatus (palmate-leaved coltsfoot)	1.8	0-3	33	0.58	N
Plantago major (common plantain)	0.5	0-0.5	17	0.08	I
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	33	0.17	N
Smilacina stellata (star-flowered Solomon's-seal)	1.1	0-3	67	0.75	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.5	0-0.5	17	0.08	N
Taraxacum officinale (common dandelion)	3.0	0-3	50	1.50	I
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	17	0.08	N
Trifolium repens (white clover)	1.8	0-3	33	0.58	I
Vicia americana (wild vetch)	0.5	0-0.5	33	0.17	N

Table 106. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Viola renifolia (kidney-leaved violet)	0.5	0-0.5	17	0.08	N

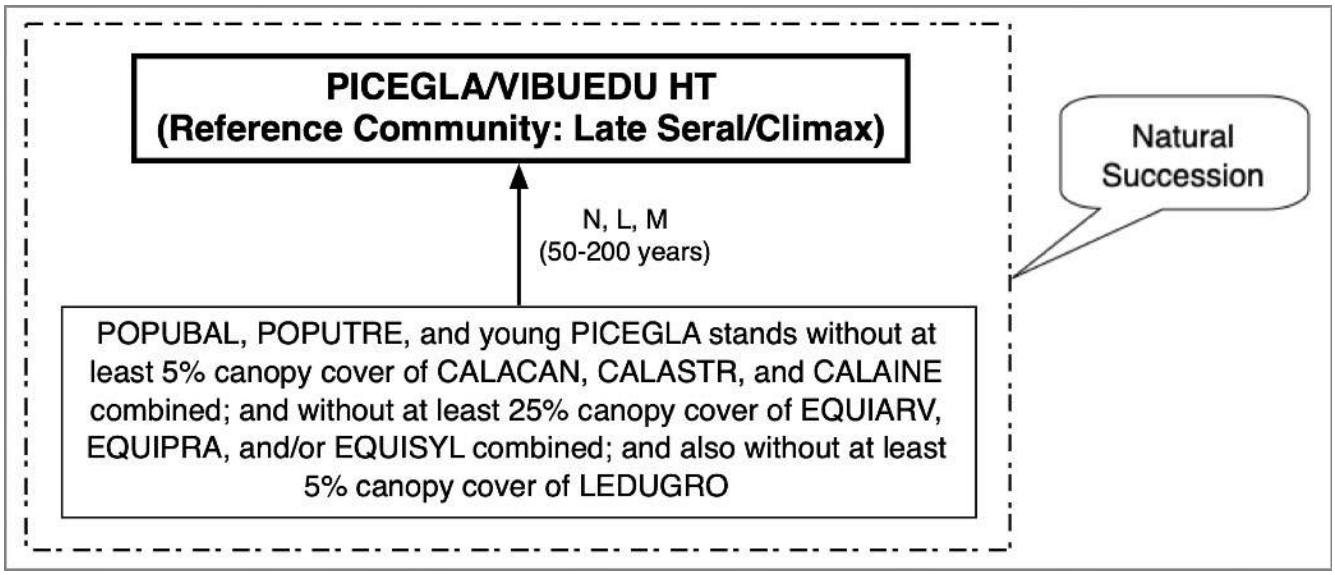
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Fluvial processes (e.g., channel migration, flooding, and deposition) are the principal origins of sites for new forest stands in riparian settings. Natural firebreaks of moist floodplains, wide channels, oxbows, and low fuel loadings on dark forest floors inhibit fire. The *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type characteristically occurs on flat, low lying sites with poor drainage, representing the wetter end of the moisture gradient of sites supporting *Picea glauca* (white spruce). New stands typically develop on sites where aging stands of *Populus balsamifera* (balsam poplar) or *Populus tremuloides* (aspen) yield the site to the shade tolerant, young *Picea glauca* (white spruce) trees.

Figure 18 shows a schematic diagram of vegetation successional pathways on sites of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type.



Successional Pathway of *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CALACAN—*Calamagrostis canadensis* (marsh reed grass)
CALAINE—*Calamagrostis inexpansa* (northern reed grass)
CALASTR—*Calamagrostis stricta* (narrow reed grass)
EQUIARV—*Equisetum arvense* (common horsetail)
EQUIPRA—*Equisetum pratense* (meadow horsetail)
EQUISYL—*Equisetum sylvaticum* (woodland horsetail)
LEDUGRO—*Ledum groenlandicum* (common Labrador tea)
PICEGLA—*Picea glauca* (white spruce)
PICEGLA/VIBUEDU HT—*Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUTRE—*Populus tremuloides* (aspen)

Figure 18. Successional pathway for sites of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 19 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

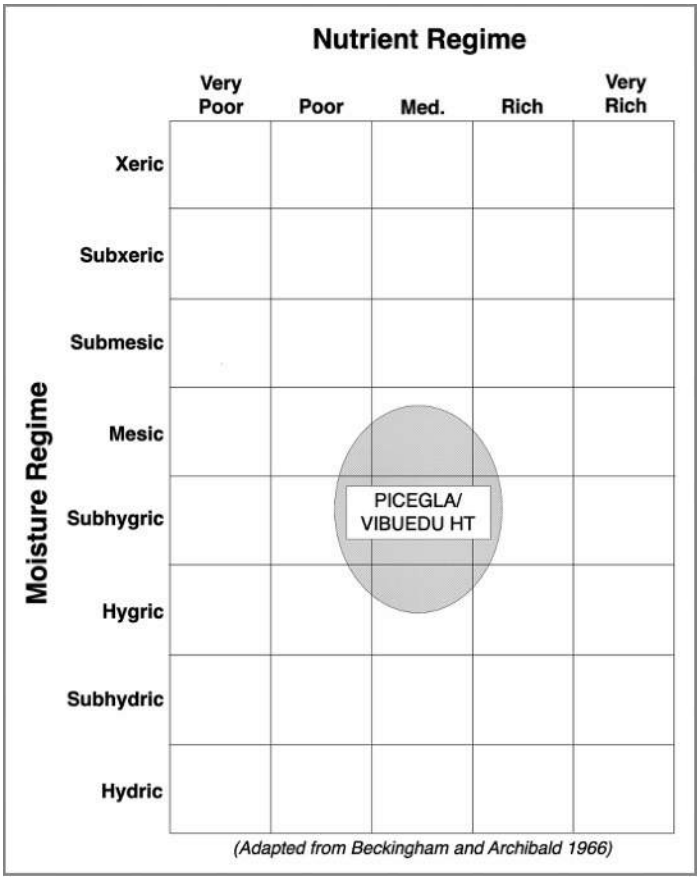


Figure 19. Edatope grid position for the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type (PICEGLA/VIBUEDU HT)

SOILS

Parent material on sites supporting the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type may be alluvial or morainal, and soils are generally Brunisols, Luvisols, or Regosols. Sites of this habitat type typically have organic (mor) layer thickness from 0 cm to 5 cm, moderately well drained to well drained mineral soils with texture ranging from sandy loam to clay (France and others 2020, Beckingham and Archibald 1996).

ADJACENT COMMUNITIES

Adjacent wetter sites will likely be dominated by the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type, the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type, or the *Picea glauca/Ledum groenlandicum* (white spruce/common Labrador tea) habitat type. Drier adjacent sites are likely to have communities dominated by *Populus tremuloides* (aspen) or upland species.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) is a late seral to climax conifer tree species, commonly replacing stand associates, *Betula* species (birch), *Populus* species (poplar), and *Pinus* species (pine), as succession progresses (Tannas 1997a).

This species typically grows in regions having long, cold winters and short, cool summers. It may be found on floodplains, upland slopes, and a variety of other landscape positions. Although it has a wide elevational range, *Picea glauca* (white spruce) is often confined to stream bottoms and lower river benches (Abrahamson 2015). It typically grows best on warm, moderately-to-well drained, upland or floodplain soils; and grows poorly on sites with stagnant water or a high water table (Abrahamson 2015).

Picea glauca (white spruce) co-dominates with *Populus tremuloides* (aspen), *Betula papyrifera* (white birch), and *Picea mariana* (black spruce) over large areas of mid seral forest (Abrahamson 2015).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is a late seral to climax conifer species, commonly replacing stand associates *Betula* species (birch), *Populus* species (poplar), and *Pinus* species (pine) as succession progresses (Tannas 1997a). This species in Alberta is restricted to the montane and subalpine natural subregions (Tannas 1997a).

Picea engelmannii (Engelmann spruce) is found in some of the highest and coldest forest environments that are characterized by long, cold winters with heavy snowpack and short, cool summers. The species is generally found on moist, cool sites extending down to lower elevations along stream bottoms where cold air flows down the valley and collects in localized frost pockets (Uchytil 1991d). *Picea engelmannii* (Engelmann spruce) often forms pure stands, but is more commonly associated with *Abies lasiocarpa* (subalpine fir). These two species frequently occur as codominants, forming widespread subalpine forests (Uchytil 1991d).

***Viburnum edule* (low-bush cranberry)**—*Viburnum edule* (low-bush cranberry) is common in Alberta in all natural regions except the Mixed Grass Prairie. It grows in moist woods, boggy or swampy woodlands, and wet thickets (Tannas 1997a).

Viburnum edule (low-bush cranberry) is moderately shade tolerant and may be prominent in all stages of forest succession. On floodplain sites, the species is present in the pioneer willow stands, through the seral *Populus balsamifera* (balsam poplar) stages, and remains prominent in mature/climax *Picea glauca* (white spruce) and *Picea mariana* (black spruce) stands (Matthews 1992a).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is a riparian shrub species that typically occurs along stream margins and other moist to wet sites at elevations between 500 m and 3,000 m. The species is not particularly drought tolerant, and on upland sites is generally restricted to areas receiving more than 50.8 cm of annual precipitation (Gucker 2012).

Cornus stolonifera (red-osier dogwood) is typically present throughout all stages of succession, but abundance is often greater in earlier than later stages. The species occupies open sites and also occurs beneath closed canopies, but is typically more abundance in sun than in shade (Gucker 2012).

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) is common and widely distributed across Alberta, often forming large groves. However, in dry areas, it is restricted to moist depression sites (Tannas 1997a). The species occurs on a wide variety of sites, such as moist uplands, dry mountainsides, avalanche chutes, talus

slopes, parklands, valley bottoms, alluvial terraces, and along streams and lake shorelines (Howard 1996). It grows on soils ranging from shallow and rocky to deep loamy sands and heavy clays. The best *Populus tremuloides* (aspen) sites are usually well drained, loamy, and high in both organic matter and nutrients (Howard 1996).

Populus tremuloides (aspen) is shade intolerant and cannot reproduce new seedlings beneath its own canopy, which means that the species is seral to conifer trees in most of its range in western North America (Howard 1996). Although, on sites where it is seral, it usually persists as a minor component well into later seral stages of the stand (Howard 1996).

Livestock

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) has poor value as forage for both livestock and wild ungulates, although it is occasionally used where better quality forage is lacking (Tannas 1997a). Herbage production is moderate to low, decreasing as seral succession progresses, and the upper canopy closes. These sites have little value as livestock range, other than shading. Lane and others (2000) recommend non-use for stands of *Picea glauca* (white spruce) on moist sites in the Lower Foothills Subregion. The moist soils are sensitive to disturbance, and cattle can easily churn the wet soil and destroy plant cover, as well as limiting tree seedling establishment.

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) palatability is poor, and it is seldom browsed by livestock (Tannas 1997a, Uchytil 1991d).

***Viburnum edule* (low-bush cranberry)**—*Viburnum edule* (low-bush cranberry) has fair forage value, but is little used by livestock, and increases under heavy grazing pressure (Tannas 1997a). The species palatability is low for livestock (Matthews 1992a).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is considered an "ice cream" plant by livestock and wildlife (Hansen and others 1995). In areas of Montana having experienced historic high levels of browsing by livestock, the species has been effectively eliminated from many sites.

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) has fair forage value, with high protein and phosphorous levels. Both its leaves and twigs are highly palatable throughout the season for livestock and wild ungulates. It is highly tolerant of heavy browsing, and is considered an increaser species and an invader of native rangeland. Clipping of its leaders stimulates growth of new suckers, as well as growth of new wood on the clipped stem (Tannas 1997a). Forage production in stands dominated by *Populus tremuloides* (aspen) varies from low to moderate, depending on stand density. Palatability of the various herbaceous species associated with this type is often high, and cattle utilization may be high as upland vegetation cures and the animals spend more time in shade that these stands provide. Livestock browse young suckers; and this, combined with trampling and soil compaction, can alter both the age structure and understory composition of stands (Thompson and Hansen 2003).

Stands of *Populus tremuloides* (aspen) are often subjected to high levels of grazing pressure because of their gentle topography and ease of access. With moderate to high, prolonged grazing pressure, palatable shrubs will be decreased relative to such species as *Symphoricarpos* species (buckbrush), *Rosa* species (rose), and *Lonicera* species (honeysuckle) in the understory. With continued long-term intense usage, a stand can be converted to the *Populus tremuloides* (aspen) community type by reduction of total shrub canopy cover to less than 25 percent (Thompson and Hansen 2003).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) timber is used primarily for pulpwood, construction lumber, furniture, boxes, crates, and pallets (USDA National Resources Conservation Service 2023). Productivity is moderate to high on these moist, rich sites (Beckingham and others 1996). However, they offer only limited potential due to the extremely fragile site conditions, generally accessible only during winter. Due to high water tables, the trees are extremely susceptible to windthrow and soil loss may follow all forms of timber harvesting. Subsequent to harvest, water tables can rise, causing problems for regeneration of trees on the site.

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is an important commercial wood producing species. The wood is white, straight grained, soft, and stiff. It is primarily used for construction lumber, but also for specialty items such as food containers and musical instruments (Uchytil 1991d).

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) timber is an important source of fiber used for pulpwood, flake-board, and other composite products. It is also used for making pallets, boxes, veneer and plywood. Higher grades are used for solid wood products such as paneling, furniture components, and flooring (USDA National Resources Conservation Service 2023).

Wildlife

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) provides important wildlife habitat values, and is browsed to some extent by small mammals, especially by snowshoe hares (Tannas 1997a). The cones of this species are a choice food for red squirrels (Tannas 1997a).

Picea glauca (white spruce) provides good thermal and hiding cover for moose, white-tailed deer, and ruffed grouse. In southwestern Alberta, ruffed grouse preferentially select drumming sites with young *Picea glauca* (white spruce) cover (Abrahamson 2015).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) stands provide forage and habitat for a wide variety of small and large wildlife species. However, these properties are characteristic of where spruce grows and the associated understory species, rather than to the tree species itself. Animals that inhabit these stands include moose, elk, mule deer, woodland caribou, porcupine, snowshoe hare, red squirrel, and chipmunks. A partial list of birds that nest and feed in *Picea engelmannii* (Engelmann spruce) includes mountain chickadee, Williamson's sapsucker, red-breasted nuthatch, brown creeper, owls, and woodpeckers (Uchytil 1991d).

***Viburnum edule* (low-bush cranberry)**—*Viburnum edule* (low-bush cranberry) is browsed quite readily by wild ungulates, primarily in winter months. The fruit is a valuable food source for a variety of bird species (Tannas 1997a). *Viburnum edule* (low-bush cranberry) is of low to moderate importance as browse for elk, mountain goat, bighorn sheep, deer, and caribou. The foliage is browsed by moose throughout the year. The fruits are a major food of grizzly and black bears. *Viburnum* species (cranberry) are important components of forest-edge and hedgerow habitats that provide cover for small mammals and birds (Matthews 1992a).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) provides hiding and thermal cover for small mammals and birds. The species is used for food and cover by white-tailed deer, mule deer, elk, moose, cottontail rabbits, snowshoe hares, and numerous birds (Costain 1989). Moose in particular are tall enough to reach the twigs of even the tallest plants. *Cornus stolonifera* (red-osier dogwood) fruit is low in sugar, so it is

initially less attractive to wildlife and less inclined to rot than other fruits. Consequently, the fruit stays on the plant through the winter and is available when fruits of other plants are gone (Gucker 2012).

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) forests provide important breeding, foraging, and resting habitat for a variety of birds and mammals. Elk browse it year-round, feeding on bark, new leaders, and sprouts. The species also provides important forage for moose, mule deer, and white-tailed deer (Howard 1996). Wildlife utilization of *Populus tremuloides* (aspen) communities varies with composition of the understory and relative age of the *Populus tremuloides* (aspen) stand. Young stands generally provide more browse. *Populus tremuloides* (aspen) crowns can grow out of reach of large ungulates in 6 to 8 years. Although many animals browse *Populus tremuloides* (aspen) year-round, it is especially valuable during fall and winter, when protein levels are high relative to other browse species (Howard 1996).

Elk browse *Populus tremuloides* (aspen) year-round, feeding on bark, buds, twigs, and sprouts. The species is important forage for mule and white-tailed deer. The deer consume leaves, buds, twigs, bark, and sprouts. New growth on burned sites or clearcuts is especially palatable to deer. Sprouts provide key summer forage for deer after herbaceous species have cured. *Populus tremuloides* (aspen) is valuable moose browse for much of the year, utilizing it on summer and winter ranges (Howard 1996).

Lagomorphs feed on *Populus tremuloides* (aspen) in summer and winter. They may girdle suckers or even mature trees, and in some parts of Canada, fairly high *Populus tremuloides* (aspen) mortality has been attributed to rabbits and hares (Howard 1996). Small rodents such as squirrels, pocket gophers, mice, and voles feed on *Populus tremuloides* (aspen) during at least part of the year. Mice and voles frequently consume *Populus tremuloides* (aspen) bark below snow level, and can girdle suckers and small trees (Howard 1996).

Beaver consume the leaves, bark, twigs, and all diameters of *Populus tremuloides* (aspen) branches. They use the stems for constructing dams and lodges, and at least temporarily, beaver can eliminate *Populus tremuloides* (aspen) from as far as 122 m from the water body. A beaver can consume 1-2 kg of aspen bark per day, and it is estimated that as many as 200 *Populus tremuloides* (aspen) trees are required to support one beaver for a year (Howard 1996).

Fisheries

***Picea glauca* (white spruce)**—Stands of *Picea glauca* (white spruce) adjacent to streams provide hiding, thermal cover, debris recruitment, and streambank stability for fish habitat (Thompson and Hansen 2003).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is an excellent shrub for controlling erosion along streams. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

***Populus tremuloides* (aspen)**—Where adjacent to streams, stands of *Populus tremuloides* (aspen) enhance fisheries by stabilizing streambanks and providing overhanging shade cover. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible (Hansen and others 1995).

Fire

***Picea glauca* (white spruce)**— *Picea glauca* (white spruce) is easily killed by fire (Fischer and Bradley 1987). The species is poorly adapted to survive fire due to the trees have thin bark and shallow roots (Abrahamson 2015). Fires in *Picea glauca* (white spruce) communities are often stand-replacing, and post-fire succession generally progresses through stages of herbaceous plants, shrubs, and deciduous trees before finally succeeding to the late seral *Picea glauca* (white spruce). On sites where fire is frequent, the same species that initially colonized the stand after fire may dominate until the next stand-replacing fire. This leads to the persistence of shade

intolerant species such as *Populus tremuloides* (aspen) and *Betula papyrifera* (white birch). Alternatively, when fire is not frequent, stands eventually become dominated by shade tolerant species, such as the *Picea glauca* (white spruce) (Abrahamson 2015).

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) spruce is very fire sensitive and is generally killed even by low-intensity fires. Post fire reestablishment is via wind-dispersed seeds, which readily germinate on fire-prepared seedbeds. The occasional mature tree that survives fire, those trees in unburned pockets, and live trees adjacent to burned areas provide the seeds for colonizing burned areas (Uchytil 1991d).

Scattered individuals or pockets of *Picea engelmannii* (Engelmann spruce) trees commonly escape fire by occurring on wetter sites where fire spread is limited. Scattered *Picea engelmannii* (Engelmann spruce) trees may escape fire by occurring on sites with discontinuous fuels, broken and rocky terrain, and/or a moist and cool environment (Uchytil 1991d).

***Viburnum edule* (low-bush cranberry)**—*Viburnum edule* (low-bush cranberry) sprouts from the stump, roots, or underground stems after light to moderate fire. Top-killed plants usually sprout within weeks after fire, and the species often becomes a dominant shrub on the site post fire. Low-severity fires may stimulate germination of seeds stored in the soil (Matthews 1992a).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) generally increases following fire, and may invade recently burned areas from adjacent unburned areas. Above ground material is usually killed by fire. However, the roots can survive all but the most severe fires that remove the duff and heat the upper soil for an extended period. The species can sprout from surviving roots or stolons and from the base of aerial stems following fire (Fischer and Bradley 1987), but can be killed by severe fires that cause extended heating of the upper soil. Light fires that partially remove the duff stimulate germination of buried seed. In moist forests of British Columbia, *Cornus stolonifera* (red-osier dogwood) appears to increase in abundance following the removal of the shading canopy by logging or burning (Gucker 2012).

***Populus tremuloides* (aspen)**—Prescribed fire is recommended to rejuvenate *Populus tremuloides* (aspen) stands. With the recent history of fire suppression, there has been a general aging of *Populus tremuloides* (aspen) stands across western North America. While conifers may replace seral *Populus tremuloides* (aspen) stands, stable stands may become less productive. In many areas stands now live longer than they did prior to fire exclusion, and many are in decline (Howard 1996). However, wet conditions in spring and summer may limit prescribed burning to the drier fall season. Fire, sometimes in combination with cutting, can be an important tool in regenerating decadent stands (Hansen and others 1995). Brown (1984) provides information for using prescribed fire in *Populus tremuloides* (aspen) stands. Protection of newly burned or cleared sites from beaver and grazing animals may be necessary for successful stand reestablishment.

Prescribed fire is often difficult to apply in *Populus tremuloides* (aspen) stands because of the abundance of live trees and sparse distribution of fine dead fuels. Even if fuels are plentiful, they are often too moist to burn easily. Prescribed fire may be possible, however, when live vegetation cures enough to contribute to fire spread, rather than to hinder it. The optimum combination of dry weather and cured fuels occurs mostly in early spring, late summer, and fall (Howard 1996). In Alberta, these moderately severe, early season burning conditions can persist from snowmelt until the first week in June (Quintilo and others 1991). In the northern forest of Alberta, Bailey (1978) found that prescribed burning in *Populus tremuloides* (aspen) forests in spring was usually not successful at relative humidity above 35 to 40 percent. He recommended that prescribed burning be conducted 8 to 10 drying days after snowmelt, when air temperature is at least 18 degrees C, relative humidity is less than 30 percent, and winds are 9-35 km/hr.

Populus tremuloides (aspen) is the classic soboliferous species: a plant that sprouts from carbohydrate-storing lateral roots (sobols). The species generally sprouts vigorously after burning. Moderately severe fire generally results in dense sprouting, and fewer sprouts may be produced after severe fire. A low severity surface fire may leave standing live trees that locally suppress sprouting, resulting in an uneven-aged stand. *Populus tremuloides* (aspen) burned in spring generally sprout later in the growing season and again the following year. Stands burned in late summer or fall usually sprout the next spring (Howard 1996).

Populus tremuloides (aspen) readily colonizes sites after fire, timber harvest, or other disturbance (Howard 1996). Even in stands where it was only a small component of the vegetation prior to burning, the aspen often gains dominance after a fire. The species is easily top-killed by fire, but root systems of top-killed stems continue to send up a profusion of sprouts for several years after burning. After a fire, a new, even-aged stand can develop within one decade (Howard 1996).

Rehabilitation/Restoration Considerations

***Picea glauca* (white spruce)**—*Picea glauca* (white spruce) is useful for long-term revegetation of coal mine overburden. In Alberta, it is considered one of the best conifers for this purpose (Abrahamson 2015). Road construction and development severely degrade riparian and wetland sites with high water tables, poor drainage, or organic soils. Therefore, roads and trails should be located on adjacent uplands.

***Picea engelmannii* (Engelmann spruce)**—*Picea engelmannii* (Engelmann spruce) is suitable for restoration and revegetation applications in Alberta ranging from the Montane Natural Subregion and above to the lower reaches of the Alpine Natural Subregion (Hardy BBT Limited 1989).

***Viburnum edule* (low-bush cranberry)**—The value of *Viburnum edule* (low-bush cranberry) for rehabilitation purposes has not been well documented. The species was studied for use in oil sands reclamation, but results have not been located (Matthews 1992a).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is valuable for revegetation of degraded sites, as it readily establishes along stream edges by direct seeding, transplanting rooted cuttings, or planting nursery-grown seedlings. Its rapid growth can quickly stabilize deteriorated streambanks (Gucker 2012).

***Populus tremuloides* (aspen)**—The wide adaptability of *Populus tremuloides* (aspen) makes it well-suited for restoration and rehabilitation on a wide range of sites. Stands of this species are unique in their ability to stabilize soil and watersheds on burned and otherwise disturbed sites. The trees produce abundant litter that contains more nitrogen, phosphorus, potassium, and calcium than does the leaf litter of most other deciduous trees. This litter decays rapidly, forming a nutrient-rich humus that reduces runoff and aids in percolation of surface water. Compared to conifer stands, more snow accumulates under aspen, and snowmelt begins earlier in the spring, allowing the soil to thaw more quickly than soil under conifer trees (Howard 1996).
Populus tremuloides (aspen) can be useful in revegetating disturbed sites having moist, well-drained soils. Best results are obtained using rooted cuttings or nursery-grown stock. Once established, growth rates are rapid. The quickly spreading aspen roots effectively stabilize exposed soils. Rooted cuttings or nursery grown seedlings are easily established on moist, well-drained soils. Growth rates are rapid and the roots of established seedlings are effective stabilizers of alluvial soil deposits (Thompson and Hansen 2003).

Populus tremuloides (aspen) seedlings transplanted onto disturbed sites have shown good establishment and are more economical to grow than vegetative cuttings. Seedlings grow a taproot and secondary roots quickly, while cuttings can be slow to establish an adequate root system. In addition, genetic diversity is greater among seedlings than cuttings. The major advantage of using cuttings is that clones with desirable traits can be selected as parent

stock. Stem cuttings are especially difficult to root unless taken from young sprouts. Root cuttings taken from young sprouts are generally more successful (Howard 1996).

Recreational Uses and Consideration

***Picea glauca* (white spruce)**—Because of high water tables and the problems associated with road construction, campgrounds should not be located in stands of *Picea glauca* (white spruce).

***Picea engelmannii* (Engelmann spruce)**—Because of high water tables and the problems associated with road construction, campgrounds should not be located in stands of *Picea engelmannii* (Engelmann spruce).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- H7. Aspen-Balsam Poplar-white spruce/alder

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Pb-Aw/Rose/Marsh reed grass
- Sw/Labrador tea-Tall bilberry/Feather moss

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Mne20 Sw/Red osier dogwood (Montane Northern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003).

Picea mariana/Calamagrostis canadensis Habitat Type
(black spruce/marsh reed grass Habitat Type)

PICEMAR/CALACAN Habitat Type
Number of Stands = 60 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 58; Other Data Sets = 2)

LOCATION AND ASSOCIATED LANDFORMS

The *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type is a major type in the Lower Foothills Natural Subregion, a major type in the Upper Foothills Natural Subregion, and a major type in the Montane Natural Subregion of Alberta. This habitat type is limited to sites that can support both *Picea mariana* (black spruce) and *Calamagrostis canadensis* (marsh reed grass), which coincides with the drier side of the moisture spectrum of the *Picea mariana* (black spruce) in muskegs, bogs, bottomlands, and relatively dry peatlands.

Photo 4 shows a typical stand of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type.

Photo 4. A stand of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (photo provided by Hilary Baker)

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 107 shows the five most prominent plant species among the four lifeforms for species recorded in all 60 stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type. This sample set contains a mix of late seral, relatively undisturbed stands, along with early seral, disturbed stands. For this reason the early seral tree species, *Pinus contorta* (lodgepole pine), remains fairly prominent. Among shrubs, only *Ledum groenlandicum* (common Labrador tea) is highly prominent; while among graminoids, the only prominent species is *Calamagrostis canadensis* (marsh reed grass). No forb species is more than moderately prominent.

Table 107. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (number = 60 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea mariana (black spruce)	34.00	Native
Pinus contorta (lodgepole pine)	11.99	Native
Populus balsamifera (balsam poplar)	3.93	Native
Picea glauca (white spruce)	2.76	Native
Populus tremuloides (aspen)	1.85	Native
Shrubs		
Ledum groenlandicum (common Labrador tea)	15.23	Native
Vaccinium vitis-idaea (bog cranberry)	3.54	Native
Linnaea borealis (twinflower)	2.08	Native
Rosa acicularis (prickly rose)	1.71	Native
Vaccinium myrtilloides (common blueberry)	1.48	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	13.50	Native
Calamagrostis stricta (narrow reed grass)	0.83	Native
Elymus innovatus (hairy wild rye)	0.66	Native
Carex disperma (two-seeded sedge)	0.58	Native
Carex vaginata (sheathed sedge)	0.41	Native

Table 107. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Cornus canadensis (bunchberry)	4.43	Native
Equisetum sylvaticum (woodland horsetail)	3.12	Native
Equisetum arvense (common horsetail)	2.90	Native
Petasites palmatus (palmate-leaved coltsfoot)	1.16	Native
Equisetum scirpoides (dwarf scouring-rush)	0.68	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 108 through Table 111, break out the vegetation recorded in all 60 stands sampled of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, moderately species rich, forested habitat type of major occurrence across the study area.

Table 108 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type. For the 60 stands comprising the habitat type, the number of unique species was 156 with 150 (96.2 percent) of them being native species.

Table 108. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (number = 60 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	10	10	0	0
Shrubs	48	46	0	2
Graminoids	22	20	0	2
Forbs	76	74	2	0
TOTAL	***156 (100.0%)***	***150 (96.2%)***	***2 (1.3%)***	***4 (2.6%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 109 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type. The average number of species per stand is 19.7, with native species comprising 19.4 species per stand or 98.5 percent.

Table 109. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (number = 60 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.6	2.6	0.0	0.0
Shrubs	7.4	7.2	0.0	0.2
Graminoids	2.1	2.0	0.0	0.0
Forbs	7.6	7.6	0.0	0.0
TOTAL	***19.7 (100.0%)***	***19.4 (98.5%)***	***0.0 (0.0%)***	***0.2 (1.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 110 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type. The average canopy cover per stand is 133.6 percent, with native species comprising 133.2 percent or 99.7 percent of the total amount of average canopy cover per stand.

Table 110. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (number = 60 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	57.7%	57.7%	0.0%	0.0%
Shrubs	39.1%	38.8%	0.0%	0.4%
Graminoids	16.8%	16.7%	0.0%	0.0%
Forbs	19.9%	19.9%	0.0%	0.0%
TOTAL	***133.6% (100.0%)***	***133.2% (99.7%)***	***0.0% (0.0%)***	***0.4% (0.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 111 shows the average number of species and average canopy cover by lifeform in stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type. The average number of species per stand was 19.7 with an average canopy cover of 133.6 percent.

Table 111. Average number of species and average canopy cover by lifeform in stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (number = 60 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.6	57.7%
Shrubs	7.4	39.1%
Graminoids	2.1	16.8%
Forbs	7.6	19.9%
TOTAL	***19.7***	***133.6%***

Sampled Stands Plant Species List

Ten tree species were recorded on at least one of the 60 stands sampled of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (Table 112). Most prominent by far of all species recorded is *Picea mariana* (black spruce). Also very prominent here is the early seral tree species, *Pinus contorta* (lodgepole pine), indicating that many of the 60 stands sampled are still in early to mid seral stage. Among the 48 shrubs recorded, only *Ledum groenlandicum* (common Labrador tea) is very prominent, although *Vaccinium vitis-idaea* (bog cranberry) is moderately prominent, occurring on 77 percent of plots sampled. *Calamagrostis canadensis* (marsh reed grass) is the only highly prominent graminoid recorded in this habitat type. Among the 76 forb species recorded, none was highly prominent, but *Cornus canadensis* (bunchberry) and *Petasites palmatus* (palmate-leaved coltsfoot) both are quite constantly recorded, occurring on 77 and 68 percent of stands sampled, respectively.

Table 112. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (number = 60 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 10)					
Abies balsamea (balsam fir)	7.8	0-20	5	0.39	N
Abies lasiocarpa (subalpine fir)	7.2	0-20	13	0.96	N
Betula papyrifera (white birch)	11.0	0-20	5	0.55	N
Larix laricina (tamarack)	7.0	0-20	18	1.29	N
Picea engelmannii x glauca (Engelmann x white spruce)	0.5	0-0.5	2	0.01	N
Picea glauca (white spruce)	11.0	0-40	25	2.76	N
Picea mariana (black spruce)	34.0	10-70	100	34.00	N
Pinus contorta (lodgepole pine)	19.4	0-60	62	11.99	N
Populus balsamifera (balsam poplar)	26.2	0-60	15	3.93	N
Populus tremuloides (aspen)	15.9	0-40	12	1.85	N

Table 112. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Shrubs (N = 48)					
Alnus crispa (green alder)	1.6	0-3	18	0.30	N
Amelanchier alnifolia (Saskatoon)	0.5	0-0.5	2	0.01	N
Arctostaphylos uva-ursi (common bearberry)	4.5	0-10	5	0.23	N
*Betula glandulos*a (bog birch)	11.3	0-30	8	0.94	N
Betula pumila (dwarf birch)	5.9	0-10	7	0.39	N
Empetrum nigrum (crowberry)	1.8	0-3	3	0.06	N
Gaultheria hispidula (creeping snowberry)	1.3	0-3	17	0.21	N
Ledum groenlandicum (common Labrador tea)	17.9	0-60	85	15.23	N
Linnaea borealis (twinflower)	3.0	0-20	68	2.08	N
Lonicera dioica (twining honeysuckle)	1.3	0-3	5	0.07	N
Lonicera involucrata (bracted honeysuckle)	2.1	0-10	47	1.00	N
Oxycoccus microcarpus (small bog cranberry)	2.6	0-10	12	0.30	N
Potentilla fruticosa (shrubby cinquefoil)	3.0	0-3	2	0.05	N
Ribes glandulosum (skunk currant)	3.0	0-3	2	0.05	N
Ribes hudsonianum (northern black currant)	0.5	0-0.5	2	0.01	N
Ribes lacustre (bristly black currant)	0.5	0-0.5	12	0.06	N
Ribes laxiflorum (mountain currant)	0.5	0-0.5	2	0.01	N
Ribes oxyacanthoides (northern gooseberry)	1.5	0-3	8	0.12	N
Ribes spp. (currant)	0.5	0-0.5	2	0.01	B
Ribes triste (wild red currant)	1.8	0-3	7	0.12	N
Rosa acicularis (prickly rose)	2.6	0-10	67	1.71	N
Rosa woodsii (common wild rose)	20.0	0-20	2	0.33	N
Rubus arcticus (dwarf raspberry)	1.2	0-3	12	0.14	N
Rubus chamaemorus (cloudberry)	4.4	0-10	22	0.95	N
Rubus idaeus (wild red raspberry)	4.8	0-10	8	0.40	N
Rubus pedatus (dwarf bramble)	5.1	0-20	20	1.03	N
Rubus pubescens (dewberry)	2.2	0-10	35	0.78	N
Salix barrattiana (Barratt's willow)	6.5	0-10	3	0.22	N
Salix bebbiana (beaked willow)	7.4	0-20	12	0.87	N
Salix discolor (pussy willow)	3.0	0-3	2	0.05	N
Salix glauca (smooth willow)	14.0	0-20	8	1.17	N
Salix myrtillifolia (myrtle-leaved willow)	12.3	0-20	12	1.43	N
Salix pedicellaris (bog willow)	3.0	0-3	2	0.05	N
Salix planifolia (flat-leaved willow)	23.5	0-60	5	1.18	N
Salix prolixa (Mackenzie's willow)	0.5	0-0.5	2	0.01	N
Salix scouleriana (Scouler's willow)	10.0	0-10	2	0.17	N
Salix spp. (willow)	2.2	0-10	17	0.37	B
Sambucus racemosa (red elderberry)	3.0	0-3	2	0.05	N
Shepherdia canadensis (Canada buffaloberry)	1.3	0-3	5	0.07	N
Sorbus scopulina (western mountain-ash)	3.0	0-3	8	0.25	N
Spiraea betulifolia (white meadowsweet)	0.5	0-0.5	2	0.01	N
Symphoricarpos occidentalis (buckbrush)	0.5	0-0.5	2	0.01	N
Vaccinium caespitosum (dwarf bilberry)	1.1	0-3	20	0.23	N

Table 112. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Vaccinium membranaceum (tall bilberry)	3.3	0-20	20	0.67	N
Vaccinium myrtilloides (common blueberry)	4.0	0-20	37	1.47	N
Vaccinium scoparium (grouseberry)	0.5	0-0.5	2	0.01	N
Vaccinium vitis-idaea (bog cranberry)	4.6	0-30	77	3.54	N
Viburnum edule (low-bush cranberry)	3.3	0-10	23	0.76	N
Graminoids (N = 22)					
Agrostis scabra (rough hair grass)	0.5	0-0.5	2	0.01	N
Bromus spp. (brome grass)	0.5	0-0.5	2	0.01	B
Calamagrostis canadensis (marsh reed grass)	14.5	0-50	93	13.50	N
Calamagrostis spp. (reed grass)	3.0	0-3	2	0.05	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	8	0.83	N
Carex aquatilis (water sedge)	0.5	0-0.5	2	0.01	N
Carex canescens (hoary sedge)	3.0	0-3	2	0.05	N
Carex concinna (beautiful sedge)	0.5	0-0.5	3	0.02	N
Carex disperma (two-seeded sedge)	3.1	0-20	18	0.57	N
Carex gynocrates (northern bog sedge)	0.5	0-0.5	3	0.02	N
Carex lasiocarpa (hairy-fruited sedge)	10.0	0-10	2	0.17	N
Carex spp. (sedge)	1.6	0-3	12	0.18	N
Carex tenera (broad-fruited sedge)	0.5	0-0.5	2	0.01	N
Carex utriculata (beaked sedge)	0.5	0-0.5	2	0.01	N
Carex vaginata (sheathed sedge)	4.1	0-10	10	0.41	N
Deschampsia cespitosa (tufted hair grass)	2.4	0-3	7	0.16	N
Elymus innovatus (hairy wild rye)	2.6	0-20	25	0.66	N
Eriophorum brachyantherum (close-sheathed cotton grass)	0.5	0-0.5	2	0.01	N
Juncus balticus (wire rush)	1.8	0-3	3	0.06	N
Oryzopsis asperifolia (white-grained mountain rice grass)	0.5	0-0.5	2	0.01	N
Poa spp. (bluegrass)	0.5	0-0.5	2	0.01	B
Schizachne purpurascens (purple oat grass)	0.5	0-0.5	3	0.02	N
Forbs (N = 76)					
Achillea millefolium (common yarrow)	1.1	0-3	22	0.23	N
Actaea rubra (red and white baneberry)	1.3	0-3	5	0.07	N
Anemone parviflora (small wood anemone)	0.5	0-0.5	3	0.02	N
Anemone richardsonii (yellow anemone)	0.5	0-0.5	2	0.01	N
Arnica cordifolia (heart-leaved arnica)	2.2	0-10	22	0.47	N
Aster ciliolatus (Lindley's aster)	1.1	0-3	20	0.23	N
Aster puniceus (purple-stemmed aster)	3.0	0-3	2	0.05	N
Caltha palustris (marsh-marigold)	0.5	0-0.5	2	0.01	N
Corallorhiza trifida (pale coralroot)	1.8	0-3	3	0.06	N
Cornus canadensis (bunchberry)	5.9	0-20	75	4.43	N
Delphinium glaucum (tall larkspur)	1.3	0-3	5	0.07	N
Epilobium angustifolium (common fireweed)	1.1	0-3	45	0.52	N
Epilobium spp. (willow-herb)	3.0	0-3	2	0.05	N

Table 112. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Equisetum arvense (common horsetail)	7.0	0-40	42	2.90	N
Equisetum fluviatile (swamp horsetail)	6.5	0-10	3	0.22	N
Equisetum pratense (meadow horsetail)	2.0	0-10	13	0.27	N
Equisetum scirpoides (dwarf scouring-rush)	2.9	0-10	23	0.68	N
Equisetum sylvaticum (woodland horsetail)	8.5	0-40	37	3.12	N
Fragaria virginiana (wild strawberry)	1.3	0-3	22	0.27	N
Galium boreale (northern bedstraw)	0.9	0-3	22	0.19	N
Galium labradoricum (Labrador bedstraw)	0.5	0-0.5	2	0.01	N
Galium triflorum (sweet-scented bedstraw)	1.8	0-3	3	0.06	N
Geocaulon lividum (northern bastard toadflax)	0.9	0-3	12	0.10	N
Geum aleppicum (yellow avens)	3.0	0-3	2	0.05	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	3	0.02	N
Geum rivale (purple avens)	1.1	0-3	7	0.08	N
Geum triflorum (three-flowered avens)	0.5	0-0.5	2	0.01	N
Goodyera repens (lesser rattlesnake plantain)	1.3	0-3	5	0.07	N
Gymnocarpium dryopteris (oak fern)	6.5	0-10	3	0.22	N
Habenaria hyperborea (northern green bog orchid)	0.5	0-0.5	3	0.02	N
Habenaria obtusata (blunt-leaved bog orchid)	1.1	0-3	7	0.08	N
Habenaria orbiculata (round-leaved bog orchid)	0.5	0-0.5	3	0.02	N
Hedysarum alpinum (alpine hedysarum)	3.0	0-3	2	0.05	N
Heracleum lanatum (cow parsnip)	3.0	0-3	2	0.05	N
Heuchera cylindrica (sticky alumroot)	0.5	0-0.5	2	0.01	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	5	0.03	N
Lathyrus venosus (purple peavine)	0.5	0-0.5	2	0.01	N
Listera borealis (northern twayblade)	0.5	0-0.5	2	0.01	N
Listera cordata (heart-leaved twayblade)	1.4	0-3	13	0.19	N
Lycopodium annotinum (stiff club-moss)	3.0	0-20	18	0.54	N
Lycopodium clavatum (running club-moss)	3.0	0-3	2	0.05	N
Lycopodium complanatum (ground-cedar)	0.5	0-0.5	3	0.02	N
Lycopodium obscurum (ground-pine)	3.0	0-3	2	0.05	N
Maianthemum canadense (wild lily-of-the-valley)	0.9	0-3	12	0.10	N
Menyanthes trifoliata (buck-bean)	0.5	0-0.5	2	0.01	N
Mertensia paniculata (tall lungwort)	1.2	0-3	30	0.36	N
Mitella nuda (bishop's-cap)	1.1	0-3	37	0.39	N
Moehringia lateriflora (blunt-leaved sandwort)	0.5	0-0.5	2	0.01	N
Moneses uniflora (one-flowered wintergreen)	1.8	0-3	7	0.12	N
Orchis rotundifolia (round-leaved orchid)	3.0	0-3	2	0.05	N
Orthilia secunda (one-sided wintergreen)	0.9	0-3	20	0.18	N
Osmorhiza occidentalis (western sweet cicely)	0.5	0-0.5	3	0.02	N
Osmorhiza purpurea (purple sweet cicely)	0.5	0-0.5	2	0.01	N
Osmorhiza spp. (sweet cicely)	3.0	0-3	2	0.05	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	2	0.01	N
Pedicularis labradorica (Labrador lousewort)	1.8	0-3	3	0.06	N
Petasites palmatus (palmate-leaved coltsfoot)	1.7	0-10	68	1.16	N

Table 112. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Polemonium acutiflorum (tall Jacob's-ladder)	0.5	0-0.5	2	0.01	N
Potentilla palustris (marsh cinquefoil)	6.5	0-10	7	0.43	N
Pyrola asarifolia (common pink wintergreen)	1.9	0-3	12	0.22	N
Pyrola chlorantha (greenish-flowered wintergreen)	1.8	0-3	3	0.06	N
Ranunculus acris (tall buttercup)	0.5	0-0.5	2	0.01	I
Senecio triangularis (brook ragwort)	0.5	0-0.5	3	0.02	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	2	0.01	N
Smilacina trifolia (three-leaved Solomon's-seal)	2.6	0-10	23	0.60	N
Stellaria crispa (wavy-leaved chickweed)	0.5	0-0.5	2	0.01	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1.0	0-3	17	0.17	N
Taraxacum officinale (common dandelion)	0.5	0-0.5	2	0.01	I
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	3	0.02	N
Tiarella trifoliata (laceflower)	3.0	0-3	2	0.05	N
Veratrum eschscholtzii (green false hellebore)	3.0	0-3	2	0.05	N
Veronica americana (American brooklime)	0.5	0-0.5	2	0.01	N
Vicia americana (wild vetch)	0.5	0-0.5	2	0.01	N
Viola adunca (early blue violet)	1.8	0-3	3	0.06	N
Viola renifolia (kidney-leaved violet)	1.0	0-3	8	0.08	N
Zigadenus elegans (white camas)	3.0	0-3	2	0.05	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 113 shows the five most prominent plant species among the four lifeforms for species recorded in all 21 relatively undisturbed late seral to climax stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/

marsh reed grass) habitat type. The tree lifeform is heavily dominated by *Picea mariana* (black spruce), the shrubs are led by *Ledum groenlandicum* (common Labrador tea), and the graminoids by *Calamagrostis canadensis* (marsh reed grass). No other species is more than moderately prominent in these late seral/climax stands of this habitat type.

Table 113. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (number = 21 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea mariana (black spruce)	45.71	Native
Pinus contorta (lodgepole pine)	3.33	Native
Larix laricina (tamarack)	2.26	Native
Picea glauca (white spruce)	0.64	Native
Populus balsamifera (balsam poplar)	0.48	Native
Shrubs		
Ledum groenlandicum (common Labrador tea)	15.07	Native
Vaccinium vitis-idaea (bog cranberry)	4.64	Native
Rubus chamaemorus (cloudberry)	2.48	Native
Salix myrtillifolia (myrtle-leaved willow)	2.38	Native
Salix glauca (smooth willow)	1.43	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	18.10	Native
Carex disperma (two-seeded sedge)	0.57	Native
Carex vaginata (sheathed sedge)	0.50	Native
Calamagrostis stricta (narrow reed grass)	0.48	Native
Carex lasiocarpa (hairy-fruited sedge)	0.48	Native
Forbs		
Equisetum sylvaticum (woodland horsetail)	4.62	Native
Equisetum arvense (common horsetail)	3.74	Native
Cornus canadensis (bunchberry)	2.36	Native
Equisetum scirpoides (dwarf scouring-rush)	1.38	Native
Petasites palmatus (palmate-leaved coltsfoot)	1.12	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 114 through Table 117, break out the vegetation recorded in 21 relatively undisturbed late seral to climax stands sampled of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of

unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, moderately species rich, forested habitat type of major occurrence across the study area.

Table 114 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/ Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type. For the 21 stands comprising the habitat type, the number of unique species was 95 with 93 (97.9 percent) of them being native species.

Table 114. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/ Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (number = 21 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	8	8	0	0
Shrubs	32	30	0	2
Graminoids	11	11	0	0
Forbs	44	44	0	0
TOTAL	***95 (100.0%)***	***93 (97.9%)***	***0 (0.0%)***	***2 (2.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 115 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type. The average number of species per stand is 16.4, with native species comprising 16.2 species per stand or 98.8 percent.

Table 115. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (number = 21 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.2	2.2	0.0	0.0
Shrubs	6.0	5.8	0.0	0.1
Graminoids	2.0	2.0	0.0	0.0
Forbs	6.2	6.2	0.0	0.0
TOTAL	***16.4 (100.0%)***	***16.2 (98.8%)***	***0.0 (0.0%)***	***0.1 (0.6%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 116 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type. The average canopy cover per stand is 128.0 percent, with native species comprising 127.8 percent or 99.9 percent of the total amount of average canopy cover per stand.

Table 116. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (number = 21 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	52.6%	52.6%	0.0%	0.0%
Shrubs	35.3%	35.1%	0.0%	0.2%
Graminoids	21.3%	21.3%	0.0%	0.0%
Forbs	18.8%	18.8%	0.0%	0.0%
TOTAL	***128.0% (100.0%)***	***127.8% (99.9%)***	***0.0% (0.0%)***	***0.2% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 117 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type. The average number of species per stand was 16.4 with an average canopy cover of 128.0 percent.

Table 117. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (number = 21 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.2	52.6%
Shrubs	6.0	35.3%
Graminoids	2.0	21.3%
Forbs	6.2	18.8%
TOTAL	***16.4***	***128.0%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

On the 21 relatively undisturbed late seral to climax stands sampled of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type, eight tree species were recorded, of which only *Picea mariana* (black spruce) was very prominent or occurred on all plots (Table 118). Among the 32 shrubs recorded,

only *Ledum groenlandicum* (common Labrador tea) is very prominent, although *Vaccinium vitis-idaea* (bog cranberry) is moderately prominent, with both species occurring on 90 percent of plots sampled. Of the 11 graminoid species recorded, only *Calamagrostis canadensis* (marsh reed grass) was highly prominent, while among the 44 forbs recorded, none was more than moderately prominent.

Table 118. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (number = 21 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 8)					
Abies balsamea (balsam fir)	0.5	0-0.5	5	0.02	N
Abies lasiocarpa (subalpine fir)	1.8	0-3	10	0.17	N
Larix laricina (tamarack)	5.9	0-20	38	2.26	N
Picea glauca (white spruce)	4.5	0-10	14	0.64	N
Picea mariana (black spruce)	45.7	20-70	100	45.71	N
Pinus contorta (lodgepole pine)	7.0	0-20	48	3.33	N
Populus balsamifera (balsam poplar)	10.0	0-10	5	0.48	N
Populus tremuloides (aspen)	0.5	0-0.5	5	0.02	N
Shrubs (N = 32)					
Alnus crispa (green alder)	1.8	0-3	10	0.17	N
Arctostaphylos uva-ursi (common bearberry)	0.5	0-0.5	5	0.02	N
Betula glandulosa (bog birch)	8.7	0-20	14	1.24	N
Betula pumila (dwarf birch)	7.7	0-10	14	1.10	N
Gaultheria hispidula (creeping snowberry)	1.1	0-3	19	0.21	N
Ledum groenlandicum (common Labrador tea)	16.7	0-40	90	15.07	N
Linnaea borealis (twinflower)	1.8	0-3	57	1.00	N
Lonicera dioica (twining honeysuckle)	0.5	0-0.5	5	0.02	N
Lonicera involucrata (bracted honeysuckle)	2.6	0-10	33	0.86	N
Oxycoccus microcarpus (small bog cranberry)	1.8	0-3	19	0.33	N
Potentilla fruticosa (shrubby cinquefoil)	3.0	0-3	5	0.14	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	5	0.02	N
Ribes spp. (currant)	0.5	0-0.5	5	0.02	B
Ribes triste (wild red currant)	3.0	0-3	5	0.14	N
Rosa acicularis (prickly rose)	2.4	0-10	43	1.02	N
Rubus arcticus (dwarf raspberry)	1.8	0-3	10	0.17	N
Rubus chamaemorus (cloudberry)	6.5	0-10	38	2.48	N
Rubus pedatus (dwarf bramble)	10.0	0-10	5	0.48	N
Rubus pubescens (dewberry)	1.0	0-3	24	0.24	N
Salix barrattiana (Barratt's willow)	3.0	0-3	5	0.14	N
Salix bebbiana (beaked willow)	3.0	0-3	5	0.14	N
Salix glauca (smooth willow)	15.0	0-20	10	1.43	N
Salix myrtillifolia (myrtle-leaved willow)	16.7	0-20	14	2.38	N
Salix pedicellaris (bog willow)	3.0	0-3	5	0.14	N
Salix planifolia (flat-leaved willow)	10.0	0-10	5	0.48	N
Salix prolixa (Mackenzie's willow)	0.5	0-0.5	5	0.02	N

Table 118. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Salix spp. (willow)	1.8	0-3	10	0.17	B
Shepherdia canadensis (Canada buffaloberry)	3.0	0-3	5	0.14	N
Vaccinium caespitosum (dwarf bilberry)	0.5	0-0.5	10	0.05	N
Vaccinium membranaceum (tall bilberry)	0.5	0-0.5	5	0.02	N
Vaccinium myrtilloides (common blueberry)	3.4	0-10	24	0.81	N
Vaccinium vitis-idaea (bog cranberry)	5.1	0-30	90	4.64	N
Graminoids (N = 11)					
Agrostis scabra (rough hair grass)	0.5	0-0.5	5	0.02	N
Calamagrostis canadensis (marsh reed grass)	19.0	0-50	95	18.10	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	5	0.48	N
Carex disperma (two-seeded sedge)	2.4	0-10	24	0.57	N
Carex gynocrates (northern bog sedge)	0.5	0-0.5	5	0.02	N
Carex lasiocarpa (hairy-fruited sedge)	10.0	0-10	5	0.48	N
Carex spp. (sedge)	1.8	0-3	19	0.33	N
Carex tenera (broad-fruited sedge)	0.5	0-0.5	5	0.02	N
Carex vaginata (sheathed sedge)	5.3	0-10	10	0.50	N
Deschampsia cespitosa (tufted hair grass)	2.2	0-3	14	0.31	N
Elymus innovatus (hairy wild rye)	2.4	0-3	19	0.45	N
Forbs (N = 44)					
Achillea millefolium (common yarrow)	1.5	0-3	24	0.36	N
Anemone parviflora (small wood anemone)	0.5	0-0.5	5	0.02	N
Arnica cordifolia (heart-leaved arnica)	1.8	0-3	10	0.17	N
Aster ciliolatus (Lindley's aster)	1.1	0-3	19	0.21	N
Cornus canadensis (bunchberry)	4.1	0-10	57	2.36	N
Epilobium angustifolium (common fireweed)	1.3	0-3	29	0.38	N
Epilobium spp. (willow-herb)	3.0	0-3	5	0.14	N
Equisetum arvense (common horsetail)	7.1	0-30	52	3.74	N
Equisetum fluviatile (swamp horsetail)	3.0	0-3	5	0.14	N
Equisetum pratense (meadow horsetail)	0.5	0-0.5	10	0.05	N
Equisetum scirpoides (dwarf scouring-rush)	5.8	0-10	24	1.38	N
Equisetum sylvaticum (woodland horsetail)	12.1	0-40	38	4.62	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	5	0.02	N
Galium boreale (northern bedstraw)	1.3	0-3	14	0.19	N
Galium labradoricum (Labrador bedstraw)	0.5	0-0.5	5	0.02	N
Geocaulon lividum (northern bastard toadflax)	0.5	0-0.5	14	0.07	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	5	0.02	N
Geum rivale (purple avens)	1.8	0-3	10	0.17	N
Habenaria obtusata (blunt-leaved bog orchid)	0.5	0-0.5	10	0.05	N
Hedysarum alpinum (alpine hedysarum)	3.0	0-3	5	0.14	N
Heuchera cylindrica (sticky alumroot)	0.5	0-0.5	5	0.02	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	5	0.02	N
Listera cordata (heart-leaved twayblade)	0.5	0-0.5	5	0.02	N
Lycopodium complanatum (ground-cedar)	0.5	0-0.5	5	0.02	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	5	0.02	N

Table 118. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Mertensia paniculata (tall lungwort)	0.5	0-0.5	24	0.12	N
Mitella nuda (bishop's-cap)	1.1	0-3	43	0.45	N
Moneses uniflora (one-flowered wintergreen)	0.5	0-0.5	5	0.02	N
Orchis rotundifolia (round-leaved orchid)	3.0	0-3	5	0.14	N
Orthilia secunda (one-sided wintergreen)	0.5	0-0.5	10	0.05	N
Osmorhiza spp. (sweet cicely)	3.0	0-3	5	0.14	N
Pedicularis labradorica (Labrador lousewort)	1.8	0-3	10	0.17	N
Petasites palmatus (palmate-leaved coltsfoot)	1.8	0-10	62	1.12	N
Potentilla palustris (marsh cinquefoil)	10.0	0-10	10	0.95	N
Pyrola asarifolia (common pink wintergreen)	2.2	0-3	14	0.31	N
Pyrola chlorantha (greenish-flowered wintergreen)	0.5	0-0.5	5	0.02	N
Senecio triangularis (brook ragwort)	0.5	0-0.5	5	0.02	N
Smilacina trifolia (three-leaved Solomon's-seal)	2.2	0-10	33	0.74	N
Stellaria crispa (wavy-leaved chickweed)	0.5	0-0.5	5	0.02	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.5	0-0.5	5	0.02	N
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	5	0.02	N
Veronica americana (American brooklime)	0.5	0-0.5	5	0.02	N
Viola adunca (early blue violet)	0.5	0-0.5	5	0.02	N
Viola renifolia (kidney-leaved violet)	0.5	0-0.5	5	0.02	N

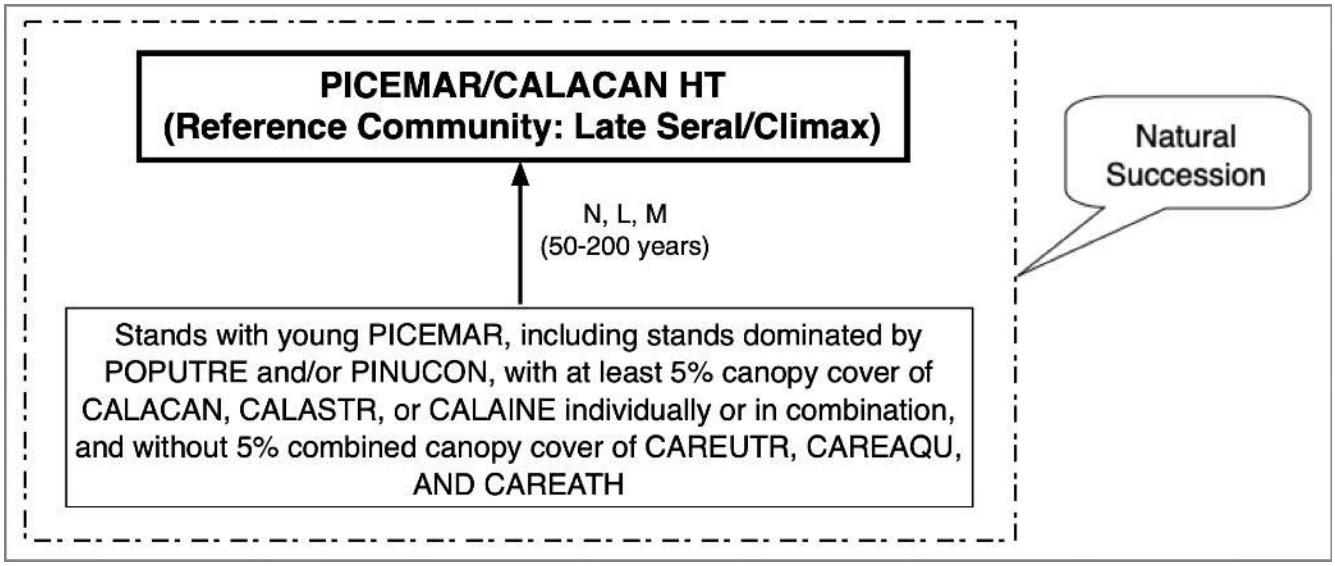
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Most succession in *Picea mariana* (black spruce) communities is set back by fire, but the *Picea mariana/ Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type typically occurs on muskegs, bogs, bottomlands, and relatively dry peatlands that seldom can sustain fire, except during periods of severe drought. After fire, *Picea mariana* (black spruce) establishes from crown-stored seed that disperses from semi-serotinous cones. Large quantities of seeds are released soon after a fire (Fryer 2014). If *Populus balsamifera* (balsam poplar) and/or *Populus tremuloides* (aspen) are in the stand prior to burning, the poplars may dominate the stand for 50 to 80 years after the fire, before the *Picea mariana* (black spruce) can regain dominance (Fryer 2014).

Figure 20 shows a schematic diagram of vegetation successional pathways on sites of the *Picea mariana/ Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type.



Successional Pathway of *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CALACAN—*Calamagrostis canadensis* (marsh reed grass)
CALAINE—*Calamagrostis inexpansa* (northern reed grass)
CALASTR—*Calamagrostis stricta* (narrow reed grass)
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
PICEMAR—*Picea mariana* (black spruce)
PICEMAR/CALACAN HT—*Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type
PINUCON—*Pinus contorta* (lodgepole pine)
POPUTRE—*Populus tremuloides* (aspen)

Figure 20. Successional pathway for sites of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 21 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

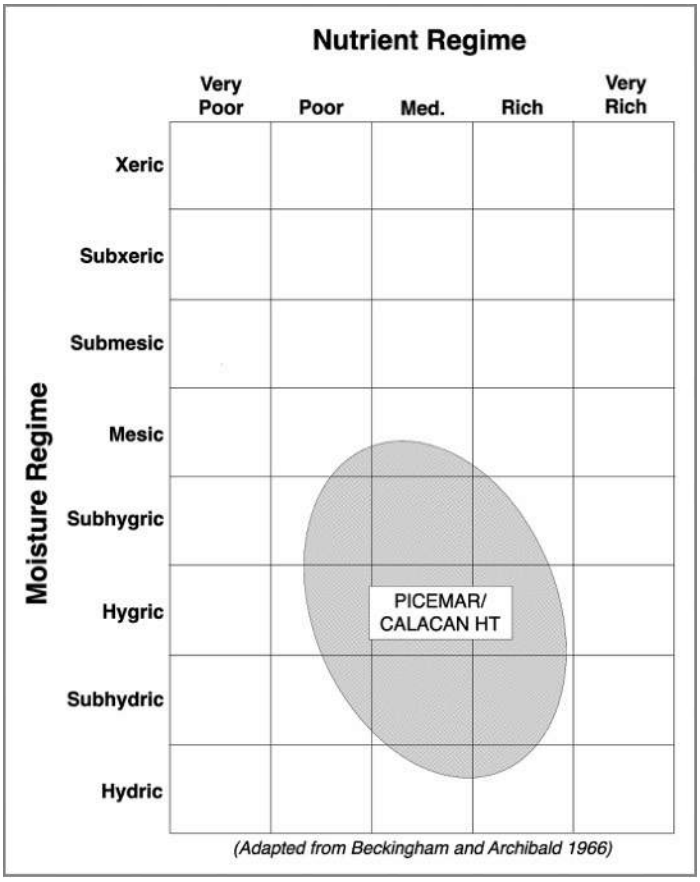


Figure 21. Edatope grid position for the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type (PICEMAR/CALACAN HT)

SOILS

Soils information is currently unavailable for sites supporting the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites are likely to have the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type. Drier adjacent sites may have either the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type or the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Picea mariana* (black spruce)**—*Picea mariana* (black spruce) grows in regions with long, cold winters and short, warm summers (Fryer 2014). It is found primarily in bogs, muskegs, and swampy woods in northern and western Alberta (Tannas 1997a). It occurs on a wide range of sites from wet lowlands and drier uplands on a variety of soils, but is found most commonly on poorly drained sites underlain with permafrost (Fryer 2014). The species is important in other boreal communities, including stands with various mixes pf *Picea glauca* (white spruce), *Pinus contorta* (lodgepole pine), *Populus tremuloides* (aspen), and *Betula papyrifera* (white birch) (Fryer 2014).

The species tolerates a wide range of soil temperature and moisture regimes, growing in relatively warm, dry soils, as well as nearly frozen wet soils that exclude deciduous and most other conifer trees. Substrate moisture varies from saturation in bogs and swamps, wet on bottomlands and flats, wet to moist along lake margins, mesic on north-facing slopes, well-drained on most other slopes, and dry on drained peatlands. *Picea mariana* (black spruce) favors acidic soils, but sometimes grows in calcareous bogs with soil pH as high as 8.0 (Fryer 2014).

Picea mariana (black spruce) is found in all stages of forest succession. It is moderately shade tolerant, and grows in open bogs and woodlands, as well as in closed-canopy forests. Although *Populus tremuloides* (aspen), *Betula papyrifera* (white birch), and shrubs often sprout or colonize after fire in these black spruce stands, the spruce usually regains dominance within 90 years or less post fire (Fryer 2014).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—*Calamagrostis stricta* (narrow reed grass) is common across Alberta, except in the prairies. It occurs farther north than *Calamagrostis inexpansa* (northern reed grass). It grows in swamps, around edges of wetlands, in moist woods, and on many moister upland sites (Tannas 1997a).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) is commonly found in Alberta in swampy, wet, coniferous wooded areas in bogs (especially peat), commonly on acidic, infertile soils and associated with *Picea mariana* (black spruce) and *Larix laricina* (tamarack) (Tannas 1997a). This species is typical of poorly drained habitats in boreal forests, open conifer treed bogs, treeless bogs, wooded swamps, wet barrens, and peatlands throughout its range (Gucker 2006).

The soils typical of *Ledum groenlandicum* (common Labrador tea) habitats are commonly described as moist to wet, acidic, nutrient-poor organics (Gucker 2006). The species is typically present in late seral communities that result from primary succession. However, following disturbances on sites where *Ledum groenlandicum* (common Labrador tea) was established, it often recolonizes the sites rapidly (Gucker 2006).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is found in all natural regions of Alberta, except the Dry Mixedgrass Region. It is the most common tree species at middle and lower altitudes along the

eastern slopes of the Rocky Mountains, forming nearly pure stands on some sites in the foothills and montane areas (Tannas 1997a).

Pinus contorta (lodgepole pine) grows at low to high elevations, in dry to wet conditions, warm to cold temperatures, and on nearly every soil type found in western North America, except on saline sites. The species is not shade tolerant, and grows best on non-calcareous soil. It is primarily an aggressive pioneer on disturbed sites, and fire perpetuates or renews the stands (Anderson 2003). As these pine stands mature, they give way to shade-tolerant conifers at ages from 50 to 100 years in mesic habitats, and 100 to 200 years on warmer and drier sites (Anderson 2003).

Pinus contorta (lodgepole pine) may establish alongside later seral, more shade-tolerant species, and its rapid growth may enable the pines to remain competitive in the canopy for several years. However, these trees do not regenerate under a canopy, and are eliminated from the stand as mortality occurs. The *Pinus contorta* (lodgepole pine) is generally replaced within 50 to 100 years by the more shade-tolerant associates (Anderson 2003).

Livestock

***Picea mariana* (black spruce)**—*Picea mariana* (black spruce) has poor value as forage for both livestock and wild ungulates, although it may occasionally be eaten when better quality forage is absent (Tannas 1997a).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—*Calamagrostis stricta* (narrow reed grass) has moderate nutritional value in early spring, but which declines as the season advances. The forage is most palatable in spring, but is avoided later in the season unless other forage is unavailable (Tannas 1997a). In general, *Calamagrostis* species (reed grass) are mostly palatable and nutritious for livestock and wildlife, but are considered to be of poor quality because their foliage becomes very rough as it matures (Johnson and others 1995). Protein content is 17 percent to 19 percent in spring, but drops to 7 percent by late summer (Tannas 1997a).

***Ledum groenlandicum* (common Labrador tea)**—Forage value of *Ledum groenlandicum* (common Labrador tea) is poor for livestock, and the habitats occupied by it represent marginal rangeland that is seldom used by livestock (Tannas 1997a).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) offers poor forage value, and is seldom eaten by livestock (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Picea mariana* (black spruce)**—The primary use for *Picea mariana* (black spruce) timber is pulpwood. It is also used for Christmas trees and heating fuel (USDA National Resources Conservation Service 2023).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) timber is used extensively for construction lumber, pulpwood, heating fuel, posts and poles, and plywood veneer (USDA National Resources Conservation Service 2023).

Wildlife

***Picea mariana* (black spruce)**—A wide variety of wildlife use *Picea mariana* (black spruce) communities as habitat. Some bird guilds use various post fire successional stages preferentially. Among bird guilds for example, cavity nesters prefer early seral stands, while foliage gleaners generally prefer more mature stands. Most wildlife avoid *Picea mariana* (black spruce) browse, but it provides important winter forage for some species, and many wildlife species consume the seeds (Fryer 2014).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—Elk may make moderate summer use of *Calamagrostis* species (reed grass) (Kufeld 1973).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) forage is used to some extent by wild ungulates, especially deer, but only when other forage is scarce (Tannas 1997a). The species may provide important cover for many wildlife species, as it is a typical component species in many important wildlife habitats (Gucker 2006). The leaves and twigs are browsed by caribou and moose (Anderson 2011).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) also offers poor forage value for wildlife, and is eaten by deer and elk only when better forage is lacking (Tannas 1997a). Stands of the species provide cover for big game animals, upland game birds, small non-game birds, and small mammals (Anderson 2003).

Fisheries

***Calamagrostis stricta* (narrow reed grass)**—The rhizomatous nature of *Calamagrostis* species (reed grass) will help provide bank stability for sites adjacent to streams (Thompson and Hansen 2003).

Fire

***Picea mariana* (black spruce)**—Fire usually kills *Picea mariana* (black spruce), because even mature trees have thin bark and shallow roots. In general, the species is poorly adapted to survive fire, and mortality is usually near 100 percent. Crowning of the fire is common in these stands due to layered fuels, with branches draped with lichens that are easily ignited, causing the fire to carry up through successive dense branches (Fryer 2014).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

***Calamagrostis stricta* (narrow reed grass)**—Fires reducing the abundance of other associated species tend to cause dramatic increase in *Calamagrostis stricta* (narrow reed grass) and other rhizomatous species (Haeussler and Coates 1986).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) underground structures often survive and rapidly sprout after fire. When burned lightly, such that some above ground stem material survives, *Ledum groenlandicum* (common Labrador tea) may sprout from stems, but when completely

top-killed, sprouting occurs from the root crown or rhizomes (Gucker 2006). Provided that a seed source is present, the species' abundant seed production and easily wind-dispersed seed suggests a high likelihood of burned site recolonization (Gucker 2006).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) thrives under the influence of fire, and on many sites fire is required to maintain its dominance. Producing serotinous cones is one adaptation to stand-replacing fire, and the seed supply is nearly always available on the tree (Anderson 2003).

The propensity of *Pinus contorta* (lodgepole pine) to form stands with high seedling density, initial rapid growth that slows with age, high susceptibility to snow breakage and wind-throw, infestation by dwarf-mistletoe and mountain pine beetles, all result in large buildups of fuel (Anderson 2003).

Rehabilitation/Restoration Considerations

***Picea mariana* (black spruce)**—*Picea mariana* (black spruce) is used for revegetating seismic lines, borrow pits, abandoned roads, and construction sites in boreal regions (Fryer 2014).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—Roads and trails should be located on adjacent uplands. *Calamagrostis stricta* (narrow reed grass) propagates by both seeds and rhizomes, making it a valuable species for stabilizing or rehabilitating suitable disturbed sites (Thompson and Hansen 2003).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) may be useful in revegetating disturbed sites, and may be a valuable indicator of contaminated sites and easily reforested sites (Gucker 2006). Plants can be started from seed or root-crown division. Collect seeds from dry capsules and plant them in fall or spring in moist peaty soil in a sunny spot. Water them thoroughly after planting and keep moist. Suckers with roots can be split off from the base of the plant in mid-December and transplanted during spring (Anderson 2011).

Many of the fens and bogs that provide important habitat for *Ledum groenlandicum* (common Labrador tea) in North America were created by glaciation. These wetlands have been disappearing over thousands of years, due to a decrease in native ungulates that graze the bogs, and encroachment by conifers and hardwoods (Anderson 2011).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is often used in reforestation projects, especially for revegetation on sites of mining disturbance. Though it grows well on nutrient poor soils, addition of nitrogen fertilizer will likely enhance growth of the plantings (Anderson 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msd12 Sb/Willow/Sedge (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type has not been described in the region.

Picea mariana/Carex aquatilis Habitat Type
(black spruce/water sedge Habitat Type)

PICEMAR/CAREAQU Habitat Type
Number of Stands = 37 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 37; Other Data Sets = 0)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of sedge species not identified to the species level (approximately 29 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This habitat type is limited to sites that can support both *Picea mariana* (black spruce) and *Carex aquatilis* (water sedge), which coincides with the wetter side of the moisture spectrum of the *Picea mariana* (black spruce) in muskegs, bogs, bottomlands, and peatlands.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 119 shows the five most prominent plant species among the four lifeforms for species recorded in all 37 stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type. Although this sample set contains a mix of late seral, relatively undisturbed stands, along with early seral, disturbed stands; only three species are highly prominent: *Picea mariana* (black spruce) among the trees, *Ledum groenlandicum* (common Labrador tea) among the shrubs, and *Carex aquatilis* (water sedge) among the graminoids. No other species in this habitat type is more than moderately prominent.

Table 119. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (number = 37 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea mariana (black spruce)	29.54	Native
Larix laricina (tamarack)	4.54	Native
Picea glauca (white spruce)	0.82	Native
Pinus contorta (lodgepole pine)	0.70	Native
Shrubs		
Ledum groenlandicum (common Labrador tea)	14.66	Native
Salix myrtillifolia (myrtle-leaved willow)	8.32	Native
Betula pumila (dwarf birch)	6.78	Native
Salix glauca (smooth willow)	2.70	Native
Salix pedicellaris (bog willow)	2.05	Native
Graminoids		
Carex aquatilis (water sedge)	18.38	Native
Calamagrostis canadensis (marsh reed grass)	2.72	Native
*Carex diandr*a (two-stamened sedge)	1.08	Native
Calamagrostis stricta (narrow reed grass)	0.81	Native
Carex utriculata (beaked sedge)	0.81	Native
Forbs		
Equisetum arvense (common horsetail)	5.27	Native
Equisetum fluviatile (swamp horsetail)	3.95	Native
Smilacina trifolia (three-leaved Solomon's-seal)	3.06	Native
Equisetum scirpoides (dwarf scouring-rush)	1.84	Native
Cornus canadensis (bunchberry)	0.85	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 120 through Table 123, break out the vegetation recorded in all 37 stands sampled of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, forested habitat type of minor occurrence across the study area.

Table 120 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type. For the 37 stands comprising the habitat type, the number of unique species was 148 with 144 (97.3 percent) of them being native species.

Table 120. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (number = 37 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	4	4	0	0
Shrubs	43	42	0	1
Graminoids	30	28	1	1
Forbs	71	70	0	1
TOTAL	***148 (100.0%)***	***144 (97.3%)***	***1 (0.7%)***	***3 (2.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 121 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type. The average number of species per stand is 20.7, with native species comprising 20.3 species per stand or 98.1 percent.

Table 121. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (number = 37 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.8	1.8	0.0	0.0
Shrubs	7.1	6.9	0.0	0.2
Graminoids	3.5	3.4	0.1	0.0
Forbs	8.3	8.2	0.0	0.1
TOTAL	***20.7 (100.0%)***	***20.3 (98.1%)***	***0.1 (0.5%)***	***0.3 (1.4%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 122 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type. The average canopy cover per stand is 135.5 percent, with native species comprising 135.0 percent or 99.6 percent of the total amount of average canopy cover per stand.

Table 122. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (number = 37 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	35.6%	35.6%	0.0%	0.0%
Shrubs	48.7%	48.3%	0.0%	0.4%
Graminoids	27.4%	27.4%	0.0%	0.0%
Forbs	23.8%	23.7%	0.0%	0.1%
TOTAL	***135.5% (100.0%)***	***135.0% (99.6%)***	***0.0% (0.0%)***	***0.5% (0.3%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 123 shows the average number of species and average canopy cover by lifeform in stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type. The average number of species per stand was 20.7 with an average canopy cover of 135.5 percent.

Table 123. Average number of species and average canopy cover by lifeform in stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (number = 37 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	1.8	35.6%
Shrubs	7.1	48.7%
Graminoids	3.5	27.4%
Forbs	8.3	23.8%
TOTAL	***20.7***	***135.5%***

Sampled Stands Plant Species List

Four tree species were recorded on the 37 stands sampled of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (Table 124). Most prominent by far of all species recorded is *Picea mariana* (black spruce). Among the 43 shrubs recorded, only *Ledum groenlandicum* (common Labrador tea) is very prominent, occurring on 89 percent of plots, although *Salix myrtillifolia* (myrtle-leaved willow) is also moderately prominent. *Carex aquatilis* (water sedge) is the only highly prominent graminoid in this habitat type, occurring on 36 of the 37 plots sampled. Among the 71 forb species recorded, two horsetails, *Equisetum arvense* (common horsetail) and *Equisetum fluviatile* (swamp horsetail), are most prominent, indicating the hydric character of sites of this habitat type.

Table 124. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (number = 37 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 4)					
Larix laricina (tamarack)	10.5	0-30	43	4.54	N
Picea glauca (white spruce)	10.2	0-20	8	0.82	N
Picea mariana (black spruce)	29.5	3-70	100	29.54	N
Pinus contorta (lodgepole pine)	2.9	0-10	24	0.70	N
Shrubs (N = 43)					
Alnus tenuifolia (river alder)	20.0	0-20	3	0.54	N
Amelanchier alnifolia (Saskatoon)	0.5	0-0.5	3	0.01	N
Andromeda polifolia (bog rosemary)	0.5	0-0.5	5	0.03	N
Arctostaphylos rubra (alpine bearberry)	1.3	0-3	8	0.11	N
Arctostaphylos uva-ursi (common bearberry)	4.5	0-10	8	0.36	N
Betula glandulosa (bog birch)	8.3	0-30	24	2.01	N
Betula pumila (dwarf birch)	11.4	0-30	59	6.78	N
Gaultheria hispidula (creeping snowberry)	1.8	0-3	5	0.09	N
Juniperus horizontalis (creeping juniper)	3.0	0-3	3	0.08	N
Kalmia microphylla (mountain laurel)	10.0	0-10	3	0.27	N
Ledum groenlandicum (common Labrador tea)	16.4	0-60	89	14.66	N
Linnaea borealis (twinflower)	1.8	0-3	38	0.66	N
Lonicera caerulea (fly honeysuckle)	0.5	0-0.5	3	0.01	N
Lonicera dioica (twining honeysuckle)	0.5	0-0.5	5	0.03	N
Lonicera involucrata (bracted honeysuckle)	2.0	0-10	22	0.43	N
Oxycoccus microcarpus (small bog cranberry)	2.4	0-10	49	1.16	N
Potentilla fruticosa (shrubby cinquefoil)	2.4	0-10	24	0.58	N
Ribes hirtellum (wild gooseberry)	1.8	0-3	5	0.09	N
Ribes lacustre (bristly black currant)	0.5	0-0.5	5	0.03	N
Ribes viscosissimum (sticky currant)	0.5	0-0.5	3	0.01	N
Rosa acicularis (prickly rose)	1.2	0-3	30	0.35	N
Rubus arcticus (dwarf raspberry)	1.8	0-10	65	1.18	N
Rubus chamaemorus (cloudberry)	2.2	0-10	19	0.42	N
Rubus pedatus (dwarf bramble)	0.5	0-0.5	3	0.01	N
Rubus pubescens (dewberry)	1.8	0-3	5	0.09	N
Salix arctica (Arctic willow)	0.5	0-0.5	3	0.01	N
Salix athabascensis (Athabasca willow)	0.5	0-0.5	3	0.01	N
Salix bebbiana (beaked willow)	12.6	0-30	14	1.70	N
Salix brachycarpa (short-capsuled willow)	3.0	0-3	3	0.08	N
Salix candida (hoary willow)	6.5	0-10	5	0.35	N
Salix glauca (smooth willow)	25.0	0-30	11	2.70	N
Salix maccalliana (velvet-fruited willow)	1.8	0-3	5	0.09	N
Salix myrtillifolia (myrtle-leaved willow)	14.7	0-40	57	8.32	N
Salix pedicellaris (bog willow)	15.2	0-30	14	2.05	N
Salix planifolia (flat-leaved willow)	14.5	0-40	8	1.18	N
Salix pseudomonticola (false mountain willow)	6.5	0-10	5	0.35	N

Table 124. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Salix serissima (autumn willow)	0.5	0-0.5	3	0.01	N
Salix spp. (willow)	2.2	0-3	16	0.35	B
Shepherdia canadensis (Canada buffaloberry)	0.5	0-0.5	3	0.01	N
Vaccinium caespitosum (dwarf bilberry)	1.3	0-3	8	0.11	N
Vaccinium myrtilloides (common blueberry)	0.5	0-0.5	3	0.01	N
Vaccinium vitis-idaea (bog cranberry)	2.2	0-10	54	1.19	N
Viburnum edule (low-bush cranberry)	1.8	0-3	5	0.09	N
Graminoids (N = 30)					
Agropyron repens (quack grass)	0.5	0-0.5	5	0.03	I
Agropyron spp. (wheat grass)	0.5	0-0.5	3	0.01	B
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	3	0.01	N
Calamagrostis canadensis (marsh reed grass)	10.1	0-20	27	2.72	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	8	0.81	N
Carex aquatilis (water sedge)	18.9	0-30	97	18.38	N
Carex capillaris (hair-like sedge)	0.5	0-0.5	5	0.03	N
Carex chordorrhiza (prostrate sedge)	3.0	0-3	5	0.16	N
Carex concinna (beautiful sedge)	0.5	0-0.5	5	0.03	N
*Carex diandr*a (two-stamened sedge)	20.0	0-30	5	1.08	N
Carex disperma (two-seeded sedge)	1.0	0-3	14	0.14	N
Carex gynocrates (northern bog sedge)	1.5	0-3	27	0.41	N
Carex leptalea (bristle-stalked sedge)	0.5	0-0.5	3	0.01	N
Carex limosa (mud sedge)	1.8	0-3	5	0.09	N
Carex livida (livid sedge)	0.5	0-0.5	3	0.01	N
Carex microptera (small-winged sedge)	4.5	0-10	8	0.36	N
Carex paupercula (bog sedge)	0.5	0-0.5	3	0.01	N
Carex prairea (prairie sedge)	0.5	0-0.5	3	0.01	N
Carex spp. (sedge)	3.3	0-10	16	0.54	N
Carex tenera (broad-fruited sedge)	1.8	0-3	5	0.09	N
Carex utriculata (beaked sedge)	10.0	0-10	8	0.81	N
Carex vaginata (sheathed sedge)	2.6	0-10	19	0.49	N
Deschampsia cespitosa (tufted hair grass)	2.3	0-10	22	0.50	N
Elymus innovatus (hairy wild rye)	0.9	0-3	16	0.15	N
Eriophorum polystachion (narrowleaf cotton grass)	3.0	0-3	3	0.08	N
Glyceria striata (fowl manna grass)	1.8	0-3	5	0.09	N
Juncus balticus (wire rush)	0.5	0-0.5	11	0.05	N
Juncus spp. (rush)	10.0	0-10	3	0.27	N
Muhlenbergia glomerata (bog muhly)	0.5	0-0.5	5	0.03	N
Scirpus spp. (bulrush)	0.5	0-0.5	3	0.01	N
Forbs (N = 71)					
Achillea millefolium (common yarrow)	0.7	0-3	38	0.26	N
Agoseris aurantiaca (orange false dandelion)	3.0	0-3	3	0.08	N
Anemone parviflora (small wood anemone)	3.0	0-3	5	0.16	N
Antennaria pulcherrima (showy everlasting)	0.5	0-0.5	5	0.03	N
Aster borealis (marsh aster)	0.5	0-0.5	3	0.01	N

Table 124. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Aster ciliolatus (Lindley's aster)	1.8	0-3	27	0.47	N
Caltha palustris (marsh-marigold)	3.0	0-3	5	0.16	N
Campanula rotundifolia (harebell)	0.5	0-0.5	5	0.03	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	3	0.01	N
Cornus canadensis (bunchberry)	3.2	0-10	27	0.85	N
Cypripedium passerinum (sparrow's-egg lady's-slipper)	0.5	0-0.5	3	0.01	N
Epilobium angustifolium (common fireweed)	0.7	0-3	32	0.23	N
Equisetum arvense (common horsetail)	8.5	0-40	62	5.27	N
Equisetum fluviatile (swamp horsetail)	24.3	0-50	16	3.95	N
Equisetum hyemale (common scouring-rush)	0.5	0-0.5	3	0.01	N
Equisetum pratense (meadow horsetail)	10.2	0-20	8	0.82	N
Equisetum scirpoides (dwarf scouring-rush)	2.7	0-20	68	1.84	N
Equisetum spp. (horsetail)	0.5	0-0.5	3	0.01	N
Equisetum sylvaticum (woodland horsetail)	5.3	0-10	14	0.72	N
Equisetum variegatum (variegated horsetail)	1.8	0-3	11	0.19	N
Fragaria vesca (woodland strawberry)	0.5	0-0.5	3	0.01	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	16	0.08	N
Galium boreale (northern bedstraw)	1.3	0-3	35	0.45	N
Galium triflorum (sweet-scented bedstraw)	0.5	0-0.5	3	0.01	N
Geocaulon lividum (northern bastard toadflax)	1.0	0-3	14	0.14	N
Geum rivale (purple avens)	3.0	0-3	3	0.08	N
Geum triflorum (three-flowered avens)	0.5	0-0.5	3	0.01	N
Habenaria hyperborea (northern green bog orchid)	1.8	0-3	5	0.09	N
Habenaria obtusata (blunt-leaved bog orchid)	0.5	0-0.5	11	0.05	N
Habenaria orbiculata (round-leaved bog orchid)	0.5	0-0.5	3	0.01	N
Habenaria spp. (bog orchid)	1.3	0-3	8	0.11	B
Habenaria viridis (bracted bog orchid)	0.5	0-0.5	3	0.01	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	3	0.01	N
Listera caurina (western twayblade)	0.5	0-0.5	3	0.01	N
Listera convallarioides (broad-lipped twayblade)	3.0	0-3	3	0.08	N
Listera cordata (heart-leaved twayblade)	3.0	0-3	3	0.08	N
Menyanthes trifoliata (buck-bean)	3.0	0-3	3	0.08	N
Mertensia paniculata (tall lungwort)	1.0	0-3	30	0.28	N
Mitella nuda (bishop's-cap)	1.1	0-3	49	0.51	N
Moneses uniflora (one-flowered wintergreen)	0.5	0-0.5	3	0.01	N
Orchis rotundifolia (round-leaved orchid)	1.3	0-3	8	0.11	N
Orthilia secunda (one-sided wintergreen)	1.3	0-3	8	0.11	N
Parnassia fimbriata (fringed grass-of-parnassus)	0.5	0-0.5	3	0.01	N
Parnassia palustris (northern grass-of-parnassus)	0.5	0-0.5	5	0.03	N
Pedicularis bracteosa (western lousewort)	0.5	0-0.5	3	0.01	N
Pedicularis groenlandica (elephant's-head)	0.8	0-3	22	0.18	N
Pedicularis labradorica (Labrador lousewort)	0.5	0-0.5	5	0.03	N
Petasites palmatus (palmate-leaved coltsfoot)	1.0	0-3	38	0.39	N

Table 124. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Petasites sagittatus (arrow-leaved coltsfoot)	1.8	0-3	16	0.28	N
Pinguicula vulgaris (common butterwort)	0.5	0-0.5	3	0.01	N
Polemonium acutiflorum (tall Jacob's-ladder)	0.5	0-0.5	3	0.01	N
Polygonum viviparum (alpine bistort)	1.3	0-3	8	0.11	N
Potentilla hookeriana (Hooker's cinquefoil)	0.5	0-0.5	3	0.01	N
Potentilla palustris (marsh cinquefoil)	5.8	0-10	14	0.78	N
Pyrola asarifolia (common pink wintergreen)	1.2	0-3	19	0.23	N
Pyrola chlorantha (greenish-flowered wintergreen)	3.0	0-3	3	0.08	N
Senecio foetidus (marsh butterweed)	3.0	0-3	3	0.08	N
Senecio integerrimus (entire-leaved groundsel)	0.5	0-0.5	5	0.03	N
Senecio pauciflorus (few-flowered ragwort)	0.5	0-0.5	5	0.03	N
Senecio triangularis (brook ragwort)	0.5	0-0.5	3	0.01	N
Smilacina stellata (star-flowered Solomon's-seal)	3.0	0-3	3	0.08	N
Smilacina trifolia (three-leaved Solomon's-seal)	4.3	0-20	73	3.16	N
Solidago multiradiata (alpine goldenrod)	10.0	0-10	3	0.27	N
Solidago spp. (goldenrod)	3.0	0-3	3	0.08	N
Spiranthes romanzoffiana (hooded ladies'-tresses)	1.3	0-3	8	0.11	N
Stellaria longifolia (long-leaved chickweed)	3.0	0-3	3	0.08	N
Tofieldia glutinosa (sticky false asphodel)	0.5	0-0.5	5	0.03	N
Triglochin maritima (seaside arrow-grass)	3.0	0-3	3	0.08	N
Valeriana dioica (northern valerian)	0.5	0-0.5	3	0.01	N
Viola renifolia (kidney-leaved violet)	1.8	0-3	5	0.09	N
Zigadenus elegans (white camas)	0.5	0-0.5	3	0.01	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 125 shows the five most prominent plant species among the four lifeforms for species recorded in all 12 relatively undisturbed late seral to climax stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type. In these later seral stands, only three species are highly prominent: *Picea mariana* (black spruce) among the trees, *Ledum groenlandicum* (common Labrador tea) among the shrubs, and *Carex aquatilis* (water sedge) among the graminoids. No other species in this habitat type is more than moderately prominent.

Table 125. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (number = 12 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea mariana (black spruce)	40.00	Native
Larix laricina (tamarack)	1.96	Native
Pinus contorta (lodgepole pine)	0.17	Native
Shrubs		
Ledum groenlandicum (common Labrador tea)	19.58	Native
Salix myrtillifolia (myrtle-leaved willow)	6.92	Native
Betula pumila (dwarf birch)	3.88	Native
Alnus tenuifolia (river alder)	1.67	Native
Vaccinium vitis-idaea (bog cranberry)	0.92	Native
Graminoids		
Carex aquatilis (water sedge)	19.17	Native
Calamagrostis canadensis (marsh reed grass)	0.83	Native
Calamagrostis stricta (narrow reed grass)	0.83	Native
Carex disperma (two-seeded sedge)	0.29	Native
Carex spp. (sedge)	0.29	Native
Forbs		
Equisetum arvense (common horsetail)	9.17	Native
Equisetum fluviatile (swamp horsetail)	4.17	Native
Smilacina trifolia (three-leaved Solomon's-seal)	3.75	Native
Equisetum scirpoides (dwarf scouring-rush)	3.42	Native
Cornus canadensis (bunchberry)	1.17	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 126 through Table 129, break out the vegetation recorded in 12 relatively undisturbed late seral to climax stands sampled of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy

cover in each group. This is a fairly common, moderately species rich, forested habitat type of minor occurrence across the study area.

Table 126 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/ Carex aquatilis* (black spruce/water sedge) habitat type. For the 12 stands comprising the habitat type, the number of unique species was 78 with 76 (97.4 percent) of them being native species.

Table 126. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (number = 12 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3	3	0	0
Shrubs	23	22	0	1
Graminoids	15	14	0	1
Forbs	37	37	0	0
TOTAL	***78 (100.0%)***	***76 (97.4%)***	***0 (0.0%)***	***2 (2.6%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 127 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type. The average number of species per stand is 17.5, with native species comprising 17.1 species per stand or 97.7 percent.

Table 127. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (number = 12 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.7	1.7	0.0	0.0
Shrubs	5.7	5.4	0.0	0.3
Graminoids	2.4	2.3	0.0	0.1
Forbs	7.7	7.7	0.0	0.0
TOTAL	***17.5 (100.0%)***	***17.1 (97.7%)***	***0.0 (0.0%)***	***0.4 (2.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 128 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type. The average canopy cover per stand is 131.0 percent, with native species comprising 130.5 percent or 99.6 percent of the total amount of average canopy cover per stand.

Table 128. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (number = 12 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	42.1%	42.1%	0.0%	0.0%
Shrubs	37.6%	37.0%	0.0%	0.5%
Graminoids	22.5%	22.5%	0.0%	0.0%
Forbs	28.8%	28.8%	0.0%	0.0%
TOTAL	***131.0% (100.0%)***	***130.5% (99.6%)***	***0.0% (0.0%)***	***0.6% (0.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 129 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type. The average number of species per stand was 17.5 with an average canopy cover of 131.0 percent.

Table 129. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (number = 12 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	1.7	42.1%
Shrubs	5.7	37.6%
Graminoids	2.4	22.5%
Forbs	7.7	28.8%
TOTAL	***17.5***	***131.0%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

Three tree species were recorded on the 12 relatively undisturbed late seral to climax stands sampled of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (Table 130). Most prominent by far is the *Picea mariana* (black spruce). Among the 23 shrubs recorded, only *Ledum groenlandicum* (common Labrador tea) is very prominent, occurring on 100 percent of plots, although *Salix myrtillifolia* (myrtle-leaved willow) is also moderately prominent. *Carex aquatilis* (water sedge) is the only highly prominent graminoid in this habitat type,

occurring on all plots sampled. Among the 37 forb species recorded, two horsetails, *Equisetum arvense* (common horsetail) and *Equisetum fluviatile* (swamp horsetail), are most prominent, indicating the hydric character of sites with the habitat type.

Table 130. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (number = 12 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 3)					
Larix laricina (tamarack)	5.9	0-10	33	1.96	N
Picea mariana (black spruce)	40.0	30-70	100	40.00	N
Pinus contorta (lodgepole pine)	0.5	0-0.5	33	0.17	N
Shrubs (N = 23)					
Alnus tenuifolia (river alder)	20.0	0-20	8	1.67	N
Arctostaphylos rubra (alpine bearberry)	1.8	0-3	17	0.29	N
Betula glandulosa (bog birch)	0.5	0-0.5	8	0.04	N
Betula pumila (dwarf birch)	9.3	0-20	42	3.88	N
Ledum groenlandicum (common Labrador tea)	19.6	3-60	100	19.58	N
Linnaea borealis (twinflower)	1.8	0-3	17	0.29	N
Lonicera dioica (twining honeysuckle)	0.5	0-0.5	8	0.04	N
Lonicera involucrata (bracted honeysuckle)	0.5	0-0.5	8	0.04	N
Oxycoccus microcarpus (small bog cranberry)	1.8	0-3	33	0.58	N
Potentilla fruticosa (shrubby cinquefoil)	0.5	0-0.5	17	0.08	N
Ribes hirtellum (wild gooseberry)	0.5	0-0.5	8	0.04	N
Rosa acicularis (prickly rose)	1.8	0-3	33	0.58	N
Rubus arcticus (dwarf raspberry)	1.2	0-3	58	0.71	N
Rubus chamaemorus (cloudberry)	0.5	0-0.5	17	0.08	N
Rubus pubescens (dewberry)	0.5	0-0.5	8	0.04	N
Salix arctica (Arctic willow)	0.5	0-0.5	8	0.04	N
Salix bebbiana (beaked willow)	10.0	0-10	8	0.83	N
Salix maccalliana (velvet-fruited willow)	0.5	0-0.5	8	0.04	N
Salix myrtillifolia (myrtle-leaved willow)	13.8	0-30	50	6.92	N
Salix spp. (willow)	2.2	0-3	25	0.54	B
Vaccinium caespitosum (dwarf bilberry)	1.8	0-3	17	0.29	N
Vaccinium myrtilloides (common blueberry)	0.5	0-0.5	8	0.04	N
Vaccinium vitis-idaea (bog cranberry)	1.6	0-3	58	0.92	N
Graminoids (N = 15)					
Agropyron spp. (wheat grass)	0.5	0-0.5	8	0.04	B
Calamagrostis canadensis (marsh reed grass)	10.0	0-10	8	0.83	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	8	0.83	N
Carex aquatilis (water sedge)	19.2	10-30	100	19.17	N
Carex capillaris (hair-like sedge)	0.5	0-0.5	8	0.04	N
Carex concinna (beautiful sedge)	0.5	0-0.5	17	0.08	N
Carex disperma (two-seeded sedge)	1.8	0-3	17	0.29	N
Carex gynocrates (northern bog sedge)	0.5	0-0.5	8	0.04	N
Carex limosa (mud sedge)	0.5	0-0.5	8	0.04	N

Table 130. (cont.)

Species	Percent Canopy Cover Average	Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex spp. (sedge)	1.8	0-3	17	0.29	N
Carex vaginata (sheathed sedge)	3.0	0-3	8	0.25	N
Deschampsia cespitosa (tufted hair grass)	3.0	0-3	8	0.25	N
Elymus innovatus (hairy wild rye)	0.5	0-0.5	8	0.04	N
Glyceria striata (fowl manna grass)	3.0	0-3	8	0.25	N
Scirpus spp. (bulrush)	0.5	0-0.5	8	0.04	N
Forbs (N = 37)					
Achillea millefolium (common yarrow)	0.5	0-0.5	17	0.08	N
Aster borealis (marsh aster)	0.5	0-0.5	8	0.04	N
Aster ciliolatus (Lindley's aster)	3.0	0-3	25	0.75	N
Caltha palustris (marsh-marigold)	3.0	0-3	8	0.25	N
Cornus canadensis (bunchberry)	3.5	0-10	33	1.17	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	33	0.17	N
Equisetum arvense (common horsetail)	11.0	0-30	83	9.17	N
Equisetum fluviatile (swamp horsetail)	50.0	0-50	8	4.17	N
Equisetum hyemale (common scouring-rush)	0.5	0-0.5	8	0.04	N
Equisetum pratense (meadow horsetail)	10.0	0-10	8	0.83	N
Equisetum scirpoides (dwarf scouring-rush)	4.1	0-10	83	3.42	N
Equisetum spp. (horsetail)	0.5	0-0.5	8	0.04	N
Equisetum sylvaticum (woodland horsetail)	2.2	0-3	25	0.54	N
Fragaria vesca (woodland strawberry)	0.5	0-0.5	8	0.04	N
Galium boreale (northern bedstraw)	0.5	0-0.5	50	0.25	N
Geocaulon lividum (northern bastard toadflax)	0.5	0-0.5	17	0.08	N
Habenaria obtusata (blunt-leaved bog orchid)	0.5	0-0.5	17	0.08	N
Habenaria viridis (bracted bog orchid)	0.5	0-0.5	8	0.04	N
Listera caurina (western twayblade)	0.5	0-0.5	8	0.04	N
Listera convallarioides (broad-lipped twayblade)	3.0	0-3	8	0.25	N
Listera cordata (heart-leaved twayblade)	3.0	0-3	8	0.25	N
Mertensia paniculata (tall lungwort)	1.1	0-3	33	0.37	N
Mitella nuda (bishop's-cap)	1.0	0-3	42	0.42	N
Orthilia secunda (one-sided wintergreen)	0.5	0-0.5	8	0.04	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	8	0.04	N
Pedicularis labradorica (Labrador lousewort)	0.5	0-0.5	8	0.04	N
Petasites palmatus (palmate-leaved coltsfoot)	0.9	0-3	50	0.46	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	8	0.04	N
Potentilla palustris (marsh cinquefoil)	3.0	0-3	8	0.25	N
Senecio foetidus (marsh butterweed)	3.0	0-3	8	0.25	N
Senecio integerrimus (entire-leaved groundsel)	0.5	0-0.5	8	0.04	N
Smilacina stellata (star-flowered Solomon's-seal)	3.0	0-3	8	0.25	N
Smilacina trifolia (three-leaved Solomon's-seal)	5.6	0-20	67	3.75	N
Solidago multiradiata (alpine goldenrod)	10.0	0-10	8	0.83	N
Spiranthes romanzoffiana (hooded ladies'-tresses)	0.5	0-0.5	8	0.04	N
Valeriana dioica (northern valerian)	0.5	0-0.5	8	0.04	N

Table 130. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Viola renifolia (kidney-leaved violet)	3.0	0-3	8	0.25	N

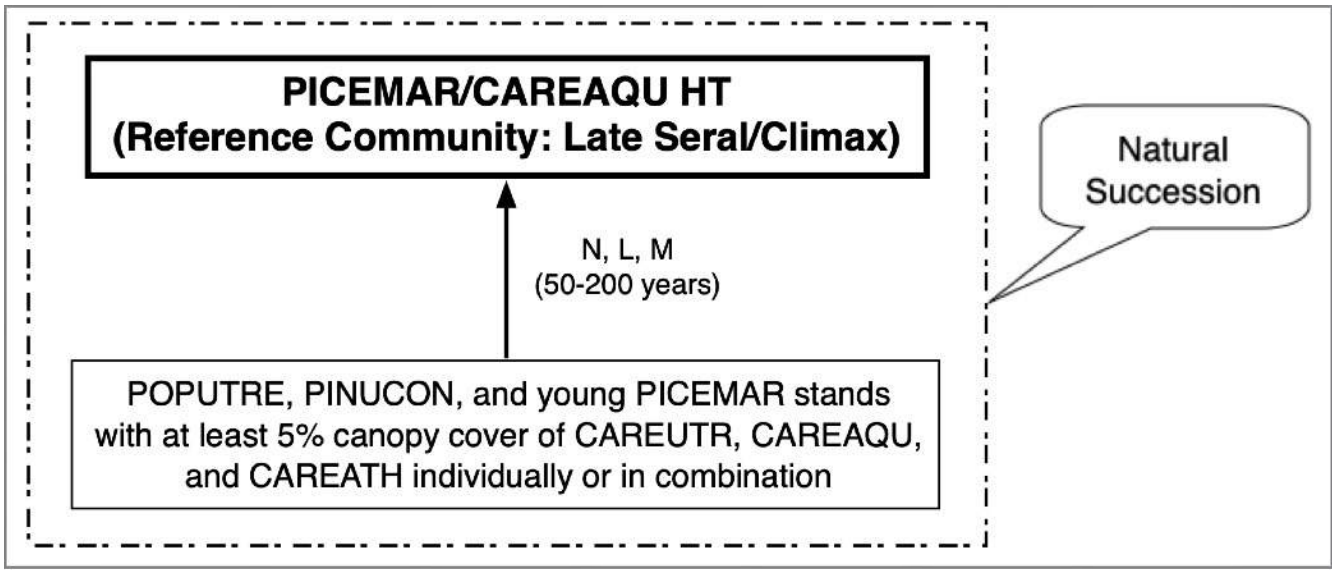
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Most succession in *Picea mariana* (black spruce) communities is set back by fire, but the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type typically occurs on muskegs, bogs, bottomlands, and relatively dry peatlands that seldom can sustain fire, except during periods of severe drought. After fire, *Picea mariana* (black spruce) establishes from crown-stored seed that disperses from semi-serotinous cones. Large quantities of seeds are released soon after a fire (Fryer 2014). If *Populus balsamifera* (balsam poplar) and/or *Populus tremuloides* (aspen) are in the stand prior to burning, the poplars may dominate the stand for 50 to 80 years after the fire, before the *Picea mariana* (black spruce) can regain dominance (Fryer 2014).

Figure 22 shows a schematic diagram of vegetation successional pathways on sites of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type.



Successional Pathway of *Picea mariana/Carex aquatilis* (black spruce/water sedge)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
PICEMAR—*Picea mariana* (black spruce)
PICEMAR/CAREAQU HT—*Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type
PINUCON—*Pinus contorta* (lodgepole pine)
POPUTRE—*Populus tremuloides* (aspen)

Figure 22. Successional pathway for sites of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 23 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

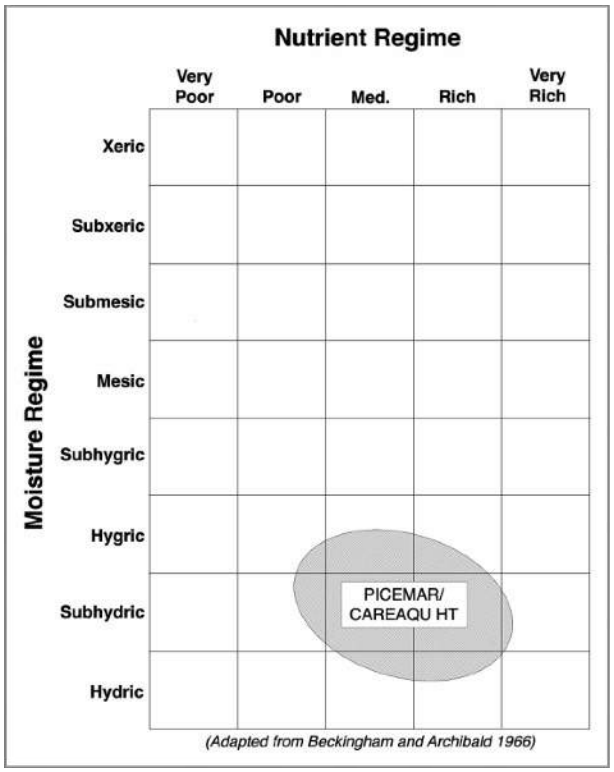


Figure 23. Edatope grid position for the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type (PICEMAR/CAREAQU HT)

SOILS

Parent material on sites supporting the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type is mostly morainal and undifferentiated organic. Soil drainage ranges from poorly drained to very poorly drained. Soil subgroups may include mesisols, humisols, and gleysols. Soil texture mostly ranges from fibric to mesic, and organic layer thickness may exceed 80 cm (France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites are likely to be dominated by *Alnus* (alder) species, *Betula* (birch) shrub species, *Salix* (willow) species, or *Carex* (sedge) species, often in a bog or fen setting. Drier adjacent sites are likely to have either the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type or the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Picea mariana* (black spruce)**—*Picea mariana* (black spruce) grows in regions with long, cold winters and short, warm summers (Fryer 2014). It is found primarily in bogs, muskegs, and swampy woods in northern and western Alberta (Tannas 1997a). It occurs on a wide range of sites from wet lowlands and drier uplands on a variety of soils, but is found most commonly on poorly drained sites underlain with permafrost (Fryer 2014). The species is important in other boreal communities, including stands with various mixes pf *Picea glauca* (white spruce), *Pinus contorta* (lodgepole pine), *Populus tremuloides* (aspen), and *Betula papyrifera* (white birch) (Fryer 2014).

The species tolerates a wide range of soil temperature and moisture regimes, growing in relatively warm, dry soils, as well as nearly frozen wet soils that exclude deciduous and most other conifer trees. Substrate moisture varies from saturation in bogs and swamps, wet on bottomlands and flats, wet to moist along lake margins, mesic on north-facing slopes, well-drained on most other slopes, and dry on drained peatlands. *Picea mariana* (black spruce) favors acidic soils, but sometimes grows in calcareous bogs with soil pH as high as 8.0 (Fryer 2014).

Picea mariana (black spruce) is found in all stages of forest succession. It is moderately shade tolerant, and grows in open bogs and woodlands, as well as in closed-canopy forests. Although *Populus tremuloides* (aspen), *Betula papyrifera* (white birch), and shrubs often sprout or colonize after fire in these black spruce stands, the spruce usually regains dominance within 90 years or less post fire (Fryer 2014).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is very common and widely distributed across Alberta (Tannas 1997a). It is a wetland species, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). *Carex aquatilis* (water sedge) is a native, wetland obligate, long-lived perennial. It is a sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of finer roots (Hauser 2006). It thrives on disturbed sites, is shade intolerant, and occurs in various stages of seral succession (Hauser 2006).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is common and widely distributed across Alberta. It is a wetland obligate, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). It is a long-lived perennial sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of fine roots (Johnson and others 1995).

Carex utriculata (beaked sedge) is strongly rhizomatous and colonial, typically forming a dense sod. Creeping rhizomes are long, slender or stout, and deep-seated. It grows on sites with high soil moisture, typically with the water table at or above the soil surface during the growing season. This is one of our wettest sedges. On some sites, water tables are above the soil surface all year, and rarely drop below the rooting zone. The species occurs on a range of soil types, with textures from silt loams or silty clays to loamy sands (Anderson 2008).

Carex utriculata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates with continually high water tables and persists indefinitely to form climax communities (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) is very common and widely distributed across Alberta (Tannas 1997a). The species is a wetland obligate, growing along slough margins, shorelines, in marshes, and wet meadows, often in standing water (Tannas 1997a). It is a long-lived perennial with moderate tolerance for drought, while tolerance is low for salinity, acidity, and shade. It does best on clay to clay loam soils (Hardy BBT Limited 1989).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) is commonly found in Alberta in swampy, wet, coniferous wooded areas in bogs (especially peat), commonly on acidic, infertile soils and associated with *Picea mariana* (black spruce) and *Larix laricina* (tamarack) (Tannas 1997a). This species is typical of poorly drained habitats in boreal forests, open conifer treed bogs, treeless bogs, wooded swamps, wet barrens, and peatlands throughout its range (Gucker 2006).
The soils typical of *Ledum groenlandicum* (common Labrador tea) habitats are commonly described as moist to wet, acidic, nutrient-poor organics (Gucker 2006). The species is typically present in late seral communities that result from primary succession. However, following disturbances on sites where *Ledum groenlandicum* (common Labrador tea) was established, it often recolonizes the sites rapidly (Gucker 2006).

Livestock
***Picea mariana* (black spruce)**—*Picea mariana* (black spruce) has poor value as forage for both livestock and wild ungulates, although it may occasionally be eaten when better quality forage is absent (Tannas 1997a).

***Carex aquatilis* (water sedge)**—The livestock forage value of *Carex aquatilis* (water sedge) is rated as good (Tannas 1997a), but varies with region, season, and previous grazing use. On narrow riparian or wetland sites within large pastures, *Carex* species (sedges) are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur. In general, *Carex* species (sedges) should respond satisfactorily to traditional grazing systems. However, on streamside sites ample residual cover should be left to protect the soil surface and trap sediments during fall rains or spring runoff. Removing cattle for at least 30 days from these streamside sites for sedge regrowth at the end of the growing season should provide sufficient residual cover (Myers 1989).

Given that *Carex aquatilis* (water sedge) grows in wet places, it is generally not grazed until late summer and fall when soils have dried (Hauser 2006). Very wet soils may deter animal use until they dry. However, if high level of grazing does occur, there will be a marked decrease in *Carex aquatilis* (water sedge) and an increase in the less palatable *Juncus balticus* (wire rush) (Tannas 1997a).

***Carex utriculata* (beaked sedge)**—Livestock forage value of *Carex utriculata* (beaked sedge) is high (Tannas 1997a, Beckingham 1991). The species is palatable in the spring, but palatability declines as the plants become coarse and tough in summer (Tannas 1997a, Hansen and others 1988). Relative palatability may then increase again in fall as the sedge cures and upland forage is less attractive. *Carex utriculata* (beaked sedge) cover decreases in response to high levels of grazing pressure, and will be replaced with less productive and less palatable species, such as *Juncus balticus* (wire rush) and *Poa* species (bluegrass) (Thompson and Hansen 2003).

In general, *Carex* species (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites, residual cover should be left to protect the banks and the soil surface, and to filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days should provide time for sufficient residual cover regrowth on streamside riparian sites (Myers 1989).

***Carex atherodes* (awned sedge)**—Livestock forage value of *Carex atherodes* (awned sedge) is high (Tannas 1997a, Beckingham 1991). *Carex atherodes* (awned sedge) provides good protein and a balance of other nutritional elements, while remaining palatable during the late season when upland forage is less palatable (Tannas 1997a, Hansen and others 1988). In general, *Carex* (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites residual cover should be left to protect the soil surface and filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days for sedge regrowth should provide sufficient residual cover on streamside riparian sites (Myers 1989).

Very wet soils may deter animal use until they dry, allowing the most palatable species to replenish their carbohydrate reserves and to persist in these communities. However, if high levels of grazing do occur, there will be a marked decrease in *Carex atherodes* (awned sedge) with an increase in less palatable species, such as *Juncus balticus* (wire rush). *Carex atherodes* (awned sedge) has medium palatability and medium tolerance for livestock use. Its chemical composition is similar to that of meadow grasses, upland short grass, and mixed prairie species. Seasonal declines in crude protein, phosphorous and carotene were also similar to that of native upland grasses (Hardy BBT Limited 1989).

***Ledum groenlandicum* (common Labrador tea)**—Forage value of *Ledum groenlandicum* (common Labrador tea) is poor for livestock, and the habitats occupied by it represent marginal rangeland that is seldom used by livestock (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Picea mariana* (black spruce)**—The primary use for *Picea mariana* (black spruce) timber is pulpwood. It is also used for Christmas trees and heating fuel (USDA National Resources Conservation Service 2023).

Wildlife

***Picea mariana* (black spruce)**—A wide variety of wildlife use *Picea mariana* (black spruce) communities as habitat. Some bird guilds use various post fire successional stages preferentially. Among bird guilds for example, cavity nesters prefer early seral stands, while foliage gleaners generally prefer more mature stands. Most wildlife avoid *Picea mariana* (black spruce) browse, but it provides important winter forage for some species, and many wildlife species consume the seeds (Fryer 2014).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is grazed by many ungulates, including moose, caribou, and elk, but it is not a major component of their diet. Due to the saturated habitat of the species, grazing by most ungulates is limited. *Carex aquatilis* (water sedge) habitat provides nesting and hiding cover for some birds, waterfowl, and small mammals. In riparian and wetland sites, The species is also an important source of food for a variety of waterfowl (Hauser 2006).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is grazed by moose, elk, mule deer, bison, grizzly bears, and sandhill cranes (Anderson 2008). The species is an important component of valuable breeding and feeding grounds for geese and other waterfowl. Birds commonly associated with *Carex utriculata* (beaked

sedge) habitats include mallard, green-winged teal, common yellowthroat, red-winged black bird, song sparrow, and tree swallow. *Carex utriculata* (beaked sedge) stands are usually more important as feeding grounds than as nesting grounds because of their low stature, lack of structural diversity, and high water levels. Elk and moose often graze *Carex utriculata* (beaked sedge) stands when *Carex atherodes* (awned sedge) is present (Anderson 2008).

***Carex atherodes* (awned sedge)**—Wetland sedge species, such as *Carex atherodes* (awned sedge) are an important component of valuable nesting and feeding grounds for geese and other waterfowl. These stands of prolific seed producing species are usually more important as feeding grounds than as nesting grounds because of their low stature, high water level, and lack of structural diversity (Thompson and Hansen 2003).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) forage is used to some extent by wild ungulates, especially deer, but only when other forage is scarce (Tannas 1997a). The species may provide important cover for many wildlife species, as it is a typical component species in many important wildlife habitats (Gucker 2006). The leaves and twigs are browsed by caribou and moose (Anderson 2011).

Fisheries

***Carex aquatilis* (water sedge)**—Stands of *Carex aquatilis* (water sedge) often are adjacent to streams supporting trout fisheries. The combined tufted and rhizomatous growth habit of the species effectively stabilizes streambanks. Overhanging *Carex* species (sedges) along the banks provide valuable resting cover and shade for fish (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—The dense network of roots of the rhizomatous *Carex utriculata* (beaked sedge) is very effective in binding soil and stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish (Thompson and Hansen 2003).

***Carex atherodes* (awned sedge)**—Stands of *Carex atherodes* (awned sedge) are found more frequently in lentic situations around depressional wetlands, sloughs, potholes, wet meadows, and fens where fish habitat is not at issue (Thompson and Hansen 2003).

Fire

***Picea mariana* (black spruce)**—Fire usually kills *Picea mariana* (black spruce), because even mature trees have thin bark and shallow roots. In general, the species is poorly adapted to survive fire, and mortality is usually near 100 percent. Crowning of the fire is common in these stands due to layered fuels, with branches draped with lichens that are easily ignited, causing the fire to carry up through successive dense branches (Fryer 2014).

***Carex aquatilis* (water sedge)**—Sites supporting stands of *Carex aquatilis* (water sedge) seldom burn, except in periods of severe drought. When stands of the species do burn, the plants are usually top-killed by the fire and soon re-establish after the fire by seed and/or lateral spread of surviving rhizomes (Hauser 2006). The rhizomes are approximately 5 cm below the ground surface, and are somewhat protected from the heat. The wet habitat also provides protection for roots and rhizomes, although the better-drained areas are more susceptible to fires during dry periods.

Stands of *Carex aquatilis* (water sedge) are suited to prescribed fire, but exclusion of livestock during the year prior to burning is necessary. Residual cover burns well in spring, prior to the growing season. Fire will reduce litter accumulations and temporarily increase productivity. However, species composition in the community will not drastically shift from dominance by *Carex aquatilis* (water sedge) (DeBenedetti and Parsons 1984). Care must

be taken in burning along streambanks, so as to avoid impairing the excellent erosion protection provided by the species (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—Sites supporting stands of *Carex utriculata* (beaked sedge) are very wet, except at times of severe drought, and therefore they seldom burn. However, *Carex utriculata* (beaked sedge) sprouts from rhizomes, so it is often able to survive after being top-killed by fire. However, peat soils, common in these communities, can burn when dry, and the heat from such fires can penetrate the soil, destroying the sedge rhizomes. It is necessary that livestock be excluded during the year prior to burning. Caution should be used with fires along streams because of the excellent erosion protection *Carex utriculata* (beaked sedge) provides. Fires do little to change plant composition of beaked sedge communities (DeBenedetti and Parsons 1984). Fire may regress seral succession in treed or shrubby fen stands back to open sedge meadows that support little woody vegetation (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) grows on wet sites that seldom dry out enough to carry fire, but the species is adapted to light intensity fire. Residual cover should burn well in early spring, prior to the growing season. Burning will reduce litter accumulations and temporarily increase productivity (Hansen and others 1988), but care should be taken with burning to avoid damage to the excellent soil erosion protection this species provides. Under drought conditions, there is danger of burning the soil peat layer and damaging the roots (Thompson and Hansen 2003).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) underground structures often survive and rapidly sprout after fire. When burned lightly, such that some above ground stem material survives, *Ledum groenlandicum* (common Labrador tea) may sprout from stems, but when completely top-killed, sprouting occurs from the root crown or rhizomes (Gucker 2006). Provided that a seed source is present, the species' abundant seed production and easily wind-dispersed seed suggests a high likelihood of burned site recolonization (Gucker 2006).

Rehabilitation/Restoration Considerations

***Picea mariana* (black spruce)**—*Picea mariana* (black spruce) is used for revegetating seismic lines, borrow pits, abandoned roads, and construction sites in boreal regions (Fryer 2014).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) provides excellent erosion protection along streambanks, buffering against the erosive force of flood events, and filtering sediments during spring flows. Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex aquatilis* (water sedge) tends to form a dense, thick sod that is highly resistant to erosion. (Hauser 2006).

***Carex utriculata* (beaked sedge)**—Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex utriculata* (beaked sedge) has a dense network of rhizomatous roots and forms a thick sod that is highly resistant to erosion and effective in stabilizing streambanks (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) rates high in value for erosion control, and high for its persistence, once established on a site (Hardy BBT Limited 1989). Generally, due to their stronger rhizomatous roots, *Carex* species (sedges) offer better streambank protection than grasses. *Carex atherodes* (awned sedge) forms a dense, thick sod highly resistant to erosion. Along streambanks, the sod may overhang the bank and sag into the water, providing additional protection from erosion (Thompson and Hansen 2003).

Carex atherodes (awned sedge) is suited for long-term revegetation of disturbed sites and erosion control on sites with a high water table. The species can rapidly re-colonize disturbed sites by seed and rhizome extension. Its rhizomes form a dense network effective in stabilizing streambanks and preventing soil erosion (Thompson and Hansen 2003).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) may be useful in revegetating disturbed sites, and may be a valuable indicator of contaminated sites and easily reforested sites (Gucker 2006). Plants can be started from seed or root-crown division. Collect seeds from dry capsules and plant them in fall or spring in moist peaty soil in a sunny spot. Water them thoroughly after planting and keep moist. Suckers with roots can be split off from the base of the plant in mid-December and transplanted during spring (Anderson 2011).

Many of the fens and bogs that provide important habitat for *Ledum groenlandicum* (common Labrador tea) in North America were created by glaciation. These wetlands have been disappearing over thousands of years, due to a decrease in native ungulates that graze the bogs, and encroachment by conifers and hardwoods (Anderson 2011).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- J20. Black spruce-Larch/sedge/moss

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Bog birch-Willow/Sedge/Peat moss
- Sb/Labrador tea-Cloudberry/Peat moss
- Sb-Lt/Bog birch/Sedge/Peat moss
- Sb-Lt/Bog birch-Willow/Sedge/Golden moss

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Sb/Bog birch/Sedge
- Sb/Willow/Sedge

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Mse23 Sb/Bog birch/Sedge (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type has not been described in the region.

Picea mariana/Ledum groenlandicum Habitat Type
(black spruce/common Labrador tea Habitat Type)

PICEMAR/LEDUGRO Habitat Type
Number of Stands = 75 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 75; Other Data Sets = 0)

LOCATION AND ASSOCIATED LANDFORMS

The *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type is a major type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This habitat type is limited to sites that can support both *Picea mariana* (black spruce) and *Ledum groenlandicum* (common Labrador tea), which coincides with the wetter side of the moisture spectrum of the *Picea mariana* (black spruce) in muskegs, bogs, bottomlands, and peatlands—i.e., nutrient poor sites with acidic soils and poor drainage.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 131 shows the five most prominent plant species among the four lifeforms for species recorded in all 75 stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type. This sample set contains a mix of late seral, relatively undisturbed stands, along with early seral, disturbed stands. The upper canopy is dominate primarily by *Picea mariana* (black spruce), with the early seal *Pinus contorta* (lodgepole pine) also fairly prominent. *Ledum groenlandicum* (common Labrador tea) dominates the shrub layer, but no other species of shrub, graminoid, or forb is more than moderately prominent.

Table 131. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type (number = 75 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea mariana (black spruce)	33.47	Native
Pinus contorta (lodgepole pine)	15.23	Native
Larix laricina (tamarack)	0.61	Native
Populus balsamifera (balsam poplar)	0.53	Native
Populus tremuloides (aspen)	0.45	Native
Shrubs		
Ledum groenlandicum (common Labrador tea)	29.60	Native
Vaccinium myrtilloides (common blueberry)	5.03	Native
Vaccinium vitis-idaea (bog cranberry)	4.33	Native
Linnaea borealis (twinflower)	2.01	Native
Salix myrtillifolia (myrtle-leaved willow)	1.84	Native
Graminoids		
Elymus innovatus (hairy wild rye)	0.57	Native
Carex aquatilis (water sedge)	0.24	Native
Carex vaginata (sheathed sedge)	0.23	Native
Carex gynocrates (northern bog sedge)	0.17	Native
Carex disperma (two-seeded sedge)	0.14	Native
Forbs		
Cornus canadensis (bunchberry)	3.23	Native
Equisetum arvense (common horsetail)	2.40	Native
Petasites palmatus (palmate-leaved coltsfoot)	0.71	Native
Smilacina trifolia (three-leaved Solomon's-seal)	0.62	Native
Epilobium angustifolium (common fireweed)	0.57	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 132 through Table 135, break out the vegetation recorded in all 75 stands sampled of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, moderately species rich, forested habitat type of major-to-minor occurrence across the study area.

Table 132 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea mariana/Ledum groenlandicum* (black spruce/

common Labrador tea) habitat type. For the 75 stands comprising the habitat type, the number of unique species was 125 with 123 (98.4 percent) of them being native species.

Table 132. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type (number = 75 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	8	8	0	0
Shrubs	44	43	0	1
Graminoids	16	15	0	1
Forbs	57	57	0	0
TOTAL	***125 (100.0%)***	***123 (98.4%)***	***0 (0.0%)***	***2 (1.6%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 133 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type. The average number of species per stand is 14.9, with native species comprising 14.8 species per stand or 99.3 percent.

Table 133. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type (number = 75 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.2	2.2	0.0	0.0
Shrubs	6.4	6.3	0.0	0.1
Graminoids	0.9	0.9	0.0	0.0
Forbs	5.4	5.4	0.0	0.0
TOTAL	***14.9 (100.0%)***	***14.8 (99.3%)***	***0.0 (0.0%)***	***0.1 (0.7%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 134 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea)

habitat type. The average canopy cover per stand is 115.5 percent, with native species comprising 115.3 percent or 99.8 percent of the total amount of average canopy cover per stand.

Table 134. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type (number = 75 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	50.6%	50.6%	0.0%	0.0%
Shrubs	51.5%	51.2%	0.0%	0.3%
Graminoids	1.7%	1.7%	0.0%	0.0%
Forbs	11.7%	11.7%	0.0%	0.0%
TOTAL	***115.5% (100.0%)***	***115.3% (99.8%)***	***0.0% (0.0%)***	***0.3% (0.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 135 shows the average number of species and average canopy cover by lifeform in stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type. The average number of species per stand was 14.9 with an average canopy cover of 115.3 percent.

Table 135. Average number of species and average canopy cover by lifeform in stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type (number = 75 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.2	50.6%
Shrubs	6.4	51.5%
Graminoids	0.9	1.7%
Forbs	5.4	11.7%
TOTAL	***14.9***	***115.5%***

Sampled Stands Plant Species List

The *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type is one of the more abundant types in this study area, with 75 stands sampled (Table 136). Among the eight tree species recorded in at least one stand, *Picea mariana* (black spruce), is by far most prominent. However, the early seral species, *Pinus contorta* (lodgepole pine), is also quite prominent, indicating that the sample set contains several stands in earlier successional stage. *Ledum groenlandicum* (common Labrador tea) is the only very prominent one of the 44 shrub species recorded. None of the 16 graminoids, and only *Cornus canadensis* (bunchberry) among the 57 forbs, was even moderately prominent.

Table 136. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type (number = 75 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 8)					
Abies lasiocarpa (subalpine fir)	1.1	0-3	11	0.12	N
Betula papyrifera (white birch)	1.1	0-3	5	0.06	N
Larix laricina (tamarack)	4.6	0-10	13	0.61	N
Picea glauca (white spruce)	2.9	0-10	5	0.15	N
Picea mariana (black spruce)	33.5	10-70	100	33.47	N
Pinus contorta (lodgepole pine)	20.8	0-60	73	15.23	N
Populus balsamifera (balsam poplar)	20.0	0-30	3	0.53	N
Populus tremuloides (aspen)	5.7	0-10	8	0.45	N
Shrubs (N = 44)					
Alnus crispa (green alder)	4.5	0-10	4	0.18	N
Amelanchier alnifolia (Saskatoon)	0.5	0-0.5	4	0.02	N
Andromeda polifolia (bog rosemary)	0.5	0-0.5	1	0.01	N
Arctostaphylos uva-ursi (common bearberry)	2.2	0-3	4	0.09	N
Betula glandulosa (bog birch)	1.5	0-3	7	0.10	N
Betula occidentalis (water birch)	10.0	0-10	1	0.13	N
Betula pumila (dwarf birch)	2.9	0-20	12	0.35	N
Empetrum nigrum (crowberry)	3.5	0-10	5	0.19	N
Gaultheria hispidula (creeping snowberry)	4.2	0-20	11	0.45	N
Kalmia polifolia (northern laurel)	0.5	0-0.5	3	0.01	N
Ledum groenlandicum (common Labrador tea)	29.6	10-70	100	29.60	N
Linnaea borealis (twinflower)	3.1	0-20	64	2.01	N
Lonicera dioica (twining honeysuckle)	3.0	0-3	1	0.04	N
Lonicera involucrata (bracted honeysuckle)	2.3	0-10	32	0.75	N
Oxycoccus microcarpus (small bog cranberry)	1.7	0-10	24	0.41	N
Ribes lacustre (bristly black currant)	4.5	0-10	4	0.18	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	1	0.01	N
Ribes triste (wild red currant)	1.3	0-3	4	0.05	N
Rosa acicularis (prickly rose)	2.2	0-10	61	1.35	N
Rosa woodsii (common wild rose)	3.0	0-3	3	0.08	N
Rubus arcticus (dwarf raspberry)	1.8	0-3	3	0.05	N
Rubus chamaemorus (cloudberry)	1.1	0-3	12	0.13	N
Rubus idaeus (wild red raspberry)	0.5	0-0.5	3	0.01	N
Rubus pedatus (dwarf bramble)	4.0	0-20	9	0.37	N
Rubus pubescens (dewberry)	1.8	0-10	12	0.22	N
Salix arbusculoides (shrubby willow)	0.5	0-0.5	1	0.01	N
Salix barclayi (Barclay's willow)	10.0	0-10	3	0.27	N
Salix bebbiana (beaked willow)	4.8	0-10	5	0.25	N
Salix candida (hoary willow)	0.5	0-0.5	1	0.01	N
Salix farriae (Farr's willow)	3.0	0-3	1	0.04	N
Salix glauca (smooth willow)	5.3	0-10	4	0.21	N
Salix maccalliana (velvet-fruited willow)	5.3	0-10	3	0.14	N

Table 136. (cont.)

Species	Percent Canopy Cover Average	Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Salix myrtillifolia (myrtle-leaved willow)	9.9	0-20	19	1.84	N
Salix pedicellaris (bog willow)	6.5	0-10	3	0.17	N
Salix planifolia (flat-leaved willow)	6.5	0-10	3	0.17	N
Salix spp. (willow)	2.6	0-10	11	0.28	B
Shepherdia canadensis (Canada buffaloberry)	3.5	0-10	11	0.37	N
Sorbus scopulina (western mountain-ash)	1.1	0-3	5	0.06	N
*Spiraea betulifoli*a (white meadowsweet)	0.5	0-0.5	4	0.02	N
Vaccinium caespitosum (dwarf bilberry)	2.3	0-10	25	0.58	N
Vaccinium membranaceum (tall bilberry)	4.9	0-20	15	0.72	N
Vaccinium myrtilloides (common blueberry)	8.2	0-40	61	5.03	N
Vaccinium vitis-idaea (bog cranberry)	6.0	0-30	72	4.33	N
Viburnum edule (low-bush cranberry)	1.8	0-3	11	0.19	N
Graminoids (N = 16)					
Calamagrostis canadensis (marsh reed grass)	3.0	0-3	1	0.04	N
Carex aquatilis (water sedge)	3.0	0-3	8	0.24	N
Carex diandra (two-stamened sedge)	3.0	0-3	1	0.04	N
Carex disperma (two-seeded sedge)	5.3	0-10	3	0.14	N
Carex gynocrates (northern bog sedge)	2.1	0-10	8	0.17	N
Carex limosa (mud sedge)	0.5	0-0.5	3	0.01	N
Carex livida (livid sedge)	3.0	0-3	1	0.04	N
Carex microptera (small-winged sedge)	3.0	0-3	1	0.04	N
Carex pauciflora (few-flowered sedge)	3.0	0-3	1	0.04	N
Carex spp. (sedge)	0.5	0-0.5	4	0.02	N
Carex vaginata (sheathed sedge)	2.9	0-10	8	0.23	N
Elymus innovatus (hairy wild rye)	1.3	0-10	43	0.57	N
Eriophorum vaginatum (sheathed cotton grass)	3.0	0-3	1	0.04	N
Muhlenbergia glomerata (bog muhly)	1.8	0-3	3	0.05	N
Poa spp. (bluegrass)	0.5	0-0.5	1	0.01	B
Schizachne purpurascens (purple oat grass)	0.5	0-0.5	3	0.01	N
Forbs (N = 57)					
Achillea millefolium (common yarrow)	1.1	0-3	21	0.24	N
Actaea rubra (red and white baneberry)	0.5	0-0.5	1	0.01	N
Anemone parviflora (small wood anemone)	0.5	0-0.5	3	0.01	N
Antennaria spp. (everlastings)	3.0	0-3	1	0.04	N
Arnica cordifolia (heart-leaved arnica)	1.1	0-3	16	0.18	N
Aster ciliolatus (Lindley's aster)	1.0	0-3	19	0.19	N
Aster conspicuus (showy aster)	3.0	0-3	3	0.08	N
Astragalus americanus (American milk vetch)	0.5	0-0.5	1	0.01	N
Botrychium virginianum (Virginia grape fern)	3.0	0-3	1	0.04	N
Caltha leptosepala (mountain marsh-marigold)	3.0	0-3	1	0.04	N
Campanula rotundifolia (harebell)	1.3	0-3	8	0.11	N
Cornus canadensis (bunchberry)	4.0	0-20	81	3.23	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	1	0.01	N
Disporum trachycarpum (fairybells)	3.0	0-3	1	0.04	N

Table 136. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Epilobium angustifolium (common fireweed)	1.6	0-10	36	0.57	N
Equisetum arvense (common horsetail)	12.9	0-50	19	2.40	N
Equisetum fluviatile (swamp horsetail)	3.0	0-3	1	0.04	N
Equisetum laevigatum (smooth scouring-rush)	0.5	0-0.5	1	0.01	N
Equisetum pratense (meadow horsetail)	4.1	0-10	5	0.22	N
Equisetum scirpoides (dwarf scouring-rush)	1.4	0-3	29	0.41	N
Equisetum sylvaticum (woodland horsetail)	1.7	0-10	28	0.47	N
Fragaria virginiana (wild strawberry)	1.1	0-3	17	0.19	N
Galium boreale (northern bedstraw)	1.1	0-3	17	0.19	N
Geocaulon lividum (northern bastard toadflax)	1.6	0-3	9	0.15	N
Geum rivale (purple avens)	0.5	0-0.5	1	0.01	N
Goodyera repens (lesser rattlesnake plantain)	0.5	0-0.5	1	0.01	N
Gymnocarpium dryopteris (oak fern)	3.0	0-3	1	0.04	N
Habenaria obtusata (blunt-leaved bog orchid)	0.5	0-0.5	3	0.01	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	7	0.03	N
Listera cordata (heart-leaved twayblade)	0.5	0-0.5	4	0.02	N
Lycopodium annotinum (stiff club-moss)	1.3	0-3	12	0.16	N
Lycopodium clavatum (running club-moss)	0.5	0-0.5	3	0.01	N
Lycopodium complanatum (ground-cedar)	3.0	0-3	4	0.12	N
Lycopodium obscurum (ground-pine)	0.5	0-0.5	1	0.01	N
Maianthemum canadense (wild lily-of-the-valley)	1.6	0-3	15	0.24	N
Mertensia paniculata (tall lungwort)	1.0	0-3	15	0.14	N
Mitella nuda (bishop's-cap)	0.9	0-3	17	0.15	N
Orchis rotundifolia (round-leaved orchid)	0.5	0-0.5	3	0.01	N
Orthilia secunda (one-sided wintergreen)	1.3	0-3	12	0.16	N
Parnassia palustris (northern grass-of-parnassus)	0.5	0-0.5	1	0.01	N
Pedicularis bracteosa (western lousewort)	0.5	0-0.5	1	0.01	N
*Pedicularis groenlandic*a (elephant's-head)	0.5	0-0.5	1	0.01	N
Pedicularis labradorica (Labrador lousewort)	1.1	0-3	5	0.06	N
Petasites palmatus (palmate-leaved coltsfoot)	1.3	0-10	56	0.71	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	1	0.01	N
Potentilla diversifolia (mountain cinquefoil)	0.5	0-0.5	1	0.01	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	4	0.02	N
Pyrola chlorantha (greenish-flowered wintergreen)	0.5	0-0.5	3	0.01	N
Pyrola grandiflora (Arctic wintergreen)	0.5	0-0.5	1	0.01	N
Smilacina racemosa (false Solomon's-seal)	3.0	0-3	1	0.04	N
Smilacina trifolia (three-leaved Solomon's-seal)	2.9	0-10	21	0.62	N
Spiranthes romanzoffiana (hooded ladies'-tresses)	0.5	0-0.5	1	0.01	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	2.4	0-3	5	0.13	N
Vicia americana (wild vetch)	3.0	0-3	1	0.04	N
Viola adunca (early blue violet)	0.5	0-0.5	1	0.01	N
Viola orbiculata (evergreen violet)	0.5	0-0.5	3	0.01	N

Table 136. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Viola renifolia (kidney-leaved violet)	1.1	0-3	5	0.06	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 137 shows the five most prominent plant species among the four lifeforms for species recorded in all 22 relatively undisturbed late seral to climax stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea). Only two species are highly prominent in these undisturbed late seral strands: *Picea mariana* (black spruce) among the trees, and *Ledum groenlandicum* (common Labrador tea) among the shrubs.

Table 137. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type (number = 22 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea mariana (black spruce)	45.46	Native
Pinus contorta (lodgepole pine)	2.61	Native
Larix laricina (tamarack)	0.66	Native
Shrubs		
Ledum groenlandicum (common Labrador tea)	33.64	Native
Vaccinium vitis-idaea (bog cranberry)	4.59	Native
Vaccinium myrtilloides (common blueberry)	2.48	Native
Linnaea borealis (twinflower)	2.23	Native
Salix myrtillifolia (myrtle-leaved willow)	2.23	Native

Table 137. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Graminoids		
Carex vaginata (sheathed sedge)	0.75	Native
Elymus innovatus (hairy wild rye)	0.61	Native
Carex gynocrates (northern bog sedge)	0.52	Native
Carex aquatilis (water sedge)	0.41	Native
Calamagrostis canadensis (marsh reed grass)	0.14	Native
Forbs		
Cornus canadensis (bunchberry)	1.46	Native
Smilacina trifolia (three-leaved Solomon's-seal)	1.30	Native
Petasites palmatus (palmate-leaved coltsfoot)	1.05	Native
Equisetum sylvaticum (woodland horsetail)	0.66	Native
Equisetum pratense (meadow horsetail)	0.59	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 138 through Table 141, break out the vegetation recorded in 22 relatively undisturbed late seral to climax stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, moderately species rich, forested habitat type of major-to-minor occurrence across the study area.

Table 138 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type. For the 22 stands comprising the habitat type, the number of unique species was 79 with 78 (98.7 percent) of them being native species.

Table 138. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type (number = 22 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3	3	0	0
Shrubs	30	29	0	1
Graminoids	11	11	0	0
Forbs	35	35	0	0
TOTAL	***79 (100.0%)***	***78 (98.7%)***	***0 (0.0%)***	***1 (1.3%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 139 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type. The average number of species per stand is 14.1, with native species comprising 13.9 species per stand or 98.6 percent.

Table 139. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type (number = 22 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.7	1.7	0.0	0.0
Shrubs	5.9	5.7	0.0	0.1
Graminoids	1.1	1.1	0.0	0.0
Forbs	5.4	5.4	0.0	0.0
TOTAL	***14.1 (100.0%)***	***13.9 (98.6%)***	***0.0 (0.0%)***	***0.1 (0.7%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 140 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type. The average canopy cover per stand is 113.1 percent, with native species comprising 112.5 percent or 99.5 percent of the total amount of average canopy cover per stand.

Table 140. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type (number = 22 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	48.7%	48.7%	0.0%	0.0%
Shrubs	52.7%	52.1%	0.0%	0.6%
Graminoids	3.0%	3.0%	0.0%	0.0%
Forbs	8.7%	8.7%	0.0%	0.0%
TOTAL	***113.1% (100.0%)***	***112.5% (99.5%)***	***0.0% (0.0%)***	***0.6% (0.5%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 141 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type. The average number of species per stand was 14.1 with an average canopy cover of 113.1 percent.

Table 141. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type (number = 22 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	1.7	48.7%
Shrubs	5.9	52.7%
Graminoids	1.1	3.0%
Forbs	5.4	8.7%
TOTAL	***14.1***	***113.1%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

On the 22 relatively undisturbed late seral to climax stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type, three tree species were recorded, with only *Picea mariana* (black spruce) being highly prominent (Table 142). Thirty shrub species were recorded, but only *Ledum groenlandicum* (common Labrador tea) occurred in all 22 plots, or is more than moderately prominent. Eleven graminoid species and 35 forbs were recorded, but no herbaceous species was even moderately prominent.

Table 142. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type (number = 22 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 3)					
Larix laricina (tamarack)	2.9	0-10	23	0.66	N
Picea mariana (black spruce)	45.5	30-70	100	45.45	N
Pinus contorta (lodgepole pine)	5.8	0-10	45	2.61	N
Shrubs (N = 30)					
Andromeda polifolia (bog rosemary)	0.5	0-0.5	5	0.02	N
Betula glandulosa (bog birch)	0.5	0-0.5	5	0.02	N
Betula occidentalis (water birch)	10.0	0-10	5	0.45	N
Betula pumila (dwarf birch)	7.0	0-20	14	0.95	N
Empetrum nigrum (crowberry)	1.8	0-3	9	0.16	N
Gaultheria hispidula (creeping snowberry)	1.8	0-3	9	0.16	N
Kalmia polifolia (northern laurel)	0.5	0-0.5	5	0.02	N
Ledum groenlandicum (common Labrador tea)	33.6	10-60	100	33.64	N
Linnaea borealis (twinflower)	4.5	0-10	50	2.23	N
Lonicera involucrata (bracted honeysuckle)	2.5	0-10	50	1.25	N
Oxycoccus microcarpus (small bog cranberry)	1.1	0-3	41	0.43	N
Rosa acicularis (prickly rose)	2.3	0-10	50	1.14	N
Rosa woodsii (common wild rose)	3.0	0-3	5	0.14	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	5	0.02	N
Rubus chamaemorus (cloudberry)	1.0	0-3	23	0.23	N
Rubus pedatus (dwarf bramble)	0.5	0-0.5	5	0.02	N
Rubus pubescens (dewberry)	0.5	0-0.5	5	0.02	N
Salix barclayi (Barclay's willow)	10.0	0-10	5	0.45	N
Salix bebbiana (beaked willow)	3.0	0-3	5	0.14	N
Salix candida (hoary willow)	0.5	0-0.5	5	0.02	N
Salix glauca (smooth willow)	3.0	0-3	5	0.14	N
Salix myrtillifolia (myrtle-leaved willow)	8.2	0-20	27	2.23	N
Salix pedicellaris (bog willow)	10.0	0-10	5	0.45	N
Salix spp. (willow)	4.5	0-10	14	0.61	B
Shepherdia canadensis (Canada buffaloberry)	0.5	0-0.5	5	0.02	N
Vaccinium caespitosum (dwarf bilberry)	1.8	0-3	18	0.32	N
Vaccinium membranaceum (tall bilberry)	1.8	0-3	9	0.16	N
Vaccinium myrtilloides (common blueberry)	5.0	0-30	50	2.48	N
Vaccinium vitis-idaea (bog cranberry)	9.2	0-30	50	4.59	N
Viburnum edule (low-bush cranberry)	1.8	0-3	9	0.16	N
Graminoids (N = 11)					
Calamagrostis canadensis (marsh reed grass)	3.0	0-3	5	0.14	N
Carex aquatilis (water sedge)	3.0	0-3	14	0.41	N
Carex diandra (two-stamened sedge)	3.0	0-3	5	0.14	N
Carex gynocrates (northern bog sedge)	2.9	0-10	18	0.52	N
Carex livida (livid sedge)	3.0	0-3	5	0.14	N

Table 142. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex microptera (small-winged sedge)	3.0	0-3	5	0.14	N
Carex spp. (sedge)	0.5	0-0.5	5	0.02	N
Carex vaginata (sheathed sedge)	4.1	0-10	18	0.75	N
Elymus innovatus (hairy wild rye)	1.9	0-3	32	0.61	N
Eriophorum vaginatum (sheathed cotton grass)	3.0	0-3	5	0.14	N
Muhlenbergia glomerata (bog muhly)	0.5	0-0.5	5	0.02	N
Forbs (N = 35)					
Achillea millefolium (common yarrow)	0.9	0-3	27	0.25	N
Anemone parviflora (small wood anemone)	0.5	0-0.5	5	0.02	N
Arnica cordifolia (heart-leaved arnica)	0.5	0-0.5	18	0.09	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	14	0.07	N
Astragalus americanus (American milk vetch)	0.5	0-0.5	5	0.02	N
Botrychium virginianum (Virginia grape fern)	3.0	0-3	5	0.14	N
Caltha leptosepala (mountain marsh-marigold)	3.0	0-3	5	0.14	N
Campanula rotundifolia (harebell)	0.5	0-0.5	9	0.05	N
Cornus canadensis (bunchberry)	2.1	0-10	68	1.45	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	18	0.09	N
Equisetum arvense (common horsetail)	1.0	0-3	23	0.23	N
Equisetum laevigatum (smooth scouring-rush)	0.5	0-0.5	5	0.02	N
Equisetum pratense (meadow horsetail)	6.5	0-10	9	0.59	N
Equisetum scirpoides (dwarf scouring-rush)	1.0	0-3	45	0.45	N
Equisetum sylvaticum (woodland horsetail)	2.9	0-10	23	0.66	N
Fragaria virginiana (wild strawberry)	2.0	0-3	23	0.45	N
Galium boreale (northern bedstraw)	1.0	0-3	23	0.23	N
Geocaulon lividum (northern bastard toadflax)	2.2	0-3	14	0.30	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	5	0.02	N
Listera cordata (heart-leaved twayblade)	0.5	0-0.5	5	0.02	N
Lycopodium clavatum (running club-moss)	0.5	0-0.5	5	0.02	N
Maianthemum canadense (wild lily-of-the-valley)	1.8	0-3	9	0.16	N
Mertensia paniculata (tall lungwort)	1.0	0-3	23	0.23	N
Mitella nuda (bishop's-cap)	1.1	0-3	18	0.20	N
Orchis rotundifolia (round-leaved orchid)	0.5	0-0.5	5	0.02	N
Orthilia secunda (one-sided wintergreen)	3.0	0-3	9	0.27	N
Parnassia palustris (northern grass-of-parnassus)	0.5	0-0.5	5	0.02	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	5	0.02	N
Pedicularis labradorica (Labrador lousewort)	0.5	0-0.5	5	0.02	N
Petasites palmatus (palmate-leaved coltsfoot)	1.9	0-10	55	1.05	N
Potentilla diversifolia (mountain cinquefoil)	0.5	0-0.5	5	0.02	N
Pyrola chlorantha (greenish-flowered wintergreen)	0.5	0-0.5	5	0.02	N
Smilacina trifolia (three-leaved Solomon's-seal)	3.2	0-10	41	1.30	N
Spiranthes romanzoffiana (hooded ladies'-tresses)	0.5	0-0.5	5	0.02	N
Viola orbiculata (evergreen violet)	0.5	0-0.5	5	0.02	N

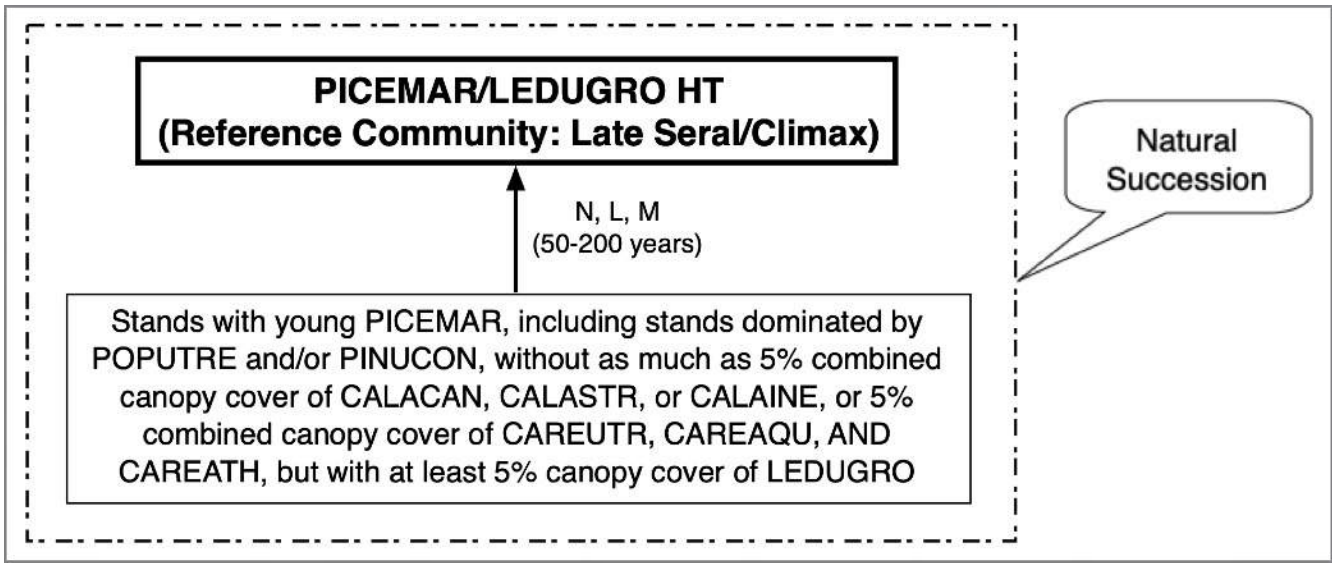
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Most succession in *Picea mariana* (black spruce) communities is set back by fire, but the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type typically occurs on muskegs, bogs, bottomlands, and relatively dry peatlands that seldom can sustain fire, except during periods of severe drought. After fire, *Picea mariana* (black spruce) establishes from crown-stored seed that disperses from semi-serotinous cones. Large quantities of seeds are released soon after a fire (Fryer 2014). If *Populus balsamifera* (balsam poplar) and/or *Populus tremuloides* (aspen) are in the stand prior to burning, the poplars may dominate the stand for 50 to 80 years after the fire, before the *Picea mariana* (black spruce) regains dominance (Fryer 2014).

Figure 24 shows a schematic diagram of vegetation successional pathways on sites of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type.



Successional Pathway of *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES

CALACAN—*Calamagrostis canadensis* (marsh reed grass)
CALAINE—*Calamagrostis inexpansa* (northern reed grass)
CALASTR—*Calamagrostis stricta* (narrow reed grass)
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)

LEDUGRO—*Ledum groenlandicum* (common Labrador tea)
PICEMAR—*Picea mariana* (black spruce)
PICEMAR/LEDUGRO HT—*Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type
PINUCON—*Pinus contorta* (lodgepole pine)
POPUTRE—*Populus tremuloides* (aspen)

Figure 24. Successional pathway for sites of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 25 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

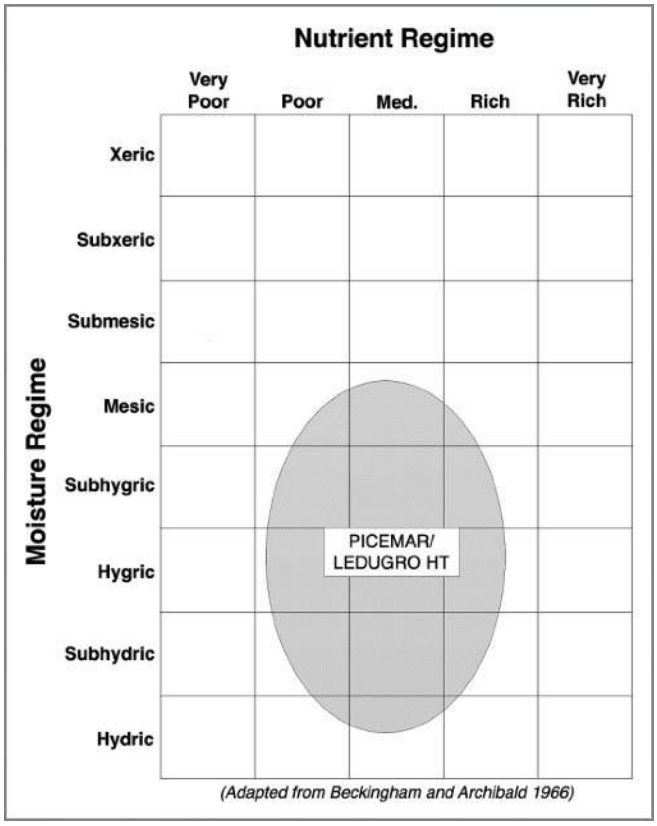


Figure 25. Edatope grid position for the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type (PICEMAR/LEDUGRO HT)

SOILS

Parent material on sites supporting the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type is predominantly morainal, alluvial, and colluvial. Soil drainage ranges from moderately well drained to well drained. Soil subgroups are mostly luvisols and brunisols. Soil texture mostly ranges from sandy loam to clay. Surface organic thickness may range from 0 cm to 5 cm (France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites are likely to have the *Picea mariana/Carex aquatilis* (black spruce/water sedge) habitat type or the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type. Drier adjacent sites will likely have the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Picea mariana* (black spruce)**—*Picea mariana* (black spruce) grows in regions with long, cold winters and short, warm summers (Fryer 2014). It is found primarily in bogs, muskegs, and swampy woods in northern and western Alberta (Tannas 1997a). It occurs on a wide range of sites from wet lowlands and drier uplands on a variety of soils, but is found most commonly on poorly drained sites underlain with permafrost (Fryer 2014). The species is important in other boreal communities, including stands with various mixes pf *Picea glauca* (white spruce), *Pinus contorta* (lodgepole pine), *Populus tremuloides* (aspen), and *Betula papyrifera* (white birch) (Fryer 2014).

The species tolerates a wide range of soil temperature and moisture regimes, growing in relatively warm, dry soils, as well as nearly frozen wet soils that exclude deciduous and most other conifer trees. Substrate moisture varies from saturation in bogs and swamps, wet on bottomlands and flats, wet to moist along lake margins, mesic on north-facing slopes, well-drained on most other slopes, and dry on drained peatlands. *Picea mariana* (black spruce) favors acidic soils, but sometimes grows in calcareous bogs with soil pH as high as 8.0 (Fryer 2014).

Picea mariana (black spruce) is found in all stages of forest succession. It is moderately shade tolerant, and grows in open bogs and woodlands, as well as in closed-canopy forests. Although *Populus tremuloides* (aspen), *Betula papyrifera* (white birch), and shrubs often sprout or colonize after fire in these black spruce stands, the spruce usually regains dominance within 90 years or less post fire (Fryer 2014).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) is commonly found in Alberta in swampy, wet, coniferous wooded areas in bogs (especially peat), commonly on acidic, infertile soils and associated with *Picea mariana* (black spruce) and *Larix laricina* (tamarack) (Tannas 1997a). This species is typical of poorly drained habitats in boreal forests, open conifer treed bogs, treeless bogs, wooded swamps, wet barrens, and peatlands throughout its range (Gucker 2006).

The soils typical of *Ledum groenlandicum* (common Labrador tea) habitats are commonly described as moist to wet, acidic, nutrient-poor organics (Gucker 2006). The species is typically present in late seral communities that result from primary succession. However, following disturbances on sites where *Ledum groenlandicum* (common Labrador tea) was established, it often recolonizes the sites rapidly (Gucker 2006).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is found in all natural regions of Alberta, except the Dry Mixedgrass Region. It is the most common tree species at middle and lower altitudes along the

eastern slopes of the Rocky Mountains, forming nearly pure stands on some sites in the foothills and montane areas (Tannas 1997a).

Pinus contorta (lodgepole pine) grows at low to high elevations, in dry to wet conditions, warm to cold temperatures, and on nearly every soil type found in western North America, except on saline sites. The species is not shade tolerant, and grows best on non-calcareous soil. It is primarily an aggressive pioneer on disturbed sites, and fire perpetuates or renews the stands (Anderson 2003). As these pine stands mature, they give way to shade-tolerant conifers at ages from 50 to 100 years in mesic habitats, and 100 to 200 years on warmer and drier sites (Anderson 2003).

Pinus contorta (lodgepole pine) may establish alongside later seral, more shade-tolerant species, and its rapid growth may enable the pines to remain competitive in the canopy for several years. However, these trees do not regenerate under a canopy, and are eliminated from the stand as mortality occurs. The *Pinus contorta* (lodgepole pine) is generally replaced within 50 to 100 years by the more shade-tolerant associates (Anderson 2003).

Livestock

***Picea mariana* (black spruce)**—*Picea mariana* (black spruce) has poor value as forage for both livestock and wild ungulates, although it may occasionally be eaten when better quality forage is absent (Tannas 1997a).

***Ledum groenlandicum* (common Labrador tea)**—Forage value of *Ledum groenlandicum* (common Labrador tea) is poor for livestock, and the habitats occupied by it represent marginal rangeland that is seldom used by livestock (Tannas 1997a).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) offers poor forage value, and is seldom eaten by livestock (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Picea mariana* (black spruce)**—The primary use for *Picea mariana* (black spruce) timber is pulpwood. It is also used for Christmas trees and heating fuel (USDA National Resources Conservation Service 2023).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) timber is used extensively for construction lumber, pulpwood, heating fuel, posts and poles, and plywood veneer (USDA National Resources Conservation Service 2023).

Wildlife

***Picea mariana* (black spruce)**—A wide variety of wildlife use *Picea mariana* (black spruce) communities as habitat. Some bird guilds use various post fire successional stages preferentially. Among bird guilds for example, cavity nesters prefer early seral stands, while foliage gleaners generally prefer more mature stands. Most wildlife avoid *Picea mariana* (black spruce) browse, but it provides important winter forage for some species, and many wildlife species consume the seeds (Fryer 2014).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) forage is used to some extent by wild ungulates, especially deer, but only when other forage is scarce (Tannas 1997a). The species may provide important cover for many wildlife species, as it is a typical component species in many

important wildlife habitats (Gucker 2006). The leaves and twigs are browsed by caribou and moose (Anderson 2011).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) also offers poor forage value for wildlife, and is eaten by deer and elk only when better forage is lacking (Tannas 1997a). Stands of the species provide cover for big game animals, upland game birds, small non-game birds, and small mammals (Anderson 2003).

Fire

***Picea mariana* (black spruce)**—Fire usually kills *Picea mariana* (black spruce), because even mature trees have thin bark and shallow roots. In general, the species is poorly adapted to survive fire, and mortality is usually near 100 percent. Crowning of the fire is common in these stands due to layered fuels, with branches draped with lichens that are easily ignited, causing the fire to carry up through successive dense branches (Fryer 2014).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) underground structures often survive and rapidly sprout after fire. When burned lightly, such that some above ground stem material survives, *Ledum groenlandicum* (common Labrador tea) may sprout from stems, but when completely top-killed, sprouting occurs from the root crown or rhizomes (Gucker 2006). Provided that a seed source is present, the species' abundant seed production and easily wind-dispersed seed suggests a high likelihood of burned site recolonization (Gucker 2006).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) thrives under the influence of fire, and on many sites fire is required to maintain its dominance. Producing serotinous cones is one adaptation to stand-replacing fire, and the seed supply is nearly always available on the tree (Anderson 2003).

The propensity of *Pinus contorta* (lodgepole pine) to form stands with high seedling density, initial rapid growth that slows with age, high susceptibility to snow breakage and wind-throw, infestation by dwarf-mistletoe and mountain pine beetles, all result in large buildups of fuel (Anderson 2003).

Rehabilitation/Restoration Considerations

***Picea mariana* (black spruce)**—*Picea mariana* (black spruce) is used for revegetating seismic lines, borrow pits, abandoned roads, and construction sites in boreal regions (Fryer 2014).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) may be useful in revegetating disturbed sites, and may be a valuable indicator of contaminated sites and easily reforested sites (Gucker 2006). Plants can be started from seed or root-crown division. Collect seeds from dry capsules and plant them in fall or spring in moist peaty soil in a sunny spot. Water them thoroughly after planting and keep moist. Suckers with roots can be split off from the base of the plant in mid-December and transplanted during spring (Anderson 2011).

Many of the fens and bogs that provide important habitat for *Ledum groenlandicum* (common Labrador tea) in North America were created by glaciation. These wetlands have been disappearing over thousands of years, due to a decrease in native ungulates that graze the bogs, and encroachment by conifers and hardwoods (Anderson 2011).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is often used in reforestation projects, especially for revegetation on sites of mining disturbance. Though it grows well on nutrient poor soils, addition of nitrogen fertilizer will likely enhance growth of the plantings (Anderson 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- J16. Black spruce-lodgepole pine/moss
- J18. Black spruce/Labrador tea/horsetail/moss
- J19. Black spruce/Labrador tea-bog cranberry/cloudberry
- J4. Lodgepole pine-Black spruce/Labrador tea/feathermoss
- J5. Lodgepole pine-black spruce/feathermoss

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Pl/Labrador tea-Bog cranberry
- Pl-Sb/Labrador tea-Bog cranberry/Feather moss
- Sb-Pl/Labrador tea-Bog cranberry/Feather moss

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Sb-Lt/Labrador tea

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Mse17 Sb-Lt/Labrador tea (Montane Southern Ecosection)
- Mne23 Sb/Labrador tea/Golden moss (Montane Northern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type has not been described in the region.

Picea mariana/Lonicera involucrata Habitat Type
(black spruce/bracted honeysuckle Habitat Type)

PICEMAR/LONIINV Habitat Type
Number of Stands = 19 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 18; Other Data Sets = 1)

LOCATION AND ASSOCIATED LANDFORMS

The *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type is a minor type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and a restricted type in the Montane Natural Subregion of Alberta. This habitat type is found on the drier side of the *Picea mariana* (black spruce) moisture requirement spectrum, having slightly less acidic soils and better nutrient and drainage conditions. Such sites commonly occur around the edges of bogs, fens and sloughs.

Photo 5 shows a typical stand of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type.

Photo 5. A stand of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type (photo provided by Alan Dodd)

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 143 shows the five most prominent plant species among the four lifeforms for species recorded in all 19 stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type. This sample set contains a mix of late seral, relatively undisturbed stands, along with early seral, disturbed stands. The upper canopy is dominate primarily by *Picea mariana* (black spruce), with the early seal *Pinus contorta* (lodgepole pine) also fairly prominent. No shrub, graminoid, or forb species is more than moderately prominent in these late seral stands of this habitat type.

Table 143. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type (number = 19 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea mariana (black spruce)	40.53	Native
Pinus contorta (lodgepole pine)	14.00	Native
Picea glauca (white spruce)	2.66	Native
Populus tremuloides (aspen)	2.66	Native
Populus balsamifera (balsam poplar)	1.58	Native
Shrubs		
Lonicera involucrata (bracted honeysuckle)	7.16	Native
Vaccinium vitis-idaea (bog cranberry)	2.45	Native
Rosa acicularis (prickly rose)	2.16	Native
Linnaea borealis (twinflower)	1.84	Native
Salix scouleriana (Scouler's willow)	1.74	Native
Graminoids		
Carex disperma (two-seeded sedge)	2.13	Native
Elymus innovatus (hairy wild rye)	1.53	Native
*Carex vaginat*a (sheathed sedge)	0.71	Native
Carex capillaris (hair-like sedge)	0.68	Native
Calamagrostis canadensis (marsh reed grass)	0.63	Native

Table 143. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Equisetum arvense (common horsetail)	6.63	Native
Cornus canadensis (bunchberry)	6.61	Native
Equisetum pratense (meadow horsetail)	1.24	Native
Equisetum sylvaticum (woodland horsetail)	1.24	Native
Arnica cordifolia (heart-leaved arnica)	1.11	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 144 through Table 147, break out the vegetation recorded in all 19 stands sampled of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, forested habitat type of minor-to-incidental occurrence across the study area.

Table 144 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type. For the 19 stands comprising the habitat type, the number of unique species was 114 with 110 (96.5 percent) of them being native species.

Table 144. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type (number = 19 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	9	9	0	0
Shrubs	31	30	0	1
Graminoids	15	15	0	0
Forbs	59	56	1	2
TOTAL	***114 (100.0%)***	***110 (96.5%)***	***1 (0.9%)***	***3 (2.6%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 145 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type. The average number of species per stand is 21.1, with native species comprising 20.7 species per stand or 98.1 percent.

Table 145. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type (number = 19 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.6	2.6	0.0	0.0
Shrubs	6.9	6.7	0.0	0.2
Graminoids	1.8	1.8	0.0	0.0
Forbs	9.8	9.6	0.1	0.1
TOTAL	***21.1 (100.0%)***	***20.7 (98.1%)***	***0.1 (0.5%)***	***0.3 (1.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 146 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type. The average canopy cover per stand is 122.0 percent, with native species comprising 121.7 percent or 99.7 percent of the total amount of average canopy cover per stand.

Table 146. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type (number = 19 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	62.0%	62.0%	0.0%	0.0%
Shrubs	25.4%	25.2%	0.0%	0.2%
Graminoids	7.0%	7.0%	0.0%	0.0%
Forbs	27.6%	27.5%	0.0%	0.1%
TOTAL	***122.0% (100.0%)***	***121.7% (99.7%)***	***0.0% (0.0%)***	***0.3% (0.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 147 shows the average number of species and average canopy cover by lifeform in stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type. The average number of species per stand was 21.1 with an average canopy cover of 122.0 percent.

Table 147. Average number of species and average canopy cover by lifeform in stands of the *Picea mariana/ Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type (number = 19 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.6	62.0%
Shrubs	6.9	25.4%
Graminoids	1.8	7.0%
Forbs	9.8	27.6%
TOTAL	***21.1***	***122.0%***

Sampled Stands Plant Species List

On the 19 stands sampled of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type, there were nine tree species recorded (Table 148). Among those nine trees, *Picea mariana* (black spruce), the type overstory indicator species, is by far most prominent. However, the early seral *Pinus contorta* (lodgepole pine) is also quite prominent, indicating that the sample set contains several stands in an earlier stage of successional development. The understory indicator species, *Lonicera involucrata* (bracted honeysuckle), is the only shrub recorded in all 19 stands sampled. Of 15 graminoids recorded, none was very prominent; while among the 59 forbs recorded, *Cornus canadensis* (bunchberry) and *Equisetum arvense* (common horsetail) both were moderately prominent.

Table 148. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type (number = 19 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 9)					
Abies balsamea (balsam fir)	1.8	0-3	11	0.18	N
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	5	0.03	N
Betula papyrifera (white birch)	1.8	0-3	11	0.18	N
Larix laricina (tamarack)	1.8	0-3	11	0.18	N
Picea glauca (white spruce)	10.1	0-20	26	2.66	N
Picea mariana (black spruce)	40.5	20-60	100	40.53	N
Pinus contorta (lodgepole pine)	22.2	0-60	63	14.00	N
Populus balsamifera (balsam poplar)	10.0	0-10	16	1.58	N
Populus tremuloides (aspen)	16.8	0-40	16	2.66	N
Shrubs (N = 31)					
Alnus crispa (green alder)	3.0	0-3	5	0.16	N
Alnus tenuifolia (river alder)	10.0	0-10	5	0.53	N
Amelanchier alnifolia (Saskatoon)	0.5	0-0.5	5	0.03	N
Betula glandulosa (bog birch)	1.3	0-3	16	0.21	N

Table 148. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Betula pumila (dwarf birch)	0.5	0-0.5	5	0.03	N
Ledum groenlandicum (common Labrador tea)	1.5	0-3	68	1.00	N
Linnaea borealis (twinflower)	2.2	0-20	84	1.84	N
Lonicera dioica (twining honeysuckle)	0.5	0-0.5	11	0.05	N
Lonicera involucrata (bracted honeysuckle)	7.2	3-20	100	7.16	N
Ribes hudsonianum (northern black currant)	0.5	0-0.5	5	0.03	N
Ribes lacustre (bristly black currant)	1.8	0-3	11	0.18	N
Ribes oxyacanthoides (northern gooseberry)	1.8	0-3	11	0.18	N
Ribes triste (wild red currant)	3.0	0-3	5	0.16	N
Rosa acicularis (prickly rose)	2.7	0-10	79	2.16	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	21	0.11	N
Rubus chamaemorus (cloudberry)	0.5	0-0.5	5	0.03	N
Rubus idaeus (wild red raspberry)	1.8	0-3	11	0.18	N
Rubus pubescens (dewberry)	1.5	0-3	26	0.39	N
Salix barclayi (Barclay's willow)	3.0	0-3	5	0.16	N
Salix barrattiana (Barratt's willow)	20.0	0-20	5	1.05	N
Salix bebbiana (beaked willow)	10.3	0-20	11	1.08	N
Salix glauca (smooth willow)	11.5	0-20	11	1.21	N
Salix planifolia (flat-leaved willow)	1.8	0-3	11	0.18	N
Salix scouleriana (Scouler's willow)	16.5	0-30	11	1.74	N
Salix spp. (willow)	1.1	0-3	21	0.24	B
Shepherdia canadensis (Canada buffaloberry)	3.5	0-10	21	0.74	N
Spiraea betulifolia (white meadowsweet)	0.5	0-0.5	5	0.03	N
Vaccinium caespitosum (dwarf bilberry)	0.5	0-0.5	5	0.03	N
Vaccinium myrtilloides (common blueberry)	4.4	0-20	37	1.61	N
Vaccinium vitis-idaea (bog cranberry)	4.2	0-20	58	2.45	N
Viburnum edule (low-bush cranberry)	2.4	0-3	21	0.50	N
Graminoids (N = 15)					
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	5	0.03	N
Calamagrostis canadensis (marsh reed grass)	3.0	0-3	21	0.63	N
Calamagrostis stricta (narrow reed grass)	3.0	0-3	5	0.16	N
Carex aquatilis (water sedge)	0.5	0-0.5	5	0.03	N
Carex atherodes (awned sedge)	0.5	0-0.5	5	0.03	N
Carex capillaris (hair-like sedge)	6.5	0-10	11	0.68	N
Carex disperma (two-seeded sedge)	10.1	0-20	21	2.13	N
Carex leptalea (bristle-stalked sedge)	0.5	0-0.5	5	0.03	N
Carex pauciflora (few-flowered sedge)	3.0	0-3	5	0.16	N
Carex spp. (sedge)	1.8	0-3	11	0.18	N
Carex tenera (broad-fruited sedge)	0.5	0-0.5	5	0.03	N
*Carex vaginat*a (sheathed sedge)	4.5	0-10	16	0.71	N
Elymus innovatus (hairy wild rye)	2.9	0-10	53	1.53	N
Oryzopsis asperifolia (white-grained mountain rice grass)	10.0	0-10	5	0.53	N
Oryzopsis hymenoides (Indian rice grass)	3.0	0-3	5	0.16	N

Table 148. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Forbs (N = 59)					
Achillea millefolium (common yarrow)	1.3	0-3	32	0.42	N
Actaea rubra (red and white baneberry)	0.5	0-0.5	11	0.05	N
Anemone parviflora (small wood anemone)	0.5	0-0.5	5	0.03	N
Anemone richardsonii (yellow anemone)	0.5	0-0.5	5	0.03	N
Arnica cordifolia (heart-leaved arnica)	7.0	0-20	16	1.11	N
Aster ciliolatus (Lindley's aster)	1.6	0-3	37	0.58	N
Aster conspicuus (showy aster)	1.8	0-3	11	0.18	N
Aster spp. (aster)	3.0	0-3	5	0.16	N
Caltha palustris (marsh-marigold)	0.5	0-0.5	5	0.03	N
Castilleja miniata (common red paintbrush)	0.5	0-0.5	5	0.03	N
Cerastium spp. (mouse-ear chickweed)	0.5	0-0.5	5	0.03	B
Cornus canadensis (bunchberry)	7.0	0-20	95	6.61	N
Cystopteris fragilis (fragile bladder fern)	1.8	0-3	11	0.18	N
Delphinium glaucum (tall larkspur)	1.3	0-3	16	0.21	N
Epilobium angustifolium (common fireweed)	1.4	0-3	74	1.03	N
Equisetum arvense (common horsetail)	31.5	0-70	21	6.63	N
Equisetum pratense (meadow horsetail)	5.9	0-10	21	1.24	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	32	0.16	N
Equisetum spp. (horsetail)	0.5	0-0.5	5	0.03	N
Equisetum sylvaticum (woodland horsetail)	5.9	0-10	21	1.24	N
Fragaria virginiana (wild strawberry)	1.6	0-3	47	0.76	N
Galium boreale (northern bedstraw)	0.8	0-3	47	0.37	N
Geocaulon lividum (northern bastard toadflax)	0.5	0-0.5	11	0.05	N
Geum aleppicum (yellow avens)	0.5	0-0.5	5	0.03	N
Geum macrophyllum (large-leaved yellow avens)	3.0	0-3	5	0.16	N
Geum rivale (purple avens)	0.5	0-0.5	16	0.08	N
Goodyera repens (lesser rattlesnake plantain)	3.0	0-3	5	0.16	N
Gymnocarpium dryopteris (oak fern)	0.5	0-0.5	5	0.03	N
Habenaria obtusata (blunt-leaved bog orchid)	0.5	0-0.5	11	0.05	N
Habenaria orbiculata (round-leaved bog orchid)	0.5	0-0.5	5	0.03	N
Hedysarum boreale (northern hedysarum)	3.0	0-3	5	0.16	N
Lathyrus ochroleucus (cream-colored vetchling)	3.5	0-10	21	0.74	N
Listera borealis (northern twayblade)	3.0	0-3	5	0.16	N
Listera cordata (heart-leaved twayblade)	3.0	0-3	5	0.16	N
Lycopodium annotinum (stiff club-moss)	4.5	0-10	16	0.71	N
Lycopodium clavatum (running club-moss)	0.5	0-0.5	5	0.03	N
Lycopodium complanatum (ground-cedar)	0.5	0-0.5	5	0.03	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	21	0.11	N
Mertensia paniculata (tall lungwort)	2.1	0-10	47	1.00	N
Mitella nuda (bishop's-cap)	1.1	0-3	47	0.50	N
Moneses uniflora (one-flowered wintergreen)	0.5	0-0.5	5	0.03	N
Orchis rotundifolia (round-leaved orchid)	0.5	0-0.5	5	0.03	N
Orthilia secunda (one-sided wintergreen)	0.5	0-0.5	5	0.03	N

Table 148. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Osmorhiza depauperata (spreading sweet cicely)	0.5	0-0.5	5	0.03	N
Osmorhiza occidentalis (western sweet cicely)	3.0	0-3	5	0.16	N
Petasites palmatus (palmate-leaved coltsfoot)	0.7	0-3	63	0.45	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	11	0.05	N
Petasites vitifolius (vine-leaved coltsfoot)	0.5	0-0.5	5	0.03	N
Polemonium acutiflorum (tall Jacob's-ladder)	0.5	0-0.5	5	0.03	N
Pyrola asarifolia (common pink wintergreen)	1.0	0-3	26	0.26	N
Pyrola chlorantha (greenish-flowered wintergreen)	0.5	0-0.5	5	0.03	N
Senecio triangularis (brook ragwort)	0.5	0-0.5	5	0.03	N
Smilacina trifolia (three-leaved Solomon's-seal)	5.3	0-10	11	0.55	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1.8	0-3	11	0.18	N
Taraxacum officinale (common dandelion)	0.5	0-0.5	5	0.03	I
Trifolium spp. (clover)	0.5	0-0.5	5	0.03	B
Vicia americana (wild vetch)	1.8	0-3	11	0.18	N
Viola orbiculata (evergreen violet)	0.5	0-0.5	5	0.03	N
Viola renifolia (kidney-leaved violet)	1.3	0-3	16	0.21	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 149 shows the five most prominent plant species among the four lifeforms for species recorded in all six relatively undisturbed late seral to climax stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type. *Picea mariana* (black spruce) dominates the canopy of late seral undisturbed strands of this habitat type. No other species is more than moderately prominent here.

Table 149. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type (number = 6 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea mariana (black spruce)	50.00	Native
Pinus contorta (lodgepole pine)	5.50	Native
Shrubs		
Lonicera involucrata (bracted honeysuckle)	5.33	Native
Salix glauca (smooth willow)	3.83	Native
Vaccinium vitis-idaea (bog cranberry)	3.83	Native
Rosa acicularis (prickly rose)	3.50	Native
Salix bebbiana (beaked willow)	3.33	Native
Graminoids		
Elymus innovatus (hairy wild rye)	2.75	Native
Carex vaginata (sheathed sedge)	0.58	Native
Calamagrostis stricta (narrow reed grass)	0.50	Native
Carex pauciflora (few-flowered sedge)	0.50	Native
Carex disperma (two-seeded sedge)	0.08	Native
Forbs		
Cornus canadensis (bunchberry)	4.83	Native
Equisetum pratense (meadow horsetail)	2.17	Native
Equisetum sylvaticum (woodland horsetail)	1.67	Native
Petasites palmatus (palmate-leaved coltsfoot)	0.75	Native
Epilobium angustifolium (common fireweed)	0.67	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 150 through Table 153, break out the vegetation recorded in six relatively undisturbed late seral to climax stands sampled of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, forested habitat type of minor-to-incidental occurrence across the study area.

Table 150 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type. For the 6 stands comprising the habitat type, the number of unique species was 42 with 41 (97.6 percent) of them being native species.

Table 150. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/ Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type (number = 6 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2	2	0	0
Shrubs	16	15	0	1
Graminoids	7	7	0	0
Forbs	17	17	0	0
TOTAL	***42 (100.0%)***	***41 (97.6%)***	***0 (0.0%)***	***1 (2.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 151 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type. The average number of species per stand is 14.4, with native species comprising 14.1 species per stand or 97.9 percent.

Table 151. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type (number = 6 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.5	1.5	0.0	0.0
Shrubs	5.8	5.5	0.0	0.3
Graminoids	1.8	1.8	0.0	0.0
Forbs	5.3	5.3	0.0	0.0
TOTAL	***14.4 (100.0%)***	***14.1 (97.9%)***	***0.0 (0.0%)***	***0.3 (2.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 152 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type. The average canopy cover per stand is 98.1 percent, with native species comprising 97.9 percent or 99.8 percent of the total amount of average canopy cover per stand.

Table 152. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type (number = 6 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	55.5%	55.5%	0.0%	0.0%
Shrubs	24.4%	24.3%	0.0%	0.2%
Graminoids	4.6%	4.6%	0.0%	0.0%
Forbs	13.6%	13.6%	0.0%	0.0%
TOTAL	***98.1% (100.0%)***	***97.9% (99.8%)***	***0.0% (0.0%)***	***0.2% (0.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 153 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type. The average number of species per stand was 14.4 with an average canopy cover of 98.1 percent.

Table 153. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type (number = 6 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	1.5	55.5%
Shrubs	5.8	24.4%
Graminoids	1.8	4.6%
Forbs	5.3	13.6%
TOTAL	***14.4***	***98.1%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

On the six relatively undisturbed late seral to climax stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type, there were two tree species recorded, with *Picea mariana* (black spruce) being far more prominence (Table 154). The understory indicator, *Lonicera involucrata* (bracted honeysuckle), is the only shrub species occurring on all plots. Of seven graminoids recorded, only *Elymus innovatus* (hairy wild rye) is even moderately prominent; while among the 17 forb species, no species is more than moderately prominent.

Table 154. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type (number = 6 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 2)					
Picea mariana (black spruce)	50.0	40-60	100	50.00	N
Pinus contorta (lodgepole pine)	11.0	0-20	50	5.50	N
Shrubs (N = 16)					
Betula glandulosa (bog birch)	0.5	0-0.5	17	0.08	N
Betula pumila (dwarf birch)	0.5	0-0.5	17	0.08	N
Ledum groenlandicum (common Labrador tea)	2.0	0-3	83	1.67	N
Linnaea borealis (twinflower)	1.1	0-3	67	0.75	N
Lonicera involucrata (bracted honeysuckle)	5.3	3-10	100	5.33	N
Rosa acicularis (prickly rose)	5.3	0-10	67	3.50	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	17	0.08	N
Rubus pubescens (dewberry)	0.5	0-0.5	17	0.08	N
Salix barclayi (Barclay's willow)	3.0	0-3	17	0.50	N
Salix bebbiana (beaked willow)	20.0	0-20	17	3.33	N
Salix glauca (smooth willow)	11.5	0-20	33	3.83	N
Salix planifolia (flat-leaved willow)	3.0	0-3	17	0.50	N
Salix spp. (willow)	0.5	0-0.5	33	0.17	B
Vaccinium caespitosum (dwarf bilberry)	0.5	0-0.5	17	0.08	N
Vaccinium myrtilloides (common blueberry)	1.8	0-3	33	0.58	N
Vaccinium vitis-idaea (bog cranberry)	11.5	0-20	33	3.83	N
Graminoids (N = 7)					
Calamagrostis stricta (narrow reed grass)	3.0	0-3	17	0.50	N
Carex disperma (two-seeded sedge)	0.5	0-0.5	17	0.08	N
Carex pauciflora (few-flowered sedge)	3.0	0-3	17	0.50	N
Carex spp. (sedge)	0.5	0-0.5	17	0.08	N
Carex tenera (broad-fruited sedge)	0.5	0-0.5	17	0.08	N
Carex vaginata (sheathed sedge)	1.8	0-3	33	0.58	N
Elymus innovatus (hairy wild rye)	4.1	0-10	67	2.75	N
Forbs (N = 17)					
Achillea millefolium (common yarrow)	0.5	0-0.5	33	0.17	N
Aster ciliolatus (Lindley's aster)	3.0	0-3	17	0.50	N
Cornus canadensis (bunchberry)	5.8	0-10	83	4.83	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	17	0.08	N
Epilobium angustifolium (common fireweed)	1.3	0-3	50	0.67	N
Equisetum arvense (common horsetail)	3.0	0-3	17	0.50	N
Equisetum pratense (meadow horsetail)	6.5	0-10	33	2.17	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	33	0.17	N
Equisetum sylvaticum (woodland horsetail)	10.0	0-10	17	1.67	N
Galium boreale (northern bedstraw)	1.8	0-3	33	0.58	N
Geocaulon lividum (northern bastard toadflax)	0.5	0-0.5	17	0.08	N
Lycopodium annotinum (stiff club-moss)	0.5	0-0.5	17	0.08	N

Table 154. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	17	0.08	N
Mertensia paniculata (tall lungwort)	1.8	0-3	33	0.58	N
Mitella nuda (bishop's-cap)	1.8	0-3	33	0.58	N
Petasites palmatus (palmate-leaved coltsfoot)	1.1	0-3	67	0.75	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	17	0.08	N

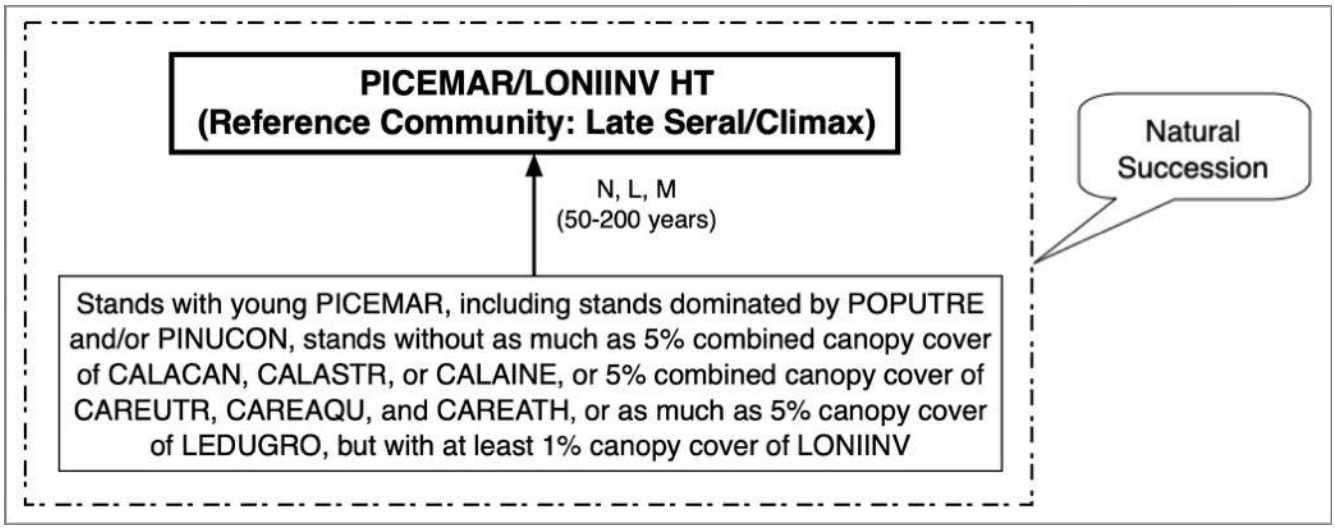
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Most succession in *Picea mariana* (black spruce) communities is set back by fire, and the *Picea mariana/ Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type lies on the drier side of the *Picea mariana* (black spruce) moisture requirement spectrum, so it is more frequently able to sustain fire than are the other, wetter, *Picea mariana* (black spruce) types. After fire, *Picea mariana* (black spruce) establishes from crown-stored seed that disperses from semi-serotinous cones. Large quantities of seeds are released soon after a fire (Fryer 2014). If *Populus balsamifera* (balsam poplar) and/or *Populus tremuloides* (aspen) are in the stand prior to burning, the poplars may dominate the stand for 50 to 80 years after the fire, before the *Picea mariana* (black spruce) regains dominance (Fryer 2014).

Figure 26 shows a schematic diagram of vegetation successional pathways on sites of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type.



Successional Pathway of *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CALACAN—*Calamagrostis canadensis* (marsh reed grass)
CALAINE—*Calamagrostis inexpansa* (northern reed grass)
CALASTR—*Calamagrostis stricta* (narrow reed grass)
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
LEDUGRO—*Ledum groenlandicum* (common Labrador tea)
LONIINV—*Lonicera involucrata* (bracted honeysuckle)
PICEMAR—*Picea mariana* (black spruce)
PICEMAR/LONIINV HT—*Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type
PINUCON—*Pinus contorta* (lodgepole pine)
POPUTRE—*Populus tremuloides* (aspen)

Figure 26. Successional pathway for sites of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 27 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

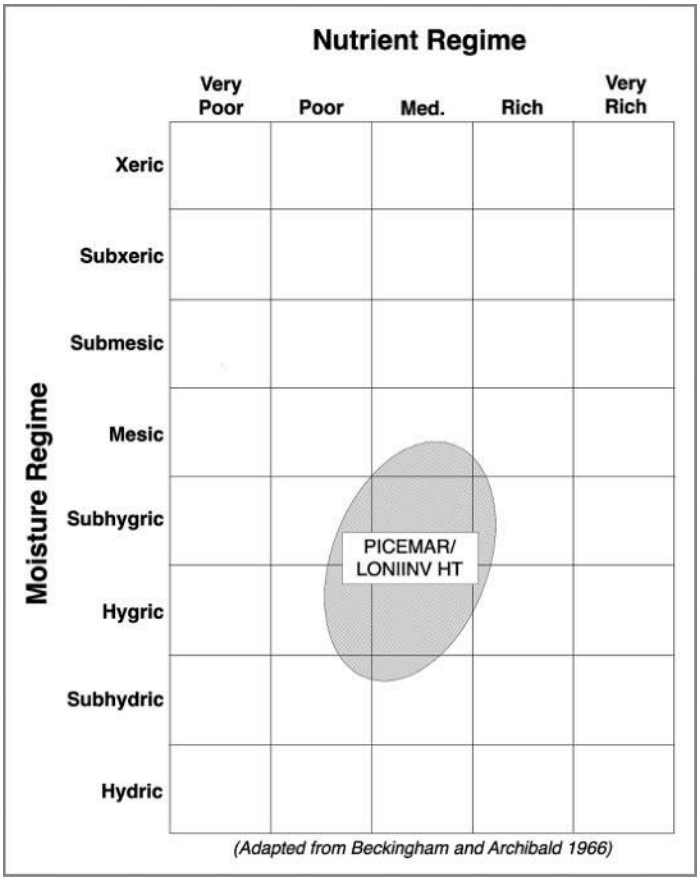


Figure 27. Edatope grid position for the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type (PICEMAR/LONIINV HT)

SOILS

Parent material on sites supporting the *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type is predominantly morainal and glaciolacustrine. Soil drainage ranges from moderately well drained to very poorly drained. Soil subgroups are mostly gleysols, regosols, and brunisols. Soil texture mostly ranges from sandy loam to silt loam. Surface organic thickness may range from 0 cm to 5 cm (France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites are likely to have the *Picea mariana/Calamagrostis canadensis* (black spruce/marsh reed grass) habitat type or the *Picea mariana/Ledum groenlandicum* (black spruce/common Labrador tea) habitat type. Drier adjacent sites are most likely to have communities dominated by *Picea glauca* (white spruce) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Picea mariana* (black spruce)**—*Picea mariana* (black spruce) grows in regions with long, cold winters and short, warm summers (Fryer 2014). It is found primarily in bogs, muskegs, and swampy woods in northern and western Alberta (Tannas 1997a). It occurs on a wide range of sites from wet lowlands and drier uplands on a variety of soils, but is found most commonly on poorly drained sites underlain with permafrost (Fryer 2014). The species is important in other boreal communities, including stands with various mixes pf *Picea glauca* (white spruce), *Pinus contorta* (lodgepole pine), *Populus tremuloides* (aspen), and *Betula papyrifera* (white birch) (Fryer 2014).

The species tolerates a wide range of soil temperature and moisture regimes, growing in relatively warm, dry soils, as well as nearly frozen wet soils that exclude deciduous and most other conifer trees. Substrate moisture varies from saturation in bogs and swamps, wet on bottomlands and flats, wet to moist along lake margins, mesic on north-facing slopes, well-drained on most other slopes, and dry on drained peatlands. *Picea mariana* (black spruce) favors acidic soils, but sometimes grows in calcareous bogs with soil pH as high as 8.0 (Fryer 2014).

Picea mariana (black spruce) is found in all stages of forest succession. It is moderately shade tolerant, and grows in open bogs and woodlands, as well as in closed-canopy forests. Although *Populus tremuloides* (aspen), *Betula papyrifera* (white birch), and shrubs often sprout or colonize after fire in these black spruce stands, the spruce usually regains dominance within 90 years or less post fire (Fryer 2014).

***Lonicera involucrata* (bracted honeysuckle)**—*Lonicera involucrata* (bracted honeysuckle) habitats are generally moist forest openings, swamps, streamsides, and meadow edges, ranging in elevation from sea level along the Pacific Coast to subalpine sites in the mountains (USDA National Resources Conservation Service 2023). The species is found in Alberta on moist, nutrient-rich sites that usually receive nutrient-rich seepage water during a portion of the growing season. These sites tend to be the most productive forested ecosites in the Upper Foothills Natural Subregion (France and others 2020).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is found in all natural regions of Alberta, except the Dry Mixedgrass Region. It is the most common tree species at middle and lower altitudes along the eastern slopes of the Rocky Mountains, forming nearly pure stands on some sites in the foothills and montane areas (Tannas 1997a).

Pinus contorta (lodgepole pine) grows at low to high elevations, in dry to wet conditions, warm to cold temperatures, and on nearly every soil type found in western North America, except on saline sites. The species is not shade tolerant, and grows best on non-calcareous soil. It is primarily an aggressive pioneer on disturbed sites, and fire perpetuates or renews the stands (Anderson 2003). As these pine stands mature, they give way to shade-tolerant conifers at ages from 50 to 100 years in mesic habitats, and 100 to 200 years on warmer and drier sites (Anderson 2003).

Pinus contorta (lodgepole pine) may establish alongside later seral, more shade-tolerant species, and its rapid growth may enable the pines to remain competitive in the canopy for several years. However, these trees do not regenerate under a canopy, and are eliminated from the stand as mortality occurs. The *Pinus contorta* (lodgepole pine) is generally replaced within 50 to 100 years by the more shade-tolerant associates (Anderson 2003).

Livestock

***Picea mariana* (black spruce)**—*Picea mariana* (black spruce) has poor value as forage for both livestock and wild ungulates, although it may occasionally be eaten when better quality forage is absent (Tannas 1997a).

***Lonicera involucrata* (bracted honeysuckle)**—The forage value of *Lonicera involucrata* (bracted honeysuckle) is rated as poor for livestock, and the species is considered an increaser in response to browsing pressure (Tannas 1997a). The species is rated as poor forage for domestic cattle and fair for sheep (Darris 2011).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) offers poor forage value, and is seldom eaten by livestock (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Picea mariana* (black spruce)**—The primary use for *Picea mariana* (black spruce) timber is pulpwood. It is also used for Christmas trees and heating fuel (USDA National Resources Conservation Service 2023).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) timber is used extensively for construction lumber, pulpwood, heating fuel, posts and poles, and plywood veneer (USDA National Resources Conservation Service 2023).

Wildlife

***Picea mariana* (black spruce)**—A wide variety of wildlife use *Picea mariana* (black spruce) communities as habitat. Some bird guilds use various post fire successional stages preferentially. Among bird guilds for example, cavity nesters prefer early seral stands, while foliage gleaners generally prefer more mature stands. Most wildlife avoid *Picea mariana* (black spruce) browse, but it provides important winter forage for some species, and many wildlife species consume the seeds (Fryer 2014).

***Lonicera involucrata* (bracted honeysuckle)**—The forage value of *Lonicera involucrata* (bracted honeysuckle) is also rated as poor for wild ungulates, although it is occasionally used by game when more preferred forage is unavailable. The fruits are eaten by birds (Tannas 1997a). *Lonicera involucrata* (bracted honeysuckle) berries are eaten by bears, small mammals, game birds including quail and grouse, and songbirds such as thrushes. The flower is a source of nectar for hummingbirds and butterflies (Darris 2011).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) also offers poor forage value for wildlife, and is eaten by deer and elk only when better forage is lacking (Tannas 1997a). Stands of the species provide cover for big game animals, upland game birds, small non-game birds, and small mammals (Anderson 2003).

Fire

***Picea mariana* (black spruce)**—Fire usually kills *Picea mariana* (black spruce), because even mature trees have thin bark and shallow roots. In general, the species is poorly adapted to survive fire, and mortality is usually near 100 percent. Crowning of the fire is common in these stands due to layered fuels, with branches draped with lichens that are easily ignited, causing the fire to carry up through successive dense branches (Fryer 2014).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) thrives under the influence of fire, and on many sites fire is required to maintain its dominance. Producing serotinous cones is one adaptation to stand-replacing fire, and the seed supply is nearly always available on the tree (Anderson 2003).

The propensity of *Pinus contorta* (lodgepole pine) to form stands with high seedling density, initial rapid growth that slows with age, high susceptibility to snow breakage and wind-throw, infestation by dwarf-mistletoe and mountain pine beetles, all result in large buildups of fuel (Anderson 2003).

Rehabilitation/Restoration Considerations

***Picea mariana* (black spruce)**—*Picea mariana* (black spruce) is used for revegetating seismic lines, borrow pits, abandoned roads, and construction sites in boreal regions (Fryer 2014).

***Lonicera involucrata* (bracted honeysuckle)**—*Lonicera involucrata* (bracted honeysuckle) is a valuable shrub for streambank erosion control and restoration of riparian areas, swamps, bogs, moist woodlands. Winter dormant branches are useful as live stakes, fascines, and other soil bioengineering practices for stabilizing streambanks, moist slopes, and the immediate shoreline of lakes or ponds (Darris 2011).

Vegetative propagation in containers or beds is easy from hardwood (winter dormant), softwood (spring) and semi-hardwood (summer) cuttings, or layering of stems if the soil or growth media is kept moist. Rooting hormones are generally not required, but may be helpful for some clones or populations. As with container or bare root nursery stock, survival and growth are improved if stakes are mulched or irrigated the first full growing season, weeds are suppressed, and animal browse is curtailed (Darris 2011).

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is often used in reforestation projects, especially for revegetation on sites of mining disturbance. Though it grows well on nutrient poor soils, addition of nitrogen fertilizer will likely enhance growth of the plantings (Anderson 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Sb-Sw/Labrador tea/Horsetail

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type has not been described in the region.

Pinus contorta/Alnus crispa Community Type
(lodgepole pine/green alder Community Type)

PINUCON/ALNUCRI Community Type
Number of Stands = 42 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 42; Other Data Sets = 0)

LOCATION AND ASSOCIATED LANDFORMS

The *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. *Pinus contorta* (lodgepole pine) is commonly established after wildfire and can occur almost anywhere in the montane subregion and upslope. Stands may persist for many decades before either succeeding to later seral communities, or burning once again. This community type is limited to site conditions that can support *Alnus crispa* (green alder), which include sites in moist or boggy woods and along streams and lakeshores.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 155 shows the five most prominent plant species among the four lifeforms for species recorded in all 42 stands of the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type. The community type is dominated by *Pinus contorta* (lodgepole pine), and *Alnus crispa* (green alder). No other species is more than moderately prominent.

Table 155. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type (number = 42 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Pinus contorta (lodgepole pine)	43.81	Native
Populus balsamifera (balsam poplar)	0.95	Native
Abies lasiocarpa (subalpine fir)	0.29	Native
Picea glauca (white spruce)	0.26	Native
Populus tremuloides (aspen)	0.23	Native
Shrubs		
Alnus crispa (green alder)	42.87	Native
Linnaea borealis (twinflower)	4.61	Native
Rosa acicularis (prickly rose)	2.83	Native
Viburnum edule (low-bush cranberry)	2.68	Native
Spiraea betulifolia (white meadowsweet)	1.50	Native
Graminoids		
Elymus innovatus (hairy wild rye)	5.12	Native
Calamagrostis rubescens (pine reed grass)	0.94	Native
Agropyron spp. (wheat grass)	0.07	Both
Calamagrostis canadensis (marsh reed grass)	0.07	Native
Calamagrostis stricta (narrow reed grass)	0.07	Native
Forbs		
Cornus canadensis (bunchberry)	5.57	Native
Aralia nudicaulis (wild sarsaparilla)	2.48	Native
Epilobium angustifolium (common fireweed)	1.95	Native
Arnica cordifolia (heart-leaved arnica)	1.37	Native
Pyrola asarifolia (common pink wintergreen)	1.14	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 156 through Table 159, break out the vegetation recorded in all 42 stands sampled of the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, forested community type of minor occurrence across the study area.

Table 156 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder)

community type. For the 42 stands comprising the community type, the number of unique species was 143 with 138 (96.5 percent) of them being native species.

Table 156. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type (number = 42 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	8	8	0	0
Shrubs	47	45	0	2
Graminoids	11	9	0	2
Forbs	77	76	1	0
TOTAL	***143 (100.0%)***	***138 (96.5%)***	***1 (0.7%)***	***4 (2.8%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 157 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type. The average number of species per stand is 21.0, with native species comprising 20.7 species per stand or 98.6 percent.

Table 157. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type (number = 42 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.0	2.0	0.0	0.0
Shrubs	8.1	8.0	0.0	0.2
Graminoids	1.1	1.0	0.0	0.0
Forbs	9.8	9.7	0.0	0.0
TOTAL	***21.0 (100.0%)***	***20.7 (98.6%)***	***0.0 (0.0%)***	***0.2 (1.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 158 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type. The

average canopy cover per stand is 143.1 percent, with native species comprising 142.6 percent or 99.7 percent of the total amount of average canopy cover per stand.

Table 158. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type (number = 42 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	45.6%	45.6%	0.0%	0.0%
Shrubs	69.7%	69.5%	0.0%	0.3%
Graminoids	6.5%	6.4%	0.0%	0.1%
Forbs	21.3%	21.2%	0.1%	0.0%
TOTAL	***143.1% (100.0%)***	***142.6% (99.7%)***	***0.1% (0.0%)***	***0.3% (0.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 159 shows the average number of species and average canopy cover by lifeform in stands of the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type. The average number of species per stand was 21.0 with an average canopy cover of 143.1 percent.

Table 159. Average number of species and average canopy cover by lifeform in stands of the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type (number = 42 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.0	45.6%
Shrubs	8.1	69.7%
Graminoids	1.1	6.5%
Forbs	9.8	21.3%
TOTAL	***21.0***	***143.1%***

Sampled Stands Plant Species List

Eight tree species were recorded on 42 stands sampled of the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type (Table 160). This is an early-to-mid seral community, but the other conifer trees recorded are all later seral species becoming established as succession progresses in these stands. Of 47 shrubs recorded, only *Alnus crispa* (green alder) was more than moderately prominent. *Elymus innovatus* (hairy wild rye) is the only graminoid, and *Cornus canadensis* (bunchberry) the only forb species even moderately prominent.

Table 160. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type (number = 42 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 8)					
Abies balsamea (balsam fir)	0.5	0-0.5	2	0.01	N
Abies lasiocarpa (subalpine fir)	1.3	0-3	21	0.29	N
Picea engelmannii (Engelmann spruce)	0.5	0-0.5	2	0.01	N
Picea glauca (white spruce)	0.5	0-0.5	52	0.26	N
Picea mariana (black spruce)	0.5	0-0.5	5	0.02	N
Pinus contorta (lodgepole pine)	43.8	20-70	100	43.81	N
Populus balsamifera (balsam poplar)	20.0	0-30	5	0.95	N
Populus tremuloides (aspen)	2.4	0-3	10	0.23	N
Shrubs (N = 47)					
Alnus crispa (green alder)	42.9	3-97.5	100	42.87	N
Alnus tenuifolia (river alder)	21.5	0-40	5	1.02	N
Amelanchier alnifolia (Saskatoon)	1.5	0-3	12	0.18	N
Arctostaphylos uva-ursi (common bearberry)	2.3	0-3	17	0.38	N
Berberis repens (creeping mahonia)	0.5	0-0.5	2	0.01	N
Chimaphila umbellata (prince's-pine)	0.5	0-0.5	10	0.05	N
Clematis occidentalis (purple clematis)	1.3	0-3	14	0.19	N
Empetrum nigrum (crowberry)	3.0	0-3	2	0.07	N
Gaultheria hispidula (creeping snowberry)	3.0	0-3	2	0.07	N
Juniperus communis (ground juniper)	1.5	0-3	12	0.18	N
Juniperus horizontalis (creeping juniper)	3.0	0-3	2	0.07	N
Ledum groenlandicum (common Labrador tea)	0.8	0-3	24	0.18	N
Linnaea borealis (twinflower)	5.0	0-20	93	4.61	N
Lonicera dioica (twining honeysuckle)	3.0	0-3	2	0.07	N
Lonicera involucrata (bracted honeysuckle)	0.5	0-0.5	21	0.11	N
Menziesia ferruginea (false azalea)	13.5	0-30	7	0.96	N
Oxycoccus microcarpus (small bog cranberry)	10.0	0-10	2	0.24	N
Potentilla fruticosa (shrubby cinquefoil)	3.0	0-3	2	0.07	N
Rhododendron albiflorum (white-flowered rhododendron)	3.0	0-3	2	0.07	N
Ribes hudsonianum (northern black currant)	0.5	0-0.5	5	0.02	N
Ribes lacustre (bristly black currant)	1.2	0-3	17	0.20	N
Ribes triste (wild red currant)	0.5	0-0.5	2	0.01	N
Rosa acicularis (prickly rose)	3.7	0-10	76	2.83	N
Rosa woodsii (common wild rose)	10.0	0-10	2	0.24	N
Rubus arcticus (dwarf raspberry)	3.0	0-3	2	0.07	N
Rubus idaeus (wild red raspberry)	3.3	0-20	36	1.17	N
Rubus parviflorus (thimbleberry)	0.5	0-0.5	5	0.02	N
Rubus pedatus (dwarf bramble)	3.3	0-10	14	0.48	N
Rubus pubescens (dewberry)	1.7	0-10	33	0.57	N
Rubus spp. (raspberry)	3.0	0-3	2	0.07	B
Salix bebbiana (beaked willow)	14.3	0-20	7	1.02	N

Table 160. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Salix candida (hoary willow)	0.5	0-0.5	2	0.01	N
Salix discolor (pussy willow)	30.0	0-30	5	1.43	N
Salix glauca (smooth willow)	6.5	0-10	5	0.31	N
Salix pedicellaris (bog willow)	10.0	0-10	2	0.24	N
Salix pyrifolia (balsam willow)	0.5	0-0.5	2	0.01	N
Salix scouleriana (Scouler's willow)	11.5	0-30	10	1.10	N
Salix spp. (willow)	1.3	0-3	14	0.19	B
Shepherdia canadensis (Canada buffaloberry)	1.8	0-3	24	0.42	N
Sorbus scopulina (western mountain-ash)	2.5	0-10	14	0.36	N
Spiraea betulifolia (white meadowsweet)	2.7	0-20	55	1.50	N
Vaccinium caespitosum (dwarf bilberry)	1.5	0-3	31	0.45	N
Vaccinium membranaceum (tall bilberry)	1.0	0-3	12	0.12	N
Vaccinium myrtilloides (common blueberry)	6.3	0-20	19	1.20	N
Vaccinium myrtillus (low bilberry)	6.5	0-10	5	0.31	N
Vaccinium vitis-idaea (bog cranberry)	5.0	0-20	26	1.30	N
Viburnum edule (low-bush cranberry)	5.4	0-30	50	2.68	N
Graminoids (N = 11)					
Agropyron spp. (wheat grass)	3.0	0-3	2	0.07	B
Calamagrostis canadensis (marsh reed grass)	3.0	0-3	2	0.07	N
Calamagrostis rubescens (pine reed grass)	5.6	0-10	17	0.94	N
Calamagrostis stricta (narrow reed grass)	3.0	0-3	2	0.07	N
Carex siccata (hay sedge)	3.0	0-3	2	0.07	N
Carex umbellata (umbellate sedge)	3.0	0-3	2	0.07	N
Cinna latifolia (drooping wood-reed)	0.5	0-0.5	2	0.01	N
Elymus innovatus (hairy wild rye)	7.4	0-40	69	5.12	N
Festuca scabrella (rough fescue)	0.5	0-0.5	2	0.01	N
Festuca spp. (fescue)	0.5	0-0.5	2	0.01	B
Trisetum spicatum (spike trisetum)	0.5	0-0.5	2	0.01	N
Forbs (N = 77)					
Achillea millefolium (common yarrow)	1.8	0-3	5	0.08	N
Actaea rubra (red and white baneberry)	1.3	0-3	7	0.10	N
Allium cernuum (nodding onion)	0.5	0-0.5	2	0.01	N
Anemone multifida (cut-leaved anemone)	0.5	0-0.5	2	0.01	N
Anemone patens (prairie crocus)	0.5	0-0.5	2	0.01	N
Angelica dawsonii (yellow angelica)	0.5	0-0.5	2	0.01	N
Antennaria neglecta (broad-leaved everlasting)	0.5	0-0.5	5	0.02	N
Antennaria parvifolia (small-leaved everlasting)	3.0	0-3	2	0.07	N
Antennaria pulcherrima (showy everlasting)	0.5	0-0.5	2	0.01	N
Antennaria racemosa (racemose everlasting)	0.5	0-0.5	5	0.02	N
Aquilegia flavescens (yellow columbine)	0.5	0-0.5	2	0.01	N
Aralia nudicaulis (wild sarsaparilla)	13.0	0-30	19	2.48	N
Arnica cordifolia (heart-leaved arnica)	1.8	0-10	76	1.37	N
Aster ciliolatus (Lindley's aster)	1.4	0-3	19	0.27	N
Aster conspicuus (showy aster)	2.2	0-20	48	1.06	N

Table 160. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Aster engelmannii (elegant aster)	3.0	0-3	2	0.07	N
Aster spp. (aster)	0.5	0-0.5	2	0.01	N
Athyrium filix-femina (lady fern)	0.5	0-0.5	2	0.01	N
Botrychium spp. (grape ferns)	0.5	0-0.5	2	0.01	N
Calypso bulbosa (Venus'-slipper)	0.5	0-0.5	5	0.02	N
Campanula rotundifolia (harebell)	0.5	0-0.5	14	0.07	N
Castilleja miniata (common red paintbrush)	1.8	0-3	10	0.17	N
Clintonia uniflora (corn lily)	0.5	0-0.5	2	0.01	N
Corallorhiza trifida (pale coralroot)	0.5	0-0.5	5	0.02	N
Cornus canadensis (bunchberry)	6.5	0-20	86	5.57	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	2	0.01	N
Disporum trachycarpum (fairybells)	0.5	0-0.5	5	0.02	N
Dryopteris carthusiana (narrow spinulose shield fern)	1.8	0-3	5	0.08	N
Epilobium angustifolium (common fireweed)	2.5	0-10	79	1.95	N
Equisetum arvense (common horsetail)	1.8	0-3	5	0.08	N
Equisetum scirpoides (dwarf scouring-rush)	1.3	0-3	7	0.10	N
Equisetum sylvaticum (woodland horsetail)	0.5	0-0.5	17	0.08	N
Erythronium grandiflorum (glacier lily)	0.5	0-0.5	2	0.01	N
Fragaria virginiana (wild strawberry)	1.3	0-3	36	0.48	N
Galium boreale (northern bedstraw)	0.5	0-0.5	17	0.08	N
Galium triflorum (sweet-scented bedstraw)	1.3	0-3	14	0.19	N
Geranium richardsonii (wild white geranium)	1.8	0-3	5	0.08	N
Goodyera oblongifolia (rattlesnake plantain)	0.5	0-0.5	10	0.05	N
Gymnocarpium dryopteris (oak fern)	1.3	0-3	7	0.10	N
Habenaria obtusata (blunt-leaved bog orchid)	0.5	0-0.5	2	0.01	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	5	0.02	N
Heracleum lanatum (cow parsnip)	2.2	0-3	7	0.15	N
Hieracium albiflorum (white hawkweed)	3.0	0-3	2	0.07	N
Hieracium umbellatum (narrow-leaved hawkweed)	0.5	0-0.5	2	0.01	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	14	0.07	N
Lilium philadelphicum (western wood lily)	0.5	0-0.5	2	0.01	N
Lupinus sericeus (silky perennial lupine)	0.5	0-0.5	5	0.02	N
Lycopodium annotinum (stiff club-moss)	1.3	0-3	24	0.30	N
Lycopodium complanatum (ground-cedar)	0.5	0-0.5	7	0.04	N
Lycopodium obscurum (ground-pine)	1.8	0-3	5	0.08	N
Maianthemum canadense (wild lily-of-the-valley)	2.0	0-10	43	0.86	N
Mertensia paniculata (tall lungwort)	2.7	0-10	21	0.57	N
Mitella nuda (bishop's-cap)	1.4	0-3	26	0.37	N
Orthilia secunda (one-sided wintergreen)	1.5	0-10	45	0.69	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	1.8	0-3	5	0.08	N
Osmorhiza depauperata (spreading sweet cicely)	0.5	0-0.5	5	0.02	N
Pedicularis bracteosa (western lousewort)	3.0	0-3	2	0.07	N
Petasites palmatus (palmate-leaved coltsfoot)	0.8	0-3	19	0.15	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	2	0.01	N

Table 160. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Pyrola asarifolia (common pink wintergreen)	1.8	0-3	62	1.14	N
Pyrola chlorantha (greenish-flowered wintergreen)	0.9	0-3	17	0.14	N
Smilacina racemosa (false Solomon's-seal)	1.5	0-3	12	0.18	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	2	0.01	N
Solidago spathulata (mountain goldenrod)	0.5	0-0.5	2	0.01	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	2	0.01	N
Stenanthium occidentale (bronzebells)	1.3	0-3	14	0.19	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1.6	0-3	21	0.35	N
Taraxacum officinale (common dandelion)	3.0	0-3	2	0.07	I
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	5	0.02	N
Valeriana sitchensis (mountain valerian)	3.0	0-3	2	0.07	N
Veratrum eschscholtzii (green false hellebore)	0.5	0-0.5	2	0.01	N
Vicia americana (wild vetch)	1.8	0-3	5	0.08	N
Viola adunca (early blue violet)	0.5	0-0.5	2	0.01	N
Viola canadensis (western Canada violet)	3.0	0-3	2	0.07	N
Viola orbiculata (evergreen violet)	0.5	0-0.5	2	0.01	N
Viola renifolia (kidney-leaved violet)	1.6	0-3	21	0.35	N
Zigadenus elegans (white camas)	0.5	0-0.5	12	0.06	N

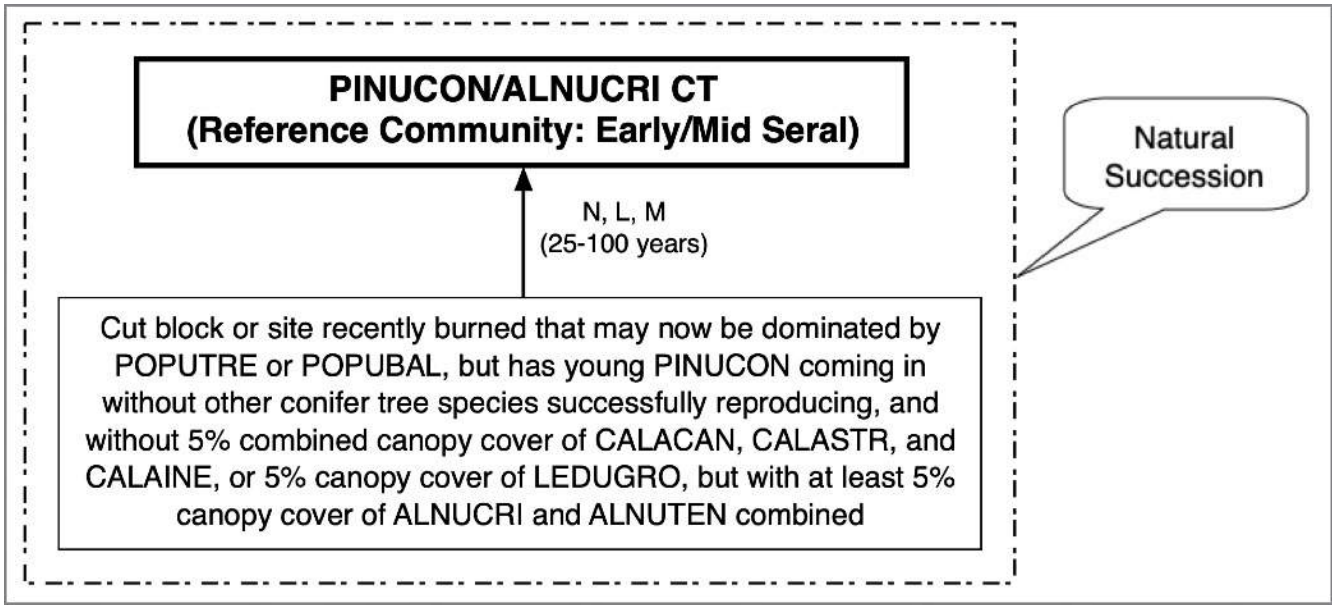
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type is a long lived, mid seral type that typically originated in a wildfire, and is likely to have its stand renewed by another fire before it can succeed to a later seral stage of dominance by a climax conifer tree species, such as *Picea glauca* (white spruce) or *Picea mariana* (black spruce). However, this community type lies on the wetter end of the *Pinus contorta* (lodgepole pine) moisture gradient, and sites are often too wet to sustain a fire, except during periods of severe drought.

Figure 28 shows a schematic diagram of vegetation successional pathways on sites of the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type.



Successional Pathway of *Pinus contorta/Alnus crispa* (lodgepole pine/green alder)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
ALNUCRI—*Alnus crispa* (green alder)
ALNUTEN—*Alnus tenuifolia* (river alder)
CALACAN—*Calamagrostis canadensis* (marsh reed grass)
CALAINE—*Calamagrostis inexpansa* (northern reed grass)
CALASTR—*Calamagrostis stricta* (narrow reed grass)
LEDUGRO—*Ledum groenlandicum* (common Labrador tea)
PINUCON—*Pinus contorta* (lodgepole pine)
PINUCON/ALNUCRI CT—*Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUTRE—*Populus tremuloides* (aspen)

Figure 28. Successional pathway for sites of the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 29 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

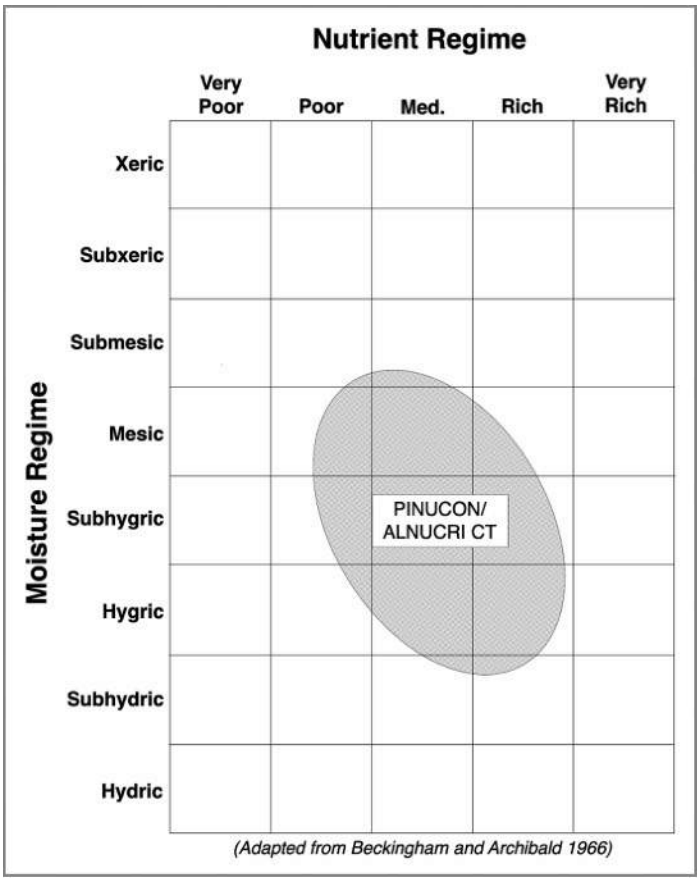


Figure 29. Edatope grid position for the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type (PINUCON/ALNUCRI CT)

SOILS

Parent material on sites supporting the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type is predominantly colluvial and morainal. Soil drainage ranges from well drained to imperfectly drained. Soil subgroups are mostly luvisols and brunisols. Soil texture mostly ranges from sandy loam to silty clay loam. Surface organic thickness may range from 0 cm to 5 cm (Baker and others 2020, France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites are likely to be dominated by the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/ marsh reed grass) community type or by the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type. Drier adjacent sites are likely to have upland communities dominated by *Picea glauca* (white spruce) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is found in all natural regions of Alberta, except the Dry Mixedgrass Region. It is the most common tree species at middle and lower altitudes along the eastern slopes of the Rocky Mountains, forming nearly pure stands on some sites in the foothills and montane areas (Tannas 1997a).

Pinus contorta (lodgepole pine) grows at low to high elevations, in dry to wet conditions, warm to cold temperatures, and on nearly every soil type found in western North America, except on saline sites. The species is not shade tolerant, and grows best on non-calcareous soil. It is primarily an aggressive pioneer on disturbed sites, and fire perpetuates or renews the stands (Anderson 2003). As these pine stands mature, they give way to shade-tolerant conifers at ages from 50 to 100 years in mesic habitats, and 100 to 200 years on warmer and drier sites (Anderson 2003).

Pinus contorta (lodgepole pine) may establish alongside later seral, more shade-tolerant species, and its rapid growth may enable the pines to remain competitive in the canopy for several years. However, these trees do not regenerate under a canopy, and are eliminated from the stand as mortality occurs. The *Pinus contorta* (lodgepole pine) is generally replaced within 50 to 100 years by the more shade-tolerant associates (Anderson 2003).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) is found in woodlands and thickets, in moist or boggy woods, along streams, in coniferous forests, and sometimes in sandy woods (Tannas 1997a). The species is a valuable understory component, protecting the soil along water courses and as a pioneer species on disturbed mineral soil. It improves the soil by adding organic matter and by fixing nitrogen (Tannas 1997a).

Alnus crispa (green alder) is a semi-shade tolerant pioneer, or seral, species. It invades and inhabits terraces above the floodplain that are subject to occasional flooding (Matthews 1992).

Livestock

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) offers poor forage value, and is seldom eaten by livestock (Tannas 1997a).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) provides fair to poor forage value. Although the leaves and twigs are thought to be nutritious and to have a fairly high protein content, the species ranks quite low in palatability, and is used only sparingly by both livestock and wild ungulates (Tannas 1997a). *Alnus crispa* (green alder) is considered an increaser in response to grazing, reproducing rapidly by both rhizomes and seed, while being fairly resistant to browsing (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) timber is used extensively for construction lumber, pulpwood, heating fuel, posts and poles, and plywood veneer (USDA National Resources Conservation Service 2023).

Wildlife

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) also offers poor forage value for wildlife, and is eaten by deer and elk only when better forage is lacking (Tannas 1997a). Stands of the species provide cover for big game animals, upland game birds, small non-game birds, and small mammals (Anderson 2003).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) leaves and young growth are readily eaten in severe weather and when other food supplies are scarce, primarily on elk and moose winter range in the upper foothills. Furthermore, the species provides important cover and habitat for wildlife, and is an important source of food for beaver (Tannas 1997a). Muskrat, beaver, cottontail, and snowshoe hares feed on alder twigs and foliage (Matthews 1992). Many birds eat alder seeds, buds, and catkins. The species is also an important component of white-tailed ptarmigan winter forage (Matthews 1992).

Fire

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) thrives under the influence of fire, and on many sites fire is required to maintain its dominance. Producing serotinous cones is one adaptation to stand-replacing fire, and the seed supply is nearly always available on the tree (Anderson 2003).

The propensity of *Pinus contorta* (lodgepole pine) to form stands with high seedling density, initial rapid growth that slows with age, high susceptibility to snow breakage and wind-throw, infestation by dwarf-mistletoe and mountain pine beetles, all result in large buildups of fuel (Anderson 2003).

***Alnus crispa* (green alder)**—Following fire, *Alnus crispa* (green alder) resprouts from the root crowns and establishes by seed from plants in nearby unburned areas. The bare mineral soil created by fire provides prime sites for *Alnus crispa* (green alder) establishment. The species does not burn easily, and dense stands can sometimes prevent fire spread. These shrubs provide shade that reduces soil temperatures, allowing spruce and other conifer trees to become established (Matthews 1992).

Rehabilitation/Restoration Considerations

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is often used in reforestation projects, especially for revegetation on sites of mining disturbance. Though it grows well on nutrient poor soils, addition of nitrogen fertilizer will likely enhance growth of the plantings (Anderson 2003).

***Alnus crispa* (green alder)**—The major value of *Alnus crispa* (green alder) in rehabilitation is its ability to invade sterile soil, thereby increasing the organic matter content and by nitrogen fixation (Matthews 1992). The species was noted for its ability to colonize tailings at the Discovery Mine in Northwest Territories (Matthews 1992).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- J8. Lodgepole pine/green alder
- L14. Lodgepole pine-white spruce/green alder/fireweed

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Pl/Green alder/Feather moss
- Pl/Green alder/Fern

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Pl/Green alder

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msd5 Green alder-Scouler's willow (Montane Southern Ecosection)
- Mse4 Pl/Green alder (Montane Southern Ecosection)
- Mnb10 Scouler's willow-Green alder (Montane Northern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type has not been described in the region.

Pinus contorta/Calamagrostis canadensis Community Type
(lodgepole pine/marsh reed grass Community Type)

PINUCON/CALACAN Community Type
Number of Stands = 93 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 93; Other Data Sets = 0)

LOCATION AND ASSOCIATED LANDFORMS

The *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type is a major type in the Lower Foothills Natural Subregion, a major type in the Upper Foothills Natural Subregion, and a major type in the Montane Natural Subregion of Alberta. *Pinus contorta* (lodgepole pine) is commonly established after wildfire and can occur almost anywhere in the montane subregion and upslope. Stands may persist for many decades before either succeeding to later seral communities, or burning once again. This community type is limited to site conditions supporting *Calamagrostis canadensis* (marsh reed grass), which includes a wide range of habitats from wet lowland sites and semi-shaded woodlands to windswept alpine ridges, although it does best on moist sites.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 161 shows the five most prominent plant species among the four lifeforms for species recorded in all 93 stands of the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type. *Pinus contorta* (lodgepole pine) heavily dominates the tree lifeform, *Alnus crispa* (green alder) the shrubs, and *Calamagrostis canadensis* (marsh reed grass) dominates the graminoids. No other species is more than moderately prominent.

Table 161. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type (number = 93 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Pinus contorta (lodgepole pine)	36.67	Native
Populus tremuloides (aspen)	5.26	Native
Populus balsamifera (balsam poplar)	1.83	Native
Betula neoalaskana (Alaska birch)	0.33	Native
Betula papyrifera (white birch)	0.32	Native
Shrubs		
Alnus crispa (green alder)	26.41	Native
Ledum groenlandicum (common Labrador tea)	5.63	Native
Linnaea borealis (twinflower)	3.33	Native
Vaccinium vitis-idaea (bog cranberry)	3.08	Native
Viburnum edule (low-bush cranberry)	2.88	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	13.66	Native
Elymus innovatus (hairy wild rye)	2.16	Native
Calamagrostis stricta (narrow reed grass)	1.72	Native
Phleum pratense (timothy)	0.22	Introduced
Melica smithii (melic grass)	0.22	Native
Forbs		
Cornus canadensis (bunchberry)	7.38	Native
Epilobium angustifolium (common fireweed)	3.48	Native
Aralia nudicaulis (wild sarsaparilla)	3.11	Native
Lycopodium annotinum (stiff club-moss)	2.29	Native
Gymnocarpium dryopteris (oak fern)	1.61	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 162 through Table 165, break out the vegetation recorded in all 93 stands sampled of the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, species rich, forested community type of major occurrence across the study area.

Table 162 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Pinus contorta/Calamagrostis canadensis* (lodgepole

pine/marsh reed grass) community type. For the 93 stands comprising the community type, the number of unique species was 190 with 185 (97.4 percent) of them being native species.

Table 162. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type (number = 93 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	11	11	0	0
Shrubs	54	53	0	1
Graminoids	24	22	2	0
Forbs	101	99	2	0
TOTAL	***190 (100.0%)***	***185 (97.4%)***	***4 (2.1%)***	***1 (0.5%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 163 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type. The average number of species per stand is 25.2, with native species comprising 25.0 species per stand or 99.2 percent.

Table 163. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type (number = 93 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.5	2.5	0.0	0.0
Shrubs	9.4	9.3	0.0	0.1
Graminoids	1.9	1.8	0.0	0.0
Forbs	11.4	11.4	0.0	0.0
TOTAL	***25.2 (100.0%)***	***25.0 (99.2%)***	***0.0 (0.0%)***	***0.1 (0.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 164 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass)

community type. The average canopy cover per stand is 159.0 percent, with native species comprising 158.6 percent or 99.7 percent of the total amount of average canopy cover per stand.

Table 164. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type (number = 93 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	44.9%	44.9%	0.0%	0.0%
Shrubs	63.0%	62.9%	0.0%	0.2%
Graminoids	18.5%	18.3%	0.2%	0.0%
Forbs	32.5%	32.5%	0.0%	0.0%
TOTAL	***159.0% (100.0%)***	***158.6% (99.7%)***	***0.3% (0.2%)***	***0.2% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 165 shows the average number of species and average canopy cover by lifeform in stands of the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type. The average number of species per stand was 25.2 with an average canopy cover of 159.0 percent.

Table 165. Average number of species and average canopy cover by lifeform in stands of the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type (number = 93 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.5	44.9%
Shrubs	9.4	63.0%
Graminoids	1.9	18.5%
Forbs	11.4	32.5%
TOTAL	***25.2***	***159.0%***

Sampled Stands Plant Species List

The *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type is the most abundant community encountered during this study, with 93 stands sampled (Table 166). Eleven tree species were recorded, with *Pinus contorta* (lodgepole pine) being by far most prominent. Another early seral species, *Populus tremuloides* (aspen), was moderately prominent also. This is an early seral pioneer community, but the other five conifer trees recorded are all later seral species becoming established as succession progresses in these stands. Among the 54 shrubs recorded, *Alnus crispa* (green alder) was highly prominent, but the stands containing this shrub species key out first to the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass)

community type. *Calamagrostis canadensis* (marsh reed grass) is the only highly prominent graminoid species on these stands. Of the 101 forb species recorded, *Cornus canadensis* (bunchberry) is most constant and prominent.

Table 166. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Pinus contorta/ Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type (number = 93 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 11)					
Abies balsamea (balsam fir)	0.5	0-0.5	1	0.01	N
Abies lasiocarpa (subalpine fir)	0.7	0-3	15	0.10	N
Betula neoalaskana (Alaska birch)	10.3	0-30	3	0.33	N
Betula papyrifera (white birch)	2.0	0-10	16	0.32	N
Picea engelmannii x glauca (Engelmann x white spruce)	0.5	0-0.5	4	0.02	N
Picea glauca (white spruce)	0.6	0-3	44	0.25	N
Picea mariana (black spruce)	0.6	0-3	22	0.13	N
Pinus contorta (lodgepole pine)	36.7	10-80	100	36.67	N
Populus balsamifera (balsam poplar)	21.3	0-40	9	1.83	N
Populus tremuloides (aspen)	14.4	0-90	37	5.26	N
Pseudotsuga menziesii (Douglas-fir)	3.0	0-3	1	0.03	N
Shrubs (N = 54)					
Alnus crispa (green alder)	34.6	0-97.5	76	26.41	N
Alnus tenuifolia (river alder)	10.0	0-10	1	0.11	N
Amelanchier alnifolia (Saskatoon)	1.7	0-10	15	0.26	N
Arctostaphylos uva-ursi (common bearberry)	2.9	0-20	10	0.28	N
Berberis repens (creeping mahonia)	0.5	0-0.5	1	0.01	N
Betula glandulosa (bog birch)	0.5	0-0.5	1	0.01	N
Betula occidentalis (water birch)	25.0	0-40	2	0.54	N
Betula pumila (dwarf birch)	3.0	0-3	2	0.06	N
Chimaphila umbellata (prince's-pine)	0.5	0-0.5	1	0.01	N
Clematis occidentalis (purple clematis)	0.5	0-0.5	3	0.02	N
Cornus stolonifera (red-osier dogwood)	5.3	0-10	3	0.17	N
Empetrum nigrum (crowberry)	0.5	0-0.5	1	0.01	N
Gaultheria hispidula (creeping snowberry)	1.1	0-3	4	0.05	N
Juniperus communis (ground juniper)	0.5	0-0.5	1	0.01	N
Ledum groenlandicum (common Labrador tea)	9.9	0-60	57	5.63	N
Ledum palustre (northern Labrador tea)	0.5	0-0.5	1	0.01	N
Linnaea borealis (twinflower)	3.5	0-20	96	3.33	N
Lonicera dioica (twining honeysuckle)	2.2	0-3	3	0.07	N
Lonicera involucrata (bracted honeysuckle)	4.0	0-50	45	1.83	N
Lonicera utahensis (red twinberry)	0.5	0-0.5	1	0.01	N
Menziesia ferruginea (false azalea)	0.5	0-0.5	2	0.01	N
Oplopanax horridum (devil's-club)	5.0	0-20	8	0.38	N
Rhododendron albiflorum (white-flowered rhododendron)	0.5	0-0.5	1	0.01	N
Ribes glandulosum (skunk currant)	2.4	0-3	4	0.10	N

Table 166. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Ribes hudsonianum (northern black currant)	0.5	0-0.5	1	0.01	N
Ribes lacustre (bristly black currant)	1.3	0-3	27	0.35	N
Ribes oxyacanthoides (northern gooseberry)	1.8	0-3	6	0.11	N
Ribes triste (wild red currant)	0.9	0-3	6	0.06	N
Rosa acicularis (prickly rose)	2.7	0-30	78	2.13	N
Rosa woodsii (common wild rose)	8.9	0-30	8	0.67	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	1	0.01	N
Rubus idaeus (wild red raspberry)	4.1	0-40	38	1.53	N
Rubus parviflorus (thimbleberry)	2.7	0-10	10	0.26	N
Rubus pedatus (dwarf bramble)	5.4	0-20	31	1.70	N
Rubus pubescens (dewberry)	2.6	0-40	68	1.74	N
Salix bebbiana (beaked willow)	10.1	0-20	20	2.05	N
Salix glauca (smooth willow)	6.5	0-10	2	0.14	N
Salix lucida (shining willow)	6.5	0-10	2	0.14	N
Salix maccalliana (velvet-fruited willow)	0.5	0-0.5	1	0.01	N
Salix pseudomonticola (false mountain willow)	10.0	0-10	1	0.11	N
Salix scouleriana (Scouler's willow)	7.0	0-10	8	0.53	N
Salix spp. (willow)	1.6	0-10	10	0.15	B
Sambucus racemosa (red elderberry)	1.1	0-3	4	0.05	N
Shepherdia canadensis (Canada buffaloberry)	1.7	0-10	13	0.22	N
Sorbus scopulina (western mountain-ash)	1.6	0-10	22	0.34	N
Spiraea betulifolia (white meadowsweet)	2.4	0-20	43	1.03	N
Symphoricarpos albus (snowberry)	0.5	0-0.5	2	0.01	N
Symphoricarpos occidentalis (buckbrush)	3.0	0-3	1	0.03	N
Vaccinium caespitosum (dwarf bilberry)	2.7	0-20	30	0.81	N
Vaccinium membranaceum (tall bilberry)	10.0	0-50	20	2.05	N
Vaccinium myrtilloides (common blueberry)	3.6	0-20	38	1.34	N
Vaccinium scoparium (grouseberry)	20.0	0-20	1	0.22	N
Vaccinium vitis-idaea (bog cranberry)	6.8	0-40	45	3.08	N
Viburnum edule (low-bush cranberry)	4.9	0-30	59	2.88	N
Graminoids (N = 24)					
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	1	0.01	N
Bromus ciliatus (fringed brome)	0.5	0-0.5	1	0.01	N
Calamagrostis canadensis (marsh reed grass)	16.3	0-80	84	13.66	N
Calamagrostis rubescens (pine reed grass)	1.5	0-3	5	0.08	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	17	1.72	N
Carex brunnescens (brownish sedge)	0.5	0-0.5	2	0.01	N
Carex deflexa (bent sedge)	3.0	0-3	1	0.03	N
Carex disperma (two-seeded sedge)	0.5	0-0.5	1	0.01	N
Carex obtusata (blunt sedge)	0.5	0-0.5	1	0.01	N
Carex preslii (Presl sedge)	0.5	0-0.5	1	0.01	N
Carex richardsonii (Richardson's sedge)	0.5	0-0.5	1	0.01	N
Carex scoparia (broom sedge)	0.5	0-0.5	1	0.01	N
Carex spp. (sedge)	0.5	0-0.5	2	0.01	N

Table 166. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Cinna latifolia (drooping wood-reed)	0.5	0-0.5	4	0.02	N
Elymus innovatus (hairy wild rye)	4.6	0-30	47	2.16	N
Helictotrichon hookeri (Hooker's oat grass)	0.5	0-0.5	1	0.01	N
Luzula parviflora (small-flowered wood-rush)	3.0	0-3	1	0.03	N
Melica smithii (melic grass)	20.0	0-20	1	0.22	N
Oryzopsis asperifolia (white-grained mountain rice grass)	4.1	0-10	4	0.18	N
Phleum pratense (timothy)	6.8	0-10	3	0.22	I
Poa palustris (fowl bluegrass)	0.5	0-0.5	1	0.01	N
Poa pratensis (Kentucky bluegrass)	0.5	0-0.5	1	0.01	I
Schizachne purpurascens (purple oat grass)	3.7	0-10	3	0.12	N
Trisetum spicatum (spike trisetum)	0.5	0-0.5	1	0.01	N
Forbs (N = 101)					
Achillea millefolium (common yarrow)	0.5	0-0.5	8	0.04	N
Actaea rubra (red and white baneberry)	1.0	0-3	11	0.11	N
Agoseris glauca (yellow false dandelion)	0.5	0-0.5	1	0.01	N
Antennaria lanata (woolly everlasting)	0.5	0-0.5	1	0.01	N
Antennaria neglecta (broad-leaved everlasting)	0.5	0-0.5	1	0.01	N
Antennaria racemosa (racemose everlasting)	3.0	0-3	1	0.03	N
Aralia nudicaulis (wild sarsaparilla)	10.3	0-60	30	3.11	N
Arnica cordifolia (heart-leaved arnica)	1.9	0-20	49	0.93	N
Arnica latifolia (broad-leaved arnica)	3.0	0-3	2	0.06	N
Aster ciliolatus (Lindley's aster)	0.9	0-3	30	0.28	N
Aster conspicuus (showy aster)	1.8	0-3	19	0.34	N
Aster spp. (aster)	0.5	0-0.5	2	0.01	N
Astragalus americanus (American milk vetch)	0.5	0-0.5	1	0.01	N
Athyrium filix-femina (lady fern)	3.5	0-20	10	0.34	N
Calypso bulbosa (Venus'-slipper)	0.5	0-0.5	2	0.01	N
Campanula lasiocarpa (Alaska harebell)	0.5	0-0.5	1	0.01	N
Campanula rotundifolia (harebell)	0.5	0-0.5	6	0.03	N
Castilleja miniata (common red paintbrush)	3.0	0-3	3	0.10	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	1	0.01	N
Coptis trifolia (goldthread)	0.5	0-0.5	6	0.03	N
Corallorhiza maculata (spotted coralroot)	0.5	0-0.5	1	0.01	N
Cornus canadensis (bunchberry)	7.6	0-30	97	7.38	N
Delphinium glaucum (tall larkspur)	2.6	0-10	8	0.19	N
Disporum hookeri (Oregon fairybells)	3.0	0-3	1	0.03	N
Disporum trachycarpum (fairybells)	0.5	0-0.5	1	0.01	N
Dryopteris assimilis (broad spinulose shield fern)	1.0	0-3	12	0.11	N
Dryopteris carthusiana (narrow spinulose shield fern)	1.8	0-3	2	0.04	N
Dryopteris filix-mas (male fern)	11.5	0-20	2	0.25	N
Epilobium angustifolium (common fireweed)	3.8	0-40	91	3.48	N
Epilobium spp. (willow-herb)	0.5	0-0.5	1	0.01	N
Equisetum arvense (common horsetail)	3.1	0-30	16	0.51	N

Table 166. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Equisetum pratense (meadow horsetail)	7.6	0-50	9	0.66	N
Equisetum scirpoides (dwarf scouring-rush)	1.3	0-3	3	0.04	N
Equisetum sylvaticum (woodland horsetail)	1.0	0-10	33	0.35	N
Fragaria vesca (woodland strawberry)	0.5	0-0.5	1	0.01	N
Fragaria virginiana (wild strawberry)	1.5	0-10	34	0.51	N
Galium boreale (northern bedstraw)	1.5	0-3	23	0.33	N
Galium triflorum (sweet-scented bedstraw)	1.1	0-3	24	0.25	N
Geocaulon lividum (northern bastard toadflax)	0.5	0-0.5	2	0.01	N
Geranium richardsonii (wild white geranium)	1.1	0-3	4	0.05	N
Geum rivale (purple avens)	0.5	0-0.5	1	0.01	N
Geum triflorum (three-flowered avens)	0.5	0-0.5	1	0.01	N
Goodyera oblongifolia (rattlesnake plantain)	1.1	0-3	4	0.05	N
Goodyera repens (lesser rattlesnake plantain)	3.0	0-3	1	0.03	N
Gymnocarpium dryopteris (oak fern)	8.3	0-70	19	1.61	N
Habenaria obtusata (blunt-leaved bog orchid)	3.0	0-3	2	0.06	N
Habenaria orbiculata (round-leaved bog orchid)	3.0	0-3	1	0.03	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	1	0.01	N
Hedysarum sulphurescens (yellow hedysarum)	0.5	0-0.5	1	0.01	N
Heracleum lanatum (cow parsnip)	2.9	0-10	12	0.34	N
Hieracium albiflorum (white hawkweed)	0.5	0-0.5	1	0.01	N
Hieracium umbellatum (narrow-leaved hawkweed)	1.0	0-3	5	0.05	N
Lathyrus ochroleucus (cream-colored vetchling)	1.6	0-10	26	0.42	N
Lathyrus venosus (purple peavine)	0.5	0-0.5	4	0.02	N
Listera cordata (heart-leaved twayblade)	0.5	0-0.5	3	0.02	N
Lupinus sericeus (silky perennial lupine)	3.0	0-3	1	0.03	N
Lycopodium annotinum (stiff club-moss)	4.4	0-40	52	2.28	N
Lycopodium clavatum (running club-moss)	0.5	0-0.5	4	0.02	N
Lycopodium complanatum (ground-cedar)	1.0	0-3	5	0.05	N
Lycopodium obscurum (ground-pine)	0.5	0-0.5	5	0.03	N
Maianthemum canadense (wild lily-of-the-valley)	1.5	0-3	48	0.73	N
Mertensia paniculata (tall lungwort)	1.5	0-10	39	0.56	N
Mitella nuda (bishop's-cap)	1.8	0-20	42	0.76	N
Moneses uniflora (one-flowered wintergreen)	3.7	0-10	3	0.12	N
Orthilia secunda (one-sided wintergreen)	1.4	0-3	31	0.45	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	1.3	0-3	3	0.04	N
Osmorhiza depauperata (spreading sweet cicely)	1.6	0-3	10	0.16	N
Osmorhiza occidentalis (western sweet cicely)	1.8	0-3	2	0.04	N
Pedicularis bracteosa (western lousewort)	0.5	0-0.5	1	0.01	N
Pedicularis labradorica (Labrador lousewort)	0.5	0-0.5	1	0.01	N
Penstemon spp. (beardtongue)	0.5	0-0.5	1	0.01	N
Petasites palmatus (palmate-leaved coltsfoot)	1.7	0-10	52	0.89	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	1	0.01	N
Potentilla tridentata (three-toothed cinquefoil)	1.3	0-3	3	0.04	N
Pyrola asarifolia (common pink wintergreen)	1.9	0-20	56	1.08	N

Table 166. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Pyrola chlorantha (greenish-flowered wintergreen)	1.3	0-3	16	0.22	N
Pyrola elliptica (white wintergreen)	0.5	0-0.5	2	0.01	N
Senecio foetidus (marsh butterweed)	0.5	0-0.5	1	0.01	N
Senecio indecorus (rayless ragwort)	3.0	0-3	1	0.03	N
Silene acaulis (moss campion)	0.5	0-0.5	1	0.01	N
Smilacina racemosa (false Solomon's-seal)	1.1	0-3	13	0.15	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	1	0.01	N
Solidago spathulata (mountain goldenrod)	0.5	0-0.5	1	0.01	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	1	0.01	N
Stenanthium occidentale (bronzebells)	1.3	0-3	3	0.04	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1.7	0-10	32	0.53	N
Streptopus roseus (rose mandarin)	6.0	0-20	4	0.26	N
Taraxacum officinale (common dandelion)	0.5	0-0.5	1	0.01	I
Thalictrum occidentale (western meadow rue)	2.2	0-3	3	0.07	N
Thalictrum spp. (meadow rue)	0.5	0-0.5	1	0.01	N
Thalictrum venulosum (veiny meadow rue)	6.5	0-10	4	0.28	N
Tiarella trifoliata (laceflower)	4.3	0-10	5	0.23	N
Tiarella unifoliata (sugarscoop)	10.0	0-10	3	0.32	N
Trifolium pratense (red clover)	3.0	0-3	1	0.03	I
Veratrum eschscholtzii (green false hellebore)	2.9	0-10	8	0.22	N
Vicia americana (wild vetch)	1.0	0-3	5	0.05	N
Viola adunca (early blue violet)	0.5	0-0.5	2	0.01	N
Viola canadensis (western Canada violet)	1.1	0-3	4	0.05	N
Viola orbiculata (evergreen violet)	1.8	0-3	2	0.04	N
Viola renifolia (kidney-leaved violet)	1.2	0-3	25	0.28	N
Woodsia glabella (smooth woodsia)	3.0	0-3	1	0.03	N

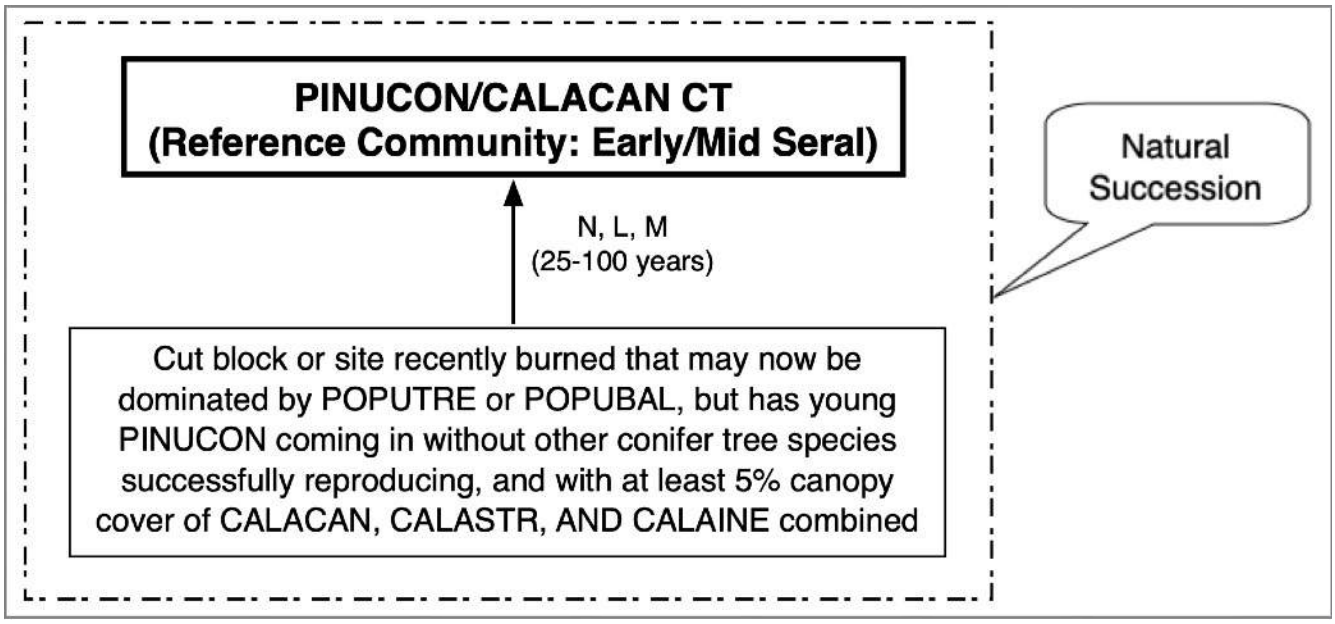
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type is a long lived, mid seral type that typically originated in a wildfire, and is likely to have its stand renewed by another fire before the community can succeed to a later seral stage of dominance by a climax conifer tree species, such as *Picea glauca* (white spruce) or *Picea mariana* (black spruce). However, this community type lies on the wetter end of the *Pinus contorta* (lodgepole pine) moisture gradient, and sites are often too wet to sustain a fire, except during periods of severe drought.

Figure 30 shows a schematic diagram of vegetation successional pathways on sites of the *Pinus contorta/ Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type.



Successional Pathway of *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CALACAN—*Calamagrostis canadensis* (marsh reed grass)
CALAINE—*Calamagrostis inexpansa* (northern reed grass)
CALASTR—*Calamagrostis stricta* (narrow reed grass)
PINUCON—*Pinus contorta* (lodgepole pine)
PINUCON/CALACAN CT—*Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUTRE—*Populus tremuloides* (aspen)

Figure 30. Successional pathway for sites of the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 31 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

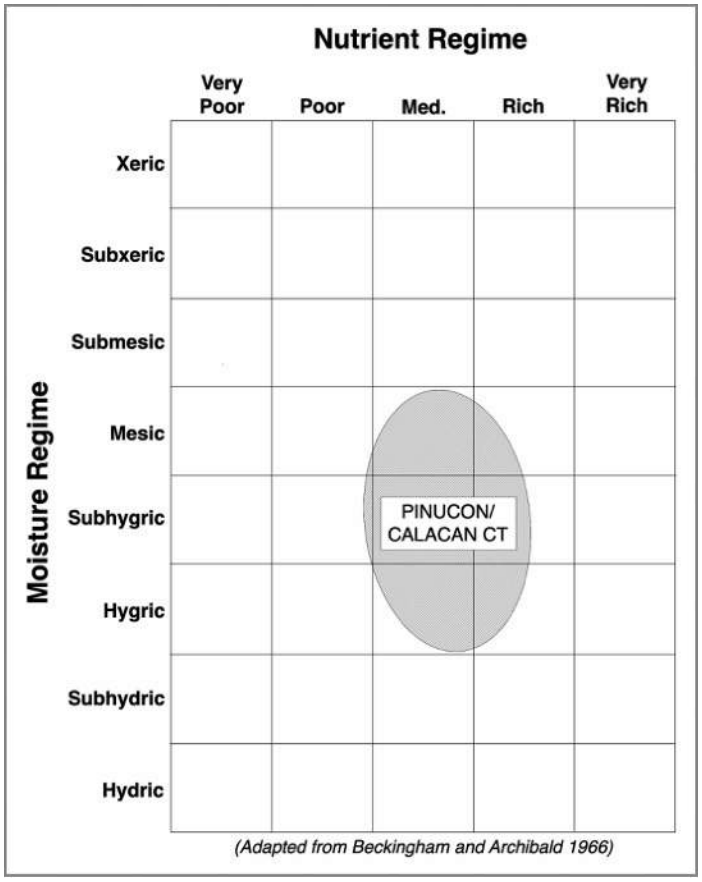


Figure 31. Edatope grid position for the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type (PINUCON/CALACAN CT)

SOILS

Parent material on sites supporting the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type is predominantly morainal. Soil drainage ranges from well drained to poorly drained. Soil subgroups are mostly luvisols and brunisols. Soil texture mostly ranges from silt loam to clay loam. Surface organic thickness may range from 0 cm to 5 cm (Baker and others 2020, France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites are likely to be dominated by *Alnus* (alder) species, *Betula* (birch) shrub species, *Salix* (willow) species, or *Carex* (sedge) species, often in a bog or fen setting. Drier adjacent sites are likely to have either the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type or the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is found in all natural regions of Alberta, except the Dry Mixedgrass Region. It is the most common tree species at middle and lower altitudes along the eastern slopes of the Rocky Mountains, forming nearly pure stands on some sites in the foothills and montane areas (Tannas 1997a).

Pinus contorta (lodgepole pine) grows at low to high elevations, in dry to wet conditions, warm to cold temperatures, and on nearly every soil type found in western North America, except on saline sites. The species is not shade tolerant, and grows best on non-calcareous soil. It is primarily an aggressive pioneer on disturbed sites, and fire perpetuates or renews the stands (Anderson 2003). As these pine stands mature, they give way to shade-tolerant conifers at ages from 50 to 100 years in mesic habitats, and 100 to 200 years on warmer and drier sites (Anderson 2003).

Pinus contorta (lodgepole pine) may establish alongside later seral, more shade-tolerant species, and its rapid growth may enable the pines to remain competitive in the canopy for several years. However, these trees do not regenerate under a canopy, and are eliminated from the stand as mortality occurs. The *Pinus contorta* (lodgepole pine) is generally replaced within 50 to 100 years by the more shade-tolerant associates (Anderson 2003).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—*Calamagrostis stricta* (narrow reed grass) is common across Alberta, except in the prairies. It occurs farther north than *Calamagrostis inexpansa* (northern reed grass). It grows in swamps, around edges of wetlands, in moist woods, and on many moister upland sites (Tannas 1997a).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) is found in woodlands and thickets, in moist or boggy woods, along streams, in coniferous forests, and sometimes in sandy woods (Tannas 1997a). The species is a valuable understory component, protecting the soil along water courses and as a pioneer species on disturbed mineral soil. It improves the soil by adding organic matter and by fixing nitrogen (Tannas 1997a).

Alnus crispa (green alder) is a semi-shade tolerant pioneer, or seral, species. It invades and inhabits terraces above the floodplain that are subject to occasional flooding (Matthews 1992).

Livestock

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) offers poor forage value, and is seldom eaten by livestock (Tannas 1997a).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most

palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—*Calamagrostis stricta* (narrow reed grass) has moderate nutritional value in early spring, but which declines as the season advances. The forage is most palatable in spring, but is avoided later in the season unless other forage is unavailable (Tannas 1997a). In general, *Calamagrostis* species (reed grass) are mostly palatable and nutritious for livestock and wildlife, but are considered to be of poor quality because their foliage becomes very rough as it matures (Johnson and others 1995). Protein content is 17 percent to 19 percent in spring, but drops to 7 percent by late summer (Tannas 1997a).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) provides fair to poor forage value. Although the leaves and twigs are thought to be nutritious and to have a fairly high protein content, the species ranks quite low in palatability, and is used only sparingly by both livestock and wild ungulates (Tannas 1997a). *Alnus crispa* (green alder) is considered an increaser in response to grazing, reproducing rapidly by both rhizomes and seed, while being fairly resistant to browsing (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) timber is used extensively for construction lumber, pulpwood, heating fuel, posts and poles, and plywood veneer (USDA National Resources Conservation Service 2023).

Wildlife

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) also offers poor forage value for wildlife, and is eaten by deer and elk only when better forage is lacking (Tannas 1997a). Stands of the species provide cover for big game animals, upland game birds, small non-game birds, and small mammals (Anderson 2003).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—Elk may make moderate summer use of *Calamagrostis* species (reed grass) (Kufeld 1973).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) leaves and young growth are readily eaten in severe weather and when other food supplies are scarce, primarily on elk and moose winter range in the upper foothills. Furthermore, the species provides important cover and habitat for wildlife, and is an important source of food for beaver (Tannas 1997a). Muskrat, beaver, cottontail, and snowshoe hares feed on alder twigs and foliage (Matthews 1992). Many birds eat alder seeds, buds, and catkins. The species is also an important component of white-tailed ptarmigan winter forage (Matthews 1992).

Fisheries

***Calamagrostis stricta* (narrow reed grass)**—The rhizomatous nature of *Calamagrostis* species (reed grass) will help provide bank stability for sites adjacent to streams (Thompson and Hansen 2003).

Fire

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) thrives under the influence of fire, and on many sites fire is required to maintain its dominance. Producing serotinous cones is one adaptation to stand-replacing fire, and the seed supply is nearly always available on the tree (Anderson 2003).

The propensity of *Pinus contorta* (lodgepole pine) to form stands with high seedling density, initial rapid growth that slows with age, high susceptibility to snow breakage and wind-throw, infestation by dwarf-mistletoe and mountain pine beetles, all result in large buildups of fuel (Anderson 2003).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

***Calamagrostis stricta* (narrow reed grass)**—Fires reducing the abundance of other associated species tend to cause dramatic increase in *Calamagrostis stricta* (narrow reed grass) and other rhizomatous species (Haeussler and Coates 1986).

***Alnus crispa* (green alder)**—Following fire, *Alnus crispa* (green alder) resprouts from the root crowns and establishes by seed from plants in nearby unburned areas. The bare mineral soil created by fire provides prime sites for *Alnus crispa* (green alder) establishment. The species does not burn easily, and dense stands can sometimes prevent fire spread. These shrubs provide shade that reduces soil temperatures, allowing spruce and other conifer trees to become established (Matthews 1992).

Rehabilitation/Restoration Considerations

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is often used in reforestation projects, especially for revegetation on sites of mining disturbance. Though it grows well on nutrient poor soils, addition of nitrogen fertilizer will likely enhance growth of the plantings (Anderson 2003).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—Roads and trails should be located on adjacent uplands. *Calamagrostis stricta* (narrow reed grass) propagates by both seeds and rhizomes, making it a valuable species for stabilizing or rehabilitating suitable disturbed sites (Thompson and Hansen 2003).

***Alnus crispa* (green alder)**—The major value of *Alnus crispa* (green alder) in rehabilitation is its ability to invade sterile soil, thereby increasing the organic matter content and by nitrogen fixation (Matthews 1992). The species was noted for its ability to colonize tailings at the Discovery Mine in Northwest Territories (Matthews 1992).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Pl/Green alder/Hairy wild rye
- Pl/Bracted honeysuckle/Fern/Feather moss

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Aw-Pl/Marsh reed grass

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type has not been described in the region.

Pinus contorta/Ledum groenlandicum Community Type
(lodgepole pine/common Labrador tea Community Type)

PINUCON/LEDUGRO Community Type
Number of Stands = 22 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 22; Other Data Sets = 0)

LOCATION AND ASSOCIATED LANDFORMS

The *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. *Pinus contorta* (lodgepole pine) is commonly established after wildfire and can occur almost anywhere in the montane subregion and upslope. Stands may persist for many decades before either succeeding to later seral communities, or burning once again. This community type is limited to sites that can support both *Pinus contorta* (lodgepole pine) and *Ledum groenlandicum* (common Labrador tea), which represents the wetter end of the moisture spectrum of the *Pinus contorta* (lodgepole pine) in muskegs, bogs, bottomlands, and peatlands—i.e., nutrient poor sites with acidic soils and poor drainage.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 167 shows the five most prominent plant species among the four lifeforms for species recorded in all 22 stands of the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type. *Pinus contorta* (lodgepole pine) heavily dominates the upper canopy, while *Ledum groenlandicum* (common Labrador tea) dominates the shrubs, with *Vaccinium vitis-idaea* (bog cranberry) being also fairly prominent. No other species is more than moderately prominent here.

Table 167. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type (number = 22 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Pinus contorta (lodgepole pine)	49.55	Native
Picea glauca (white spruce)	0.27	Native
Picea mariana (black spruce)	0.23	Native
Abies lasiocarpa (subalpine fir)	0.14	Native
Populus tremuloides (aspen)	0.05	Native
Shrubs		
Ledum groenlandicum (common Labrador tea)	30.46	Native
Vaccinium vitis-idaea (bog cranberry)	14.36	Native
Vaccinium membranaceum (tall bilberry)	7.43	Native
Linnaea borealis (twinflower)	4.18	Native
Rubus pedatus (dwarf bramble)	3.55	Native
Graminoids		
Elymus innovatus (hairy wild rye)	3.71	Native
Calamagrostis rubescens (pine reed grass)	0.05	Native
Forbs		
Cornus canadensis (bunchberry)	6.57	Native
Lycopodium annotinum (stiff club-moss)	2.34	Native
Epilobium angustifolium (common fireweed)	0.96	Native
Arnica latifolia (broad-leaved arnica)	0.93	Native
Arnica cordifolia (heart-leaved arnica)	0.89	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 168 through Table 171, break out the vegetation recorded in all 22 stands sampled of the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, forested community type of minor occurrence across the study area.

Table 168 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type. For the 22 stands comprising the community type, the number of unique species was 73 with 72 (98.6 percent) of them being native species.

Table 168. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type (number = 22 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	6	6	0	0
Shrubs	32	31	0	1
Graminoids	2	2	0	0
Forbs	33	33	0	0
TOTAL	***73 (100.0%)***	***72 (98.6%)***	***0 (0.0%)***	***1 (1.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 169 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type. The average number of species per stand is 15.4, with native species comprising 15.1 species per stand or 98.1 percent.

Table 169. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type (number = 22 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.2	2.2	0.0	0.0
Shrubs	7.0	6.7	0.0	0.2
Graminoids	0.6	0.6	0.0	0.0
Forbs	5.6	5.6	0.0	0.0
TOTAL	***15.4 (100.0%)***	***15.1 (98.1%)***	***0.0 (0.0%)***	***0.2 (1.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 170 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type. The average canopy cover per stand is 143.9 percent, with native species comprising 143.3 percent or 99.6 percent of the total amount of average canopy cover per stand.

Table 170. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type (number = 22 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	50.3%	50.3%	0.0%	0.0%
Shrubs	73.7%	73.1%	0.0%	0.6%
Graminoids	3.8%	3.8%	0.0%	0.0%
Forbs	16.2%	16.2%	0.0%	0.0%
TOTAL	***143.9% (100.0%)***	***143.3% (99.6%)***	***0.0% (0.0%)***	***0.6% (0.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 171 shows the average number of species and average canopy cover by lifeform in stands of the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type. The average number of species per stand was 15.4 with an average canopy cover of 143.9 percent.

Table 171. Average number of species and average canopy cover by lifeform in stands of the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type (number = 22 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.2	50.3%
Shrubs	7.0	73.7%
Graminoids	0.6	3.8%
Forbs	5.6	16.2%
TOTAL	***15.4***	***143.9%***

Sampled Stands Plant Species List

On the 22 stands sampled of the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type, six trees were recorded, with only *Pinus contorta* (lodgepole pine) highly prominent (Table 172). Of the 32shrubs recorded, only *Ledum groenlandicum* (common Labrador tea) was highly prominent and occurring on all plots. Only two graminoid species were recorded, with *Elymus innovatus* (hairy wild rye) being moderately prominent. Among the 33 forbs recorded, *Cornus canadensis* (bunchberry) was most prominent and occurring on 95 percent of plots sampled.

Table 172. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type (number = 22 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 6)					
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	27	0.14	N
Picea engelmannii (Engelmann spruce)	0.5	0-0.5	5	0.02	N
Picea glauca (white spruce)	0.9	0-3	32	0.27	N
Picea mariana (black spruce)	0.5	0-0.5	45	0.23	N
Pinus contorta (lodgepole pine)	49.5	20-90	100	49.55	N
Populus tremuloides (aspen)	0.5	0-0.5	9	0.05	N
Shrubs (N = 32)					
Alnus crispa (green alder)	1.8	0-3	27	0.48	N
Arctostaphylos uva-ursi (common bearberry)	5.3	0-10	9	0.48	N
Betula glandulosa (bog birch)	6.5	0-10	9	0.59	N
Betula pumila (dwarf birch)	0.5	0-0.5	5	0.02	N
Chimaphila umbellata (prince's-pine)	3.0	0-3	5	0.14	N
Juniperus communis (ground juniper)	0.5	0-0.5	14	0.07	N
Ledum groenlandicum (common Labrador tea)	30.5	10-80	100	30.45	N
Linnaea borealis (twinflower)	5.1	0-30	82	4.18	N
*Lonicera dioic*a (twining honeysuckle)	0.5	0-0.5	5	0.02	N
*Lonicera involucrat*a (bracted honeysuckle)	1.8	0-3	9	0.16	N
Menziesia ferruginea (false azalea)	0.5	0-0.5	9	0.05	N
Potentilla fruticosa (shrubby cinquefoil)	0.5	0-0.5	5	0.02	N
Rhododendron albiflorum (white-flowered rhododendron)	4.9	0-20	23	1.11	N
Ribes lacustre (bristly black currant)	1.8	0-3	9	0.16	N
Rosa acicularis (prickly rose)	6.5	0-40	32	2.07	N
Rosa woodsii (common wild rose)	3.0	0-3	5	0.14	N
Rubus idaeus (wild red raspberry)	0.5	0-0.5	5	0.02	N
Rubus pedatus (dwarf bramble)	7.8	0-20	45	3.55	N
Rubus pubescens (dewberry)	1.1	0-3	18	0.20	N
Salix bebbiana (beaked willow)	11.5	0-20	9	1.05	N
Salix discolor (pussy willow)	10.0	0-10	5	0.45	N
Salix myrtillifolia (myrtle-leaved willow)	10.0	0-10	5	0.45	N
Salix scouleriana (Scouler's willow)	16.5	0-30	9	1.50	N
Salix spp. (willow)	2.5	0-3	23	0.57	B
Shepherdia canadensis (Canada buffaloberry)	3.7	0-10	14	0.50	N
Sorbus scopulina (western mountain-ash)	3.6	0-10	32	1.14	N
Spiraea betulifolia (white meadowsweet)	3.0	0-3	5	0.14	N
Vaccinium caespitosum (dwarf bilberry)	4.8	0-20	36	1.73	N
Vaccinium membranaceum (tall bilberry)	18.2	0-40	41	7.43	N
Vaccinium myrtilloides (common blueberry)	2.4	0-3	18	0.43	N
Vaccinium vitis-idaea (bog cranberry)	18.6	0-50	77	14.36	N
Viburnum edule (low-bush cranberry)	0.5	0-0.5	9	0.05	N

Table 172. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Graminoids (N = 2)					
Calamagrostis rubescens (pine reed grass)	0.5	0-0.5	9	0.05	N
Elymus innovatus (hairy wild rye)	7.4	0-50	50	3.70	N
Forbs (N = 33)					
Achillea millefolium (common yarrow)	0.5	0-0.5	9	0.05	N
Arnica cordifolia (heart-leaved arnica)	2.0	0-10	45	0.89	N
Arnica latifolia (broad-leaved arnica)	6.8	0-10	14	0.93	N
Aster ciliolatus (Lindley's aster)	4.5	0-10	14	0.61	N
Calypso bulbosa (Venus'-slipper)	0.5	0-0.5	9	0.05	N
Campanula rotundifolia (harebell)	0.5	0-0.5	5	0.02	N
Cornus canadensis (bunchberry)	6.9	0-20	95	6.57	N
Epilobium angustifolium (common fireweed)	1.8	0-3	55	0.95	N
Equisetum pratense (meadow horsetail)	0.5	0-0.5	9	0.05	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	9	0.05	N
Equisetum sylvaticum (woodland horsetail)	0.5	0-0.5	14	0.07	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	9	0.05	N
Geocaulon lividum (northern bastard toadflax)	3.0	0-3	5	0.14	N
Gymnocarpium dryopteris (oak fern)	0.5	0-0.5	5	0.02	N
Habenaria obtusata (blunt-leaved bog orchid)	3.0	0-3	9	0.27	N
Listera cordata (heart-leaved twayblade)	1.1	0-3	18	0.20	N
Lycopodium annotinum (stiff club-moss)	4.3	0-10	55	2.34	N
Lycopodium clavatum (running club-moss)	0.5	0-0.5	9	0.05	N
Lycopodium complanatum (ground-cedar)	0.5	0-0.5	9	0.05	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	14	0.07	N
Mertensia paniculata (tall lungwort)	3.7	0-10	14	0.50	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	14	0.07	N
Orthilia secunda (one-sided wintergreen)	2.5	0-3	23	0.57	N
Pedicularis labradorica (Labrador lousewort)	3.0	0-3	5	0.14	N
Petasites palmatus (palmate-leaved coltsfoot)	1.2	0-3	32	0.39	N
Polemonium pulcherrimum (showy Jacob's-ladder)	0.5	0-0.5	5	0.02	N
Pyrola asarifolia (common pink wintergreen)	1.3	0-3	14	0.18	N
Pyrola chlorantha (greenish-flowered wintergreen)	1.8	0-3	9	0.16	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	5	0.02	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	2.4	0-3	18	0.43	N
Veratrum eschscholtzii (green false hellebore)	3.0	0-3	5	0.14	N
Viola renifolia (kidney-leaved violet)	3.0	0-3	5	0.14	N
Zigadenus elegans (white camas)	0.5	0-0.5	9	0.05	N

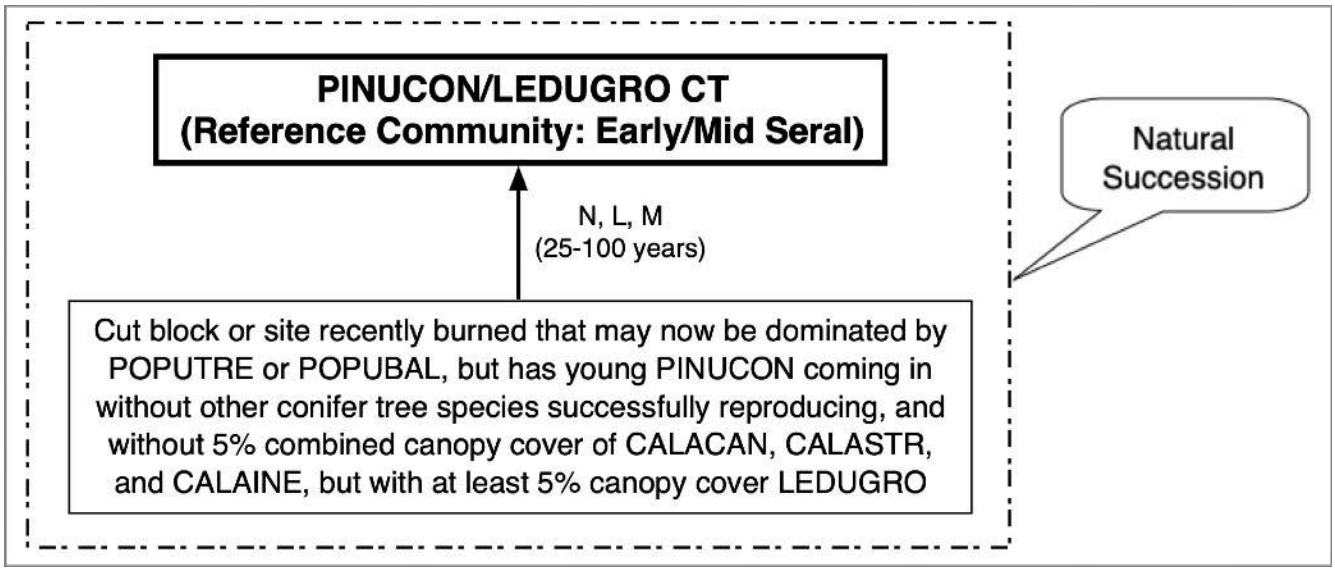
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type is a long lived, mid seral type that typically originated in a wildfire, and is likely to have its stand renewed by another fire before the community can succeed to a later seral stage of dominance by a climax conifer tree species, such as *Picea glauca* (white spruce) or *Picea mariana* (black spruce). However, this community type lies on the wetter end of the *Pinus contorta* (lodgepole pine) moisture gradient, and sites are often too wet to sustain a fire, except during periods of severe drought.

Figure 32 shows a schematic diagram of vegetation successional pathways on sites of the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type.



Successional Pathway of *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CALACAN—*Calamagrostis canadensis* (marsh reed grass)
CALAINE—*Calamagrostis inexpansa* (northern reed grass)
CALASTR—*Calamagrostis stricta* (narrow reed grass)
LEDUGRO—*Ledum groenlandicum* (common Labrador tea)
PINUCON—*Pinus contorta* (lodgepole pine)
PINUCON/LEDUGRO CT—*Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUTRE—*Populus tremuloides* (aspen)

Figure 32. Successional pathway for sites of the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 33 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

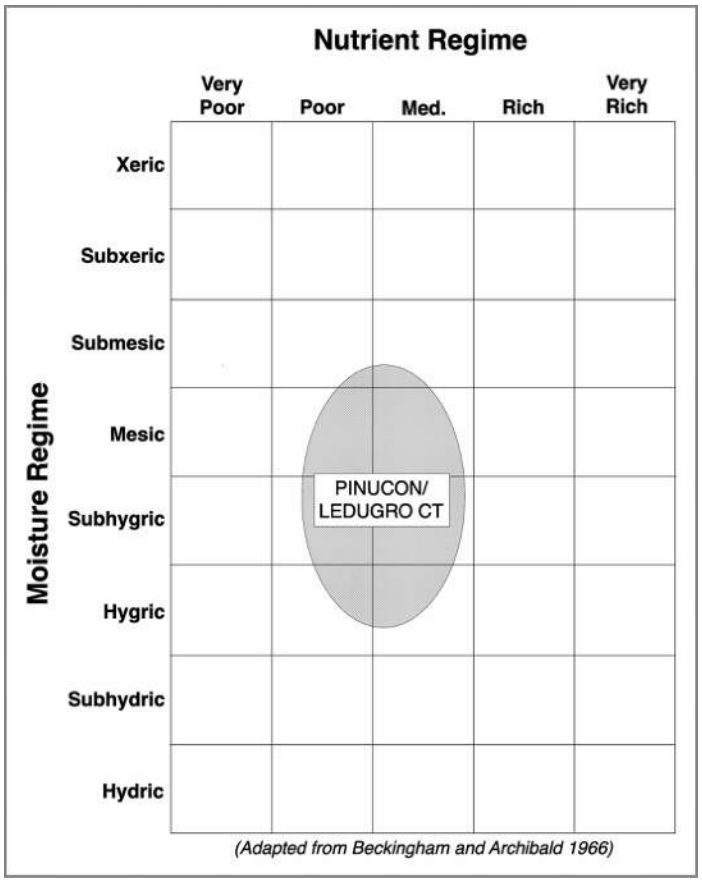


Figure 33. Edatope grid position for the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type (PINUCON/LEDUGRO CT)

SOILS

Parent material on sites supporting the *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type is predominantly morainal and glaciofluvial. Soil drainage ranges from well drained to imperfectly drained. Soil subgroups are mostly luvisols and brunisols. Soil texture mostly ranges from sandy loam to clay loam. Surface organic thickness may range from 0 cm to 5 cm (Baker and others 2020, France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites may be dominated by the *Pinus contorta/Calamagrostis canadensis* (lodgepole pine/marsh reed grass) community type. Drier adjacent sites will likely be dominated by the *Pinus contorta/Alnus crispa* (lodgepole pine/green alder) community type, or have communities dominated by *Picea glauca* (white spruce) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is found in all natural regions of Alberta, except the Dry Mixedgrass Region. It is the most common tree species at middle and lower altitudes along the eastern slopes of the Rocky Mountains, forming nearly pure stands on some sites in the foothills and montane areas (Tannas 1997a).

Pinus contorta (lodgepole pine) grows at low to high elevations, in dry to wet conditions, warm to cold temperatures, and on nearly every soil type found in western North America, except on saline sites. The species is not shade tolerant, and grows best on non-calcareous soil. It is primarily an aggressive pioneer on disturbed sites, and fire perpetuates or renews the stands (Anderson 2003). As these pine stands mature, they give way to shade-tolerant conifers at ages from 50 to 100 years in mesic habitats, and 100 to 200 years on warmer and drier sites (Anderson 2003).

Pinus contorta (lodgepole pine) may establish alongside later seral, more shade-tolerant species, and its rapid growth may enable the pines to remain competitive in the canopy for several years. However, these trees do not regenerate under a canopy, and are eliminated from the stand as mortality occurs. The *Pinus contorta* (lodgepole pine) is generally replaced within 50 to 100 years by the more shade-tolerant associates (Anderson 2003).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) is commonly found in Alberta in swampy, wet, coniferous wooded areas in bogs (especially peat), commonly on acidic, infertile soils and associated with *Picea mariana* (black spruce) and *Larix laricina* (tamarack) (Tannas 1997a). This species is typical of poorly drained habitats in boreal forests, open conifer treed bogs, treeless bogs, wooded swamps, wet barrens, and peatlands throughout its range (Gucker 2006).

The soils typical of *Ledum groenlandicum* (common Labrador tea) habitats are commonly described as moist to wet, acidic, nutrient-poor organics (Gucker 2006). The species is typically present in late seral communities that result from primary succession. However, following disturbances on sites where *Ledum groenlandicum* (common Labrador tea) was established, it often recolonizes the sites rapidly (Gucker 2006).

***Vaccinium vitis-idaea* (bog cranberry)**—*Vaccinium vitis-idaea* (bog cranberry) grows as an understory dominant or co-dominant in a variety of forest communities, including many dominated by *Pinus contorta* (lodgepole pine), as well as in bog and muskeg communities (Tannas 1997a). It also occurs as a dominant or indicator in dwarf shrub and shrub tundra communities (Tirmenstein 1991). This species is a low, creeping, evergreen subshrub that commonly reaches only 5 cm to 15 cm in height. It typically grows in dense rhizomatous colonies and frequently forms mats (Tirmenstein 1991).

Livestock

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) offers poor forage value, and is seldom eaten by livestock (Tannas 1997a).

***Ledum groenlandicum* (common Labrador tea)**—Forage value of *Ledum groenlandicum* (common Labrador tea) is poor for livestock, and the habitats occupied by it represent marginal rangeland that is seldom used by livestock (Tannas 1997a).

***Vaccinium vitis-idaea* (bog cranberry)**—*Vaccinium vitis-idaea* (bog cranberry) browse is of little value to domestic livestock, but provides some winter browse for caribou. It is not eaten by domestic sheep if more preferred forage is available (Tirmenstein 1991). Forage value for livestock is poor (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) timber is used extensively for construction lumber, pulpwood, heating fuel, posts and poles, and plywood veneer (USDA National Resources Conservation Service 2023).

Wildlife

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) also offers poor forage value for wildlife, and is eaten by deer and elk only when better forage is lacking (Tannas 1997a). Stands of the species provide cover for big game animals, upland game birds, small non-game birds, and small mammals (Anderson 2003).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) forage is used to some extent by wild ungulates, especially deer, but only when other forage is scarce (Tannas 1997a). The species may provide important cover for many wildlife species, as it is a typical component species in many important wildlife habitats (Gucker 2006). The leaves and twigs are browsed by caribou and moose (Anderson 2011).

***Vaccinium vitis-idaea* (bog cranberry)**—*Vaccinium vitis-idaea* (bog cranberry) browse is readily eaten by barren-ground caribou, black bear, moose, arctic hare, and snowshoe hare. In some parts of Canada, *Vaccinium vitis-idaea* (bog cranberry) browse is a primary food of barren-ground caribou. The evergreen leaves are an important item in their winter diet. The berries are an important food source for many species of birds and mammals. The fruits are an important spruce grouse food during spring, summer, and fall (Tirmenstein 1991).

Fire

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) thrives under the influence of fire, and on many sites fire is required to maintain its dominance. Producing serotinous cones is one adaptation to stand-replacing fire, and the seed supply is nearly always available on the tree (Anderson 2003).

The propensity of *Pinus contorta* (lodgepole pine) to form stands with high seedling density, initial rapid growth that slows with age, high susceptibility to snow breakage and wind-throw, infestation by dwarf-mistletoe and mountain pine beetles, all result in large buildups of fuel (Anderson 2003).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) underground structures often survive and rapidly sprout after fire. When burned lightly, such that some above ground stem material survives, *Ledum groenlandicum* (common Labrador tea) may sprout from stems, but when completely top-killed, sprouting occurs from the root crown or rhizomes (Gucker 2006). Provided that a seed source is present, the species' abundant seed production and easily wind-dispersed seed suggests a high likelihood of burned site recolonization (Gucker 2006).

***Vaccinium vitis-idaea* (bog cranberry)**—Underground regenerative structures of *Vaccinium vitis-idaea* (bog cranberry) generally survive light fires. Plants often survive, even when aerial portions are killed by the fire. However, the entire plant may be killed by moderate to heavy, duff-consuming fires. Survivability is related to soil moisture levels, season of burn, fire severity and intensity, and rhizome depth (Tirmenstein 1991).

Rehabilitation/Restoration Considerations

***Pinus contorta* (lodgepole pine)**—*Pinus contorta* (lodgepole pine) is often used in reforestation projects, especially for revegetation on sites of mining disturbance. Though it grows well on nutrient poor soils, addition of nitrogen fertilizer will likely enhance growth of the plantings (Anderson 2003).

***Ledum groenlandicum* (common Labrador tea)**—*Ledum groenlandicum* (common Labrador tea) may be useful in revegetating disturbed sites, and may be a valuable indicator of contaminated sites and easily reforested sites (Gucker 2006). Plants can be started from seed or root-crown division. Collect seeds from dry capsules and plant them in fall or spring in moist peaty soil in a sunny spot. Water them thoroughly after planting and keep moist. Suckers with roots can be split off from the base of the plant in mid-December and transplanted during spring (Anderson 2011).

Many of the fens and bogs that provide important habitat for *Ledum groenlandicum* (common Labrador tea) in North America were created by glaciation. These wetlands have been disappearing over thousands of years, due to a decrease in native ungulates that graze the bogs, and encroachment by conifers and hardwoods (Anderson 2011).

***Vaccinium vitis-idaea* (bog cranberry)**—Potential rehabilitation value of *Vaccinium vitis-idaea* (bog cranberry) has not been well documented. The plants are able to survive on extremely harsh sites, and some rehabilitation potential is possible. The species can be readily propagated from seed, as well as from stem or rhizome cuttings (Tirmenstein 1991).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- J6. Lodgepole pine/Labrador tea-bog cranberry
- J7. Lodgepole pine/Labrador tea-bearberry

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Pb-Aw/Rose/Marsh reed grass
- Pl/Labrador tea-Bog cranberry
- Pl/Labrador tea-Tall bilberry/Feather moss
- Pl-Sb/Labrador tea-Bog cranberry/Feather moss

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Mne12 Pl/Alder (Montane Northern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Pinus contorta/Ledum groenlandicum* (lodgepole pine/common Labrador tea) community type has not been described in the region.

Betula papyrifera Community Type (white birch Community Type)

BETUPAP Community Type
Number of Stands = 20 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 6; Other Data Sets = 14)

LOCATION AND ASSOCIATED LANDFORMS

The *Betula papyrifera* (white birch) community type is an incidental type in the Lower Foothills Natural Subregion, a restricted type in the Upper Foothills Natural Subregion, and a restricted type in the Montane Natural Subregion of Alberta. This community type is an early to mid seral type that is found on alluvial terraces of streams and rivers and around lakes and sloughs, often as the result of beaver cutting out either *Populus balsamifera* (balsam poplar) or *Populus tremuloides* (aspen), and leaving the less palatable birch trees standing.

Photo 6 shows a typical stand of the *Betula papyrifera* (white birch) community type.

Photo 6. A stand of the *Betula papyrifera* (white birch) community type

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 173 shows the five most prominent plant species among the four lifeforms for species recorded in all 20 stands of the *Betula papyrifera* (white birch) community type. *Betula papyrifera* (white birch) heavily dominates the canopy of this community type. No other species in any lifeform group is more than moderately prominent here.

Table 173. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Betula papyrifera* (white birch) community type (number = 20 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Betula papyrifera (white birch)	49.38	Native
Populus balsamifera (balsam poplar)	3.53	Native
Populus tremuloides (aspen)	0.83	Native
Picea glauca (white spruce)	0.30	Native
Pinus contorta (lodgepole pine)	0.03	Native
Shrubs		
Amelanchier alnifolia (Saskatoon)	8.85	Native
Corylus cornuta (beaked hazelnut)	6.93	Native
Cornus stolonifera (red-osier dogwood)	5.85	Native
Prunus virginiana (choke cherry)	4.80	Native
Salix bebbiana (beaked willow)	4.35	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	8.35	Native
Poa pratensis (Kentucky bluegrass)	3.60	Introduced
Carex sprengelii (Sprengel's sedge)	1.65	Native
Calamagrostis stricta (narrow reed grass)	1.50	Native
Bromus inermis (smooth brome)	1.15	Introduced

Table 173. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Aralia nudicaulis (wild sarsaparilla)	7.48	Native
Equisetum arvense (common horsetail)	2.55	Native
Galium boreale (northern bedstraw)	1.83	Native
Cornus canadensis (bunchberry)	1.58	Native
Fragaria virginiana (wild strawberry)	1.13	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 174 through Table 177, break out the vegetation recorded in all 22 stands sampled of the *Betula papyrifera* (white birch) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, species rich, forested community type of incidental-to-restricted occurrence across the study area.

Table 174 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula papyrifera* (white birch) community type. For the 22 stands comprising the community type, the number of unique species was 146 with 136 (93.2 percent) of them being native species.

Table 174. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Betula papyrifera* (white birch) community type (number = 22 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	5	5	0	0
Shrubs	40	38	0	2
Graminoids	24	21	3	0
Forbs	77	72	4	1
TOTAL	***146 (100.0%)***	***136 (93.2%)***	***7 (4.8%)***	***3 (2.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 175 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula papyrifera* (white birch) community type. The average number of species per stand is 25.1, with native species comprising 23.5 species per stand or 93.6 percent.

Table 175. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Betula papyrifera* (white birch) community type (number = 20 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.0	2.0	0.0	0.0
Shrubs	8.4	7.9	0.0	0.5
Graminoids	3.0	2.4	0.6	0.0
Forbs	11.7	11.2	0.4	0.1
TOTAL	***25.1 (100.0%)***	***23.5 (93.6%)***	***1.0 (4.0%)***	***0.6 (2.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 176 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula papyrifera* (white birch) community type. The average canopy cover per stand is 160.4 percent, with native species comprising 152.4 percent or 95.0 percent of the total amount of average canopy cover per stand.

Table 176. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Betula papyrifera* (white birch) community type (number = 20 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	54.1%	54.1%	0.0%	0.0%
Shrubs	60.9%	58.9%	0.0%	2.0%
Graminoids	19.7%	14.9%	4.8%	0.0%
Forbs	25.9%	24.5%	0.8%	0.5%
TOTAL	***160.4% (100.0%)***	***152.4% (95.0%)***	***5.6% (3.5%)***	***2.5% (1.5%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 177 shows the average number of species and average canopy cover by lifeform in stands of the *Betula papyrifera* (white birch) community type. The average number of species per stand was 25.1 with an average canopy cover of 160.4 percent.

Table 177. Average number of species and average canopy cover by lifeform in stands of the *Betula papyrifera* (white birch) community type (number = 20 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.0	54.1%
Shrubs	8.4	60.9%
Graminoids	3.0	19.7%
Forbs	11.7	25.9%
TOTAL	***25.1***	***160.4%***

Sampled Stands Plant Species List

Five tree species were recorded on the 20 stands sampled of the *Betula papyrifera* (white birch) community type, but only *Betula papyrifera* (white birch) occurred on all plots (Table 178). The late seral *Picea glauca* (white spruce) was already coming in on seven of the 20 stands. Of 40 shrub species recorded, none was highly prominent, although several were moderately prominent. *Calamagrostis canadensis* (marsh reed grass) was the most prominent of the 24 graminoid species, and *Aralia nudicaulis* (wild sarsaparilla) led the 77 forb species recorded.

Table 178. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Betula papyrifera* (white birch) community type (number = 20 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 5)					
Betula papyrifera (white birch)	49.4	10-97.5	100	49.38	N
Picea glauca (white spruce)	0.9	0-3	35	0.30	N
Pinus contorta (lodgepole pine)	0.5	0-0.5	5	0.03	N
Populus balsamifera (balsam poplar)	17.6	0-30	20	3.53	N
Populus tremuloides (aspen)	2.1	0-3	40	0.83	N
Shrubs (N = 40)					
Alnus crispa (green alder)	10.8	0-40	25	2.70	N
Alnus tenuifolia (river alder)	20.0	0-20	5	1.00	N
Amelanchier alnifolia (Saskatoon)	19.7	0-60	45	8.85	N
Arctostaphylos uva-ursi (common bearberry)	6.5	0-10	10	0.65	N
Betula occidentalis (water birch)	3.0	0-3	10	0.30	N
Cornus stolonifera (red-osier dogwood)	13.0	0-30	45	5.85	N
Corylus cornuta (beaked hazelnut)	23.1	0-97.5	30	6.92	N
Elaeagnus commutata (silverberry)	5.3	0-10	20	1.05	N
Juniperus communis (ground juniper)	0.5	0-0.5	5	0.03	N
Ledum groenlandicum (common Labrador tea)	20.3	0-40	10	2.03	N

Table 178. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Linnaea borealis (twinflower)	4.3	0-20	45	1.93	N
Lonicera dioica (twining honeysuckle)	2.5	0-10	30	0.75	N
Lonicera involucrata (bracted honeysuckle)	15.0	0-20	20	3.00	N
Potentilla fruticosa (shrubby cinquefoil)	0.5	0-0.5	10	0.05	N
Prunus pensylvanica (pin cherry)	15.0	0-20	10	1.50	N
Prunus virginiana (choke cherry)	16.0	0-30	30	4.80	N
Rhamnus alnifolia (alder-leaved buckthorn)	3.0	0-3	5	0.15	N
Rhus radicans (poison ivy)	0.5	0-0.5	5	0.03	N
Ribes lacustre (bristly black currant)	3.0	0-3	10	0.30	N
Ribes oxyacanthoides (northern gooseberry)	1.2	0-3	35	0.43	N
Ribes triste (wild red currant)	10.3	0-30	15	1.55	N
Rosa acicularis (prickly rose)	2.9	0-10	30	0.88	N
Rosa spp. (rose)	4.0	0-10	45	1.80	B
Rubus idaeus (wild red raspberry)	3.5	0-10	60	2.10	N
Rubus parviflorus (thimbleberry)	0.5	0-0.5	10	0.05	N
Rubus pubescens (dewberry)	2.0	0-10	65	1.30	N
Salix bebbiana (beaked willow)	10.9	0-40	40	4.35	N
Salix lutea (yellow willow)	1.8	0-3	10	0.18	N
Salix planifolia (flat-leaved willow)	0.5	0-0.5	5	0.03	N
Salix pseudomonticola (false mountain willow)	0.5	0-0.5	5	0.03	N
Salix scouleriana (Scouler's willow)	6.5	0-10	10	0.65	N
Salix spp. (willow)	3.0	0-3	5	0.15	B
Shepherdia canadensis (Canada buffaloberry)	2.9	0-10	20	0.58	N
Spiraea betulifolia (white meadowsweet)	0.5	0-0.5	5	0.03	N
Symphoricarpos albus (snowberry)	0.5	0-0.5	10	0.05	N
Symphoricarpos occidentalis (buckbrush)	1.8	0-3	10	0.18	N
Symphoricarpos spp. (snowberry)	4.3	0-10	25	1.08	N
Vaccinium myrtilloides (common blueberry)	0.5	0-0.5	5	0.03	N
Vaccinium myrtillus (low bilberry)	20.0	0-20	5	1.00	N
Viburnum edule (low-bush cranberry)	5.2	0-30	50	2.58	N
Graminoids (N = 24)					
Agropyron trachycaulum (slender wheat grass)	2.2	0-3	15	0.33	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	5	0.03	N
Agrostis stolonifera (redtop)	0.5	0-0.5	5	0.03	I
Bromus ciliatus (fringed brome)	1.8	0-3	10	0.18	N
Bromus inermis (smooth brome)	11.5	0-20	10	1.15	I
Calamagrostis canadensis (marsh reed grass)	15.2	0-40	55	8.35	N
Calamagrostis stricta (narrow reed grass)	30.0	0-30	5	1.50	N
Carex brevior (slender-beaked sedge)	0.5	0-0.5	5	0.03	N
Carex curta (short sedge)	3.0	0-3	5	0.15	N
Carex deweyana (Dewey's sedge)	0.5	0-0.5	5	0.03	N
Carex eburnea (bristle-leaved sedge)	10.0	0-10	10	1.00	N
Carex loliacea (rye-grass sedge)	0.5	0-0.5	5	0.03	N
Carex praegracilis (graceful sedge)	0.5	0-0.5	5	0.03	N

Table 178. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
*Carex siccat*a (hay sedge)	3.0	0-3	10	0.30	N
Carex spp. (sedge)	1.3	0-3	15	0.20	N
Carex sprengelii (Sprengel's sedge)	11.0	0-20	15	1.65	N
Elymus innovatus (hairy wild rye)	0.5	0-0.5	10	0.05	N
Glyceria striata (fowl manna grass)	0.5	0-0.5	10	0.05	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	5	0.03	N
Oryzopsis asperifolia (white-grained mountain rice grass)	0.5	0-0.5	5	0.03	N
Poa interior (inland bluegrass)	0.5	0-0.5	10	0.05	N
Poa palustris (fowl bluegrass)	1.8	0-3	10	0.18	N
Poa pratensis (Kentucky bluegrass)	9.0	0-30	40	3.60	I
Schizachne purpurascens (purple oat grass)	2.9	0-10	25	0.73	N
Forbs (N = 77)					
Achillea millefolium (common yarrow)	1.1	0-3	20	0.23	N
Achillea sibirica (many-flowered yarrow)	0.5	0-0.5	10	0.05	N
Actaea rubra (red and white baneberry)	0.5	0-0.5	45	0.23	N
Anemone canadensis (Canada anemone)	0.5	0-0.5	5	0.03	N
Anemone multifida (cut-leaved anemone)	0.5	0-0.5	10	0.05	N
Anemone spp. (anemone)	0.5	0-0.5	5	0.03	N
Apocynum androsaemifolium (spreading dogbane)	3.0	0-3	5	0.15	N
Aralia nudicaulis (wild sarsaparilla)	13.6	0-40	55	7.47	N
Arnica cordifolia (heart-leaved arnica)	0.5	0-0.5	10	0.05	N
Arnica spp. (arnicas)	0.5	0-0.5	5	0.03	N
Artemisia campestris (plains wormwood)	0.5	0-0.5	10	0.05	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	15	0.08	N
Aster conspicuus (showy aster)	0.8	0-3	40	0.33	N
Aster hesperius (western willow aster)	10.0	0-10	5	0.50	N
Aster laevis (smooth aster)	1.8	0-3	10	0.18	N
Aster puniceus (purple-stemmed aster)	0.5	0-0.5	5	0.03	N
Athyrium filix-femina (lady fern)	0.5	0-0.5	10	0.05	N
Caltha palustris (marsh-marigold)	0.5	0-0.5	5	0.03	N
Campanula rotundifolia (harebell)	0.5	0-0.5	20	0.10	N
Cardamine pensylvanica (bitter cress)	0.5	0-0.5	5	0.03	N
Circaea alpina (small enchanter's nightshade)	0.5	0-0.5	5	0.03	N
Cirsium undulatum (wavy-leaved thistle)	5.3	0-10	10	0.53	N
Cornus canadensis (bunchberry)	3.2	0-10	50	1.58	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	5	0.03	N
Disporum trachycarpum (fairybells)	1.8	0-3	10	0.18	N
Dryopteris spp. (unknown fern)	3.0	0-3	5	0.15	N
Epilobium angustifolium (common fireweed)	0.7	0-3	60	0.42	N
Equisetum arvense (common horsetail)	12.8	0-30	20	2.55	N
Equisetum sylvaticum (woodland horsetail)	1.3	0-3	15	0.20	N
Erigeron philadelphicus (Philadelphia fleabane)	0.5	0-0.5	5	0.03	N
Fragaria virginiana (wild strawberry)	2.0	0-10	55	1.13	N

Table 178. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Gaillardia aristata (gaillardia)	0.5	0-0.5	10	0.05	N
Galium boreale (northern bedstraw)	3.7	0-20	50	1.83	N
Galium triflorum (sweet-scented bedstraw)	0.5	0-0.5	45	0.23	N
Gentianella amarella (felwort)	0.5	0-0.5	10	0.05	N
Geum aleppicum (yellow avens)	0.5	0-0.5	5	0.03	N
Glycyrrhiza lepidota (wild licorice)	20.0	0-20	5	1.00	N
Gymnocarpium dryopteris (oak fern)	1.8	0-3	10	0.18	N
Habenaria orbiculata (round-leaved bog orchid)	0.5	0-0.5	5	0.03	N
Halenia deflexa (spurred gentian)	0.5	0-0.5	10	0.05	N
Hedysarum alpinum (alpine hedysarum)	1.8	0-3	10	0.18	N
Heracleum lanatum (cow parsnip)	0.5	0-0.5	5	0.03	N
Hieracium umbellatum (narrow-leaved hawkweed)	0.5	0-0.5	10	0.05	N
Lathyrus ochroleucus (cream-colored vetchling)	0.8	0-3	40	0.33	N
Lycopodium annotinum (stiff club-moss)	1.8	0-3	10	0.18	N
Machaeranthera canescens (hoary aster)	0.5	0-0.5	5	0.03	N
Maianthemum canadense (wild lily-of-the-valley)	0.7	0-3	55	0.40	N
Melilotus officinalis (yellow sweet-clover)	3.0	0-3	5	0.15	I
Mertensia paniculata (tall lungwort)	1.2	0-3	35	0.43	N
Mitella nuda (bishop's-cap)	1.8	0-3	20	0.35	N
Moss spp. (moss)	10.0	0-10	5	0.50	B
Orthilia secunda (one-sided wintergreen)	0.5	0-0.5	10	0.05	N
Osmorhiza depauperata (spreading sweet cicely)	0.5	0-0.5	15	0.08	N
Petasites frigidus (arctic sweet coltsfoot)	1.8	0-3	10	0.18	N
Petasites palmatus (palmate-leaved coltsfoot)	1.3	0-3	15	0.20	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	30	0.15	N
Sanicula marilandica (snakeroot)	3.0	0-3	10	0.30	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	5	0.03	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	10	0.05	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	20	0.10	N
Solidago canadensis (Canada goldenrod)	10.0	0-10	5	0.50	N
Solidago gigantea (late goldenrod)	0.5	0-0.5	5	0.03	N
Solidago spp. (goldenrod)	0.5	0-0.5	5	0.03	N
Sonchus arvensis (perennial sow-thistle)	1.8	0-3	10	0.18	I
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.5	0-0.5	15	0.08	N
Taraxacum officinale (common dandelion)	2.4	0-3	20	0.48	I
Thalictrum dasycarpum (tall meadow rue)	3.0	0-3	5	0.15	N
Thalictrum occidentale (western meadow rue)	3.0	0-3	5	0.15	N
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	10	0.05	N
Trientalis borealis (northern starflower)	0.5	0-0.5	5	0.03	N
Trifolium repens (white clover)	0.5	0-0.5	5	0.03	I
Urtica dioica (common nettle)	0.5	0-0.5	10	0.05	N
Vicia americana (wild vetch)	0.5	0-0.5	20	0.10	N
Viola adunca (early blue violet)	0.5	0-0.5	10	0.05	N

Table 178. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Viola canadensis (western Canada violet)	3.0	0-3	5	0.15	N
Viola renifolia (kidney-leaved violet)	1.8	0-3	10	0.18	N
Zigadenus elegans (white camas)	0.5	0-0.5	10	0.05	N

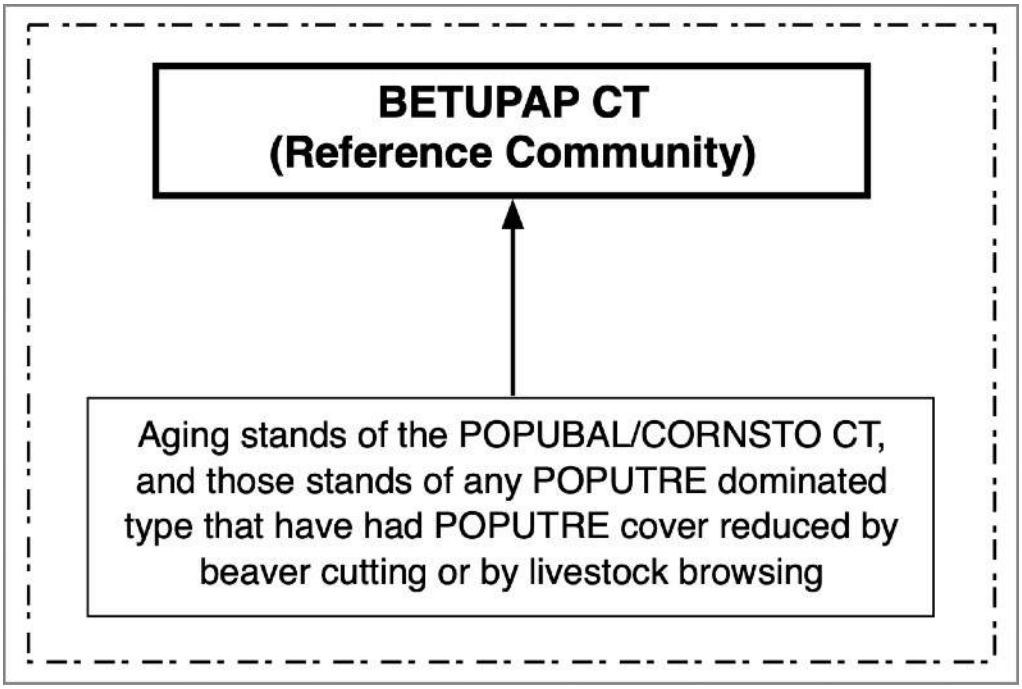
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Betula papyrifera* (white birch) community type is an early-to-mid seral type that, in the absence of fire, will succeed to a conifer tree, usually *Picea glauca* (white spruce), dominated habitat type. It is common for stands of *Betula papyrifera* (white birch) to originate due to associated *Populus tremuloides* (aspen) and/or *Populus balsamifera* (balsam poplar) trees having been removed from the site by beaver harvesting.

Figure 34 shows a schematic diagram of vegetation successional pathways on sites of the *Betula papyrifera* (white birch) community type.



Successional Pathway of *Betula papyrifera* (white birch) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Betula papyrifera* (white birch) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
BETUPAP CT—*Betula papyrifera* (white birch) community type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
POPUTRE—*Populus tremuloides* (aspen)

Figure 34. Successional pathway for sites of the *Betula papyrifera* (white birch) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 35 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Betula papyrifera* (white birch) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

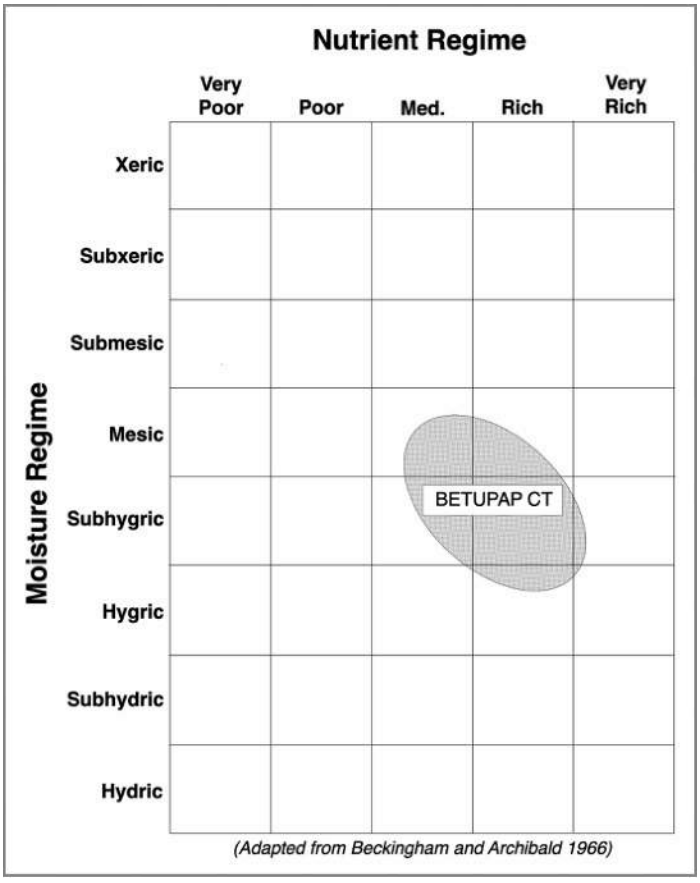


Figure 35. Edatope grid position for the *Betula papyrifera* (white birch) community type (BETUPAP CT)

SOILS

Parent material on sites supporting the *Betula papyrifera* (white birch) community type may be alluvial or morainal, and soils are generally brunisols, luvisols, or regosols. Sites of this community type typically have organic layer thickness less than 5 cm, and are moderately well drained to well drained with texture ranging from sand to silty clay loam (Beckingham and Archibald 1996).

ADJACENT COMMUNITIES

Adjacent wetter sites are often dominated by *Salix* species (willow), *Carex atherodes* (awned sedge), *Calamagrostis canadensis* (marsh reed grass), *Phragmites australis* (reed), or *Alnus* species (alder). Drier sites are likely to have *Populus tremuloides* (aspen) or *Picea glauca* (white spruce) upland communities.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Betula papyrifera* (white birch)**—*Betula papyrifera* (white birch) occurs commonly in most natural regions of Alberta, growing on moist upland sites, in bogs, and along shorelines (Tannas 1997a).

Betula papyrifera (white birch) grows best on deep, well-drained to moderately well-drained, sandy or silty soils; but also grows on a wide range of soil textures from gravels to silts, and organic bog and peat soils. This is a short-lived, shade-intolerant, pioneer species. It rapidly colonizes open disturbed sites created by wildfire, wind-throw, or avalanche; but lasts only a single generation before being replaced by shade-tolerant conifer species (Uchytil 1991c).

Livestock

***Betula papyrifera* (white birch)**—*Betula papyrifera* (white birch) forage value is rated as fair, with palatability generally moderate. Level of utilization varies widely, depending on availability of more preferred species. *Betula* species (birch) generally are increasers in response to grazing, being tolerant of moderate to heavy browse utilization and readily suckering to produce new stems (Tannas 1997a). Stands in healthy condition often support a dense understory of palatable shrubs of high forage value (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Betula papyrifera* (white birch)**—*Betula papyrifera* (white birch) wood is used for pulp, veneer, plywood, and heating fuel (USDA National Resources Conservation Service 2023).

Wildlife

***Betula papyrifera* (white birch)**—Stands of *Betula papyrifera* (white birch) provide valuable cover, shade, and food for a variety of wildlife species. Although it is a poor-quality browse, the species is important to wintering moose. Its nutritional quality is poor in the winter, but it is important because of its sheer abundance in young stands. Young *Betula papyrifera* (white birch) stands provide prime deer and moose cover (Thompson and Hansen 2003).

Numerous cavity nesting birds nest in *Betula papyrifera* (white birch), including woodpeckers, chickadees, nuthatches, and swallows (Uchytil 1991c). Snowshoe hares browse *Betula papyrifera* (white birch) seedlings and saplings, and porcupines use the inner bark. Numerous birds and small mammals eat the buds, catkins and seeds. Redpolls, siskins, and chickadees obtain a considerable portion of their annual diet from *Betula papyrifera* (white birch) seeds. Voles and shrews also eat the seeds (Thompson and Hansen 2003).

Fisheries

***Betula papyrifera* (white birch)**—The streamside locations of many *Betula papyrifera* (white birch) stands have fisheries value by providing shade and streambank stability (Thompson and Hansen 2003).

Fire

***Betula papyrifera* (white birch)**—*Betula papyrifera* (white birch) is well adapted to fire, recovering quickly by seedling establishment and vegetative regeneration. Seedling establishment is the most significant method of post fire recovery, because it is a prolific producer of lightweight seeds easily dispersed by wind and that readily germinate on burned sites. Young trees sprout from the root collar of top-killed trees, but this sprouting ability decreases after about 40 to 60 years of age. As a forest type, *Betula papyrifera* (white birch) is one of the least flammable. The canopy often has a high moisture content and the understory is lush. Crown fires in coniferous stands often stop at the boundary of large *Betula papyrifera* (white birch) stands or become slow-moving ground fires. However during dry periods, these stands will burn readily (Uchytil 1991c).

Rehabilitation/Restoration Considerations

***Betula papyrifera* (white birch)**—*Betula papyrifera* (white birch) is useful for revegetation and soil stabilization of severely disturbed sites. It is used to reclaim a variety of mine spoils, and best results are obtained by planting 2-year-old or older rooted nursery stock (Uchytil 1991c).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Betula papyrifera* (white birch) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Betula papyrifera* (white birch) community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003).

Populus balsamifera/Cornus stolonifera Community Type
(balsam poplar/red-osier dogwood Community Type)

POPUBAL/CORNSTO Community Type
Number of Stands = 81 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 14; Other Data Sets = 67)

LOCATION AND ASSOCIATED LANDFORMS

The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type is a major type in the Lower Foothills Natural Subregion, a major type in the Upper Foothills Natural Subregion, and a major type in the Montane Natural Subregion of Alberta. This early to mid seral community type occurs on alluvial terraces of streams and rivers, as well as around lakes, sloughs, and other moist sites throughout the study area.

Photo 7 shows a typical stand of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type.

Photo 7. A stand of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type (photo provided by Hilary Baker)

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 179 shows the five most prominent plant species among the four lifeforms for species recorded in all 81 stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type. *Populus balsamifera* (balsam poplar) heavily dominates the canopy of this community type. *Cornus stolonifera* (red-osier dogwood) among the shrubs is the only other species more than moderately prominent.

Table 179. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type (number = 81 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus balsamifera (balsam poplar)	59.97	Native
Betula papyrifera (white birch)	1.32	Native
Populus tremuloides (aspen)	0.39	Native
Picea glauca (white spruce)	0.38	Native
Pinus contorta (lodgepole pine)	0.14	Native
Shrubs		
Cornus stolonifera (red-osier dogwood)	14.62	Native
Rosa acicularis (prickly rose)	4.54	Native
Salix bebbiana (beaked willow)	3.54	Native
Symphoricarpos occidentalis (buckbrush)	3.19	Native
Elaeagnus commutata (silverberry)	3.07	Native
Graminoids		
Poa pratensis (Kentucky bluegrass)	4.27	Introduced
Calamagrostis canadensis (marsh reed grass)	4.20	Native
Agrostis stolonifera (redtop)	1.49	Introduced
Phleum pratense (timothy)	1.37	Introduced
Bromus inermis (smooth brome)	1.17	Introduced

Table 179. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Equisetum arvense (common horsetail)	6.25	Native
Aralia nudicaulis (wild sarsaparilla)	1.67	Native
Fragaria virginiana (wild strawberry)	1.19	Native
Aster conspicuus (showy aster)	1.18	Native
Taraxacum officinale (common dandelion)	1.14	Introduced

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 180 through Table 183, break out the vegetation recorded in all 81 stands sampled of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, species rich, forested community type of major occurrence across the study area.

Table 180 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type. For the 81 stands comprising the community type, the number of unique species was 294 with 249 (84.7 percent) of them being native species.

Table 180. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type (number = 81 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	7	7	0	0
Shrubs	66	63	0	3
Graminoids	57	44	11	2
Forbs	164	135	23	6
TOTAL	***294 (100.0%)***	***249 (84.7%)***	***34 (11.6%)***	***11 (3.7%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 181 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type. The average number of species per stand is 24.8, with native species comprising 21.7 species per stand or 87.5 percent.

Table 181. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type (number = 81 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.9	1.9	0.0	0.0
Shrubs	7.4	7.2	0.0	0.2
Graminoids	3.3	2.0	1.2	0.0
Forbs	12.2	10.6	1.5	0.1
TOTAL	***24.8 (100.0%)***	***21.7 (87.5%)***	***2.7 (10.9%)***	***0.3 (1.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 182 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type. The average canopy cover per stand is 172.6 percent, with native species comprising 159.4 percent or 92.3 percent of the total amount of average canopy cover per stand.

Table 182. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type (number = 81 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	62.3%	62.3%	0.0%	0.0%
Shrubs	60.3%	59.3%	0.0%	1.0%
Graminoids	20.6%	11.3%	9.1%	0.1%
Forbs	29.4%	26.5%	2.8%	0.1%
TOTAL	***172.6% (100.0%)***	***159.4% (92.3%)***	***11.9% (6.9%)***	***1.3% (0.7%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 183 shows the average number of species and average canopy cover by lifeform in stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type. The average number of species per stand was 24.8 with an average canopy cover of 172.6 percent.

Table 183. Average number of species and average canopy cover by lifeform in stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type (number = 81 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	1.9	62.3%
Shrubs	7.4	60.3%
Graminoids	3.3	20.6%
Forbs	12.2	29.4%
TOTAL	***24.8***	***172.6%***

Sampled Stands Plant Species List

The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type is tremendously diverse vegetatively, due to its typical riparian setting with a broad range of site conditions; and this level of diversity is further amplified by the concentration of disturbance from the many users of these productive sites. In 81stands sampled of the community type, seven tree species were recorded, but only *Populus balsamifera* (balsam poplar) was highly prominent (Table 184). Sixty-six shrubs were recorded, led by *Cornus stolonifera* (red-osier dogwood), with several other species being moderately prominent. None of the 57 graminoid species was highly prominent, although the grazing disturbance increaser, *Poa pratensis* (Kentucky bluegrass), was most prominent. Among the 164 forb species recorded, no single species stood out, and only *Equisetum arvense* (common horsetail) was even moderately prominent.

Table 184. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type (number = 81 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 7)					
Betula papyrifera (white birch)	5.9	0-20	22	1.31	N
Picea glauca (white spruce)	1.2	0-3	32	0.38	N
Pinus contorta (lodgepole pine)	3.7	0-10	4	0.14	N
Pinus flexilis (limber pine)	0.5	0-0.5	1	0.01	N
Populus balsamifera (balsam poplar)	60.0	10-97.5	100	59.97	N
Populus tremuloides (aspen)	1.4	0-3	28	0.39	N
Pseudotsuga menziesii (Douglas-fir)	3.0	0-3	2	0.07	N
Shrubs (N = 66)					
Acer glabrum (mountain maple)	3.0	0-3	1	0.04	N
Alnus crispa (green alder)	13.8	0-60	10	1.36	N
Alnus tenuifolia (river alder)	12.2	0-60	23	2.86	N
Amelanchier alnifolia (Saskatoon)	3.0	0-30	40	1.17	N
Arctostaphylos uva-ursi (common bearberry)	1.1	0-3	5	0.06	N

Table 184. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Betula glandulosa (bog birch)	3.0	0-3	1	0.04	N
Betula occidentalis (water birch)	16.3	0-60	11	1.81	N
Clematis ligusticifolia (western clematis)	0.5	0-0.5	2	0.01	N
Clematis occidentalis (purple clematis)	3.0	0-3	2	0.07	N
Clematis spp. (clematis)	0.5	0-0.5	1	0.01	N
Cornus stolonifera (red-osier dogwood)	18.8	0-70	78	14.62	N
Corylus cornuta (beaked hazelnut)	1.3	0-3	4	0.05	N
Crataegus douglasii (Douglas hawthorn)	3.0	0-3	1	0.04	N
Crataegus rotundifolia (round-leaved hawthorn)	10.0	0-10	1	0.12	N
Dryas drummondii (yellow mountain avens)	10.0	0-10	1	0.12	N
Elaeagnus commutata (silverberry)	14.6	0-70	21	3.07	N
Juniperus communis (ground juniper)	0.5	0-0.5	1	0.01	N
Juniperus horizontalis (creeping juniper)	0.5	0-0.5	1	0.01	N
Juniperus scopulorum (Rocky Mountain juniper)	10.0	0-10	1	0.12	N
Ledum groenlandicum (common Labrador tea)	3.0	0-3	1	0.04	N
Linnaea borealis (twinflower)	1.0	0-3	6	0.06	N
Lonicera dioica (twining honeysuckle)	3.3	0-10	10	0.32	N
Lonicera involucrata (bracted honeysuckle)	6.8	0-30	23	1.59	N
Oplopanax horridum (devil's-club)	0.5	0-0.5	1	0.01	N
Potentilla fruticosa (shrubby cinquefoil)	1.1	0-3	5	0.06	N
Prunus virginiana (choke cherry)	7.6	0-40	22	1.69	N
Rhamnus alnifolia (alder-leaved buckthorn)	10.0	0-10	1	0.12	N
Ribes americanum (wild black currant)	10.3	0-20	2	0.25	N
Ribes hudsonianum (northern black currant)	0.5	0-0.5	2	0.01	N
Ribes lacustre (bristly black currant)	4.4	0-20	10	0.44	N
Ribes oxyacanthoides (northern gooseberry)	1.8	0-3	32	0.59	N
Ribes spp. (currant)	1.8	0-3	5	0.09	B
Ribes triste (wild red currant)	2.0	0-10	10	0.20	N
Rosa acicularis (prickly rose)	8.6	0-30	53	4.54	N
Rosa spp. (rose)	9.0	0-20	10	0.89	B
Rosa woodsii (common wild rose)	11.4	0-30	23	2.67	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	1	0.01	N
Rubus idaeus (wild red raspberry)	6.0	0-30	36	2.15	N
Rubus parviflorus (thimbleberry)	1.1	0-3	5	0.06	N
Rubus pubescens (dewberry)	2.3	0-10	33	0.77	N
Salix bebbiana (beaked willow)	6.8	0-30	52	3.54	N
Salix boothii (Booth's willow)	5.3	0-10	4	0.20	N
Salix discolor (pussy willow)	40.2	0-80	4	1.49	N
Salix drummondiana (Drummond's willow)	60.0	0-60	1	0.74	N
Salix exigua (sandbar willow)	9.4	0-30	7	0.70	N
Salix glauca (smooth willow)	31.5	0-60	2	0.78	N
Salix lucida (shining willow)	20.2	0-40	4	0.75	N
Salix lutea (yellow willow)	8.0	0-50	17	1.39	N
Salix melanopsis (dusky willow)	0.5	0-0.5	1	0.01	N

Table 184. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Salix myrtillifolia (myrtle-leaved willow)	20.0	0-20	1	0.25	N
Salix petiolaris (basket willow)	0.5	0-0.5	1	0.01	N
Salix planifolia (flat-leaved willow)	3.9	0-20	10	0.38	N
Salix pseudomonticola (false mountain willow)	0.5	0-0.5	2	0.01	N
Salix scouleriana (Scouler's willow)	4.7	0-20	12	0.57	N
Salix spp. (willow)	3.0	0-3	1	0.04	B
Shepherdia argentea (thorny buffaloberry)	1.8	0-3	2	0.04	N
Shepherdia canadensis (Canada buffaloberry)	9.3	0-40	15	1.38	N
Spiraea alba (narrow-leaved meadowsweet)	10.0	0-10	1	0.12	N
Spiraea betulifolia (white meadowsweet)	0.5	0-0.5	4	0.02	N
Spiraea densiflora (pink meadowsweet)	3.0	0-3	1	0.04	N
Symphoricarpos albus (snowberry)	2.6	0-10	10	0.26	N
Symphoricarpos occidentalis (buckbrush)	7.2	0-40	44	3.19	N
Symphoricarpos spp. (snowberry)	10.8	0-20	5	0.53	N
Vaccinium caespitosum (dwarf bilberry)	0.5	0-0.5	1	0.01	N
Viburnum edule (low-bush cranberry)	5.3	0-20	33	1.77	N
Viburnum opulus (high-bush cranberry)	0.5	0-0.5	1	0.01	N
Graminoids (N = 57)					
Agroelymus hirtiflorus (slender wheat grass x hairy wild rye hybrid)	0.5	0-0.5	1	0.01	N
Agropyron dasystachyum (northern wheat grass)	0.5	0-0.5	4	0.02	N
Agropyron pectiniforme (crested wheat grass)	10.0	0-10	1	0.12	I
Agropyron repens (quack grass)	2.0	0-3	15	0.29	I
Agropyron trachycaulum (slender wheat grass)	3.1	0-20	20	0.61	N
Agrostis exarata (spike redtop)	0.5	0-0.5	1	0.01	N
Agrostis scabra (rough hair grass)	20.0	0-20	1	0.25	N
Agrostis stolonifera (redtop)	15.1	0-20	10	1.49	I
Alopecurus occidentalis (alpine foxtail)	1.8	0-3	2	0.04	N
Alopecurus pratensis (meadow foxtail)	0.5	0-0.5	1	0.01	I
Beckmannia syzigachne (slough grass)	0.5	0-0.5	1	0.01	N
Bromus anomalus (nodding brome)	0.5	0-0.5	1	0.01	N
Bromus ciliatus (fringed brome)	1.1	0-3	10	0.11	N
Bromus inermis (smooth brome)	5.3	0-40	22	1.17	I
Bromus inermis subsp. *pumpellianus* (northern awnless brome)	3.0	0-3	1	0.04	N
Calamagrostis canadensis (marsh reed grass)	8.7	0-60	48	4.20	N
Calamagrostis purpurascens (purple reed grass)	3.0	0-3	1	0.04	N
Calamagrostis stricta (narrow reed grass)	8.7	0-20	6	0.54	N
Carex aquatilis (water sedge)	50.0	0-50	1	0.62	N
Carex atherodes (awned sedge)	10.0	0-10	2	0.25	N
Carex bebbii (Bebb's sedge)	3.0	0-3	1	0.04	N
Carex deweyana (Dewey's sedge)	1.8	0-3	5	0.09	N
Carex disperma (two-seeded sedge)	0.5	0-0.5	2	0.01	N
Carex eburnea (bristle-leaved sedge)	0.5	0-0.5	1	0.01	N

Table 184. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex lanuginosa (woolly sedge)	0.5	0-0.5	2	0.01	N
Carex obtusata (blunt sedge)	0.5	0-0.5	1	0.01	N
Carex prairea (prairie sedge)	0.5	0-0.5	1	0.01	N
Carex spp. (sedge)	0.5	0-0.5	1	0.01	N
Carex utriculata (beaked sedge)	6.5	0-10	2	0.16	N
Cinna latifolia (drooping wood-reed)	1.8	0-3	2	0.04	N
Dactylis glomerata (orchard grass)	6.5	0-10	2	0.16	I
Deschampsia cespitosa (tufted hair grass)	3.2	0-10	10	0.31	N
Elymus canadensis (Canada wild rye)	3.7	0-10	4	0.14	N
Elymus glaucus (smooth wild rye)	11.5	0-20	2	0.28	N
Elymus innovatus (hairy wild rye)	6.0	0-20	14	0.81	N
Elymus virginicus (Virginia wild rye)	0.5	0-0.5	2	0.01	N
Festuca idahoensis (bluebunch fescue)	1.3	0-3	4	0.05	N
Festuca ovina (sheep fescue)	0.5	0-0.5	1	0.01	I
Festuca pratensis (meadow fescue)	0.5	0-0.5	1	0.01	I
Festuca spp. (fescue)	10.0	0-10	1	0.12	B
Glyceria grandis (common tall manna grass)	20.0	0-20	1	0.25	N
Glyceria striata (fowl manna grass)	0.5	0-0.5	1	0.01	N
Hierochloe odorata (sweet grass)	0.5	0-0.5	1	0.01	N
Hordeum jubatum (foxtail barley)	0.5	0-0.5	2	0.01	N
Juncus balticus (wire rush)	5.9	0-10	5	0.29	N
Melica subulata (Alaska onion grass)	1.8	0-3	2	0.04	N
Oryzopsis asperifolia (white-grained mountain rice grass)	1.8	0-3	2	0.04	N
Phalaris arundinacea (reed canary grass)	27.8	0-80	4	1.03	N
Phleum pratense (timothy)	5.6	0-50	25	1.37	I
Poa compressa (Canada bluegrass)	6.8	0-10	4	0.25	I
Poa cusickii (early bluegrass)	0.5	0-0.5	1	0.01	N
Poa palustris (fowl bluegrass)	3.6	0-30	19	0.67	N
Poa pratensis (Kentucky bluegrass)	11.5	0-40	37	4.27	I
Poa spp. (bluegrass)	0.5	0-0.5	1	0.01	B
Schizachne purpurascens (purple oat grass)	5.3	0-10	2	0.13	N
Scirpus microcarpus (small-fruited bulrush)	5.3	0-10	2	0.13	N
Trisetum spicatum (spike trisetum)	0.5	0-0.5	1	0.01	N
Forbs (N = 164)					
Achillea millefolium (common yarrow)	1.3	0-3	23	0.30	N
Achillea sibirica (many-flowered yarrow)	0.5	0-0.5	7	0.04	N
Actaea rubra (red and white baneberry)	2.5	0-20	27	0.67	N
Agoseris glauca (yellow false dandelion)	0.5	0-0.5	1	0.01	N
Agrimonia striata (agrimony)	0.5	0-0.5	1	0.01	N
Allium cernuum (nodding onion)	0.5	0-0.5	1	0.01	N
Anemone canadensis (Canada anemone)	0.5	0-0.5	1	0.01	N
Anemone cylindrica (long-fruited anemone)	0.5	0-0.5	1	0.01	N
Anemone multifida (cut-leaved anemone)	1.3	0-3	4	0.05	N

Table 184. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Anemone spp. (anemone)	0.5	0-0.5	1	0.01	N
Angelica arguta (white angelica)	2.2	0-10	9	0.19	N
Antennaria anaphaloides (tall everlasting)	1.8	0-3	2	0.04	N
Antennaria parvifolia (small-leaved everlasting)	0.5	0-0.5	4	0.02	N
Apocynum cannabinum (Indian hemp)	0.5	0-0.5	1	0.01	N
Aquilegia brevistyla (blue columbine)	3.0	0-3	1	0.04	N
Aralia nudicaulis (wild sarsaparilla)	5.4	0-20	31	1.67	N
Arctium lappa (great burdock)	0.5	0-0.5	1	0.01	I
Aster ciliolatus (Lindley's aster)	1.2	0-3	14	0.16	N
Aster conspicuus (showy aster)	3.1	0-20	38	1.18	N
Aster engelmannii (elegant aster)	0.5	0-0.5	1	0.01	N
Aster falcatus (creeping white prairie aster)	0.5	0-0.5	1	0.01	N
Aster hesperius (western willow aster)	0.8	0-3	10	0.08	N
Aster laevis (smooth aster)	1.8	0-3	17	0.30	N
Aster puniceus (purple-stemmed aster)	0.5	0-0.5	2	0.01	N
Aster spp. (aster)	2.2	0-3	4	0.08	N
Athyrium filix-femina (lady fern)	3.7	0-10	4	0.14	N
Barbarea orthoceras (American winter cress)	3.0	0-3	1	0.04	N
Botrychium virginianum (Virginia grape fern)	0.5	0-0.5	4	0.02	N
Callitriche verna (vernal water-starwort)	0.5	0-0.5	2	0.01	N
Castilleja miniata (common red paintbrush)	3.0	0-3	1	0.04	N
Chenopodium album (lamb's-quarters)	0.5	0-0.5	1	0.01	I
Chenopodium salinum (oak-leaved goosefoot)	0.5	0-0.5	1	0.01	N
Chrysanthemum leucanthemum (ox-eye daisy)	0.5	0-0.5	2	0.01	I
Cicuta maculata (water-hemlock)	0.5	0-0.5	2	0.01	N
Circaea alpina (small enchanter's nightshade)	4.5	0-10	4	0.17	N
Cirsium arvense (Canada thistle)	2.6	0-10	23	0.60	I
Cirsium hookerianum (white thistle)	3.0	0-3	1	0.04	N
Cirsium spp. (thistle)	0.5	0-0.5	1	0.01	B
Cirsium vulgare (bull thistle)	0.5	0-0.5	1	0.01	I
Cornus canadensis (bunchberry)	3.5	0-20	15	0.52	N
Crepis spp. (crepis)	0.5	0-0.5	1	0.01	B
Delphinium glaucum (tall larkspur)	1.4	0-3	14	0.19	N
Disporum trachycarpum (fairybells)	0.5	0-0.5	9	0.04	N
Dryopteris cristata (crested shield fern)	0.5	0-0.5	1	0.01	N
Dryopteris spp. (unknown fern)	3.0	0-3	1	0.04	N
Echium vulgare (common viper's bugloss)	3.0	0-3	1	0.04	I
Epilobium anagallidifolium (alpine willowherb)	1.1	0-3	5	0.06	N
Epilobium angustifolium (common fireweed)	3.0	0-20	31	0.93	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	1	0.01	N
Equisetum arvense (common horsetail)	8.7	0-60	72	6.25	N
Equisetum fluviatile (swamp horsetail)	3.0	0-3	1	0.04	N
Equisetum hyemale (common scouring-rush)	0.5	0-0.5	1	0.01	N
Equisetum laevigatum (smooth scouring-rush)	0.5	0-0.5	2	0.01	N

Table 184. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Equisetum pratense (meadow horsetail)	16.8	0-60	6	1.04	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	1	0.01	N
Equisetum sylvaticum (woodland horsetail)	20.2	0-40	4	0.75	N
Erigeron spp. (erigeron)	0.5	0-0.5	1	0.01	N
Erysimum cheiranthoides (wormseed mustard)	0.5	0-0.5	1	0.01	N
Euphorbia esula (leafy spurge)	0.5	0-0.5	1	0.01	I
Forb spp. (forb)	1.0	0-3	6	0.06	B
Fragaria virginiana (wild strawberry)	2.3	0-20	51	1.19	N
Galeopsis tetrahit (hemp-nettle)	2.9	0-10	5	0.14	I
Galium boreale (northern bedstraw)	1.3	0-3	41	0.54	N
Galium trifidum (small bedstraw)	0.5	0-0.5	2	0.01	N
Galium triflorum (sweet-scented bedstraw)	1.3	0-3	31	0.40	N
Gentianella amarella (felwort)	0.5	0-0.5	1	0.01	N
Geocaulon lividum (northern bastard toadflax)	3.0	0-3	1	0.04	N
Geranium richardsonii (wild white geranium)	1.6	0-3	17	0.27	N
Geranium viscosissimum (sticky purple geranium)	0.5	0-0.5	2	0.01	N
Geum aleppicum (yellow avens)	1.0	0-3	6	0.06	N
Geum macrophyllum (large-leaved yellow avens)	1.1	0-3	15	0.17	N
Geum triflorum (three-flowered avens)	0.5	0-0.5	2	0.01	N
Glycyrrhiza lepidota (wild licorice)	0.5	0-0.5	1	0.01	N
Gymnocarpium dryopteris (oak fern)	0.5	0-0.5	4	0.02	N
Habenaria dilatata (tall white bog orchid)	0.5	0-0.5	1	0.01	N
Halenia deflexa (spurred gentian)	0.5	0-0.5	1	0.01	N
Hedysarum alpinum (alpine hedysarum)	3.0	0-3	1	0.04	N
Heracleum lanatum (cow parsnip)	2.4	0-20	25	0.58	N
Heuchera cylindrica (sticky alumroot)	0.5	0-0.5	1	0.01	N
Hieracium umbellatum (narrow-leaved hawkweed)	0.9	0-3	7	0.07	N
Lactuca pulchella (common blue lettuce)	0.5	0-0.5	1	0.01	N
Lathyrus ochroleucus (cream-colored vetchling)	1.0	0-3	40	0.41	N
Lilium philadelphicum (western wood lily)	0.5	0-0.5	2	0.01	N
Linum lewisii (wild blue flax)	0.5	0-0.5	1	0.01	N
Lomatium dissectum (mountain wild parsnip)	0.5	0-0.5	2	0.01	N
Lupinus sericeus (silky perennial lupine)	0.5	0-0.5	1	0.01	N
Lysimachia ciliata (fringed loosestrife)	7.0	0-20	4	0.26	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	11	0.06	N
Medicago lupulina (black medick)	0.5	0-0.5	4	0.02	I
Melilotus alba (white sweet-clover)	0.5	0-0.5	5	0.02	I
Melilotus officinalis (yellow sweet-clover)	1.5	0-3	6	0.09	I
Mentha arvensis (wild mint)	2.6	0-10	9	0.22	N
Mertensia paniculata (tall lungwort)	2.7	0-20	32	0.86	N
Mirabilis albida (white four-o'clock)	0.5	0-0.5	1	0.01	N
Mitella nuda (bishop's-cap)	1.3	0-3	20	0.25	N
Mitella spp. (miterwort)	0.5	0-0.5	1	0.01	N
Moehringia lateriflora (blunt-leaved sandwort)	0.5	0-0.5	1	0.01	N

Table 184. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Monarda fistulosa (wild bergamot)	0.5	0-0.5	1	0.01	N
Montia spp. (montia)	0.5	0-0.5	1	0.01	N
Myosotis laxa (small forget-me-not)	1.8	0-3	2	0.04	N
Orthilia secunda (one-sided wintergreen)	0.5	0-0.5	1	0.01	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	0.5	0-0.5	2	0.01	N
Osmorhiza depauperata (spreading sweet cicely)	1.1	0-3	11	0.12	N
Osmorhiza occidentalis (western sweet cicely)	1.1	0-3	5	0.06	N
Osmorhiza spp. (sweet cicely)	0.5	0-0.5	1	0.01	N
Pedicularis bracteosa (western lousewort)	0.5	0-0.5	1	0.01	N
Pedicularis spp. (lousewort)	0.5	0-0.5	1	0.01	N
Penstemon procerus (slender blue beardtongue)	3.0	0-3	1	0.04	N
Petasites frigidus (arctic sweet coltsfoot)	1.0	0-3	30	0.30	N
Petasites palmatus (palmate-leaved coltsfoot)	2.6	0-10	10	0.26	N
Plantago major (common plantain)	0.5	0-0.5	5	0.02	I
Plantago patagonica (Pursh's plantain)	0.5	0-0.5	2	0.01	N
Polygonum amphibium (water smartweed)	10.0	0-10	1	0.12	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	1	0.01	N
Potentilla gracilis (graceful cinquefoil)	3.0	0-3	1	0.04	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	1	0.01	N
Prunella vulgaris (heal-all)	0.5	0-0.5	2	0.01	N
Pyrola asarifolia (common pink wintergreen)	0.7	0-3	15	0.10	N
Ranunculus acris (tall buttercup)	0.5	0-0.5	2	0.01	I
Ranunculus spp. (ranunculus)	0.5	0-0.5	1	0.01	B
Rumex occidentalis (western dock)	0.5	0-0.5	2	0.01	N
Sanicula marilandica (snakeroot)	0.5	0-0.5	1	0.01	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	7	0.04	N
Senecio foetidus (marsh butterweed)	0.5	0-0.5	1	0.01	N
Senecio pauperculus (balsam groundsel)	3.0	0-3	1	0.04	N
Senecio pseudaureus (thin-leaved ragwort)	20.0	0-20	1	0.25	N
Senecio triangularis (brook ragwort)	1.8	0-3	2	0.04	N
Sisymbrium loeselii (tall hedge mustard)	0.5	0-0.5	1	0.01	I
Sisyrinchium montanum (common blue-eyed grass)	3.0	0-3	1	0.04	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	4	0.02	N
Smilacina stellata (star-flowered Solomon's-seal)	1.8	0-10	47	0.84	N
Solanum dulcamara (climbing nightshade)	0.5	0-0.5	1	0.01	I
Solidago canadensis (Canada goldenrod)	4.3	0-20	22	0.96	N
Solidago gigantea (late goldenrod)	3.7	0-10	4	0.14	N
Solidago missouriensis (low goldenrod)	1.8	0-3	2	0.04	N
Sonchus arvensis (perennial sow-thistle)	1.1	0-3	5	0.06	I
Sonchus arvensis subsp. *uliginosus* (smooth perennial sow-thistle)	0.5	0-0.5	1	0.01	I
Spiranthes romanzoffiana (hooded ladies'-tresses)	0.5	0-0.5	1	0.01	N
Stachys palustris (marsh hedge-nettle)	3.0	0-3	1	0.04	N

Table 184. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Stellaria longifolia (long-leaved chickweed)	3.0	0-3	1	0.04	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	2	0.01	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.9	0-3	7	0.07	N
Tanacetum vulgare (common tansy)	1.8	0-3	2	0.04	I
Taraxacum ceratophorum (northern dandelion)	0.5	0-0.5	1	0.01	N
Taraxacum officinale (common dandelion)	2.2	0-10	53	1.14	I
Thalictrum dasycarpum (tall meadow rue)	3.0	0-3	1	0.04	N
Thalictrum occidentale (western meadow rue)	1.0	0-3	6	0.06	N
Thalictrum spp. (meadow rue)	0.5	0-0.5	2	0.01	N
Thalictrum venulosum (veiny meadow rue)	2.3	0-10	20	0.46	N
Thermopsis rhombifolia (golden bean)	0.5	0-0.5	1	0.01	N
Trientalis borealis (northern starflower)	0.5	0-0.5	1	0.01	N
Trifolium hybridum (alsike clover)	0.9	0-3	7	0.07	I
Trifolium repens (white clover)	2.9	0-10	15	0.43	I
Trifolium spp. (clover)	3.0	0-3	1	0.04	B
Urtica dioica (common nettle)	1.8	0-3	10	0.17	N
Verbascum thapsus (common mullein)	1.8	0-3	2	0.04	I
Vicia americana (wild vetch)	1.5	0-10	53	0.77	N
Viola adunca (early blue violet)	0.5	0-0.5	1	0.01	N
Viola canadensis (western Canada violet)	1.6	0-10	21	0.35	N
Viola palustris (marsh violet)	0.5	0-0.5	1	0.01	N
Viola renifolia (kidney-leaved violet)	0.5	0-0.5	5	0.02	N
Viola spp. (violet)	0.5	0-0.5	1	0.01	B
Zigadenus elegans (white camas)	0.5	0-0.5	1	0.01	N
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	1	0.01	N

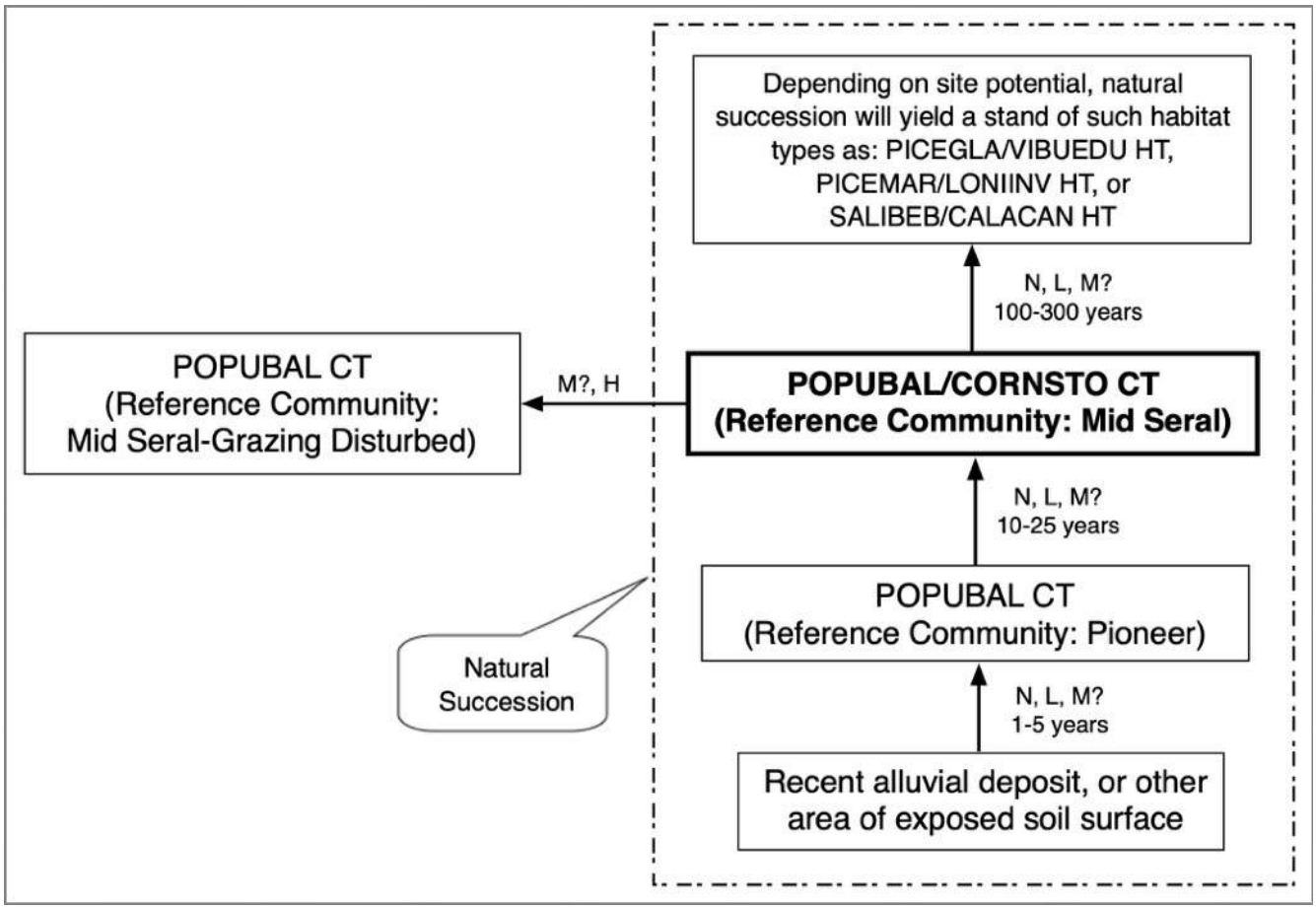
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type represents a mid-seral stage of either primary or secondary succession. *Populus balsamifera* (balsam poplar) in a primary successional situation occurs typically by seeded establishment on riverine alluvial deposits. The most common example of secondary successional stands of this community occurs on burned areas where re-establishment may be by seed or vegetative resprouting. In this study area, stands of this community type typically will have later seral conifer trees species invading to indicate the climax potential of the site.

Figure 36 shows a schematic diagram of vegetation successional pathways on sites of the *Populus balsamifera/ Cornus stolonifera* (balsam poplar/red-osier dogwood) community type.



Successional Pathway of *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
PICEGLA/VIBUEDU HT—*Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type
PICEMAR/LONIINV HT—*Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
POPUBAL CT—*Populus balsamifera* (balsam poplar) community type
SALIBEB/CALACAN HT—*Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type

Figure 36. Successional pathway for sites of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types. We see little indication that *Salix* (willows) can re-establish on a site after it becomes dominated by non-willow species.

EDATOPE

Figure 37 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

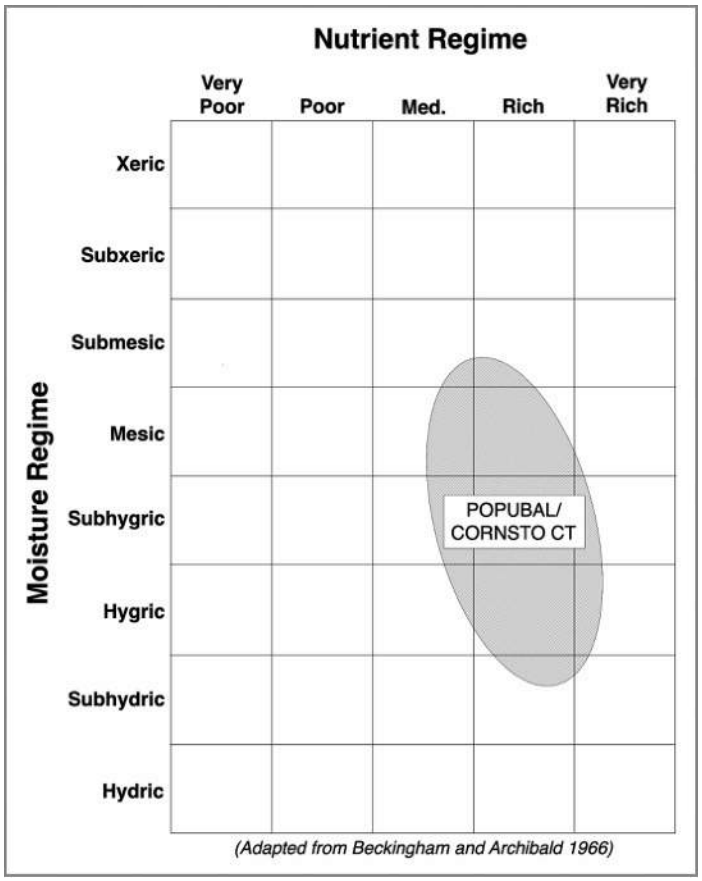


Figure 37. Edatope grid position for the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type (POPUBAL/CORNSTO CT)

SOILS

Parent material on sites supporting the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type may be alluvial or morainal, and soils are generally brunisols and luvisols, or regosols. Sites of this community type typically have organic layer thickness less than 5 cm, and are moderately well drained to imperfectly drained with texture ranging from sandy loam to silt loam (France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter communities are typically dominated by *Salix* species (willow), *Alnus* species (alder), *Carex* species (sedge), or *Calamagrostis canadensis* (marsh reed grass). Adjacent drier sites are likely to be dominated by *Populus tremuloides* (aspen) or *Picea glauca* (white spruce) upland communities.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) is common throughout most of Alberta on well drained sites having high available moisture. In drier areas, the species is restricted to shorelines, riverine floodplains, and moist slopes (Tannas 1997a). It generally occurs on moist sites, such as river floodplains, stream and lake shores, moist depressions, and swamps, but will also grow on drier sites (Harris 1990).

The species is capable of regenerating from root suckers, stump sprouts, stem sprouts, and buried branches. Root suckering is thought to be primarily a means of expansion, rather than simply a means of recovery following clearcutting or fire. Stands are often polyclonal, with several genotypes and their sprouts occurring together in a stand (Harris 1990).

Populus balsamifera (balsam poplar) is an early seral pioneer species, which colonizes disturbed wet sites by seeding or suckering. It is among the fastest growing tree species in temperate latitudes. Rapid early growth allows it to establish on a site and to dominate it for up to 100 years. The species is highly tolerant of flooding (Harris 1990).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is a riparian shrub species that typically occurs along stream margins and other moist to wet sites at elevations between 500 m and 3,000 m. The species is not particularly drought tolerant, and on upland sites is generally restricted to areas receiving more than 50.8 cm of annual precipitation (Gucker 2012).

Cornus stolonifera (red-osier dogwood) is typically present throughout all stages of succession, but abundance is often greater in earlier than later stages. The species occupies open sites and also occurs beneath closed canopies, but is typically more abundance in sun than in shade (Gucker 2012).

***Viburnum edule* (low-bush cranberry)**—*Viburnum edule* (low-bush cranberry) is common in Alberta in all natural regions except the Mixed Grass Prairie. It grows in moist woods, boggy or swampy woodlands, and wet thickets (Tannas 1997a).

Viburnum edule (low-bush cranberry) is moderately shade tolerant and may be prominent in all stages of forest succession. On floodplain sites, the species is present in the pioneer willow stands, through the seral *Populus balsamifera* (balsam poplar) stages, and remains prominent in mature/climax *Picea glauca* (white spruce) and *Picea mariana* (black spruce) stands (Matthews 1992a).

Livestock

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) has poor forage value for livestock. While nutrient levels are probably acceptable, the resinous twigs and foliage are less palatable than those of other *Populus* (poplar) species. Therefore, heavy utilization of it usually indicates an over-population of wild ungulates, or over grazing by livestock (Tannas 1997a). Stands may be subjected to high levels of grazing pressure because of gentle topography and ease of access. With prolonged moderate to high grazing pressure,

palatable shrubs in the understory will decrease relative to less preferred species, such as *Symphoricarpos* species (buckbrush), *Rosa* species (rose), and *Lonicera* species (honeysuckle) (Thompson and Hansen 2003).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is considered an "ice cream" plant by livestock and wildlife (Hansen and others 1995). In areas of Montana having experienced historic high levels of browsing by livestock, the species has been effectively eliminated from many sites.

***Viburnum edule* (low-bush cranberry)**—*Viburnum edule* (low-bush cranberry) has fair forage value, but is little used by livestock, and increases under heavy grazing pressure (Tannas 1997a). The species palatability is low for livestock (Matthews 1992a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) is a commercial tree in Alberta. It is used for plywood, pulpwood, boxes and crates, and to make high-grade paper and particle board (Tannas 1997a). Cutting mature *Populus balsamifera* (balsam poplar) results in sprouting from callus tissue and dormant buds. Stump sprouting is most pronounced on winter-logged areas. Trees cut in summer have few surviving sprouts after four years (Thompson and Hansen 2003).

Wildlife

***Populus balsamifera* (balsam poplar)**—Northern forests containing *Populus balsamifera* (balsam poplar) support a wide variety of wildlife—including moose, elk, Stone's sheep, mountain goat, mountain caribou, mule deer, wolf, coyote, black bear, grizzly bear, lynx, snowshoe hare, wolverine, and pine marten (Harris 1990). The species is a valuable resource of food and construction material for beaver (Tannas 1997a). Moose sparingly browse young *Populus balsamifera* (balsam poplar), and will strip bark from the trees in times of winter food shortage (Harris 1990). The spreading crown of *Populus balsamifera* (balsam poplar) provides nesting sites for large birds. A variety of birds and mammals, such as woodpeckers, owls, wood ducks, and squirrels, nest in trunk cavities (Hansen and others 1995).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) provides hiding and thermal cover for small mammals and birds. The species is used for food and cover by white-tailed deer, mule deer, elk, moose, cottontail rabbits, snowshoe hares, and numerous birds (Costain 1989). Moose in particular are tall enough to reach the twigs of even the tallest plants. *Cornus stolonifera* (red-osier dogwood) fruit is low in sugar, so it is initially less attractive to wildlife and less inclined to rot than other fruits. Consequently, the fruit stays on the plant through the winter and is available when fruits of other plants are gone (Gucker 2012).

***Viburnum edule* (low-bush cranberry)**—*Viburnum edule* (low-bush cranberry) is browsed quite readily by wild ungulates, primarily in winter months. The fruit is a valuable food source for a variety of bird species (Tannas 1997a). *Viburnum edule* (low-bush cranberry) is of low to moderate importance as browse for elk, mountain goat, bighorn sheep, deer, and caribou. The foliage is browsed by moose throughout the year. The fruits are a major food of grizzly and black bears. *Viburnum* species (cranberry) are important components of forest-edge and hedgerow habitats that provide cover for small mammals and birds (Matthews 1992a).

Fisheries

***Populus balsamifera* (balsam poplar)**—When located near a stream, stands of *Populus balsamifera* (balsam poplar) provide thermal cover, debris, and streambank stability. This is particularly important on the higher gradient streams where scouring by seasonal flooding may occur (Hansen and others 1995).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is an excellent shrub for controlling erosion along streams. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

Fire

***Populus balsamifera* (balsam poplar)**—Although severe fire kills *Populus balsamifera* (balsam poplar), it is considered one of the most well adapted tree species to fire in the northern forest. Its ability to sprout from roots, stumps, and buried branches enables it to quickly recover from fire (Harris 1990). Moderate fire may top-kill some trees, but light fires usually do not harm mature *Populus balsamifera* (balsam poplar). Young trees may be top-killed because of their thin bark, and repeated burning may eliminate the species from a site by preventing regeneration (Thompson and Hansen 2003).

Populus balsamifera (balsam poplar) is most susceptible to fire during late summer and fall. If a manager wants to extend the life of a *Populus balsamifera* (balsam poplar) stand, fire ***MAY BE*** used as a tool in the pole to early mature stage of development. If fire is used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that wildlife browsing be closely monitored to protect the young sprouts (Hansen and others 1995).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) generally increases following fire, and may invade recently burned areas from adjacent unburned areas. Above ground material is usually killed by fire. However, the roots can survive all but the most severe fires that remove the duff and heat the upper soil for an extended period. The species can sprout from surviving roots or stolons and from the base of aerial stems following fire (Fischer and Bradley 1987), but can be killed by severe fires that cause extended heating of the upper soil. Light fires that partially remove the duff stimulate germination of buried seed. In moist forests of British Columbia, *Cornus stolonifera* (red-osier dogwood) appears to increase in abundance following the removal of the shading canopy by logging or burning (Gucker 2012).

***Viburnum edule* (low-bush cranberry)**—*Viburnum edule* (low-bush cranberry) sprouts from the stump, roots, or underground stems after light to moderate fire. Top-killed plants usually sprout within weeks after fire, and the species often becomes a dominant shrub on the site post fire. Low-severity fires may stimulate germination of seeds stored in the soil (Matthews 1992a).

Rehabilitation/Restoration Considerations

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) is an important riparian species for stabilizing river banks and maintaining river islands subject to recurring scouring by floods and alluvium deposition (Thompson and Hansen 2003). With healthy natural vegetation associated, these stands are relatively stable because of the strong root systems of the associated species. Management should emphasize the understory shrub layer in streambank revegetation projects. This is most important on higher gradient streams. Managers should strive to maintain a buffer of a *Populus balsamifera* (balsam poplar) community adjacent to all rivers and streams where possible. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize the streambanks, and dissipate flood energy (Thompson and Hansen 2003).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is valuable for revegetation of degraded sites, as it readily establishes along stream edges by direct seeding, transplanting rooted cuttings, or planting nursery-grown seedlings. Its rapid growth can quickly stabilize deteriorated streambanks (Gucker 2012).

***Viburnum edule* (low-bush cranberry)**—The value of *Viburnum edule* (low-bush cranberry) for rehabilitation purposes has not been well documented. The species was studied for use in oil sands reclamation, but results have not been located (Matthews 1992a).

Recreational Uses and Consideration

***Populus balsamifera* (balsam poplar)**—Because of their common proximity to streams and lakes, recreational developments and transportation corridors are common in *Populus balsamifera* (balsam poplar) stands. Opportunities in and near stands of *Populus balsamifera* (balsam poplar) are excellent for fishing, big game, and waterfowl hunting, and observing a variety of wildlife. Care must be taken when locating structures in this type due to potential for flooding (Thompson and Hansen 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- F13. Balsam poplar/Willow/Horsetail

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Pb-Aw/Green alder/Fern
- Pb/Willow/Horsetail
- Pb/Willow/Yellow mountain avens

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Pb/Thimbleberry

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msg20 Balsam poplar/Willow (Montane Southern Ecosection)
- Msg12 Pb/Thimbleberry (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995);
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001); and
- *Classification and Management of the Fort Harrison and Limestone Hills Training Area* (West Central Montana) Ecological Solutions Group 2017).

Populus balsamifera Community Type
(balsam poplar Community Type)

POPUBAL Community Type
Number of Stands = 29 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 11; Other Data Sets = 18)

LOCATION AND ASSOCIATED LANDFORMS

The *Populus balsamifera* (balsam poplar) community type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This early seral community type occurs on alluvial terraces of streams and rivers, as well as around lakes, sloughs, and other moist sites throughout the study area.

Photo 8 shows a typical stand of the *Populus balsamifera* (balsam poplar) community type.

Photo 8. A stand of the *Populus balsamifera* (balsam poplar) community type

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the

plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 185 shows the five most prominent plant species among the four lifeforms for species recorded in all 29 stands of the *Populus balsamifera* (balsam poplar) community type. *Populus balsamifera* (balsam poplar) heavily dominates all vegetation in this mostly disturbed community type. No other species is more than moderately prominent, but to indicate the high degree of disturbance on these stands, the two most prominent other species are introduced grasses, *Bromus inermis* (smooth brome) and *Poa pratensis* (Kentucky bluegrass).

Table 185. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Populus balsamifera* (balsam poplar) community type (number = 29 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus balsamifera (balsam poplar)	63.79	Native
Populus tremuloides (aspen)	0.09	Native
Picea glauca (white spruce)	0.07	Native
Pseudotsuga menziesii (Douglas-fir)	0.03	Native
Abies lasiocarpa (subalpine fir)	0.02	Native
Shrubs		
Rosa woodsii (common wild rose)	4.71	Native
Symphoricarpos occidentalis (buckbrush)	4.22	Native
Rosa acicularis (prickly rose)	3.00	Native
Elaeagnus commutata (silverberry)	2.76	Native
Symphoricarpos albus (snowberry)	2.17	Native
Graminoids		
Bromus inermis (smooth brome)	9.57	Introduced
Poa pratensis (Kentucky bluegrass)	9.53	Introduced
Phleum pratense (timothy)	4.91	Introduced
Calamagrostis canadensis (marsh reed grass)	4.36	Native
Agrostis stolonifera (redtop)	2.76	Introduced
Forbs		
Thalictrum occidentale (western meadow rue)	5.88	Native
Heracleum lanatum (cow parsnip)	4.91	Native
Taraxacum officinale (common dandelion)	3.02	Introduced
Melilotus alba (white sweet-clover)	2.76	Introduced
Fragaria virginiana (wild strawberry)	2.03	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 186 through Table 189, break out the vegetation recorded in all 29 stands sampled of the *Populus balsamifera* (balsam poplar) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species rich, forested community type of minor occurrence across the study area.

Table 186 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus balsamifera* (balsam poplar) community type. For the 29 stands comprising the community type, the number of unique species was 201 with 170 (84.6 percent) of them being native species.

Table 186. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Populus balsamifera* (balsam poplar) community type (number = 29 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	8	8	0	0
Shrubs	42	39	0	3
Graminoids	44	33	8	3
Forbs	107	90	13	4
TOTAL	***201 (100.0%)***	***170 (84.6%)***	***21 (10.4%)***	***10 (5.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 187 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus balsamifera* (balsam poplar) community type. The average number of species per stand is 22.8, with native species comprising 19.4 species per stand or 85.1 percent.

Table 187. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Populus balsamifera* (balsam poplar) community type (number = 29 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.5	1.5	0.0	0.0
Shrubs	5.0	4.8	0.0	0.2
Graminoids	3.8	2.1	1.5	0.1
Forbs	12.5	11.0	1.3	0.1
TOTAL	***22.8 (100.0%)***	***19.4 (85.1%)***	***2.8 (12.3%)***	***0.4 (1.8%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 188 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus balsamifera* (balsam poplar) community type. The average canopy cover per stand is 183.9 percent, with native species comprising 146.8 percent or 79.8 percent of the total amount of average canopy cover per stand.

Table 188. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Populus balsamifera* (balsam poplar) community type (number = 29 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	64.1%	64.1%	0.0%	0.0%
Shrubs	32.6%	31.5%	0.0%	1.1%
Graminoids	38.2%	9.8%	28.2%	0.3%
Forbs	49.0%	41.4%	7.4%	0.2%
TOTAL	***183.9% (100.0%)***	***146.8% (79.8%)***	***35.6% (19.3%)***	***1.6% (0.9%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 189 shows the average number of species and average canopy cover by lifeform in stands of the *Populus balsamifera* (balsam poplar) community type. The average number of species per stand was 22.8 with an average canopy cover of 183.9 percent.

Table 189. Average number of species and average canopy cover by lifeform in stands of the *Populus balsamifera* (balsam poplar) community type (number = 29 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	1.5	64.1%
Shrubs	5.0	32.6%
Graminoids	3.8	38.2%
Forbs	12.5	49.0%
TOTAL	***22.8***	***183.9%***

Sampled Stands Plant Species List

The *Populus balsamifera* (balsam poplar) community type contains the stands dominated by *Populus balsamifera* (balsam poplar) that are too early seral or disturbed to key out to the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type. *Populus balsamifera* (balsam poplar) is the only one of eight tree species recorded that was at all prominent (Table 190). Among the 42 shrubs recorded, the most prominent are the disturbance increasers: *Rosa woodsii* (common wild rose) and *Symphoricarpos occidentalis* (buckbrush). Likewise, the 44 graminoids recorded are led by *Bromus inermis* (smooth brome) and *Poa pratensis* (Kentucky bluegrass). Among the 107 forbs recorded, none is more than moderately prominent.

Table 190. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Populus balsamifera* (balsam poplar) community type (number = 29 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 8)					
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	3	0.02	N
Betula papyrifera (white birch)	0.5	0-0.5	3	0.02	N
Picea glauca (white spruce)	0.5	0-0.5	14	0.07	N
Pinus monticola (western white pine)	0.5	0-0.5	3	0.02	N
Pinus ponderosa (ponderosa pine)	0.5	0-0.5	3	0.02	N
Populus balsamifera (balsam poplar)	63.8	10-90	100	63.79	N
Populus tremuloides (aspen)	0.5	0-0.5	17	0.09	N
Pseudotsuga menziesii (Douglas-fir)	0.5	0-0.5	7	0.03	N
Shrubs (N = 42)					
Alnus crispa (green alder)	50.0	0-50	3	1.72	N
Alnus tenuifolia (river alder)	4.9	0-20	17	0.84	N
Amelanchier alnifolia (Saskatoon)	4.0	0-20	48	1.91	N
Arctostaphylos uva-ursi (common bearberry)	0.5	0-0.5	7	0.03	N
Berberis repens (creeping mahonia)	0.5	0-0.5	3	0.02	N
Betula occidentalis (water birch)	20.0	0-20	3	0.69	N
Clematis ligusticifolia (western clematis)	0.5	0-0.5	3	0.02	N
Cornus stolonifera (red-osier dogwood)	0.5	0-0.5	14	0.07	N
Corylus cornuta (beaked hazelnut)	6.5	0-10	7	0.45	N
Dryas drummondii (yellow mountain avens)	20.0	0-30	7	1.38	N

Table 190. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Elaeagnus commutata (silverberry)	26.7	0-30	10	2.76	N
Juniperus communis (ground juniper)	0.5	0-0.5	3	0.02	N
Linnaea borealis (twinflower)	0.5	0-0.5	3	0.02	N
Lonicera dioica (twining honeysuckle)	0.5	0-0.5	3	0.02	N
Lonicera involucrata (bracted honeysuckle)	4.1	0-10	28	1.12	N
Potentilla fruticosa (shrubby cinquefoil)	1.3	0-3	10	0.14	N
Prunus pensylvanica (pin cherry)	3.0	0-3	3	0.10	N
Prunus virginiana (choke cherry)	4.3	0-10	17	0.74	N
Ribes inerme (mountain gooseberry)	3.0	0-3	3	0.10	N
Ribes oxyacanthoides (northern gooseberry)	1.3	0-3	31	0.41	N
Ribes spp. (currant)	0.5	0-0.5	7	0.03	B
Ribes triste (wild red currant)	3.0	0-3	3	0.10	N
Rosa acicularis (prickly rose)	12.4	0-60	24	3.00	N
Rosa spp. (rose)	10.2	0-20	10	1.05	B
Rosa woodsii (common wild rose)	15.2	0-50	31	4.71	N
Rubus idaeus (wild red raspberry)	6.4	0-20	31	2.00	N
Rubus parviflorus (thimbleberry)	8.8	0-20	17	1.52	N
Rubus pubescens (dewberry)	0.5	0-0.5	3	0.02	N
Salix bebbiana (beaked willow)	0.5	0-0.5	7	0.03	N
Salix boothii (Booth's willow)	0.5	0-0.5	3	0.02	N
Salix drummondiana (Drummond's willow)	0.5	0-0.5	10	0.05	N
Salix exigua (sandbar willow)	0.5	0-0.5	3	0.02	N
Salix petiolaris (basket willow)	0.5	0-0.5	3	0.02	N
Salix spp. (willow)	0.5	0-0.5	3	0.02	B
Sambucus racemosa (red elderberry)	0.5	0-0.5	3	0.02	N
Shepherdia canadensis (Canada buffaloberry)	4.5	0-10	21	0.93	N
Sorbus scopulina (western mountain-ash)	0.5	0-0.5	3	0.02	N
Spiraea betulifolia (white meadowsweet)	0.5	0-0.5	14	0.07	N
Symphoricarpos albus (snowberry)	21.0	0-40	10	2.17	N
Symphoricarpos occidentalis (buckbrush)	7.7	0-30	55	4.22	N
Symphoricarpos spp. (snowberry)	0.5	0-0.5	3	0.02	N
Viburnum edule (low-bush cranberry)	0.5	0-0.5	7	0.03	N
Graminoids (N = 44)					
Agropyron dasystachyum (northern wheat grass)	10.0	0-10	3	0.34	N
Agropyron pectiniforme (crested wheat grass)	3.0	0-3	3	0.10	I
Agropyron repens (quack grass)	1.3	0-3	10	0.14	I
Agropyron smithii (western wheat grass)	10.0	0-10	3	0.34	N
Agropyron spp. (wheat grass)	1.8	0-3	7	0.12	B
Agropyron trachycaulum (slender wheat grass)	6.5	0-10	7	0.45	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	3	0.02	N
Agrostis stolonifera (redtop)	40.0	0-40	7	2.76	I
Bromus carinatus (keeled brome)	1.8	0-3	14	0.24	N
Bromus ciliatus (fringed brome)	2.4	0-3	14	0.33	N
Bromus inermis (smooth brome)	27.8	0-90	34	9.57	I

Table 190. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Bromus inermis subsp. *pumpellianus* (northern awnless brome)	0.5	0-0.5	3	0.02	N
Bromus spp. (brome grass)	3.0	0-3	3	0.10	B
Calamagrostis canadensis (marsh reed grass)	18.1	0-40	24	4.36	N
Calamagrostis rubescens (pine reed grass)	0.5	0-0.5	3	0.02	N
Carex concinna (beautiful sedge)	0.5	0-0.5	3	0.02	N
Carex geyeri (Geyer's sedge)	0.5	0-0.5	3	0.02	N
Carex hookerana (Hooker's sedge)	0.5	0-0.5	3	0.02	N
Carex microglochin (short-awned sedge)	0.5	0-0.5	3	0.02	N
Carex microptera (small-winged sedge)	0.5	0-0.5	7	0.03	N
Carex obtusata (blunt sedge)	0.5	0-0.5	3	0.02	N
Carex pachystachya (sedge)	0.5	0-0.5	3	0.02	N
Carex praegracilis (graceful sedge)	3.0	0-3	3	0.10	N
Carex spp. (sedge)	0.5	0-0.5	7	0.03	N
Carex sprengelii (Sprengel's sedge)	3.0	0-3	10	0.31	N
Dactylis glomerata (orchard grass)	30.0	0-30	3	1.03	I
Deschampsia cespitosa (tufted hair grass)	5.3	0-10	7	0.36	N
Elymus canadensis (Canada wild rye)	10.0	0-10	3	0.34	N
Elymus glaucus (smooth wild rye)	1.3	0-3	10	0.14	N
Elymus innovatus (hairy wild rye)	0.5	0-0.5	7	0.03	N
Elymus virginicus (Virginia wild rye)	0.5	0-0.5	10	0.05	N
Festuca idahoensis (bluebunch fescue)	0.5	0-0.5	3	0.02	N
Festuca rubra subsp. *arctica* (Richardson's fescue)	3.0	0-3	7	0.21	N
Grass spp. (Unknown grass)	3.0	0-3	3	0.10	B
Koeleria macrantha (June grass)	0.5	0-0.5	3	0.02	N
Phleum pratense (timothy)	13.0	0-40	38	4.91	I
Poa compressa (Canada bluegrass)	3.0	0-3	3	0.10	I
Poa cusickii (early bluegrass)	0.5	0-0.5	3	0.02	N
Poa interior (inland bluegrass)	0.5	0-0.5	7	0.03	N
Poa nervosa (Wheeler's bluegrass)	1.8	0-3	7	0.12	N
Poa palustris (fowl bluegrass)	6.6	0-20	14	0.91	N
Poa pratensis (Kentucky bluegrass)	18.4	0-50	52	9.53	I
Stipa comata (needle-and-thread)	20.0	0-20	3	0.69	N
Stipa viridula (green needle grass)	3.0	0-3	3	0.10	N
Forbs (N = 107)					
Achillea millefolium (common yarrow)	2.6	0-10	45	1.16	N
Actaea rubra (red and white baneberry)	5.4	0-20	24	1.29	N
Allium cernuum (nodding onion)	0.5	0-0.5	14	0.07	N
Allium spp. (onion)	0.5	0-0.5	3	0.02	N
Anemone cylindrica (long-fruited anemone)	0.5	0-0.5	10	0.05	N
Angelica arguta (white angelica)	10.3	0-30	10	1.07	N
Antennaria rosea (rosy everlasting)	20.0	0-20	3	0.69	N
Aralia nudicaulis (wild sarsaparilla)	1.8	0-3	7	0.12	N
Arnica cordifolia (heart-leaved arnica)	3.0	0-3	3	0.10	N

Table 190. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Aster ciliolatus (Lindley's aster)	2.6	0-10	24	0.62	N
Aster conspicuus (showy aster)	4.5	0-30	28	1.24	N
Aster hesperius (western willow aster)	6.5	0-10	7	0.45	N
Aster laevis (smooth aster)	3.4	0-10	17	0.59	N
Aster modestus (large northern aster)	1.3	0-3	10	0.14	N
Aster puniceus (purple-stemmed aster)	0.5	0-0.5	7	0.03	N
Aster spp. (aster)	0.5	0-0.5	7	0.03	N
Aster subspicatus (leafy-bracted aster)	3.0	0-3	10	0.31	N
Astragalus americanus (American milk vetch)	0.5	0-0.5	3	0.02	N
Astragalus spp. (milk vetch)	0.5	0-0.5	3	0.02	B
Athyrium filix-femina (lady fern)	20.0	0-20	3	0.69	N
Campanula rotundifolia (harebell)	1.3	0-3	10	0.14	N
Castilleja miniata (common red paintbrush)	0.5	0-0.5	3	0.02	N
Castilleja spp. (paintbrush)	0.5	0-0.5	7	0.03	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	3	0.02	N
Cerastium nutans (long-stalked mouse-ear chickweed)	0.5	0-0.5	3	0.02	N
Chrysanthemum leucanthemum (ox-eye daisy)	0.5	0-0.5	7	0.03	I
Cirsium arvense (Canada thistle)	6.5	0-10	14	0.90	I
Cirsium spp. (thistle)	0.5	0-0.5	3	0.02	B
Conium maculatum (poison hemlock)	0.5	0-0.5	3	0.02	I
Cornus canadensis (bunchberry)	10.0	0-10	3	0.34	N
Delphinium glaucum (tall larkspur)	2.4	0-10	17	0.41	N
Disporum trachycarpum (fairybells)	1.3	0-3	10	0.14	N
Epilobium angustifolium (common fireweed)	4.4	0-30	41	1.81	N
Epilobium latifolium (broad-leaved fireweed)	10.0	0-10	3	0.34	N
Equisetum arvense (common horsetail)	2.1	0-10	31	0.66	N
Equisetum hyemale (common scouring-rush)	0.5	0-0.5	7	0.03	N
Equisetum pratense (meadow horsetail)	0.5	0-0.5	3	0.02	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	3	0.02	N
Forb spp. (forb)	3.0	0-3	3	0.10	B
Fragaria virginiana (wild strawberry)	3.7	0-20	55	2.03	N
Galeopsis tetrahit (hemp-nettle)	3.0	0-3	3	0.10	I
Galium boreale (northern bedstraw)	2.2	0-10	34	0.76	N
Galium triflorum (sweet-scented bedstraw)	0.5	0-0.5	17	0.09	N
Gentianella amarella (felwort)	0.5	0-0.5	3	0.02	N
Geranium richardsonii (wild white geranium)	3.9	0-10	34	1.34	N
Geranium spp. (geranium)	0.5	0-0.5	3	0.02	B
Geranium viscosissimum (sticky purple geranium)	0.5	0-0.5	7	0.03	N
Geum aleppicum (yellow avens)	1.8	0-3	7	0.12	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	3	0.02	N
Glycyrrhiza lepidota (wild licorice)	20.0	0-20	3	0.69	N
Hackelia floribunda (large-flowered stickseed)	0.5	0-0.5	3	0.02	N
Hackelia jessicae (Jessica's stickseed)	1.8	0-3	7	0.12	N

Table 190. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Heracleum lanatum (cow parsnip)	13.0	0-40	38	4.91	N
Heterotheca villosa (golden aster)	0.5	0-0.5	3	0.02	N
Heuchera cylindrica (sticky alumroot)	0.5	0-0.5	3	0.02	N
Hieracium umbellatum (narrow-leaved hawkweed)	0.5	0-0.5	3	0.02	N
Lathyrus ochroleucus (cream-colored vetchling)	3.8	0-30	48	1.84	N
Lathyrus venosus (purple peavine)	0.5	0-0.5	3	0.02	N
Linaria vulgaris (butter-and-eggs)	0.5	0-0.5	3	0.02	I
Linum lewisii (wild blue flax)	0.5	0-0.5	3	0.02	N
Lupinus argenteus (silvery perennial lupine)	0.5	0-0.5	3	0.02	N
Maianthemum canadense (wild lily-of-the-valley)	3.0	0-3	3	0.10	N
Melilotus alba (white sweet-clover)	80.0	0-80	3	2.76	I
Mertensia paniculata (tall lungwort)	1.8	0-3	21	0.36	N
Mitella nuda (bishop's-cap)	3.0	0-3	3	0.10	N
Monarda fistulosa (wild bergamot)	0.5	0-0.5	10	0.05	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	10.0	0-10	3	0.34	N
Osmorhiza depauperata (spreading sweet cicely)	1.8	0-3	7	0.12	N
Osmorhiza occidentalis (western sweet cicely)	10.3	0-20	7	0.71	N
Pedicularis bracteosa (western lousewort)	0.5	0-0.5	10	0.05	N
Penstemon confertus (yellow beardtongue)	3.0	0-3	3	0.10	N
Petasites frigidus (arctic sweet coltsfoot)	3.0	0-3	3	0.10	N
Polemonium pulcherrimum (showy Jacob's-ladder)	3.0	0-3	3	0.10	N
Potentilla argentea (silvery cinquefoil)	1.8	0-3	7	0.12	I
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	14	0.07	N
Potentilla pensylvanica (prairie cinquefoil)	0.5	0-0.5	7	0.03	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	14	0.07	N
Sanicula marilandica (snakeroot)	5.3	0-10	7	0.36	N
Senecio pauperculus (balsam groundsel)	1.3	0-3	21	0.28	N
Senecio pseudaureus (thin-leaved ragwort)	3.0	0-3	7	0.21	N
Senecio triangularis (brook ragwort)	3.0	0-3	3	0.10	N
Silene menziesii (Menzies'catchfly)	3.0	0-3	3	0.10	N
Sium suave (water parsnip)	0.5	0-0.5	3	0.02	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	3	0.02	N
Smilacina stellata (star-flowered Solomon's-seal)	2.7	0-20	55	1.47	N
Solidago canadensis (Canada goldenrod)	20.0	0-20	3	0.69	N
Solidago gigantea (late goldenrod)	0.5	0-0.5	7	0.03	N
Solidago missouriensis (low goldenrod)	1.1	0-3	14	0.16	N
Sonchus arvensis (perennial sow-thistle)	0.5	0-0.5	7	0.03	I
Sonchus spp. (sow thistle)	0.5	0-0.5	3	0.02	I
Spiranthes romanzoffiana (hooded ladies'-tresses)	0.5	0-0.5	7	0.03	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	3.0	0-3	3	0.10	N
Taraxacum ceratophorum (northern dandelion)	0.5	0-0.5	3	0.02	N
Taraxacum officinale (common dandelion)	5.8	0-20	52	3.02	I
Thalictrum occidentale (western meadow rue)	28.4	0-80	21	5.88	N

Table 190. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Thalictrum spp. (meadow rue)	10.0	0-10	7	0.69	N
Thalictrum venulosum (veiny meadow rue)	1.5	0-10	41	0.62	N
Thermopsis rhombifolia (golden bean)	3.0	0-3	3	0.10	N
Trifolium hybridum (alsike clover)	3.0	0-3	3	0.10	I
Trifolium pratense (red clover)	0.5	0-0.5	7	0.03	I
Trifolium repens (white clover)	1.3	0-3	21	0.28	I
Urtica dioica (common nettle)	4.1	0-10	14	0.57	N
Veratrum eschscholtzii (green false hellebore)	0.5	0-0.5	7	0.03	N
Vicia americana (wild vetch)	2.2	0-10	45	0.98	N
Viola adunca (early blue violet)	0.5	0-0.5	14	0.07	N
Viola canadensis (western Canada violet)	6.3	0-30	28	1.74	N
Zigadenus elegans (white camas)	0.5	0-0.5	3	0.02	N

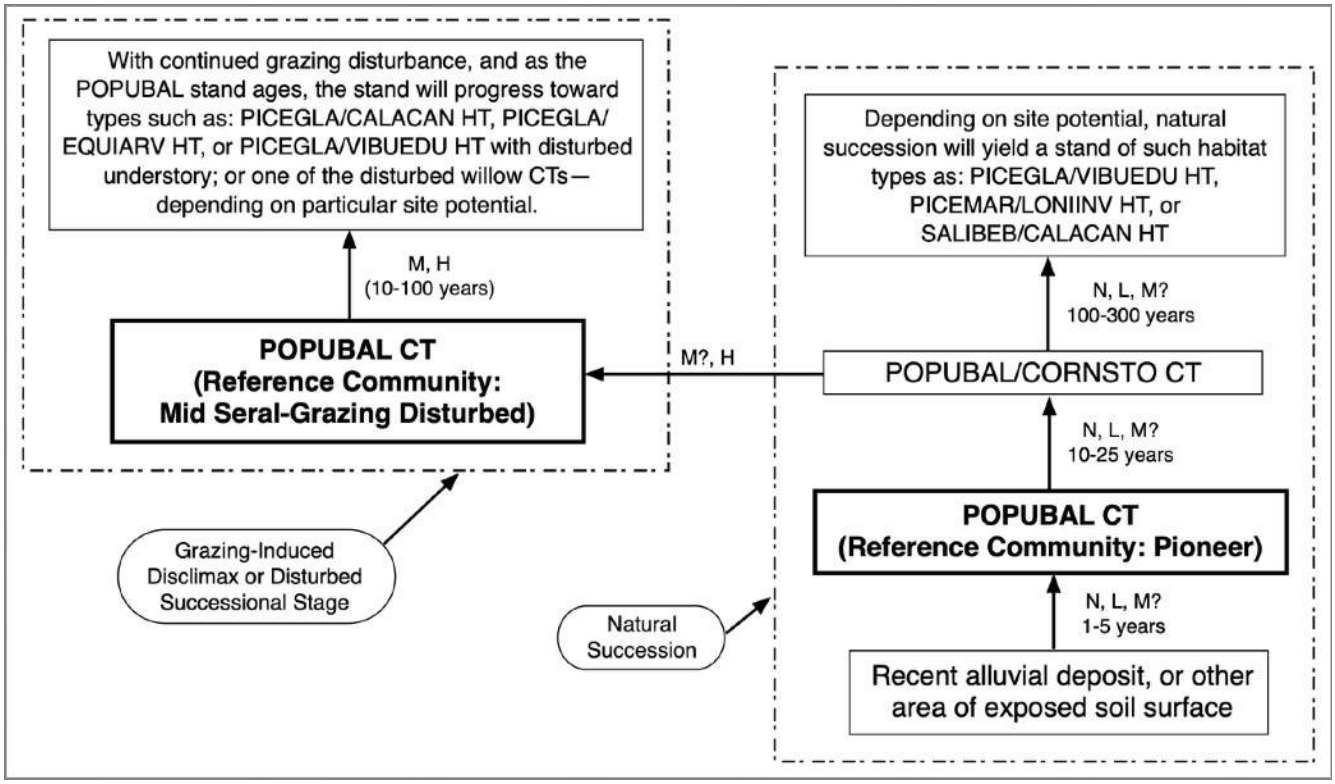
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Populus balsamifera* (balsam poplar) community type is derived most commonly by grazing disturbance on a stand of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type. Depending of the level of continued grazing pressure, the stand may still succeed to its potential late seral/climax community by gaining canopy dominance of the appropriate conifer tree species.

Figure 38 shows a schematic diagram of vegetation successional pathways on sites of the *Populus balsamifera* (balsam poplar) community type.



Successional Pathway of *Populus balsamifera* (balsam poplar) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Populus balsamifera* (balsam poplar) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
POPUBAL CT—*Populus balsamifera* (balsam poplar) community type
PICEGLA/CALACAN HT—*Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type
PICEGLA/EQUIARV HT—*Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type
PICEGLA/VIBUEDU HT—*Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type
PICEMAR/LONIINV HT—*Picea mariana/Lonicera involucrata* (black spruce/bracted honeysuckle) habitat type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
SALIBEB/CALACAN HT—*Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type

Figure 38. Successional pathway for sites of the *Populus balsamifera* (balsam poplar) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the

appropriate types. We see little indication that *Salix* (willows) can re-establish on a site after it becomes dominated by non-willow species.

EDATOPE

Figure 39 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Populus balsamifera* (balsam poplar) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

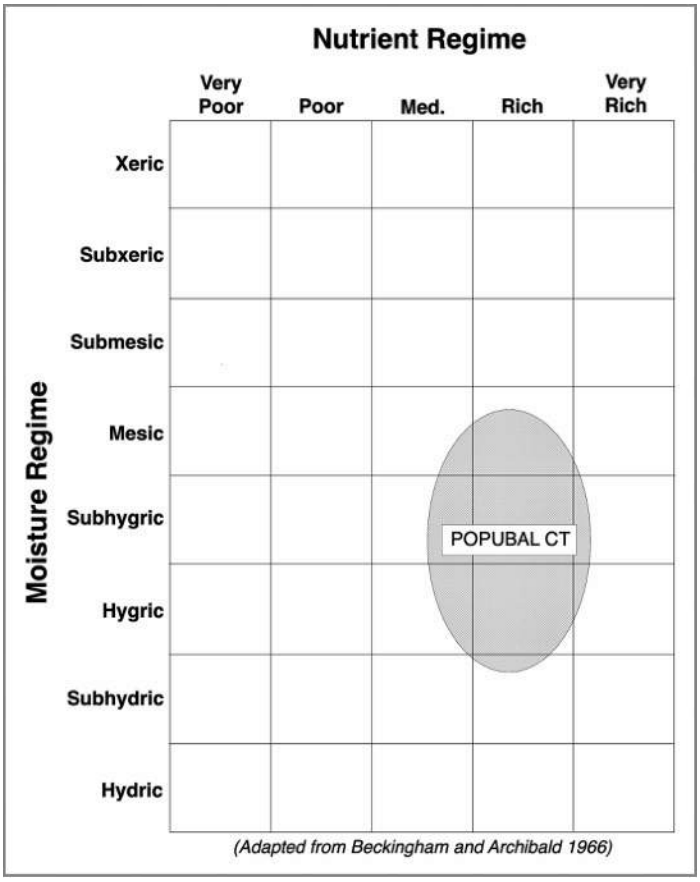


Figure 39. Edatope grid position for the *Populus balsamifera* (balsam poplar) community type (POPUBAL CT)

SOILS

Parent material on sites supporting the *Populus balsamifera* (balsam poplar) community type may be alluvial or morainal, and soils are generally brunisols, gleysols, and regosols. Sites of this community type typically have organic layer thickness less than 5 cm, and are moderately well drained to well drained, with surface texture ranging from sandy loam to silty clay loam (France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites are typically dominated by *Salix* species (willow), *Alnus* species (alder), *Carex* species (sedge), or *Calamagrostis canadensis* (marsh reed grass). Adjacent drier sites are likely to be dominated by *Populus tremuloides* (aspen) or *Picea glauca* (white spruce) upland communities.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) is common throughout most of Alberta on well drained sites having high available moisture. In drier areas, the species is restricted to shorelines, riverine floodplains, and moist slopes (Tannas 1997a). It generally occurs on moist sites, such as river floodplains, stream and lake shores, moist depressions, and swamps, but will also grow on drier sites (Harris 1990).

The species is capable of regenerating from root suckers, stump sprouts, stem sprouts, and buried branches. Root suckering is thought to be primarily a means of expansion, rather than simply a means of recovery following clearcutting or fire. Stands are often polyclonal, with several genotypes and their sprouts occurring together in a stand (Harris 1990).

Populus balsamifera (balsam poplar) is an early seral pioneer species, which colonizes disturbed wet sites by seeding or suckering. It is among the fastest growing tree species in temperate latitudes. Rapid early growth allows it to establish on a site and to dominate it for up to 100 years. The species is highly tolerant of flooding (Harris 1990).

Livestock

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) has poor forage value for livestock. While nutrient levels are probably acceptable, the resinous twigs and foliage are less palatable than those of other *Populus* (poplar) species. Therefore, heavy utilization of it usually indicates an over-population of wild ungulates, or over grazing by livestock (Tannas 1997a). Stands may be subjected to high levels of grazing pressure because of gentle topography and ease of access. With prolonged moderate to high grazing pressure, palatable shrubs in the understory will decrease relative to less preferred species, such as *Symphoricarpos* species (buckbrush), *Rosa* species (rose), and *Lonicera* species (honeysuckle) (Thompson and Hansen 2003).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) is a commercial tree in Alberta. It is used for plywood, pulpwood, boxes and crates, and to make high-grade paper and particle board (Tannas 1997a). Cutting mature *Populus balsamifera* (balsam poplar) results in sprouting from callus tissue and dormant buds. Stump sprouting is most pronounced on winter-logged areas. Trees cut in summer have few surviving sprouts after four years (Thompson and Hansen 2003).

Wildlife

***Populus balsamifera* (balsam poplar)**—Northern forests containing *Populus balsamifera* (balsam poplar) support a wide variety of wildlife—including moose, elk, Stone's sheep, mountain goat, mountain caribou, mule deer, wolf, coyote, black bear, grizzly bear, lynx, snowshoe hare, wolverine, and pine marten (Harris 1990). The

species is a valuable resource of food and construction material for beaver (Tannas 1997a). Moose sparingly browse young *Populus balsamifera* (balsam poplar), and will strip bark from the trees in times of winter food shortage (Harris 1990). The spreading crown of *Populus balsamifera* (balsam poplar) provides nesting sites for large birds. A variety of birds and mammals, such as woodpeckers, owls, wood ducks, and squirrels, nest in trunk cavities (Hansen and others 1995).

Fisheries

***Populus balsamifera* (balsam poplar)**—When located near a stream, stands of *Populus balsamifera* (balsam poplar) provide thermal cover, debris, and streambank stability. This is particularly important on the higher gradient streams where scouring by seasonal flooding may occur (Hansen and others 1995).

Fire

***Populus balsamifera* (balsam poplar)**—Although severe fire kills *Populus balsamifera* (balsam poplar), it is considered one of the most well adapted tree species to fire in the northern forest. Its ability to sprout from roots, stumps, and buried branches enables it to quickly recover from fire (Harris 1990). Moderate fire may top-kill some trees, but light fires usually do not harm mature *Populus balsamifera* (balsam poplar). Young trees may be top-killed because of their thin bark, and repeated burning may eliminate the species from a site by preventing regeneration (Thompson and Hansen 2003).

Populus balsamifera (balsam poplar) is most susceptible to fire during late summer and fall. If a manager wants to extend the life of a *Populus balsamifera* (balsam poplar) stand, fire ***MAY BE*** used as a tool in the pole to early mature stage of development. If fire is used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that wildlife browsing be closely monitored to protect the young sprouts (Hansen and others 1995).

Rehabilitation/Restoration Considerations

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) is an important riparian species for stabilizing river banks and maintaining river islands subject to recurring scouring by floods and alluvium deposition (Thompson and Hansen 2003). With healthy natural vegetation associated, these stands are relatively stable because of the strong root systems of the associated species. Management should emphasize the understory shrub layer in streambank revegetation projects. This is most important on higher gradient streams. Managers should strive to maintain a buffer of a *Populus balsamifera* (balsam poplar) community adjacent to all rivers and streams where possible. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize the streambanks, and dissipate flood energy (Thompson and Hansen 2003).

Recreational Uses and Consideration

***Populus balsamifera* (balsam poplar)**—Because of their common proximity to streams and lakes, recreational developments and transportation corridors are common in *Populus balsamifera* (balsam poplar) stands. Opportunities in and near stands of *Populus balsamifera* (balsam poplar) are excellent for fishing, big game, and waterfowl hunting, and observing a variety of wildlife. Care must be taken when locating structures in this type due to potential for flooding (Thompson and Hansen 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Populus balsamifera* (balsam poplar) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- F5. Balsam poplar/snowberry

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Pb-Aw/Rose/Marsh reed grass

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Pb/Cow parsnip/Kentucky bluegrass
- Pb/Snowberry
- Pb/Snowberry/Smooth brome

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msg3 Pb/Snowberry/smooth brome (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Populus balsamifera* (balsam poplar) community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995);
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001); and
- *Classification and Management of the Fort Harrison and Limestone Hills Training Area* (West Central Montana) Ecological Solutions Group 2017).

Populus tremuloides/Calamagrostis canadensis Community Type
(aspen/marsh reed grass Community Type)

POPUTRE/CALACAN Community Type
Number of Stands = 73 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 55; Other Data Sets = 18)

LOCATION AND ASSOCIATED LANDFORMS

The *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type is a major type in the Lower Foothills Natural Subregion, a major type in the Upper Foothills Natural Subregion, and a major type in the Montane Natural Subregion of Alberta. This community type occurs on a wide variety of sites, such as moist uplands, valley bottoms, alluvial terraces, and along streams and lake shorelines on soils ranging from shallow and rocky to deep loamy sands. The best sites for the type are moist, usually well drained, loamy, and high in organic matter and nutrients.

Photo 9 shows a typical stand of the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type.

Photo 9. A stand of the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 191 shows the five most prominent plant species among the four lifeforms for species recorded in all 73 stands of the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type. *Populus tremuloides* (aspen) is by far the most prominent species in this community type, but *Populus balsamifera* (balsam poplar) is also fairly prominent. Also fairly prominent are two shrubs, *Alnus crispa* (green alder) and *Rosa acicularis* (prickly rose), along with the graminoid, *Calamagrostis canadensis* (marsh reed grass). No other specie is more than moderately prominent.

Table 191. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type (number = 73 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus tremuloides (aspen)	56.92	Native
Populus balsamifera (balsam poplar)	11.08	Native
Betula papyrifera (white birch)	2.08	Native
Picea glauca (white spruce)	0.36	Native
Pinus contorta (lodgepole pine)	0.36	Native
Shrubs		
Alnus crispa (green alder)	13.11	Native
Rosa acicularis (prickly rose)	10.15	Native
Viburnum edule (low-bush cranberry)	4.31	Native
Linnaea borealis (twinflower)	2.84	Native
Salix bebbiana (beaked willow)	2.43	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	18.49	Native
Elymus innovatus (hairy wild rye)	3.73	Native
Calamagrostis stricta (narrow reed grass)	1.51	Native
Poa pratensis (Kentucky bluegrass)	1.38	Introduced
Poa palustris (fowl bluegrass)	0.23	Native

Table 191. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Aralia nudicaulis (wild sarsaparilla)	6.71	Native
Cornus canadensis (bunchberry)	4.36	Native
Epilobium angustifolium (common fireweed)	4.06	Native
Lathyrus ochroleucus (cream-colored vetchling)	2.24	Native
Fragaria virginiana (wild strawberry)	2.12	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 192 through Table 195, break out the vegetation recorded in all 81 stands sampled of the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, species rich, forested community type of major occurrence across the study area.

Table 192 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type. For the 73 stands comprising the community type, the number of unique species was 212 with 198 (93.4 percent) of them being native species.

Table 192. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type (number = 73 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	10	10	0	0
Shrubs	49	47	0	2
Graminoids	33	29	3	1
Forbs	120	112	6	2
TOTAL	***212 (100.0%)***	***198 (93.4%)***	***9 (4.2%)***	***5 (2.4%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 193 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type. The average number of species per stand is 29.4, with native species comprising 28.5 species per stand or 96.9 percent.

Table 193. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type (number = 73 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.4	2.4	0.0	0.0
Shrubs	8.7	8.6	0.0	0.2
Graminoids	2.6	2.3	0.2	0.0
Forbs	15.7	15.2	0.4	0.0
TOTAL	***29.4 (100.0%)***	***28.5 (96.9%)***	***0.6 (2.0%)***	***0.2 (0.7%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 194 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type. The average canopy cover per stand is 196.4 percent, with native species comprising 192.9 percent or 98.2 percent of the total amount of average canopy cover per stand.

Table 194. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type (number = 73 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	70.9%	70.9%	0.0%	0.0%
Shrubs	57.7%	56.8%	0.0%	0.8%
Graminoids	26.9%	25.3%	1.5%	0.0%
Forbs	41.0%	39.8%	1.1%	0.1%
TOTAL	***196.4% (100.0%)***	***192.9% (98.2%)***	***2.6% (1.3%)***	***0.9% (0.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 195 shows the average number of species and average canopy cover by lifeform in stands of the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type. The average number of species per stand was 29.4 with an average canopy cover of 196.4 percent.

Table 195. Average number of species and average canopy cover by lifeform in stands of the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type (number = 73 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.4	70.9%
Shrubs	8.7	57.7%
Graminoids	2.6	26.9%
Forbs	15.7	41.0%
TOTAL	***29.4***	***196.4%***

Sampled Stands Plant Species List

In 73 stands sampled of the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type, 10 tree species were recorded, led by *Populus tremuloides* (aspen) and followed well behind by *Populus balsamifera* (balsam poplar) (Table 196). The 49 shrubs recorded are led by *Alnus crispa* (green alder) and *Rosa acicularis* (prickly rose), with a few others being moderately prominent. Of the 33 graminoids recorded, only *Calamagrostis canadensis* (marsh reed grass) was very prominent; and of the 120 forbs recorded, only a few were even moderately prominent.

Table 196. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Populus tremuloides/ Calamagrostis canadensis* (aspen/marsh reed grass) community type (number = 73 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 10)					
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	1	0.01	N
Betula neoalaskana (Alaska birch)	3.0	0-3	1	0.04	N
Betula papyrifera (white birch)	7.2	0-40	29	2.08	N
Picea engelmannii (Engelmann spruce)	0.5	0-0.5	1	0.01	N
Picea glauca (white spruce)	0.9	0-3	38	0.36	N
Picea mariana (black spruce)	0.5	0-0.5	1	0.01	N
Pinus contorta (lodgepole pine)	2.0	0-3	18	0.36	N
Populus balsamifera (balsam poplar)	25.3	0-80	44	11.08	N
Populus tremuloides (aspen)	56.9	10-97.5	100	56.92	N
Pseudotsuga menziesii (Douglas-fir)	0.5	0-0.5	1	0.01	N
Shrubs (N = 49)					
Alnus crispa (green alder)	28.1	0-80	47	13.11	N
Alnus tenuifolia (river alder)	18.6	0-40	7	1.27	N
Amelanchier alnifolia (Saskatoon)	3.3	0-20	42	1.38	N
Arctostaphylos uva-ursi (common bearberry)	9.5	0-40	8	0.78	N
Betula glandulosa (bog birch)	40.0	0-40	1	0.55	N

Table 196. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Clematis occidentalis (purple clematis)	2.2	0-3	4	0.09	N
Clematis spp. (clematis)	3.0	0-3	1	0.04	N
Cornus stolonifera (red-osier dogwood)	10.2	0-30	21	2.10	N
Corylus cornuta (beaked hazelnut)	14.3	0-30	4	0.59	N
Kalmia polifolia (northern laurel)	0.5	0-0.5	1	0.01	N
Ledum groenlandicum (common Labrador tea)	2.9	0-10	12	0.36	N
Linnaea borealis (twinflower)	4.8	0-20	59	2.84	N
Lonicera dioica (twining honeysuckle)	1.8	0-3	25	0.43	N
Lonicera involucrata (bracted honeysuckle)	3.2	0-40	51	1.63	N
Menziesia ferruginea (false azalea)	0.5	0-0.5	1	0.01	N
Oplopanax horridum (devil's-club)	10.0	0-10	1	0.14	N
Prunus virginiana (choke cherry)	3.4	0-10	7	0.23	N
Ribes americanum (wild black currant)	3.0	0-3	1	0.04	N
Ribes hirtellum (wild gooseberry)	1.1	0-3	5	0.06	N
Ribes lacustre (bristly black currant)	2.3	0-10	15	0.34	N
Ribes oxyacanthoides (northern gooseberry)	1.7	0-10	16	0.28	N
Ribes triste (wild red currant)	1.6	0-3	12	0.20	N
Rosa acicularis (prickly rose)	12.0	0-40	85	10.15	N
Rosa spp. (rose)	21.5	0-40	3	0.59	B
Rosa woodsii (common wild rose)	8.9	0-20	8	0.73	N
Rubus arcticus (dwarf raspberry)	1.8	0-3	3	0.05	N
Rubus idaeus (wild red raspberry)	2.8	0-10	56	1.55	N
Rubus parviflorus (thimbleberry)	4.5	0-10	4	0.18	N
Rubus pubescens (dewberry)	3.0	0-10	74	2.18	N
Salix bebbiana (beaked willow)	8.5	0-20	29	2.43	N
Salix glauca (smooth willow)	30.0	0-30	3	0.82	N
Salix scouleriana (Scouler's willow)	4.7	0-20	10	0.45	N
Salix serissima (autumn willow)	3.0	0-3	1	0.04	N
Salix spp. (willow)	1.4	0-3	15	0.21	B
Sambucus racemosa (red elderberry)	0.5	0-0.5	1	0.01	N
Shepherdia canadensis (Canada buffaloberry)	3.9	0-20	25	0.95	N
Sorbus scopulina (western mountain-ash)	1.0	0-3	7	0.07	N
Spiraea betulifolia (white meadowsweet)	6.2	0-20	34	2.14	N
Spiraea densiflora (pink meadowsweet)	20.0	0-20	1	0.27	N
Symphoricarpos albus (snowberry)	2.3	0-10	15	0.34	N
Symphoricarpos occidentalis (buckbrush)	3.3	0-10	30	1.01	N
Symphoricarpos spp. (snowberry)	3.7	0-10	4	0.15	N
Vaccinium caespitosum (dwarf bilberry)	6.2	0-30	21	1.27	N
Vaccinium membranaceum (tall bilberry)	2.9	0-10	5	0.16	N
Vaccinium myrtilloides (common blueberry)	3.3	0-20	11	0.36	N
Vaccinium scoparium (grouseberry)	10.0	0-10	1	0.14	N
Vaccinium vitis-idaea (bog cranberry)	1.9	0-3	10	0.18	N
Viburnum edule (low-bush cranberry)	5.9	0-30	73	4.31	N
Viburnum opulus (high-bush cranberry)	30.0	0-30	1	0.41	N

Table 196. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Graminoids (N = 33)					
Agroelymus hirtiflorus (slender wheat grass x hairy wild rye hybrid)	3.0	0-3	1	0.04	N
Agropyron dasystachyum (northern wheat grass)	3.0	0-3	1	0.04	N
Agropyron repens (quack grass)	3.0	0-3	1	0.04	I
Agropyron spicatum (bluebunch wheat grass)	0.5	0-0.5	1	0.01	N
Agropyron trachycaulum (slender wheat grass)	1.6	0-3	10	0.15	N
Agrostis exarata (spike redtop)	0.5	0-0.5	1	0.01	N
Bromus carinatus (keeled brome)	3.0	0-3	1	0.04	N
Bromus ciliatus (fringed brome)	1.0	0-3	7	0.07	N
Calamagrostis canadensis (marsh reed grass)	19.3	0-60	96	18.49	N
Calamagrostis stricta (narrow reed grass)	36.7	0-50	4	1.51	N
Carex disperma (two-seeded sedge)	3.0	0-3	1	0.04	N
Carex obtusata (blunt sedge)	0.5	0-0.5	1	0.01	N
Carex prairea (prairie sedge)	0.5	0-0.5	1	0.01	N
Carex siccata (hay sedge)	0.5	0-0.5	1	0.01	N
Carex spp. (sedge)	0.5	0-0.5	5	0.03	N
Carex utriculata (beaked sedge)	10.0	0-10	1	0.14	N
Cinna latifolia (drooping wood-reed)	0.5	0-0.5	1	0.01	N
Danthonia parryi (Parry oat grass)	0.5	0-0.5	1	0.01	N
Deschampsia cespitosa (tufted hair grass)	10.0	0-10	1	0.14	N
Elymus glaucus (smooth wild rye)	5.3	0-10	3	0.14	N
Elymus innovatus (hairy wild rye)	6.6	0-20	56	3.73	N
Festuca spp. (fescue)	0.5	0-0.5	1	0.01	B
Hierochloe odorata (sweet grass)	0.5	0-0.5	1	0.01	N
Juncus confusus (few-flowered rush)	0.5	0-0.5	1	0.01	N
Koeleria macrantha (June grass)	0.5	0-0.5	1	0.01	N
Oryzopsis asperifolia (white-grained mountain rice grass)	2.5	0-10	8	0.21	N
Oryzopsis canadensis (Canadian rice grass)	3.0	0-3	1	0.04	N
Phleum pratense (timothy)	1.5	0-3	7	0.10	I
Poa palustris (fowl bluegrass)	4.1	0-10	5	0.23	N
Poa pratensis (Kentucky bluegrass)	10.1	0-70	14	1.38	I
Schizachne purpurascens (purple oat grass)	1.6	0-3	12	0.20	N
Stipa columbiana (Columbia needle grass)	1.8	0-3	3	0.05	N
Trisetum spicatum (spike trisetum)	0.5	0-0.5	1	0.01	N
Forbs (N = 120)					
Achillea millefolium (common yarrow)	0.9	0-3	33	0.30	N
Achillea sibirica (many-flowered yarrow)	3.0	0-3	1	0.04	N
Actaea rubra (red and white baneberry)	1.3	0-3	27	0.34	N
Agoseris aurantiaca (orange false dandelion)	3.0	0-3	1	0.04	N
Allium cernuum (nodding onion)	0.5	0-0.5	1	0.01	N
Anaphalis margaritacea (pearly everlasting)	0.5	0-0.5	1	0.01	N
Anemone multifida (cut-leaved anemone)	3.0	0-3	1	0.04	N

Table 196. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Anemone parviflora (small wood anemone)	0.5	0-0.5	1	0.01	N
Aralia nudicaulis (wild sarsaparilla)	10.7	0-40	63	6.71	N
Arnica cordifolia (heart-leaved arnica)	3.7	0-30	32	1.16	N
Arnica fulgens (shining arnica)	10.0	0-10	1	0.14	N
Aster ciliolatus (Lindley's aster)	2.3	0-10	60	1.36	N
Aster conspicuus (showy aster)	2.9	0-10	40	1.16	N
Aster laevis (smooth aster)	3.5	0-10	5	0.19	N
Aster spp. (aster)	0.5	0-0.5	4	0.02	N
Astragalus alpinus (alpine milk vetch)	0.5	0-0.5	1	0.01	N
Athyrium filix-femina (lady fern)	1.8	0-3	3	0.05	N
Botrychium virginianum (Virginia grape fern)	3.0	0-3	1	0.04	N
Callitriche verna (vernal water-starwort)	0.5	0-0.5	1	0.01	N
Campanula rotundifolia (harebell)	0.5	0-0.5	1	0.01	N
Castilleja miniata (common red paintbrush)	1.4	0-3	11	0.16	N
Cerastium arvense (field mouse-ear chickweed)	1.3	0-3	4	0.05	N
Cirsium arvense (Canada thistle)	3.0	0-3	1	0.04	I
Corallorhiza maculata (spotted coralroot)	0.5	0-0.5	1	0.01	N
Cornus canadensis (bunchberry)	5.5	0-30	79	4.36	N
Corydalis aurea (golden corydalis)	0.5	0-0.5	1	0.01	N
Delphinium glaucum (tall larkspur)	2.7	0-10	16	0.45	N
Disporum trachycarpum (fairybells)	0.5	0-0.5	8	0.04	N
Dryopteris assimilis (broad spinulose shield fern)	0.5	0-0.5	1	0.01	N
Dryopteris carthusiana (narrow spinulose shield fern)	0.5	0-0.5	3	0.01	N
Epilobium angustifolium (common fireweed)	4.6	0-30	88	4.06	N
Epilobium ciliatum (northern willowherb)	3.0	0-3	1	0.04	N
Equisetum arvense (common horsetail)	1.6	0-10	30	0.49	N
Equisetum palustre (marsh horsetail)	3.0	0-3	1	0.04	N
Equisetum pratense (meadow horsetail)	0.5	0-0.5	4	0.02	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	4	0.02	N
Equisetum sylvaticum (woodland horsetail)	2.0	0-3	21	0.41	N
Fragaria vesca (woodland strawberry)	0.5	0-0.5	1	0.01	N
Fragaria virginiana (wild strawberry)	2.5	0-10	85	2.12	N
Galium boreale (northern bedstraw)	1.4	0-10	70	0.99	N
Galium trifidum (small bedstraw)	0.5	0-0.5	1	0.01	N
Galium triflorum (sweet-scented bedstraw)	0.6	0-3	36	0.21	N
Gentianella amarella (felwort)	0.5	0-0.5	1	0.01	N
Geocaulon lividum (northern bastard toadflax)	0.5	0-0.5	3	0.01	N
Geranium bicknellii (Bicknell's geranium)	1.8	0-3	3	0.05	N
Geranium richardsonii (wild white geranium)	2.0	0-10	21	0.40	N
Geranium viscosissimum (sticky purple geranium)	3.0	0-3	1	0.04	N
Geum macrophyllum (large-leaved yellow avens)	2.2	0-3	4	0.09	N
Geum rivale (purple avens)	3.0	0-3	1	0.04	N
Geum triflorum (three-flowered avens)	0.5	0-0.5	3	0.01	N

Table 196. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Gymnocarpium dryopteris (oak fern)	3.3	0-20	11	0.36	N
Habenaria orbiculata (round-leaved bog orchid)	0.5	0-0.5	3	0.01	N
Habenaria viridis (bracted bog orchid)	0.5	0-0.5	3	0.01	N
Hackelia americana (nodding stickseed)	0.5	0-0.5	1	0.01	N
Halenia deflexa (spurred gentian)	0.5	0-0.5	5	0.03	N
Hedysarum sulphurescens (yellow hedysarum)	3.0	0-3	1	0.04	N
Heracleum lanatum (cow parsnip)	3.4	0-20	27	0.93	N
Heuchera cylindrica (sticky alumroot)	1.8	0-3	3	0.05	N
Hieracium cynoglossoides (woolly hawkweed)	0.5	0-0.5	1	0.01	N
Hieracium umbellatum (narrow-leaved hawkweed)	0.5	0-0.5	5	0.03	N
Lathyrus ochroleucus (cream-colored vetchling)	2.8	0-20	79	2.24	N
Lathyrus venosus (purple peavine)	0.5	0-0.5	3	0.01	N
Lilium philadelphicum (western wood lily)	0.9	0-3	8	0.08	N
Lithospermum incisum (narrow-leaved puccoon)	3.0	0-3	1	0.04	N
Lycopodium annotinum (stiff club-moss)	0.5	0-0.5	1	0.01	N
Lycopodium complanatum (ground-cedar)	2.2	0-3	4	0.09	N
Lycopodium obscurum (ground-pine)	1.8	0-3	3	0.05	N
Maianthemum canadense (wild lily-of-the-valley)	1.1	0-3	64	0.70	N
Mentha arvensis (wild mint)	0.5	0-0.5	1	0.01	N
Mertensia paniculata (tall lungwort)	2.5	0-10	68	1.71	N
Mitella nuda (bishop's-cap)	1.4	0-10	56	0.79	N
Monarda fistulosa (wild bergamot)	0.5	0-0.5	3	0.01	N
Orthilia secunda (one-sided wintergreen)	0.7	0-3	16	0.12	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	0.5	0-0.5	4	0.02	N
Osmorhiza depauperata (spreading sweet cicely)	1.6	0-3	10	0.15	N
Osmorhiza occidentalis (western sweet cicely)	0.5	0-0.5	1	0.01	N
Osmorhiza purpurea (purple sweet cicely)	0.5	0-0.5	1	0.01	N
Oxytropis deflexa (reflexed locoweed)	0.5	0-0.5	1	0.01	N
Penstemon spp. (beardtongue)	3.0	0-3	1	0.04	N
Petasites frigidus (arctic sweet coltsfoot)	1.5	0-3	18	0.26	N
Petasites palmatus (palmate-leaved coltsfoot)	1.6	0-10	52	0.84	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	1	0.01	N
Petasites vitifolius (vine-leaved coltsfoot)	0.5	0-0.5	1	0.01	N
Potentilla diversifolia (mountain cinquefoil)	5.3	0-10	3	0.14	N
Potentilla glandulosa (sticky cinquefoil)	3.0	0-3	1	0.04	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	1	0.01	N
Pyrola asarifolia (common pink wintergreen)	2.1	0-10	60	1.27	N
Pyrola chlorantha (greenish-flowered wintergreen)	3.0	0-3	3	0.08	N
Ranunculus acris (tall buttercup)	0.5	0-0.5	3	0.01	I
Ranunculus spp. (ranunculus)	0.5	0-0.5	3	0.01	B
Sanicula marilandica (snakeroot)	1.3	0-3	4	0.05	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	1	0.01	N
Senecio canus (prairie groundsel)	10.0	0-10	1	0.14	N
Senecio eremophilus (cut-leaved ragwort)	0.5	0-0.5	1	0.01	N

Table 196. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Senecio pauperculus (balsam groundsel)	3.0	0-3	1	0.04	N
Senecio spp. (senecio)	3.0	0-3	1	0.04	B
Smilacina racemosa (false Solomon's-seal)	3.8	0-20	15	0.58	N
Smilacina stellata (star-flowered Solomon's-seal)	2.9	0-10	12	0.36	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	4	0.02	N
Solidago gigantea (late goldenrod)	0.5	0-0.5	1	0.01	N
Spiranthes romanzoffiana (hooded ladies'-tresses)	0.5	0-0.5	1	0.01	N
Stachys palustris (marsh hedge-nettle)	0.5	0-0.5	1	0.01	N
Stellaria calycantha (northern stitchwort)	0.5	0-0.5	1	0.01	N
Stellaria longifolia (long-leaved chickweed)	1.8	0-3	3	0.05	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1.0	0-3	15	0.14	N
Taraxacum officinale (common dandelion)	2.9	0-20	18	0.52	I
Thalictrum occidentale (western meadow rue)	0.5	0-0.5	3	0.01	N
Thalictrum venulosum (veiny meadow rue)	1.4	0-3	26	0.37	N
Thermopsis rhombifolia (golden bean)	0.5	0-0.5	1	0.01	N
Trientalis borealis (northern starflower)	0.5	0-0.5	1	0.01	N
Trifolium hybridum (alsike clover)	4.6	0-20	8	0.38	I
Trifolium pratense (red clover)	0.5	0-0.5	3	0.01	I
Trifolium repens (white clover)	1.2	0-3	10	0.12	I
Urtica dioica (common nettle)	3.0	0-3	1	0.04	N
Vicia americana (wild vetch)	1.2	0-3	62	0.72	N
Viola adunca (early blue violet)	0.5	0-0.5	5	0.03	N
Viola canadensis (western Canada violet)	3.9	0-20	25	0.95	N
Viola orbiculata (evergreen violet)	1.3	0-3	4	0.05	N
Viola renifolia (kidney-leaved violet)	1.7	0-10	11	0.18	N
Zigadenus elegans (white camas)	0.5	0-0.5	1	0.01	N

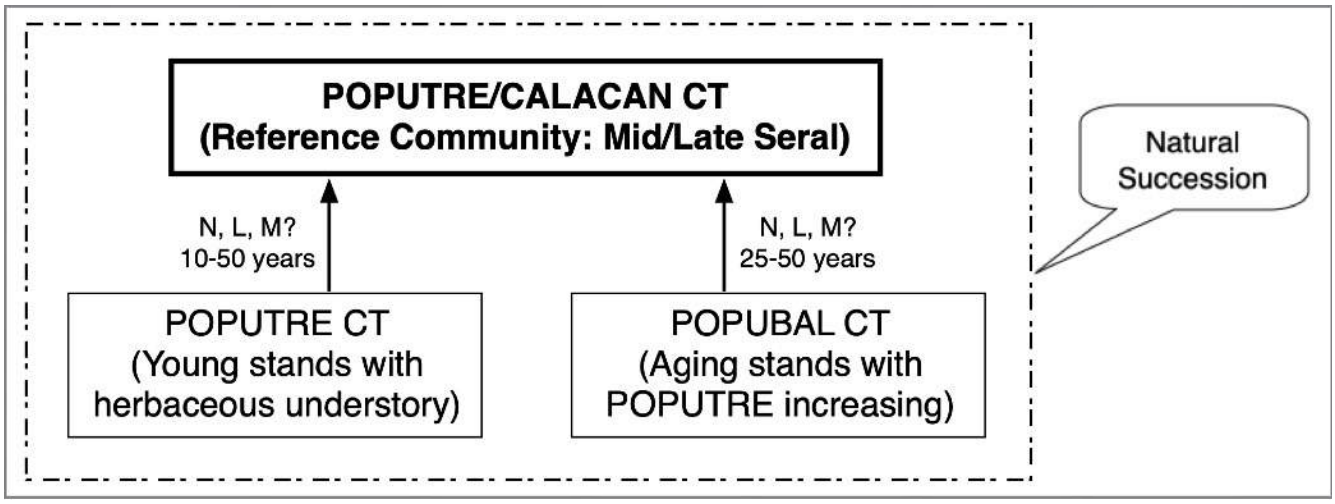
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type is a mid-to-late seral community type that may persist for several decades until the site appropriate climax conifer tree species become established in the stand. However, stands of this community type may be renewed by low-to-moderate intensity fire that removes the young conifer trees, while allowing the *Populus tremuloides* (aspen) and the *Calamagrostis canadensis* (marsh reed grass) to survive most low-to-moderate intensity wildfire by resprouting from the roots.

Figure 40 shows a schematic diagram of vegetation successional pathways on sites of the *Populus tremuloides/ Calamagrostis canadensis* (aspen/marsh reed grass) community type.



Successional Pathway of *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions Reference Community = *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
POPUBAL CT—*Populus balsamifera* (balsam poplar) community type
POPUTRE—*Populus tremuloides* (aspen)
POPUTRE/CALACAN CT—*Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type
POPUTRE CT—*Populus tremuloides* (aspen) community type

Figure 40. Successional pathway for sites of the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types. We see little indication that *Salix* (willows) can re-establish on a site after it becomes dominated by non-willow species.

EDATOPE

Figure 41 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

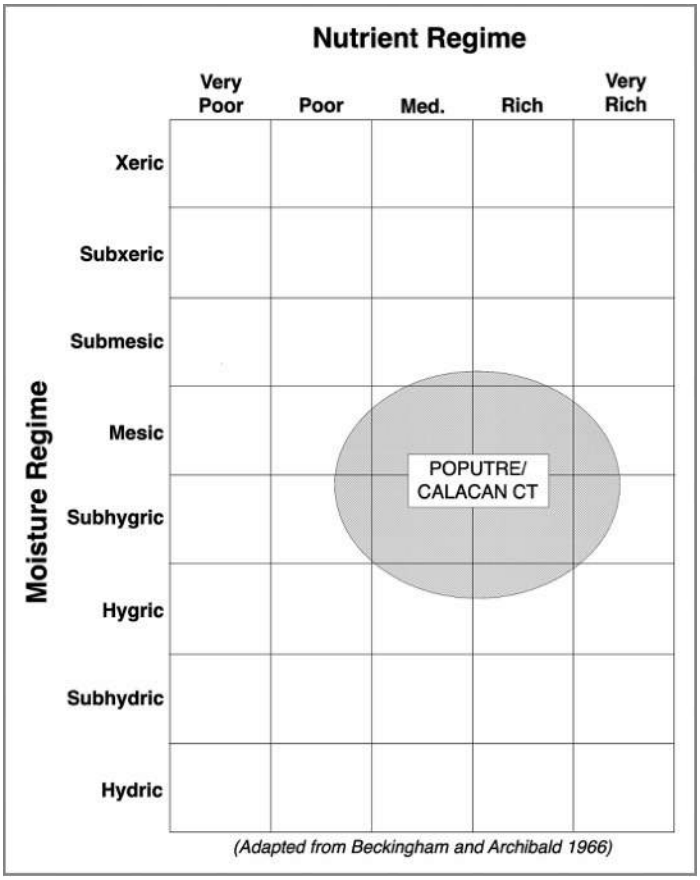


Figure 41. Edatope grid position for the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type (POPUTRE/CALACAN CT)

SOILS

Parent material on sites supporting the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type are mostly morainal, and soils are generally brunisols, gleysols, and luvisols. Sites of this community type typically have organic layer thickness less than 5 cm, and are moderately well drained to well drained, with surface texture ranging from sandy loam to silty clay loam (Baker and others 2020, France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter communities are typically dominated by *Salix* species (willow), *Alnus* species (alder), *Carex* species (sedge), or *Calamagrostis canadensis* (marsh reed grass). Adjacent drier sites may be dominated by the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type or the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) is common and widely distributed across Alberta, often forming large groves. However, in dry areas, it is restricted to moist depression sites (Tannas 1997a). The species occurs on a wide variety of sites, such as moist uplands, dry mountainsides, avalanche chutes, talus slopes, parklands, valley bottoms, alluvial terraces, and along streams and lake shorelines (Howard 1996). It grows on soils ranging from shallow and rocky to deep loamy sands and heavy clays. The best *Populus tremuloides* (aspen) sites are usually well drained, loamy, and high in both organic matter and nutrients (Howard 1996).

Populus tremuloides (aspen) is shade intolerant and cannot reproduce new seedlings beneath its own canopy, which means that the species is seral to conifer trees in most of its range in western North America (Howard 1996). Although, on sites where it is seral, it usually persists as a minor component well into later seral stages of the stand (Howard 1996).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—*Calamagrostis stricta* (narrow reed grass) is common across Alberta, except in the prairies. It occurs farther north than *Calamagrostis inexpansa* (northern reed grass). It grows in swamps, around edges of wetlands, in moist woods, and on many moister upland sites (Tannas 1997a).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) is found in woodlands and thickets, in moist or boggy woods, along streams, in coniferous forests, and sometimes in sandy woods (Tannas 1997a). The species is a valuable understory component, protecting the soil along water courses and as a pioneer species on disturbed mineral soil. It improves the soil by adding organic matter and by fixing nitrogen (Tannas 1997a).

Alnus crispa (green alder) is a semi-shade tolerant pioneer, or seral, species. It invades and inhabits terraces above the floodplain that are subject to occasional flooding (Matthews 1992).

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) is common throughout most of Alberta on well drained sites having high available moisture. In drier areas, the species is restricted to shorelines, riverine floodplains, and moist slopes (Tannas 1997a). It generally occurs on moist sites, such as river floodplains, stream and lake shores, moist depressions, and swamps, but will also grow on drier sites (Harris 1990).

The species is capable of regenerating from root suckers, stump sprouts, stem sprouts, and buried branches. Root suckering is thought to be primarily a means of expansion, rather than simply a means of recovery following clearcutting or fire. Stands are often polyclonal, with several genotypes and their sprouts occurring together in a stand (Harris 1990).

Populus balsamifera (balsam poplar) is an early seral pioneer species, which colonizes disturbed wet sites by seeding or suckering. It is among the fastest growing tree species in temperate latitudes. Rapid early growth allows it to establish on a site and to dominate it for up to 100 years. The species is highly tolerant of flooding (Harris 1990).

Livestock

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) has fair forage value, with high protein and phosphorous levels. Both its leaves and twigs are highly palatable throughout the season for livestock and wild ungulates. It is highly tolerant of heavy browsing, and is considered an increaser species and an invader of native rangeland. Clipping of its leaders stimulates growth of new suckers, as well as growth of new wood on the clipped stem (Tannas 1997a). Forage production in stands dominated by *Populus tremuloides* (aspen) varies from low to moderate, depending on stand density. Palatability of the various herbaceous species associated with this type is often high, and cattle utilization may be high as upland vegetation cures and the animals spend more time in shade that these stands provide. Livestock browse young suckers; and this, combined with trampling and soil compaction, can alter both the age structure and understory composition of stands (Thompson and Hansen 2003).

Stands of *Populus tremuloides* (aspen) are often subjected to high levels of grazing pressure because of their gentle topography and ease of access. With moderate to high, prolonged grazing pressure, palatable shrubs will be decreased relative to such species as *Symphoricarpos* species (buckbrush), *Rosa* species (rose), and *Lonicera* species (honeysuckle) in the understory. With continued long-term intense usage, a stand can be converted to the *Populus tremuloides* (aspen) community type by reduction of total shrub canopy cover to less than 25 percent (Thompson and Hansen 2003).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—*Calamagrostis stricta* (narrow reed grass) has moderate nutritional value in early spring, but which declines as the season advances. The forage is most palatable in spring, but is avoided later in the season unless other forage is unavailable (Tannas 1997a). In general, *Calamagrostis* species (reed grass) are mostly palatable and nutritious for livestock and wildlife, but are considered to be of poor quality because their foliage becomes very rough as it matures (Johnson and others 1995). Protein content is 17 percent to 19 percent in spring, but drops to 7 percent by late summer (Tannas 1997a).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) provides fair to poor forage value. Although the leaves and twigs are thought to be nutritious and to have a fairly high protein content, the species ranks quite low in palatability, and is used only sparingly by both livestock and wild ungulates (Tannas 1997a). *Alnus crispa* (green alder) is considered an increaser in response to grazing, reproducing rapidly by both rhizomes and seed, while being fairly resistant to browsing (Tannas 1997a).

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) has poor forage value for livestock. While nutrient levels are probably acceptable, the resinous twigs and foliage are less palatable than those of other *Populus* (poplar) species. Therefore, heavy utilization of it usually indicates an over-population of wild ungulates, or over grazing by livestock (Tannas 1997a). Stands may be subjected to high levels of grazing pressure because of gentle topography and ease of access. With prolonged moderate to high grazing pressure,

palatable shrubs in the understory will decrease relative to less preferred species, such as *Symphoricarpos* species (buckbrush), *Rosa* species (rose), and *Lonicera* species (honeysuckle) (Thompson and Hansen 2003).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) timber is an important source of fiber used for pulpwood, flake-board, and other composite products. It is also used for making pallets, boxes, veneer and plywood. Higher grades are used for solid wood products such as paneling, furniture components, and flooring (USDA National Resources Conservation Service 2023).

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) is a commercial tree in Alberta. It is used for plywood, pulpwood, boxes and crates, and to make high-grade paper and particle board (Tannas 1997a). Cutting mature *Populus balsamifera* (balsam poplar) results in sprouting from callus tissue and dormant buds. Stump sprouting is most pronounced on winter-logged areas. Trees cut in summer have few surviving sprouts after four years (Thompson and Hansen 2003).

Wildlife

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) forests provide important breeding, foraging, and resting habitat for a variety of birds and mammals. Elk browse it year-round, feeding on bark, new leaders, and sprouts. The species also provides important forage for moose, mule deer, and white-tailed deer (Howard 1996). Wildlife utilization of *Populus tremuloides* (aspen) communities varies with composition of the understory and relative age of the *Populus tremuloides* (aspen) stand. Young stands generally provide more browse. *Populus tremuloides* (aspen) crowns can grow out of reach of large ungulates in 6 to 8 years. Although many animals browse *Populus tremuloides* (aspen) year-round, it is especially valuable during fall and winter, when protein levels are high relative to other browse species (Howard 1996).

Elk browse *Populus tremuloides* (aspen) year-round, feeding on bark, buds, twigs, and sprouts. The species is important forage for mule and white-tailed deer. The deer consume leaves, buds, twigs, bark, and sprouts. New growth on burned sites or clearcuts is especially palatable to deer. Sprouts provide key summer forage for deer after herbaceous species have cured. *Populus tremuloides* (aspen) is valuable moose browse for much of the year, utilizing it on summer and winter ranges (Howard 1996).

Lagomorphs feed on *Populus tremuloides* (aspen) in summer and winter. They may girdle suckers or even mature trees, and in some parts of Canada, fairly high *Populus tremuloides* (aspen) mortality has been attributed to rabbits and hares (Howard 1996). Small rodents such as squirrels, pocket gophers, mice, and voles feed on *Populus tremuloides* (aspen) during at least part of the year. Mice and voles frequently consume *Populus tremuloides* (aspen) bark below snow level, and can girdle suckers and small trees (Howard 1996).

Beaver consume the leaves, bark, twigs, and all diameters of *Populus tremuloides* (aspen) branches. They use the stems for constructing dams and lodges, and at least temporarily, beaver can eliminate *Populus tremuloides* (aspen) from as far as 122 m from the water body. A beaver can consume 1-2 kg of aspen bark per day, and it is estimated that as many as 200 *Populus tremuloides* (aspen) trees are required to support one beaver for a year (Howard 1996).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—Elk may make moderate summer use of *Calamagrostis* species (reed grass) (Kufeld 1973).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) leaves and young growth are readily eaten in severe weather and when other food supplies are scarce, primarily on elk and moose winter range in the upper foothills. Furthermore, the species provides important cover and habitat for wildlife, and is an important source of food for beaver (Tannas 1997a). Muskrat, beaver, cottontail, and snowshoe hares feed on alder twigs and foliage (Matthews 1992). Many birds eat alder seeds, buds, and catkins. The species is also an important component of white-tailed ptarmigan winter forage (Matthews 1992).

***Populus balsamifera* (balsam poplar)**—Northern forests containing *Populus balsamifera* (balsam poplar) support a wide variety of wildlife—including moose, elk, Stone's sheep, mountain goat, mountain caribou, mule deer, wolf, coyote, black bear, grizzly bear, lynx, snowshoe hare, wolverine, and pine marten (Harris 1990). The species is a valuable resource of food and construction material for beaver (Tannas 1997a). Moose sparingly browse young *Populus balsamifera* (balsam poplar), and will strip bark from the trees in times of winter food shortage (Harris 1990). The spreading crown of *Populus balsamifera* (balsam poplar) provides nesting sites for large birds. A variety of birds and mammals, such as woodpeckers, owls, wood ducks, and squirrels, nest in trunk cavities (Hansen and others 1995).

Fisheries

***Populus tremuloides* (aspen)**—Where adjacent to streams, stands of *Populus tremuloides* (aspen) enhance fisheries by stabilizing streambanks and providing overhanging shade cover. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible (Hansen and others 1995).

***Calamagrostis stricta* (narrow reed grass)**—The rhizomatous nature of *Calamagrostis* species (reed grass) will help provide bank stability for sites adjacent to streams (Thompson and Hansen 2003).

***Populus balsamifera* (balsam poplar)**—When located near a stream, stands of *Populus balsamifera* (balsam poplar) provide thermal cover, debris, and streambank stability. This is particularly important on the higher gradient streams where scouring by seasonal flooding may occur (Hansen and others 1995).

Fire

***Populus tremuloides* (aspen)**—Prescribed fire is recommended to rejuvenate *Populus tremuloides* (aspen) stands. With the recent history of fire suppression, there has been a general aging of *Populus tremuloides* (aspen) stands across western North America. While conifers may replace seral *Populus tremuloides* (aspen) stands, stable stands may become less productive. In many areas stands now live longer than they did prior to fire exclusion, and many are in decline (Howard 1996). However, wet conditions in spring and summer may limit prescribed burning to the drier fall season. Fire, sometimes in combination with cutting, can be an important tool in regenerating decadent stands (Hansen and others 1995). Brown (1984) provides information for using prescribed fire in *Populus tremuloides* (aspen) stands. Protection of newly burned or cleared sites from beaver and grazing animals may be necessary for successful stand reestablishment.

Prescribed fire is often difficult to apply in *Populus tremuloides* (aspen) stands because of the abundance of live trees and sparse distribution of fine dead fuels. Even if fuels are plentiful, they are often too moist to burn easily. Prescribed fire may be possible, however, when live vegetation cures enough to contribute to fire spread, rather than to hinder it. The optimum combination of dry weather and cured fuels occurs mostly in early spring, late summer, and fall (Howard 1996). In Alberta, these moderately severe, early season burning conditions can persist from snowmelt until the first week in June (Quintilo and others 1991). In the northern forest of Alberta, Bailey (1978) found that prescribed burning in *Populus tremuloides* (aspen) forests in spring was usually not successful

at relative humidity above 35 to 40 percent. He recommended that prescribed burning be conducted 8 to 10 drying days after snowmelt, when air temperature is at least 18 degrees C, relative humidity is less than 30 percent, and winds are 9-35 km/hr.

Populus tremuloides (aspen) is the classic soboliferous species: a plant that sprouts from carbohydrate-storing lateral roots (sobols). The species generally sprouts vigorously after burning. Moderately severe fire generally results in dense sprouting, and fewer sprouts may be produced after severe fire. A low severity surface fire may leave standing live trees that locally suppress sprouting, resulting in an uneven-aged stand. *Populus tremuloides* (aspen) burned in spring generally sprout later in the growing season and again the following year. Stands burned in late summer or fall usually sprout the next spring (Howard 1996).

Populus tremuloides (aspen) readily colonizes sites after fire, timber harvest, or other disturbance (Howard 1996). Even in stands where it was only a small component of the vegetation prior to burning, the aspen often gains dominance after a fire. The species is easily top-killed by fire, but root systems of top-killed stems continue to send up a profusion of sprouts for several years after burning. After a fire, a new, even-aged stand can develop within one decade (Howard 1996).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

***Calamagrostis stricta* (narrow reed grass)**—Fires reducing the abundance of other associated species tend to cause dramatic increase in *Calamagrostis stricta* (narrow reed grass) and other rhizomatous species (Haeussler and Coates 1986).

***Alnus crispa* (green alder)**—Following fire, *Alnus crispa* (green alder) resprouts from the root crowns and establishes by seed from plants in nearby unburned areas. The bare mineral soil created by fire provides prime sites for *Alnus crispa* (green alder) establishment. The species does not burn easily, and dense stands can sometimes prevent fire spread. These shrubs provide shade that reduces soil temperatures, allowing spruce and other conifer trees to become established (Matthews 1992).

***Populus balsamifera* (balsam poplar)**—Although severe fire kills *Populus balsamifera* (balsam poplar), it is considered one of the most well adapted tree species to fire in the northern forest. Its ability to sprout from roots, stumps, and buried branches enables it to quickly recover from fire (Harris 1990). Moderate fire may top-kill some trees, but light fires usually do not harm mature *Populus balsamifera* (balsam poplar). Young trees may be top-killed because of their thin bark, and repeated burning may eliminate the species from a site by preventing regeneration (Thompson and Hansen 2003).

Populus balsamifera (balsam poplar) is most susceptible to fire during late summer and fall. If a manager wants to extend the life of a *Populus balsamifera* (balsam poplar) stand, fire ***MAY BE*** used as a tool in the pole to early mature stage of development. If fire is used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that wildlife browsing be closely monitored to protect the young sprouts (Hansen and others 1995).

Rehabilitation/Restoration Considerations

***Populus tremuloides* (aspen)**—The wide adaptability of *Populus tremuloides* (aspen) makes it well-suited for restoration and rehabilitation on a wide range of sites. Stands of this species are unique in their ability to stabilize soil and watersheds on burned and otherwise disturbed sites. The trees produce abundant litter that contains more

nitrogen, phosphorus, potassium, and calcium than does the leaf litter of most other deciduous trees. This litter decays rapidly, forming a nutrient-rich humus that reduces runoff and aids in percolation of surface water. Compared to conifer stands, more snow accumulates under aspen, and snowmelt begins earlier in the spring, allowing the soil to thaw more quickly than soil under conifer trees (Howard 1996).

Populus tremuloides (aspen) can be useful in revegetating disturbed sites having moist, well-drained soils. Best results are obtained using rooted cuttings or nursery-grown stock. Once established, growth rates are rapid. The quickly spreading aspen roots effectively stabilize exposed soils. Rooted cuttings or nursery grown seedlings are easily established on moist, well-drained soils. Growth rates are rapid and the roots of established seedlings are effective stabilizers of alluvial soil deposits (Thompson and Hansen 2003).

Populus tremuloides (aspen) seedlings transplanted onto disturbed sites have shown good establishment and are more economical to grow than vegetative cuttings. Seedlings grow a taproot and secondary roots quickly, while cuttings can be slow to establish an adequate root system. In addition, genetic diversity is greater among seedlings than cuttings. The major advantage of using cuttings is that clones with desirable traits can be selected as parent stock. Stem cuttings are especially difficult to root unless taken from young sprouts. Root cuttings taken from young sprouts are generally more successful (Howard 1996).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—Roads and trails should be located on adjacent uplands. *Calamagrostis stricta* (narrow reed grass) propagates by both seeds and rhizomes, making it a valuable species for stabilizing or rehabilitating suitable disturbed sites (Thompson and Hansen 2003).

***Alnus crispa* (green alder)**—The major value of *Alnus crispa* (green alder) in rehabilitation is its ability to invade sterile soil, thereby increasing the organic matter content and by nitrogen fixation (Matthews 1992). The species was noted for its ability to colonize tailings at the Discovery Mine in Northwest Territories (Matthews 1992).

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) is an important riparian species for stabilizing river banks and maintaining river islands subject to recurring scouring by floods and alluvium deposition (Thompson and Hansen 2003). With healthy natural vegetation associated, these stands are relatively stable because of the strong root systems of the associated species. Management should emphasize the understory shrub layer in streambank revegetation projects. This is most important on higher gradient streams. Managers should strive to maintain a buffer of a *Populus balsamifera* (balsam poplar) community adjacent to all rivers and streams where possible. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize the streambanks, and dissipate flood energy (Thompson and Hansen 2003).

Recreational Uses and Consideration

***Populus balsamifera* (balsam poplar)**—Because of their common proximity to streams and lakes, recreational developments and transportation corridors are common in *Populus balsamifera* (balsam poplar) stands. Opportunities in and near stands of *Populus balsamifera* (balsam poplar) are excellent for fishing, big game, and waterfowl hunting, and observing a variety of wildlife. Care must be taken when locating structures in this type due to potential for flooding (Thompson and Hansen 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- E5. Aspen/alder
- E6. Aw/Alder/Marsh reed grass/Hairy wild rye

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Aw-Pl/Fireweed (harvested)
- Aw-Pl-Sw/Green alder/Feather moss
- Aw-Pl-Sw/Rose/Marsh reed grass
- Pb-Aw/Rose/Marsh reed grass

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Aw/Cow parsnip
- Aw/Marsh reed grass-Kentucky bluegrass
- Aw-Pb/Marsh reed grass

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msg9a Aw-Pb/Marsh reed grass (Montane Southern Ecosection)
- Msg22 Aw/Marsh reed grass-Kentucky bluegrass (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type has not been described in the region.

Populus tremuloides/Viburnum edule Community Type
(aspen/low-bush cranberry Community Type)

POPUTRE/VIBUEDU Community Type
Number of Stands = 54 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 8; Other Data Sets = 46)

LOCATION AND ASSOCIATED LANDFORMS

The *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This community type often forms extensive stands around lakes, sloughs, depressions, and low, moist forest sites near streams and rivers, and on alluvial terraces and moist seep areas on valley slopes.

Photo 10 shows a typical stand of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type.

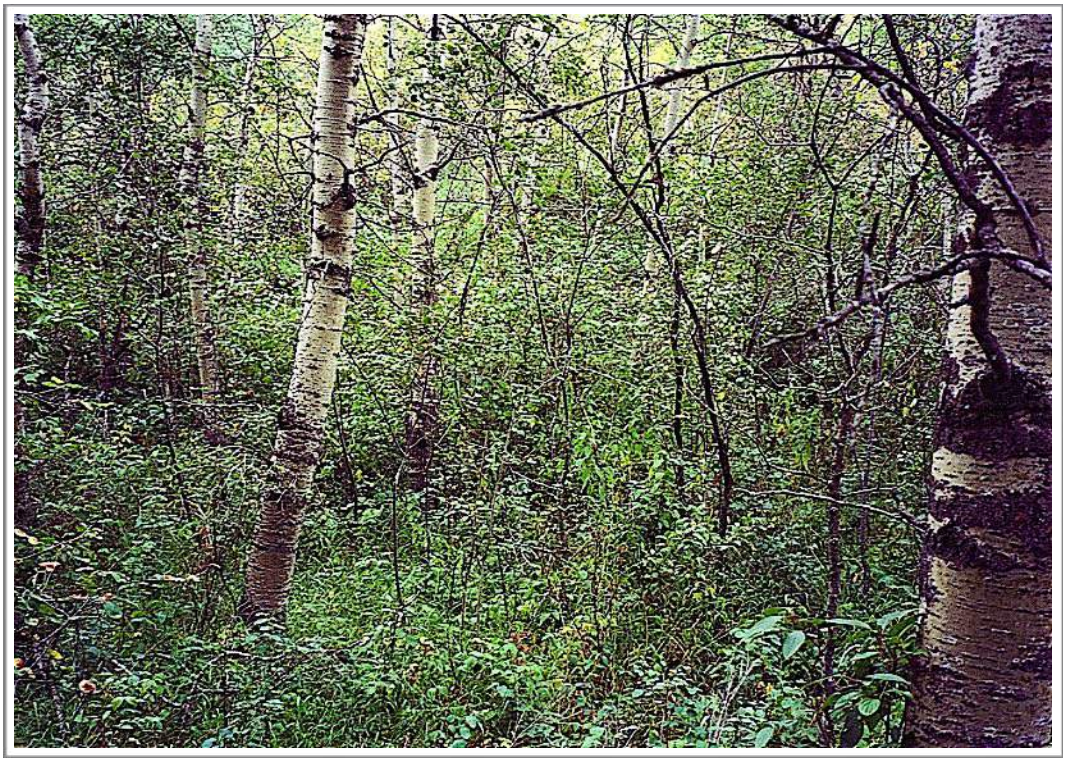


Photo 10. A stand of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 197 shows the five most prominent plant species among the four lifeforms for species recorded in all 54 stands of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type. *Populus tremuloides* (aspen) heavily dominates this community type. *Populus balsamifera* (balsam poplar) is also fairly prominent, but no other species is more than moderately prominent.

Table 197. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type (number = 54 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus tremuloides (aspen)	46.85	Native
Populus balsamifera (balsam poplar)	13.50	Native
Pinus contorta (lodgepole pine)	1.92	Native
Betula papyrifera (white birch)	1.07	Native
Populus angustifolia (narrow-leaf cottonwood)	0.19	Native
Shrubs		
Cornus stolonifera (red-osier dogwood)	8.82	Native
Viburnum edule (low-bush cranberry)	7.95	Native
Alnus crispa (green alder)	5.25	Native
Rosa woodsii (common wild rose)	4.63	Native
Rosa acicularis (prickly rose)	4.03	Native
Graminoids		
Poa pratensis (Kentucky bluegrass)	2.56	Introduced
Calamagrostis canadensis (marsh reed grass)	0.84	Native
Bromus inermis (smooth brome)	0.73	Introduced
Elymus innovatus (hairy wild rye)	0.51	Native
Phleum pratense (timothy)	0.38	Introduced

Table 197. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Aralia nudicaulis (wild sarsaparilla)	4.32	Native
Equisetum arvense (common horsetail)	3.58	Native
Epilobium angustifolium (common fireweed)	3.12	Native
Cornus canadensis (bunchberry)	2.70	Native
Fragaria virginiana (wild strawberry)	1.95	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 198 through Table 201, break out the vegetation recorded in all 54 stands sampled of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species rich, forested community type of minor occurrence across the study area.

Table 198 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type. For the 54 stands comprising the community type, the number of unique species was 221 with 195 (88.2 percent) of them being native species.

Table 198. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type (number = 54 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	8	8	0	0
Shrubs	53	50	0	3
Graminoids	43	34	7	2
Forbs	117	103	9	5
TOTAL	***221 (100.0%)***	***195 (88.2%)***	***16 (7.2%)***	***10 (4.5%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 199 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type. The average number of species per stand is 26.4, with native species comprising 24.6 species per stand or 93.2 percent.

Table 199. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type (number = 54 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.1	2.1	0.0	0.0
Shrubs	8.6	8.5	0.0	0.1
Graminoids	2.7	1.9	0.7	0.1
Forbs	13.0	12.1	0.8	0.1
TOTAL	***26.4 (100.0%)***	***24.6 (93.2%)***	***1.5 (5.7%)***	***0.3 (1.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 200 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type. The average canopy cover per stand is 163.2 percent, with native species comprising 157.1 percent or 96.3 percent of the total amount of average canopy cover per stand.

Table 200. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type (number = 54 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	63.7%	63.7%	0.0%	0.0%
Shrubs	59.6%	59.5%	0.0%	0.1%
Graminoids	7.1%	3.2%	3.9%	0.0%
Forbs	32.6%	30.7%	1.9%	0.1%
TOTAL	***163.2% (100.0%)***	***157.1% (96.3%)***	***5.8% (3.6%)***	***0.3% (0.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 201 shows the average number of species and average canopy cover by lifeform in stands of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type. The average number of species per stand was 26.4 with an average canopy cover of 163.2 percent.

Table 201. Average number of species and average canopy cover by lifeform in stands of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type (number = 54 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.1	63.7%
Shrubs	8.6	59.6%
Graminoids	2.7	7.1%
Forbs	13.0	32.6%
TOTAL	***26.4***	***163.2%***

Sampled Stands Plant Species List

Eight tree species were recorded in the 54 stands sampled of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type (Table 202). *Populus tremuloides* (aspen) was by far most prominent, followed by *Populus balsamifera* (balsam poplar). None of the 53 shrubs recorded was highly prominent, but several were moderately so, led by *Cornus stolonifera* (red-osier dogwood) and *Viburnum edule* (low-bush cranberry). None of the 43 graminoids was very prominent, but *Poa pratensis* (Kentucky bluegrass) was the leading species among them, nor were any of the 117 forbs recorded was very prominent. *Fragaria virginiana* (wild strawberry) was most constant, recorded on 72 percent of stands sampled.

Table 202. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Populus tremuloides/ Viburnum edule* (aspen/low-bush cranberry) community type (number = 54 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 8)					
Betula papyrifera (white birch)	8.2	0-40	13	1.06	N
Picea engelmannii (Engelmann spruce)	3.0	0-3	2	0.06	N
Picea glauca (white spruce)	0.7	0-3	20	0.15	N
Pinus contorta (lodgepole pine)	17.3	0-40	11	1.92	N
Populus angustifolia (narrow-leaf cottonwood)	10.0	0-10	2	0.19	N
Populus balsamifera (balsam poplar)	22.1	0-80	61	13.50	N
Populus tremuloides (aspen)	46.9	10-90	100	46.85	N
Pseudotsuga menziesii (Douglas-fir)	0.5	0-0.5	2	0.01	N
Shrubs (N = 53)					
Acer glabrum (mountain maple)	10.0	0-10	2	0.19	N
Alnus crispa (green alder)	25.8	0-70	20	5.25	N
Alnus tenuifolia (river alder)	5.6	0-10	15	0.82	N
Amelanchier alnifolia (Saskatoon)	5.5	0-20	56	3.07	N
Arctostaphylos uva-ursi (common bearberry)	1.3	0-3	6	0.07	N
Berberis repens (creeping mahonia)	10.3	0-20	4	0.38	N

Table 202. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Betula glandulosa (bog birch)	0.5	0-0.5	2	0.01	N
Betula occidentalis (water birch)	7.0	0-20	6	0.39	N
Clematis occidentalis (purple clematis)	1.8	0-3	4	0.06	N
Clematis spp. (clematis)	3.0	0-3	2	0.06	N
Cornus stolonifera (red-osier dogwood)	14.4	0-40	61	8.81	N
Corylus cornuta (beaked hazelnut)	1.5	0-3	9	0.14	N
Crataegus douglasii (Douglas hawthorn)	10.0	0-10	2	0.19	N
Elaeagnus commutata (silverberry)	11.5	0-20	4	0.43	N
Juniperus communis (ground juniper)	0.5	0-0.5	4	0.02	N
Ledum groenlandicum (common Labrador tea)	1.3	0-3	11	0.15	N
Linnaea borealis (twinflower)	3.9	0-20	33	1.29	N
Lonicera caerulea (fly honeysuckle)	3.0	0-3	2	0.06	N
Lonicera dioica (twining honeysuckle)	1.0	0-3	19	0.19	N
Lonicera involucrata (bracted honeysuckle)	3.6	0-10	37	1.34	N
Pachistima myrsinites (mountain-lover)	0.5	0-0.5	2	0.01	N
Prunus pensylvanica (pin cherry)	0.5	0-0.5	2	0.01	N
Prunus virginiana (choke cherry)	5.2	0-30	26	1.34	N
Rhamnus alnifolia (alder-leaved buckthorn)	0.5	0-0.5	2	0.01	N
Ribes hirtellum (wild gooseberry)	1.3	0-3	6	0.07	N
Ribes lacustre (bristly black currant)	2.2	0-10	13	0.29	N
Ribes oxyacanthoides (northern gooseberry)	2.1	0-10	28	0.59	N
Ribes spp. (currant)	3.0	0-3	2	0.06	B
Ribes triste (wild red currant)	0.5	0-0.5	6	0.03	N
Rosa acicularis (prickly rose)	7.5	0-20	54	4.03	N
Rosa spp. (rose)	0.5	0-0.5	2	0.01	B
Rosa woodsii (common wild rose)	11.4	0-40	41	4.63	N
Rubus idaeus (wild red raspberry)	6.0	0-30	50	3.01	N
Rubus parviflorus (thimbleberry)	0.5	0-0.5	2	0.01	N
Rubus pubescens (dewberry)	3.6	0-40	59	2.12	N
Salix bebbiana (beaked willow)	7.5	0-30	44	3.33	N
Salix drummondiana (Drummond's willow)	0.5	0-0.5	2	0.01	N
Salix lutea (yellow willow)	0.5	0-0.5	2	0.01	N
Salix petiolaris (basket willow)	0.5	0-0.5	2	0.01	N
Salix pseudomonticola (false mountain willow)	16.0	0-60	7	1.19	N
Salix scouleriana (Scouler's willow)	5.4	0-20	15	0.80	N
Salix spp. (willow)	1.3	0-3	6	0.07	B
Shepherdia canadensis (Canada buffaloberry)	3.7	0-10	31	1.18	N
Spiraea betulifolia (white meadowsweet)	5.7	0-20	13	0.74	N
Symphoricarpos albus (snowberry)	11.0	0-20	6	0.61	N
Symphoricarpos occidentalis (buckbrush)	7.5	0-50	39	2.94	N
Symphoricarpos spp. (snowberry)	7.6	0-30	15	1.12	N
Vaccinium caespitosum (dwarf bilberry)	2.9	0-10	11	0.32	N
Vaccinium membranaceum (tall bilberry)	0.5	0-0.5	2	0.01	N
Vaccinium myrtilloides (common blueberry)	1.3	0-3	6	0.07	N

Table 202. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Vaccinium myrtillus (low bilberry)	3.0	0-3	2	0.06	N
Vaccinium vitis-idaea (bog cranberry)	3.0	0-3	4	0.11	N
Viburnum edule (low-bush cranberry)	12.6	0-70	63	7.95	N
Graminoids (N = 43)					
Agropyron dasystachyum (northern wheat grass)	0.5	0-0.5	2	0.01	N
Agropyron repens (quack grass)	1.0	0-3	9	0.09	I
Agropyron spp. (wheat grass)	0.5	0-0.5	2	0.01	B
Agropyron trachycaulum (slender wheat grass)	1.6	0-3	20	0.33	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	4	0.02	N
Agrostis stolonifera (redtop)	2.2	0-3	6	0.12	I
Alopecurus aequalis (short-awn meadow-foxtail)	0.5	0-0.5	2	0.01	N
Alopecurus pratensis (meadow foxtail)	3.0	0-3	2	0.06	I
Beckmannia syzigachne (slough grass)	0.5	0-0.5	2	0.01	N
Bromus ciliatus (fringed brome)	0.9	0-3	13	0.11	N
Bromus inermis (smooth brome)	6.6	0-20	11	0.73	I
Bromus vulgaris (woodland brome)	0.5	0-0.5	2	0.01	N
Calamagrostis canadensis (marsh reed grass)	1.8	0-3	48	0.84	N
Calamagrostis rubescens (pine reed grass)	0.5	0-0.5	4	0.02	N
Calamagrostis stricta (narrow reed grass)	0.5	0-0.5	2	0.01	N
Carex atherodes (awned sedge)	0.5	0-0.5	2	0.01	N
Carex capillaris (hair-like sedge)	0.5	0-0.5	2	0.01	N
Carex deweyana (Dewey's sedge)	0.5	0-0.5	4	0.02	N
Carex disperma (two-seeded sedge)	6.5	0-10	4	0.24	N
Carex interior (inland sedge)	0.5	0-0.5	2	0.01	N
Carex lanuginosa (woolly sedge)	3.0	0-3	2	0.06	N
Carex leptalea (bristle-stalked sedge)	0.5	0-0.5	2	0.01	N
Carex praegracilis (graceful sedge)	1.3	0-3	6	0.07	N
Carex scopulorum (Holm's Rocky Mountain sedge)	3.0	0-3	2	0.06	N
Carex siccata (hay sedge)	3.0	0-3	2	0.06	N
Carex spp. (sedge)	1.8	0-3	7	0.13	N
Carex sprengelii (Sprengel's sedge)	1.8	0-3	4	0.06	N
Carex utriculata (beaked sedge)	3.0	0-3	2	0.06	N
Carex xerantica (white-scaled sedge)	3.0	0-3	2	0.06	N
Cinna latifolia (drooping wood-reed)	0.5	0-0.5	2	0.01	N
Elymus glaucus (smooth wild rye)	0.5	0-0.5	2	0.01	N
Elymus innovatus (hairy wild rye)	2.3	0-10	22	0.51	N
Festuca idahoensis (bluebunch fescue)	0.5	0-0.5	2	0.01	N
Festuca spp. (fescue)	0.5	0-0.5	4	0.02	B
Glyceria grandis (common tall manna grass)	10.0	0-10	2	0.19	N
Glyceria spp. (manna grass)	0.5	0-0.5	2	0.01	N
Koeleria macrantha (June grass)	0.5	0-0.5	2	0.01	N
Oryzopsis asperifolia (white-grained mountain rice grass)	0.5	0-0.5	4	0.02	N
Phleum pratense (timothy)	2.9	0-10	13	0.38	I

Table 202. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Poa compressa (Canada bluegrass)	0.5	0-0.5	2	0.01	I
Poa palustris (fowl bluegrass)	1.0	0-3	9	0.09	N
Poa pratensis (Kentucky bluegrass)	10.6	0-40	24	2.56	I
Schizachne purpurascens (purple oat grass)	1.0	0-3	9	0.09	N
Forbs (N = 117)					
Achillea millefolium (common yarrow)	1.1	0-3	22	0.25	N
Achillea sibirica (many-flowered yarrow)	0.5	0-0.5	4	0.02	N
Actaea rubra (red and white baneberry)	0.7	0-3	39	0.29	N
Angelica arguta (white angelica)	0.5	0-0.5	2	0.01	N
Antennaria anaphaloides (tall everlasting)	0.5	0-0.5	2	0.01	N
Antennaria spp. (everlastings)	0.5	0-0.5	2	0.01	N
Apocynum androsaemifolium (spreading dogbane)	0.5	0-0.5	2	0.01	N
Apocynum cannabinum (Indian hemp)	3.0	0-3	2	0.06	N
Aquilegia flavescens (yellow columbine)	0.5	0-0.5	2	0.01	N
Aralia nudicaulis (wild sarsaparilla)	10.6	0-50	41	4.31	N
Arenaria spp. (sandwort)	3.0	0-3	2	0.06	B
Arnica cordifolia (heart-leaved arnica)	4.6	0-20	11	0.51	N
Aster ciliolatus (Lindley's aster)	1.1	0-3	24	0.26	N
Aster conspicuus (showy aster)	2.9	0-20	54	1.54	N
Aster laevis (smooth aster)	0.5	0-0.5	2	0.01	N
Aster spp. (aster)	3.0	0-3	2	0.06	N
Athyrium filix-femina (lady fern)	0.5	0-0.5	2	0.01	N
Callitriche verna (vernal water-starwort)	0.5	0-0.5	2	0.01	N
Campanula rotundifolia (harebell)	0.5	0-0.5	2	0.01	N
Castilleja miniata (common red paintbrush)	0.5	0-0.5	6	0.03	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	4	0.02	N
Circaea alpina (small enchanter's nightshade)	0.5	0-0.5	2	0.01	N
Cirsium arvense (Canada thistle)	1.0	0-3	9	0.09	I
Clintonia uniflora (corn lily)	0.5	0-0.5	2	0.01	N
Convolvulus arvensis (field bindweed)	0.5	0-0.5	2	0.01	I
Corallorhiza striata (striped coralroot)	0.5	0-0.5	2	0.01	N
Corallorhiza trifida (pale coralroot)	3.0	0-3	2	0.06	N
Cornus canadensis (bunchberry)	5.6	0-30	48	2.70	N
Cypripedium calceolus (yellow lady's-slipper)	0.5	0-0.5	2	0.01	N
Delphinium glaucum (tall larkspur)	1.3	0-3	6	0.07	N
Disporum trachycarpum (fairybells)	0.5	0-0.5	20	0.10	N
Dryopteris carthusiana (narrow spinulose shield fern)	0.5	0-0.5	2	0.01	N
Epilobium angustifolium (common fireweed)	4.8	0-40	65	3.12	N
Epilobium ciliatum (northern willowherb)	1.8	0-3	4	0.06	N
Equisetum arvense (common horsetail)	8.1	0-70	44	3.58	N
Equisetum hyemale (common scouring-rush)	0.5	0-0.5	2	0.01	N
Equisetum laevigatum (smooth scouring-rush)	0.5	0-0.5	2	0.01	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	2	0.01	N

Table 202. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Equisetum sylvaticum (woodland horsetail)	0.5	0-0.5	2	0.01	N
Erigeron philadelphicus (Philadelphia fleabane)	0.5	0-0.5	2	0.01	N
Forb spp. (forb)	0.5	0-0.5	2	0.01	B
Fragaria virginiana (wild strawberry)	2.7	0-20	72	1.95	N
Galeopsis tetrahit (hemp-nettle)	0.5	0-0.5	4	0.02	I
Galium aparine (cleavers)	3.0	0-3	2	0.06	N
Galium boreale (northern bedstraw)	1.4	0-3	54	0.73	N
Galium triflorum (sweet-scented bedstraw)	0.9	0-3	31	0.30	N
Geranium richardsonii (wild white geranium)	2.7	0-10	17	0.44	N
Geranium viscosissimum (sticky purple geranium)	3.0	0-3	2	0.06	N
Geum aleppicum (yellow avens)	0.5	0-0.5	2	0.01	N
Geum macrophyllum (large-leaved yellow avens)	1.3	0-3	19	0.23	N
Geum triflorum (three-flowered avens)	0.5	0-0.5	2	0.01	N
Habenaria obtusata (blunt-leaved bog orchid)	0.5	0-0.5	2	0.01	N
Habenaria orbiculata (round-leaved bog orchid)	1.3	0-3	6	0.07	N
Habenaria spp. (bog orchid)	0.5	0-0.5	2	0.01	B
Habenaria viridis (bracted bog orchid)	0.5	0-0.5	6	0.03	N
Halenia deflexa (spurred gentian)	0.5	0-0.5	2	0.01	N
Heracleum lanatum (cow parsnip)	1.3	0-3	17	0.22	N
Hieracium umbellatum (narrow-leaved hawkweed)	0.5	0-0.5	2	0.01	N
Lathyrus ochroleucus (cream-colored vetchling)	1.7	0-10	63	1.05	N
Lilium philadelphicum (western wood lily)	0.5	0-0.5	2	0.01	N
Listera cordata (heart-leaved twayblade)	0.5	0-0.5	2	0.01	N
Lycopodium annotinum (stiff club-moss)	0.5	0-0.5	2	0.01	N
Lycopodium clavatum (running club-moss)	0.5	0-0.5	2	0.01	N
Lycopodium complanatum (ground-cedar)	0.5	0-0.5	2	0.01	N
Lysimachia ciliata (fringed loosestrife)	3.0	0-3	2	0.06	N
Maianthemum canadense (wild lily-of-the-valley)	1.2	0-3	35	0.41	N
Medicago lupulina (black medick)	0.5	0-0.5	2	0.01	I
Menyanthes trifoliata (buck-bean)	0.5	0-0.5	2	0.01	N
Mertensia paniculata (tall lungwort)	2.2	0-10	48	1.06	N
Mitella nuda (bishop's-cap)	1.6	0-3	26	0.41	N
Orthilia secunda (one-sided wintergreen)	1.0	0-3	19	0.19	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	1.3	0-3	6	0.07	N
Osmorhiza depauperata (spreading sweet cicely)	1.5	0-3	9	0.14	N
Osmorhiza spp. (sweet cicely)	0.5	0-0.5	2	0.01	N
Oxytropis spp. (locoweed)	0.5	0-0.5	2	0.01	B
Pedicularis labradorica (Labrador lousewort)	0.5	0-0.5	2	0.01	N
Petasites frigidus (arctic sweet coltsfoot)	1.3	0-3	39	0.52	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	6	0.03	N
Plantago major (common plantain)	1.1	0-3	7	0.08	I
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	2	0.01	N
Potentilla norvegica (rough cinquefoil)	1.8	0-3	4	0.06	N
Potentilla paradoxa (bushy cinquefoil)	0.5	0-0.5	2	0.01	N

Table 202. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Pyrola asarifolia (common pink wintergreen)	1.9	0-10	48	0.92	N
Ranunculus abortivus (small-flowered buttercup)	3.0	0-3	2	0.06	N
Ranunculus pedatifidus (northern buttercup)	0.5	0-0.5	2	0.01	N
Sanicula marilandica (snakeroot)	0.5	0-0.5	4	0.02	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	2	0.01	N
Senecio eremophilus (cut-leaved ragwort)	0.5	0-0.5	2	0.01	N
Senecio pauperculus (balsam groundsel)	1.8	0-3	4	0.06	N
Senecio pseudaureus (thin-leaved ragwort)	1.8	0-3	4	0.06	N
Silene menziesii (Menzies'catchfly)	0.5	0-0.5	4	0.02	N
Smilacina racemosa (false Solomon's-seal)	2.9	0-10	9	0.27	N
Smilacina stellata (star-flowered Solomon's-seal)	2.2	0-20	37	0.82	N
Solidago canadensis (Canada goldenrod)	3.4	0-10	9	0.31	N
Solidago missouriensis (low goldenrod)	10.0	0-10	2	0.19	N
Solidago spp. (goldenrod)	0.5	0-0.5	2	0.01	N
Sonchus arvensis (perennial sow-thistle)	0.5	0-0.5	2	0.01	I
Stachys palustris (marsh hedge-nettle)	0.5	0-0.5	2	0.01	N
Stellaria calycantha (northern stitchwort)	0.5	0-0.5	2	0.01	N
Stenanthium occidentale (bronzebells)	0.5	0-0.5	2	0.01	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	5.3	0-10	4	0.19	N
Taraxacum officinale (common dandelion)	1.7	0-10	33	0.57	I
Thalictrum occidentale (western meadow rue)	5.4	0-20	9	0.50	N
Thalictrum spp. (meadow rue)	0.5	0-0.5	4	0.02	N
Thalictrum venulosum (veiny meadow rue)	1.7	0-10	22	0.38	N
Trifolium hybridum (alsike clover)	4.4	0-20	9	0.41	I
Trifolium repens (white clover)	9.0	0-20	7	0.67	I
Urtica dioica (common nettle)	0.5	0-0.5	7	0.04	N
Valeriana dioica (northern valerian)	3.0	0-3	2	0.06	N
Veronica americana (American brooklime)	0.5	0-0.5	4	0.02	N
Vicia americana (wild vetch)	1.3	0-10	59	0.80	N
Viola adunca (early blue violet)	0.5	0-0.5	4	0.02	N
Viola canadensis (western Canada violet)	2.0	0-10	15	0.30	N
Viola orbiculata (evergreen violet)	3.0	0-3	2	0.06	N
Viola renifolia (kidney-leaved violet)	1.3	0-3	6	0.07	N
Viola spp. (violet)	0.5	0-0.5	2	0.01	B
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	2	0.01	N

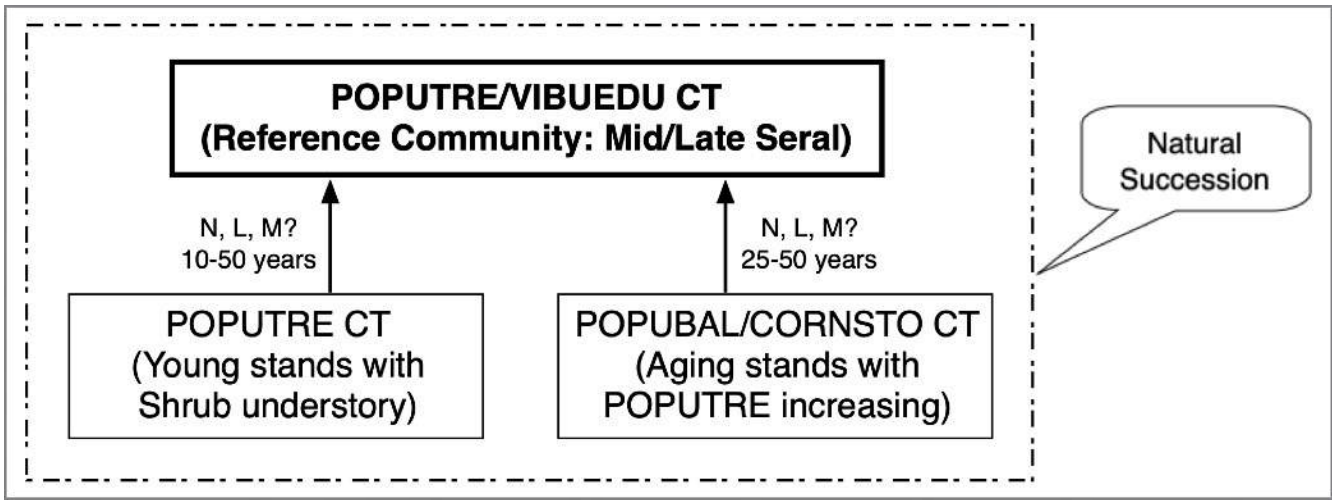
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type is a mid-to-late seral type that may persist for several decades until climax species of conifer tree become established in the stand. However, stands of this community type may be renewed by low-to-moderate intensity fire that removes the young conifer trees, as the *Populus tremuloides* (aspen) and the understory shrubs can usually survive all but the most intense wildfire by resprouting from the roots.

Figure 42 shows a schematic diagram of vegetation successional pathways on sites of the *Populus tremuloides/ Viburnum edule* (aspen/low-bush cranberry) community type.



Successional Pathway of *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
POPUTRE—*Populus tremuloides* (aspen)
POPUTRE CT—*Populus tremuloides* (aspen) community type
POPUTRE/VIBUEDU CT—*Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type

Figure 42. Successional pathway for sites of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types. We see little indication that *Salix* (willows) or such late seral species as *Viburnum edule* (low-bush cranberry) can become re-established on sites that have become dominated by rhizomatous, disturbance

induced competitors (e.g., *Symphoricarpos occidentalis* [buckbrush], *Rosa acicularis* [prickly rose], *Elaeagnus commutata* [silverberry], *Bromus inermis* [smooth brome], *Poa pratensis* [Kentucky bluegrass], etc.).

EDATOPE

Figure 43 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

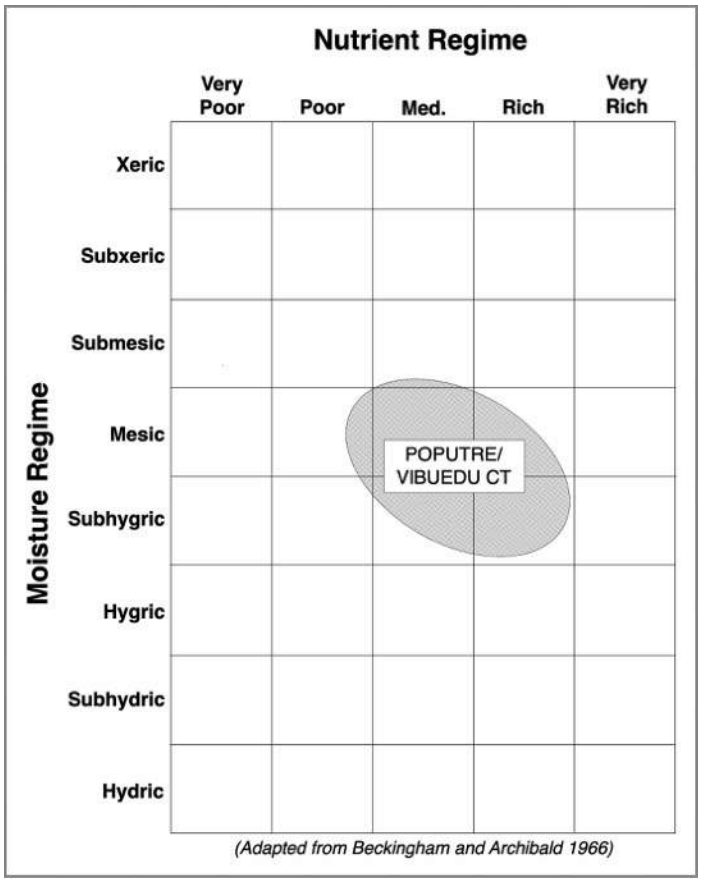


Figure 43. Edatope grid position for the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type (POPUTRE/VIBUEDU CT)

SOILS

Parent material on sites supporting the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type are mostly morainal and alluvial, and soils are mostly brunisols and luvisols. Sites of this community type typically have organic layer thickness less than 5 cm, and are moderately well drained to well drained, with surface texture ranging from sand to clay loam (Baker and others 2020, France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites are likely to be dominated by the *Populus tremuloides/Calamagrostis canadensis* (aspen/ marsh reed grass) community type. Adjacent drier sites are likely to have *Populus tremuloides* (aspen) or *Picea glauca* (white spruce) upland communities.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) is common and widely distributed across Alberta, often forming large groves. However, in dry areas, it is restricted to moist depression sites (Tannas 1997a). The species occurs on a wide variety of sites, such as moist uplands, dry mountainsides, avalanche chutes, talus slopes, parklands, valley bottoms, alluvial terraces, and along streams and lake shorelines (Howard 1996). It grows on soils ranging from shallow and rocky to deep loamy sands and heavy clays. The best *Populus tremuloides* (aspen) sites are usually well drained, loamy, and high in both organic matter and nutrients (Howard 1996).

Populus tremuloides (aspen) is shade intolerant and cannot reproduce new seedlings beneath its own canopy, which means that the species is seral to conifer trees in most of its range in western North America (Howard 1996). Although, on sites where it is seral, it usually persists as a minor component well into later seral stages of the stand (Howard 1996).

***Viburnum edule* (low-bush cranberry)**—*Viburnum edule* (low-bush cranberry) is common in Alberta in all natural regions except the Mixed Grass Prairie. It grows in moist woods, boggy or swampy woodlands, and wet thickets (Tannas 1997a).

Viburnum edule (low-bush cranberry) is moderately shade tolerant and may be prominent in all stages of forest succession. On floodplain sites, the species is present in the pioneer willow stands, through the seral *Populus balsamifera* (balsam poplar) stages, and remains prominent in mature/climax *Picea glauca* (white spruce) and *Picea mariana* (black spruce) stands (Matthews 1992a).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is a riparian shrub species that typically occurs along stream margins and other moist to wet sites at elevations between 500 m and 3,000 m. The species is not particularly drought tolerant, and on upland sites is generally restricted to areas receiving more than 50.8 cm of annual precipitation (Gucker 2012).

Cornus stolonifera (red-osier dogwood) is typically present throughout all stages of succession, but abundance is often greater in earlier than later stages. The species occupies open sites and also occurs beneath closed canopies, but is typically more abundance in sun than in shade (Gucker 2012).

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) is common throughout most of Alberta on well drained sites having high available moisture. In drier areas, the species is restricted to shorelines, riverine floodplains, and moist slopes (Tannas 1997a). It generally occurs on moist sites, such as river floodplains, stream and lake shores, moist depressions, and swamps, but will also grow on drier sites (Harris 1990).

The species is capable of regenerating from root suckers, stump sprouts, stem sprouts, and buried branches. Root suckering is thought to be primarily a means of expansion, rather than simply a means of recovery following

clearcutting or fire. Stands are often polyclonal, with several genotypes and their sprouts occurring together in a stand (Harris 1990).

Populus balsamifera (balsam poplar) is an early seral pioneer species, which colonizes disturbed wet sites by seeding or suckering. It is among the fastest growing tree species in temperate latitudes. Rapid early growth allows it to establish on a site and to dominate it for up to 100 years. The species is highly tolerant of flooding (Harris 1990).

Livestock

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) has fair forage value, with high protein and phosphorous levels. Both its leaves and twigs are highly palatable throughout the season for livestock and wild ungulates. It is highly tolerant of heavy browsing, and is considered an increaser species and an invader of native rangeland. Clipping of its leaders stimulates growth of new suckers, as well as growth of new wood on the clipped stem (Tannas 1997a). Forage production in stands dominated by *Populus tremuloides* (aspen) varies from low to moderate, depending on stand density. Palatability of the various herbaceous species associated with this type is often high, and cattle utilization may be high as upland vegetation cures and the animals spend more time in shade that these stands provide. Livestock browse young suckers; and this, combined with trampling and soil compaction, can alter both the age structure and understory composition of stands (Thompson and Hansen 2003).

Stands of *Populus tremuloides* (aspen) are often subjected to high levels of grazing pressure because of their gentle topography and ease of access. With moderate to high, prolonged grazing pressure, palatable shrubs will be decreased relative to such species as *Symphoricarpos* species (buckbrush), *Rosa* species (rose), and *Lonicera* species (honeysuckle) in the understory. With continued long-term intense usage, a stand can be converted to the *Populus tremuloides* (aspen) community type by reduction of total shrub canopy cover to less than 25 percent (Thompson and Hansen 2003).

***Viburnum edule* (low-bush cranberry)**—*Viburnum edule* (low-bush cranberry) has fair forage value, but is little used by livestock, and increases under heavy grazing pressure (Tannas 1997a). The species palatability is low for livestock (Matthews 1992a).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is considered an “ice cream” plant by livestock and wildlife (Hansen and others 1995). In areas of Montana having experienced historic high levels of browsing by livestock, the species has been effectively eliminated from many sites.

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) has poor forage value for livestock. While nutrient levels are probably acceptable, the resinous twigs and foliage are less palatable than those of other *Populus* (poplar) species. Therefore, heavy utilization of it usually indicates an over-population of wild ungulates, or over grazing by livestock (Tannas 1997a). Stands may be subjected to high levels of grazing pressure because of gentle topography and ease of access. With prolonged moderate to high grazing pressure, palatable shrubs in the understory will decrease relative to less preferred species, such as *Symphoricarpos* species (buckbrush), *Rosa* species (rose), and *Lonicera* species (honeysuckle) (Thompson and Hansen 2003).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) timber is an important source of fiber used for pulpwood, flake-board, and other composite products. It is also used for making pallets, boxes, veneer and

plywood. Higher grades are used for solid wood products such as paneling, furniture components, and flooring (USDA National Resources Conservation Service 2023).

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) is a commercial tree in Alberta. It is used for plywood, pulpwood, boxes and crates, and to make high-grade paper and particle board (Tannas 1997a). Cutting mature *Populus balsamifera* (balsam poplar) results in sprouting from callus tissue and dormant buds. Stump sprouting is most pronounced on winter-logged areas. Trees cut in summer have few surviving sprouts after four years (Thompson and Hansen 2003).

Wildlife

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) forests provide important breeding, foraging, and resting habitat for a variety of birds and mammals. Elk browse it year-round, feeding on bark, new leaders, and sprouts. The species also provides important forage for moose, mule deer, and white-tailed deer (Howard 1996). Wildlife utilization of *Populus tremuloides* (aspen) communities varies with composition of the understory and relative age of the *Populus tremuloides* (aspen) stand. Young stands generally provide more browse. *Populus tremuloides* (aspen) crowns can grow out of reach of large ungulates in 6 to 8 years. Although many animals browse *Populus tremuloides* (aspen) year-round, it is especially valuable during fall and winter, when protein levels are high relative to other browse species (Howard 1996).

Elk browse *Populus tremuloides* (aspen) year-round, feeding on bark, buds, twigs, and sprouts. The species is important forage for mule and white-tailed deer. The deer consume leaves, buds, twigs, bark, and sprouts. New growth on burned sites or clearcuts is especially palatable to deer. Sprouts provide key summer forage for deer after herbaceous species have cured. *Populus tremuloides* (aspen) is valuable moose browse for much of the year, utilizing it on summer and winter ranges (Howard 1996).

Lagomorphs feed on *Populus tremuloides* (aspen) in summer and winter. They may girdle suckers or even mature trees, and in some parts of Canada, fairly high *Populus tremuloides* (aspen) mortality has been attributed to rabbits and hares (Howard 1996). Small rodents such as squirrels, pocket gophers, mice, and voles feed on *Populus tremuloides* (aspen) during at least part of the year. Mice and voles frequently consume *Populus tremuloides* (aspen) bark below snow level, and can girdle suckers and small trees (Howard 1996).

Beaver consume the leaves, bark, twigs, and all diameters of *Populus tremuloides* (aspen) branches. They use the stems for constructing dams and lodges, and at least temporarily, beaver can eliminate *Populus tremuloides* (aspen) from as far as 122 m from the water body. A beaver can consume 1-2 kg of aspen bark per day, and it is estimated that as many as 200 *Populus tremuloides* (aspen) trees are required to support one beaver for a year (Howard 1996).

***Viburnum edule* (low-bush cranberry)**—*Viburnum edule* (low-bush cranberry) is browsed quite readily by wild ungulates, primarily in winter months. The fruit is a valuable food source for a variety of bird species (Tannas 1997a). *Viburnum edule* (low-bush cranberry) is of low to moderate importance as browse for elk, mountain goat, bighorn sheep, deer, and caribou. The foliage is browsed by moose throughout the year. The fruits are a major food of grizzly and black bears. *Viburnum* species (cranberry) are important components of forest-edge and hedgerow habitats that provide cover for small mammals and birds (Matthews 1992a).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) provides hiding and thermal cover for small mammals and birds. The species is used for food and cover by white-tailed deer, mule deer, elk, moose, cottontail rabbits, snowshoe hares, and numerous birds (Costain 1989). Moose in particular are tall enough to reach the twigs of even the tallest plants. *Cornus stolonifera* (red-osier dogwood) fruit is low in sugar, so it is

initially less attractive to wildlife and less inclined to rot than other fruits. Consequently, the fruit stays on the plant through the winter and is available when fruits of other plants are gone (Gucker 2012).

***Populus balsamifera* (balsam poplar)**—Northern forests containing *Populus balsamifera* (balsam poplar) support a wide variety of wildlife—including moose, elk, Stone's sheep, mountain goat, mountain caribou, mule deer, wolf, coyote, black bear, grizzly bear, lynx, snowshoe hare, wolverine, and pine marten (Harris 1990). The species is a valuable resource of food and construction material for beaver (Tannas 1997a). Moose sparingly browse young *Populus balsamifera* (balsam poplar), and will strip bark from the trees in times of winter food shortage (Harris 1990). The spreading crown of *Populus balsamifera* (balsam poplar) provides nesting sites for large birds. A variety of birds and mammals, such as woodpeckers, owls, wood ducks, and squirrels, nest in trunk cavities (Hansen and others 1995).

Fisheries

***Populus tremuloides* (aspen)**—Where adjacent to streams, stands of *Populus tremuloides* (aspen) enhance fisheries by stabilizing streambanks and providing overhanging shade cover. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible (Hansen and others 1995).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is an excellent shrub for controlling erosion along streams. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

***Populus balsamifera* (balsam poplar)**—When located near a stream, stands of *Populus balsamifera* (balsam poplar) provide thermal cover, debris, and streambank stability. This is particularly important on the higher gradient streams where scouring by seasonal flooding may occur (Hansen and others 1995).

Fire

***Populus tremuloides* (aspen)**—Prescribed fire is recommended to rejuvenate *Populus tremuloides* (aspen) stands. With the recent history of fire suppression, there has been a general aging of *Populus tremuloides* (aspen) stands across western North America. While conifers may replace seral *Populus tremuloides* (aspen) stands, stable stands may become less productive. In many areas stands now live longer than they did prior to fire exclusion, and many are in decline (Howard 1996). However, wet conditions in spring and summer may limit prescribed burning to the drier fall season. Fire, sometimes in combination with cutting, can be an important tool in regenerating decadent stands (Hansen and others 1995). Brown (1984) provides information for using prescribed fire in *Populus tremuloides* (aspen) stands. Protection of newly burned or cleared sites from beaver and grazing animals may be necessary for successful stand reestablishment.

Prescribed fire is often difficult to apply in *Populus tremuloides* (aspen) stands because of the abundance of live trees and sparse distribution of fine dead fuels. Even if fuels are plentiful, they are often too moist to burn easily. Prescribed fire may be possible, however, when live vegetation cures enough to contribute to fire spread, rather than to hinder it. The optimum combination of dry weather and cured fuels occurs mostly in early spring, late summer, and fall (Howard 1996). In Alberta, these moderately severe, early season burning conditions can persist from snowmelt until the first week in June (Quintilo and others 1991). In the northern forest of Alberta, Bailey (1978) found that prescribed burning in *Populus tremuloides* (aspen) forests in spring was usually not successful at relative humidity above 35 to 40 percent. He recommended that prescribed burning be conducted 8 to 10 drying days after snowmelt, when air temperature is at least 18 degrees C, relative humidity is less than 30 percent, and winds are 9-35 km/hr.

Populus tremuloides (aspen) is the classic soboliferous species: a plant that sprouts from carbohydrate-storing lateral roots (sobols). The species generally sprouts vigorously after burning. Moderately severe fire generally

results in dense sprouting, and fewer sprouts may be produced after severe fire. A low severity surface fire may leave standing live trees that locally suppress sprouting, resulting in an uneven-aged stand. *Populus tremuloides* (aspen) burned in spring generally sprout later in the growing season and again the following year. Stands burned in late summer or fall usually sprout the next spring (Howard 1996).

Populus tremuloides (aspen) readily colonizes sites after fire, timber harvest, or other disturbance (Howard 1996). Even in stands where it was only a small component of the vegetation prior to burning, the aspen often gains dominance after a fire. The species is easily top-killed by fire, but root systems of top-killed stems continue to send up a profusion of sprouts for several years after burning. After a fire, a new, even-aged stand can develop within one decade (Howard 1996).

***Viburnum edule* (low-bush cranberry)**—*Viburnum edule* (low-bush cranberry) sprouts from the stump, roots, or underground stems after light to moderate fire. Top-killed plants usually sprout within weeks after fire, and the species often becomes a dominant shrub on the site post fire. Low-severity fires may stimulate germination of seeds stored in the soil (Matthews 1992a).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) generally increases following fire, and may invade recently burned areas from adjacent unburned areas. Above ground material is usually killed by fire. However, the roots can survive all but the most severe fires that remove the duff and heat the upper soil for an extended period. The species can sprout from surviving roots or stolons and from the base of aerial stems following fire (Fischer and Bradley 1987), but can be killed by severe fires that cause extended heating of the upper soil. Light fires that partially remove the duff stimulate germination of buried seed. In moist forests of British Columbia, *Cornus stolonifera* (red-osier dogwood) appears to increase in abundance following the removal of the shading canopy by logging or burning (Gucker 2012).

***Populus balsamifera* (balsam poplar)**—Although severe fire kills *Populus balsamifera* (balsam poplar), it is considered one of the most well adapted tree species to fire in the northern forest. Its ability to sprout from roots, stumps, and buried branches enables it to quickly recover from fire (Harris 1990). Moderate fire may top-kill some trees, but light fires usually do not harm mature *Populus balsamifera* (balsam poplar). Young trees may be top-killed because of their thin bark, and repeated burning may eliminate the species from a site by preventing regeneration (Thompson and Hansen 2003).

Populus balsamifera (balsam poplar) is most susceptible to fire during late summer and fall. If a manager wants to extend the life of a *Populus balsamifera* (balsam poplar) stand, fire ***MAY BE*** used as a tool in the pole to early mature stage of development. If fire is used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that wildlife browsing be closely monitored to protect the young sprouts (Hansen and others 1995).

Rehabilitation/Restoration Considerations

***Populus tremuloides* (aspen)**—The wide adaptability of *Populus tremuloides* (aspen) makes it well-suited for restoration and rehabilitation on a wide range of sites. Stands of this species are unique in their ability to stabilize soil and watersheds on burned and otherwise disturbed sites. The trees produce abundant litter that contains more nitrogen, phosphorus, potassium, and calcium than does the leaf litter of most other deciduous trees. This litter decays rapidly, forming a nutrient-rich humus that reduces runoff and aids in percolation of surface water. Compared to conifer stands, more snow accumulates under aspen, and snowmelt begins earlier in the spring, allowing the soil to thaw more quickly than soil under conifer trees (Howard 1996).

Populus tremuloides (aspen) can be useful in revegetating disturbed sites having moist, well-drained soils. Best results are obtained using rooted cuttings or nursery-grown stock. Once established, growth rates are rapid. The

quickly spreading aspen roots effectively stabilize exposed soils. Rooted cuttings or nursery grown seedlings are easily established on moist, well-drained soils. Growth rates are rapid and the roots of established seedlings are effective stabilizers of alluvial soil deposits (Thompson and Hansen 2003).

Populus tremuloides (aspen) seedlings transplanted onto disturbed sites have shown good establishment and are more economical to grow than vegetative cuttings. Seedlings grow a taproot and secondary roots quickly, while cuttings can be slow to establish an adequate root system. In addition, genetic diversity is greater among seedlings than cuttings. The major advantage of using cuttings is that clones with desirable traits can be selected as parent stock. Stem cuttings are especially difficult to root unless taken from young sprouts. Root cuttings taken from young sprouts are generally more successful (Howard 1996).

***Viburnum edule* (low-bush cranberry)**—The value of *Viburnum edule* (low-bush cranberry) for rehabilitation purposes has not been well documented. The species was studied for use in oil sands reclamation, but results have not been located (Matthews 1992a).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is valuable for revegetation of degraded sites, as it readily establishes along stream edges by direct seeding, transplanting rooted cuttings, or planting nursery-grown seedlings. Its rapid growth can quickly stabilize deteriorated streambanks (Gucker 2012).

***Populus balsamifera* (balsam poplar)**—*Populus balsamifera* (balsam poplar) is an important riparian species for stabilizing river banks and maintaining river islands subject to recurring scouring by floods and alluvium deposition (Thompson and Hansen 2003). With healthy natural vegetation associated, these stands are relatively stable because of the strong root systems of the associated species. Management should emphasize the understory shrub layer in streambank revegetation projects. This is most important on higher gradient streams. Managers should strive to maintain a buffer of a *Populus balsamifera* (balsam poplar) community adjacent to all rivers and streams where possible. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize the streambanks, and dissipate flood energy (Thompson and Hansen 2003).

Recreational Uses and Consideration

***Populus balsamifera* (balsam poplar)**—Because of their common proximity to streams and lakes, recreational developments and transportation corridors are common in *Populus balsamifera* (balsam poplar) stands. Opportunities in and near stands of *Populus balsamifera* (balsam poplar) are excellent for fishing, big game, and waterfowl hunting, and observing a variety of wildlife. Care must be taken when locating structures in this type due to potential for flooding (Thompson and Hansen 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- E5. Aspen/alder

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Aw/Green alder
- Aw/Rose-Low bush cranberry/Marsh reed grass
- Aw-Sw-Pl/Canada buffaloberry/Hairy wild rye

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Aw/Willow
- Pb-Aw/Red-osier dogwood/Kentucky bluegrass

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msg15 Aw/Willow (Montane Southern Ecosection)
- Mcc3 Aw/Red-osier dogwood (Montane Cypress Hills Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003).

Populus tremuloides Community Type
(aspen Community Type)

POPUTRE Community Type
Number of Stands = 20 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 7; Other Data Sets = 13)

LOCATION AND ASSOCIATED LANDFORMS

The *Populus tremuloides* (aspen) community type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This community type is usually the result of grazing disturbance, and is typically found on readily accessible moist sites around lakes, sloughs, and on alluvial terraces that have been subjected to long-term high levels of grazing pressure.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 203 shows the five most prominent plant species among the four lifeforms for species recorded in all 20 stands of the *Populus tremuloides* (aspen) community type. *Populus tremuloides* (aspen) heavily dominates this community type. *Alnus crispa* (green alder) and *Symphoricarpos albus* (snowberry) are fairly prominent shrub species, but no graminoid or forb species are more than moderately prominent.

Table 203. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Populus tremuloides* (aspen) community type (number = 20 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus tremuloides (aspen)	67.88	Native
Betula papyrifera (white birch)	3.53	Native
Pinus contorta (lodgepole pine)	1.83	Native
Populus balsamifera (balsam poplar)	1.15	Native
Picea glauca (white spruce)	0.13	Native
Shrubs		
Alnus crispa (green alder)	19.50	Native
Symphoricarpos albus (snowberry)	10.00	Native
Symphoricarpos occidentalis (buckbrush)	6.80	Native
Rosa woodsii (common wild rose)	5.33	Native
Prunus virginiana (choke cherry)	3.13	Native
Graminoids		
Bromus inermis (smooth brome)	3.50	Introduced
Poa pratensis (Kentucky bluegrass)	3.18	Introduced
Elymus innovatus (hairy wild rye)	2.15	Native
Phleum pratense (timothy)	1.68	Introduced
Agropyron repens (quack grass)	1.50	Introduced
Forbs		
Aralia nudicaulis (wild sarsaparilla)	3.60	Native
Cornus canadensis (bunchberry)	2.35	Native
Heracleum lanatum (cow parsnip)	2.18	Native
Osmorhiza chilensis (blunt-fruited sweet cicely)	2.18	Native
Fragaria virginiana (wild strawberry)	1.70	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 204 through Table 207, break out the vegetation recorded in all 20 stands sampled of the *Populus tremuloides* (aspen) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, species rich, generally disturbed, forested community type of minor occurrence across the study area.

Table 204 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus tremuloides* (aspen) community type. For the 20

stands comprising the community type, the number of unique species was 160 with 146 (91.3 percent) of them being native species.

Table 204. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Populus tremuloides* (aspen) community type (number = 20 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	7	7	0	0
Shrubs	37	36	0	1
Graminoids	31	25	4	2
Forbs	85	78	7	0
TOTAL	***160 (100.0%)***	***146 (91.3%)***	***11 (6.9%)***	***3 (1.9%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 205 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus tremuloides* (aspen) community type. The average number of species per stand is 23.2, with native species comprising 21.4 species per stand or 92.2 percent.

Table 205. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Populus tremuloides* (aspen) community type (number = 20 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.9	1.9	0.0	0.0
Shrubs	6.0	5.9	0.0	0.1
Graminoids	2.9	2.0	0.8	0.1
Forbs	12.4	11.6	0.8	0.0
TOTAL	***23.2 (100.0%)***	***21.4 (92.2%)***	***1.6 (6.9%)***	***0.2 (0.9%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 206 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Populus tremuloides* (aspen) community type. The average canopy cover per stand is 196.0 percent, with native species comprising 181.3 percent or 92.5 percent of the total amount of average canopy cover per stand.

Table 206. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Populus tremuloides* (aspen) community type (number = 20 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	74.6%	74.6%	0.0%	0.0%
Shrubs	65.2%	65.0%	0.0%	0.2%
Graminoids	17.6%	7.1%	9.9%	0.7%
Forbs	38.7%	34.7%	4.1%	0.0%
TOTAL	***196.0% (100.0%)***	***181.3% (92.5%)***	***13.9% (7.1%)***	***0.8% (0.4%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 207 shows the average number of species and average canopy cover by lifeform in stands of the *Populus tremuloides* (aspen) community type. The average number of species per stand was 23.2 with an average canopy cover of 196.0 percent.

Table 207. Average number of species and average canopy cover by lifeform in stands of the *Populus tremuloides* (aspen) community type (number = 20 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	1.9	74.6%
Shrubs	6.0	65.2%
Graminoids	2.9	17.6%
Forbs	12.4	38.7%
TOTAL	***23.2***	***196.0%***

Sampled Stands Plant Species List

The *Populus tremuloides* (aspen) community type contains stands dominated by *Populus tremuloides* (aspen), but which do not key out to either of the *Populus tremuloides* (aspen) community types described above. Stands of this community type often have disturbed understories. Seven tree species were recorded in the 20 stands sampled, with *Populus tremuloides* (aspen) being by far the most prominent (Table 208). Thirty-seven shrubs were recorded, led by *Alnus crispa* (green alder) and *Symphoricarpos albus* (snowberry), with *Rosa woodsii* (common wild rose) and *Symphoricarpos occidentalis* (buckbrush) close behind. Of 31 graminoids recorded, none were very prominent, but the two leaders were the non-native grazing increasers, *Bromus inermis* (smooth brome) and *Poa pratensis* (Kentucky bluegrass). None of the 85 forbs recorded were especially prominent.

Table 208. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Populus tremuloides* (aspen) community type (number = 20 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 7)					
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	5	0.03	N
Betula papyrifera (white birch)	35.3	0-70	10	3.53	N
Picea glauca (white spruce)	0.5	0-0.5	25	0.13	N
Picea mariana (black spruce)	0.5	0-0.5	5	0.03	N
Pinus contorta (lodgepole pine)	7.3	0-20	25	1.83	N
Populus balsamifera (balsam poplar)	7.7	0-10	15	1.15	N
Populus tremuloides (aspen)	67.9	10-97.5	100	67.88	N
Shrubs (N = 37)					
Acer glabrum (mountain maple)	0.5	0-0.5	5	0.03	N
Alnus crispa (green alder)	55.7	0-90	35	19.50	N
Alnus tenuifolia (river alder)	20.0	0-20	5	1.00	N
Amelanchier alnifolia (Saskatoon)	7.5	0-20	40	3.00	N
Arctostaphylos uva-ursi (common bearberry)	3.0	0-3	5	0.15	N
Berberis repens (creeping mahonia)	10.0	0-10	10	1.00	N
Clematis ligusticifolia (western clematis)	0.5	0-0.5	5	0.03	N
Clematis occidentalis (purple clematis)	0.5	0-0.5	5	0.03	N
Cornus stolonifera (red-osier dogwood)	0.5	0-0.5	15	0.08	N
Crataegus douglasii (Douglas hawthorn)	3.0	0-3	10	0.30	N
Crataegus rotundifolia (round-leaved hawthorn)	10.0	0-10	5	0.50	N
Juniperus scopulorum (Rocky Mountain juniper)	0.5	0-0.5	5	0.03	N
Ledum groenlandicum (common Labrador tea)	1.8	0-3	10	0.18	N
Linnaea borealis (twinflower)	4.6	0-10	35	1.63	N
Lonicera involucrata (bracted honeysuckle)	1.8	0-3	20	0.35	N
Prunus virginiana (choke cherry)	8.9	0-40	35	3.13	N
Ribes americanum (wild black currant)	20.0	0-20	5	1.00	N
Ribes lacustre (bristly black currant)	0.5	0-0.5	10	0.05	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	5	0.03	N
Ribes spp. (currant)	1.8	0-3	10	0.18	B
Rosa acicularis (prickly rose)	5.1	0-20	50	2.55	N
Rosa woodsii (common wild rose)	15.2	0-60	35	5.33	N
Rubus idaeus (wild red raspberry)	4.1	0-10	20	0.83	N
Rubus parviflorus (thimbleberry)	30.0	0-30	5	1.50	N
Rubus pubescens (dewberry)	3.0	0-3	20	0.60	N
Salix boothii (Booth's willow)	0.5	0-0.5	5	0.03	N
Shepherdia canadensis (Canada buffaloberry)	3.7	0-10	15	0.55	N
Sorbus scopulina (western mountain-ash)	3.0	0-3	5	0.15	N
Spiraea betulifolia (white meadowsweet)	2.6	0-10	35	0.90	N
Symphoricarpos albus (snowberry)	50.0	0-70	20	10.00	N
Symphoricarpos occidentalis (buckbrush)	15.1	0-40	45	6.80	N
Symphoricarpos spp. (snowberry)	20.0	0-20	5	1.00	N
Vaccinium caespitosum (dwarf bilberry)	0.5	0-0.5	10	0.05	N

Table 208. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Vaccinium membranaceum (tall bilberry)	5.3	0-10	10	0.53	N
Vaccinium myrtilloides (common blueberry)	0.5	0-0.5	5	0.03	N
Vaccinium vitis-idaea (bog cranberry)	20.3	0-40	10	2.03	N
Viburnum edule (low-bush cranberry)	0.5	0-0.5	30	0.15	N
Graminoids (N = 31)					
Agropyron dasystachyum (northern wheat grass)	3.0	0-3	5	0.15	N
Agropyron repens (quack grass)	15.0	0-20	10	1.50	I
Agropyron smithii (western wheat grass)	0.5	0-0.5	5	0.03	N
Agropyron trachycaulum (slender wheat grass)	1.8	0-3	10	0.18	N
Agrostis scabra (rough hair grass)	3.0	0-3	10	0.30	N
Alopecurus occidentalis (alpine foxtail)	3.0	0-3	5	0.15	N
Bromus carinatus (keeled brome)	3.0	0-3	5	0.15	N
Bromus ciliatus (fringed brome)	3.0	0-3	5	0.15	N
Bromus inermis (smooth brome)	23.3	0-30	15	3.50	I
Bromus vulgaris (woodland brome)	0.5	0-0.5	5	0.03	N
Calamagrostis canadensis (marsh reed grass)	2.2	0-3	15	0.33	N
Calamagrostis rubescens (pine reed grass)	3.0	0-3	10	0.30	N
Calamagrostis stricta (narrow reed grass)	3.0	0-3	5	0.15	N
Carex diandra (two-stamened sedge)	0.5	0-0.5	5	0.03	N
Carex obtusata (blunt sedge)	3.0	0-3	5	0.15	N
Carex praegracilis (graceful sedge)	0.5	0-0.5	5	0.03	N
Carex sprengelii (Sprengel's sedge)	5.3	0-10	10	0.53	N
Carex torreyi (Torrey's sedge)	0.5	0-0.5	5	0.03	N
Elymus canadensis (Canada wild rye)	0.5	0-0.5	5	0.03	N
Elymus glaucus (smooth wild rye)	0.5	0-0.5	5	0.03	N
Elymus innovatus (hairy wild rye)	10.8	0-20	20	2.15	N
Elymus virginicus (Virginia wild rye)	1.8	0-3	20	0.35	N
Festuca spp. (fescue)	10.0	0-10	5	0.50	B
Hordeum jubatum (foxtail barley)	0.5	0-0.5	5	0.03	N
Melica subulata (Alaska onion grass)	10.3	0-20	10	1.03	N
Phleum pratense (timothy)	6.7	0-10	25	1.68	I
Poa palustris (fowl bluegrass)	3.0	0-3	5	0.15	N
Poa pratensis (Kentucky bluegrass)	12.7	0-40	25	3.18	I
Poa spp. (bluegrass)	3.0	0-3	5	0.15	B
Schizachne purpurascens (purple oat grass)	0.5	0-0.5	5	0.03	N
Trisetum canescens (tall trisetum)	4.5	0-10	15	0.68	N
Forbs (N = 85)					
Achillea millefolium (common yarrow)	1.5	0-3	25	0.38	N
Actaea rubra (red and white baneberry)	2.0	0-3	25	0.50	N
Angelica arguta (white angelica)	1.8	0-3	10	0.18	N
Antennaria anaphaloides (tall everlasting)	0.5	0-0.5	5	0.03	N
Aralia nudicaulis (wild sarsaparilla)	12.0	0-40	30	3.60	N
Arnica cordifolia (heart-leaved arnica)	2.9	0-10	30	0.88	N
Arnica latifolia (broad-leaved arnica)	0.5	0-0.5	5	0.03	N

Table 208. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Asparagus officinalis (asparagus)	0.5	0-0.5	5	0.03	I
Aster ciliolatus (Lindley's aster)	1.1	0-3	20	0.23	N
Aster conspicuus (showy aster)	1.3	0-3	30	0.40	N
Aster eatonii (Eaton's aster)	0.5	0-0.5	5	0.03	N
Aster hesperius (western willow aster)	0.5	0-0.5	10	0.05	N
Aster laevis (smooth aster)	0.5	0-0.5	25	0.13	N
Athyrium filix-femina (lady fern)	0.5	0-0.5	5	0.03	N
Campanula rotundifolia (harebell)	0.5	0-0.5	10	0.05	N
Castilleja miniata (common red paintbrush)	0.5	0-0.5	5	0.03	N
Cirsium arvense (Canada thistle)	4.1	0-10	20	0.83	I
Cirsium vulgare (bull thistle)	30.0	0-30	5	1.50	I
Cornus canadensis (bunchberry)	6.7	0-20	35	2.35	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	5	0.03	N
Disporum trachycarpum (fairybells)	0.5	0-0.5	15	0.08	N
Dryopteris assimilis (broad spinulose shield fern)	10.0	0-10	5	0.50	N
Epilobium angustifolium (common fireweed)	3.5	0-10	40	1.40	N
Equisetum arvense (common horsetail)	1.3	0-3	15	0.20	N
Equisetum hyemale (common scouring-rush)	20.0	0-20	5	1.00	N
Equisetum sylvaticum (woodland horsetail)	0.5	0-0.5	5	0.03	N
Erythronium grandiflorum (glacier lily)	10.3	0-20	10	1.03	N
Fragaria vesca (woodland strawberry)	0.5	0-0.5	5	0.03	N
Fragaria virginiana (wild strawberry)	3.4	0-10	50	1.70	N
Galium boreale (northern bedstraw)	1.3	0-3	50	0.63	N
Galium triflorum (sweet-scented bedstraw)	3.6	0-20	35	1.28	N
Geranium richardsonii (wild white geranium)	2.9	0-10	40	1.18	N
Geranium viscosissimum (sticky purple geranium)	0.5	0-0.5	15	0.08	N
Geum aleppicum (yellow avens)	3.0	0-3	5	0.15	N
Geum macrophyllum (large-leaved yellow avens)	1.8	0-3	10	0.18	N
Habenaria hyperborea (northern green bog orchid)	3.0	0-3	5	0.15	N
Hackelia americana (nodding stickseed)	0.5	0-0.5	10	0.05	N
Hackelia floribunda (large-flowered stickseed)	0.5	0-0.5	5	0.03	N
Hackelia jessicae (Jessica's stickseed)	0.5	0-0.5	5	0.03	N
Heracleum lanatum (cow parsnip)	14.5	0-40	15	2.18	N
Lathyrus ochroleucus (cream-colored vetchling)	2.4	0-10	45	1.08	N
Lomatium dissectum (mountain wild parsnip)	3.0	0-3	5	0.15	N
Lycopodium annotinum (stiff club-moss)	0.5	0-0.5	5	0.03	N
Lycopodium complanatum (ground-cedar)	0.5	0-0.5	5	0.03	N
Lycopodium obscurum (ground-pine)	0.5	0-0.5	5	0.03	N
Lysimachia ciliata (fringed loosestrife)	0.5	0-0.5	5	0.03	N
Maianthemum canadense (wild lily-of-the-valley)	2.9	0-10	25	0.73	N
Medicago lupulina (black medick)	3.0	0-3	5	0.15	I
Medicago sativa (alfalfa)	0.5	0-0.5	5	0.03	I
Mentha arvensis (wild mint)	3.0	0-3	5	0.15	N
Mertensia paniculata (tall lungwort)	2.4	0-3	20	0.48	N

Table 208. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Mitella nuda (bishop's-cap)	4.8	0-10	25	1.20	N
Monarda fistulosa (wild bergamot)	1.8	0-3	10	0.18	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	10.9	0-20	20	2.18	N
Osmorhiza depauperata (spreading sweet cicely)	3.5	0-10	20	0.70	N
Osmorhiza occidentalis (western sweet cicely)	0.5	0-0.5	5	0.03	N
Osmorhiza spp. (sweet cicely)	0.5	0-0.5	5	0.03	N
Petasites frigidus (arctic sweet coltsfoot)	0.5	0-0.5	5	0.03	N
Petasites palmatus (palmate-leaved coltsfoot)	2.9	0-10	25	0.73	N
Plantago major (common plantain)	0.5	0-0.5	5	0.03	I
Pyrola asarifolia (common pink wintergreen)	0.9	0-3	30	0.28	N
Pyrola elliptica (white wintergreen)	3.0	0-3	5	0.15	N
Pyrola grandiflora (Arctic wintergreen)	0.5	0-0.5	5	0.03	N
Ranunculus uncinatus (hairy buttercup)	0.5	0-0.5	10	0.05	N
Sanicula marilandica (snakeroot)	1.3	0-3	15	0.20	N
Senecio foetidus (marsh butterweed)	10.0	0-10	5	0.50	N
Senecio pauperculus (balsam groundsel)	1.8	0-3	10	0.18	N
Senecio pseudaureus (thin-leaved ragwort)	1.8	0-3	10	0.18	N
Silene menziesii (Menzies'catchfly)	0.5	0-0.5	5	0.03	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	10	0.05	N
Smilacina stellata (star-flowered Solomon's-seal)	0.9	0-3	30	0.28	N
Solidago canadensis (Canada goldenrod)	15.0	0-20	10	1.50	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1.1	0-3	20	0.23	N
Taraxacum ceratophorum (northern dandelion)	0.5	0-0.5	5	0.03	N
Taraxacum officinale (common dandelion)	4.3	0-10	35	1.50	I
Thalictrum dasycarpum (tall meadow rue)	10.0	0-10	5	0.50	N
Thalictrum occidentale (western meadow rue)	1.8	0-3	20	0.35	N
Thalictrum venulosum (veiny meadow rue)	3.0	0-3	10	0.30	N
Urtica dioica (common nettle)	1.8	0-3	10	0.18	N
Valeriana sitchensis (mountain valerian)	0.5	0-0.5	5	0.03	N
Veratrum eschscholtzii (green false hellebore)	0.5	0-0.5	5	0.03	N
Vicia americana (wild vetch)	0.9	0-3	30	0.28	N
Viola adunca (early blue violet)	0.5	0-0.5	5	0.03	N
Viola canadensis (western Canada violet)	2.5	0-10	30	0.75	N
Viola glabella (yellow wood violet)	3.0	0-3	5	0.15	N

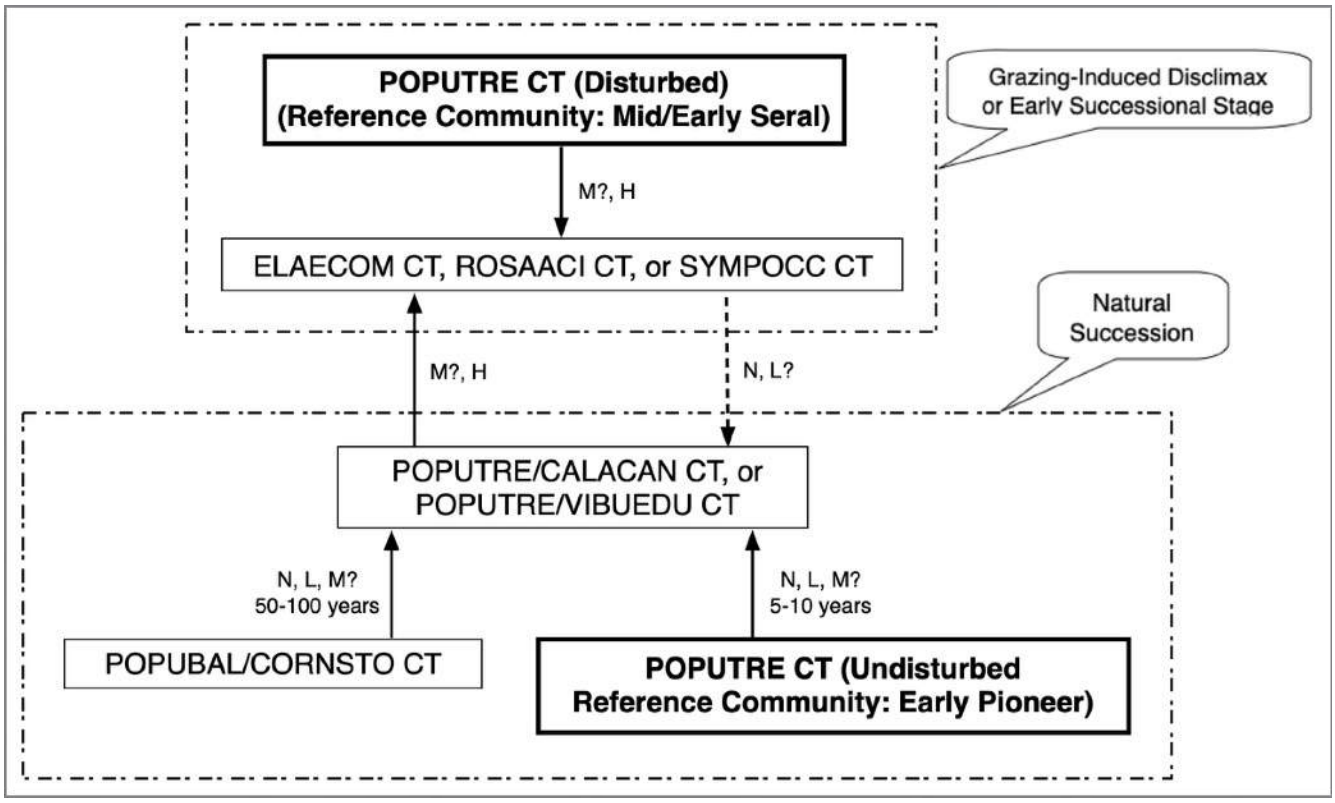
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Populus tremuloides* (aspen) community type is usually the result of long term heavy grazing disturbance of the *Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type or the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type. Such intensive utilization often removes the palatable understory graminoid and/or shrub components, leaving the *Populus tremuloides* (aspen) canopy dominating a disturbed understory.

Figure 44 shows a schematic diagram of vegetation successional pathways on sites of the *Populus tremuloides* (aspen) community type.



Successional Pathway of *Populus tremuloides* (aspen) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Populus tremuloides* (aspen) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
ELAECOM CT—*Elaeagnus commutata* (silverberry) community type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
POPUTRE/CALACAN CT—*Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type
POPUTRE CT—*Populus tremuloides* (aspen) community type
POPUTRE/VIBUEDU CT—*Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type
ROSAACI CT—*Rosa acicularis* (prickly rose) community type
SYMPOCC CT—*Symphoricarpos occidentalis* (buckbrush) community type

Figure 44. Successional pathway for sites of the *Populus tremuloides* (aspen) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types. We see little indication that *Salix* (willows) or such late seral species as *Viburnum edule* (low-bush cranberry) can become re-established on sites that have become dominated by rhizomatous, disturbance induced competitors (e.g., *Symphoricarpos occidentalis* [buckbrush], *Rosa acicularis* [prickly rose], *Elaeagnus commutata* [silverberry], *Bromus inermis* [smooth brome], *Poa pratensis* [Kentucky bluegrass], etc.).

EDATOPE

Figure 45 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Populus tremuloides* (aspen) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

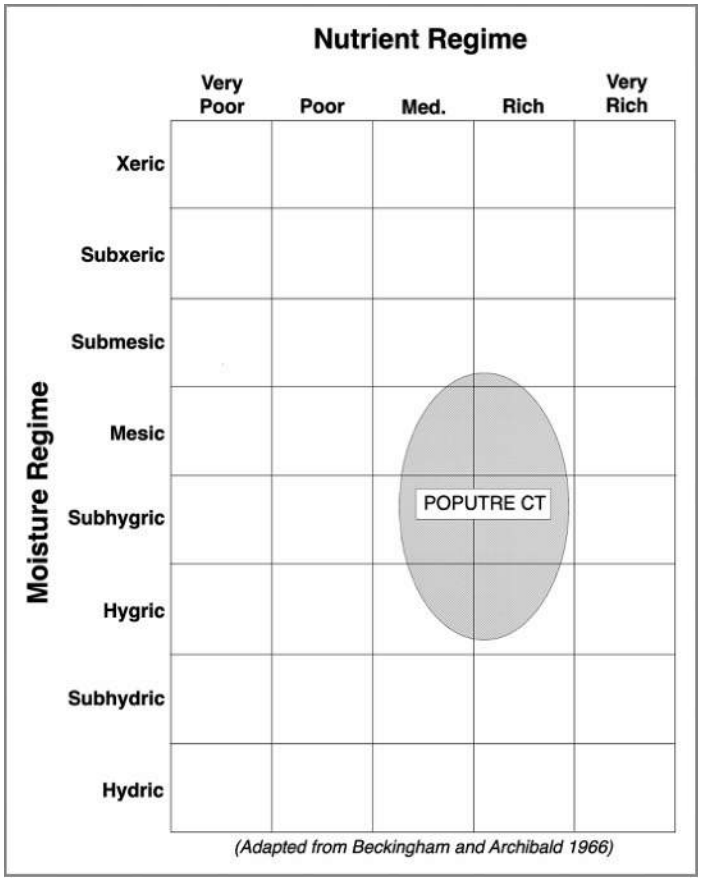


Figure 45. Edatope grid position for the *Populus tremuloides* (aspen) community type (POPUTRE CT)

SOILS

Parent material on sites supporting the *Populus tremuloides* (aspen) community type are mostly morainal and eolian, and soils are mostly brunisols regosols, and luvisols. Sites of this community type typically have organic layer thickness less than 5 cm, and are moderately well drained to rapidly drained, with surface texture ranging from silt loam to loam (Baker and others 2020, France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites are typically dominated by *Salix* species (willow), *Alnus* species (alder), *Carex* species (sedge), or *Calamagrostis canadensis* (marsh reed grass). Adjacent drier sites are likely to be dominated by *Populus tremuloides* (aspen) or *Picea glauca* (white spruce) upland communities.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) is common and widely distributed across Alberta, often forming large groves. However, in dry areas, it is restricted to moist depression sites (Tannas 1997a). The species occurs on a wide variety of sites, such as moist uplands, dry mountainsides, avalanche chutes, talus slopes, parklands, valley bottoms, alluvial terraces, and along streams and lake shorelines (Howard 1996). It grows on soils ranging from shallow and rocky to deep loamy sands and heavy clays. The best *Populus tremuloides* (aspen) sites are usually well drained, loamy, and high in both organic matter and nutrients (Howard 1996).

Populus tremuloides (aspen) is shade intolerant and cannot reproduce new seedlings beneath its own canopy, which means that the species is seral to conifer trees in most of its range in western North America (Howard 1996). Although, on sites where it is seral, it usually persists as a minor component well into later seral stages of the stand (Howard 1996).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) is found in woodlands and thickets, in moist or boggy woods, along streams, in coniferous forests, and sometimes in sandy woods (Tannas 1997a). The species is a valuable understory component, protecting the soil along water courses and as a pioneer species on disturbed mineral soil. It improves the soil by adding organic matter and by fixing nitrogen (Tannas 1997a).

Alnus crispa (green alder) is a semi-shade tolerant pioneer, or seral, species. It invades and inhabits terraces above the floodplain that are subject to occasional flooding (Matthews 1992).

Livestock

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) has fair forage value, with high protein and phosphorous levels. Both its leaves and twigs are highly palatable throughout the season for livestock and wild ungulates. It is highly tolerant of heavy browsing, and is considered an increaser species and an invader of native rangeland. Clipping of its leaders stimulates growth of new suckers, as well as growth of new wood on the clipped stem (Tannas 1997a). Forage production in stands dominated by *Populus tremuloides* (aspen) varies from low to moderate, depending on stand density. Palatability of the various herbaceous species associated with this type is often high, and cattle utilization may be high as upland vegetation cures and the animals spend more time in shade that these stands provide. Livestock browse young suckers; and this, combined with trampling and soil compaction, can alter both the age structure and understory composition of stands (Thompson and Hansen 2003).

Stands of *Populus tremuloides* (aspen) are often subjected to high levels of grazing pressure because of their gentle topography and ease of access. With moderate to high, prolonged grazing pressure, palatable shrubs will be decreased relative to such species as *Symphoricarpos* species (buckbrush), *Rosa* species (rose), and *Lonicera* species (honeysuckle) in the understory. With continued long-term intense usage, a stand can be converted to the *Populus tremuloides* (aspen) community type by reduction of total shrub canopy cover to less than 25 percent (Thompson and Hansen 2003).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) provides fair to poor forage value. Although the leaves and twigs are thought to be nutritious and to have a fairly high protein content, the species ranks quite low in palatability, and is used only sparingly by both livestock and wild ungulates (Tannas 1997a). *Alnus crispa* (green alder) is considered an increaser in response to grazing, reproducing rapidly by both rhizomes and seed, while being fairly resistant to browsing (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Timber

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) timber is an important source of fiber used for pulpwood, flake-board, and other composite products. It is also used for making pallets, boxes, veneer and plywood. Higher grades are used for solid wood products such as paneling, furniture components, and flooring (USDA National Resources Conservation Service 2023).

Wildlife

***Populus tremuloides* (aspen)**—*Populus tremuloides* (aspen) forests provide important breeding, foraging, and resting habitat for a variety of birds and mammals. Elk browse it year-round, feeding on bark, new leaders, and sprouts. The species also provides important forage for moose, mule deer, and white-tailed deer (Howard 1996). Wildlife utilization of *Populus tremuloides* (aspen) communities varies with composition of the understory and relative age of the *Populus tremuloides* (aspen) stand. Young stands generally provide more browse. *Populus tremuloides* (aspen) crowns can grow out of reach of large ungulates in 6 to 8 years. Although many animals browse *Populus tremuloides* (aspen) year-round, it is especially valuable during fall and winter, when protein levels are high relative to other browse species (Howard 1996).

Elk browse *Populus tremuloides* (aspen) year-round, feeding on bark, buds, twigs, and sprouts. The species is important forage for mule and white-tailed deer. The deer consume leaves, buds, twigs, bark, and sprouts. New growth on burned sites or clearcuts is especially palatable to deer. Sprouts provide key summer forage for deer after herbaceous species have cured. *Populus tremuloides* (aspen) is valuable moose browse for much of the year, utilizing it on summer and winter ranges (Howard 1996).

Lagomorphs feed on *Populus tremuloides* (aspen) in summer and winter. They may girdle suckers or even mature trees, and in some parts of Canada, fairly high *Populus tremuloides* (aspen) mortality has been attributed to rabbits and hares (Howard 1996). Small rodents such as squirrels, pocket gophers, mice, and voles feed on *Populus tremuloides* (aspen) during at least part of the year. Mice and voles frequently consume *Populus tremuloides* (aspen) bark below snow level, and can girdle suckers and small trees (Howard 1996).

Beaver consume the leaves, bark, twigs, and all diameters of *Populus tremuloides* (aspen) branches. They use the stems for constructing dams and lodges, and at least temporarily, beaver can eliminate *Populus tremuloides* (aspen) from as far as 122 m from the water body. A beaver can consume 1-2 kg of aspen bark per day, and it is estimated that as many as 200 *Populus tremuloides* (aspen) trees are required to support one beaver for a year (Howard 1996).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) leaves and young growth are readily eaten in severe weather and when other food supplies are scarce, primarily on elk and moose winter range in the upper foothills. Furthermore, the species provides important cover and habitat for wildlife, and is an important source of food for beaver (Tannas 1997a). Muskrat, beaver, cottontail, and snowshoe hares feed on alder twigs and foliage

(Matthews 1992). Many birds eat alder seeds, buds, and catkins. The species is also an important component of white-tailed ptarmigan winter forage (Matthews 1992).

Fisheries

***Populus tremuloides* (aspen)**—Where adjacent to streams, stands of *Populus tremuloides* (aspen) enhance fisheries by stabilizing streambanks and providing overhanging shade cover. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible (Hansen and others 1995).

Fire

***Populus tremuloides* (aspen)**—Prescribed fire is recommended to rejuvenate *Populus tremuloides* (aspen) stands. With the recent history of fire suppression, there has been a general aging of *Populus tremuloides* (aspen) stands across western North America. While conifers may replace seral *Populus tremuloides* (aspen) stands, stable stands may become less productive. In many areas stands now live longer than they did prior to fire exclusion, and many are in decline (Howard 1996). However, wet conditions in spring and summer may limit prescribed burning to the drier fall season. Fire, sometimes in combination with cutting, can be an important tool in regenerating decadent stands (Hansen and others 1995). Brown (1984) provides information for using prescribed fire in *Populus tremuloides* (aspen) stands. Protection of newly burned or cleared sites from beaver and grazing animals may be necessary for successful stand reestablishment.

Prescribed fire is often difficult to apply in *Populus tremuloides* (aspen) stands because of the abundance of live trees and sparse distribution of fine dead fuels. Even if fuels are plentiful, they are often too moist to burn easily. Prescribed fire may be possible, however, when live vegetation cures enough to contribute to fire spread, rather than to hinder it. The optimum combination of dry weather and cured fuels occurs mostly in early spring, late summer, and fall (Howard 1996). In Alberta, these moderately severe, early season burning conditions can persist from snowmelt until the first week in June (Quintilo and others 1991). In the northern forest of Alberta, Bailey (1978) found that prescribed burning in *Populus tremuloides* (aspen) forests in spring was usually not successful at relative humidity above 35 to 40 percent. He recommended that prescribed burning be conducted 8 to 10 drying days after snowmelt, when air temperature is at least 18 degrees C, relative humidity is less than 30 percent, and winds are 9-35 km/hr.

Populus tremuloides (aspen) is the classic soboliferous species: a plant that sprouts from carbohydrate-storing lateral roots (sobols). The species generally sprouts vigorously after burning. Moderately severe fire generally results in dense sprouting, and fewer sprouts may be produced after severe fire. A low severity surface fire may leave standing live trees that locally suppress sprouting, resulting in an uneven-aged stand. *Populus tremuloides* (aspen) burned in spring generally sprout later in the growing season and again the following year. Stands burned in late summer or fall usually sprout the next spring (Howard 1996).

Populus tremuloides (aspen) readily colonizes sites after fire, timber harvest, or other disturbance (Howard 1996). Even in stands where it was only a small component of the vegetation prior to burning, the aspen often gains dominance after a fire. The species is easily top-killed by fire, but root systems of top-killed stems continue to send up a profusion of sprouts for several years after burning. After a fire, a new, even-aged stand can develop within one decade (Howard 1996).

***Alnus crispa* (green alder)**—Following fire, *Alnus crispa* (green alder) resprouts from the root crowns and establishes by seed from plants in nearby unburned areas. The bare mineral soil created by fire provides prime sites for *Alnus crispa* (green alder) establishment. The species does not burn easily, and dense stands can sometimes prevent fire spread. These shrubs provide shade that reduces soil temperatures, allowing spruce and other conifer trees to become established (Matthews 1992).

Rehabilitation/Restoration Considerations

***Populus tremuloides* (aspen)**—The wide adaptability of *Populus tremuloides* (aspen) makes it well-suited for restoration and rehabilitation on a wide range of sites. Stands of this species are unique in their ability to stabilize soil and watersheds on burned and otherwise disturbed sites. The trees produce abundant litter that contains more nitrogen, phosphorus, potassium, and calcium than does the leaf litter of most other deciduous trees. This litter decays rapidly, forming a nutrient-rich humus that reduces runoff and aids in percolation of surface water. Compared to conifer stands, more snow accumulates under aspen, and snowmelt begins earlier in the spring, allowing the soil to thaw more quickly than soil under conifer trees (Howard 1996).

Populus tremuloides (aspen) can be useful in revegetating disturbed sites having moist, well-drained soils. Best results are obtained using rooted cuttings or nursery-grown stock. Once established, growth rates are rapid. The quickly spreading aspen roots effectively stabilize exposed soils. Rooted cuttings or nursery grown seedlings are easily established on moist, well-drained soils. Growth rates are rapid and the roots of established seedlings are effective stabilizers of alluvial soil deposits (Thompson and Hansen 2003).

Populus tremuloides (aspen) seedlings transplanted onto disturbed sites have shown good establishment and are more economical to grow than vegetative cuttings. Seedlings grow a taproot and secondary roots quickly, while cuttings can be slow to establish an adequate root system. In addition, genetic diversity is greater among seedlings than cuttings. The major advantage of using cuttings is that clones with desirable traits can be selected as parent stock. Stem cuttings are especially difficult to root unless taken from young sprouts. Root cuttings taken from young sprouts are generally more successful (Howard 1996).

***Alnus crispa* (green alder)**—The major value of *Alnus crispa* (green alder) in rehabilitation is its ability to invade sterile soil, thereby increasing the organic matter content and by nitrogen fixation (Matthews 1992). The species was noted for its ability to colonize tailings at the Discovery Mine in Northwest Territories (Matthews 1992).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Populus tremuloides* (aspen) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- E10. Aspen/white meadowsweet

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Aw-Sw-Pl//Hairy wild rye

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Aw/Alder
- Aw/Cow parsnip/Kentucky bluegrass
- Aw/Foothills rough fescue/Strawberry
- Aw/Snowberry/Kentucky bluegrass
- Aw/Timothy-Kentucky bluegrass
- Aw/White meadowsweet/Kentucky bluegrass

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msg9 Aw/Snowberry/Kentucky bluegrass (Montane Southern Ecosection)
- Msg7 Aw/Timothy-Kentucky bluegrass (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Populus tremuloides* (aspen) community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995);
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001);
- *Classification and Management of the Fort Harrison and Limestone Hills Training Area* (West Central Montana) Ecological Solutions Group 2017); and
- *Classification and Management of Upland, Riparian, and Wetland Sites of USDI Bureau of Land Management's Miles City Field Office, Eastern Montana USA* (Hansen and others 2008).

Salix barclayi/Deschampsia cespitosa Habitat Type (Barclay's willow/tufted hair grass Habitat Type)

SALIBAR/DESCCES Habitat Type
Number of Stands = 10 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 10; Other Data Sets = 0)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. This is one of the drier willow dominated habitat types. It is typically found on moist sites on glacial moraines, along lake shores and river banks, and moist-to-mesic forest openings.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 209 shows the five most prominent plant species among the four lifeforms for species recorded in all 10 stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type. *Salix barclayi* (Barclay's willow) is most prominent, followed by *Betula glandulosa* (bog birch), *Carex preslii* (Presl sedge), *Deschampsia cespitosa* (tufted hair grass), and *Aster ciliolatus* (Lindley's aster). No other species is more than moderately prominent in these stands.

Table 209. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (number = 10 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	0.30	Native
Shrubs		
Salix barclayi (Barclay's willow)	33.00	Native
Betula glandulosa (bog birch)	17.30	Native
Dryas drummondii (yellow mountain avens)	1.00	Native
Potentilla fruticosa (shrubby cinquefoil)	0.70	Native
Ribes lacustre (bristly black currant)	0.65	Native
Graminoids		
Carex preslii (Presl sedge)	17.10	Native
Deschampsia cespitosa (tufted hair grass)	15.00	Native
Agropyron trachycaulum (slender wheat grass)	8.10	Native
Elymus innovatus (hairy wild rye)	7.10	Native
Schizachne purpurascens (purple oat grass)	6.25	Native
Forbs		
Aster ciliolatus (Lindley's aster)	11.20	Native
Fragaria virginiana (wild strawberry)	6.05	Native
Thalictrum venulosum (veiny meadow rue)	5.30	Native
Achillea millefolium (common yarrow)	5.25	Native
Geum triflorum (three-flowered avens)	4.10	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 210 through Table 213, break out the vegetation recorded in all 10 stands sampled of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, species rich, shrub dominated habitat type of incidental occurrence across the study area.

Table 210 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type. For the 10 stands comprising the habitat type, the number of unique species was 82 with 75 (91.5 percent) of them being native species.

Table 210. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (number = 10 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	8	8	0	0
Graminoids	23	19	3	1
Forbs	50	47	3	0
TOTAL	***82 (100.0%)***	***75 (91.5%)***	***6 (7.3%)***	***1 (1.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 211 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type. The average number of species per stand is 35.6, with native species comprising 33.2 species per stand or 93.3 percent.

Table 211. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (number = 10 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.1	0.1	0.0	0.0
Shrubs	3.7	3.7	0.0	0.0
Graminoids	10.8	9.2	1.2	0.4
Forbs	21.0	20.2	0.8	0.0
TOTAL	***35.6 (100.0%)***	***33.2 (93.3%)***	***2.0 (5.6%)***	***0.4 (1.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 212 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type. The average canopy cover per stand is 193.2 percent, with native species comprising 189.1 percent or 97.9 percent of the total amount of average canopy cover per stand.

Table 212. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (number = 10 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.3%	0.3%	0.0%	0.0%
Shrubs	53.6%	53.6%	0.0%	0.0%
Graminoids	84.3%	81.6%	2.5%	0.2%
Forbs	55.0%	53.6%	1.4%	0.0%
TOTAL	***193.2% (100.0%)***	***189.1% (97.9%)***	***3.9% (2.0%)***	***0.2% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 213 shows the average number of species and average canopy cover by lifeform in stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type. The average number of species per stand was 35.6 with an average canopy cover of 193.2 percent.

Table 213. Average number of species and average canopy cover by lifeform in stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (number = 10 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.1	0.3%
Shrubs	3.7	53.6%
Graminoids	10.8	84.3%
Forbs	21.0	55.0%
TOTAL	***35.6***	***193.2%***

Sampled Stands Plant Species List

A total of 82 plant species were recorded on at least one of the six stands sampled of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (Table 214). One tree species was recorded in a small amount on one plot. Among the eight shrub species recorded, only *Salix barclayi* (Barclay's willow) and *Betula glandulosa* (bog birch) are very prominent. Among the graminoids, *Carex aquatilis* (water sedge) is the most prominent of 10 species recorded, while of 17 forbs recorded, none is notably prominent.

Table 214. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (number = 10 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 1)					
Picea glauca (white spruce)	3.0	0-3	10	0.30	N
Shrubs (N = 8)					
Arctostaphylos uva-ursi (common bearberry)	3.0	0-3	10	0.30	N
Betula glandulosa (bog birch)	17.3	0.5-80	100	17.30	N
Dryas drummondii (yellow mountain avens)	10.0	0-10	10	1.00	N
Potentilla fruticosa (shrubby cinquefoil)	1.8	0-3	40	0.70	N
Ribes lacustre (bristly black currant)	2.2	0-3	30	0.65	N
Rosa acicularis (prickly rose)	0.5	0-0.5	10	0.05	N
Rubus arcticus (dwarf raspberry)	0.9	0-3	70	0.60	N
Salix barclayi (Barclay's willow)	33.0	10-60	100	33.00	N
Graminoids (N = 23)					
Agroelymus hirtiflorus (slender wheat grass x hairy wild rye hybrid)	10.0	0-10	10	1.00	N
Agropyron trachycaulum (slender wheat grass)	9.0	0-20	90	8.10	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	20	0.10	N
Bromus ciliatus (fringed brome)	6.8	0-10	30	2.05	N
Bromus inermis (smooth brome)	0.5	0-0.5	10	0.05	I
Bromus inermis subsp. *pumpellianus* (northern awnless brome)	0.5	0-0.5	60	0.30	N
Calamagrostis canadensis (marsh reed grass)	12.6	0-20	40	5.05	N
Carex aquatilis (water sedge)	50.0	0-50	10	5.00	N
Carex preslii (Presl sedge)	19.0	0-30	90	17.10	N
Danthonia californica (California oat grass)	6.9	0-20	60	4.15	N
Deschampsia cespitosa (tufted hair grass)	15.0	10-20	100	15.00	N
Elymus innovatus (hairy wild rye)	14.2	0-30	50	7.10	N
Festuca rubra (red fescue)	0.5	0-0.5	40	0.20	B
Festuca saximontana (Rocky Mountain fescue)	5.6	0-10	70	3.95	N
Festuca scabrella (rough fescue)	0.5	0-0.5	20	0.10	N
Helictotrichon hookeri (Hooker's oat grass)	0.5	0-0.5	10	0.05	N
Hierochloe odorata (sweet grass)	0.5	0-0.5	10	0.05	N
Juncus balticus (wire rush)	5.7	0.5-40	100	5.65	N
Koeleria macrantha (June grass)	1.1	0-3	40	0.45	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	30	0.15	N
Phleum pratense (timothy)	3.7	0-10	30	1.10	I
Poa pratensis (Kentucky bluegrass)	1.7	0-10	80	1.35	I
Schizachne purpurascens (purple oat grass)	7.8	0-30	80	6.25	N
Forbs (N = 50)					
Achillea millefolium (common yarrow)	5.8	0-10	90	5.25	N
Agoseris glauca (yellow false dandelion)	1.3	0-3	30	0.40	N
Antennaria anaphaloides (tall everlasting)	1.8	0-3	20	0.35	N
Antennaria parvifolia (small-leaved everlasting)	0.5	0-0.5	10	0.05	N

Table 214. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Aster ciliolatus (Lindley's aster)	12.4	0-30	90	11.20	N
Astragalus alpinus (alpine milk vetch)	5.8	0-20	60	3.45	N
Botrychium lunaria (moonwort)	0.5	0-0.5	10	0.05	N
Campanula rotundifolia (harebell)	0.5	0-0.5	30	0.15	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	30	0.15	N
Delphinium glaucum (tall larkspur)	6.6	0-20	40	2.65	N
Dodecatheon conjugens (mountain shooting star)	0.5	0-0.5	10	0.05	N
Epilobium angustifolium (common fireweed)	1.1	0-3	80	0.90	N
Equisetum arvense (common horsetail)	3.0	0-3	10	0.30	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	20	0.10	N
Erigeron peregrinus (wandering daisy)	0.5	0-0.5	10	0.05	N
Fragaria virginiana (wild strawberry)	6.1	0.5-20	100	6.05	N
Galium boreale (northern bedstraw)	1.3	0.5-3	100	1.25	N
Gentianella amarella (felwort)	0.5	0-0.5	70	0.35	N
Geranium viscosissimum (sticky purple geranium)	3.0	0-3	10	0.30	N
Geum aleppicum (yellow avens)	2.2	0-10	70	1.55	N
Geum rivale (purple avens)	0.5	0-0.5	20	0.10	N
Geum triflorum (three-flowered avens)	8.2	0-20	50	4.10	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	10	0.05	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	40	0.20	N
Mertensia paniculata (tall lungwort)	2.3	0-10	80	1.85	N
Oxytropis monticola (late yellow locoweed)	0.5	0-0.5	10	0.05	N
Oxytropis splendens (showy locoweed)	0.5	0-0.5	10	0.05	N
Penstemon procerus (slender blue beardtongue)	0.8	0-3	80	0.65	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	20	0.10	N
Petasites vitifolius (vine-leaved coltsfoot)	0.5	0-0.5	10	0.05	N
Polemonium pulcherrimum (showy Jacob's-ladder)	0.5	0-0.5	30	0.15	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	40	0.20	N
Potentilla gracilis (graceful cinquefoil)	2.2	0.5-10	100	2.20	N
Ranunculus cardiophyllus (heart-leaved buttercup)	0.9	0-3	60	0.55	N
Rumex acetosa (green sorrel)	0.5	0-0.5	50	0.25	N
Senecio pauciflorus (few-flowered ragwort)	0.5	0-0.5	10	0.05	N
Sisyrinchium montanum (common blue-eyed grass)	0.5	0-0.5	30	0.15	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	30	0.15	N
Solidago spathulata (mountain goldenrod)	0.5	0-0.5	10	0.05	N
Stellaria longifolia (long-leaved chickweed)	0.9	0-3	60	0.55	N
Taraxacum ceratophorum (northern dandelion)	0.5	0-0.5	10	0.05	N
Taraxacum officinale (common dandelion)	1.8	0-3	60	1.05	I
Thalictrum venulosum (veiny meadow rue)	5.9	0-20	90	5.30	N
Trifolium hybridum (alsike clover)	0.5	0-0.5	10	0.05	I
Trifolium repens (white clover)	3.0	0-3	10	0.30	I
Urtica dioica (common nettle)	0.5	0-0.5	10	0.05	N
Valeriana dioica (northern valerian)	1.0	0-3	50	0.50	N
Vicia americana (wild vetch)	1.1	0-3	90	0.95	N

Table 214. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Viola adunca (early blue violet)	0.5	0-0.5	70	0.35	N
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	60	0.30	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 215 shows the five most prominent plant species among the four lifeforms for species recorded in all three relatively undisturbed late seral to climax stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type. No trees were present on these later seral stands. *Salix barclayi* (Barclay's willow) is by far most prominent of all species present, but four graminoid species are also fairly prominent,: *Carex aquatilis* (water sedge), *Deschampsia cespitosa* (tufted hair grass), *Carex preslii* (Presl sedge), and *Calamagrostis canadensis* (marsh reed grass).

Table 215. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (number = 3 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Salix barclayi (Barclay's willow)	50.00	Native
Betula glandulosa (bog birch)	8.67	Native
Ribes lacustre (bristly black currant)	2.00	Native
Rubus arcticus (dwarf raspberry)	0.50	Native
Potentilla fruticosa (shrubby cinquefoil)	0.17	Native

Table 215. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Graminoids		
Carex aquatilis (water sedge)	16.67	Native
Deschampsia cespitosa (tufted hair grass)	13.33	Native
Carex preslii (Presl sedge)	10.17	Native
Calamagrostis canadensis (marsh reed grass)	10.00	Native
Agropyron trachycaulum (slender wheat grass)	6.83	Native
Forbs		
Aster ciliolatus (Lindley's aster)	8.67	Native
Delphinium glaucum (tall larkspur)	6.67	Native
Achillea millefolium (common yarrow)	4.33	Native
Mertensia paniculata (tall lungwort)	4.33	Native
Geum aleppicum (yellow avens)	3.50	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 216 through Table 219, break out the vegetation recorded in three relatively undisturbed late seral to climax stands sampled of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, species rich, shrub dominated habitat type of incidental occurrence across the study area.

Table 216 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type. For the 3 stands comprising the habitat type, the number of unique species was 50 with 48 (96.0 percent) of them being native species.

Table 216. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (number = 3 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	6	6	0	0
Graminoids	14	13	1	0
Forbs	30	29	1	0
TOTAL	***50 (100.0%)***	***48 (96.0%)***	***2 (4.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 217 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type. The average number of species per stand is 27.6, with native species comprising 26.7 species per stand or 96.7 percent.

Table 217. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (number = 3 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	4.3	4.3	0.0	0.0
Graminoids	8.3	7.7	0.7	0.0
Forbs	15.0	14.7	0.3	0.0
TOTAL	***27.6 (100.0%)***	***26.7 (96.7%)***	***1.0 (3.6%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 218 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type. The average canopy cover per stand is 166.3 percent, with native species comprising 165.8 percent or 99.7 percent of the total amount of average canopy cover per stand.

Table 218. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (number = 3 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	61.5%	61.5%	0.0%	0.0%
Graminoids	66.5%	66.2%	0.3%	0.0%
Forbs	38.3%	38.2%	0.2%	0.0%
TOTAL	***166.3% (100.0%)***	***165.8% (99.7%)***	***0.5% (0.3%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 219 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type. The average number of species per stand was 27.6 with an average canopy cover of 166.3 percent.

Table 219. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (number = 3 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	4.3	61.5%
Graminoids	8.3	66.5%
Forbs	15.0	38.3%
TOTAL	***27.6***	***166.3%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 50 plant species were recorded on at least one of three relatively undisturbed late seral to climax stands sampled of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (Table 220). No tree species was recorded in these plots, and among six shrub species recorded, only *Salix barclayi* (Barclay's willow) is highly prominent. Among 14 graminoid species recorded, *Carex aquatilis* (water sedge) is most prominent, notably followed by *Deschampsia cespitosa* (tufted hair grass), *Carex preslii* (Presl sedge), and *Calamagrostis canadensis* (marsh reed grass). Of 30 forb species recorded, none is more than moderately prominent.

Table 220. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (number = 3 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Shrubs (N = 6)					
Betula glandulosa (bog birch)	8.7	3-20	100	8.67	N
Potentilla fruticosa (shrubby cinquefoil)	0.5	0-0.5	33	0.17	N
Ribes lacustre (bristly black currant)	3.0	0-3	67	2.00	N
Rosa acicularis (prickly rose)	0.5	0-0.5	33	0.17	N
Rubus arcticus (dwarf raspberry)	0.5	0.5-0.5	100	0.50	N
Salix barclayi (Barclay's willow)	50.0	40-60	100	50.00	N
Graminoids (N = 14)					
Agropyron trachycaulum (slender wheat grass)	6.8	0.5-10	100	6.83	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	33	0.17	N
Bromus ciliatus (fringed brome)	0.5	0-0.5	33	0.17	N
Bromus inermis subsp. *pumpellianus* (northern awnless brome)	0.5	0-0.5	33	0.17	N
Calamagrostis canadensis (marsh reed grass)	15.0	0-20	67	10.00	N
Carex aquatilis (water sedge)	50.0	0-50	33	16.67	N
Carex preslii (Presl sedge)	15.3	0-30	67	10.17	N
Deschampsia cespitosa (tufted hair grass)	13.3	10-20	100	13.33	N
Elymus innovatus (hairy wild rye)	0.5	0-0.5	67	0.33	N
Festuca saximontana (Rocky Mountain fescue)	6.5	0-10	67	4.33	N
Juncus balticus (wire rush)	3.7	0.5-10	100	3.67	N
Koeleria macrantha (June grass)	0.5	0-0.5	33	0.17	N
Poa pratensis (Kentucky bluegrass)	0.5	0-0.5	67	0.33	I
Schizachne purpurascens (purple oat grass)	0.5	0-0.5	33	0.17	N
Forbs (N = 30)					
Achillea millefolium (common yarrow)	6.5	0-10	67	4.33	N
Antennaria anaphaloides (tall everlasting)	0.5	0-0.5	33	0.17	N
Aster ciliolatus (Lindley's aster)	8.7	3-20	100	8.67	N
Astragalus alpinus (alpine milk vetch)	0.5	0-0.5	33	0.17	N
Campanula rotundifolia (harebell)	0.5	0-0.5	33	0.17	N
Delphinium glaucum (tall larkspur)	20.0	0-20	33	6.67	N
Epilobium angustifolium (common fireweed)	1.8	0-3	67	1.17	N
Equisetum arvense (common horsetail)	3.0	0-3	33	1.00	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	33	0.17	N
Erigeron peregrinus (wandering daisy)	0.5	0-0.5	33	0.17	N
Fragaria virginiana (wild strawberry)	1.3	0.5-3	100	1.33	N
Galium boreale (northern bedstraw)	0.5	0.5-0.5	100	0.50	N
Gentianella amarella (felwort)	0.5	0-0.5	33	0.17	N
Geranium viscosissimum (sticky purple geranium)	3.0	0-3	33	1.00	N
Geum aleppicum (yellow avens)	5.3	0-10	67	3.50	N
Geum rivale (purple avens)	0.5	0-0.5	33	0.17	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	33	0.17	N

Table 220. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Mertensia paniculata (tall lungwort)	6.5	0-10	67	4.33	N
Penstemon procerus (slender blue beardtongue)	3.0	0-3	33	1.00	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	33	0.17	N
Polemonium pulcherrimum (showy Jacob's-ladder)	0.5	0-0.5	33	0.17	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	33	0.17	N
Potentilla gracilis (graceful cinquefoil)	0.5	0.5-0.5	100	0.50	N
Ranunculus cardiophyllus (heart-leaved buttercup)	0.5	0-0.5	33	0.17	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	33	0.17	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	67	0.33	N
Taraxacum officinale (common dandelion)	0.5	0-0.5	33	0.17	I
Thalictrum venulosum (veiny meadow rue)	1.8	0-3	67	1.17	N
Valeriana dioica (northern valerian)	0.5	0-0.5	33	0.17	N
Vicia americana (wild vetch)	0.5	0-0.5	67	0.33	N

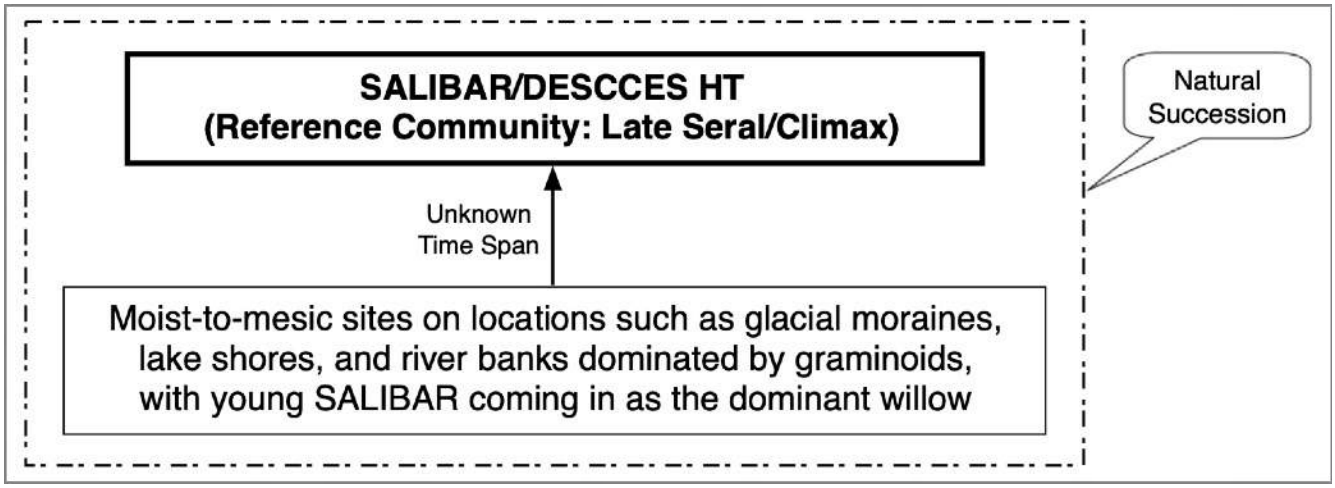
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Potential for the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type may develop on a site via primary succession (hydrarch succession) by gradual filling of a shallow depression until a stand of *Deschampsia cespitosa* (tufted hair grass) develops and the required conditions for *Salix barclayi* (Barclay's willow) are met. Heavy grazing disturbance in this habitat type can reduce the *Deschampsia cespitosa* (tufted hair grass) cover and change the stand to the *Salix barclayi* (Barclay's willow) community type.

Figure 46 shows a schematic diagram of vegetation successional pathways on sites of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type.



Successional Pathway of *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
SALIBAR—*Salix barclayi* (Barclay's willow)
SALIBAR/DESCCES HT—*Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type

Figure 46. Successional pathway for sites of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 47 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

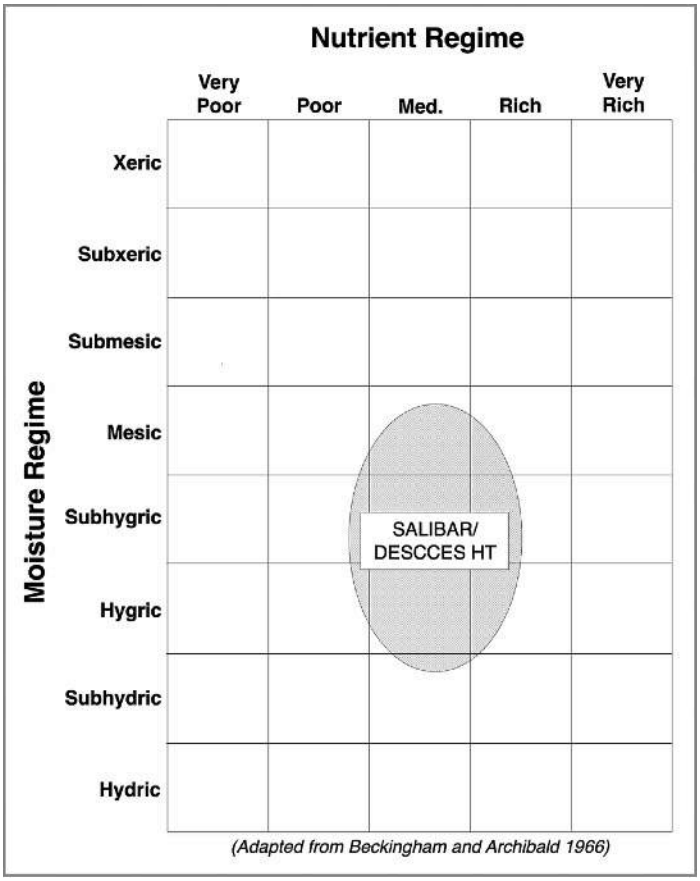


Figure 47. Edatope grid position for the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type (SALIBAR/DESCCES HT)

SOILS

Soils information is currently unavailable for sites supporting the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites may be dominated by *Salix* species (willow), *Carex aquatilis* (water sedge), or *Carex utriculata* (beaked sedge), *Calamagrostis canadensis* (marsh reed grass), or *Alnus* species (alder). Adjacent drier sites are likely to have *Populus tremuloides* (aspen) or *Picea glauca* (white spruce) upland communities.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix barclayi* (Barclay's willow)**—*Salix barclayi* (Barclay's willow) is a thicket forming shrub found along streams and margins of wetlands and lakes, alpine and subalpine slopes, moist to mesic forest openings (Argus 2003, Lesica 2012).

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) is common throughout most natural regions of Alberta, occurring in moist meadows, along slough margins, and in boggy areas (Tannas 1997a). The species can occur as a pioneer, as well as either a component or a dominant in mid and late seral stands. It is rarely found in dense shade. It can be an aggressive colonizer on disturbed sites, particularly at higher elevation sites (Walsh 1995).

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) grows along streams, in muskegs and bogs, and on moist to somewhat dry sites at higher elevations (Tannas 1997a). This species is characteristic of many mixed shrub and tussock tundra communities in northern Canada. In southwestern Canada, it often occurs on wetland sites including bogs and fens, within *Pinus contorta* (lodgepole pine), *Picea* species (spruce), or *Abies lasiocarpa* (subalpine fir) forest types, and is often associated with *Alnus* species (alders) and *Salix* species (willows) (Tollefson 2007).

Betula glandulosa (bog birch) occupies a wide variety of sites, ranging from rocky subarctic and alpine tundra to deep, organic, boreal soils. It is a wetland species occurring most commonly on moist, acidic, nutrient-poor organic sites including fens, swamps, bogs, muskegs, wet meadows, lake and stream margins, and seepage areas. The species dominates open valley bottoms in the Canadian Rocky Mountains. Although it is primarily a wetland plant, it does not appear to tolerate continuous flooding (Tollefson 2007). *Betula glandulosa* (bog birch) is shade intolerant and is often found in canopy openings within *Picea mariana* (black spruce) woodlands in northern Canada (Tollefson 2007).

***Carex preslii* (Presl sedge)**—*Carex preslii* (Presl sedge) is a densely cespitose species that grows on dry to seasonally dry sites (Hitchcock and others 1969, Flora of North America 1993+). The species occurs in coniferous forest openings, moist meadows, along streams, lakes, and valleys up to the subalpine (Lesica 2012).

Livestock

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) has high protein content early in the season, and is generally palatable to both livestock and wildlife throughout the season. The species is a grazing decreaser. Although cropped tufts may resprout from the base, these are relatively short lived. The species depends primarily on seed for reproduction (Tannas 1997a).

Deschampsia cespitosa (tufted hair grass) provides good to excellent forage for all classes of livestock. It is often an abundant source of forage throughout its growing season. However, it decreases with excessive grazing. Long term, intensive use reduces seed production. *Deschampsia cespitosa* (tufted hair grass) is a key indicator of condition and grazing utilization in certain mountain meadow communities (Walsh 1995).

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) has fair nutritional value similar to that of *Alnus* species (alders), is tolerant of moderate to heavy browsing, and is an especially competitive species, forming extensive stands in western and northern rangelands (Tannas 1997a). However, the species produces carbon and nitrogen-based anti-herbivore compounds that deter browsing (Tollefson 2007).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix barclayi* (Barclay's willow)**—In spring and summer the catkins and young leaves are eaten by many mammals and birds. Moose, caribou, and deer all eat the twigs and young branches, while the twigs and bark are eaten by hares and lemmings. Winter buds are a principle food source for ptarmigan and grouse (CYSIP 2023).

***Deschampsia cespitosa* (tufted hair grass)**—Use of *Deschampsia cespitosa* (tufted hair grass) by wildlife species is variable, although it provides palatable forage early spring through summer. It is frequently grazed by bears, and feral horses in the foothills of western Alberta were found to graze it (Walsh 1995).

***Betula glandulosa* (bog birch)**—Numerous wildlife species eat *Betula glandulosa* (bog birch), including moose, mule deer, white-tailed deer, Rocky Mountain elk, mountain goats, caribou, grizzly bears, black bears, small mammals, beaver, birds, and insects (Tollefson 2007).

Fire

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) generally survives all but the most severe fires. It usually sprouts from the root crown after aerial portions are burned. Tufts formed by the leaves often protect basal buds from fire damage. Within just a few years *Deschampsia cespitosa* (tufted hair grass) usually recovers to pre-fire abundance (Walsh 1995).

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) can survive low to moderate-severity fires. The species has deep roots and rhizomes that typically are protected from all but high-severity fires. It regenerates after fire by sprouting from the root crown and from dormant buds on the rhizomes (Tollefson 2007).

Rehabilitation/Restoration Considerations

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) has a broad ecological range and is useful for revegetation, particularly on disturbances at high elevation or high latitude. It grows at a medium rate compared to other grasses and has a poor rate of spread, but it highly competitive, relative to other plants evaluated for high latitude revegetation. It has low to medium potential for short-term revegetation, but has medium to high potential for long-term revegetation, and is a valuable soil stabilizer, especially in wet, acidic sites (Walsh 1995).

***Betula glandulosa* (bog birch)**—The erosion control potential for *Betula glandulosa* (bog birch) is high, with the dense root systems important in helping to stabilize streambanks. Because it grows somewhat slowly, its short-term (1-3 years) revegetation potential is low, but the species is suitable for longer term (>3 years) revegetation of exposed mineral soil (Tollefson 2007).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type has not been described in the region.

Salix barclayi Community Type
(Barclay's willow Community Type)

SALIBAR Community Type
Number of Stands = 12 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 11; Other Data Sets = 1)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix barclayi* (Barclay's willow) community type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. This is one of the drier willow dominated community types. It is typically found on moist sites on glacial moraines, along lake shores and river banks, and moist-to-mesic forest openings.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 221 shows the five most prominent plant species among the four lifeforms for species recorded in all 12 stands of the *Salix barclayi* (Barclay's willow) community type. *Salix barclayi* (Barclay's willow) is most prominent, followed well behind by *Betula glandulosa* (bog birch), *Carex preslii* (Presl sedge), and *Agropyron trachycaulum* (slender wheat grass). No other species is more than moderately prominent in these stands.

Table 221. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix barclayi* (Barclay's willow) community type (number = 12 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Pinus contorta (lodgepole pine)	0.25	Native
Picea glauca (white spruce)	0.08	Native
Populus tremuloides (aspen)	0.04	Native
Shrubs		
Salix barclayi (Barclay's willow)	35.00	Native
Betula glandulosa (bog birch)	15.08	Native
Alnus crispa (green alder)	5.83	Native
Potentilla fruticosa (shrubby cinquefoil)	1.83	Native
Rubus arcticus (dwarf raspberry)	0.67	Native
Graminoids		
Carex preslii (Presl sedge)	16.71	Native
Agropyron trachycaulum (slender wheat grass)	10.17	Native
Carex aquatilis (water sedge)	9.17	Native
Elymus innovatus (hairy wild rye)	5.25	Native
Calamagrostis canadensis (marsh reed grass)	5.08	Native
Forbs		
Fragaria virginiana (wild strawberry)	5.58	Native
Aster ciliolatus (Lindley's aster)	5.46	Native
Potentilla gracilis (graceful cinquefoil)	4.21	Native
Thalictrum venulosum (veiny meadow rue)	3.17	Native
Achillea millefolium (common yarrow)	2.38	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 222 through Table 225, break out the vegetation recorded in 12 stands of the *Salix barclayi* (Barclay's willow) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, species rich, shrub dominated community type of incidental occurrence across the study area.

Table 222 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix barclayi* (Barclay's willow) community type. For the 12 stands comprising the community type, the number of unique species was 115 with 107 (93.0 percent) of them being native species.

Table 222. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix barclayi* (Barclay's willow) community type (number = 12 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3	3	0	0
Shrubs	10	10	0	0
Graminoids	24	20	3	1
Forbs	78	74	3	1
TOTAL	***115 (100.0%)***	***107 (93.0%)***	***6 (5.2%)***	***2 (1.7%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 223 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix barclayi* (Barclay's willow) community type. The average number of species per stand is 31.0, with native species comprising 29.7 species per stand or 95.8 percent.

Table 223. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix barclayi* (Barclay's willow) community type (number = 12 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.3	0.3	0.0	0.0
Shrubs	3.8	3.8	0.0	0.0
Graminoids	7.5	6.8	0.6	0.2
Forbs	19.4	18.8	0.6	0.1
TOTAL	***31.0 (100.0%)***	***29.7 (95.8%)***	***1.2 (3.9%)***	***0.3 (1.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 224 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix barclayi* (Barclay's willow) community type. The average canopy cover per stand is 163.0 percent, with native species comprising 160.4 percent or 98.4 percent of the total amount of average canopy cover per stand.

Table 224. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix barclayi* (Barclay's willow) community type (number = 12 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.4%	0.4%	0.0%	0.0%
Shrubs	59.5%	59.5%	0.0%	0.0%
Graminoids	62.3%	60.9%	1.1%	0.3%
Forbs	40.8%	39.7%	0.9%	0.3%
TOTAL	***163.0% (100.0%)***	***160.4% (98.4%)***	***2.0% (1.2%)***	***0.5% (0.3%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 225 shows the average number of species and average canopy cover by lifeform in stands of the *Salix barclayi* (Barclay's willow) community type. The average number of species per stand was 31.0 with an average canopy cover of 163.0 percent.

Table 225. Average number of species and average canopy cover by lifeform in stands of the *Salix barclayi* (Barclay's willow) community type (number = 12 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.3	0.4%
Shrubs	3.8	59.5%
Graminoids	7.5	62.3%
Forbs	19.4	40.8%
TOTAL	***31.0***	***163.0%***

Sampled Stands Plant Species List

A total of 115 plant species were recorded on at least one of 12 stands sampled of the *Salix barclayi* (Barclay's willow) community type (Table 226). Three tree species were recorded in small amounts, while among the 10 shrub species recorded, only *Salix barclayi* (Barclay's willow) and *Betula glandulosa* (bog birch) are very prominent. Among 24 graminoid species, only *Carex preslii* (Presl sedge) and *Agropyron trachycaulum* (slender wheat grass) are more than moderately prominent, and of 78 forb species recorded, none is notably prominent.

Table 226. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix barclayi* (Barclay's willow) community type (number = 12 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 3)					
Picea glauca (white spruce)	0.5	0-0.5	17	0.08	N
Pinus contorta (lodgepole pine)	3.0	0-3	8	0.25	N
Populus tremuloides (aspen)	0.5	0-0.5	8	0.04	N
Shrubs (N = 10)					
Alnus crispa (green alder)	70.0	0-70	8	5.83	N
Arctostaphylos uva-ursi (common bearberry)	1.8	0-3	33	0.58	N
Betula glandulosa (bog birch)	16.5	0-40	92	15.08	N
Potentilla fruticosa (shrubby cinquefoil)	4.4	0-20	42	1.83	N
Ribes lacustre (bristly black currant)	0.5	0-0.5	17	0.08	N
Rosa acicularis (prickly rose)	0.5	0-0.5	17	0.08	N
Rubus arcticus (dwarf raspberry)	1.3	0-3	50	0.67	N
Salix barclayi (Barclay's willow)	35.0	20-50	100	35.00	N
Salix bebbiana (beaked willow)	3.0	0-3	8	0.25	N
Vaccinium caespitosum (dwarf bilberry)	0.5	0-0.5	8	0.04	N
Graminoids (N = 24)					
Agropyron trachycaulum (slender wheat grass)	12.2	0-30	83	10.17	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	8	0.04	N
Bromus ciliatus (fringed brome)	1.8	0-3	17	0.29	N
Bromus inermis (smooth brome)	10.0	0-10	8	0.83	I
Bromus inermis subsp. *pumpellianus* (northern awnless brome)	0.5	0-0.5	8.00	0.04	N
Calamagrostis canadensis (marsh reed grass)	10.2	0-20	50	5.08	N
Calamagrostis montanensis (plains reed grass)	0.5	0-0.5	8	0.04	N
Calamagrostis purpurascens (purple reed grass)	3.0	0-3	8	0.25	N
Carex aquatilis (water sedge)	55.0	0-80	17	9.17	N
Carex brunnescens (brownish sedge)	0.5	0-0.5	8	0.04	N
Carex microptera (small-winged sedge)	0.5	0-0.5	8	0.04	N
Carex preslii (Presl sedge)	22.3	0-50	75	16.71	N
Danthonia californica (California oat grass)	4.8	0-10	42	2.00	N
Deschampsia cespitosa (tufted hair grass)	0.5	0-0.5	75	0.38	N
Elymus glaucus (smooth wild rye)	10.0	0-10	8	0.83	N
Elymus innovatus (hairy wild rye)	15.8	0-40	33	5.25	N
Festuca rubra (red fescue)	1.8	0-3	17	0.29	B
Festuca saximontana (Rocky Mountain fescue)	6.1	0-10	75	4.54	N
Festuca scabrella (rough fescue)	0.5	0-0.5	17	0.08	N
Juncus balticus (wire rush)	2.1	0-10	75	1.58	N
Koeleria macrantha (June grass)	0.5	0-0.5	17	0.08	N
Poa compressa (Canada bluegrass)	0.5	0-0.5	17	0.08	I
Poa pratensis (Kentucky bluegrass)	0.5	0-0.5	33	0.17	I
Schizachne purpurascens (purple oat grass)	10.3	0-40	42	4.29	N

Table 226. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Forbs (N = 78)					
Achillea millefolium (common yarrow)	3.2	0-10	75	2.38	N
Agoseris glauca (yellow false dandelion)	0.5	0-0.5	25	0.13	N
Anaphalis margaritacea (pearly everlasting)	0.5	0-0.5	8	0.04	N
Anemone multifida (cut-leaved anemone)	0.5	0-0.5	17	0.08	N
Angelica arguta (white angelica)	0.5	0-0.5	8	0.04	N
Antennaria anaphaloides (tall everlasting)	0.5	0-0.5	33	0.17	N
Antennaria parvifolia (small-leaved everlasting)	0.5	0-0.5	17	0.08	N
Arnica amplexicaulis (stem-clasping arnica)	3.0	0-3	8	0.25	N
Arnica fulgens (shining arnica)	0.5	0-0.5	8	0.04	N
Aster alpinus (alpine aster)	0.5	0-0.5	17	0.08	N
Aster ciliolatus (Lindley's aster)	7.3	0-30	75	5.46	N
Aster conspicuus (showy aster)	3.0	0-3	8	0.25	N
Aster laevis (smooth aster)	0.5	0-0.5	8	0.04	N
Aster subspicatus (leafy-bracted aster)	10.0	0-10	8	0.83	N
Astragalus alpinus (alpine milk vetch)	2.9	0-10	42	1.21	N
Botrychium lunaria (moonwort)	0.5	0-0.5	8	0.04	N
Campanula rotundifolia (harebell)	0.5	0-0.5	25	0.13	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	8	0.04	N
Collomia linearis (narrow-leaved collomia)	0.5	0-0.5	8	0.04	N
Crepis runcinata (scapose hawk's-beard)	0.5	0-0.5	8	0.04	N
Delphinium glaucum (tall larkspur)	1.5	0-3	42	0.63	N
Draba cana (whitlow-grass)	0.5	0-0.5	8	0.04	N
Epilobium angustifolium (common fireweed)	3.5	0-10	67	2.33	N
Equisetum arvense (common horsetail)	0.5	0-0.5	8	0.04	N
Equisetum pratense (meadow horsetail)	0.5	0-0.5	8	0.04	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	17	0.08	N
Equisetum variegatum (variegated horsetail)	0.5	0-0.5	8	0.04	N
Erigeron compositus (compound-leaved fleabane)	0.5	0-0.5	8	0.04	N
Erigeron peregrinus (wandering daisy)	0.5	0-0.5	8	0.04	N
Fragaria virginiana (wild strawberry)	7.4	0-20	75	5.58	N
Galium boreale (northern bedstraw)	0.7	0-3	92	0.67	N
Gentianella amarella (felwort)	0.5	0-0.5	42	0.21	N
Geranium viscosissimum (sticky purple geranium)	3.0	0-3	8	0.25	N
Geum aleppicum (yellow avens)	5.3	0-10	17	0.88	N
Geum rivale (purple avens)	2.2	0-3	25	0.54	N
Geum triflorum (three-flowered avens)	8.7	0-20	25	2.17	N
Habenaria dilatata (tall white bog orchid)	0.5	0-0.5	8	0.04	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	33	0.17	N
Hieracium umbellatum (narrow-leaved hawkweed)	0.5	0-0.5	8	0.04	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	33	0.17	N
Mertensia paniculata (tall lungwort)	2.9	0-10	67	1.96	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	8	0.04	N
Oxytropis monticola (late yellow locoweed)	0.5	0-0.5	17	0.08	N

Table 226. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Oxytropis splendens (showy locoweed)	0.5	0-0.5	8	0.04	N
Parnassia fimbriata (fringed grass-of-parnassus)	3.0	0-3	8	0.25	N
Parnassia palustris (northern grass-of-parnassus)	0.5	0-0.5	8	0.04	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	8	0.04	N
Pedicularis labradorica (Labrador lousewort)	0.5	0-0.5	8	0.04	N
Penstemon procerus (slender blue beardtongue)	1.1	0-3	33	0.37	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	8	0.04	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	17	0.08	N
Petasites vitifolius (vine-leaved coltsfoot)	0.5	0-0.5	8	0.04	N
Polemonium pulcherrimum (showy Jacob's-ladder)	0.5	0-0.5	33	0.17	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	75	0.38	N
Potentilla gracilis (graceful cinquefoil)	5.6	0-20	75	4.21	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	8	0.04	N
Pyrola spp. (wintergreen)	0.5	0-0.5	8	0.04	N
Rumex acetosa (green sorrel)	0.5	0-0.5	25	0.13	N
Senecio pauciflorus (few-flowered ragwort)	1.3	0-3	25	0.33	N
Sisyrinchium montanum (common blue-eyed grass)	0.5	0-0.5	8	0.04	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	58	0.29	N
Solidago multiradiata (alpine goldenrod)	0.5	0-0.5	17	0.08	N
Solidago spathulata (mountain goldenrod)	0.5	0-0.5	8	0.04	N
Stellaria calycantha (northern stitchwort)	0.5	0-0.5	8	0.04	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	58	0.29	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	8	0.04	N
Taraxacum officinale (common dandelion)	1.5	0-3	42	0.63	I
Thalictrum occidentale (western meadow rue)	3.0	0-3	8	0.25	N
Thalictrum venulosum (veiny meadow rue)	4.2	0-10	75	3.17	N
Trifolium pratense (red clover)	0.5	0-0.5	8	0.04	I
Trifolium repens (white clover)	3.0	0-3	8	0.25	I
Valeriana dioica (northern valerian)	0.9	0-3	58	0.50	N
Vicia americana (wild vetch)	1.1	0-3	67	0.75	N
Viola adunca (early blue violet)	0.5	0-0.5	42	0.21	N
Viola orbiculata (evergreen violet)	0.5	0-0.5	8	0.04	N
Viola renifolia (kidney-leaved violet)	0.5	0-0.5	8	0.04	N
Viola spp. (violet)	3.0	0-3	8	0.25	B
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	33	0.17	N

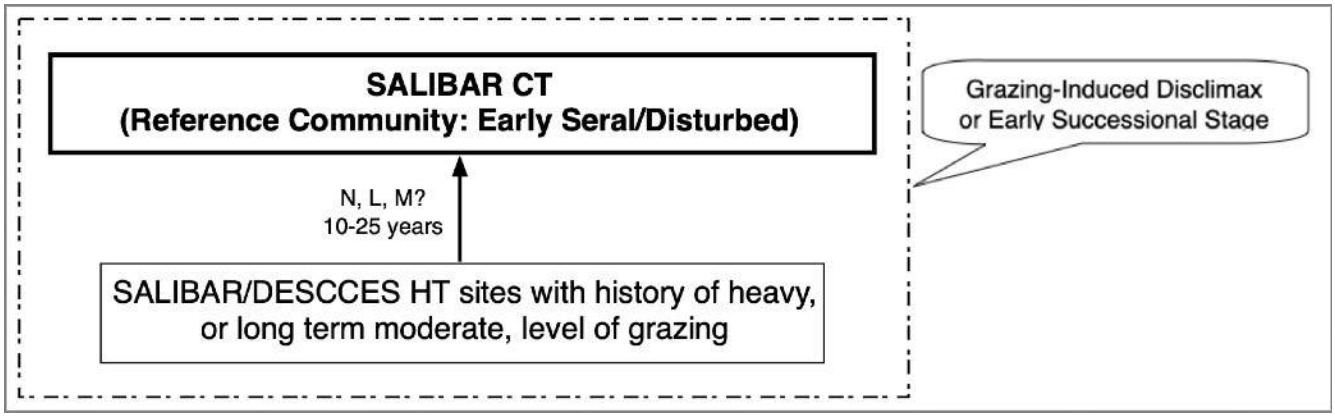
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Stands of the *Salix barclayi* (Barclay's willow) community type are generally the result of heavy grazing disturbance altering the understory of the *Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type by removing the highly palatable *Deschampsia cespitosa* (tufted hair grass), and replacing it with disturbance species, such as *Poa pratensis* (Kentucky bluegrass).

Figure 48 shows a schematic diagram of vegetation successional pathways on sites of the *Salix barclayi* (Barclay's willow) community type.



Successional Pathway of *Salix barclayi* (Barclay's willow) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix barclayi* (Barclay's willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
SALIBAR CT—*Salix barclayi* (Barclay's willow) community type
SALIBAR/DESCCES HT—*Salix barclayi/Deschampsia cespitosa* (Barclay's willow/tufted hair grass) habitat type

Figure 48. Successional pathway for sites of the *Salix barclayi* (Barclay's willow) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 49 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix barclayi* (Barclay's willow) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

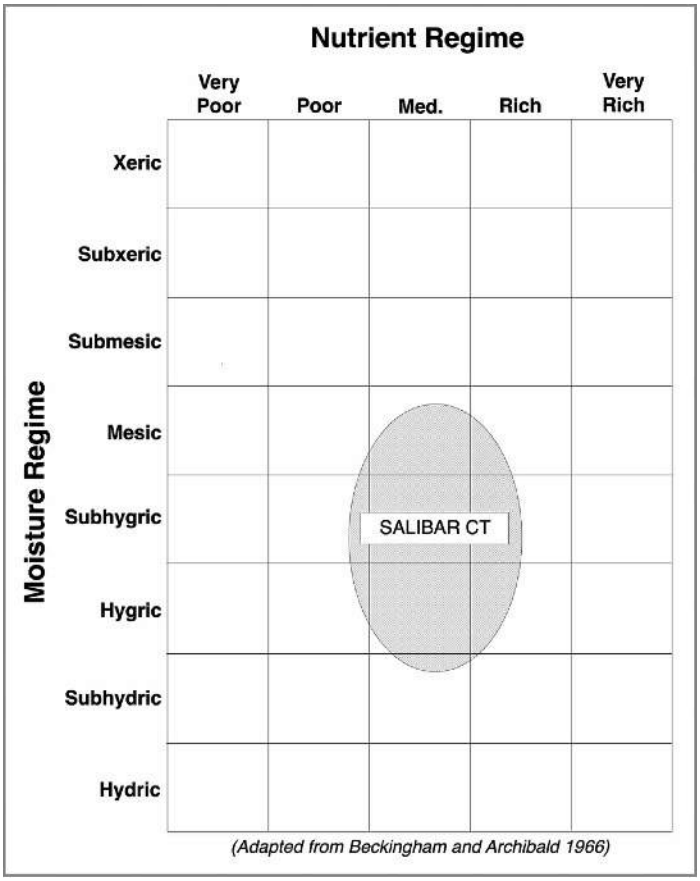


Figure 49. Edatope grid position for the *Salix barclayi* (Barclay's willow) community type (SALIBAR CT)

SOILS

Soils information is currently unavailable for sites supporting the *Salix barclayi* (Barclay's willow) community type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species*.

ADJACENT COMMUNITIES

Adjacent wetter sites may be dominated by *Salix* species (willow), *Carex aquatilis* (water sedge), or *Carex utriculata* (beaked sedge), *Calamagrostis canadensis* (marsh reed grass), or *Alnus* species (alder). Adjacent drier sites are likely to have *Populus tremuloides* (aspen) or *Picea glauca* (white spruce) upland communities.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix barclayi* (Barclay's willow)**—*Salix barclayi* (Barclay's willow) is a thicket forming shrub found along streams and margins of wetlands and lakes, alpine and subalpine slopes, moist to mesic forest openings (Argus 2003, Lesica 2012).

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) grows along streams, in muskegs and bogs, and on moist to somewhat dry sites at higher elevations (Tannas 1997a). This species is characteristic of many mixed shrub and tussock tundra communities in northern Canada. In southwestern Canada, it often occurs on wetland sites including bogs and fens, within *Pinus contorta* (lodgepole pine), *Picea* species (spruce), or *Abies lasiocarpa* (subalpine fir) forest types, and is often associated with *Alnus* species (alders) and *Salix* species (willows) (Tollefson 2007).

Betula glandulosa (bog birch) occupies a wide variety of sites, ranging from rocky subarctic and alpine tundra to deep, organic, boreal soils. It is a wetland species occurring most commonly on moist, acidic, nutrient-poor organic sites including fens, swamps, bogs, muskegs, wet meadows, lake and stream margins, and seepage areas. The species dominates open valley bottoms in the Canadian Rocky Mountains. Although it is primarily a wetland plant, it does not appear to tolerate continuous flooding (Tollefson 2007). *Betula glandulosa* (bog birch) is shade intolerant and is often found in canopy openings within *Picea mariana* (black spruce) woodlands in northern Canada (Tollefson 2007).

Livestock

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) has fair nutritional value similar to that of *Alnus* species (alders), is tolerant of moderate to heavy browsing, and is an especially competitive species, forming extensive stands in western and northern rangelands (Tannas 1997a). However, the species produces carbon and nitrogen-based anti-herbivore compounds that deter browsing (Tollefson 2007).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix barclayi* (Barclay's willow)**—In spring and summer the catkins and young leaves are eaten by many mammals and birds. Moose, caribou, and deer all eat the twigs and young branches, while the twigs and bark are eaten by hares and lemmings. Winter buds are a principle food source for ptarmigan and grouse (CYSIP 2023).

***Betula glandulosa* (bog birch)**—Numerous wildlife species eat *Betula glandulosa* (bog birch), including moose, mule deer, white-tailed deer, Rocky Mountain elk, mountain goats, caribou, grizzly bears, black bears, small mammals, beaver, birds, and insects (Tollefson 2007).

Fire

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) can survive low to moderate-severity fires. The species has deep roots and rhizomes that typically are protected from all but high-severity fires. It regenerates after fire by sprouting from the root crown and from dormant buds on the rhizomes (Tollefson 2007).

Rehabilitation/Restoration Considerations

***Betula glandulosa* (bog birch)**—The erosion control potential for *Betula glandulosa* (bog birch) is high, with the dense root systems important in helping to stabilize streambanks. Because it grows somewhat slowly, its short-term (1-3 years) revegetation potential is low, but the species is suitable for longer term (>3 years) revegetation of exposed mineral soil (Tollefson 2007).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix barclayi* (Barclay's willow) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix barclayi* (Barclay's willow) community type has not been described in the region.

Salix bebbiana/Calamagrostis canadensis Habitat Type
(beaked willow/marsh reed grass Habitat Type)

SALIBEB/CALACAN Habitat Type
Number of Stands = 18 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 12; Other Data Sets = 6)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type is a major type in the Lower Foothills Natural Subregion, a major type in the Upper Foothills Natural Subregion, and a major type in the Montane Natural Subregion of Alberta. This habitat type occupies moist areas on alluvial terraces, around lakes and sloughs, and near springs, seeps. Stands are found on sites more on the drier side of the *Salix bebbiana* (beaked willow) moisture spectrum than are stands with *Carex* (sedge) dominated understories.

Photo 11 shows a typical stand of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type.

Photo 11. A stand of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (photo provided by Alan Dodd)

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 227 shows the five most prominent plant species among the four lifeforms for species recorded in all 18 stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type. *Salix bebbiana* (beaked willow) is by far most prominent, followed well behind by *Calamagrostis canadensis* (marsh reed grass) and *Poa pratensis* (Kentucky bluegrass). No other species is more than moderately prominent here.

Table 227. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (number = 18 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	0.56	Native
Pinus contorta (lodgepole pine)	0.22	Native
Betula papyrifera (white birch)	0.19	Native
Abies lasiocarpa (subalpine fir)	0.03	Native
Picea mariana (black spruce)	0.03	Native
Shrubs		
Salix bebbiana (beaked willow)	50.00	Native
Salix pseudomonticola (false mountain willow)	4.25	Native
Salix myrtillifolia (myrtle-leaved willow)	4.06	Native
Salix scouleriana (Scouler's willow)	3.33	Native
Rosa acicularis (prickly rose)	3.03	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	18.33	Native
Poa pratensis (Kentucky bluegrass)	12.31	Introduced
Phleum pratense (timothy)	4.94	Introduced
Deschampsia cespitosa (tufted hair grass)	2.22	Native
Juncus balticus (wire rush)	2.22	Native

Table 227. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Equisetum arvense (common horsetail)	3.69	Native
Heracleum lanatum (cow parsnip)	3.08	Native
Urtica dioica (common nettle)	2.36	Native
Fragaria virginiana (wild strawberry)	2.31	Native
Taraxacum officinale (common dandelion)	1.86	Introduced

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 228 through Table 231, break out the vegetation recorded in all 18 stands sampled of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, species rich, shrub dominated habitat type of major occurrence across the study area.

Table 228 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type. For the 18 stands comprising the habitat type, the number of unique species was 169 with 149 (88.2 percent) of them being native species.

Table 228. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (number = 18 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	7	7	0	0
Shrubs	40	38	0	2
Graminoids	30	23	6	1
Forbs	92	81	11	0
TOTAL	***169 (100.0%)***	***149 (88.2%)***	***17 (10.1%)***	***3 (1.8%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 229 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type. The average number of species per stand is 27.4, with native species comprising 23.6 species per stand or 86.1 percent.

Table 229. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (number = 18 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.1	1.1	0.0	0.0
Shrubs	6.2	5.8	0.0	0.4
Graminoids	5.2	3.5	1.6	0.1
Forbs	14.9	13.2	1.8	0.0
TOTAL	***27.4 (100.0%)***	***23.6 (86.1%)***	***3.4 (12.4%)***	***0.5 (1.8%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 230 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type. The average canopy cover per stand is 162.2 percent, with native species comprising 139.9 percent or 86.3 percent of the total amount of average canopy cover per stand.

Table 230. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (number = 18 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.1%	1.1%	0.0%	0.0%
Shrubs	80.0%	79.6%	0.0%	0.4%
Graminoids	46.4%	28.9%	17.5%	0.0%
Forbs	34.8%	30.4%	4.4%	0.0%
TOTAL	***162.2% (100.0%)***	***139.9% (86.3%)***	***21.9% (13.5%)***	***0.4% (0.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 231 shows the average number of species and average canopy cover by lifeform in stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type. The average number of species per stand was 27.4 with an average canopy cover of 162.2 percent.

Table 231. Average number of species and average canopy cover by lifeform in stands of the *Salix bebbiana/ Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (number = 18 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	1.1	1.1%
Shrubs	6.2	80.0%
Graminoids	5.2	46.4%
Forbs	14.9	34.8%
TOTAL	***27.4***	***162.2%***

Sampled Stands Plant Species List

In 18 stands sampled of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type, seven tree species were recorded, all in small amounts (Table 232). *Salix bebbiana* (beaked willow) was the only one of 40 shrub species with high prominence. *Calamagrostis canadensis* (marsh reed grass) was most prominent of 30 graminoids recorded, followed by *Poa pratensis* (Kentucky bluegrass). Of the 92 forbs recorded, none was very prominent.

Table 232. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix bebbiana/ Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (number = 18 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 7)					
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	6	0.03	N
Betula papyrifera (white birch)	1.8	0-3	11	0.19	N
Picea glauca (white spruce)	1.0	0-3	56	0.56	N
Picea mariana (black spruce)	0.5	0-0.5	6	0.03	N
Pinus contorta (lodgepole pine)	1.3	0-3	17	0.22	N
Populus balsamifera (balsam poplar)	0.5	0-0.5	6	0.03	N
Populus tremuloides (aspen)	0.5	0-0.5	6	0.03	N
Shrubs (N = 40)					
Alnus crispa (green alder)	21.5	0-40	11	2.39	N
Alnus tenuifolia (river alder)	3.0	0-3	6	0.17	N
Amelanchier alnifolia (Saskatoon)	1.8	0-3	11	0.19	N
Betula glandulosa (bog birch)	30.0	0-30	6	1.67	N
Betula occidentalis (water birch)	3.0	0-3	6	0.17	N
Cornus stolonifera (red-osier dogwood)	6.5	0-10	11	0.72	N
Gaultheria hispidula (creeping snowberry)	0.5	0-0.5	6	0.03	N
Juniperus communis (ground juniper)	0.5	0-0.5	6	0.03	N
Ledum groenlandicum (common Labrador tea)	0.5	0-0.5	6	0.03	N

Table 232. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Linnaea borealis (twinflower)	0.5	0-0.5	11	0.06	N
Lonicera dioica (twining honeysuckle)	30.0	0-30	6	1.67	N
Lonicera involucrata (bracted honeysuckle)	1.4	0-3	44	0.64	N
Lonicera utahensis (red twinberry)	0.5	0-0.5	6	0.03	N
Potentilla fruticosa (shrubby cinquefoil)	1.8	0-3	11	0.19	N
Ribes americanum (wild black currant)	0.5	0-0.5	11	0.06	N
Ribes hirtellum (wild gooseberry)	0.5	0-0.5	6	0.03	N
Ribes lacustre (bristly black currant)	1.3	0-3	17	0.22	N
Ribes oxyacanthoides (northern gooseberry)	5.4	0-20	22	1.19	N
Ribes spp. (currant)	1.8	0-3	11	0.19	B
Ribes triste (wild red currant)	0.5	0-0.5	11	0.06	N
Rosa acicularis (prickly rose)	7.8	0-30	39	3.03	N
Rosa spp. (rose)	0.5	0-0.5	33	0.17	B
Rosa woodsii (common wild rose)	10.0	0-10	6	0.56	N
Rubus idaeus (wild red raspberry)	3.5	0-10	44	1.56	N
Rubus pedatus (dwarf bramble)	0.5	0-0.5	6	0.03	N
Rubus pubescens (dewberry)	1.3	0-3	17	0.22	N
Salix bebbiana (beaked willow)	50.0	10-80	100	50.00	N
Salix drummondiana (Drummond's willow)	0.5	0-0.5	6	0.03	N
Salix lutea (yellow willow)	3.0	0-3	6	0.17	N
Salix myrtillifolia (myrtle-leaved willow)	18.3	0-40	22	4.06	N
Salix petiolaris (basket willow)	3.0	0-3	6	0.17	N
Salix planifolia (flat-leaved willow)	9.0	0-20	22	2.00	N
Salix pseudomonticola (false mountain willow)	12.8	0-40	33	4.25	N
Salix scouleriana (Scouler's willow)	60.0	0-60	6	3.33	N
Sambucus racemosa (red elderberry)	0.5	0-0.5	6	0.03	N
Shepherdia canadensis (Canada buffaloberry)	3.0	0-3	6	0.17	N
Symphoricarpos occidentalis (buckbrush)	1.3	0-3	17	0.22	N
Vaccinium caespitosum (dwarf bilberry)	0.5	0-0.5	6	0.03	N
Vaccinium vitis-idaea (bog cranberry)	0.5	0-0.5	11	0.06	N
Viburnum edule (low-bush cranberry)	1.8	0-3	11	0.19	N
Graminoids (N = 30)					
Agropyron repens (quack grass)	0.5	0-0.5	11	0.06	I
Agropyron trachycaulum (slender wheat grass)	1.3	0-3	17	0.22	N
Alopecurus occidentalis (alpine foxtail)	1.3	0-3	17	0.22	N
Alopecurus pratensis (meadow foxtail)	3.0	0-3	6	0.17	I
Bromus anomalus (nodding brome)	0.5	0-0.5	6	0.03	N
Bromus ciliatus (fringed brome)	0.9	0-3	39	0.33	N
Bromus inermis (smooth brome)	0.5	0-0.5	6	0.03	I
Calamagrostis canadensis (marsh reed grass)	18.3	10-40	100	18.33	N
Carex aquatilis (water sedge)	3.0	0-3	6	0.17	N
Carex atherodes (awned sedge)	3.0	0-3	6	0.17	N
Carex deweyana (Dewey's sedge)	0.5	0-0.5	6	0.03	N
Carex hoodii (Hood's sedge)	10.0	0-10	6	0.56	N

Table 232. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex lanuginosa (woolly sedge)	0.5	0-0.5	6	0.03	N
Carex microglochin (short-awned sedge)	1.3	0-3	17	0.22	N
Carex sprengelii (Sprengel's sedge)	0.5	0-0.5	6	0.03	N
Carex utriculata (beaked sedge)	0.5	0-0.5	6	0.03	N
Deschampsia cespitosa (tufted hair grass)	20.0	0-30	11	2.22	N
Elymus glaucus (smooth wild rye)	3.0	0-3	6	0.17	N
Elymus innovatus (hairy wild rye)	10.3	0-20	11	1.14	N
Elymus virginicus (Virginia wild rye)	0.5	0-0.5	6	0.03	N
Festuca idahoensis (bluebunch fescue)	1.8	0-3	11	0.19	N
Festuca scabrella (rough fescue)	0.5	0-0.5	11	0.06	N
Festuca spp. (fescue)	0.5	0-0.5	6	0.03	B
Glyceria striata (fowl manna grass)	4.5	0-10	17	0.75	N
Juncus balticus (wire rush)	20.0	0-30	11	2.22	N
Luzula multiflora (field wood-rush)	0.5	0-0.5	6	0.03	N
Phleum pratense (timothy)	6.8	0-30	72	4.94	I
Poa interior (inland bluegrass)	0.5	0-0.5	6	0.03	N
Poa palustris (fowl bluegrass)	6.2	0-10	28	1.72	N
Poa pratensis (Kentucky bluegrass)	20.1	0-50	61	12.31	I
Forbs (N = 92)					
Achillea millefolium (common yarrow)	1.2	0-3	61	0.72	N
Actaea rubra (red and white baneberry)	0.5	0-0.5	17	0.08	N
Anemone parviflora (small wood anemone)	0.5	0-0.5	6	0.03	N
Angelica arguta (white angelica)	0.5	0-0.5	11	0.06	N
Antennaria anaphaloides (tall everlasting)	0.5	0-0.5	6	0.03	N
Antennaria parvifolia (small-leaved everlasting)	0.5	0-0.5	6	0.03	N
Arabis hirsuta (hairy rock cress)	0.5	0-0.5	6	0.03	N
Aralia nudicaulis (wild sarsaparilla)	5.3	0-10	11	0.58	N
Arnica chamissonis (leafy arnica)	0.5	0-0.5	6	0.03	N
Arnica cordifolia (heart-leaved arnica)	0.5	0-0.5	11	0.06	N
Artemisia ludoviciana (prairie sagewort)	0.5	0-0.5	6	0.03	N
Artemisia michauxiana (Michaux's sagewort)	0.5	0-0.5	6	0.03	N
Aster ciliolatus (Lindley's aster)	2.5	0-10	56	1.36	N
Aster conspicuus (showy aster)	0.5	0-0.5	11	0.06	N
Aster eatonii (Eaton's aster)	10.0	0-10	6	0.56	N
Aster laevis (smooth aster)	10.0	0-10	6	0.56	N
Aster modestus (large northern aster)	0.5	0-0.5	22	0.11	N
Aster puniceus (purple-stemmed aster)	3.0	0-3	6	0.17	N
Aster subspicatus (leafy-bracted aster)	1.8	0-3	11	0.19	N
Botrychium virginianum (Virginia grape fern)	0.5	0-0.5	6	0.03	N
Callitriche verna (vernal water-starwort)	3.0	0-3	6	0.17	N
Castilleja miniata (common red paintbrush)	0.5	0-0.5	6	0.03	N
Castilleja rhexifolia (alpine red paintbrush)	0.5	0-0.5	6	0.03	N
Castilleja spp. (paintbrush)	3.0	0-3	6	0.17	N
Chrysanthemum leucanthemum (ox-eye daisy)	3.0	0-3	6	0.17	I

Table 232. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Cirsium arvense (Canada thistle)	0.5	0-0.5	22	0.11	I
Cornus canadensis (bunchberry)	0.5	0-0.5	11	0.06	N
Delphinium glaucum (tall larkspur)	1.6	0-3	50	0.81	N
Dryopteris carthusiana (narrow spinulose shield fern)	0.5	0-0.5	6	0.03	N
Epilobium anagallidifolium (alpine willowherb)	0.5	0-0.5	6	0.03	N
Epilobium angustifolium (common fireweed)	1.4	0-10	78	1.06	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	11	0.06	N
Equisetum arvense (common horsetail)	5.5	0-30	67	3.69	N
Equisetum sylvaticum (woodland horsetail)	5.3	0-10	17	0.89	N
Fragaria virginiana (wild strawberry)	4.2	0-20	56	2.31	N
Galeopsis tetrahit (hemp-nettle)	0.5	0-0.5	6	0.03	I
Galium boreale (northern bedstraw)	0.5	0-0.5	33	0.17	N
Galium triflorum (sweet-scented bedstraw)	1.1	0-3	22	0.25	N
Geranium richardsonii (wild white geranium)	1.9	0-10	39	0.72	N
Geum aleppicum (yellow avens)	0.5	0-0.5	6	0.03	N
Geum macrophyllum (large-leaved yellow avens)	2.5	0-10	33	0.83	N
Glycyrrhiza lepidota (wild licorice)	0.5	0-0.5	6	0.03	N
Gymnocarpium dryopteris (oak fern)	20.0	0-20	6	1.11	N
Habenaria hyperborea (northern green bog orchid)	0.5	0-0.5	6	0.03	N
Hackelia americana (nodding stickseed)	0.5	0-0.5	11	0.06	N
Heracleum lanatum (cow parsnip)	6.9	0-20	44	3.08	N
Heuchera richardsonii (Richardson's alumroot)	0.5	0-0.5	6	0.03	N
Lathyrus ochroleucus (cream-colored vetchling)	1.0	0-3	28	0.28	N
Lycopodium annotinum (stiff club-moss)	0.5	0-0.5	6	0.03	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	6	0.03	N
Medicago lupulina (black medick)	0.5	0-0.5	6	0.03	I
Melilotus officinalis (yellow sweet-clover)	0.5	0-0.5	6	0.03	I
Mentha arvensis (wild mint)	1.8	0-3	11	0.19	N
Mertensia paniculata (tall lungwort)	3.3	0-10	33	1.11	N
Mitella nuda (bishop's-cap)	1.3	0-3	17	0.22	N
Monarda fistulosa (wild bergamot)	0.5	0-0.5	6	0.03	N
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	6	0.03	N
Perideridia gairdneri (squawroot)	0.5	0-0.5	6	0.03	N
Petasites frigidus (arctic sweet coltsfoot)	1.8	0-3	11	0.19	N
Petasites palmatus (palmate-leaved coltsfoot)	5.3	0-10	11	0.58	N
Petasites sagittatus (arrow-leaved coltsfoot)	10.0	0-10	6	0.56	N
Plantago major (common plantain)	0.5	0-0.5	17	0.08	I
Plantago patagonica (Pursh's plantain)	3.0	0-3	6	0.17	N
Polemonium acutiflorum (tall Jacob's-ladder)	3.0	0-3	6	0.17	N
Potentilla diversifolia (mountain cinquefoil)	0.5	0-0.5	6	0.03	N
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	6	0.03	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	11	0.06	N
Ranunculus acris (tall buttercup)	1.8	0-3	11	0.19	I

Table 232. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Rumex occidentalis (western dock)	0.5	0-0.5	6	0.03	N
Scutellaria galericulata (marsh skullcap)	3.0	0-3	6	0.17	N
Senecio foetidus (marsh butterweed)	0.5	0-0.5	6	0.03	N
Senecio pauciflorus (few-flowered ragwort)	3.0	0-3	6	0.17	N
Senecio pauperculus (balsam groundsel)	0.5	0-0.5	17	0.08	N
Sisymbrium loeselii (tall hedge mustard)	0.5	0-0.5	6	0.03	I
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	17	0.08	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	39	0.19	N
Solidago canadensis (Canada goldenrod)	6.3	0-20	28	1.75	N
Solidago missouriensis (low goldenrod)	0.5	0-0.5	6	0.03	N
Stachys palustris (marsh hedge-nettle)	0.5	0-0.5	17	0.08	N
Stellaria calycantha (northern stitchwort)	0.5	0-0.5	11	0.06	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	6	0.03	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1.1	0-3	22	0.25	N
Taraxacum officinale (common dandelion)	2.4	0-10	78	1.86	I
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	39	0.19	N
Thlaspi arvense (stinkweed)	0.5	0-0.5	6	0.03	I
Trifolium repens (white clover)	11.0	0-20	17	1.83	I
Urtica dioica (common nettle)	6.1	0-30	39	2.36	N
Vicia americana (wild vetch)	1.4	0-3	44	0.64	N
*Viola canadensi*s (western Canada violet)	0.5	0-0.5	11	0.06	N
Viola palustris (marsh violet)	0.5	0-0.5	6	0.03	N
Viola renifolia (kidney-leaved violet)	0.5	0-0.5	6	0.03	N
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	6	0.03	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present

are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 233 shows the five most prominent plant species among the four lifeforms for species recorded in all five relatively undisturbed late seral to climax stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type. *Salix bebbiana* (beaked willow) is by far most prominent, followed by *Calamagrostis canadensis* (marsh reed grass). No other species more than moderately prominent here.

Table 233. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (number = 5 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Betula papyrifera (white birch)	0.60	Native
Abies lasiocarpa (subalpine fir)	0.10	Native
Pinus contorta (lodgepole pine)	0.10	Native
Shrubs		
Salix bebbiana (beaked willow)	62.00	Native
Alnus crispa (green alder)	8.00	Native
Rosa acicularis (prickly rose)	2.60	Native
Cornus stolonifera (red-osier dogwood)	2.00	Native
Rosa woodsii (common wild rose)	2.00	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	24.00	Native
Poa pratensis (Kentucky bluegrass)	4.00	Introduced
Phleum pratense (timothy)	2.10	Introduced
Carex hoodii (Hood's sedge)	2.00	Native
Alopecurus occidentalis (alpine foxtail)	0.60	Native
Forbs		
Equisetum arvense (common horsetail)	8.10	Native
Gymnocarpium dryopteris (oak fern)	4.00	Native
Mertensia paniculata (tall lungwort)	2.70	Native
Epilobium angustifolium (common fireweed)	2.30	Native
Solidago canadensis (Canada goldenrod)	2.10	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 234 through Table 237, break out the vegetation recorded in five relatively undisturbed late seral to climax stands sampled of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/

marsh reed grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, species rich, shrub dominated habitat type of major occurrence across the study area.

Table 234 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/ Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type. For the 5 stands comprising the habitat type, the number of unique species was 62 with 58 (93.5 percent) of them being native species.

Table 234. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/ Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (number = 5 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3	3	0	0
Shrubs	18	17	0	1
Graminoids	11	9	2	0
Forbs	30	29	1	0
TOTAL	***62 (100.0%)***	***58 (93.5%)***	***3 (4.8%)***	***1 (1.6%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 235 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type. The average number of species per stand is 19.8, with native species comprising 18.2 species per stand or 91.9 percent.

Table 235. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (number = 5 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.6	0.6	0.0	0.0
Shrubs	6.0	5.6	0.0	0.4
Graminoids	3.2	2.6	0.6	0.0
Forbs	10.0	9.4	0.6	0.0
TOTAL	***19.8 (100.0%)***	***18.2 (91.9%)***	***1.2 (6.1%)***	***0.4 (2.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 236 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type. The average canopy cover per stand is 149.4 percent, with native species comprising 142.3 percent or 95.2 percent of the total amount of average canopy cover per stand.

Table 236. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (number = 5 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.8%	0.8%	0.0%	0.0%
Shrubs	82.6%	82.4%	0.0%	0.2%
Graminoids	34.8%	28.7%	6.1%	0.0%
Forbs	31.2%	30.4%	0.8%	0.0%
TOTAL	***149.4% (100.0%)***	***142.3% (95.2%)***	***6.9% (4.6%)***	***0.2% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 237 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type. The average number of species per stand was 19.8 with an average canopy cover of 149.4 percent.

Table 237. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (number = 5 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.6	0.8%
Shrubs	6.0	82.6%
Graminoids	3.2	34.8%
Forbs	10.0	31.2%
TOTAL	***19.8***	***149.4%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 62 plant species were recorded on at least one of five relatively undisturbed late seral to climax stands sampled of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (Table 238). Three tree species were recorded in small amounts on these five stands, while of 18 shrub species, only *Salix bebbiana* (beaked willow) was very prominent or recorded on all five plots. Similarly, *Calamagrostis canadensis* (marsh reed grass) was the only graminoid species with high prominence or 100 percent constancy. Of the 30 forbs recorded, none was more than moderately prominent.

Table 238. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (number = 5 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 3)					
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	20	0.10	N
Betula papyrifera (white birch)	3.0	0-3	20	0.60	N
Pinus contorta (lodgepole pine)	0.5	0-0.5	20	0.10	N
Shrubs (N = 18)					
Alnus crispa (green alder)	40.0	0-40	20	8.00	N
Cornus stolonifera (red-osier dogwood)	10.0	0-10	20	2.00	N
Linnaea borealis (twinflower)	0.5	0-0.5	20	0.10	N
Lonicera involucrata (bracted honeysuckle)	3.0	0-3	60	1.80	N
Ribes americanum (wild black currant)	0.5	0-0.5	40	0.20	N
Ribes lacustre (bristly black currant)	3.0	0-3	20	0.60	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	20	0.10	N
Ribes triste (wild red currant)	0.5	0-0.5	20	0.10	N
Rosa acicularis (prickly rose)	6.5	0-10	40	2.60	N
Rosa spp. (rose)	0.5	0-0.5	40	0.20	B
Rosa woodsii (common wild rose)	10.0	0-10	20	2.00	N
Rubus idaeus (wild red raspberry)	1.8	0-3	40	0.70	N
Rubus pubescens (dewberry)	1.8	0-3	40	0.70	N
Salix bebbiana (beaked willow)	62.0	40-80	100	62.00	N
Salix pseudomonticola (false mountain willow)	3.0	0-3	20	0.60	N
Sambucus racemosa (red elderberry)	0.5	0-0.5	20	0.10	N
Symphoricarpos occidentalis (buckbrush)	1.8	0-3	40	0.70	N
Viburnum edule (low-bush cranberry)	0.5	0-0.5	20	0.10	N
Graminoids (N = 11)					
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	20	0.10	N
Alopecurus occidentalis (alpine foxtail)	3.0	0-3	20	0.60	N
Bromus anomalus (nodding brome)	0.5	0-0.5	20	0.10	N
Bromus ciliatus (fringed brome)	3.0	0-3	20	0.60	N
Calamagrostis canadensis (marsh reed grass)	24.0	10-40	100	24.00	N
Carex hoodii (Hood's sedge)	10.0	0-10	20	2.00	N
Elymus glaucus (smooth wild rye)	3.0	0-3	20	0.60	N
Glyceria striata (fowl manna grass)	3.0	0-3	20	0.60	N
Phleum pratense (timothy)	5.3	0-10	40	2.10	I

Table 238. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Poa interior (inland bluegrass)	0.5	0-0.5	20	0.10	N
Poa pratensis (Kentucky bluegrass)	20.0	0-20	20	4.00	I
Forbs (N = 30)					
Achillea millefolium (common yarrow)	0.5	0-0.5	20	0.10	N
Actaea rubra (red and white baneberry)	0.5	0-0.5	40	0.20	N
Aralia nudicaulis (wild sarsaparilla)	10.0	0-10	20	2.00	N
Arnica cordifolia (heart-leaved arnica)	0.5	0-0.5	20	0.10	N
Aster ciliolatus (Lindley's aster)	3.0	0-3	20	0.60	N
Aster conspicuus (showy aster)	0.5	0-0.5	20	0.10	N
Delphinium glaucum (tall larkspur)	1.3	0-3	60	0.80	N
Epilobium angustifolium (common fireweed)	2.9	0-10	80	2.30	N
Equisetum arvense (common horsetail)	13.5	0-30	60	8.10	N
Equisetum sylvaticum (woodland horsetail)	3.0	0-3	20	0.60	N
Fragaria virginiana (wild strawberry)	3.0	0-3	20	0.60	N
Galium boreale (northern bedstraw)	0.5	0-0.5	40	0.20	N
Galium triflorum (sweet-scented bedstraw)	1.8	0-3	40	0.70	N
Geranium richardsonii (wild white geranium)	10.0	0-10	20	2.00	N
Gymnocarpium dryopteris (oak fern)	20.0	0-20	20	4.00	N
Heracleum lanatum (cow parsnip)	1.8	0-3	40	0.70	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	40	0.20	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	20	0.10	N
Mertensia paniculata (tall lungwort)	4.5	0-10	60	2.70	N
Monarda fistulosa (wild bergamot)	0.5	0-0.5	20	0.10	N
Petasites frigidus (arctic sweet coltsfoot)	1.8	0-3	40	0.70	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	20	0.10	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	20	0.10	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	20	0.10	N
Solidago canadensis (Canada goldenrod)	5.3	0-10	40	2.10	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	3.0	0-3	20	0.60	N
Taraxacum officinale (common dandelion)	1.3	0-3	60	0.80	I
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	60	0.30	N
Urtica dioica (common nettle)	0.5	0-0.5	20	0.10	N
Viola renifolia (kidney-leaved violet)	0.5	0-0.5	20	0.10	N

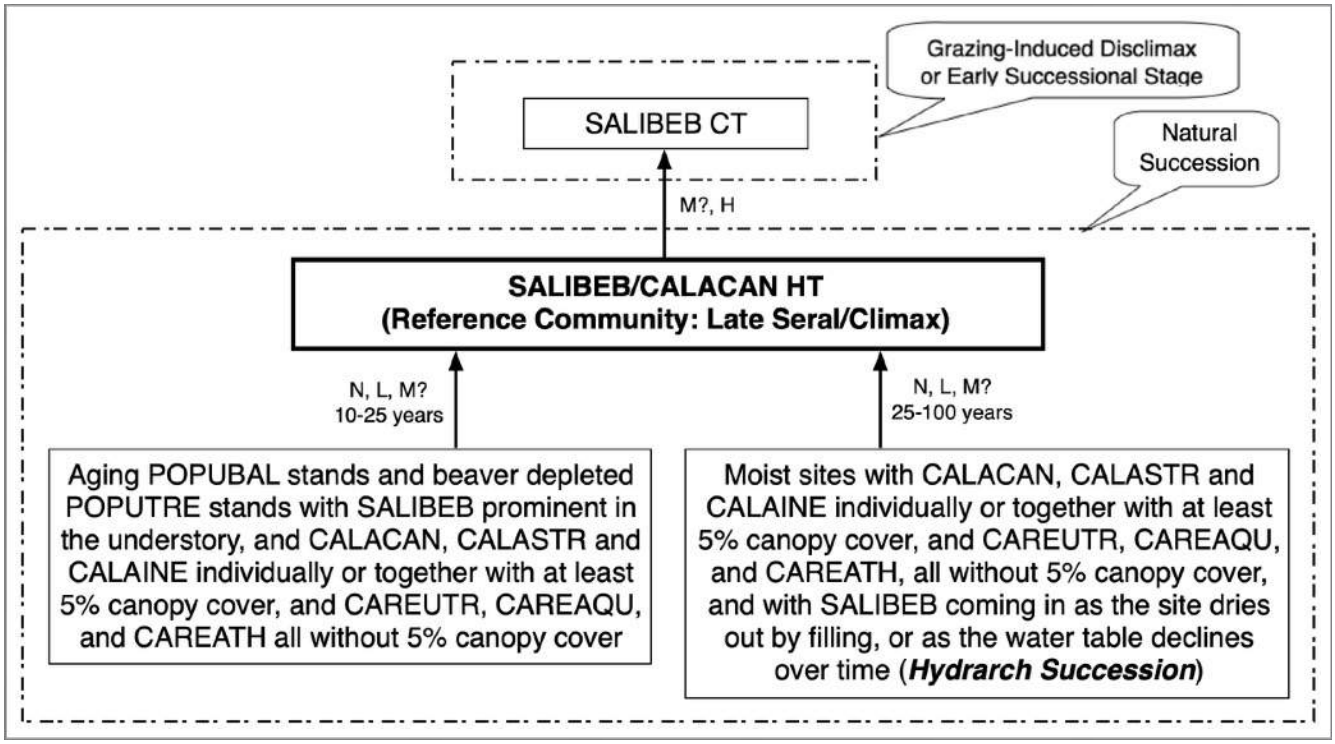
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type can develop on a site typically through two kinds of natural succession: 1) primary succession (hydrarch succession) whereby a wet meadow stand of *Calamagrostis canadensis* (marsh reed grass) located in a shallow depression gradually fills in enough for *Salix bebbiana* (beaked willow) to become established; and 2) secondary succession wherein aging *Populus balsamifera* (balsam poplar) stands, or beaver depleted *Populus tremuloides* (aspen) stands, have both *Salix bebbiana* (beaked willow) and *Calamagrostis canadensis* (marsh reed grass) prominent in their understory.

Figure 50 shows a schematic diagram of vegetation successional pathways on sites of the *Salix bebbiana/ Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type.



Successional Pathway of *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES

CALACAN—*Calamagrostis canadensis* (marsh reed grass)
CALAINE—*Calamagrostis inexpansa* (northern reed grass)
CALASTR—*Calamagrostis stricta* (narrow reed grass)
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUTRE—*Populus tremuloides* (aspen)

SALIBEB—*Salix bebbiana* (beaked willow)
SALIBEB CT—*Salix bebbiana* (beaked willow) community type
SALIBEB/CALACAN HT—*Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type

Figure 50. Successional pathway for sites of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 51 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

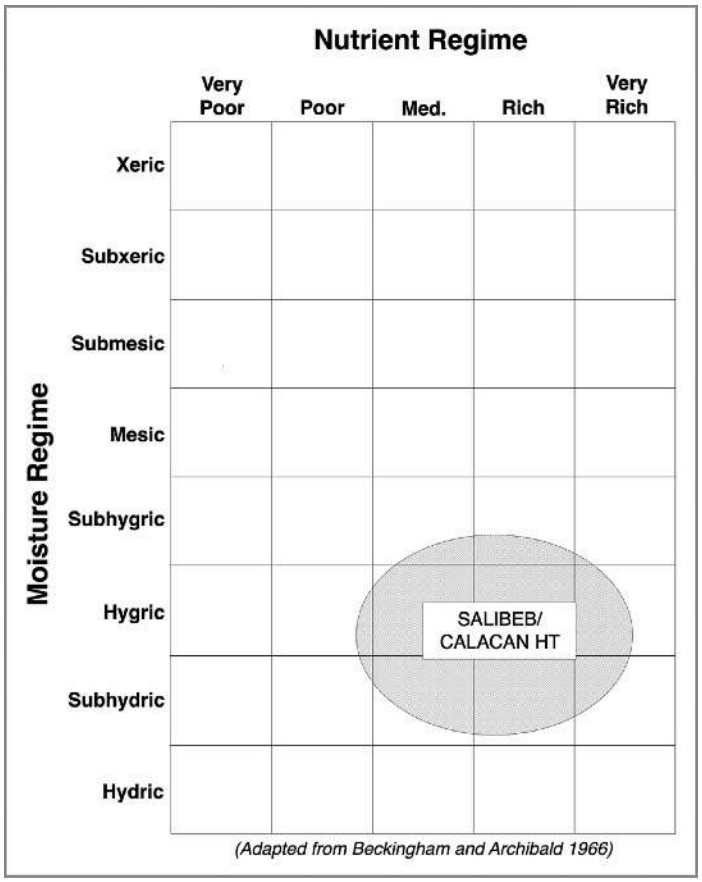


Figure 51. Edatope grid position for the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type (SALIBEB/CALACAN HT)

SOILS

Parent material on sites supporting the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type is predominantly morainal and undifferentiated organic. *Salix bebbiana* (beaked willow) is usually found on moist sandy or gravelly soils but is adapted to a wide variety of soil textures, and sites are poorly drained. These soils often have a thick organic layer of peaty mor humus. Soil subgroups are commonly gleysols and fibrisols, and surface texture typically varies from clay loam to sandy loam, with humic or fibric upper horizons often present. (France and others 2020, Beckingham and Archibald 1996).

ADJACENT COMMUNITIES

Adjacent wetter sites are likely to have either the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type, the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type, or the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type. Adjacent drier sites may have communities dominated by *Populus balsamifera* (balsam poplar), *Populus tremuloides* (aspen) or *Picea glauca* (white spruce).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is a common and widespread species throughout most natural regions in Alberta. It grows in open woods, moist fescue grasslands, on shores and floodplains, often forming extensive thickets (Tannas 1997a). In northern Alberta, this species is common around sloughs in prairies, and in foothills, upland forests, wet lowlands, thickets, and muskegs. It is often found in thickets adjacent to streams, swamps, and lakes (Tesky 1992).

Salix bebbiana (beaked willow) is usually found on moist sandy or gravelly soils, but is adapted to a wide variety of soil textures. It will tolerate moderately alkaline soils, but does poorly in extremely acidic or alkaline conditions. It can survive short periods of standing water, but growth rates decline sharply if water persists above the root collar. *Salix bebbiana* (beaked willow) is not drought tolerant, however; and prefers sites with adequate moisture. It is a pioneer species that is shade intolerant and grows best in full sunlight (Tesky 1992).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—*Calamagrostis stricta* (narrow reed grass) is common across Alberta, except in the prairies. It occurs farther north than *Calamagrostis inexpansa* (northern reed grass). It grows in swamps, around edges of wetlands, in moist woods, and on many moister upland sites (Tannas 1997a).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) is found in woodlands and thickets, in moist or boggy woods, along streams, in coniferous forests, and sometimes in sandy woods (Tannas 1997a). The species is a

valuable understory component, protecting the soil along water courses and as a pioneer species on disturbed mineral soil. It improves the soil by adding organic matter and by fixing nitrogen (Tannas 1997a).

Alnus crispa (green alder) is a semi-shade tolerant pioneer, or seral, species. It invades and inhabits terraces above the floodplain that are subject to occasional flooding (Matthews 1992).

***Equisetum arvense* (common horsetail)**—*Equisetum arvense* (common horsetail) is a native, perennial, rhizomatous cryptogam (Sullivan 1993). The species is very common throughout all natural regions of Alberta. It is found on a variety of sites, including roadsides, gravelly banks, sandy areas, moist woods, low areas, cultivated fields, and disturbed sites (Tannas 1997b).

Equisetum arvense (common horsetail) is present in both early seral and climax communities; its presence largely dictated by edaphic conditions instead of shade or other factors. It is an early colonizer on alluvial deposits and persists through succession, occurring in later seral communities as an herbaceous dominant (Sullivan 1993).

Livestock

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) has good forage value, being very nutritious with higher protein content than most grasses. The species is rated as one of the most palatable of willows (Tannas 1997a). It is resistant to heavy browsing and is considered a grazing increaser. However, severely injured or dying plants may indicate deteriorated range condition or a very high game population (Tannas 1997a).

In stands dominated by *Salix bebbiana* (beaked willow), forage production is moderate to high. The species rates as good forage value (Tannas 1997a); and the associated wetland sedges (*Carex atherodes* [awned sedge], *Carex aquatilis* [water sedge], and *Carex utriculata* [beaked sedge]) all rate as fair to good forage value (Stone and Lawrence 2000, Tannas 1997a). As a result, high use by livestock is common after sites dry out somewhat in summer. The moist, fine textured soils are extremely susceptible to trampling damage, becoming compacted and hummocked with prolonged presence of livestock. In some stands, the *Salix* (willows) may become highlined, clubbed, or decadent clumps. With continued overuse, *Salix* (willows) can show a sharp decline in vigour and may even be finally eliminated from the site.

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—*Calamagrostis stricta* (narrow reed grass) has moderate nutritional value in early spring, but which declines as the season advances. The forage is most palatable in spring, but is avoided later in the season unless other forage is unavailable (Tannas 1997a). In general, *Calamagrostis* species (reed grass) are mostly palatable and nutritious for livestock and wildlife, but are considered to be of poor quality because their foliage becomes very rough as it matures (Johnson and others 1995). Protein content is 17 percent to 19 percent in spring, but drops to 7 percent by late summer (Tannas 1997a).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) provides fair to poor forage value. Although the leaves and twigs are thought to be nutritious and to have a fairly high protein content, the species ranks quite low in palatability, and is used only sparingly by both livestock and wild ungulates (Tannas 1997a). *Alnus crispa* (green alder) is considered an increaser in response to grazing, reproducing rapidly by both rhizomes and seed, while being fairly resistant to browsing (Tannas 1997a).

***Equisetum arvense* (common horsetail)**—*Equisetum arvense* (common horsetail) has poor forage value, and is a grazing increaser, especially on sandy and gravelly soils (Tannas 1997b). In wild hay, if in excessive quantities, *Equisetum* species (horsetails) are known to cause scours, paralysis, and occasionally death. Hay containing around 20 percent or more *Equisetum* species (horsetails) can produce poisoning symptoms in horses. Symptoms appear in 2-5 weeks, beginning with weight loss, loss of muscular control, and followed by falling, exhaustion, and possibly death. Cattle, sheep, and goats are rarely affected (Hansen and others 1995).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is used extensively by wild ungulates, especially moose, and is an important food source for small mammals. It also provides valuable shelter and habitat for birds and other wildlife (Tannas 1997a). Where stands of *Salix bebbiana* (beaked willow) occur on winter game ranges, browsing of *Salix bebbiana* (beaked willow) by wild ungulates is often severe enough to reduce plant vigour and regeneration. *Salix bebbiana* (beaked willow) is a highly valuable browse for elk, with high levels of utilization common (Tesky 1992). Continued use may lead to conversion to an herbaceous community dominated by *Poa palustris* (fowl bluegrass) and *Poa pratensis* (Kentucky bluegrass). Moose and beaver also heavily utilize most species of *Salix* (willow). *Salix bebbiana* (beaked willow) provides cover and protection for many birds and mammals, and also provides shade along banks of streams and ponds (Tesky 1992).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—Elk may make moderate summer use of *Calamagrostis* species (reed grass) (Kufeld 1973).

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) leaves and young growth are readily eaten in severe weather and when other food supplies are scarce, primarily on elk and moose winter range in the upper foothills. Furthermore, the species provides important cover and habitat for wildlife, and is an important source of food for beaver (Tannas 1997a). Muskrat, beaver, cottontail, and snowshoe hares feed on alder twigs and foliage (Matthews 1992). Many birds eat alder seeds, buds, and catkins. The species is also an important component of white-tailed ptarmigan winter forage (Matthews 1992).

***Equisetum arvense* (common horsetail)**—*Equisetum arvense* (common horsetail) is a common food item for grizzly bears, and is a minor to important component of the spring and early summer diet of black bears (Sullivan 1993). Caribou, moose, sheep and grizzly bear all eat *Equisetum arvense* (common horsetail), and it is also a favorite food of geese and other waterfowl (CYSIP 2023).

Fisheries

***Salix bebbiana* (beaked willow)**—The importance of *Salix* species (willows) in streambank stabilization, cover, and thermal protection for fisheries cannot be over emphasized. The herbaceous understory aids in filtering out sediments during overbank flows, thereby contributing to streambank building (Hansen and others 1995).

***Calamagrostis stricta* (narrow reed grass)**—The rhizomatous nature of *Calamagrostis* species (reed grass) will help provide bank stability for sites adjacent to streams (Thompson and Hansen 2003).

Fire

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) will sprout vigorously from the basal stem after fire. The light wind blown seeds readily colonize exposed mineral soil after severe fires. *Salix bebbiana* (beaked willow) usually becomes the dominant species in willow stands after fires on upland sites and in thickets adjacent to streams, swamps, and lakes (Tesky 1992).

Salix bebbiana (beaked willow) is highly adapted to fire in most habitats, sprouting rapidly from basal stems following fire (Haeussler and Coates 1986). Fast moving fires maximize sprouting, while slower burns cause more damage to plants. Prescribed burning is a commonly used wildlife management tool to rejuvenate decadent communities dominated by this willow. The light seeds readily colonize exposed mineral soil after hot fires. The degree to which this species invades after fire, however, depends on the time of year, weather, and presence of a mineral seedbed. Prescribed burning is a common wildlife management tool used to rejuvenate decadent *Salix bebbiana* (beaked willow) communities (Tesky 1992).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

***Calamagrostis stricta* (narrow reed grass)**—Fires reducing the abundance of other associated species tend to cause dramatic increase in *Calamagrostis stricta* (narrow reed grass) and other rhizomatous species (Haeussler and Coates 1986).

***Alnus crispa* (green alder)**—Following fire, *Alnus crispa* (green alder) resprouts from the root crowns and establishes by seed from plants in nearby unburned areas. The bare mineral soil created by fire provides prime sites for *Alnus crispa* (green alder) establishment. The species does not burn easily, and dense stands can sometimes prevent fire spread. These shrubs provide shade that reduces soil temperatures, allowing spruce and other conifer trees to become established (Matthews 1992).

***Equisetum arvense* (common horsetail)**—*Equisetum arvense* (common horsetail) usually occurs in moist habitats that do not undergo frequent fire. However when it does burn, it is top-killed by most fires. The rhizomes are particularly resistant to fire because they are buried deep in the mineral soil, so it regenerates rapidly after a fire (Sullivan 1993).

Rehabilitation/Restoration Considerations

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is a relatively good soil stabilizer and is valuable for revegetating streambanks and other disturbed sites (Tesky 1992). Stands dominated by *Salix bebbiana* (beaked willow) receive high use by wildlife and livestock. Soils and streambanks are highly susceptible to trampling damage, especially when soils are wet. Deferring grazing until sites are drier can reduce trampling and compaction problems (Marlow 1984). Unless the high water tables are maintained, the understories in these stands will be converted to dominance by introduced grass species and weedy forbs (Hansen and others 1995).

Salix bebbiana (beaked willow) is valuable for revegetating streambanks and other disturbed sites. Cuttings are best taken in the spring from dormant two to four year old wood and should be planted on sites that have sufficient moisture to start and carry them through the growing season. Cuttings 30 cm to 50 cm long and more than 1 cm in diameter produce the best results, with the cuttings rooting freely along the entire length of the stem. Shoots from cuttings can be expected to appear 10 to 20 days after planting. However, use of rooted cuttings and nursery grown stock will produce better results.

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—Roads and trails should be located on adjacent uplands. *Calamagrostis stricta* (narrow reed grass) propagates by both seeds and rhizomes, making it a valuable species for stabilizing or rehabilitating suitable disturbed sites (Thompson and Hansen 2003).

***Alnus crispa* (green alder)**—The major value of *Alnus crispa* (green alder) in rehabilitation is its ability to invade sterile soil, thereby increasing the organic matter content and by nitrogen fixation (Matthews 1992). The species was noted for its ability to colonize tailings at the Discovery Mine in Northwest Territories (Matthews 1992).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Willow-Bog birch/Marsh reed grass

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Mse23 Sb/Bog birch/Sedge (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type has not been described in the region.

Salix bebbiana/Carex aquatilis Habitat Type
(beaked willow/water sedge Habitat Type)

SALIBEB/CAREAQU Habitat Type
Number of Stands = 10 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 6; Other Data Sets = 4)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type is a major type in the Lower Foothills Natural Subregion, a major type in the Upper Foothills Natural Subregion, and a major type in the Montane Natural Subregion of Alberta. This habitat type is found more on the wetter side of the *Salix bebbiana* (beaked willow) moisture spectrum. It occupies moist to wet areas around sloughs, lake shores, on alluvial terraces, near springs, seeps, and sub-irrigated meadows characterized by fine textured substrates and poor drainage.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 239 shows the five most prominent plant species among the four lifeforms for species recorded in all 10 stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type. *Salix bebbiana* (beaked willow) is most prominent, followed by *Carex aquatilis* (water sedge) and *Calamagrostis canadensis* (marsh reed grass). No other species is more than moderately prominent in these stands.

Table 239. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (number = 10 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	0.65	Native
Betula papyrifera (white birch)	0.05	Native
Pinus contorta (lodgepole pine)	0.05	Native
Populus tremuloides (aspen)	0.05	Native
Shrubs		
Salix bebbiana (beaked willow)	36.00	Native
Betula pumila (dwarf birch)	4.00	Native
Salix arbusculoides (shrubby willow)	4.00	Native
Salix maccalliana (velvet-fruited willow)	3.60	Native
Salix petiolaris (basket willow)	3.00	Native
Graminoids		
Carex aquatilis (water sedge)	25.00	Native
Calamagrostis canadensis (marsh reed grass)	11.30	Native
Carex curta (short sedge)	4.00	Native
Carex utriculata (beaked sedge)	2.35	Native
Agropyron trachycaulum (slender wheat grass)	2.00	Native
Forbs		
Equisetum fluviatile (swamp horsetail)	8.00	Native
Fragaria virginiana (wild strawberry)	3.45	Native
Viola renifolia (kidney-leaved violet)	2.35	Native
Equisetum variegatum (variegated horsetail)	2.00	Native
Taraxacum officinale (common dandelion)	2.00	Introduced

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 240 through Table 243, break out the vegetation recorded in all 10 stands sampled of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, species rich, shrub dominated habitat type of major occurrence across the study area.

Table 240 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type. For the 10 stands comprising the habitat type, the number of unique species was 118 with 111 (94.1 percent) of them being native species.

Table 240. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (number = 10 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	4	4	0	0
Shrubs	27	26	0	1
Graminoids	23	19	4	0
Forbs	64	62	1	1
TOTAL	***118 (100.0%)***	***111 (94.1%)***	***5 (4.2%)***	***2 (1.7%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 241 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type. The average number of species per stand is 21.8, with native species comprising 21.1 species per stand or 96.8 percent.

Table 241. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (number = 10 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.6	0.6	0.0	0.0
Shrubs	5.1	5.0	0.0	0.1
Graminoids	4.5	4.1	0.4	0.0
Forbs	11.6	11.4	0.1	0.1
TOTAL	***21.8 (100.0%)***	***21.1 (96.8%)***	***0.5 (2.3%)***	***0.2 (0.9%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 242 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type. The average canopy cover per stand is 148.6 percent, with native species comprising 144.8 percent or 97.5 percent of the total amount of average canopy cover per stand.

Table 242. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (number = 10 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.8%	0.8%	0.0%	0.0%
Shrubs	62.7%	62.6%	0.0%	0.1%
Graminoids	52.8%	51.1%	1.7%	0.0%
Forbs	32.4%	30.3%	2.0%	0.1%
TOTAL	***148.6% (100.0%)***	***144.8% (97.5%)***	***3.7% (2.5%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 243 shows the average number of species and average canopy cover by lifeform in stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type. The average number of species per stand was 21.8 with an average canopy cover of 148.6 percent.

Table 243. Average number of species and average canopy cover by lifeform in stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (number = 10 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.6	0.8%
Shrubs	5.1	62.7%
Graminoids	4.5	52.8%
Forbs	11.6	32.4%
TOTAL	***21.8***	***148.6%***

Sampled Stands Plant Species List

A total of 118 plant species were recorded on at least one of 10 stands sampled of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (Table 244). Four tree species were recorded in small amounts on these stands, while among the 27 shrub species recorded, only *Salix bebbiana* (beaked willow) was very prominent or occurred on all plots. *Carex aquatilis* (water sedge) is the graminoid species with highest prominence and is the only one with 100 percent constancy, although *Calamagrostis canadensis* (marsh reed grass) is also fairly highly prominent. Of the 64 forbs recorded, none is more than moderately prominent.

Table 244. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (number = 10 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 4)					
Betula papyrifera (white birch)	0.5	0-0.5	10	0.05	N
Picea glauca (white spruce)	2.2	0-3	30	0.65	N
Pinus contorta (lodgepole pine)	0.5	0-0.5	10	0.05	N
Populus tremuloides (aspen)	0.5	0-0.5	10	0.05	N
Shrubs (N = 27)					
Betula glandulosa (bog birch)	3.5	0-10	40	1.40	N
Betula pumila (dwarf birch)	20.0	0-30	20	4.00	N
Cornus stolonifera (red-osier dogwood)	20.0	0-20	10	2.00	N
Corylus cornuta (beaked hazelnut)	10.0	0-10	10	1.00	N
Elaeagnus commutata (silverberry)	3.0	0-3	10	0.30	N
Ledum groenlandicum (common Labrador tea)	1.8	0-3	20	0.35	N
Linnaea borealis (twinflower)	0.5	0-0.5	20	0.10	N
Lonicera dioica (twining honeysuckle)	0.5	0-0.5	10	0.05	N
Lonicera involucrata (bracted honeysuckle)	10.0	0-10	10	1.00	N
Potentilla fruticosa (shrubby cinquefoil)	0.5	0-0.5	10	0.05	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	10	0.05	N
Rosa acicularis (prickly rose)	0.5	0-0.5	10	0.05	N
Rosa spp. (rose)	0.5	0-0.5	10	0.05	B
Rubus arcticus (dwarf raspberry)	1.5	0-3	50	0.75	N
Rubus pedatus (dwarf bramble)	3.0	0-3	10	0.30	N
Rubus pubescens (dewberry)	1.3	0-3	30	0.40	N
Salix arbusculoides (shrubby willow)	40.0	0-40	10	4.00	N
Salix bebbiana (beaked willow)	36.0	10-90	100	36.00	N
Salix candida (hoary willow)	0.5	0-0.5	10	0.05	N
Salix lutea (yellow willow)	20.0	0-20	10	2.00	N
Salix maccalliana (velvet-fruited willow)	12.0	0-30	30	3.60	N
Salix myrtillifolia (myrtle-leaved willow)	10.0	0-10	10	1.00	N
Salix petiolaris (basket willow)	15.0	0-20	20	3.00	N
Salix planifolia (flat-leaved willow)	0.5	0-0.5	10	0.05	N
Salix pseudomonticola (false mountain willow)	0.5	0-0.5	10	0.05	N
Salix serissima (autumn willow)	10.0	0-10	10	1.00	N
Viburnum edule (low-bush cranberry)	0.5	0-0.5	10	0.05	N
Graminoids (N = 23)					
Agropyron trachycaulum (slender wheat grass)	10.0	0-10	20	2.00	N
Agrostis scabra (rough hair grass)	5.3	0-10	20	1.05	N
Agrostis stolonifera (redtop)	3.0	0-3	10	0.30	I
Alopecurus occidentalis (alpine foxtail)	0.5	0-0.5	10	0.05	N
Bromus ciliatus (fringed brome)	0.5	0-0.5	10	0.05	N
Calamagrostis canadensis (marsh reed grass)	18.8	0-60	60	11.30	N
Calamagrostis stricta (narrow reed grass)	5.3	0-10	20	1.05	N
Carex aquatilis (water sedge)	25.0	10-70	100	25.00	N

Table 244. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex aurea (golden sedge)	3.0	0-3	10	0.30	N
Carex capillaris (hair-like sedge)	1.8	0-3	20	0.35	N
Carex curta (short sedge)	40.0	0-40	10	4.00	N
Carex disperma (two-seeded sedge)	10.0	0-10	10	1.00	N
Carex gynocrates (northern bog sedge)	3.0	0-3	10	0.30	N
Carex spp. (sedge)	0.5	0-0.5	10	0.05	N
Carex utriculata (beaked sedge)	7.8	0-20	30	2.35	N
Deschampsia cespitosa (tufted hair grass)	10.0	0-10	10	1.00	N
Elymus innovatus (hairy wild rye)	0.5	0-0.5	10	0.05	N
Festuca ovina (sheep fescue)	0.5	0-0.5	10	0.05	I
Juncus balticus (wire rush)	0.5	0-0.5	30	0.15	N
Juncus spp. (rush)	10.0	0-10	10	1.00	N
Poa compressa (Canada bluegrass)	3.0	0-3	10	0.30	I
Poa interior (inland bluegrass)	0.5	0-0.5	10	0.05	N
Poa pratensis (Kentucky bluegrass)	10.0	0-10	10	1.00	I
Forbs (N = 64)					
Achillea millefolium (common yarrow)	1.3	0-3	60	0.80	N
Aconitum delphinifolium (monkshood)	0.5	0-0.5	10	0.05	N
Adenocaulon bicolor (pathfinder)	3.0	0-3	10	0.30	N
Agoseris glauca (yellow false dandelion)	0.5	0-0.5	10	0.05	N
Antennaria pulcherrima (showy everlasting)	0.5	0-0.5	10	0.05	N
Arnica spp. (arnicas)	0.5	0-0.5	10	0.05	N
Aster borealis (marsh aster)	0.5	0-0.5	20	0.10	N
Aster ciliolatus (Lindley's aster)	1.1	0-3	40	0.45	N
Aster conspicuus (showy aster)	3.0	0-3	10	0.30	N
Aster engelmannii (elegant aster)	0.5	0-0.5	10	0.05	N
Aster hesperius (western willow aster)	0.5	0-0.5	10	0.05	N
Castilleja lutescens (stiff yellow paintbrush)	3.0	0-3	10	0.30	N
Castilleja miniata (common red paintbrush)	0.5	0-0.5	10	0.05	N
Cornus canadensis (bunchberry)	1.8	0-3	20	0.35	N
Delphinium glaucum (tall larkspur)	1.8	0-3	20	0.35	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	30	0.15	N
Equisetum arvense (common horsetail)	2.9	0-10	60	1.75	N
Equisetum fluviatile (swamp horsetail)	80.0	0-80	10	8.00	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	10	0.05	N
Equisetum variegatum (variegated horsetail)	20.0	0-20	10	2.00	N
Fragaria virginiana (wild strawberry)	5.8	0-20	60	3.45	N
Galium boreale (northern bedstraw)	1.3	0-3	30	0.40	N
Galium trifidum (small bedstraw)	0.5	0-0.5	20	0.10	N
Galium triflorum (sweet-scented bedstraw)	3.0	0-3	20	0.60	N
Gentianella amarella (felwort)	0.5	0-0.5	10	0.05	N
Geranium richardsonii (wild white geranium)	0.5	0-0.5	10	0.05	N
Geum aleppicum (yellow avens)	1.1	0-3	40	0.45	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	10	0.05	N

Table 244. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Geum triflorum (three-flowered avens)	3.0	0-3	20	0.60	N
Habenaria spp. (bog orchid)	0.5	0-0.5	10	0.05	B
Habenaria viridis (bracted bog orchid)	0.5	0-0.5	20	0.10	N
Halenia deflexa (spurred gentian)	0.5	0-0.5	10	0.05	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	10	0.05	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	10	0.05	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	10	0.05	N
Mentha arvensis (wild mint)	0.5	0-0.5	10	0.05	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	10	0.05	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	40	0.20	N
Oxytropis splendens (showy locoweed)	3.0	0-3	10	0.30	N
Parnassia fimbriata (fringed grass-of-parnassus)	0.5	0-0.5	10	0.05	N
Parnassia palustris (northern grass-of-parnassus)	1.8	0-3	20	0.35	N
Parnassia parviflora (small northern grass-of-parnassus)	0.5	0-0.5	10	0.05	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	20	0.10	N
Penstemon spp. (beardtongue)	0.5	0-0.5	10	0.05	N
Petasites frigidus (arctic sweet coltsfoot)	3.7	0-10	30	1.10	N
Petasites palmatus (palmate-leaved coltsfoot)	1.8	0-3	20	0.35	N
Petasites sagittatus (arrow-leaved coltsfoot)	3.0	0-3	10	0.30	N
Polemonium pulcherrimum (showy Jacob's-ladder)	0.5	0-0.5	10	0.05	N
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	10	0.05	N
Potentilla palustris (marsh cinquefoil)	0.5	0-0.5	20	0.10	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	10	0.05	N
Rumex occidentalis (western dock)	0.5	0-0.5	10	0.05	N
Senecio indecorus (rayless ragwort)	0.5	0-0.5	10	0.05	N
Senecio pauciflorus (few-flowered ragwort)	0.5	0-0.5	10	0.05	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	10	0.05	N
Smilacina trifolia (three-leaved Solomon's-seal)	0.5	0-0.5	10	0.05	N
Solidago canadensis (Canada goldenrod)	1.8	0-3	40	0.70	N
Stellaria longipes (long-stalked chickweed)	1.8	0-3	20	0.35	N
Taraxacum officinale (common dandelion)	20.0	0-20	10	2.00	I
Thalictrum venulosum (veiny meadow rue)	1.3	0-3	30	0.40	N
Valeriana dioica (northern valerian)	6.5	0-10	20	1.30	N
Vicia americana (wild vetch)	1.3	0-3	30	0.40	N
Viola canadensis (western Canada violet)	0.5	0-0.5	10	0.05	N
Viola renifolia (kidney-leaved violet)	7.8	0-20	30	2.35	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 245 shows the five most prominent plant species among the four lifeforms for species recorded in all three relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type. *Salix bebbiana* (beaked willow) is by far most prominent, followed well behind by *Carex aquatilis* (water sedge) and *Carex curta* (short sedge). No other species is more than moderately prominent in these stands.

Table 245. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (number = 3 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Salix bebbiana (beaked willow)	63.33	Native
Corylus cornuta (beaked hazelnut)	3.33	Native
Lonicera involucrata (bracted honeysuckle)	3.33	Native
Ledum groenlandicum (common Labrador tea)	1.17	Native
Rubus arcticus (dwarf raspberry)	1.17	Native
Graminoids		
Carex aquatilis (water sedge)	30.00	Native
Carex curta (short sedge)	13.33	Native
Calamagrostis canadensis (marsh reed grass)	4.33	Native
Agrostis scabra (rough hair grass)	3.33	Native
Carex disperma (two-seeded sedge)	3.33	Native
Forbs		
Equisetum arvense (common horsetail)	1.17	Native
Achillea millefolium (common yarrow)	1.00	Native
Adenocaulon bicolor (pathfinder)	1.00	Native
Aster ciliolatus (Lindley's aster)	1.00	Native
Cornus canadensis (bunchberry)	1.00	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 246 through Table 249, break out the vegetation recorded in three relatively undisturbed late seral to climax stands sampled of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, species rich, shrub dominated habitat type of major occurrence across the study area.

Table 246 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type. For the 3 stands comprising the habitat type, the number of unique species was 51 with 49 (96.1 percent) of them being native species.

Table 246. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (number = 3 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	11	10	0	1
Graminoids	10	9	1	0
Forbs	30	30	0	0
TOTAL	***51 (100.0%)***	***49 (96.1%)***	***1 (2.0%)***	***1 (2.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 247 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type. The average number of species per stand is 20.6, with native species comprising 20.0 species per stand or 97.1 percent.

Table 247. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (number = 3 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	5.0	4.7	0.0	0.3
Graminoids	4.3	4.0	0.3	0.0
Forbs	11.3	11.3	0.0	0.0
TOTAL	***20.6 (100.0%)***	***20.0 (97.1%)***	***0.3 (1.5%)***	***0.3 (1.5%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 248 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type. The average canopy cover per stand is 148.3 percent, with native species comprising 147.2 percent or 99.2 percent of the total amount of average canopy cover per stand.

Table 248. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (number = 3 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	74.2%	74.0%	0.0%	0.2%
Graminoids	58.5%	57.5%	1.0%	0.0%
Forbs	15.7%	15.7%	0.0%	0.0%
TOTAL	***148.3% (100.0%)***	***147.2% (99.2%)***	***1.0% (0.7%)***	***0.2% (0.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 249 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type. The average number of species per stand was 20.6 with an average canopy cover of 148.3 percent.

Table 249. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (number = 3 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	5.0	74.2%
Graminoids	4.3	58.5%
Forbs	11.3	15.7%
TOTAL	***20.6***	***148.3%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 51 plant species were recorded on at least one of three relatively undisturbed late seral to climax stands sampled of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (Table 250). No trees were recorded on these three stands, and among the 11 shrub species recorded, only *Salix bebbiana* (beaked willow) was very prominent or occurred on all plots sampled. Of 10 graminoid species recorded, *Carex aquatilis* (water sedge) was by far most prominent. However, *Carex curta* (short sedge) also had a moderately high prominence value by virtue of having a high amount of canopy cover on a single plot. Among the 30 forbs recorded, none was very prominent.

Table 250. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (number = 3 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Shrubs (N = 11)					
Betula glandulosa (bog birch)	0.5	0-0.5	33	0.17	N
Corylus cornuta (beaked hazelnut)	10.0	0-10	33	3.33	N
Elaeagnus commutata (silverberry)	3.0	0-3	33	1.00	N
Ledum groenlandicum (common Labrador tea)	1.8	0-3	67	1.17	N
Linnaea borealis (twinflower)	0.5	0-0.5	33	0.17	N
Lonicera involucrata (bracted honeysuckle)	10.0	0-10	33	3.33	N
Rosa spp. (rose)	0.5	0-0.5	33	0.17	B
Rubus arcticus (dwarf raspberry)	1.8	0-3	67	1.17	N
Rubus pubescens (dewberry)	0.5	0-0.5	33	0.17	N
Salix bebbiana (beaked willow)	63.3	40-90	100	63.33	N
Viburnum edule (low-bush cranberry)	0.5	0-0.5	33	0.17	N
Graminoids (N = 10)					
Agrostis scabra (rough hair grass)	10.0	0-10	33	3.33	N
Calamagrostis canadensis (marsh reed grass)	6.5	0-10	67	4.33	N
Calamagrostis stricta (narrow reed grass)	0.5	0-0.5	33	0.17	N
Carex aquatilis (water sedge)	30.0	10-70	100	30.00	N
Carex aurea (golden sedge)	3.0	0-3	33	1.00	N
Carex capillaris (hair-like sedge)	3.0	0-3	33	1.00	N
Carex curta (short sedge)	40.0	0-40	33	13.33	N

Table 250. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex disperma (two-seeded sedge)	10.0	0-10	33	3.33	N
Carex utriculata (beaked sedge)	3.0	0-3	33	1.00	N
Poa compressa (Canada bluegrass)	3.0	0-3	33	1.00	I
Forbs (N = 30)					
Achillea millefolium (common yarrow)	3.0	0-3	33	1.00	N
Adenocaulon bicolor (pathfinder)	3.0	0-3	33	1.00	N
Aster borealis (marsh aster)	0.5	0-0.5	33	0.17	N
Aster ciliolatus (Lindley's aster)	3.0	0-3	33	1.00	N
Aster engelmannii (elegant aster)	0.5	0-0.5	33	0.17	N
Cornus canadensis (bunchberry)	3.0	0-3	33	1.00	N
Equisetum arvense (common horsetail)	1.8	0-3	67	1.17	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	33	0.17	N
Fragaria virginiana (wild strawberry)	3.0	0-3	33	1.00	N
Galium boreale (northern bedstraw)	0.5	0-0.5	33	0.17	N
Galium trifidum (small bedstraw)	0.5	0-0.5	33	0.17	N
Galium triflorum (sweet-scented bedstraw)	3.0	0-3	33	1.00	N
Gentianella amarella (felwort)	0.5	0-0.5	33	0.17	N
Geum triflorum (three-flowered avens)	3.0	0-3	33	1.00	N
Habenaria viridis (bracted bog orchid)	0.5	0-0.5	67	0.33	N
Halenia deflexa (spurred gentian)	0.5	0-0.5	33	0.17	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	33	0.17	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	33	0.17	N
Mentha arvensis (wild mint)	0.5	0-0.5	33	0.17	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	67	0.33	N
Parnassia fimbriata (fringed grass-of-parnassus)	0.5	0-0.5	33	0.17	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	33	0.17	N
Petasites frigidus (arctic sweet coltsfoot)	0.5	0-0.5	33	0.17	N
Potentilla palustris (marsh cinquefoil)	0.5	0-0.5	67	0.33	N
Rumex occidentalis (western dock)	0.5	0-0.5	33	0.17	N
Senecio pauciflorus (few-flowered ragwort)	0.5	0-0.5	33	0.17	N
Solidago canadensis (Canada goldenrod)	3.0	0-3	33	1.00	N
Stellaria longipes (long-stalked chickweed)	3.0	0-3	33	1.00	N
Valeriana dioica (northern valerian)	3.0	0-3	33	1.00	N
Viola renifolia (kidney-leaved violet)	3.0	0-3	33	1.00	N

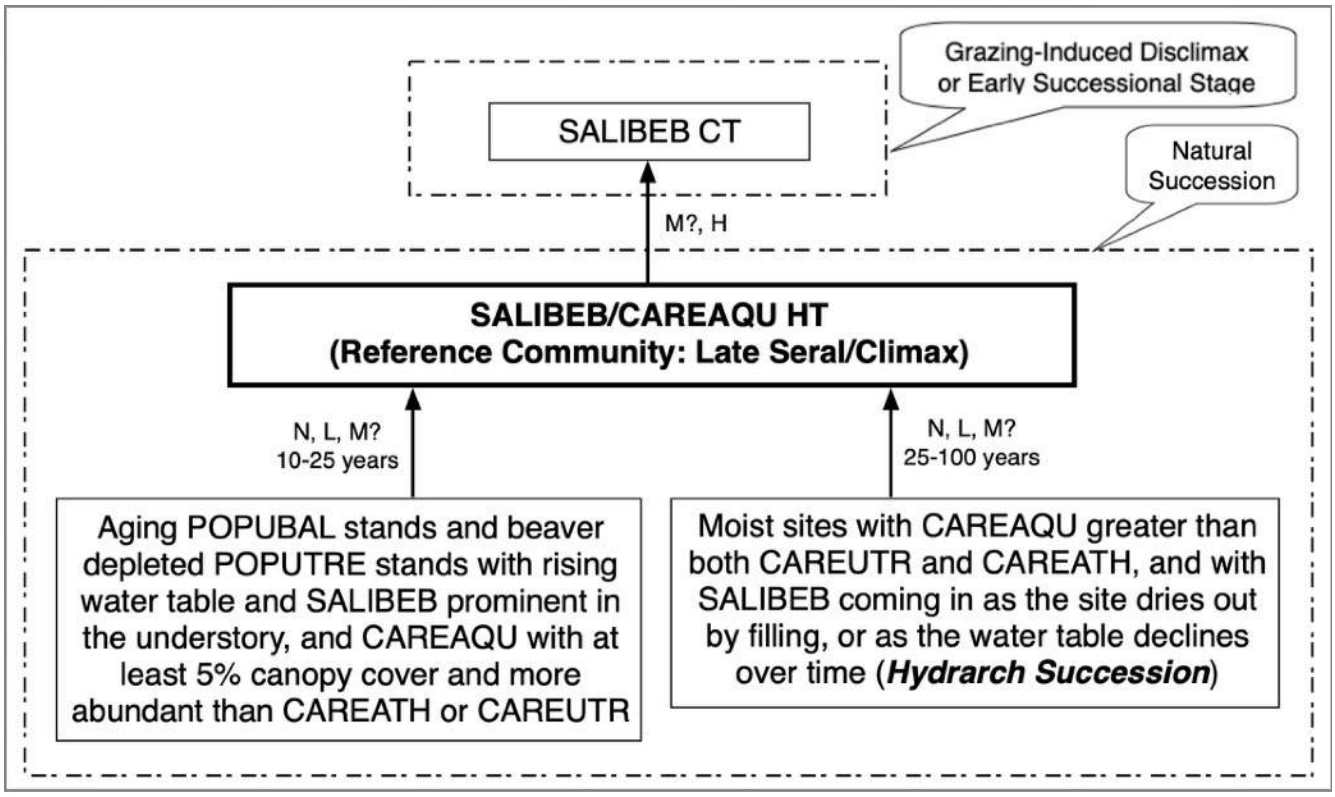
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type can develop on a site typically through two kinds of natural succession: 1) primary succession (hydrarch succession) whereby a wet meadow stand of *Carex aquatilis* (water sedge) located in a shallow depression gradually fills in enough for *Salix bebbiana* (beaked willow) to become established; and 2) secondary succession wherein aging *Populus balsamifera* (balsam poplar) stands, or beaver depleted *Populus tremuloides* (aspen) stands, have both *Salix bebbiana* (beaked willow) and *Carex aquatilis* (water sedge) prominent in their understory.

Figure 52 shows a schematic diagram of vegetation successional pathways on sites of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type.



Successional Pathway of *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUTRE—*Populus tremuloides* (aspen)
SALIBEB—*Salix bebbiana* (beaked willow)

SALIBEB CT—*Salix bebbiana* (beaked willow) community type
SALIBEB/CAREAQU HT—*Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type

Figure 52. Successional pathway for sites of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 53 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

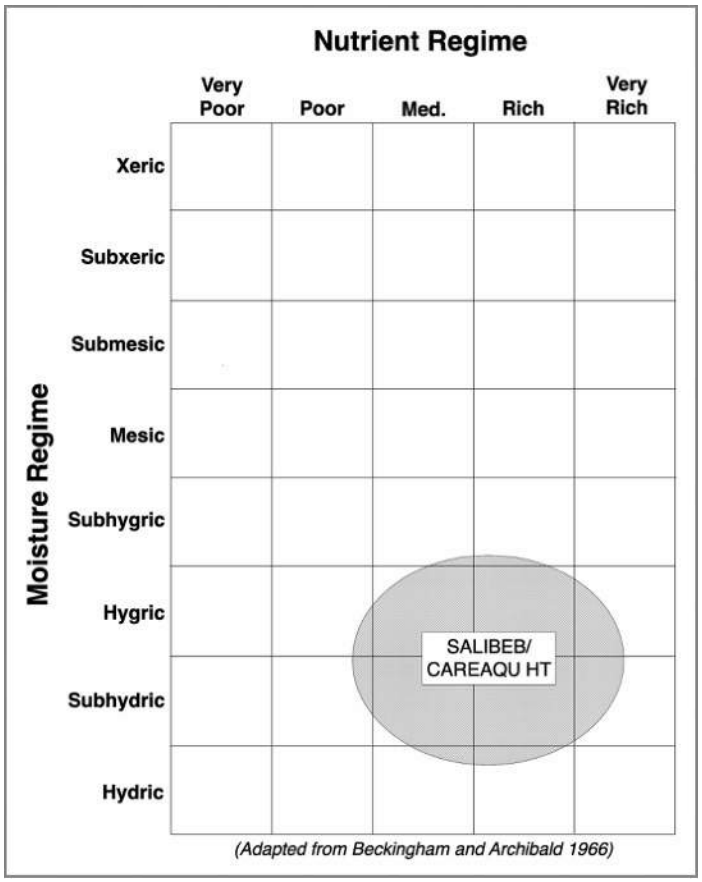


Figure 53. Edatope grid position for the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type (SALIBEB/CAREAQU HT)

SOILS

Parent material on sites supporting the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type is predominantly morainal and alluvial, and soils are mostly brunisols. Soil drainage ranges from well drained to imperfectly drained, with surface texture mostly loamy sand. Organic thickness is mostly 0 cm to 5 cm thick (France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites are likely to have the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type. Adjacent drier sites will likely have the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type or the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is a common and widespread species throughout most natural regions in Alberta. It grows in open woods, moist fescue grasslands, on shores and floodplains, often forming extensive thickets (Tannas 1997a). In northern Alberta, this species is common around sloughs in prairies, and in foothills, upland forests, wet lowlands, thickets, and muskegs. It is often found in thickets adjacent to streams, swamps, and lakes (Tesky 1992).

Salix bebbiana (beaked willow) is usually found on moist sandy or gravelly soils, but is adapted to a wide variety of soil textures. It will tolerate moderately alkaline soils, but does poorly in extremely acidic or alkaline conditions. It can survive short periods of standing water, but growth rates decline sharply if water persists above the root collar. *Salix bebbiana* (beaked willow) is not drought tolerant, however; and prefers sites with adequate moisture. It is a pioneer species that is shade intolerant and grows best in full sunlight (Tesky 1992).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is very common and widely distributed across Alberta (Tannas 1997a). It is a wetland species, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). *Carex aquatilis* (water sedge) is a native, wetland obligate, long-lived perennial. It is a sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of finer roots (Hauser 2006). It thrives on disturbed sites, is shade intolerant, and occurs in various stages of seral succession (Hauser 2006).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

Livestock

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) has good forage value, being very nutritious with higher protein content than most grasses. The species is rated as one of the most palatable of willows (Tannas 1997a). It is resistant to heavy browsing and is considered a grazing increaser. However, severely injured or dying plants may indicate deteriorated range condition or a very high game population (Tannas 1997a).

In stands dominated by *Salix bebbiana* (beaked willow), forage production is moderate to high. The species rates as good forage value (Tannas 1997a); and the associated wetland sedges (*Carex atherodes* [awned sedge], *Carex aquatilis* [water sedge], and *Carex utriculata* [beaked sedge]) all rate as fair to good forage value (Stone and Lawrence 2000, Tannas 1997a). As a result, high use by livestock is common after sites dry out somewhat in summer. The moist, fine textured soils are extremely susceptible to trampling damage, becoming compacted and hummocked with prolonged presence of livestock. In some stands, the *Salix* (willows) may become highlined, clubbed, or decadent clumps. With continued overuse, *Salix* (willows) can show a sharp decline in vigour and may even be finally eliminated from the site.

***Carex aquatilis* (water sedge)**—The livestock forage value of *Carex aquatilis* (water sedge) is rated as good (Tannas 1997a), but varies with region, season, and previous grazing use. On narrow riparian or wetland sites within large pastures, *Carex* species (sedges) are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur. In general, *Carex* species (sedges) should respond satisfactorily to traditional grazing systems. However, on streamside sites ample residual cover should be left to protect the soil surface and trap sediments during fall rains or spring runoff. Removing cattle for at least 30 days from these streamside sites for sedge regrowth at the end of the growing season should provide sufficient residual cover (Myers 1989).

Given that *Carex aquatilis* (water sedge) grows in wet places, it is generally not grazed until late summer and fall when soils have dried (Hauser 2006). Very wet soils may deter animal use until they dry. However, if high level of grazing does occur, there will be a marked decrease in *Carex aquatilis* (water sedge) and an increase in the less palatable *Juncus balticus* (wire rush) (Tannas 1997a).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is used extensively by wild ungulates, especially moose, and is an important food source for small mammals. It also provides valuable shelter and habitat for birds and other wildlife (Tannas 1997a). Where stands of *Salix bebbiana* (beaked willow) occur on winter game ranges, browsing of *Salix bebbiana* (beaked willow) by wild ungulates is often severe enough to reduce plant vigour and regeneration. *Salix bebbiana* (beaked willow) is a highly valuable browse for elk, with high levels of utilization common (Tesky 1992). Continued use may lead to conversion to an herbaceous community dominated by *Poa palustris* (fowl bluegrass) and *Poa pratensis* (Kentucky bluegrass). Moose and

beaver also heavily utilize most species of *Salix* (willow). *Salix bebbiana* (beaked willow) provides cover and protection for many birds and mammals, and also provides shade along banks of streams and ponds (Tesky 1992).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is grazed by many ungulates, including moose, caribou, and elk, but it is not a major component of their diet. Due to the saturated habitat of the species, grazing by most ungulates is limited. *Carex aquatilis* (water sedge) habitat provides nesting and hiding cover for some birds, waterfowl, and small mammals. In riparian and wetland sites, The species is also an important source of food for a variety of waterfowl (Hauser 2006).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

Fisheries

***Salix bebbiana* (beaked willow)**—The importance of *Salix* species (willows) in streambank stabilization, cover, and thermal protection for fisheries cannot be over emphasized. The herbaceous understory aids in filtering out sediments during overbank flows, thereby contributing to streambank building (Hansen and others 1995).

***Carex aquatilis* (water sedge)**—Stands of *Carex aquatilis* (water sedge) often are adjacent to streams supporting trout fisheries. The combined tufted and rhizomatous growth habit of the species effectively stabilizes streambanks. Overhanging *Carex* species (sedges) along the banks provide valuable resting cover and shade for fish (Thompson and Hansen 2003).

Fire

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) will sprout vigorously from the basal stem after fire. The light wind blown seeds readily colonize exposed mineral soil after severe fires. *Salix bebbiana* (beaked willow) usually becomes the dominant species in willow stands after fires on upland sites and in thickets adjacent to streams, swamps, and lakes (Tesky 1992).

Salix bebbiana (beaked willow) is highly adapted to fire in most habitats, sprouting rapidly from basal stems following fire (Haeussler and Coates 1986). Fast moving fires maximize sprouting, while slower burns cause more damage to plants. Prescribed burning is a commonly used wildlife management tool to rejuvenate decadent communities dominated by this willow. The light seeds readily colonize exposed mineral soil after hot fires. The degree to which this species invades after fire, however, depends on the time of year, weather, and presence of a mineral seedbed. Prescribed burning is a common wildlife management tool used to rejuvenate decadent *Salix bebbiana* (beaked willow) communities (Tesky 1992).

***Carex aquatilis* (water sedge)**—Sites supporting stands of *Carex aquatilis* (water sedge) seldom burn, except in periods of severe drought. When stands of the species do burn, the plants are usually top-killed by the fire and soon re-establish after the fire by seed and/or lateral spread of surviving rhizomes (Hauser 2006). The rhizomes are approximately 5 cm below the ground surface, and are somewhat protected from the heat. The wet habitat also provides protection for roots and rhizomes, although the better-drained areas are more susceptible to fires during dry periods.

Stands of *Carex aquatilis* (water sedge) are suited to prescribed fire, but exclusion of livestock during the year prior to burning is necessary. Residual cover burns well in spring, prior to the growing season. Fire will reduce litter accumulations and temporarily increase productivity. However, species composition in the community will not drastically shift from dominance by *Carex aquatilis* (water sedge) (DeBenedetti and Parsons 1984). Care must be taken in burning along streambanks, so as to avoid impairing the excellent erosion protection provided by the species (Thompson and Hansen 2003).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

Rehabilitation/Restoration Considerations

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is a relatively good soil stabilizer and is valuable for revegetating streambanks and other disturbed sites (Tesky 1992). Stands dominated by *Salix bebbiana* (beaked willow) receive high use by wildlife and livestock. Soils and streambanks are highly susceptible to trampling damage, especially when soils are wet. Deferring grazing until sites are drier can reduce trampling and compaction problems (Marlow 1984). Unless the high water tables are maintained, the understories in these stands will be converted to dominance by introduced grass species and weedy forbs (Hansen and others 1995).

Salix bebbiana (beaked willow) is valuable for revegetating streambanks and other disturbed sites. Cuttings are best taken in the spring from dormant two to four year old wood and should be planted on sites that have sufficient moisture to start and carry them through the growing season. Cuttings 30 cm to 50 cm long and more than 1 cm in diameter produce the best results, with the cuttings rooting freely along the entire length of the stem. Shoots from cuttings can be expected to appear 10 to 20 days after planting. However, use of rooted cuttings and nursery grown stock will produce better results.

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) provides excellent erosion protection along streambanks, buffering against the erosive force of flood events, and filtering sediments during spring flows. Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex aquatilis* (water sedge) tends to form a dense, thick sod that is highly resistant to erosion. (Hauser 2006).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Willow/Foothills rough fescue-Hairy wild rye

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Willow/Tufted hair grass

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type has not been described in the region.

Salix bebbiana/Carex atherodes Habitat Type
(beaked willow/awned sedge Habitat Type)

SALIBEB/CAREATH Habitat Type
Number of Stands = 7 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 1; Other Data Sets = 6)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. This habitat type is found more on the wetter side of the *Salix bebbiana* (beaked willow) moisture spectrum. It occupies moist to wet areas around sloughs, lake shores, on alluvial terraces, near springs, seeps, and sub-irrigated meadows characterized by fine textured substrates and poor drainage.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 251 shows the five most prominent plant species among the four lifeforms for species recorded in all seven stands sampled of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type. *Salix bebbiana* (beaked willow) is by far most prominent, followed by *Carex atherodes* (awned sedge) and *Equisetum arvense* (common horsetail). No other species is more than moderately prominent in these stands.

Table 251. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (number = 7 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	0.14	Native
Populus tremuloides (aspen)	0.07	Native
Shrubs		
Salix bebbiana (beaked willow)	61.07	Native
Salix petiolaris (basket willow)	7.57	Native
Salix planifolia (flat-leaved willow)	0.93	Native
Betula glandulosa (bog birch)	0.57	Native
Cornus stolonifera (red-osier dogwood)	0.43	Native
Graminoids		
Carex atherodes (awned sedge)	32.86	Native
Bromus inermis (smooth brome)	5.71	Introduced
Calamagrostis canadensis (marsh reed grass)	4.29	Native
Carex norvegica (Norway sedge)	2.86	Native
Bromus ciliatus (fringed brome)	1.43	Native
Forbs		
Equisetum arvense (common horsetail)	14.29	Native
Polygonum amphibium (water smartweed)	3.29	Native
Heracleum lanatum (cow parsnip)	2.93	Native
Taraxacum officinale (common dandelion)	1.93	Introduced
Aster laevis (smooth aster)	1.86	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 252 through Table 255, break out the vegetation recorded in all seven stands sampled of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species rich, shrub dominated habitat type of minor-to-incidental occurrence across the study area.

Table 252 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type. For the 7 stands comprising the habitat type, the number of unique species was 73 with 60 (82.2 percent) of them being native species.

Table 252. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (number = 7 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2	2	0	0
Shrubs	16	15	0	1
Graminoids	14	10	4	0
Forbs	41	33	6	2
TOTAL	***73 (100.0%)***	***60 (82.2%)***	***10 (13.7%)***	***3 (4.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 253 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type. The average number of species per stand is 19.0, with native species comprising 16.3 species per stand or 85.8 percent.

Table 253. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (number = 7 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.4	0.4	0.0	0.0
Shrubs	4.9	4.7	0.0	0.1
Graminoids	3.6	2.9	0.7	0.0
Forbs	10.1	8.3	1.6	0.3
TOTAL	***19.0 (100.0%)***	***16.3 (85.8%)***	***2.3 (12.1%)***	***0.4 (2.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 254 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type. The average canopy cover per stand is 165.4 percent, with native species comprising 152.3 percent or 92.1 percent of the total amount of average canopy cover per stand.

Table 254. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (number = 7 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.2%	0.2%	0.0%	0.0%
Shrubs	73.2%	73.1%	0.0%	0.1%
Graminoids	51.7%	43.7%	8.0%	0.0%
Forbs	40.3%	35.2%	4.2%	0.9%
TOTAL	***165.4% (100.0%)***	***152.3% (92.1%)***	***12.2% (7.4%)***	***0.9% (0.6%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 255 shows the average number of species and average canopy cover by lifeform in stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type. The average number of species per stand was 19.0 with an average canopy cover of 165.4 percent.

Table 255. Average number of species and average canopy cover by lifeform in stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (number = 7 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.4	0.2%
Shrubs	4.9	73.2%
Graminoids	3.6	51.7%
Forbs	10.1	40.3%
TOTAL	***19.0***	***165.4%***

Sampled Stands Plant Species List

A total of 73 plant species were recorded on at least one of seven stands sampled of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (Table 256). In these stands, two tree species were recorded in very small amounts, but *Salix bebbiana* (beaked willow) overwhelmingly dominates the shrub lifeform, with *Salix petiolaris* (basket willow) in a distant second place. *Carex atherodes* (awned sedge) is the only highly prominent one of 14 graminoid species recorded, and *Equisetum arvense* (common horsetail) is the only highly prominent forb among the 41 species recorded.

Table 256. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (number = 7 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 2)					
Picea glauca (white spruce)	0.5	0-0.5	29	0.14	N
Populus tremuloides (aspen)	0.5	0-0.5	14	0.07	N
Shrubs (N = 16)					
Betula glandulosa (bog birch)	1.3	0-3	43	0.57	N
Betula occidentalis (water birch)	0.5	0-0.5	29	0.14	N
Cornus stolonifera (red-osier dogwood)	3.0	0-3	14	0.43	N
Ribes lacustre (bristly black currant)	0.5	0-0.5	14	0.07	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	43	0.21	N
Rosa acicularis (prickly rose)	0.5	0-0.5	14	0.07	N
Rosa spp. (rose)	0.5	0-0.5	14	0.07	B
Rosa woodsii (common wild rose)	3.0	0-3	14	0.43	N
Salix bebbiana (beaked willow)	61.1	20-97.5	100	61.07	N
Salix lutea (yellow willow)	3.0	0-3	14	0.43	N
Salix maccalliana (velvet-fruited willow)	0.5	0-0.5	43	0.21	N
Salix myrtillifolia (myrtle-leaved willow)	3.0	0-3	14	0.43	N
Salix petiolaris (basket willow)	17.7	0-30	43	7.57	N
Salix planifolia (flat-leaved willow)	2.2	0-3	43	0.93	N
Salix pseudomonticola (false mountain willow)	0.5	0-0.5	29	0.14	N
Symphoricarpos occidentalis (buckbrush)	3.0	0-3	14	0.43	N
Graminoids (N = 14)					
Agropyron smithii (western wheat grass)	0.5	0-0.5	14	0.07	N
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	14	0.07	N
Agrostis stolonifera (redtop)	3.0	0-3	14	0.43	I
Bromus ciliatus (fringed brome)	10.0	0-10	14	1.43	N
Bromus inermis (smooth brome)	20.0	0-20	29	5.71	I
Calamagrostis canadensis (marsh reed grass)	15.0	0-20	29	4.29	N
Carex aenea (silvery-flowered sedge)	0.5	0-0.5	14	0.07	N
Carex atherodes (awned sedge)	32.9	10-80	100	32.86	N
Carex norvegica (Norway sedge)	10.0	0-10	29	2.86	N
Deschampsia cespitosa (tufted hair grass)	10.0	0-10	14	1.43	N
Hordeum jubatum (foxtail barley)	0.5	0-0.5	14	0.07	N
Phleum pratense (timothy)	10.0	0-10	14	1.43	I
Poa palustris (fowl bluegrass)	1.3	0-3	43	0.57	N
Poa pratensis (Kentucky bluegrass)	3.0	0-3	14	0.43	I
Forbs (N = 41)					
Achillea millefolium (common yarrow)	0.5	0-0.5	14	0.07	N
Achillea spp. (yarrow)	3.0	0-3	14	0.43	B
Anemone cylindrica (long-fruited anemone)	0.5	0-0.5	14	0.07	N
Arnica chamissonis (leafy arnica)	0.5	0-0.5	14	0.07	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	14	0.07	N
Aster laevis (smooth aster)	6.5	0-10	29	1.86	N

Table 256. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Cicuta maculata (water-hemlock)	0.5	0-0.5	14	0.07	N
Cirsium arvense (Canada thistle)	3.7	0-10	43	1.57	I
Delphinium glaucum (tall larkspur)	10.0	0-10	14	1.43	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	43	0.21	N
Equisetum arvense (common horsetail)	33.3	0-50	43	14.29	N
Erigeron philadelphicus (Philadelphia fleabane)	3.0	0-3	14	0.43	N
Erysimum cheiranthoides (wormseed mustard)	0.5	0-0.5	14	0.07	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	43	0.21	N
Galium boreale (northern bedstraw)	0.5	0-0.5	29	0.14	N
Geum macrophyllum (large-leaved yellow avens)	1.8	0-3	57	1.00	N
Geum rivale (purple avens)	3.0	0-3	14	0.43	N
Heracleum lanatum (cow parsnip)	10.3	0-20	29	2.93	N
Mentha arvensis (wild mint)	3.0	0-3	29	0.86	N
Mertensia paniculata (tall lungwort)	2.2	0-3	43	0.93	N
Mitella nuda (bishop's-cap)	1.8	0-3	29	0.50	N
Pedicularis bracteosa (western lousewort)	0.5	0-0.5	29	0.14	N
Petasites sagittatus (arrow-leaved coltsfoot)	10.0	0-10	14	1.43	N
Polygonum amphibium (water smartweed)	11.5	0-20	29	3.29	N
*Polygonum convolvulu*s (wild buckwheat)	0.5	0-0.5	14	0.07	I
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	29	0.14	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	14	0.07	N
Rumex occidentalis (western dock)	0.5	0-0.5	29	0.14	N
Sanicula marilandica (snakeroot)	0.5	0-0.5	14	0.07	N
Senecio vulgaris (common groundsel)	0.5	0-0.5	14	0.07	I
Smilacina stellata (star-flowered Solomon's-seal)	5.3	0-10	29	1.50	N
Solidago canadensis (Canada goldenrod)	5.3	0-10	29	1.50	N
Solidago rigida (stiff goldenrod)	0.5	0-0.5	14	0.07	N
Sonchus arvensis (perennial sow-thistle)	1.8	0-3	29	0.50	I
Stachys palustris (marsh hedge-nettle)	0.5	0-0.5	14	0.07	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	14	0.07	N
Taraxacum officinale (common dandelion)	4.5	0-10	43	1.93	I
Thalictrum occidentale (western meadow rue)	3.0	0-3	14	0.43	N
Thalictrum venulosum (veiny meadow rue)	3.0	0-3	14	0.43	N
Vicia americana (wild vetch)	0.5	0-0.5	57	0.29	N
Viola spp. (violet)	3.0	0-3	14	0.43	B

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 257 shows the five most prominent plant species among the four lifeforms for species recorded in all three relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type. The two type indicator species, *Salix bebbiana* (beaked willow) and *Carex atherodes* (awned sedge), are together most prominent, followed by *Equisetum arvens*e (common horsetail) and *Calamagrostis canadensis* (marsh reed grass).

Table 257. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (number = 3 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	0.33	Native
Shrubs		
Salix bebbiana (beaked willow)	59.17	Native
Betula glandulosa (bog birch)	1.17	Native
Salix planifolia (flat-leaved willow)	1.17	Native
Salix lutea (yellow willow)	1.00	Native
Salix myrtillifolia (myrtle-leaved willow)	1.00	Native
Graminoids		
Carex atherodes (awned sedge)	46.67	Native
Calamagrostis canadensis (marsh reed grass)	10.00	Native
Carex norvegica (Norway sedge)	6.67	Native
Poa palustris (fowl bluegrass)	0.17	Native
Forbs		
*Equisetum arvens*e (common horsetail)	30.00	Native
Aster laevis (smooth aster)	4.33	Native
Mertensia paniculata (tall lungwort)	2.00	Native
Geum macrophyllum (large-leaved yellow avens)	1.17	Native
Mitella nuda (bishop's-cap)	1.17	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 258 through Table 261, break out the vegetation recorded in three relatively undisturbed late seral to climax stands sampled of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species rich, shrub dominated habitat type of minor-to-incidental occurrence across the study area.

Table 258 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type. For the 3 stands comprising the habitat type, the number of unique species was 30 with 29 (96.7 percent) of them being native species.

Table 258. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (number = 3 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	12	11	0	1
Graminoids	4	4	0	0
Forbs	13	13	0	0
TOTAL	***30 (100.0%)***	***29 (96.7%)***	***0 (0.0%)***	***1 (3.3%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 259 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type. The average number of species per stand is 18.1, with native species comprising 17.7 species per stand or 97.8 percent.

Table 259. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (number = 3 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.7	0.7	0.0	0.0
Shrubs	6.7	6.3	0.0	0.3
Graminoids	2.7	2.7	0.0	0.0
Forbs	8.0	8.0	0.0	0.0
TOTAL	***18.1 (100.0%)***	***17.7 (97.8%)***	***0.0 (0.0%)***	***0.3 (1.7%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 260 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type. The average canopy cover per stand is 171.8 percent, with native species comprising 171.7 percent or 99.9 percent of the total amount of average canopy cover per stand.

Table 260. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (number = 3 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.3%	0.3%	0.0%	0.0%
Shrubs	66.2%	66.0%	0.0%	0.2%
Graminoids	63.5%	63.5%	0.0%	0.0%
Forbs	41.8%	41.8%	0.0%	0.0%
TOTAL	***171.8% (100.0%)***	***171.7% (99.9%)***	***0.0% (0.0%)***	***0.2% (0.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 261 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type. The average number of species per stand was 18.1 with an average canopy cover of 171.8 percent.

Table 261. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (number = 3 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.7	0.3%
Shrubs	6.7	66.2%
Graminoids	2.7	63.5%
Forbs	8.0	41.8%
TOTAL	***18.1***	***171.8%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 30 plant species were recorded on at least one of three relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (Table 262). A very small amount of the tree species, *Picea glauca* (white spruce), was recorded, while *Salix bebbiana* (beaked willow) was the only prominent shrub among 12 species recorded. Of only four graminoid species recorded, *Carex atherodes* (awned sedge) was most prominent, followed by *Calamagrostis canadensis* (marsh reed grass). Of 13 forb species recorded, only *Equisetum arvens*e (common horsetail) is highly prominent.

Table 262. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (number = 3 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 1)					
Picea glauca (white spruce)	0.5	0-0.5	67	0.33	N
Shrubs (N = 12)					
Betula glandulosa (bog birch)	1.8	0-3	67	1.17	N
Betula occidentalis (water birch)	0.5	0-0.5	67	0.33	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	67	0.33	N
Rosa acicularis (prickly rose)	0.5	0-0.5	33	0.17	N
Rosa spp. (rose)	0.5	0-0.5	33	0.17	B
Salix bebbiana (beaked willow)	59.2	30-97.5	100	59.17	N
Salix lutea (yellow willow)	3.0	0-3	33	1.00	N
Salix maccalliana (velvet-fruited willow)	0.5	0-0.5	67	0.33	N
Salix myrtillifolia (myrtle-leaved willow)	3.0	0-3	33	1.00	N
Salix petiolaris (basket willow)	3.0	0-3	33	1.00	N
Salix planifolia (flat-leaved willow)	1.8	0-3	67	1.17	N
Salix pseudomonticola (false mountain willow)	0.5	0-0.5	67	0.33	N
Graminoids (N = 4)					
Calamagrostis canadensis (marsh reed grass)	15.0	0-20	67	10.00	N
Carex atherodes (awned sedge)	46.7	20-80	100	46.67	N
Carex norvegica (Norway sedge)	10.0	0-10	67	6.67	N
Poa palustris (fowl bluegrass)	0.5	0-0.5	33	0.17	N

Table 262. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Forbs (N = 13)					
Aster laevis (smooth aster)	6.5	0-10	67	4.33	N
Cicuta maculata (water-hemlock)	0.5	0-0.5	33	0.17	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	67	0.33	N
*Equisetum arvens*e (common horsetail)	45.0	0-50	67	30.00	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	67	0.33	N
Geum macrophyllum (large-leaved yellow avens)	1.8	0-3	67	1.17	N
Mentha arvensis (wild mint)	3.0	0-3	33	1.00	N
Mertensia paniculata (tall lungwort)	3.0	0-3	67	2.00	N
Mitella nuda (bishop's-cap)	1.8	0-3	67	1.17	N
Pedicularis bracteosa (western lousewort)	0.5	0-0.5	67	0.33	N
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	67	0.33	N
Rumex occidentalis (western dock)	0.5	0-0.5	67	0.33	N
Vicia americana (wild vetch)	0.5	0-0.5	67	0.33	N

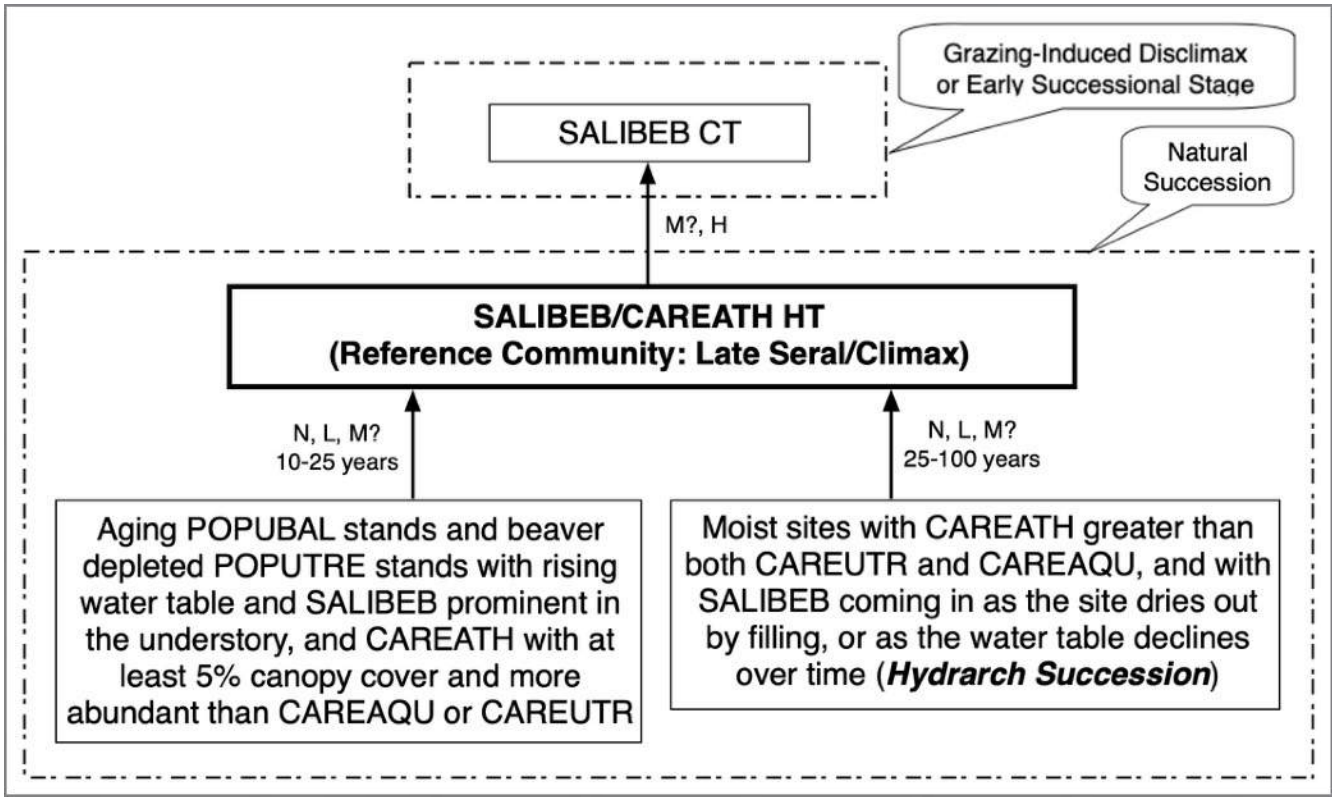
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type can develop on a site typically through two kinds of natural succession: 1) primary succession (hydrarch succession) whereby a wet meadow stand of *Carex atherodes* (awned sedge) located in a shallow depression gradually fills in enough for *Salix bebbiana* (beaked willow) to become established; and 2) secondary succession wherein aging *Populus balsamifera* (balsam poplar) stands, or beaver depleted *Populus tremuloides* (aspen) stands, have both *Salix bebbiana* (beaked willow) and *Carex atherodes* (awned sedge) prominent in their understory.

Figure 54 shows a schematic diagram of vegetation successional pathways on sites of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type.



Successional Pathway of *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUTRE—*Populus tremuloides* (aspen)
SALIBEB—*Salix bebbiana* (beaked willow)
SALIBEB/CAREATH HT—*Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type
SALIBEB CT—*Salix bebbiana* (beaked willow) community type

Figure 54. Successional pathway for sites of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 55 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

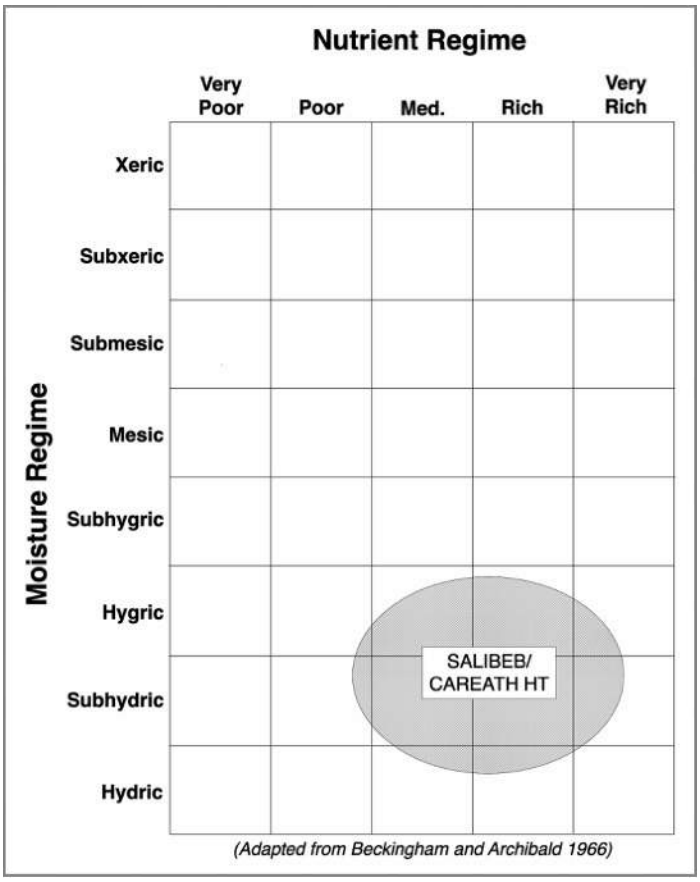


Figure 55. Edatope grid position for the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (SALIBEB/CAREATH HT)

SOILS

Parent material on sites supporting the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type is predominantly morainal and undifferentiated organic. *Salix bebbiana* (beaked willow) is usually found on moist sandy or gravelly soils but is adapted to a wide variety of soil textures, and sites are poorly drained. These soils often have a thick organic layer of peaty mor humus. Soil subgroups are commonly gleysols and fibrisols, and surface texture typically varies from clay loam to sandy loam, with humic or fibric upper horizons often present. (France and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites often have the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type or the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type. Adjacent drier sites will likely have the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is a common and widespread species throughout most natural regions in Alberta. It grows in open woods, moist fescue grasslands, on shores and floodplains, often forming extensive thickets (Tannas 1997a). In northern Alberta, this species is common around sloughs in prairies, and in foothills, upland forests, wet lowlands, thickets, and muskegs. It is often found in thickets adjacent to streams, swamps, and lakes (Tesky 1992).

Salix bebbiana (beaked willow) is usually found on moist sandy or gravelly soils, but is adapted to a wide variety of soil textures. It will tolerate moderately alkaline soils, but does poorly in extremely acidic or alkaline conditions. It can survive short periods of standing water, but growth rates decline sharply if water persists above the root collar. *Salix bebbiana* (beaked willow) is not drought tolerant, however; and prefers sites with adequate moisture. It is a pioneer species that is shade intolerant and grows best in full sunlight (Tesky 1992).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) is very common and widely distributed across Alberta (Tannas 1997a). The species is a wetland obligate, growing along slough margins, shorelines, in marshes, and wet meadows, often in standing water (Tannas 1997a). It is a long-lived perennial with moderate tolerance for drought, while tolerance is low for salinity, acidity, and shade. It does best on clay to clay loam soils (Hardy BBT Limited 1989).

***Equisetum arvense* (common horsetail)**—*Equisetum arvense* (common horsetail) is a native, perennial, rhizomatous cryptogam (Sullivan 1993). The species is very common throughout all natural regions of Alberta. It is found on a variety of sites, including roadsides, gravelly banks, sandy areas, moist woods, low areas, cultivated fields, and disturbed sites (Tannas 1997b).

Equisetum arvense (common horsetail) is present in both early seral and climax communities; its presence largely dictated by edaphic conditions instead of shade or other factors. It is an early colonizer on alluvial deposits and persists through succession, occurring in later seral communities as an herbaceous dominant (Sullivan 1993).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

Livestock

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) has good forage value, being very nutritious with higher protein content than most grasses. The species is rated as one of the most palatable of willows (Tannas 1997a). It is resistant to heavy browsing and is considered a grazing increaser. However, severely injured or dying plants may indicate deteriorated range condition or a very high game population (Tannas 1997a).

In stands dominated by *Salix bebbiana* (beaked willow), forage production is moderate to high. The species rates as good forage value (Tannas 1997a); and the associated wetland sedges (*Carex atherodes* [awned sedge], *Carex aquatilis* [water sedge], and *Carex utriculata* [beaked sedge]) all rate as fair to good forage value (Stone and

Lawrence 2000, Tannas 1997a). As a result, high use by livestock is common after sites dry out somewhat in summer. The moist, fine textured soils are extremely susceptible to trampling damage, becoming compacted and hummocked with prolonged presence of livestock. In some stands, the *Salix* (willows) may become highlined, clubbed, or decadent clumps. With continued overuse, *Salix* (willows) can show a sharp decline in vigour and may even be finally eliminated from the site.

***Carex atherodes* (awned sedge)**—Livestock forage value of *Carex atherodes* (awned sedge) is high (Tannas 1997a, Beckingham 1991). *Carex atherodes* (awned sedge) provides good protein and a balance of other nutritional elements, while remaining palatable during the late season when upland forage is less palatable (Tannas 1997a, Hansen and others 1988). In general, *Carex* (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites residual cover should be left to protect the soil surface and filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days for sedge regrowth should provide sufficient residual cover on streamside riparian sites (Myers 1989).

Very wet soils may deter animal use until they dry, allowing the most palatable species to replenish their carbohydrate reserves and to persist in these communities. However, if high levels of grazing do occur, there will be a marked decrease in *Carex atherodes* (awned sedge) with an increase in less palatable species, such as *Juncus balticus* (wire rush). *Carex atherodes* (awned sedge) has medium palatability and medium tolerance for livestock use. Its chemical composition is similar to that of meadow grasses, upland short grass, and mixed prairie species. Seasonal declines in crude protein, phosphorous and carotene were also similar to that of native upland grasses (Hardy BBT Limited 1989).

***Equisetum arvense* (common horsetail)**—*Equisetum arvense* (common horsetail) has poor forage value, and is a grazing increaser, especially on sandy and gravelly soils (Tannas 1997b). In wild hay, if in excessive quantities, *Equisetum* species (horsetails) are known to cause scours, paralysis, and occasionally death. Hay containing around 20 percent or more *Equisetum* species (horsetails) can produce poisoning symptoms in horses. Symptoms appear in 2-5 weeks, beginning with weight loss, loss of muscular control, and followed by falling, exhaustion, and possibly death. Cattle, sheep, and goats are rarely affected (Hansen and others 1995).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is used extensively by wild ungulates, especially moose, and is an important food source for small mammals. It also provides valuable shelter and habitat for birds and other wildlife (Tannas 1997a). Where stands of *Salix bebbiana* (beaked willow) occur on winter game ranges, browsing of *Salix bebbiana* (beaked willow) by wild ungulates is often severe enough to reduce plant vigour and regeneration. *Salix bebbiana* (beaked willow) is a highly valuable browse for elk, with high levels of utilization common (Tesky 1992). Continued use may lead to conversion to an herbaceous community dominated by *Poa palustris* (fowl bluegrass) and *Poa pratensis* (Kentucky bluegrass). Moose and

beaver also heavily utilize most species of *Salix* (willow). *Salix bebbiana* (beaked willow) provides cover and protection for many birds and mammals, and also provides shade along banks of streams and ponds (Tesky 1992).

***Carex atherodes* (awned sedge)**—Wetland sedge species, such as *Carex atherodes* (awned sedge) are an important component of valuable nesting and feeding grounds for geese and other waterfowl. These stands of prolific seed producing species are usually more important as feeding grounds than as nesting grounds because of their low stature, high water level, and lack of structural diversity (Thompson and Hansen 2003).

***Equisetum arvense* (common horsetail)**—*Equisetum arvense* (common horsetail) is a common food item for grizzly bears, and is a minor to important component of the spring and early summer diet of black bears (Sullivan 1993). Caribou, moose, sheep and grizzly bear all eat *Equisetum arvense* (common horsetail), and it is also a favorite food of geese and other waterfowl (CYSIP 2023).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

Fisheries

***Salix bebbiana* (beaked willow)**—The importance of *Salix* species (willows) in streambank stabilization, cover, and thermal protection for fisheries cannot be over emphasized. The herbaceous understory aids in filtering out sediments during overbank flows, thereby contributing to streambank building (Hansen and others 1995).

***Carex atherodes* (awned sedge)**—Stands of *Carex atherodes* (awned sedge) are found more frequently in lentic situations around depressional wetlands, sloughs, potholes, wet meadows, and fens where fish habitat is not at issue (Thompson and Hansen 2003).

Fire

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) will sprout vigorously from the basal stem after fire. The light wind blown seeds readily colonize exposed mineral soil after severe fires. *Salix bebbiana* (beaked willow) usually becomes the dominant species in willow stands after fires on upland sites and in thickets adjacent to streams, swamps, and lakes (Tesky 1992).

Salix bebbiana (beaked willow) is highly adapted to fire in most habitats, sprouting rapidly from basal stems following fire (Haeussler and Coates 1986). Fast moving fires maximize sprouting, while slower burns cause more damage to plants. Prescribed burning is a commonly used wildlife management tool to rejuvenate decadent communities dominated by this willow. The light seeds readily colonize exposed mineral soil after hot fires. The degree to which this species invades after fire, however, depends on the time of year, weather, and presence of a mineral seedbed. Prescribed burning is a common wildlife management tool used to rejuvenate decadent *Salix bebbiana* (beaked willow) communities (Tesky 1992).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) grows on wet sites that seldom dry out enough to carry fire, but the species is adapted to light intensity fire. Residual cover should burn well in early spring, prior to the growing season. Burning will reduce litter accumulations and temporarily increase productivity (Hansen and others 1988), but care should be taken with burning to avoid damage to the excellent soil erosion protection this species provides. Under drought conditions, there is danger of burning the soil peat layer and damaging the roots (Thompson and Hansen 2003).

***Equisetum arvense* (common horsetail)**—*Equisetum arvense* (common horsetail) usually occurs in moist habitats that do not undergo frequent fire. However when it does burn, it is top-killed by most fires. The rhizomes

are particularly resistant to fire because they are buried deep in the mineral soil, so it regenerates rapidly after a fire (Sullivan 1993).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

Rehabilitation/Restoration Considerations

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is a relatively good soil stabilizer and is valuable for revegetating streambanks and other disturbed sites (Tesky 1992). Stands dominated by *Salix bebbiana* (beaked willow) receive high use by wildlife and livestock. Soils and streambanks are highly susceptible to trampling damage, especially when soils are wet. Deferring grazing until sites are drier can reduce trampling and compaction problems (Marlow 1984). Unless the high water tables are maintained, the understories in these stands will be converted to dominance by introduced grass species and weedy forbs (Hansen and others 1995).

Salix bebbiana (beaked willow) is valuable for revegetating streambanks and other disturbed sites. Cuttings are best taken in the spring from dormant two to four year old wood and should be planted on sites that have sufficient moisture to start and carry them through the growing season. Cuttings 30 cm to 50 cm long and more than 1 cm in diameter produce the best results, with the cuttings rooting freely along the entire length of the stem. Shoots from cuttings can be expected to appear 10 to 20 days after planting. However, use of rooted cuttings and nursery grown stock will produce better results.

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) rates high in value for erosion control, and high for its persistence, once established on a site (Hardy BBT Limited 1989). Generally, due to their stronger rhizomatous roots, *Carex* species (sedges) offer better streambank protection than grasses. *Carex atherodes* (awned sedge) forms a dense, thick sod highly resistant to erosion. Along streambanks, the sod may overhang the bank and sag into the water, providing additional protection from erosion (Thompson and Hansen 2003).

Carex atherodes (awned sedge) is suited for long-term revegetation of disturbed sites and erosion control on sites with a high water table. The species can rapidly re-colonize disturbed sites by seed and rhizome extension. Its rhizomes form a dense network effective in stabilizing streambanks and preventing soil erosion (Thompson and Hansen 2003).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Willow/Foothills rough fescue-Hairy wild rye

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Mcb6 Beaked willow/Horsetail (Montane Cypress Hills Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003); and
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001).

Salix bebbiana/Carex utriculata Habitat Type
(beaked willow/beaked sedge Habitat Type)

SALIBEB/CAREUTR Habitat Type
Number of Stands = 9 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 1; Other Data Sets = 8)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type is a major type in the Lower Foothills Natural Subregion, a major type in the Upper Foothills Natural Subregion, and a major type in the Montane Natural Subregion of Alberta. This habitat type is found more on the wetter side of the *Salix bebbiana* (beaked willow) moisture spectrum. It occupies moist to wet areas around sloughs, lake shores, on alluvial terraces, near springs, seeps, and sub-irrigated meadows characterized by fine textured substrates and poor drainage.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 263 shows the five most prominent plant species among the four lifeforms for species recorded in all nine stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type. *Salix bebbiana* (beaked willow) is most prominent, followed by *Carex utriculata* (beaked sedge) and *Calamagrostis canadensis* (marsh reed grass). No other species is more than moderately prominent in these stands.

Table 263. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (number = 9 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Betula papyrifera (white birch)	0.33	Native
Picea glauca (white spruce)	0.06	Native
Populus balsamifera (balsam poplar)	0.06	Native
Shrubs		
Salix bebbiana (beaked willow)	35.56	Native
Salix myrtillifolia (myrtle-leaved willow)	2.22	Native
Rosa woodsii (common wild rose)	1.17	Native
Symphoricarpos occidentalis (buckbrush)	1.17	Native
Betula glandulosa (bog birch)	1.11	Native
Graminoids		
Carex utriculata (beaked sedge)	26.67	Native
Calamagrostis canadensis (marsh reed grass)	18.89	Native
Juncus balticus (wire rush)	7.78	Native
Agrostis stolonifera (redtop)	4.44	Introduced
Phleum pratense (timothy)	3.72	Introduced
Forbs		
Mentha arvensis (wild mint)	3.22	Native
Solidago canadensis (Canada goldenrod)	2.28	Native
Angelica arguta (white angelica)	1.44	Native
Cicuta maculata (water-hemlock)	1.44	Native
Equisetum fluviatile (swamp horsetail)	1.17	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 264 through Table 267, break out the vegetation recorded in all nine stands sampled of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, species rich, shrub dominated habitat type of major occurrence across the study area.

Table 264 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type. For the 9 stands comprising the habitat type, the number of unique species was 97 with 84 (86.6 percent) of them being native species.

Table 264. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (number = 9 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3	3	0	0
Shrubs	19	19	0	0
Graminoids	24	20	4	0
Forbs	51	42	7	2
TOTAL	***97 (100.0%)***	***84 (86.6%)***	***11 (11.3%)***	***2 (2.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 265 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type. The average number of species per stand is 18.6, with native species comprising 16.4 species per stand or 88.2 percent.

Table 265. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (number = 9 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.3	0.3	0.0	0.0
Shrubs	3.6	3.6	0.0	0.0
Graminoids	5.8	4.8	1.0	0.0
Forbs	8.9	7.7	1.0	0.2
TOTAL	***18.6 (100.0%)***	***16.4 (88.2%)***	***2.0 (10.8%)***	***0.2 (1.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 266 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type. The average canopy cover per stand is 146.1 percent, with native species comprising 132.9 percent or 91.0 percent of the total amount of average canopy cover per stand.

Table 266. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (number = 9 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.4%	0.4%	0.0%	0.0%
Shrubs	44.4%	44.4%	0.0%	0.0%
Graminoids	78.4%	69.9%	8.6%	0.0%
Forbs	22.8%	18.2%	3.2%	1.4%
TOTAL	***146.1% (100.0%)***	***132.9% (91.0%)***	***11.7% (8.0%)***	***1.4% (1.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 267 shows the average number of species and average canopy cover by lifeform in stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type. The average number of species per stand was 18.6 with an average canopy cover of 146.1 percent.

Table 267. Average number of species and average canopy cover by lifeform in stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (number = 9 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.3	0.4%
Shrubs	3.6	44.4%
Graminoids	5.8	78.4%
Forbs	8.9	22.8%
TOTAL	***18.6***	***146.1%***

Sampled Stands Plant Species List

A total of 97 plant species were recorded on at least one of nine stands sampled of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (Table 268). Three tree species were recorded in small amounts, while *Salix bebbiana* (beaked willow) overwhelmingly dominates the shrub layer. *Carex utriculata* (beaked sedge) was most prominent among 24 graminoid species recorded, followed closely by *Calamagrostis canadensis* (marsh reed grass), while none of the 51 forb species recorded is very prominent.

Table 268. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (number = 9 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 3)					
Betula papyrifera (white birch)	3.0	0-3	11	0.33	N
Picea glauca (white spruce)	0.5	0-0.5	11	0.06	N
Populus balsamifera (balsam poplar)	0.5	0-0.5	11	0.06	N
Shrubs (N = 19)					
Alnus crispa (green alder)	0.5	0-0.5	11	0.06	N
Alnus tenuifolia (river alder)	3.0	0-3	11	0.33	N
Betula glandulosa (bog birch)	10.0	0-10	11	1.11	N
Betula occidentalis (water birch)	0.5	0-0.5	11	0.06	N
Cornus stolonifera (red-osier dogwood)	0.5	0-0.5	22	0.11	N
Elaeagnus commutata (silverberry)	0.5	0-0.5	11	0.06	N
Potentilla fruticosa (shrubby cinquefoil)	1.8	0-3	22	0.39	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	11	0.06	N
Rosa acicularis (prickly rose)	0.5	0-0.5	11	0.06	N
Rosa woodsii (common wild rose)	5.3	0-10	22	1.17	N
Rubus idaeus (wild red raspberry)	1.8	0-3	22	0.39	N
Salix bebbiana (beaked willow)	35.6	10-70	100	35.56	N
Salix discolor (pussy willow)	3.0	0-3	11	0.33	N
Salix drummondiana (Drummond's willow)	3.0	0-3	11	0.33	N
Salix lutea (yellow willow)	3.0	0-3	11	0.33	N
Salix myrtillifolia (myrtle-leaved willow)	20.0	0-20	11	2.22	N
Salix planifolia (flat-leaved willow)	3.0	0-3	11	0.33	N
Salix pseudomonticola (false mountain willow)	3.0	0-3	11	0.33	N
Symphoricarpos occidentalis (buckbrush)	5.3	0-10	22	1.17	N
Graminoids (N = 24)					
Agrostis stolonifera (redtop)	13.3	0-20	33	4.44	I
Alopecurus occidentalis (alpine foxtail)	3.0	0-3	22	0.67	N
Beckmannia syzigachne (slough grass)	4.5	0-10	33	1.50	N
Bromus inermis (smooth brome)	0.5	0-0.5	11	0.06	I
Calamagrostis canadensis (marsh reed grass)	42.5	0-80	44	18.89	N
Carex aquatilis (water sedge)	5.3	0-10	22	1.17	N
Carex atherodes (awned sedge)	8.7	0-20	33	2.89	N
Carex curta (short sedge)	10.0	0-10	11	1.11	N
Carex diandra (two-stamened sedge)	10.0	0-10	11	1.11	N
Carex lanuginosa (woolly sedge)	2.2	0-3	33	0.72	N
Carex praegracilis (graceful sedge)	0.5	0-0.5	11	0.06	N
Carex spp. (sedge)	0.5	0-0.5	11	0.06	N
Carex utriculata (beaked sedge)	26.7	10-60	100	26.67	N
Deschampsia cespitosa (tufted hair grass)	0.5	0-0.5	11	0.06	N
Glyceria grandis (common tall manna grass)	20.0	0-20	11	2.22	N
Glyceria striata (fowl manna grass)	10.0	0-10	11	1.11	N
Hordeum jubatum (foxtail barley)	0.5	0-0.5	11	0.06	N

Table 268. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Juncus balticus (wire rush)	23.3	0-40	33	7.78	N
Juncus vaseyi (big-head rush)	0.5	0-0.5	11	0.06	N
Phalaris arundinacea (reed canary grass)	10.0	0-10	11	1.11	N
Phleum pratense (timothy)	8.4	0-20	44	3.72	I
Poa palustris (fowl bluegrass)	11.5	0-20	22	2.56	N
Poa pratensis (Kentucky bluegrass)	3.0	0-3	11	0.33	I
Scirpus microcarpus (small-fruited bulrush)	0.5	0-0.5	22	0.11	N
Forbs (N = 51)					
Angelica arguta (white angelica)	6.5	0-10	22	1.44	N
Arnica chamissonis (leafy arnica)	0.5	0-0.5	11	0.06	N
Aster borealis (marsh aster)	0.5	0-0.5	11	0.06	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	22	0.11	N
Aster eatonii (Eaton's aster)	3.0	0-3	11	0.33	N
Aster puniceus (purple-stemmed aster)	0.5	0-0.5	11	0.06	N
Chrysanthemum leucanthemum (ox-eye daisy)	0.5	0-0.5	11	0.06	I
Cicuta maculata (water-hemlock)	6.5	0-10	22	1.44	N
Cirsium arvense (Canada thistle)	0.5	0-0.5	11	0.06	I
Epilobium ciliatum (northern willowherb)	1.3	0-3	33	0.44	N
Equisetum arvense (common horsetail)	1.5	0-3	56	0.83	N
Equisetum fluviatile (swamp horsetail)	5.3	0-10	22	1.17	N
Fragaria vesca (woodland strawberry)	0.5	0-0.5	11	0.06	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	33	0.17	N
Galium boreale (northern bedstraw)	0.5	0-0.5	11	0.06	N
Geranium richardsonii (wild white geranium)	3.0	0-3	11	0.33	N
Geum aleppicum (yellow avens)	10.0	0-10	11	1.11	N
Geum macrophyllum (large-leaved yellow avens)	2.4	0-3	44	1.06	N
Geum spp. (avens)	0.5	0-0.5	11	0.06	N
Heracleum lanatum (cow parsnip)	10.0	0-10	11	1.11	N
Lysimachia ciliata (fringed loosestrife)	0.5	0-0.5	11	0.06	N
Medicago lupulina (black medick)	0.5	0-0.5	11	0.06	I
Mentha arvensis (wild mint)	7.3	0-20	44	3.22	N
Monarda fistulosa (wild bergamot)	3.0	0-3	11	0.33	N
Parnassia palustris (northern grass-of-parnassus)	0.5	0-0.5	11	0.06	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	11	0.06	N
Petasites frigidus (arctic sweet coltsfoot)	1.3	0-3	33	0.44	N
Potentilla anserina (silverweed)	0.5	0-0.5	11	0.06	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	11	0.06	N
Potentilla palustris (marsh cinquefoil)	3.0	0-3	11	0.33	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	11	0.06	N
Ranunculus acris (tall buttercup)	10.0	0-10	11	1.11	I
Ranunculus repens (creeping buttercup)	3.0	0-3	11	0.33	I
Rumex occidentalis (western dock)	0.5	0-0.5	22	0.11	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	11	0.06	N
Senecio pauperculus (balsam groundsel)	0.5	0-0.5	11	0.06	N

Table 268. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Sium suave (water parsnip)	0.5	0-0.5	11	0.06	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	22	0.11	N
Solidago canadensis (Canada goldenrod)	10.3	0-20	22	2.28	N
Solidago missouriensis (low goldenrod)	0.5	0-0.5	11	0.06	N
Spiranthes romanzoffiana (hooded ladies'-tresses)	0.5	0-0.5	11	0.06	N
Stellaria calycantha (northern stitchwort)	0.5	0-0.5	11	0.06	N
Taraxacum officinale (common dandelion)	1.3	0-3	33	0.44	I
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	11	0.06	N
Trifolium repens (white clover)	10.0	0-10	11	1.11	I
Veronica scutellata (marsh speedwell)	0.5	0-0.5	11	0.06	N
Vicia americana (wild vetch)	1.0	0-3	56	0.56	N
Viola adunca (early blue violet)	0.5	0-0.5	11	0.06	N
Viola palustris (marsh violet)	0.5	0-0.5	11	0.06	N
Viola spp. (violet)	3.0	0-3	11	0.33	B

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 269 shows the five most prominent plant species among the four lifeforms for species recorded in all three relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type. The two type indicator species, *Salix bebbiana* (beaked willow) and *Calamagrostis canadensis* (marsh reed grass), are most prominent, followed closely by *Carex utriculata* (beaked sedge). No other species is more than moderately prominent in these stands.

Table 269. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (number = 3 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Betula papyrifera (white birch)	1.00	Native
Shrubs		
Salix bebbiana (beaked willow)	40.00	Native
Betula glandulosa (bog birch)	3.33	Native
Alnus tenuifolia (river alder)	1.00	Native
Rubus idaeus (wild red raspberry)	1.00	Native
Salix discolor (pussy willow)	1.00	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	46.67	Native
Carex utriculata (beaked sedge)	36.67	Native
Carex curta (short sedge)	3.33	Native
Forbs		
Equisetum arvense (common horsetail)	1.17	Native
Geum macrophyllum (large-leaved yellow avens)	1.00	Native
Potentilla palustris (marsh cinquefoil)	1.00	Native
Aster borealis (marsh aster)	0.17	Native
Aster ciliolatus (Lindley's aster)	0.17	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 270 through Table 273, break out the vegetation recorded in three relatively undisturbed late seral to climax stands sampled of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, species rich, shrub dominated habitat type of major occurrence across the study area.

Table 270 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type. For the 3 stands comprising the habitat type, the number of unique species was 27 with 27 (100.0 percent) of them being native species.

Table 270. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (number = 3 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	10	10	0	0
Graminoids	3	3	0	0
Forbs	13	13	0	0
TOTAL	***27 (100.0%)***	***27 (100.0%)***	***0 (0.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 271 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type. The average number of species per stand is 11.0, with native species comprising 11.0 species per stand or 100.0 percent.

Table 271. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (number = 3 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.3	0.3	0.0	0.0
Shrubs	4.0	4.0	0.0	0.0
Graminoids	2.0	2.0	0.0	0.0
Forbs	4.7	4.7	0.0	0.0
TOTAL	***11.0 (100.0%)***	***11.0 (100.0%)***	***0.0 (0.0%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 272 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type. The average canopy cover per stand is 141.3 percent, with native species comprising 141.3 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 272. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (number = 3 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.0%	1.0%	0.0%	0.0%
Shrubs	48.8%	48.8%	0.0%	0.0%
Graminoids	86.7%	86.7%	0.0%	0.0%
Forbs	4.8%	4.8%	0.0%	0.0%
TOTAL	***141.3% (100.0%)***	***141.3% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 273 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type. The average number of species per stand was 11.0 with an average canopy cover of 141.3 percent.

Table 273. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (number = 3 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.3	1.0%
Shrubs	4.0	48.8%
Graminoids	2.0	86.7%
Forbs	4.7	4.8%
TOTAL	***11.0***	***141.3%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 27 plant species were recorded on at least one of three relatively undisturbed late seral to climax stands sampled of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (Table 274). A small amount of tree species *Betula papyrifera* (white birch) was recorded, and *Salix bebbiana* (beaked willow) is the only highly prominent shrub species present. Of the three graminoid species recorded, *Calamagrostis canadensis* (marsh reed grass) is most prominent, followed closely by *Carex utriculata* (beaked sedge), which had less average canopy cover, but occurred on all plots. None of the 13 forbs recorded was notably prominent.

Table 274. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (number = 3 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 1)					
Betula papyrifera (white birch)	3.0	0-3	33	1.00	N
Shrubs (N = 10)					
Alnus tenuifolia (river alder)	3.0	0-3	33	1.00	N
Betula glandulosa (bog birch)	10.0	0-10	33	3.33	N
Cornus stolonifera (red-osier dogwood)	0.5	0-0.5	33	0.17	N
Potentilla fruticosa (shrubby cinquefoil)	0.5	0-0.5	33	0.17	N
Rosa acicularis (prickly rose)	0.5	0-0.5	33	0.17	N
Rubus idaeus (wild red raspberry)	3.0	0-3	33	1.00	N
Salix bebbiana (beaked willow)	40.0	20-70	100	40.00	N
Salix discolor (pussy willow)	3.0	0-3	33	1.00	N
Salix drummondiana (Drummond's willow)	3.0	0-3	33	1.00	N
Salix planifolia (flat-leaved willow)	3.0	0-3	33	1.00	N
Graminoids (N = 3)					
Calamagrostis canadensis (marsh reed grass)	70.0	0-80	67	46.67	N
Carex curta (short sedge)	10.0	0-10	33	3.33	N
Carex utriculata (beaked sedge)	36.7	10-60	100	36.67	N
Forbs (N = 13)					
Aster borealis (marsh aster)	0.5	0-0.5	33	0.17	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	33	0.17	N
Aster puniceus (purple-stemmed aster)	0.5	0-0.5	33	0.17	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	33	0.17	N
Equisetum arvense (common horsetail)	1.8	0-3	67	1.17	N
Fragaria vesca (woodland strawberry)	0.5	0-0.5	33	0.17	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	33	0.17	N
Geum macrophyllum (large-leaved yellow avens)	3.0	0-3	33	1.00	N
Petasites frigidus (arctic sweet coltsfoot)	0.5	0-0.5	33	0.17	N
Potentilla palustris (marsh cinquefoil)	3.0	0-3	33	1.00	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	33	0.17	N
Vicia americana (wild vetch)	0.5	0-0.5	33	0.17	N
Viola adunca (early blue violet)	0.5	0-0.5	33	0.17	N

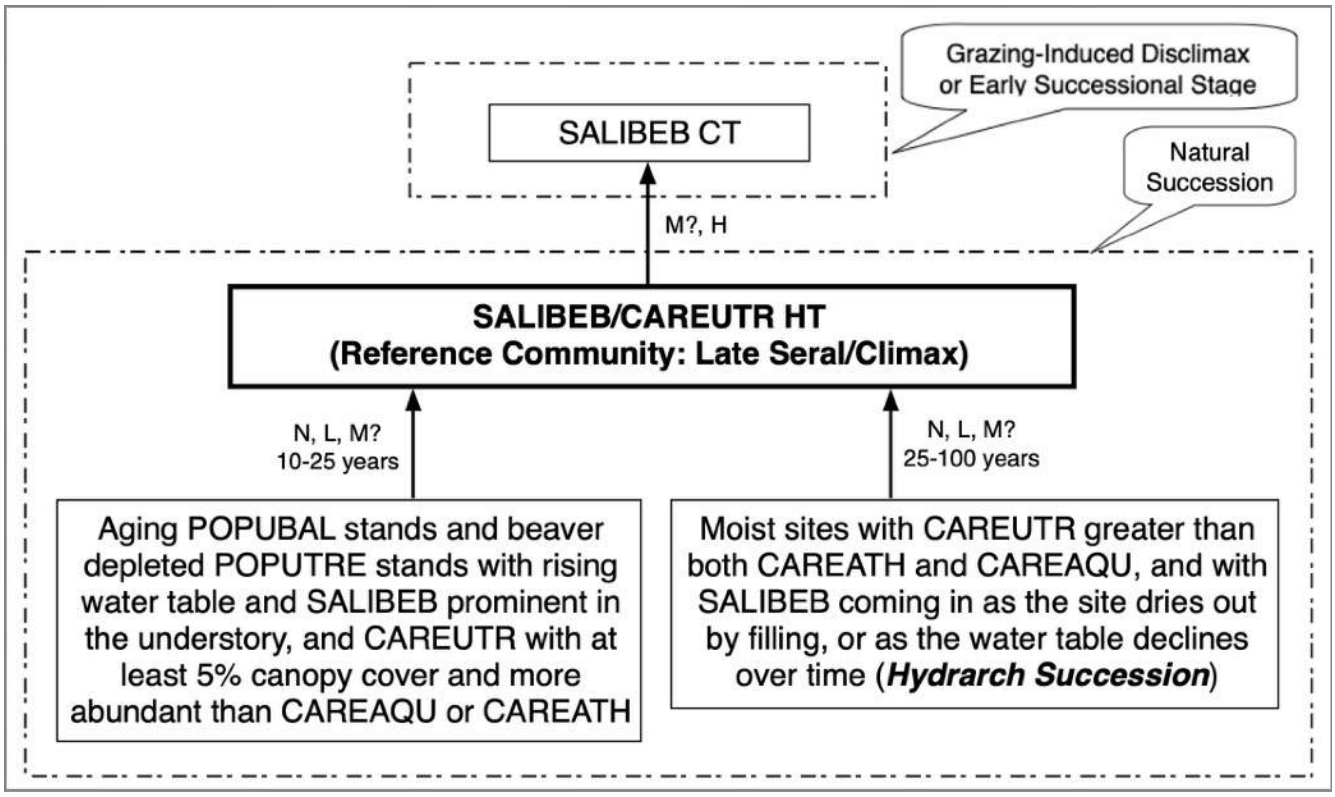
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type can develop on a site typically through two kinds of natural succession: 1) primary succession (hydrarch succession) whereby a wet meadow stand of *Carex utriculata* (beaked sedge) located in a shallow depression gradually fills in enough for *Salix bebbiana* (beaked willow) to become established; and 2) secondary succession wherein aging *Populus balsamifera* (balsam poplar) stands, or beaver depleted *Populus tremuloides* (aspen) stands, have both *Salix bebbiana* (beaked willow) and *Carex utriculata* (beaked sedge) prominent in their understory.

Figure 56 shows a schematic diagram of vegetation successional pathways on sites of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type.



Successional Pathway of *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUTRE—*Populus tremuloides* (aspen)
SALIBEB—*Salix bebbiana* (beaked willow)

SALIBEB/CAREUTR HT—*Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type
SALIBEB CT—*Salix bebbiana* (beaked willow) community type

Figure 56. Successional pathway for sites of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 57 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

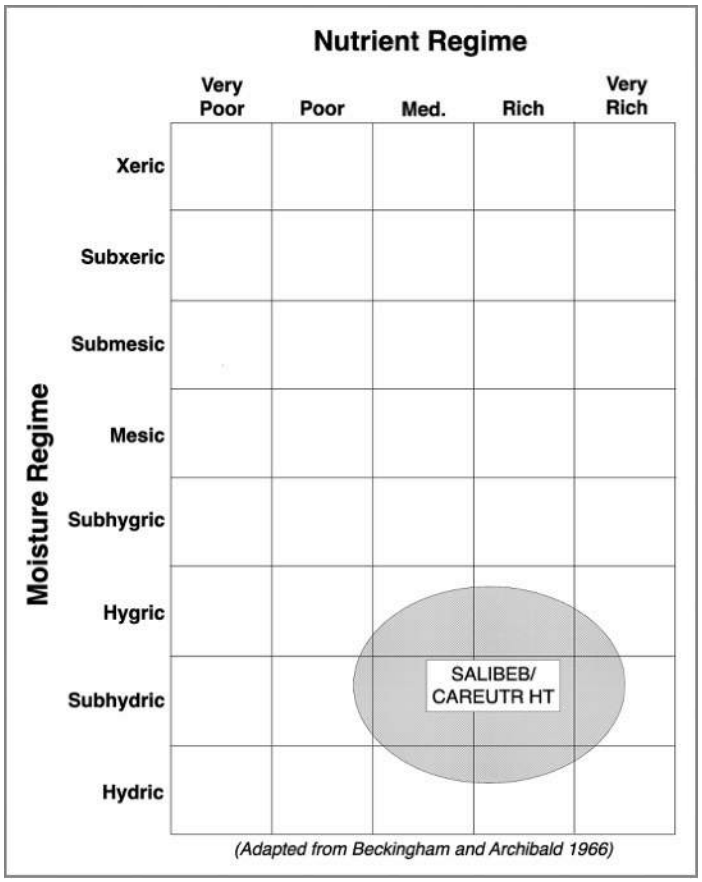


Figure 57. Edatope grid position for the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type (SALIBEB/CAREUTR HT)

SOILS

Parent material on sites supporting the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type is predominantly morainal and undifferentiated organic. *Salix bebbiana* (beaked willow) is usually found on moist sandy or gravelly soils but is adapted to a wide variety of soil textures, and sites are poorly drained. These soils often have a thick organic layer of peaty mor humus. Soil subgroups are commonly gleysols and fibrisols, and surface texture typically varies from clay loam to sandy loam, with humic or fibric upper horizons often present. (France and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites are likely to have the *Typha latifolia* (cattail) habitat type, the *Carex utriculata* (beaked sedge) habitat type, or be open water. Adjacent drier sites may have the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type, the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type, or the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is a common and widespread species throughout most natural regions in Alberta. It grows in open woods, moist fescue grasslands, on shores and floodplains, often forming extensive thickets (Tannas 1997a). In northern Alberta, this species is common around sloughs in prairies, and in foothills, upland forests, wet lowlands, thickets, and muskegs. It is often found in thickets adjacent to streams, swamps, and lakes (Tesky 1992).

Salix bebbiana (beaked willow) is usually found on moist sandy or gravelly soils, but is adapted to a wide variety of soil textures. It will tolerate moderately alkaline soils, but does poorly in extremely acidic or alkaline conditions. It can survive short periods of standing water, but growth rates decline sharply if water persists above the root collar. *Salix bebbiana* (beaked willow) is not drought tolerant, however; and prefers sites with adequate moisture. It is a pioneer species that is shade intolerant and grows best in full sunlight (Tesky 1992).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is common and widely distributed across Alberta. It is a wetland obligate, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). It is a long-lived perennial sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of fine roots (Johnson and others 1995).

Carex utriculata (beaked sedge) is strongly rhizomatous and colonial, typically forming a dense sod. Creeping rhizomes are long, slender or stout, and deep-seated. It grows on sites with high soil moisture, typically with the water table at or above the soil surface during the growing season. This is one of our wettest sedges. On some sites, water tables are above the soil surface all year, and rarely drop below the rooting zone. The species occurs on a range of soil types, with textures from silt loams or silty clays to loamy sands (Anderson 2008).

Carex utriculata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates with continually high water tables and persists indefinitely to form climax communities (Anderson 2008).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

Livestock

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) has good forage value, being very nutritious with higher protein content than most grasses. The species is rated as one of the most palatable of willows (Tannas 1997a). It is resistant to heavy browsing and is considered a grazing increaser. However, severely injured or dying plants may indicate deteriorated range condition or a very high game population (Tannas 1997a).

In stands dominated by *Salix bebbiana* (beaked willow), forage production is moderate to high. The species rates as good forage value (Tannas 1997a); and the associated wetland sedges (*Carex atherodes* [awned sedge], *Carex aquatilis* [water sedge], and *Carex utriculata* [beaked sedge]) all rate as fair to good forage value (Stone and Lawrence 2000, Tannas 1997a). As a result, high use by livestock is common after sites dry out somewhat in summer. The moist, fine textured soils are extremely susceptible to trampling damage, becoming compacted and hummocked with prolonged presence of livestock. In some stands, the *Salix* (willows) may become highlined, clubbed, or decadent clumps. With continued overuse, *Salix* (willows) can show a sharp decline in vigour and may even be finally eliminated from the site.

***Carex utriculata* (beaked sedge)**—Livestock forage value of *Carex utriculata* (beaked sedge) is high (Tannas 1997a, Beckingham 1991). The species is palatable in the spring, but palatability declines as the plants become coarse and tough in summer (Tannas 1997a, Hansen and others 1988). Relative palatability may then increase again in fall as the sedge cures and upland forage is less attractive. *Carex utriculata* (beaked sedge) cover decreases in response to high levels of grazing pressure, and will be replaced with less productive and less palatable species, such as *Juncus balticus* (wire rush) and *Poa* species (bluegrass) (Thompson and Hansen 2003).

In general, *Carex* species (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites, residual cover should be left to protect the banks and the soil surface, and to filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days should provide time for sufficient residual cover regrowth on streamside riparian sites (Myers 1989).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is used extensively by wild ungulates, especially moose, and is an important food source for small mammals. It also provides valuable shelter and habitat for birds and other wildlife (Tannas 1997a). Where stands of *Salix bebbiana* (beaked willow) occur on winter game ranges, browsing of *Salix bebbiana* (beaked willow) by wild ungulates is often severe enough to reduce plant vigour and regeneration. *Salix bebbiana* (beaked willow) is a highly valuable browse for elk, with high levels of utilization common (Tesky 1992). Continued use may lead to conversion to an herbaceous community dominated by *Poa palustris* (fowl bluegrass) and *Poa pratensis* (Kentucky bluegrass). Moose and beaver also heavily utilize most species of *Salix* (willow). *Salix bebbiana* (beaked willow) provides cover and protection for many birds and mammals, and also provides shade along banks of streams and ponds (Tesky 1992).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is grazed by moose, elk, mule deer, bison, grizzly bears, and sandhill cranes (Anderson 2008). The species is an important component of valuable breeding and feeding grounds for geese and other waterfowl. Birds commonly associated with *Carex utriculata* (beaked sedge) habitats include mallard, green-winged teal, common yellowthroat, red-winged black bird, song sparrow, and tree swallow. *Carex utriculata* (beaked sedge) stands are usually more important as feeding grounds than as nesting grounds because of their low stature, lack of structural diversity, and high water levels. Elk and moose often graze *Carex utriculata* (beaked sedge) stands when *Carex atherodes* (awned sedge) is present (Anderson 2008).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

Fisheries

***Salix bebbiana* (beaked willow)**—The importance of *Salix* species (willows) in streambank stabilization, cover, and thermal protection for fisheries cannot be over emphasized. The herbaceous understory aids in filtering out sediments during overbank flows, thereby contributing to streambank building (Hansen and others 1995).

***Carex utriculata* (beaked sedge)**—The dense network of roots of the rhizomatous *Carex utriculata* (beaked sedge) is very effective in binding soil and stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish (Thompson and Hansen 2003).

Fire

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) will sprout vigorously from the basal stem after fire. The light wind blown seeds readily colonize exposed mineral soil after severe fires. *Salix bebbiana* (beaked willow) usually becomes the dominant species in willow stands after fires on upland sites and in thickets adjacent to streams, swamps, and lakes (Tesky 1992).

Salix bebbiana (beaked willow) is highly adapted to fire in most habitats, sprouting rapidly from basal stems following fire (Haeussler and Coates 1986). Fast moving fires maximize sprouting, while slower burns cause more damage to plants. Prescribed burning is a commonly used wildlife management tool to rejuvenate decadent communities dominated by this willow. The light seeds readily colonize exposed mineral soil after hot fires. The degree to which this species invades after fire, however, depends on the time of year, weather, and presence of a mineral seedbed. Prescribed burning is a common wildlife management tool used to rejuvenate decadent *Salix bebbiana* (beaked willow) communities (Tesky 1992).

***Carex utriculata* (beaked sedge)**—Sites supporting stands of *Carex utriculata* (beaked sedge) are very wet, except at times of severe drought, and therefore they seldom burn. However, *Carex utriculata* (beaked sedge) sprouts from rhizomes, so it is often able to survive after being top-killed by fire. However, peat soils, common in

these communities, can burn when dry, and the heat from such fires can penetrate the soil, destroying the sedge rhizomes. It is necessary that livestock be excluded during the year prior to burning. Caution should be used with fires along streams because of the excellent erosion protection *Carex utriculata* (beaked sedge) provides. Fires do little to change plant composition of beaked sedge communities (DeBenedetti and Parsons 1984). Fire may regress seral succession in treed or shrubby fen stands back to open sedge meadows that support little woody vegetation (Anderson 2008).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

Rehabilitation/Restoration Considerations

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is a relatively good soil stabilizer and is valuable for revegetating streambanks and other disturbed sites (Tesky 1992). Stands dominated by *Salix bebbiana* (beaked willow) receive high use by wildlife and livestock. Soils and streambanks are highly susceptible to trampling damage, especially when soils are wet. Deferring grazing until sites are drier can reduce trampling and compaction problems (Marlow 1984). Unless the high water tables are maintained, the understories in these stands will be converted to dominance by introduced grass species and weedy forbs (Hansen and others 1995).

Salix bebbiana (beaked willow) is valuable for revegetating streambanks and other disturbed sites. Cuttings are best taken in the spring from dormant two to four year old wood and should be planted on sites that have sufficient moisture to start and carry them through the growing season. Cuttings 30 cm to 50 cm long and more than 1 cm in diameter produce the best results, with the cuttings rooting freely along the entire length of the stem. Shoots from cuttings can be expected to appear 10 to 20 days after planting. However, use of rooted cuttings and nursery grown stock will produce better results.

***Carex utriculata* (beaked sedge)**—Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex utriculata* (beaked sedge) has a dense network of rhizomatous roots and forms a thick sod that is highly resistant to erosion and effective in stabilizing streambanks (Anderson 2008).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Willow/Foothills rough fescue-Hairy wild rye

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msd3a Willow/Tufted hairgrass (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type has not been described in the region.

Salix bebbiana Community Type
(beaked willow Community Type)

SALIBEB Community Type
Number of Stands = 36 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 12; Other Data Sets = 24)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix bebbiana* (beaked willow) community type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This community type occupies moist to wet areas around sloughs, lake shores, on alluvial terraces, near springs, seeps, and sub-irrigated meadows characterized by fine textured substrates and poor drainage. These stands are typically disturbed communities located where livestock have unlimited physical access to the site.

Photo 12 shows a typical stand of the *Salix bebbiana* (beaked willow) community type.

Photo 12. A stand of the *Salix bebbiana* (beaked willow) community type

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 275 shows the five most prominent plant species among the four lifeforms for species recorded in all 36 stands of the *Salix bebbiana* (beaked willow) community type. Only *Salix bebbiana* (beaked willow) is more than moderately prominent in these mostly disturbed stands.

Table 275. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix bebbiana* (beaked willow) community type (number = 36 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus tremuloides (aspen)	0.19	Native
Picea glauca (white spruce)	0.17	Native
Populus balsamifera (balsam poplar)	0.03	Native
Larix laricina (tamarack)	0.01	Native
Pseudotsuga menziesii (Douglas-fir)	0.01	Native
Shrubs		
Salix bebbiana (beaked willow)	56.53	Native
Alnus crispa (green alder)	3.61	Native
Symphoricarpos occidentalis (buckbrush)	3.28	Native
Betula glandulosa (bog birch)	2.50	Native
Salix pseudomonticola (false mountain willow)	2.42	Native
Graminoids		
Poa pratensis (Kentucky bluegrass)	9.58	Introduced
Phleum pratense (timothy)	7.06	Introduced
Bromus inermis (smooth brome)	5.82	Introduced
Juncus balticus (wire rush)	4.65	Native
Deschampsia cespitosa (tufted hair grass)	3.58	Native

Table 275. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Aster ciliolatus (Lindley's aster)	3.11	Native
Equisetum arvense (common horsetail)	2.17	Native
Heracleum lanatum (cow parsnip)	2.04	Native
Taraxacum officinale (common dandelion)	2.04	Introduced
Fragaria virginiana (wild strawberry)	1.94	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 276 through Table 279, break out the vegetation recorded in 36 stands of the *Salix bebbiana* (beaked willow) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, species rich, shrub dominated community type of minor occurrence across the study area.

Table 276 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana* (beaked willow) community type. For the 36 stands comprising the community type, the number of unique species was 226 with 198 (87.6 percent) of them being native species.

Table 276. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix bebbiana* (beaked willow) community type (number = 36 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	5	5	0	0
Shrubs	43	40	0	3
Graminoids	51	45	6	0
Forbs	127	108	14	5
TOTAL	***226 (100.0%)***	***198 (87.6%)***	***20 (8.8%)***	***8 (3.4%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 277 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana* (beaked willow) community type. The average number of species per stand is 23.9, with native species comprising 20.0 species per stand or 83.7 percent.

Table 277. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix bebbiana* (beaked willow) community type (number = 36 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.4	0.4	0.0	0.0
Shrubs	5.0	4.8	0.0	0.2
Graminoids	5.5	3.7	1.8	0.0
Forbs	13.0	11.1	1.8	0.2
TOTAL	***23.9 (100.0%)***	***20.0 (83.7%)***	***3.6 (15.1%)***	***0.4 (1.7%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 278 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix bebbiana* (beaked willow) community type. The average canopy cover per stand is 164.3 percent, with native species comprising 134.2 percent or 81.7 percent of the total amount of average canopy cover per stand.

Table 278. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix bebbiana* (beaked willow) community type (number = 36 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.4%	0.4%	0.0%	0.0%
Shrubs	86.8%	86.2%	0.0%	0.6%
Graminoids	45.4%	22.3%	23.0%	0.0%
Forbs	31.7%	25.2%	6.3%	0.2%
TOTAL	***164.3% (100.0%)***	***134.2% (81.7%)***	***29.4% (17.9%)***	***0.7% (0.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 279 shows the average number of species and average canopy cover by lifeform in stands of the *Salix bebbiana* (beaked willow) community type. The average number of species per stand was 23.9 with an average canopy cover of 164.3 percent.

Table 279. Average number of species and average canopy cover by lifeform in stands of the *Salix bebbiana* (beaked willow) community type (number = 36 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.4	0.4%
Shrubs	5.0	86.8%
Graminoids	5.5	45.4%
Forbs	13.0	31.7%
TOTAL	***23.9***	***164.3%***

Sampled Stands Plant Species List

A total of 226 plant species were recorded on at least one of 36 stands sampled of the *Salix bebbiana* (beaked willow) community type (Table 280). This community type contains stands dominated by *Salix bebbiana* (beaked willow), that do not key out to any of the four *Salix bebbiana* (beaked willow) dominated habitat types described above. This community type tends to contain stands that are more disturbed and in an early seral stage. Five tree species were recorded in small amounts, and *Salix bebbiana* (beaked willow) overwhelmingly dominates the 43 shrub species recorded. Of 51 graminoid species recorded, none is dominant; but the three most prominent are grazing disturbance indicators: *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (timothy), and *Bromus inermis* (smooth brome). Of 127 forbs recorded, none is especially prominent.

Table 280. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix bebbiana* (beaked willow) community type (number = 36 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 5)					
Larix laricina (tamarack)	0.5	0-0.5	3	0.01	N
Picea glauca (white spruce)	0.9	0-3	19	0.17	N
Populus balsamifera (balsam poplar)	0.5	0-0.5	6	0.03	N
Populus tremuloides (aspen)	1.8	0-3	11	0.19	N
Pseudotsuga menziesii (Douglas-fir)	0.5	0-0.5	3	0.01	N
Shrubs (N = 43)					
Acer glabrum (mountain maple)	0.5	0-0.5	3	0.01	N
Alnus crispa (green alder)	65.0	0-80	6	3.61	N
Amelanchier alnifolia (Saskatoon)	0.8	0-3	22	0.18	N
Betula glandulosa (bog birch)	45.0	0-70	6	2.50	N
Betula occidentalis (water birch)	14.5	0-40	8	1.21	N
Betula pumila (dwarf birch)	50.0	0-50	3	1.39	N
Cornus stolonifera (red-osier dogwood)	7.8	0-20	11	0.86	N
Elaeagnus commutata (silverberry)	3.0	0-3	8	0.25	N

Table 280. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Juniperus horizontalis (creeping juniper)	3.0	0-3	3	0.08	N
Linnaea borealis (twinflower)	0.5	0-0.5	3	0.01	N
Lonicera dioica (twining honeysuckle)	1.8	0-3	6	0.10	N
Lonicera involucrata (bracted honeysuckle)	0.5	0-0.5	8	0.04	N
Lonicera utahensis (red twinberry)	0.5	0-0.5	3	0.01	N
Oxycoccus microcarpus (small bog cranberry)	3.0	0-3	3	0.08	N
Potentilla fruticosa (shrubby cinquefoil)	1.3	0-3	36	0.46	N
Prunus virginiana (choke cherry)	0.5	0-0.5	3	0.01	N
Ribes hirtellum (wild gooseberry)	3.0	0-3	3	0.08	N
Ribes lacustre (bristly black currant)	1.8	0-3	6	0.10	N
Ribes oxyacanthoides (northern gooseberry)	2.3	0-10	33	0.78	N
Ribes spp. (currant)	3.0	0-3	3	0.08	B
Rosa acicularis (prickly rose)	4.5	0-10	8	0.37	N
Rosa spp. (rose)	1.8	0-3	11	0.19	B
Rosa woodsii (common wild rose)	5.7	0-30	36	2.07	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	6	0.03	N
Rubus idaeus (wild red raspberry)	11.0	0-40	19	2.14	N
Rubus parviflorus (thimbleberry)	20.0	0-20	3	0.56	N
Rubus pubescens (dewberry)	0.5	0-0.5	3	0.01	N
Salix bebbiana (beaked willow)	56.5	10-97.5	100	56.53	N
Salix boothii (Booth's willow)	9.2	0-20	14	1.28	N
Salix discolor (pussy willow)	10.0	0-10	3	0.28	N
Salix drummondiana (Drummond's willow)	1.8	0-3	6	0.10	N
Salix lutea (yellow willow)	3.0	0-3	3	0.08	N
Salix maccalliana (velvet-fruited willow)	1.8	0-3	6	0.10	N
Salix myrtillifolia (myrtle-leaved willow)	20.0	0-20	3	0.56	N
Salix petiolaris (basket willow)	6.8	0-20	14	0.94	N
Salix planifolia (flat-leaved willow)	9.9	0-30	19	1.93	N
Salix pseudomonticola (false mountain willow)	12.4	0-40	19	2.42	N
Salix spp. (willow)	10.0	0-10	3	0.28	B
Shepherdia canadensis (Canada buffaloberry)	3.0	0-3	3	0.08	N
Symphoricarpos albus (snowberry)	5.3	0-10	6	0.29	N
Symphoricarpos occidentalis (buckbrush)	10.7	0-50	31	3.28	N
Symphoricarpos spp. (snowberry)	25.3	0-50	6	1.40	N
Viburnum edule (low-bush cranberry)	0.5	0-0.5	3	0.01	N
Graminoids (N = 51)					
Agropyron repens (quack grass)	1.0	0-3	14	0.14	I
Agropyron smithii (western wheat grass)	0.5	0-0.5	3	0.01	N
Agropyron trachycaulum (slender wheat grass)	6.8	0-40	39	2.64	N
Agrostis exarata (spike redtop)	3.0	0-3	6	0.17	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	3	0.01	N
Agrostis stolonifera (redtop)	6.5	0-10	6	0.36	I
Alopecurus aequalis (short-awn meadow-foxtail)	3.0	0-3	3	0.08	N
Alopecurus occidentalis (alpine foxtail)	2.4	0-3	11	0.26	N

Table 280. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Bromus carinatus (keeled brome)	0.5	0-0.5	3	0.01	N
Bromus ciliatus (fringed brome)	2.5	0-10	33	0.83	N
Bromus inermis (smooth brome)	26.2	0-80	22	5.82	I
Bromus inermis subsp. *pumpellianus* (northern awnless brome)	3.0	0-3	3	0.08	N
Calamagrostis canadensis (marsh reed grass)	2.5	0-3	14	0.35	N
Calamagrostis purpurascens (purple reed grass)	0.5	0-0.5	3	0.01	N
Calamagrostis stricta (narrow reed grass)	3.0	0-3	6	0.17	N
Carex aenea (silvery-flowered sedge)	0.5	0-0.5	3	0.01	N
Carex aquatilis (water sedge)	3.0	0-3	3	0.08	N
Carex atherodes (awned sedge)	1.8	0-3	6	0.10	N
Carex disperma (two-seeded sedge)	0.5	0-0.5	3	0.01	N
Carex gynocrates (northern bog sedge)	10.0	0-10	3	0.28	N
Carex hookerana (Hooker's sedge)	10.0	0-10	3	0.28	N
Carex lanuginosa (woolly sedge)	1.1	0-3	11	0.12	N
Carex microptera (small-winged sedge)	4.5	0-10	8	0.37	N
Carex praegracilis (graceful sedge)	0.5	0-0.5	3	0.01	N
Carex sartwellii (Sartwell's sedge)	3.0	0-3	3	0.08	N
Carex scopulorum (Holm's Rocky Mountain sedge)	20.0	0-20	3	0.56	N
Carex spectabilis (showy sedge)	3.0	0-3	3	0.08	N
Carex spp. (sedge)	1.3	0-3	8	0.11	N
Carex sprengelii (Sprengel's sedge)	0.5	0-0.5	8	0.04	N
Carex utriculata (beaked sedge)	0.5	0-0.5	3	0.01	N
Deschampsia cespitosa (tufted hair grass)	8.6	0-50	42	3.58	N
Elymus innovatus (hairy wild rye)	15.0	0-20	6	0.83	N
Elymus virginicus (Virginia wild rye)	0.5	0-0.5	3	0.01	N
Eriophorum vaginatum (sheathed cotton grass)	0.5	0-0.5	3	0.01	N
Festuca idahoensis (bluebunch fescue)	5.3	0-10	6	0.29	N
Festuca pratensis (meadow fescue)	3.0	0-3	3	0.08	I
Festuca scabrella (rough fescue)	0.5	0-0.5	6	0.03	N
Glyceria striata (fowl manna grass)	12.7	0-40	14	1.76	N
Hierochloe odorata (sweet grass)	10.0	0-10	3	0.28	N
Hordeum jubatum (foxtail barley)	0.5	0-0.5	3	0.01	N
Juncus balticus (wire rush)	16.8	0-80	28	4.65	N
Koeleria macrantha (June grass)	0.5	0-0.5	8	0.04	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	3	0.01	N
Muhlenbergia asperifolia (scratch grass)	0.5	0-0.5	3	0.01	N
Oryzopsis hymenoides (Indian rice grass)	0.5	0-0.5	3	0.01	N
Phleum commutatum (mountain timothy)	10.0	0-10	3	0.28	N
Phleum pratense (timothy)	12.1	0-50	58	7.06	I
Poa glauca (timberline bluegrass)	3.0	0-3	3	0.08	N
Poa palustris (fowl bluegrass)	7.1	0-50	39	2.78	N
Poa pratensis (Kentucky bluegrass)	12.8	0-60	75	9.58	I

Table 280. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Scirpus hudsonianus (Hudson Bay bulrush)	30.0	0-30	3	0.83	N
Forbs (N = 127)					
Achillea millefolium (common yarrow)	1.7	0-10	44	0.76	N
Actaea rubra (red and white baneberry)	1.3	0-3	8	0.11	N
Agoseris glauca (yellow false dandelion)	0.5	0-0.5	3	0.01	N
Allium schoenoprasum (wild chives)	0.5	0-0.5	6	0.03	N
Anemone cylindrica (long-fruited anemone)	0.5	0-0.5	3	0.01	N
Angelica arguta (white angelica)	0.5	0-0.5	6	0.03	N
Antennaria anaphaloides (tall everlasting)	0.5	0-0.5	3	0.01	N
Arnica chamissonis (leafy arnica)	0.5	0-0.5	6	0.03	N
Arnica fulgens (shining arnica)	0.5	0-0.5	3	0.01	N
Artemisia ludoviciana (prairie sagewort)	1.3	0-3	8	0.11	N
Aster borealis (marsh aster)	1.0	0-3	14	0.14	N
Aster ciliolatus (Lindley's aster)	8.6	0-30	36	3.11	N
Aster conspicuus (showy aster)	1.8	0-3	6	0.10	N
Aster eatonii (Eaton's aster)	10.0	0-10	3	0.28	N
Aster ericoides (tufted white prairie aster)	1.3	0-3	8	0.11	N
Aster hesperius (western willow aster)	0.5	0-0.5	8	0.04	N
Aster laevis (smooth aster)	2.7	0-10	25	0.67	N
Aster modestus (large northern aster)	1.8	0-3	11	0.19	N
Aster subspicatus (leafy-bracted aster)	3.0	0-3	8	0.25	N
Campanula rotundifolia (harebell)	0.5	0-0.5	3	0.01	N
Castilleja rhexifolia (alpine red paintbrush)	0.5	0-0.5	3	0.01	N
Castilleja spp. (paintbrush)	3.0	0-3	3	0.08	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	6	0.03	N
Cerastium nutans (long-stalked mouse-ear chickweed)	0.5	0-0.5	3	0.01	N
Chrysanthemum leucanthemum (ox-eye daisy)	0.5	0-0.5	3	0.01	I
Chrysosplenium tetrandrum (green saxifrage)	0.5	0-0.5	3	0.01	N
Cicuta maculata (water-hemlock)	0.5	0-0.5	3	0.01	N
Cirsium arvense (Canada thistle)	2.2	0-10	39	0.86	I
Cirsium vulgare (bull thistle)	0.5	0-0.5	3	0.01	I
Convolvulus arvensis (field bindweed)	0.5	0-0.5	3	0.01	I
Cynoglossum officinale (hound's-tongue)	3.0	0-3	3	0.08	I
Cystopteris fragilis (fragile bladder fern)	6.5	0-10	6	0.36	N
Delphinium glaucum (tall larkspur)	3.9	0-10	14	0.54	N
Disporum trachycarpum (fairybells)	1.8	0-3	6	0.10	N
Drosera anglica (oblong-leaved sundew)	3.0	0-3	3	0.08	N
Epilobium anagallidifolium (alpine willowherb)	0.5	0-0.5	3	0.01	N
Epilobium angustifolium (common fireweed)	1.4	0-3	44	0.64	N
Epilobium ciliatum (northern willowherb)	1.5	0-3	14	0.21	N
Epilobium spp. (willow-herb)	0.5	0-0.5	3	0.01	N
Equisetum arvense (common horsetail)	5.2	0-30	42	2.17	N
Equisetum laevigatum (smooth scouring-rush)	0.5	0-0.5	3	0.01	N

Table 280. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Equisetum pratense (meadow horsetail)	0.5	0-0.5	3	0.01	N
Equisetum scirpoides (dwarf scouring-rush)	3.0	0-3	3	0.08	N
Equisetum spp. (horsetail)	0.5	0-0.5	3	0.01	N
Equisetum sylvaticum (woodland horsetail)	0.5	0-0.5	3	0.01	N
Equisetum variegatum (variegated horsetail)	0.5	0-0.5	3	0.01	N
Erigeron philadelphicus (Philadelphia fleabane)	0.5	0-0.5	3	0.01	N
Erysimum cheiranthoides (wormseed mustard)	0.5	0-0.5	3	0.01	N
Forb spp. (forb)	0.5	0-0.5	3	0.01	B
Fragaria vesca (woodland strawberry)	0.5	0-0.5	3	0.01	N
Fragaria virginiana (wild strawberry)	3.0	0-20	64	1.94	N
Galeopsis tetrahit (hemp-nettle)	0.5	0-0.5	3	0.01	I
Galium boreale (northern bedstraw)	1.0	0-3	42	0.42	N
Galium triflorum (sweet-scented bedstraw)	3.0	0-3	3	0.08	N
Geranium richardsonii (wild white geranium)	2.9	0-10	36	1.06	N
Geranium viscosissimum (sticky purple geranium)	0.5	0-0.5	8	0.04	N
Geum aleppicum (yellow avens)	1.5	0-3	14	0.21	N
Geum macrophyllum (large-leaved yellow avens)	2.8	0-10	47	1.31	N
Geum rivale (purple avens)	0.5	0-0.5	3	0.01	N
Geum triflorum (three-flowered avens)	0.5	0-0.5	3	0.01	N
Glycyrrhiza lepidota (wild licorice)	0.5	0-0.5	3	0.01	N
Habenaria hyperborea (northern green bog orchid)	0.5	0-0.5	3	0.01	N
Habenaria spp. (bog orchid)	0.5	0-0.5	3	0.01	B
Hackelia americana (nodding stickseed)	0.5	0-0.5	3	0.01	N
Helianthus nuttallii (common tall sunflower)	0.5	0-0.5	3	0.01	N
Heracleum lanatum (cow parsnip)	7.4	0-30	28	2.04	N
Heuchera cylindrica (sticky alumroot)	3.0	0-3	3	0.08	N
Heuchera richardsonii (Richardson's alumroot)	0.5	0-0.5	3	0.01	N
Hieracium umbellatum (narrow-leaved hawkweed)	3.0	0-3	3	0.08	N
Lappula spp. (stickseed)	0.5	0-0.5	6	0.03	B
Lappula squarrosa (bluebur)	0.5	0-0.5	3	0.01	I
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	19	0.10	N
Lysimachia ciliata (fringed loosestrife)	1.8	0-3	6	0.10	N
Medicago lupulina (black medick)	0.5	0-0.5	3	0.01	I
Mentha arvensis (wild mint)	2.9	0-10	14	0.40	N
Menyanthes trifoliata (buck-bean)	20.0	0-20	3	0.56	N
Mertensia paniculata (tall lungwort)	1.3	0-3	17	0.22	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	8	0.04	N
Monarda fistulosa (wild bergamot)	0.5	0-0.5	3	0.01	N
Osmorhiza depauperata (spreading sweet cicely)	1.1	0-3	11	0.12	N
Oxytropis sericea (early yellow locoweed)	0.5	0-0.5	3	0.01	N
Oxytropis splendens (showy locoweed)	0.5	0-0.5	3	0.01	N
Pedicularis bracteosa (western lousewort)	1.8	0-3	6	0.10	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	3	0.01	N
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	3	0.01	N

Table 280. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Perideridia gairdneri (squawroot)	0.5	0-0.5	8	0.04	N
Petasites frigidus (arctic sweet coltsfoot)	5.3	0-10	6	0.29	N
Petasites palmatus (palmate-leaved coltsfoot)	6.5	0-10	6	0.36	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	3	0.01	N
Plantago major (common plantain)	0.5	0-0.5	11	0.06	I
Potentilla anserina (silverweed)	0.5	0-0.5	3	0.01	N
Potentilla gracilis (graceful cinquefoil)	2.0	0-10	22	0.44	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	3	0.01	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	3	0.01	N
Ranunculus acris (tall buttercup)	7.0	0-20	8	0.58	I
Rumex occidentalis (western dock)	0.5	0-0.5	3	0.01	N
Rumex spp. (sorrel)	3.0	0-3	3	0.08	B
Sanicula marilandica (snakeroot)	0.5	0-0.5	8	0.04	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	6	0.03	N
Senecio eremophilus (cut-leaved ragwort)	0.5	0-0.5	3	0.01	N
Senecio pauciflorus (few-flowered ragwort)	3.0	0-3	3	0.08	N
Senecio pauperculus (balsam groundsel)	0.9	0-3	19	0.17	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	3	0.01	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	28	0.14	N
Solidago canadensis (Canada goldenrod)	4.2	0-20	22	0.93	N
Solidago gigantea (late goldenrod)	1.8	0-3	6	0.10	N
Solidago missouriensis (low goldenrod)	6.8	0-10	8	0.57	N
Sonchus arvensis (perennial sow-thistle)	25.3	0-50	6	1.40	I
Spiranthes romanzoffiana (hooded ladies'-tresses)	0.5	0-0.5	3	0.01	N
Stachys palustris (marsh hedge-nettle)	0.5	0-0.5	6	0.03	N
Stellaria calycantha (northern stitchwort)	0.5	0-0.5	3	0.01	N
Stellaria longifolia (long-leaved chickweed)	1.8	0-3	6	0.10	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	6	0.03	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.5	0-0.5	6	0.03	N
Taraxacum officinale (common dandelion)	3.1	0-20	67	2.04	I
Thalictrum occidentale (western meadow rue)	0.5	0-0.5	6	0.03	N
Thalictrum spp. (meadow rue)	0.5	0-0.5	3	0.01	N
Thalictrum venulosum (veiny meadow rue)	1.4	0-3	31	0.43	N
Trifolium repens (white clover)	5.4	0-20	22	1.19	I
Triglochin maritima (seaside arrow-grass)	0.5	0-0.5	3	0.01	N
Urtica dioica (common nettle)	1.3	0-3	17	0.22	N
Vicia americana (wild vetch)	1.4	0-3	72	0.99	N
Viola adunca (early blue violet)	1.3	0-3	8	0.11	N
Viola canadensis (western Canada violet)	1.3	0-3	17	0.22	N
Viola palustris (marsh violet)	1.8	0-3	6	0.10	N
Viola spp. (violet)	0.5	0-0.5	6	0.03	B
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	8	0.04	N

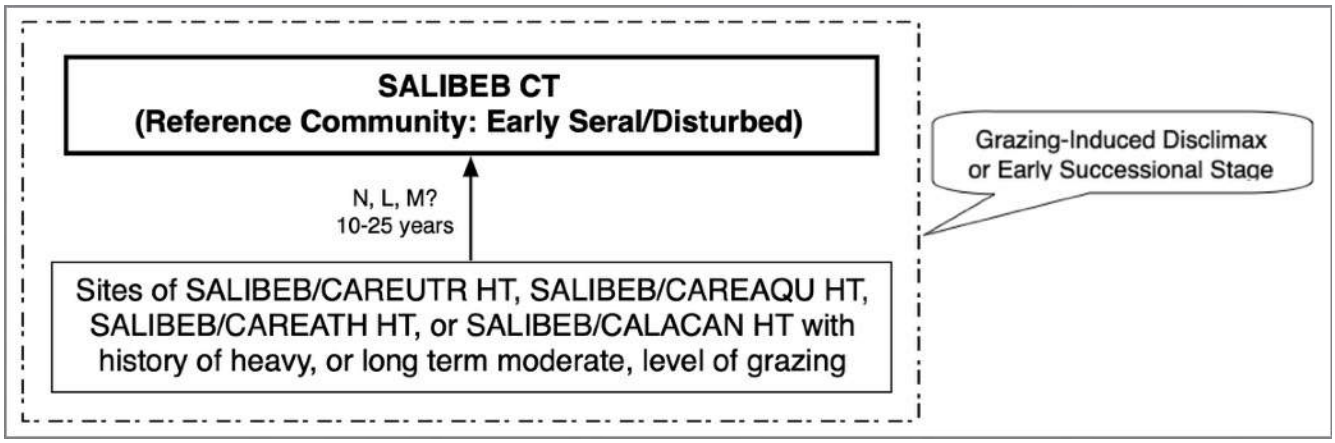
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix bebbiana* (beaked willow) community type is usually the result of heavy, long term livestock grazing pressure on a stand of any of the four habitat types dominated by *Salix bebbiana* (beaked willow) described above, wherein the palatable graminoid understory species are reduced and replaced with disturbance increaser herbaceous, usually introduced species, such as *Poa pratensis* (Kentucky bluegrass).

Figure 58 shows a schematic diagram of vegetation successional pathways on sites of the *Salix bebbiana* (beaked willow) community type.



Successional Pathway of *Salix bebbiana* (beaked willow) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix bebbiana* (beaked willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES

SALIBEB/CALACAN HT—*Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type
SALIBEB/CAREAQU HT—*Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type
SALIBEB/CAREATH HT—*Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type
SALIBEB/CAREUTR HT—*Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type
SALIBEB CT—*Salix bebbiana* (beaked willow) community type

Figure 58. Successional pathway for sites of the *Salix bebbiana* (beaked willow) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under

undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 59 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix bebbiana* (beaked willow) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

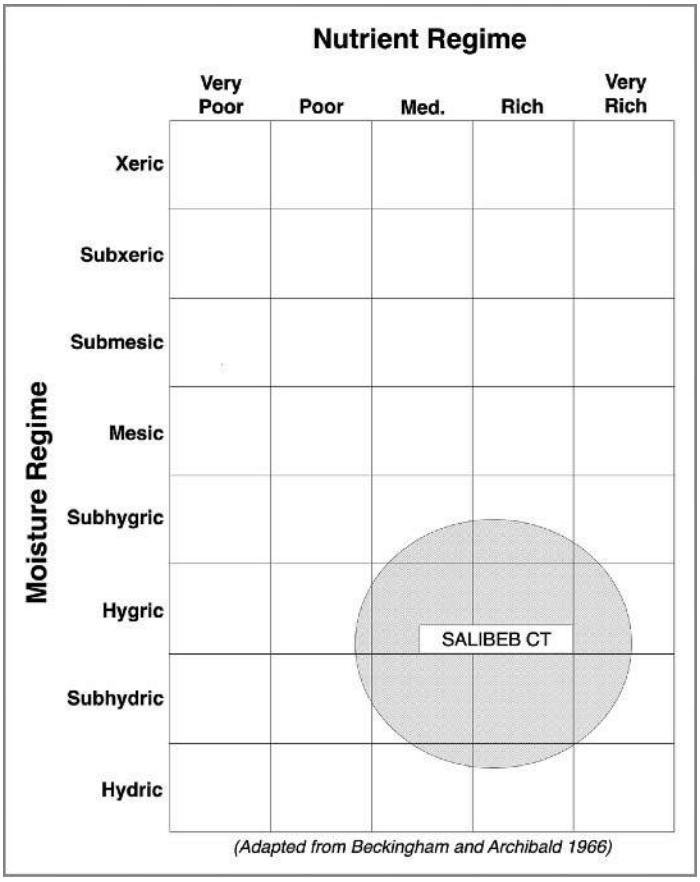


Figure 59. Edatope grid position for the *Salix bebbiana* (beaked willow) community type (SALIBEB CT)

SOILS

Parent material on sites supporting the *Salix bebbiana* (beaked willow) community type is predominantly fluvial. *Salix bebbiana* (beaked willow) is usually found on moist sandy or gravelly soils but is adapted to a wide variety of soil textures, and sites are poorly drained. These soils often have a thick organic layer of peaty mor humus. Soil subgroups are commonly regosols and gleysols, and surface texture typically varies from loamy sand to silty clay loam (France and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites can be dominated by any of several different wetland *Carex* (sedge) species, *Salix pedicellaris* (bog willow) or *Salix planifolia* (flat-leaved willow). Adjacent drier sites are most likely to be dominated by stands of *Populus tremuloides* (aspen) or *Picea glauca* (white spruce).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is a common and widespread species throughout most natural regions in Alberta. It grows in open woods, moist fescue grasslands, on shores and floodplains, often forming extensive thickets (Tannas 1997a). In northern Alberta, this species is common around sloughs in prairies, and in foothills, upland forests, wet lowlands, thickets, and muskegs. It is often found in thickets adjacent to streams, swamps, and lakes (Tesky 1992).

Salix bebbiana (beaked willow) is usually found on moist sandy or gravelly soils, but is adapted to a wide variety of soil textures. It will tolerate moderately alkaline soils, but does poorly in extremely acidic or alkaline conditions. It can survive short periods of standing water, but growth rates decline sharply if water persists above the root collar. *Salix bebbiana* (beaked willow) is not drought tolerant, however; and prefers sites with adequate moisture. It is a pioneer species that is shade intolerant and grows best in full sunlight (Tesky 1992).

Livestock

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) has good forage value, being very nutritious with higher protein content than most grasses. The species is rated as one of the most palatable of willows (Tannas 1997a). It is resistant to heavy browsing and is considered a grazing increaser. However, severely injured or dying plants may indicate deteriorated range condition or a very high game population (Tannas 1997a).

In stands dominated by *Salix bebbiana* (beaked willow), forage production is moderate to high. The species rates as good forage value (Tannas 1997a); and the associated wetland sedges (*Carex atherodes* [awned sedge], *Carex aquatilis* [water sedge], and *Carex utriculata* [beaked sedge]) all rate as fair to good forage value (Stone and Lawrence 2000, Tannas 1997a). As a result, high use by livestock is common after sites dry out somewhat in summer. The moist, fine textured soils are extremely susceptible to trampling damage, becoming compacted and hummocked with prolonged presence of livestock. In some stands, the *Salix* (willows) may become highlined, clubbed, or decadent clumps. With continued overuse, *Salix* (willows) can show a sharp decline in vigour and may even be finally eliminated from the site.

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is used extensively by wild ungulates, especially moose, and is an important food source for small mammals. It also provides valuable shelter and habitat for birds and other wildlife (Tannas 1997a). Where stands of *Salix bebbiana* (beaked willow) occur on winter game ranges, browsing of *Salix bebbiana* (beaked willow) by wild ungulates is often severe enough to reduce plant vigour and regeneration. *Salix bebbiana* (beaked willow) is a highly valuable browse for elk, with high levels of utilization common (Tesky 1992). Continued use may lead to conversion to an herbaceous community dominated by *Poa palustris* (fowl bluegrass) and *Poa pratensis* (Kentucky bluegrass). Moose and

beaver also heavily utilize most species of *Salix* (willow). *Salix bebbiana* (beaked willow) provides cover and protection for many birds and mammals, and also provides shade along banks of streams and ponds (Tesky 1992).

Fisheries

***Salix bebbiana* (beaked willow)**—The importance of *Salix* species (willows) in streambank stabilization, cover, and thermal protection for fisheries cannot be over emphasized. The herbaceous understory aids in filtering out sediments during overbank flows, thereby contributing to streambank building (Hansen and others 1995).

Fire

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) will sprout vigorously from the basal stem after fire. The light wind blown seeds readily colonize exposed mineral soil after severe fires. *Salix bebbiana* (beaked willow) usually becomes the dominant species in willow stands after fires on upland sites and in thickets adjacent to streams, swamps, and lakes (Tesky 1992).

Salix bebbiana (beaked willow) is highly adapted to fire in most habitats, sprouting rapidly from basal stems following fire (Haeussler and Coates 1986). Fast moving fires maximize sprouting, while slower burns cause more damage to plants. Prescribed burning is a commonly used wildlife management tool to rejuvenate decadent communities dominated by this willow. The light seeds readily colonize exposed mineral soil after hot fires. The degree to which this species invades after fire, however, depends on the time of year, weather, and presence of a mineral seedbed. Prescribed burning is a common wildlife management tool used to rejuvenate decadent *Salix bebbiana* (beaked willow) communities (Tesky 1992).

Rehabilitation/Restoration Considerations

***Salix bebbiana* (beaked willow)**—*Salix bebbiana* (beaked willow) is a relatively good soil stabilizer and is valuable for revegetating streambanks and other disturbed sites (Tesky 1992). Stands dominated by *Salix bebbiana* (beaked willow) receive high use by wildlife and livestock. Soils and streambanks are highly susceptible to trampling damage, especially when soils are wet. Deferring grazing until sites are drier can reduce trampling and compaction problems (Marlow 1984). Unless the high water tables are maintained, the understories in these stands will be converted to dominance by introduced grass species and weedy forbs (Hansen and others 1995).

Salix bebbiana (beaked willow) is valuable for revegetating streambanks and other disturbed sites. Cuttings are best taken in the spring from dormant two to four year old wood and should be planted on sites that have sufficient moisture to start and carry them through the growing season. Cuttings 30 cm to 50 cm long and more than 1 cm in diameter produce the best results, with the cuttings rooting freely along the entire length of the stem. Shoots from cuttings can be expected to appear 10 to 20 days after planting. However, use of rooted cuttings and nursery grown stock will produce better results.

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix bebbiana* (beaked willow) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Willow/Cow parsnip-Horsetail

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Beaked willow/Cow parsnip/Kentucky bluegrass

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msd19 Beaked willow/Cow parsnip/Kentucky bluegrass (Montane Southern Ecosection)
- Mnb12 Willow/Timothy (Montane Northern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix bebbiana* (beaked willow) community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995);
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001); and
- *Classification and Management of Upland, Riparian, and Wetland Sites of USDI Bureau of Land Management's Miles City Field Office, Eastern Montana USA* (Hansen and others 2008).

Salix drummondiana/Carex utriculata Habitat Type
(Drummond's willow/beaked sedge Habitat Type)

SALIDRU/CAREUTR Habitat Type
Number of Stands = 6 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 2; Other Data Sets = 4)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. Stands of this habitat type are located along the banks and shorelines of streams, rivers, beaver ponds, lakes, wet meadows, fens, and marshes. It occurs at moderate elevations, ranging from lower forested and non-forested foothills upslope to subalpine habitats.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 281 shows the five most prominent plant species among the four lifeforms for species recorded in all six stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type. Only the two type indicator species, *Salix drummondiana* (Drummond's willow) and *Carex utriculata* (beaked sedge), are more than moderately prominent in these stands.

Table 281. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (number = 6 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea engelmannii (Engelmann spruce)	0.17	Native
Abies lasiocarpa (subalpine fir)	0.08	Native
Shrubs		
Salix drummondiana (Drummond's willow)	61.67	Native
Salix myrtillifolia (myrtle-leaved willow)	6.67	Native
Alnus tenuifolia (river alder)	1.75	Native
Betula pumila (dwarf birch)	1.67	Native
Salix planifolia (flat-leaved willow)	1.67	Native
Graminoids		
Carex utriculata (beaked sedge)	46.67	Native
Carex aquatilis (water sedge)	8.33	Native
Calamagrostis canadensis (marsh reed grass)	6.83	Native
Carex atherodes (awned sedge)	6.67	Native
Poa palustris (fowl bluegrass)	1.75	Native
Forbs		
Geum macrophyllum (large-leaved yellow avens)	3.92	Native
Petasites frigidus (arctic sweet coltsfoot)	1.75	Native
Potentilla palustris (marsh cinquefoil)	1.75	Native
Senecio triangularis (brook ragwort)	1.75	Native
Mentha arvensis (wild mint)	0.58	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 282 through Table 285, break out the vegetation recorded in all six stands sampled of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, moderately species rich, shrub dominated habitat type of incidental occurrence across the study area.

Table 282 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type. For the 6 stands comprising the habitat type, the number of unique species was 54 with 52 (96.3 percent) of them being native species.

Table 282. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (number = 6 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2	2	0	0
Shrubs	23	22	0	1
Graminoids	10	9	1	0
Forbs	19	19	0	0
TOTAL	***54 (100.0%)***	***52 (96.3%)***	***1 (1.9%)***	***1 (1.9%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 283 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type. The average number of species per stand is 13.3, with native species comprising 12.9 species per stand or 97.0 percent.

Table 283. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (number = 6 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.5	0.5	0.0	0.0
Shrubs	5.3	5.0	0.0	0.3
Graminoids	2.8	2.7	0.2	0.0
Forbs	4.7	4.7	0.0	0.0
TOTAL	***13.3 (100.0%)***	***12.9 (97.0%)***	***0.2 (1.5%)***	***0.3 (2.3%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 284 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type. The average canopy cover per stand is 167.4 percent, with native species comprising 165.2 percent or 98.7 percent of the total amount of average canopy cover per stand.

Table 284. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (number = 6 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.3%	0.3%	0.0%	0.0%
Shrubs	78.9%	78.3%	0.0%	0.6%
Graminoids	75.8%	74.2%	1.7%	0.0%
Forbs	12.4%	12.4%	0.0%	0.0%
TOTAL	***167.4% (100.0%)***	***165.2% (98.7%)***	***1.7% (1.0%)***	***0.6% (0.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 285 shows the average number of species and average canopy cover by lifeform in stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type. The average number of species per stand was 13.3 with an average canopy cover of 167.4 percent.

Table 285. Average number of species and average canopy cover by lifeform in stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (number = 6 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.5	0.3%
Shrubs	5.3	78.9%
Graminoids	2.8	75.8%
Forbs	4.7	12.4%
TOTAL	***13.3***	***167.4%***

Sampled Stands Plant Species List

A total of 54 plant species were recorded on at least one of six stands sampled of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (Table 286). On these six stands, two tree species were recorded in very small amounts, and of the 23 shrubs recorded, *Salix drummondiana* (Drummond's willow) is overwhelmingly dominant. *Carex utriculata* (beaked sedge) dominates the 10 species graminoid layer, while none of the 19 forb species is notably prominent.

Table 286. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (number = 6 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 2)					
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	17	0.08	N
Picea engelmannii (Engelmann spruce)	0.5	0-0.5	33	0.17	N
Shrubs (N = 23)					
Alnus tenuifolia (river alder)	5.3	0-10	33	1.75	N
Betula glandulosa (bog birch)	3.0	0-3	17	0.50	N
Betula pumila (dwarf birch)	10.0	0-10	17	1.67	N
Cornus stolonifera (red-osier dogwood)	0.5	0-0.5	17	0.08	N
Juniperus communis (ground juniper)	0.5	0-0.5	17	0.08	N
Lonicera involucrata (bracted honeysuckle)	2.2	0-3	50	1.08	N
Menziesia ferruginea (false azalea)	0.5	0-0.5	17	0.08	N
Potentilla fruticosa (shrubby cinquefoil)	0.5	0-0.5	17	0.08	N
Rhamnus alnifolia (alder-leaved buckthorn)	0.5	0-0.5	17	0.08	N
Ribes hudsonianum (northern black currant)	0.5	0-0.5	17	0.08	N
Ribes oxyacanthoides (northern gooseberry)	3.0	0-3	17	0.50	N
Ribes spp. (currant)	1.8	0-3	33	0.58	B
Rosa acicularis (prickly rose)	0.5	0-0.5	17	0.08	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	17	0.08	N
Rubus pedatus (dwarf bramble)	3.0	0-3	17	0.50	N
Salix bebbiana (beaked willow)	3.0	0-3	17	0.50	N
Salix boothii (Booth's willow)	3.0	0-3	17	0.50	N
Salix drummondiana (Drummond's willow)	61.7	30-80	100	61.67	N
Salix myrtillifolia (myrtle-leaved willow)	40.0	0-40	17	6.67	N
Salix planifolia (flat-leaved willow)	10.0	0-10	17	1.67	N
Salix prolixa (Mackenzie's willow)	0.5	0-0.5	17	0.08	N
Vaccinium scoparium (grouseberry)	0.5	0-0.5	17	0.08	N
Viburnum edule (low-bush cranberry)	3.0	0-3	17	0.50	N
Graminoids (N = 10)					
Agrostis scabra (rough hair grass)	10.0	0-10	17	1.67	N
Calamagrostis canadensis (marsh reed grass)	10.3	0-30	67	6.83	N
Carex aquatilis (water sedge)	50.0	0-50	17	8.33	N
Carex atherodes (awned sedge)	40.0	0-40	17	6.67	N
Carex disperma (two-seeded sedge)	3.0	0-3	17	0.50	N
Carex flava (yellow sedge)	0.5	0-0.5	17	0.08	N
Carex kelloggii (Kellogg's sedge)	10.0	0-10	17	1.67	N
Carex utriculata (beaked sedge)	70.0	0-80	67	46.67	N
Poa palustris (fowl bluegrass)	5.3	0-10	33	1.75	N
Poa pratensis (Kentucky bluegrass)	10.0	0-10	17	1.67	I
Forbs (N = 19)					
Angelica arguta (white angelica)	0.5	0-0.5	17	0.08	N
Aster modestus (large northern aster)	0.5	0-0.5	33	0.17	N

Table 286. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Botrychium lanceolatum (lance-leaved grape fern)	0.5	0-0.5	17	0.08	N
Caltha spp. (marsh marigold)	0.5	0-0.5	17	0.08	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	33	0.17	N
Epilobium ciliatum (northern willowherb)	3.0	0-3	17	0.50	N
Equisetum arvense (common horsetail)	3.0	0-3	17	0.50	N
Equisetum pratense (meadow horsetail)	0.5	0-0.5	17	0.08	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	17	0.08	N
Geum macrophyllum (large-leaved yellow avens)	7.8	0-20	50	3.92	N
Mentha arvensis (wild mint)	1.8	0-3	33	0.58	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	17	0.08	N
Petasites frigidus (arctic sweet coltsfoot)	5.3	0-10	33	1.75	N
Potentilla palustris (marsh cinquefoil)	5.3	0-10	33	1.75	N
Pyrola asarifolia (common pink wintergreen)	0.5	0-0.5	17	0.08	N
Senecio triangularis (brook ragwort)	5.3	0-10	33	1.75	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	33	0.17	N
Vicia americana (wild vetch)	0.5	0-0.5	17	0.08	N
Viola canadensis (western Canada violet)	3.0	0-3	17	0.50	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 287 shows the five most prominent plant species among the four lifeforms for species recorded in all four relatively undisturbed late seral to climax stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type. The two type indicator species, *Salix drummondiana* (Drummond's willow) and *Carex utriculata* (beaked sedge), are by far most prominent, followed well behind by *Carex aquatilis* (water

sedge) and *Salix myrtillifolia* (myrtle-leaved willow). No other species is more than moderately prominent in these stands.

Table 287. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (number = 4 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea engelmannii (Engelmann spruce)	0.13	Native
Shrubs		
Salix drummondiana (Drummond's willow)	57.50	Native
Salix myrtillifolia (myrtle-leaved willow)	10.00	Native
Betula pumila (dwarf birch)	2.50	Native
Betula glandulosa (bog birch)	0.75	Native
Rubus pedatus (dwarf bramble)	0.75	Native
Graminoids		
Carex utriculata (beaked sedge)	52.50	Native
Carex aquatilis (water sedge)	12.50	Native
Agrostis scabra (rough hair grass)	2.50	Native
Carex kelloggii (Kellogg's sedge)	2.50	Native
Poa palustris (fowl bluegrass)	2.50	Native
Forbs		
Geum macrophyllum (large-leaved yellow avens)	5.13	Native
Potentilla palustris (marsh cinquefoil)	2.63	Native
Epilobium ciliatum (northern willowherb)	0.75	Native
Mentha arvensis (wild mint)	0.75	Native
Viola canadensis (western Canada violet)	0.75	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 288 through Table 291, break out the vegetation recorded in four relatively undisturbed late seral to climax stands sampled of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, moderately species rich, shrub dominated habitat type of incidental occurrence across the study area.

Table 288 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix*

drummondiana/Carex utriculata (Drummond's willow/beaked sedge) habitat type. For the 4 stands comprising the habitat type, the number of unique species was 35 with 33 (94.3 percent) of them being native species.

Table 288. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (number = 4 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	13	12	0	1
Graminoids	8	7	1	0
Forbs	13	13	0	0
TOTAL	***35 (100.0%)***	***33 (94.3%)***	***1 (2.9%)***	***1 (2.9%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 289 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type. The average number of species per stand is 10.9, with native species comprising 10.4 species per stand or 95.4 percent.

Table 289. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (number = 4 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.3	0.3	0.0	0.0
Shrubs	4.0	3.8	0.0	0.3
Graminoids	2.8	2.5	0.3	0.0
Forbs	3.8	3.8	0.0	0.0
TOTAL	***10.9 (100.0%)***	***10.4 (95.4%)***	***0.3 (2.8%)***	***0.3 (2.8%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 290 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix drummondiana/Carex utriculata*

(Drummond's willow/beaked sedge) habitat type. The average canopy cover per stand is 159.6 percent, with native species comprising 157.0 percent or 98.4 percent of the total amount of average canopy cover per stand.

Table 290. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (number = 4 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.1%	0.1%	0.0%	0.0%
Shrubs	73.1%	73.0%	0.0%	0.1%
Graminoids	75.4%	72.9%	2.5%	0.0%
Forbs	11.0%	11.0%	0.0%	0.0%
TOTAL	***159.6% (100.0%)***	***157.0% (98.4%)***	***2.5% (1.6%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 291 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type. The average number of species per stand was 10.9 with an average canopy cover of 159.6 percent.

Table 291. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (number = 4 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.3	0.1%
Shrubs	4.0	73.1%
Graminoids	2.8	75.4%
Forbs	3.8	11.0%
TOTAL	***10.9***	***159.6%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 35 plant species were recorded on at least one of four relatively undisturbed late seral to climax stands sampled of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (Table 292). A small amount of *Picea engelmannii* (Engelmann spruce) was present on these stands, and *Salix drummondiana* (Drummond's willow) is most prominent of 13 shrub species recorded, followed distantly by *Salix myrtillifolia* (myrtle-leaved willow). *Carex utriculata* (beaked sedge) is most prominent among eight graminoids,

followed well behind by *Carex aquatilis* (water sedge), while none of the 13 forbs is more than moderately prominent.

Table 292. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (number = 4 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 1)					
Picea engelmannii (Engelmann spruce)	0.5	0-0.5	25	0.13	N
Shrubs (N = 13)					
Alnus tenuifolia (river alder)	0.5	0-0.5	25	0.13	N
Betula glandulosa (bog birch)	3.0	0-3	25	0.75	N
Betula pumila (dwarf birch)	10.0	0-10	25	2.50	N
Cornus stolonifera (red-osier dogwood)	0.5	0-0.5	25	0.13	N
Juniperus communis (ground juniper)	0.5	0-0.5	25	0.13	N
Lonicera involucrata (bracted honeysuckle)	0.5	0-0.5	25	0.13	N
Potentilla fruticosa (shrubby cinquefoil)	0.5	0-0.5	25	0.13	N
Rhamnus alnifolia (alder-leaved buckthorn)	0.5	0-0.5	25	0.13	N
Ribes spp. (currant)	0.5	0-0.5	25	0.13	B
Rubus pedatus (dwarf bramble)	3.0	0-3	25	0.75	N
Salix boothii (Booth's willow)	3.0	0-3	25	0.75	N
Salix drummondiana (Drummond's willow)	57.5	30-70	100	57.50	N
Salix myrtillifolia (myrtle-leaved willow)	40.0	0-40	25	10.00	N
Graminoids (N = 8)					
Agrostis scabra (rough hair grass)	10.0	0-10	25	2.50	N
Calamagrostis canadensis (marsh reed grass)	0.5	0-0.5	50	0.25	N
Carex aquatilis (water sedge)	50.0	0-50	25	12.50	N
Carex flava (yellow sedge)	0.5	0-0.5	25	0.13	N
Carex kelloggii (Kellogg's sedge)	10.0	0-10	25	2.50	N
Carex utriculata (beaked sedge)	70.0	0-80	75	52.50	N
Poa palustris (fowl bluegrass)	10.0	0-10	25	2.50	N
Poa pratensis (Kentucky bluegrass)	10.0	0-10	25	2.50	I
Forbs (N = 13)					
Angelica arguta (white angelica)	0.5	0-0.5	25	0.13	N
Aster modestus (large northern aster)	0.5	0-0.5	25	0.13	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	25	0.13	N
Epilobium ciliatum (northern willowherb)	3.0	0-3	25	0.75	N
Equisetum pratense (meadow horsetail)	0.5	0-0.5	25	0.13	N
Geum macrophyllum (large-leaved yellow avens)	10.3	0-20	50	5.13	N
Mentha arvensis (wild mint)	3.0	0-3	25	0.75	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	25	0.13	N
Petasites frigidus (arctic sweet coltsfoot)	0.5	0-0.5	25	0.13	N
Potentilla palustris (marsh cinquefoil)	5.3	0-10	50	2.63	N
Senecio triangularis (brook ragwort)	0.5	0-0.5	25	0.13	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	25	0.13	N

Table 292. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Viola canadensis (western Canada violet)	3.0	0-3	25	0.75	N

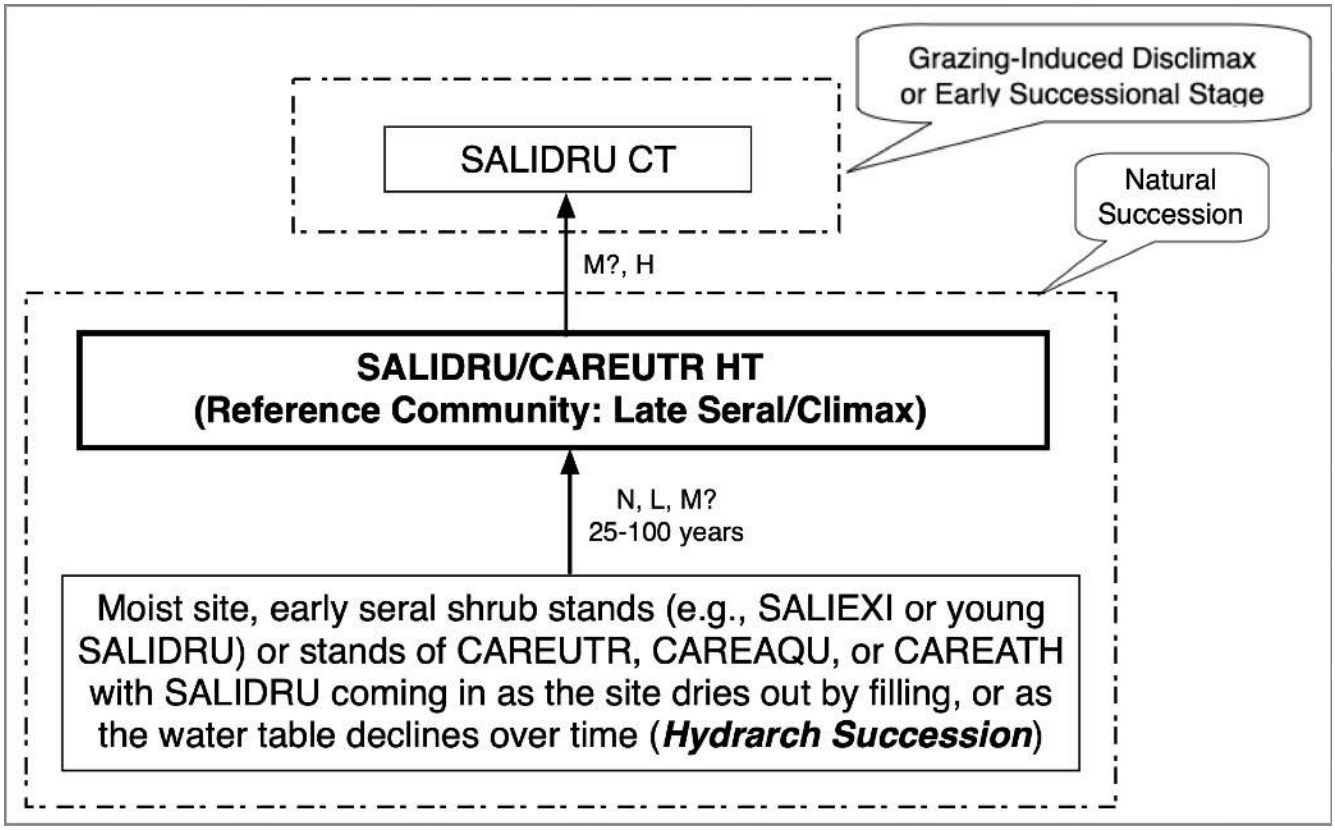
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type is usually the result of primary succession, wherein an aging stand of a pioneer riparian shrub species, such as *Salix exigua* (sandbar willow) that has either *Carex aquatilis* (water sedge), *Carex atherodes* (awned sedge), or *Carex utriculata* (beaked sedge) in the understory, is replaced by the climax, late seral, *Salix drummondiana* (Drummond's willow).

Figure 60 shows a schematic diagram of vegetation successional pathways on sites of the *Salix drummondiana/ Carex utriculata* (Drummond's willow/beaked sedge) habitat type.



Successional Pathway of *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
SALIDRU—*Salix drummondiana* (Drummond's willow)
SALIDRU/CAREUTR HT—*Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type
SALIDRU CT—*Salix drummondiana* (Drummond's willow) community type
SALIEXI—*Salix exigua* (sandbar willow)

Figure 60. Successional pathway for sites of the *Salix drummondiana/Carex utriculata* (Drummond's willow/ beaked sedge) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 61 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

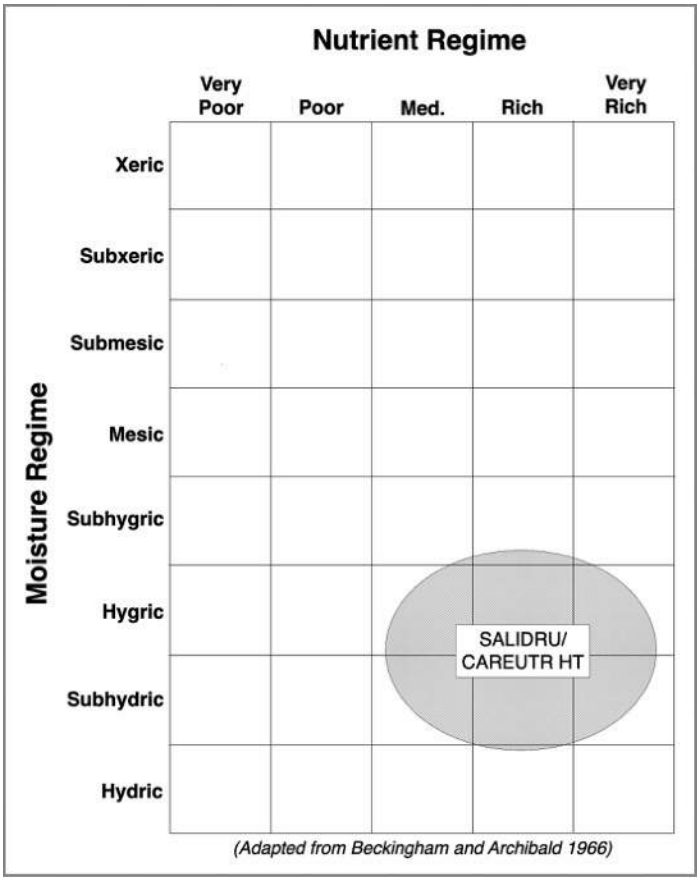


Figure 61. Edatope grid position for the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type (SALIDRU/CAREUTR HT)

SOILS

Soils information is currently unavailable for sites supporting the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites may have such types as the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type, the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type, the *Carex utriculata* (beaked sedge) habitat type, the *Carex aquatilis* (water sedge) habitat type, or the *Carex atherodes* (awned sedge)

habitat type. Adjacent drier sites may have the *Calamagrostis canadensis* (marsh reed grass) habitat type, or any of several communities dominated by *Populus tremuloides* (aspen) or *Picea glauca* (white spruce).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix drummondiana* (Drummond's willow)**—*Salix drummondiana* (Drummond's willow) occurs from the southern Yukon Territory south through British Columbia to the Sierra Nevada of California and eastward throughout the Rocky Mountains, commonly dominating, or co-dominating, shrubby communities along middle elevation mountain streams (Uchytil 1991).

Salix drummondiana (Drummond's willow) occurs along the borders of streams, rivers, beaver ponds, and lakes, and in wet meadows and marshes. It is found at moderate elevations, ranging from lower forested and non-forested foothills to subalpine habitats (Uchytil 1991).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is common and widely distributed across Alberta. It is a wetland obligate, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). It is a long-lived perennial sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of fine roots (Johnson and others 1995).

Carex utriculata (beaked sedge) is strongly rhizomatous and colonial, typically forming a dense sod. Creeping rhizomes are long, slender or stout, and deep-seated. It grows on sites with high soil moisture, typically with the water table at or above the soil surface during the growing season. This is one of our wettest sedges. On some sites, water tables are above the soil surface all year, and rarely drop below the rooting zone. The species occurs on a range of soil types, with textures from silt loams or silty clays to loamy sands (Anderson 2008).

Carex utriculata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates with continually high water tables and persists indefinitely to form climax communities (Anderson 2008).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is very common and widely distributed across Alberta (Tannas 1997a). It is a wetland species, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). *Carex aquatilis* (water sedge) is a native, wetland obligate, long-lived perennial. It is a sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of finer roots (Hauser 2006). It thrives on disturbed sites, is shade intolerant, and occurs in various stages of seral succession (Hauser 2006).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) is very common and widely distributed across Alberta (Tannas 1997a). The species is a wetland obligate, growing along slough margins, shorelines, in marshes, and wet meadows, often in standing water (Tannas 1997a). It is a long-lived perennial with moderate tolerance for drought, while tolerance is low for salinity, acidity, and shade. It does best on clay to clay loam soils (Hardy BBT Limited 1989).

Livestock

***Salix drummondiana* (Drummond's willow)**—Stands of *Salix drummondiana* (Drummond's willow) tend to be highly productive, but the dense stands often inhibit animal access (Hansen and others 1988). The species is palatable to livestock, but its importance in their diets remains uncertain. The protein value is rated as poor for the species, and its energy value is rated as fair (Uchytil 1991).

***Carex utriculata* (beaked sedge)**—Livestock forage value of *Carex utriculata* (beaked sedge) is high (Tannas 1997a, Beckingham 1991). The species is palatable in the spring, but palatability declines as the plants become coarse and tough in summer (Tannas 1997a, Hansen and others 1988). Relative palatability may then increase again in fall as the sedge cures and upland forage is less attractive. *Carex utriculata* (beaked sedge) cover decreases in response to high levels of grazing pressure, and will be replaced with less productive and less palatable species, such as *Juncus balticus* (wire rush) and *Poa* species (bluegrass) (Thompson and Hansen 2003).

In general, *Carex* species (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites, residual cover should be left to protect the banks and the soil surface, and to filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days should provide time for sufficient residual cover regrowth on streamside riparian sites (Myers 1989).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

***Carex aquatilis* (water sedge)**—The livestock forage value of *Carex aquatilis* (water sedge) is rated as good (Tannas 1997a), but varies with region, season, and previous grazing use. On narrow riparian or wetland sites within large pastures, *Carex* species (sedges) are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur. In general, *Carex* species (sedges) should respond satisfactorily to traditional grazing systems. However, on streamside sites ample residual cover should be left to protect the soil surface and trap sediments during fall rains or spring runoff. Removing cattle for at least 30 days from these streamside sites for sedge regrowth at the end of the growing season should provide sufficient residual cover (Myers 1989).

Given that *Carex aquatilis* (water sedge) grows in wet places, it is generally not grazed until late summer and fall when soils have dried (Hauser 2006). Very wet soils may deter animal use until they dry. However, if high level of grazing does occur, there will be a marked decrease in *Carex aquatilis* (water sedge) and an increase in the less palatable *Juncus balticus* (wire rush) (Tannas 1997a).

***Carex atherodes* (awned sedge)**—Livestock forage value of *Carex atherodes* (awned sedge) is high (Tannas 1997a, Beckingham 1991). *Carex atherodes* (awned sedge) provides good protein and a balance of other nutritional elements, while remaining palatable during the late season when upland forage is less palatable (Tannas 1997a, Hansen and others 1988). In general, *Carex* (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites residual cover should be left to protect the soil surface and filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days for sedge regrowth should provide sufficient residual cover on streamside riparian sites (Myers 1989).

Very wet soils may deter animal use until they dry, allowing the most palatable species to replenish their carbohydrate reserves and to persist in these communities. However, if high levels of grazing do occur, there will be a marked decrease in *Carex atherodes* (awned sedge) with an increase in less palatable species, such as *Juncus balticus* (wire rush). *Carex atherodes* (awned sedge) has medium palatability and medium tolerance for livestock use. Its chemical composition is similar to that of meadow grasses, upland short grass, and mixed prairie species. Seasonal declines in crude protein, phosphorous and carotene were also similar to that of native upland grasses (Hardy BBT Limited 1989).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix drummondiana* (Drummond's willow)**—Moose consume large amounts of *Salix drummondiana* (Drummond's willow) during the winter, but use by other wild ungulates is generally moderate to light (Uchytil 1991). Willows are a preferred food and building material of beaver. Willow shoots, catkins, buds, and leaves are eaten by ducks and grouse, other birds, and small mammals (Uchytil 1991).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is grazed by moose, elk, mule deer, bison, grizzly bears, and sandhill cranes (Anderson 2008). The species is an important component of valuable breeding and feeding grounds for geese and other waterfowl. Birds commonly associated with *Carex utriculata* (beaked sedge) habitats include mallard, green-winged teal, common yellowthroat, red-winged black bird, song sparrow, and tree swallow. *Carex utriculata* (beaked sedge) stands are usually more important as feeding grounds than as nesting grounds because of their low stature, lack of structural diversity, and high water levels. Elk and moose often graze *Carex utriculata* (beaked sedge) stands when *Carex atherodes* (awned sedge) is present (Anderson 2008).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is grazed by many ungulates, including moose, caribou, and elk, but it is not a major component of their diet. Due to the saturated habitat of the species, grazing by most ungulates is limited. *Carex aquatilis* (water sedge) habitat provides nesting and hiding cover for some birds, waterfowl, and small mammals. In riparian and wetland sites, The species is also an important source of food for a variety of waterfowl (Hauser 2006).

***Carex atherodes* (awned sedge)**—Wetland sedge species, such as *Carex atherodes* (awned sedge) are an important component of valuable nesting and feeding grounds for geese and other waterfowl. These stands of prolific seed producing species are usually more important as feeding grounds than as nesting grounds because of their low stature, high water level, and lack of structural diversity (Thompson and Hansen 2003).

Fisheries

***Salix drummondiana* (Drummond's willow)**—Dense stands of *Salix drummondiana* (Drummond's willow) enhance fisheries by shading the stream and by supporting overhanging banks (Hansen and others 1988).

***Carex utriculata* (beaked sedge)**—The dense network of roots of the rhizomatous *Carex utriculata* (beaked sedge) is very effective in binding soil and stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish (Thompson and Hansen 2003).

***Carex aquatilis* (water sedge)**—Stands of *Carex aquatilis* (water sedge) often are adjacent to streams supporting trout fisheries. The combined tufted and rhizomatous growth habit of the species effectively stabilizes streambanks. Overhanging *Carex* species (sedges) along the banks provide valuable resting cover and shade for fish (Thompson and Hansen 2003).

***Carex atherodes* (awned sedge)**—Stands of *Carex atherodes* (awned sedge) are found more frequently in lentic situations around depressional wetlands, sloughs, potholes, wet meadows, and fens where fish habitat is not at issue (Thompson and Hansen 2003).

Fire

***Salix drummondiana* (Drummond's willow)**—*Salix drummondiana* (Drummond's willow) sprouts from the root crown after being top-killed by fire. Also, its abundant wind-dispersed seed can be important in colonizing burned sites. Fire is relatively infrequent in the moist meadow and stream side habitats that the species occupies. In fact, these riparian areas frequently act as natural fire breaks (Uchytil 1991). Prescribed burning is an effective method

of rejuvenating decadent stands. Sprouting is maximized by quick, hot fire, since slower burns cause more damage and result in fewer sprouts (Hansen and others 1988).

***Carex utriculata* (beaked sedge)**—Sites supporting stands of *Carex utriculata* (beaked sedge) are very wet, except at times of severe drought, and therefore they seldom burn. However, *Carex utriculata* (beaked sedge) sprouts from rhizomes, so it is often able to survive after being top-killed by fire. However, peat soils, common in these communities, can burn when dry, and the heat from such fires can penetrate the soil, destroying the sedge rhizomes. It is necessary that livestock be excluded during the year prior to burning. Caution should be used with fires along streams because of the excellent erosion protection *Carex utriculata* (beaked sedge) provides. Fires do little to change plant composition of beaked sedge communities (DeBenedetti and Parsons 1984). Fire may regress seral succession in treed or shrubby fen stands back to open sedge meadows that support little woody vegetation (Anderson 2008).

***Carex aquatilis* (water sedge)**—Sites supporting stands of *Carex aquatilis* (water sedge) seldom burn, except in periods of severe drought. When stands of the species do burn, the plants are usually top-killed by the fire and soon re-establish after the fire by seed and/or lateral spread of surviving rhizomes (Hauser 2006). The rhizomes are approximately 5 cm below the ground surface, and are somewhat protected from the heat. The wet habitat also provides protection for roots and rhizomes, although the better-drained areas are more susceptible to fires during dry periods.

Stands of *Carex aquatilis* (water sedge) are suited to prescribed fire, but exclusion of livestock during the year prior to burning is necessary. Residual cover burns well in spring, prior to the growing season. Fire will reduce litter accumulations and temporarily increase productivity. However, species composition in the community will not drastically shift from dominance by *Carex aquatilis* (water sedge) (DeBenedetti and Parsons 1984). Care must be taken in burning along streambanks, so as to avoid impairing the excellent erosion protection provided by the species (Thompson and Hansen 2003).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) grows on wet sites that seldom dry out enough to carry fire, but the species is adapted to light intensity fire. Residual cover should burn well in early spring, prior to the growing season. Burning will reduce litter accumulations and temporarily increase productivity (Hansen and others 1988), but care should be taken with burning to avoid damage to the excellent soil erosion protection this species provides. Under drought conditions, there is danger of burning the soil peat layer and damaging the roots (Thompson and Hansen 2003).

Rehabilitation/Restoration Considerations

***Salix drummondiana* (Drummond's willow)**—*Salix drummondiana* (Drummond's willow) is recommended for use in revegetating disturbed riparian areas. The species is especially useful for streambank stabilization (Uchytil 1991).

***Carex utriculata* (beaked sedge)**—Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex utriculata* (beaked sedge) has a dense network of rhizomatous roots and forms a thick sod that is highly resistant to erosion and effective in stabilizing streambanks (Anderson 2008).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) provides excellent erosion protection along streambanks, buffering against the erosive force of flood events, and filtering sediments during spring flows. Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex aquatilis* (water sedge) tends to form a dense, thick sod that is highly resistant to erosion. (Hauser 2006).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) rates high in value for erosion control, and high for its persistence, once established on a site (Hardy BBT Limited 1989). Generally, due to their stronger rhizomatous roots, *Carex* species (sedges) offer better streambank protection than grasses. *Carex atherodes* (awned sedge) forms a dense, thick sod highly resistant to erosion. Along streambanks, the sod may overhang the bank and sag into the water, providing additional protection from erosion (Thompson and Hansen 2003).

Carex atherodes (awned sedge) is suited for long-term revegetation of disturbed sites and erosion control on sites with a high water table. The species can rapidly re-colonize disturbed sites by seed and rhizome extension. Its rhizomes form a dense network effective in stabilizing streambanks and preventing soil erosion (Thompson and Hansen 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type was previously described in the region for the following geographic location(s):

- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995).

Salix drummondiana Community Type
(Drummond's willow Community Type)

SALIDRU Community Type
Number of Stands = 10 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 2; Other Data Sets = 8)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix drummondiana* (Drummond's willow) community type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. Stands of this community type are located along the banks and shorelines of streams, rivers, beaver ponds, lakes, wet meadows, fens, and marshes. It occurs at moderate elevations, ranging from lower forested and non-forested foothills upslope to subalpine habitats.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 293 shows the five most prominent plant species among the four lifeforms for species recorded in all 10 stands of the *Salix drummondiana* (Drummond's willow) community type. *Salix drummondiana* (Drummond's willow) is by far most prominent, followed far behind by *Calamagrostis canadensis* (marsh reed grass). No other species is more than moderately prominent.

Table 293. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix drummondiana* (Drummond's willow) community type (number = 10 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus balsamifera (balsam poplar)	0.35	Native
Picea engelmannii (Engelmann spruce)	0.10	Native
Abies lasiocarpa (subalpine fir)	0.05	Native
Pseudotsuga menziesii (Douglas-fir)	0.05	Native
Shrubs		
Salix drummondiana (Drummond's willow)	66.00	Native
Lonicera involucrata (bracted honeysuckle)	6.05	Native
Salix maccalliana (velvet-fruited willow)	6.00	Native
Betula glandulosa (bog birch)	3.00	Native
Salix planifolia (flat-leaved willow)	2.30	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	10.65	Native
Poa pratensis (Kentucky bluegrass)	8.00	Introduced
Bromus inermis (smooth brome)	4.00	Introduced
Carex brunnescens (brownish sedge)	2.00	Native
Poa palustris (fowl bluegrass)	1.35	Native
Forbs		
Equisetum arvense (common horsetail)	4.00	Native
Senecio triangularis (brook ragwort)	2.35	Native
Thalictrum occidentale (western meadow rue)	2.05	Native
Cirsium arvense (Canada thistle)	1.30	Introduced
Parnassia fimbriata (fringed grass-of-parnassus)	1.30	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 294 through Table 297, break out the vegetation recorded in 10 stands of the *Salix drummondiana* (Drummond's willow) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, moderately species rich, shrub dominated community type of incidental occurrence across the study area.

Table 294 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix drummondiana* (Drummond's willow) community type. For the 10 stands comprising the community type, the number of unique species was 92 with 82 (89.1 percent) of them being native species.

Table 294. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix drummondiana* (Drummond's willow) community type (number = 10 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	4	4	0	0
Shrubs	25	23	0	2
Graminoids	18	14	4	0
Forbs	45	41	3	1
TOTAL	***92 (100.0%)***	***82 (89.1%)***	***7 (7.6%)***	***3 (3.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 295 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix drummondiana* (Drummond's willow) community type. The average number of species per stand is 14.5, with native species comprising 13.0 species per stand or 89.7 percent.

Table 295. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix drummondiana* (Drummond's willow) community type (number = 10 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.6	0.6	0.0	0.0
Shrubs	4.1	3.8	0.0	0.3
Graminoids	2.8	2.1	0.7	0.0
Forbs	7.0	6.5	0.4	0.1
TOTAL	***14.5 (100.0%)***	***13.0 (89.7%)***	***1.1 (7.6%)***	***0.4 (2.8%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 296 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix drummondiana* (Drummond's willow) community type. The average canopy cover per stand is 143.4 percent, with native species comprising 128.3 percent or 89.4 percent of the total amount of average canopy cover per stand.

Table 296. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix drummondiana* (Drummond's willow) community type (number = 10 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.6%	0.6%	0.0%	0.0%
Shrubs	93.1%	91.7%	0.0%	1.4%
Graminoids	26.9%	14.6%	12.4%	0.0%
Forbs	22.9%	21.5%	1.4%	0.1%
TOTAL	***143.4% (100.0%)***	***128.3% (89.4%)***	***13.8% (9.6%)***	***1.4% (1.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 297 shows the average number of species and average canopy cover by lifeform in stands of the *Salix drummondiana* (Drummond's willow) community type community type. The average number of species per stand was 14.5 with an average canopy cover of 143.4 percent.

Table 297. Average number of species and average canopy cover by lifeform in stands of the *Salix drummondiana* (Drummond's willow) community type (number = 10 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.6	0.6%
Shrubs	4.1	93.1%
Graminoids	2.8	26.9%
Forbs	7.0	22.9%
TOTAL	***14.5***	***143.4%***

Sampled Stands Plant Species List

A total of 92 plant species were recorded on at least one of 10 stands sampled of the *Salix drummondiana* (Drummond's willow) community type (Table 298). Four tree species were recorded in small amounts, while *Salix drummondiana* (Drummond's willow) was by far most prominent among 25 shrub species recorded. Of the 18 graminoid species, *Calamagrostis canadensis* (marsh reed grass) is most prominent, followed by *Poa pratensis* (Kentucky bluegrass), and none of the 45 forbs recorded is very prominent.

Table 298. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix drummondiana* (Drummond's willow) community type (number = 10 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 4)					
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	10	0.05	N
Picea engelmannii (Engelmann spruce)	0.5	0-0.5	20	0.10	N
Populus balsamifera (balsam poplar)	1.8	0-3	20	0.35	N
Pseudotsuga menziesii (Douglas-fir)	0.5	0-0.5	10	0.05	N
Shrubs (N = 25)					
Alnus tenuifolia (river alder)	20.0	0-20	10	2.00	N
Arctostaphylos uva-ursi (common bearberry)	0.5	0-0.5	10	0.05	N
Betula glandulosa (bog birch)	30.0	0-30	10	3.00	N
Cornus stolonifera (red-osier dogwood)	20.0	0-20	10	2.00	N
Elaeagnus commutata (silverberry)	6.5	0-10	20	1.30	N
Lonicera involucrata (bracted honeysuckle)	20.2	0-40	30	6.05	N
Rhamnus alnifolia (alder-leaved buckthorn)	0.5	0-0.5	10	0.05	N
Ribes glandulosum (skunk currant)	0.5	0-0.5	10	0.05	N
Ribes lacustre (bristly black currant)	1.8	0-3	20	0.35	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	10	0.05	N
Ribes spp. (currant)	10.0	0-10	10	1.00	B
Ribes triste (wild red currant)	0.5	0-0.5	10	0.05	N
Rosa spp. (rose)	1.8	0-3	20	0.35	B
Rubus idaeus (wild red raspberry)	3.0	0-3	10	0.30	N
Salix barclayi (Barclay's willow)	0.5	0-0.5	10	0.05	N
Salix boothii (Booth's willow)	3.0	0-3	10	0.30	N
Salix drummondiana (Drummond's willow)	66.0	50-90	100	66.00	N
Salix exigua (sandbar willow)	3.0	0-3	10	0.30	N
Salix glauca (smooth willow)	10.0	0-10	10	1.00	N
Salix lutea (yellow willow)	0.5	0-0.5	20	0.10	N
Salix maccalliana (velvet-fruited willow)	60.0	0-60	10	6.00	N
Salix melanopsis (dusky willow)	0.5	0-0.5	10	0.05	N
Salix myrtillifolia (myrtle-leaved willow)	3.0	0-3	10	0.30	N
Salix planifolia (flat-leaved willow)	11.5	0-20	20	2.30	N
Shepherdia canadensis (Canada buffaloberry)	0.5	0-0.5	10	0.05	N
Graminoids (N = 18)					
Agropyron dasystachyum (northern wheat grass)	0.5	0-0.5	10	0.05	N
Agropyron repens (quack grass)	3.0	0-3	10	0.30	I
Agrostis stolonifera (redtop)	0.5	0-0.5	10	0.05	I
Bromus ciliatus (fringed brome)	0.5	0-0.5	10	0.05	N
Bromus inermis (smooth brome)	20.0	0-20	20	4.00	I
Calamagrostis canadensis (marsh reed grass)	17.8	0-70	60	10.65	N
Carex aenea (silvery-flowered sedge)	0.5	0-0.5	10	0.05	N
Carex brunnescens (brownish sedge)	20.0	0-20	10	2.00	N
Carex deweyana (Dewey's sedge)	0.5	0-0.5	10	0.05	N
Carex illota (small-headed sedge)	0.5	0-0.5	10	0.05	N

Table 298. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex limosa (mud sedge)	0.5	0-0.5	10	0.05	N
Carex trisperma (three-seeded sedge)	0.5	0-0.5	10	0.05	N
Carex utriculata (beaked sedge)	0.5	0-0.5	10	0.05	N
Carex vesicaria (blister sedge)	0.5	0-0.5	10	0.05	N
Glyceria striata (fowl manna grass)	0.5	0-0.5	10	0.05	N
Juncus ensifolius (equitant-leaved rush)	0.5	0-0.5	10	0.05	N
Poa palustris (fowl bluegrass)	4.5	0-10	30	1.35	N
Poa pratensis (Kentucky bluegrass)	26.7	0-60	30	8.00	I
Forbs (N = 45)					
Achillea millefolium (common yarrow)	0.5	0-0.5	30	0.15	N
Anaphalis margaritacea (pearly everlasting)	0.5	0-0.5	10	0.05	N
Anemone multifida (cut-leaved anemone)	0.5	0-0.5	10	0.05	N
Arnica latifolia (broad-leaved arnica)	10.0	0-10	10	1.00	N
Aster ciliolatus (Lindley's aster)	3.0	0-3	10	0.30	N
Aster conspicuus (showy aster)	0.5	0-0.5	10	0.05	N
Aster maccallae (MacCalla's aster)	0.5	0-0.5	10	0.05	N
Aster modestus (large northern aster)	10.0	0-10	10	1.00	N
Aster sibiricus (Arctic aster)	0.5	0-0.5	20	0.10	N
Aster spp. (aster)	3.0	0-3	10	0.30	N
Cirsium arvense (Canada thistle)	6.5	0-10	20	1.30	I
Cirsium spp. (thistle)	0.5	0-0.5	10	0.05	B
Collomia linearis (narrow-leaved collomia)	0.5	0-0.5	10	0.05	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	10	0.05	N
Epilobium anagallidifolium (alpine willowherb)	0.5	0-0.5	10	0.05	N
Epilobium angustifolium (common fireweed)	1.5	0-3	50	0.75	N
Equisetum arvense (common horsetail)	40.0	0-40	10	4.00	N
Equisetum pratense (meadow horsetail)	0.5	0-0.5	10	0.05	N
*Fragaria virginian*a (wild strawberry)	1.1	0-3	40	0.45	N
Galeopsis tetrahit (hemp-nettle)	0.5	0-0.5	10	0.05	I
Galium aparine (cleavers)	0.5	0-0.5	20	0.10	N
Galium boreale (northern bedstraw)	0.5	0-0.5	10	0.05	N
Galium triflorum (sweet-scented bedstraw)	5.3	0-10	20	1.05	N
Geranium richardsonii (wild white geranium)	0.5	0-0.5	10	0.05	N
Geum macrophyllum (large-leaved yellow avens)	2.9	0-10	40	1.15	N
Habenaria saccata (slender bog orchid)	0.5	0-0.5	10	0.05	N
Heracleum lanatum (cow parsnip)	3.7	0-10	30	1.10	N
Mentha arvensis (wild mint)	5.3	0-10	20	1.05	N
Mertensia paniculata (tall lungwort)	3.0	0-3	10	0.30	N
Mimulus lewisii (red monkeyflower)	0.5	0-0.5	10	0.05	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	10	0.05	N
Parnassia fimbriata (fringed grass-of-parnassus)	6.5	0-10	20	1.30	N
Polemonium acutiflorum (tall Jacob's-ladder)	0.5	0-0.5	10	0.05	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	10	0.05	N
Potentilla palustris (marsh cinquefoil)	3.0	0-3	10	0.30	N

Table 298. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Pyrola minor (lesser wintergreen)	0.5	0-0.5	10	0.05	N
Scutellaria galericulata (marsh skullcap)	3.0	0-3	10	0.30	N
Senecio integerrimus (entire-leaved groundsel)	10.0	0-10	10	1.00	N
Senecio triangularis (brook ragwort)	7.8	0-20	30	2.35	N
Stenanthium occidentale (bronzebells)	0.5	0-0.5	10	0.05	N
Taraxacum officinale (common dandelion)	0.5	0-0.5	10	0.05	I
Thalictrum occidentale (western meadow rue)	10.3	0-20	20	2.05	N
Trollius albiflorus (globeflower)	1.8	0-3	20	0.35	N
Vicia americana (wild vetch)	0.5	0-0.5	20	0.10	N
Xerophyllum tenax (bear-grass)	0.5	0-0.5	10	0.05	N

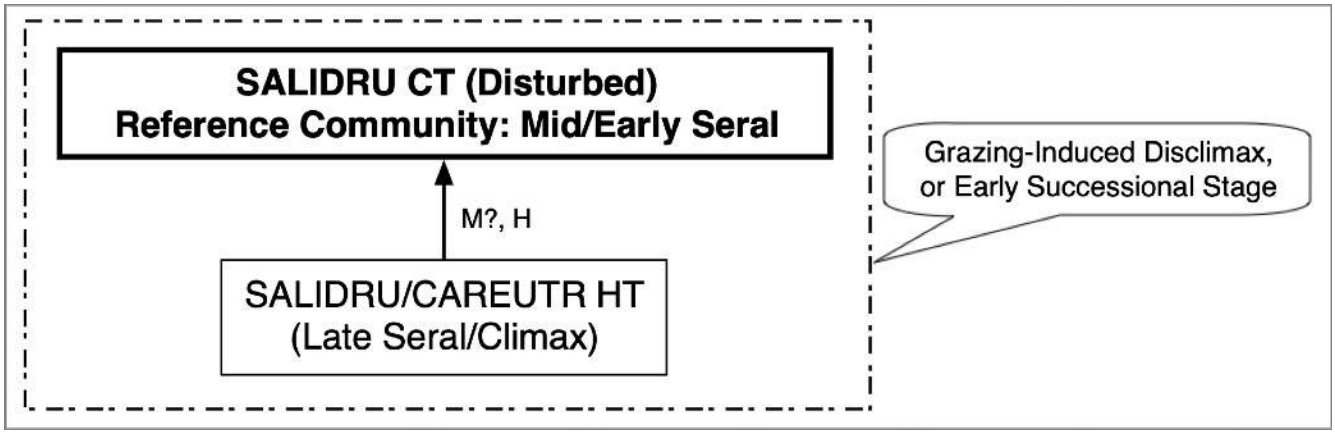
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Stands of the *Salix drummondiana* (Drummond's willow) community type are usually the result of heavy, long term grazing pressure on stands of the *Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type, wherein the palatable graminoid understory is reduced and replaced by disturbance increaser, mostly introduced, herbaceous species such as *Poa pratensis* (Kentucky bluegrass).

Figure 62 shows a schematic diagram of vegetation successional pathways on sites of the *Salix drummondiana* (Drummond's willow) community type.



Successional Pathway of *Salix drummondiana* (Drummond's willow) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix drummondiana* (Drummond's willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES

SALIDRU/CAREUTR HT—*Salix drummondiana/Carex utriculata* (Drummond's willow/beaked sedge) habitat type
SALIDRU CT—*Salix drummondiana* (Drummond's willow) community type

Figure 62. Successional pathway for sites of the *Salix drummondiana* (Drummond's willow) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 63 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix drummondiana* (Drummond's willow) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

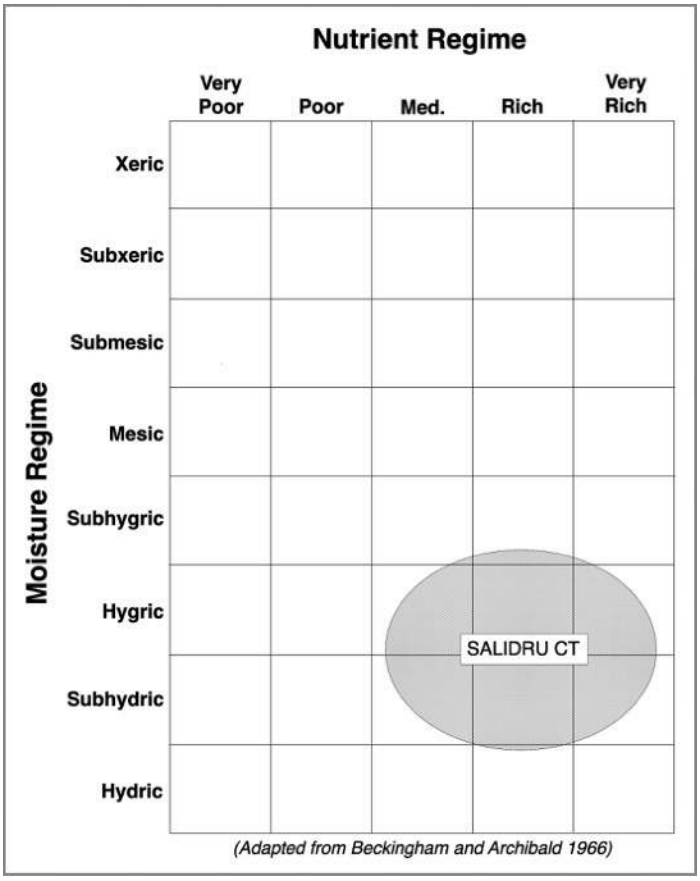


Figure 63. Edatope grid position for the *Salix drummondiana* (Drummond's willow) community type (SALIDRU CT)

SOILS

Soils information is currently unavailable for sites supporting the *Salix drummondiana* (Drummond's willow) community type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites may have such types as the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type, the *Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type, the *Carex utriculata* (beaked sedge) habitat type, the *Carex aquatilis* (water sedge) habitat type, or the *Carex atherodes* (awned sedge) habitat type. Adjacent drier sites may have the *Calamagrostis canadensis* (marsh reed grass) habitat type, or any of several communities dominated by *Populus tremuloides* (aspen) or *Picea glauca* (white spruce).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix drummondiana* (Drummond's willow)**—*Salix drummondiana* (Drummond's willow) occurs from the southern Yukon Territory south through British Columbia to the Sierra Nevada of California and eastward

throughout the Rocky Mountains, commonly dominating, or co-dominating, shrubby communities along middle elevation mountain streams (Uchytil 1991).

Salix drummondiana (Drummond's willow) occurs along the borders of streams, rivers, beaver ponds, and lakes, and in wet meadows and marshes. It is found at moderate elevations, ranging from lower forested and non-forested foothills to subalpine habitats (Uchytil 1991).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

Livestock

***Salix drummondiana* (Drummond's willow)**—Stands of *Salix drummondiana* (Drummond's willow) tend to be highly productive, but the dense stands often inhibit animal access (Hansen and others 1988). The species is palatable to livestock, but its importance in their diets remains uncertain. The protein value is rated as poor for the species, and its energy value is rated as fair (Uchytil 1991).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix drummondiana* (Drummond's willow)**—Moose consume large amounts of *Salix drummondiana* (Drummond's willow) during the winter, but use by other wild ungulates is generally moderate to light (Uchytil 1991). Willows are a preferred food and building material of beaver. Willow shoots, catkins, buds, and leaves are eaten by ducks and grouse, other birds, and small mammals (Uchytil 1991).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

Fisheries

***Salix drummondiana* (Drummond's willow)**—Dense stands of *Salix drummondiana* (Drummond's willow) enhance fisheries by shading the stream and by supporting overhanging banks (Hansen and others 1988).

Fire

***Salix drummondiana* (Drummond's willow)**—*Salix drummondiana* (Drummond's willow) sprouts from the root crown after being top-killed by fire. Also, its abundant wind-dispersed seed can be important in colonizing burned sites. Fire is relatively infrequent in the moist meadow and stream side habitats that the species occupies. In fact, these riparian areas frequently act as natural fire breaks (Uchytil 1991). Prescribed burning is an effective method of rejuvenating decadent stands. Sprouting is maximized by quick, hot fire, since slower burns cause more damage and result in fewer sprouts (Hansen and others 1988).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

Rehabilitation/Restoration Considerations

***Salix drummondiana* (Drummond's willow)**—*Salix drummondiana* (Drummond's willow) is recommended for use in revegetating disturbed riparian areas. The species is especially useful for streambank stabilization (Uchytil 1991).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix drummondiana* (Drummond's willow) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msd10 Drummond's willow (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix drummondiana* (Drummond's willow) community type was previously described in the region for the following geographic location(s):

- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995).

Salix exigua Community Type
(sandbar willow Community Type)

SALIEXI Community Type
Number of Stands = 23 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 5; Other Data Sets = 18)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix exigua* (sandbar willow) community type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. Typical sites of this community type are on moist alluvial deposits along rivers and streams. Occurrence is frequent on suitable sites, but stands of this type rarely cover large areas. Stands typically form narrow bands parallel to the stream channel on the latest vegetated sediment deposits.

Photo 13 shows a typical stand of the *Salix exigua* (sandbar willow) community type.

Photo 13. A stand of the *Salix exigua* (sandbar willow) community type

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 299 shows the five most prominent plant species among the four lifeforms for species recorded in all 23 stands of the *Salix exigua* (sandbar willow) community type. *Salix exigua* (sandbar willow) is by far the most prominent, followed far behind by *Calamagrostis canadensis* (marsh reed grass). No other species in these stands is more than moderately prominent.

Table 299. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix exigua* (sandbar willow) community type (number = 23 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus balsamifera (balsam poplar)	0.04	Native
Populus angustifolia (narrow-leaf cottonwood)	0.02	Native
Shrubs		
Salix exigua (sandbar willow)	59.35	Native
Cornus stolonifera (red-osier dogwood)	3.07	Native
Rosa woodsii (common wild rose)	3.04	Native
Betula glandulosa (bog birch)	2.20	Native
Salix discolor (pussy willow)	1.74	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	15.89	Native
Deschampsia cespitosa (tufted hair grass)	3.94	Native
Bromus inermis (smooth brome)	3.74	Introduced
Poa pratensis (Kentucky bluegrass)	2.85	Introduced
Poa palustris (fowl bluegrass)	2.46	Native

Table 299. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Equisetum arvense (common horsetail)	3.09	Native
Heracleum lanatum (cow parsnip)	1.74	Native
Sonchus arvensis subsp. *uliginosus* (smooth perennial sow-thistle)	1.74	Introduced
Taraxacum officinale (common dandelion)	1.72	Introduced
Vicia americana (wild vetch)	1.09	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 300 through Table 303, break out the vegetation recorded in 23 stands of the *Salix exigua* (sandbar willow) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated community type of minor-to-incidental occurrence across the study area.

Table 300 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix exigua* (sandbar willow) community type. For the 23 stands comprising the community type, the number of unique species was 143 with 117 (81.8 percent) of them being native species.

Table 300. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix exigua* (sandbar willow) community type (number = 23 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2	2	0	0
Shrubs	22	20	0	2
Graminoids	34	28	6	0
Forbs	85	67	16	2
TOTAL	***143 (100.0%)***	***117 (81.8%)***	***22 (15.4%)***	***4 (2.8%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 301 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix exigua* (sandbar willow) community type. The average number of species per stand is 15.5, with native species comprising 12.9 species per stand or 83.2 percent.

Table 301. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix exigua* (sandbar willow) community type (number = 23 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.1	0.1	0.0	0.0
Shrubs	2.8	2.7	0.0	0.1
Graminoids	4.2	3.3	1.0	0.0
Forbs	8.4	6.8	1.5	0.1
TOTAL	***15.5 (100.0%)***	***12.9 (83.2%)***	***2.5 (16.1%)***	***0.2 (1.3%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 302 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix exigua* (sandbar willow) community type. The average canopy cover per stand is 145.6 percent, with native species comprising 131.2 percent or 90.1 percent of the total amount of average canopy cover per stand.

Table 302. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix exigua* (sandbar willow) community type (number = 23 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.1%	0.1%	0.0%	0.0%
Shrubs	75.2%	75.1%	0.0%	0.1%
Graminoids	44.7%	37.2%	7.5%	0.0%
Forbs	25.6%	18.7%	6.7%	0.2%
TOTAL	***145.6% (100.0%)***	***131.2% (90.1%)***	***14.2% (9.8%)***	***0.2% (0.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 303 shows the average number of species and average canopy cover by lifeform in stands of the *Salix exigua* (sandbar willow) community type. The average number of species per stand was 15.5 with an average canopy cover of 145.6 percent.

Table 303. Average number of species and average canopy cover by lifeform in stands of the *Salix exigua* (sandbar willow) community type (number = 23 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.1	0.1%
Shrubs	2.8	75.2%
Graminoids	4.2	44.7%
Forbs	8.4	25.6%
TOTAL	***15.5***	***145.6%***

Sampled Stands Plant Species List

A total of 143 plant species were recorded on at least one of the 23 stands sampled of the *Salix exigua* (sandbar willow) community type (Table 304). This community type is an early seral type that typically is replaced by one of a variety of later seral species for which the site might have potential to support. Two tree species were recorded in very small amounts. *Salix exigua* (sandbar willow) overwhelmingly dominates the 22 shrub species recorded, and *Calamagrostis canadensis* (marsh reed grass) likewise dominates the 34 graminoids recorded. None of the 85 forbs recorded is notably prominent.

Table 304. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix exigua* (sandbar willow) community type (number = 23 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 2)					
Populus angustifolia (narrow-leaf cottonwood)	0.5	0-0.5	4	0.02	N
Populus balsamifera (balsam poplar)	0.5	0-0.5	9	0.04	N
Shrubs (N = 22)					
Betula glandulosa (bog birch)	25.3	0-50	9	2.20	N
Betula pumila (dwarf birch)	30.0	0-30	4	1.30	N
Cornus stolonifera (red-osier dogwood)	23.5	0-50	13	3.07	N
Elaeagnus commutata (silverberry)	30.0	0-30	4	1.30	N
Potentilla fruticosa (shrubby cinquefoil)	0.5	0-0.5	9	0.04	N
Ribes lacustre (bristly black currant)	3.4	0-10	22	0.74	N
Ribes oxyacanthoides (northern gooseberry)	1.8	0-3	17	0.30	N
Rosa acicularis (prickly rose)	0.5	0-0.5	9	0.04	N
Rosa spp. (rose)	0.5	0-0.5	9	0.04	B
Rosa woodsii (common wild rose)	35.0	0-50	9	3.04	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	9	0.04	N
Rubus idaeus (wild red raspberry)	0.5	0-0.5	4	0.02	N
Rubus parviflorus (thimbleberry)	0.5	0-0.5	4	0.02	N

Table 304. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Rubus spp. (raspberry)	0.5	0-0.5	4	0.02	B
Salix bebbiana (beaked willow)	3.0	0-3	4	0.13	N
Salix discolor (pussy willow)	40.0	0-40	4	1.74	N
Salix exigua (sandbar willow)	59.3	10-97.5	100	59.35	N
Salix lucida (shining willow)	0.5	0-0.5	4	0.02	N
Salix lutea (yellow willow)	3.4	0-10	22	0.74	N
Salix maccalliana (velvet-fruited willow)	3.0	0-3	4	0.13	N
Symphoricarpos albus (snowberry)	0.5	0-0.5	4	0.02	N
Symphoricarpos occidentalis (buckbrush)	10.0	0-10	9	0.87	N
Graminoids (N = 34)					
Agropyron repens (quack grass)	0.5	0-0.5	13	0.07	I
Agropyron smithii (western wheat grass)	5.4	0-20	22	1.17	N
Agropyron trachycaulum (slender wheat grass)	5.3	0-20	35	1.85	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	4	0.02	N
Agrostis stolonifera (redtop)	6.5	0-10	9	0.57	I
Alopecurus aequalis (short-awn meadow-foxtail)	0.5	0-0.5	4	0.02	N
Beckmannia syzigachne (slough grass)	0.5	0-0.5	4	0.02	N
Bromus ciliatus (fringed brome)	7.8	0-20	13	1.02	N
Bromus inermis (smooth brome)	14.3	0-50	26	3.74	I
Bromus inermis subsp. *pumpellianus* (northern awnless brome)	0.5	0-0.5	4	0.02	N
Calamagrostis canadensis (marsh reed grass)	40.6	0-97.5	39	15.89	N
Calamagrostis purpurascens (purple reed grass)	20.0	0-20	4	0.87	N
Calamagrostis stricta (narrow reed grass)	3.0	0-3	4	0.13	N
Carex aenea (silvery-flowered sedge)	0.5	0-0.5	9	0.04	N
Carex aquatilis (water sedge)	3.0	0-3	4	0.13	N
Carex atherodes (awned sedge)	7.8	0-20	26	2.02	N
Carex lanuginosa (woolly sedge)	6.5	0-10	9	0.57	N
Carex spp. (sedge)	0.5	0-0.5	4	0.02	N
Carex utriculata (beaked sedge)	40.0	0-40	4	1.74	N
Deschampsia cespitosa (tufted hair grass)	30.2	0-70	13	3.93	N
Eleocharis palustris (creeping spike-rush)	3.0	0-3	4	0.13	N
Elymus canadensis (Canada wild rye)	1.3	0-3	13	0.17	N
Festuca saximontana (Rocky Mountain fescue)	30.0	0-30	4	1.30	N
Hordeum jubatum (foxtail barley)	1.1	0-3	17	0.20	N
Juncus balticus (wire rush)	6.5	0-10	9	0.57	N
Phalaris arundinacea (reed canary grass)	5.3	0-10	9	0.46	N
Phleum pratense (timothy)	3.0	0-3	4	0.13	I
Poa compressa (Canada bluegrass)	1.8	0-3	9	0.15	I
Poa palustris (fowl bluegrass)	7.1	0-10	35	2.46	N
Poa pratensis (Kentucky bluegrass)	8.2	0-30	35	2.85	I
Scirpus microcarpus (small-fruited bulrush)	10.0	0-10	9	0.87	N
Scirpus pungens (three-square rush)	1.8	0-3	9	0.15	N
Spartina pectinata (prairie cord grass)	16.5	0-30	9	1.43	N

Table 304. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Stipa viridula (green needle grass)	0.5	0-0.5	4	0.02	N
Forbs (N = 85)					
Achillea millefolium (common yarrow)	2.5	0-10	26	0.65	N
Anemone multifida (cut-leaved anemone)	0.5	0-0.5	4	0.02	N
Apocynum cannabinum (Indian hemp)	0.5	0-0.5	4	0.02	N
Apocynum spp. (dogbane)	0.5	0-0.5	4	0.02	N
Arnica chamissonis (leafy arnica)	0.5	0-0.5	13	0.07	N
Artemisia biennis (biennial sagewort)	10.0	0-10	4	0.43	N
Artemisia ludoviciana (prairie sagewort)	10.0	0-10	4	0.43	N
Asclepias speciosa (showy milkweed)	0.5	0-0.5	4	0.02	N
Aster brachyactis (rayless aster)	0.5	0-0.5	4	0.02	N
Aster ciliolatus (Lindley's aster)	6.0	0-20	17	1.04	N
Aster conspicuus (showy aster)	0.5	0-0.5	4	0.02	N
Aster eatonii (Eaton's aster)	0.5	0-0.5	4	0.02	N
Aster ericoides (tufted white prairie aster)	1.3	0-3	13	0.17	N
Aster hesperius (western willow aster)	0.5	0-0.5	13	0.07	N
Aster laevis (smooth aster)	5.3	0-10	9	0.46	N
Aster modestus (large northern aster)	0.5	0-0.5	13	0.07	N
Campanula rotundifolia (harebell)	0.5	0-0.5	4	0.02	N
Chenopodium fremontii (Fremont's goosefoot)	10.0	0-10	4	0.43	N
Cicuta maculata (water-hemlock)	0.5	0-0.5	4	0.02	N
Cirsium arvense (Canada thistle)	3.0	0-3	9	0.26	I
Delphinium glaucum (tall larkspur)	2.9	0-10	22	0.63	N
Descurainia sophia (flixweed)	0.5	0-0.5	4	0.02	I
Epilobium angustifolium (common fireweed)	1.5	0-3	22	0.33	N
Equisetum arvense (common horsetail)	14.2	0-40	22	3.09	N
Erysimum cheiranthoides (wormseed mustard)	1.8	0-3	9	0.15	N
Forb spp. (forb)	3.0	0-3	4	0.13	B
Fragaria vesca (woodland strawberry)	0.5	0-0.5	4	0.02	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	17	0.09	N
Galeopsis tetrahit (hemp-nettle)	0.5	0-0.5	4	0.02	I
Galium boreale (northern bedstraw)	0.5	0-0.5	22	0.11	N
Galium triflorum (sweet-scented bedstraw)	3.0	0-3	4	0.13	N
Gentianella amarella (felwort)	0.5	0-0.5	9	0.04	N
Geranium richardsonii (wild white geranium)	2.9	0-10	22	0.63	N
Geum aleppicum (yellow avens)	1.8	0-3	9	0.15	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	9	0.04	N
Geum rivale (purple avens)	1.8	0-3	9	0.15	N
Geum triflorum (three-flowered avens)	20.0	0-20	4	0.87	N
Glycyrrhiza lepidota (wild licorice)	3.5	0-10	17	0.61	N
Helianthus nuttallii (common tall sunflower)	0.5	0-0.5	4	0.02	N
Heracleum lanatum (cow parsnip)	20.0	0-20	9	1.74	N
Hieracium umbellatum (narrow-leaved hawkweed)	0.5	0-0.5	4	0.02	N
Lactuca pulchella (common blue lettuce)	0.5	0-0.5	4	0.02	N

Table 304. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	13	0.07	N
Melilotus alba (white sweet-clover)	3.0	0-3	4	0.13	I
Melilotus officinalis (yellow sweet-clover)	0.5	0-0.5	9	0.04	I
Mentha arvensis (wild mint)	0.5	0-0.5	4	0.02	N
Mertensia paniculata (tall lungwort)	2.1	0-10	26	0.54	N
Petasites palmatus (palmate-leaved coltsfoot)	3.0	0-3	4	0.13	N
Petasites sagittatus (arrow-leaved coltsfoot)	3.0	0-3	4	0.13	N
Physostegia parviflora (false dragonhead)	0.5	0-0.5	4	0.02	N
Plantago major (common plantain)	0.5	0-0.5	4	0.02	I
Polemonium spp. (Jacob's-ladder)	3.0	0-3	4	0.13	N
Polygonum amphibium (water smartweed)	2.2	0-3	13	0.28	N
Polygonum lapathifolium (pale persicaria)	0.5	0-0.5	4	0.02	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	4	0.02	N
Potentilla anserina (silverweed)	4.8	0-10	17	0.83	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	4	0.02	N
Potentilla rivalis (brook cinquefoil)	10.0	0-10	4	0.43	N
*Ranunculus cymbalari*a (seaside buttercup)	3.0	0-3	4	0.13	N
Ranunculus macounii (Macoun's buttercup)	0.5	0-0.5	4	0.02	N
Rorippa sylvestris (creeping yellow cress)	20.0	0-20	4	0.87	I
Rumex acetosa (green sorrel)	0.5	0-0.5	9	0.04	N
Rumex crispus (curled dock)	1.8	0-3	9	0.15	I
Rumex occidentalis (western dock)	3.0	0-3	4	0.13	N
Rumex triangulivalvis (narrow-leaved dock)	3.0	0-3	4	0.13	N
Senecio indecorus (rayless ragwort)	0.5	0-0.5	9	0.04	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	13	0.07	N
Solidago canadensis (Canada goldenrod)	1.8	0-10	39	0.72	N
Solidago spp. (goldenrod)	1.8	0-3	9	0.15	N
Sonchus arvensis (perennial sow-thistle)	0.5	0-0.5	17	0.09	I
Sonchus arvensis subsp. *uliginosus* (smooth perennial sow-thistle)	40.0	0-40	4	1.74	I
Stachys palustris (marsh hedge-nettle)	0.5	0-0.5	17	0.09	N
Stellaria longifolia (long-leaved chickweed)	3.0	0-3	4	0.13	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	13	0.07	N
Taraxacum officinale (common dandelion)	3.6	0-20	48	1.72	I
Thalictrum venulosum (veiny meadow rue)	3.3	0-10	26	0.87	N
Thlaspi arvense (stinkweed)	0.5	0-0.5	4	0.02	I
Trifolium repens (white clover)	11.5	0-20	9	1.00	I
Trifolium spp. (clover)	0.5	0-0.5	4	0.02	B
Urtica dioica (common nettle)	0.5	0-0.5	9	0.04	N
Valeriana dioica (northern valerian)	0.5	0-0.5	4	0.02	N
Vicia americana (wild vetch)	4.2	0-20	26	1.09	N
Viola adunca (early blue violet)	0.5	0-0.5	4	0.02	N
Xanthium strumarium (cocklebur)	0.5	0-0.5	9	0.04	N
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	4	0.02	N

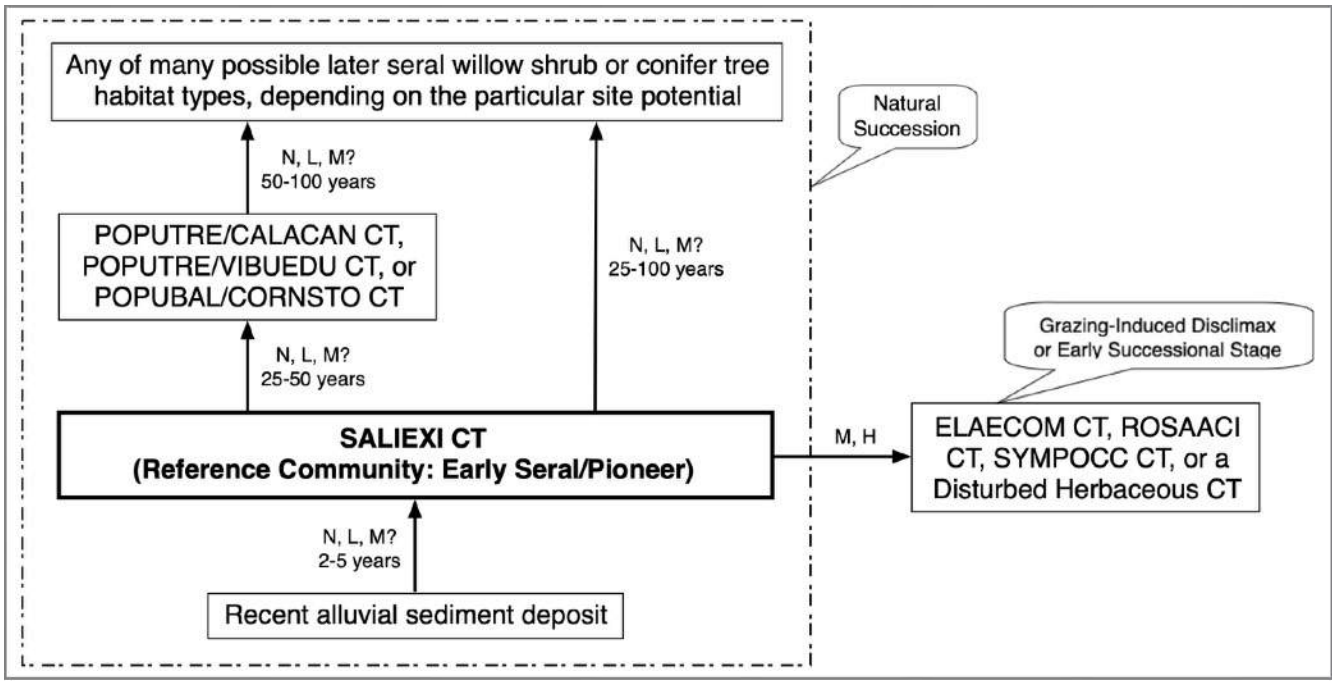
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix exigua* (sandbar willow) community type is an early seral, pioneer community that establishes on recent, low lying, fluvial sediment deposits. Stands of *Salix exigua* (sandbar willow) may persist for decades, but later seral species of trees and other more shade tolerant shrubs typically invade the stands, as additional sediment deposition builds the new terrace surface higher. This process represents a form of primary succession typically associated with riverine dynamics.

Figure 64 shows a schematic diagram of vegetation successional pathways on sites of the *Salix exigua* (sandbar willow) community type.



Successional Pathway of *Salix exigua* (sandbar willow) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix exigua* (sandbar willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES

Disturbed Herbaceous CT—Disturbed Herbaceous community type
ELAECOM CT—*Elaeagnus commutata* (silverberry) community type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type

POPUTRE/CALACAN CT—*Populus tremuloides/Calamagrostis canadensis* (aspen/marsh reed grass) community type
POPUTRE/VIBUEDU CT—*Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type
ROSAACI CT—*Rosa acicularis* (prickly rose) community type
SALIEXI CT—*Salix exigua* (sandbar willow) community type
SYMPOCC CT—*Symphoricarpos occidentalis* (buckbrush) community type

Figure 64. Successional pathway for sites of the *Salix exigua* (sandbar willow) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 65 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix exigua* (sandbar willow) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

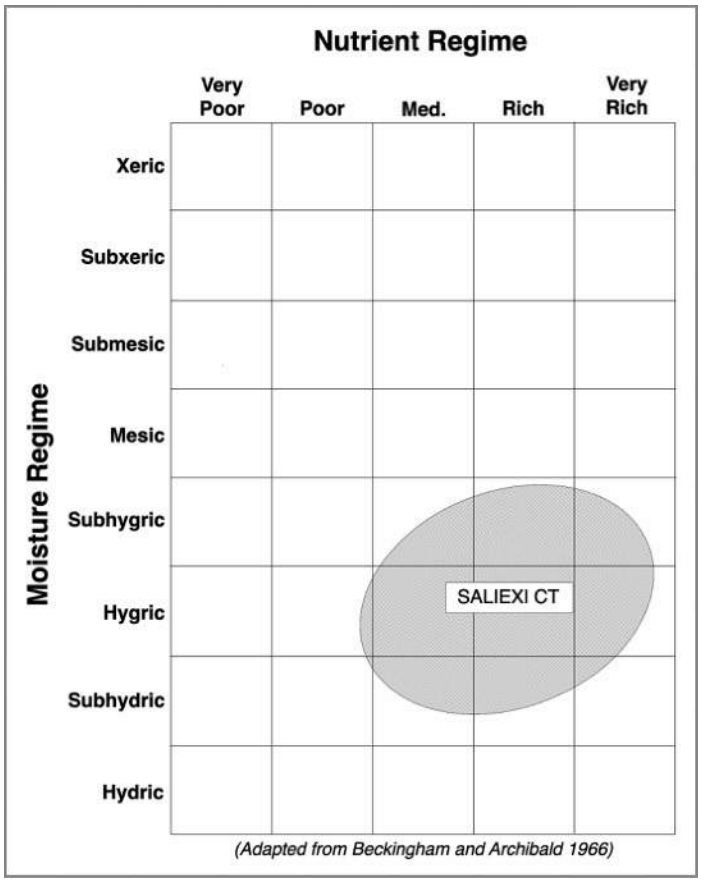


Figure 65. Edatope grid position for the *Salix exigua* (sandbar willow) community type (SALIEXI CT)

SOILS

Parent materials for sites supporting the *Salix exigua* (sandbar willow) community type typically are recent fluvial deposits ranging in texture from sandy gravels to heavy clays. Surface soils are usually moist in the spring and early summer. Mineral soil textures on sampled stands ranged from sand and gravel to clay. Subsoils typically remain saturated throughout the growing season, although older stands may have accumulated enough deposition subsequent to initial establishment to elevate the surface substantially above the late season water table (Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Wetter communities are usually absent, but in some cases there can be herbaceous emergent species such as *Carex aquatilis* (water sedge) or *Typha latifolia* (common cattail). Adjacent drier communities can include such types as those dominated by *Populus balsamifera* (balsam poplar), *Populus tremuloides* (aspen), and *Salix bebbiana* (beaked willow).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix exigua* (sandbar willow)**—*Salix exigua* (sandbar willow) commonly occurs in most natural regions of Alberta, growing on moist to wet sites on alluvial soils along streams and rivers, on floodplains, lake shores and around sloughs (Tannas 1997a).

Salix exigua (sandbar willow) is a pioneer species that rapidly colonizes fresh alluvial deposits. It is both drought resistant and very tolerant of flooding (Anderson 2006). The species regenerates both by seed and asexually by root sprouts. At high elevations it is confined to stream side communities, while at low to mid-elevations, it may be found on moist, well-drained benches, floodplains, and bottomlands (Anderson 2006)

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

Livestock

***Salix exigua* (sandbar willow)**—As with most *Salix* (willow) species, the forage value of *Salix exigua* (sandbar willow) is good. Although readily available for browsing, this is one of the least palatable of willows (Tannas 1997a). Being our only rhizomatous willow species, *Salix exigua* (sandbar willow) is a grazing increaser, capable of spreading rapidly and forming extensive colonies (Tannas 1997a).

Forage production is low to occasionally moderate in stands of *Salix exigua* (sandbar willow) due to the high densities of stems. Dense stands inhibit livestock access. Overuse by livestock will result in reduced vigour by the *Salix* (willows) present, as indicated by highlining, clubbing, or dead clumps. With continued overuse, *Salix*

(willows) decline in vigour and may be eliminated from the site. However, release from high levels of grazing pressure will allow them to re-establish if they have not been entirely eliminated from the site (Hansen and others 1995). Forage value is rated as good (Tannas 1997a), but palatability is lower than some associated shrub species, such as *Cornus stolonifera* (red-osier dogwood) or other *Salix* (willow) species.

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix exigua* (sandbar willow)**—*Salix exigua* (sandbar willow) can form extensive stands or thickets, with densely spaced stems that provide excellent thermal and hiding cover for wildlife. It is normally not as heavily browsed as other *Salix* (willow) species, however beaver do heavily utilize it. *Salix* (willows) in general are a preferred food of moose, and it also is browsed by elk, but is only slightly importance as browse for mule deer (Anderson 2006).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

Fisheries

***Salix exigua* (sandbar willow)**—*Salix exigua* (sandbar willow) typically provides only limited overhanging shade due to its upright growth habit. However, the importance of *Salix* (willows) for streambank protection cannot be over emphasized. The herbaceous understory filters out sediments during high flows, thereby contributing to streambank building. Some stands may be so dense as to hinder most recreational fishing (Thompson and Hansen 2003).

Fire

***Salix exigua* (sandbar willow)**—*Salix exigua* (sandbar willow) is usually top-killed by fire, but readily resprouts from roots, root crowns, and basal stems following fire. It is among the first species to reappear after a fire. *Salix exigua* (sandbar willow) dominated communities, like other riparian vegetation, can act as a natural firebreak, due to a high water table and proximity to nearby surface water (Anderson 2006). Although the high soil and fuel moisture content characteristic of stands of *Salix exigua* (sandbar willow) minimize the occurrence of fire, the species is adapted to survive all but severe fire. It sprouts from its roots after light to moderate fire, and its numerous wind-dispersed seeds from off-site sources are important in revegetating burned areas. Due to the proximity to surface water or high water table, *Salix exigua* (sandbar willow) stands can serve as natural fire breaks (Anderson 2006).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

Rehabilitation/Restoration Considerations

***Salix exigua* (sandbar willow)**—Unlike most other willows, *Salix exigua* (sandbar willow) can send up individual stems from a complex underground root system, making it an excellent woody species for stabilizing streambanks. Woody species provide the greatest streambank protection. Herbaceous species rarely afford sufficiently strong bank protection. Management should emphasize *Salix* (willows) for physically protecting the streambank (Thompson and Hansen 2003).

Salix exigua (sandbar willow) is a pioneering species commonly located along irrigation ditches, cutbanks, and wet areas adjacent to roads. It has an excellent capability to rapidly colonize and spread on disturbed areas, making it useful in streambank stabilization and revegetation projects at low to mid elevations. Once *Salix exigua* (sandbar willow) has stabilized soils on a site, other shrub and herbaceous species can become established. Because of this characteristic, it would be wise for land managers to maintain these stands. Once degradation occurs, rapid erosion of the streambank can follow with devastating results (Hansen and others 1995).

Degraded sites or exposed sand/gravel bars can be revegetated using *Salix exigua* (sandbar willow). Cuttings should be rooted and grown in a nursery to maximize survival. *Salix exigua* (sandbar willow) will produce an abundance of roots along the entire cut stem. Cuttings are best taken in spring from two to four year old dormant wood. Cuttings 30 cm to 50 cm long and greater than 1 cm in diameter produce best results. Shoots from cuttings can be expected to appear 10 days after planting (Anderson 2006).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix exigua* (sandbar willow) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix exigua* (sandbar willow) community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995);
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001); and
- *Classification and Management of Upland, Riparian, and Wetland Sites of USDI Bureau of Land Management's Miles City Field Office, Eastern Montana USA* (Hansen and others 2008).

Salix glauca/Carex aquatilis Habitat Type
(smooth willow/water sedge Habitat Type)

SALIGLA/CAREAQU Habitat Type
Number of Stands = 15 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 14; Other Data Sets = 1)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type is an incidental type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. Stands of this habitat type are fairly common in the Upper Foothills and Montane Natural Subregions of Alberta, occurring in moist woods, along river valleys, on floodplains, fens, bogs, and muskegs.

Photo 14 shows a typical stand of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type.

Photo 14. A stand of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (photo provided by Hilary Baker)

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 305 shows the five most prominent plant species among the four lifeforms for species recorded in all 15 stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type. Only the two type indicator species, *Salix glauca* (smooth willow) and *Carex aquatilis* (water sedge), are more than moderately prominent in these stands.

Table 305. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (number = 15 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea mariana (black spruce)	0.47	Native
Picea glauca (white spruce)	0.27	Native
Larix laricina (tamarack)	0.20	Native
Shrubs		
Salix glauca (smooth willow)	50.00	Native
Betula pumila (dwarf birch)	8.20	Native
Salix myrtillifolia (myrtle-leaved willow)	6.87	Native
Betula glandulosa (bog birch)	6.07	Native
Salix barclayi (Barclay's willow)	4.00	Native
Graminoids		
Carex aquatilis (water sedge)	33.33	Native
Carex utriculata (beaked sedge)	6.67	Native
Deschampsia cespitosa (tufted hair grass)	4.33	Native
Calamagrostis canadensis (marsh reed grass)	2.00	Native
Calamagrostis stricta (narrow reed grass)	1.33	Native
Forbs		
Delphinium glaucum (tall larkspur)	1.27	Native
Valeriana dioica (northern valerian)	1.13	Native
Equisetum arvense (common horsetail)	1.10	Native
Mertensia paniculata (tall lungwort)	0.93	Native
Menyanthes trifoliata (buck-bean)	0.67	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.
[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 306 through Table 309, break out the vegetation recorded in all 15 stands sampled of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated habitat type of incidental-to-minor occurrence across the study area.

Table 306 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type. For the 15 stands comprising the habitat type, the number of unique species was 98 with 95 (96.9 percent) of them being native species.

Table 306. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (number = 15 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3	3	0	0
Shrubs	18	18	0	0
Graminoids	26	24	0	2
Forbs	51	50	0	1
TOTAL	***98 (100.0%)***	***95 (96.9%)***	***0 (0.0%)***	***3 (3.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 307 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type. The average number of species per stand is 15.4, with native species comprising 15.2 species per stand or 98.7 percent.

Table 307. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (number = 15 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.5	0.5	0.0	0.0
Shrubs	4.1	4.1	0.0	0.0
Graminoids	3.9	3.8	0.0	0.1
Forbs	6.9	6.8	0.0	0.1
TOTAL	***15.4 (100.0%)***	***15.2 (98.7%)***	***0.0 (0.0%)***	***0.2 (1.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 308 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type. The average canopy cover per stand is 146.0 percent, with native species comprising 145.7 percent or 99.8 percent of the total amount of average canopy cover per stand.

Table 308. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (number = 15 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.9%	0.9%	0.0%	0.0%
Shrubs	83.1%	83.1%	0.0%	0.0%
Graminoids	51.1%	50.8%	0.0%	0.2%
Forbs	10.9%	10.9%	0.0%	0.0%
TOTAL	***146.0% (100.0%)***	***145.7% (99.8%)***	***0.0% (0.0%)***	***0.3% (0.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 309 shows the average number of species and average canopy cover by lifeform in stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type. The average number of species per stand was 15.4 with an average canopy cover of 146.0 percent.

Table 309. Average number of species and average canopy cover by lifeform in stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (number = 15 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.5	0.9%
Shrubs	4.1	83.1%
Graminoids	3.9	51.1%
Forbs	6.9	10.9%
TOTAL	***15.4***	***146.0%***

Sampled Stands Plant Species List

A total of 98 plant species were recorded on at least one of 15 stands sampled of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (Table 310). On these stands, three tree species were recorded in very small amounts. Of the 18 shrubs recorded, *Salix glauca* (smooth willow) is overwhelmingly dominant. *Carex aquatilis* (water sedge) dominates the 26 species graminoid layer, while none of the 51 forb species is notably prominent.

Table 310. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (number = 15 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 3)					
Larix laricina (tamarack)	3.0	0-3	7	0.20	N
Picea glauca (white spruce)	1.3	0-3	20	0.27	N
Picea mariana (black spruce)	1.8	0-3	27	0.47	N
Shrubs (N = 18)					
Arctostaphylos uva-ursi (common bearberry)	0.5	0-0.5	7	0.03	N
Betula glandulosa (bog birch)	15.2	0-40	40	6.07	N
Betula pumila (dwarf birch)	20.5	0-30	40	8.20	N
Ledum groenlandicum (common Labrador tea)	3.0	0-3	7	0.20	N
Lonicera involucrata (bracted honeysuckle)	0.5	0-0.5	7	0.03	N
Oxycoccus microcarpus (small bog cranberry)	1.8	0-3	13	0.23	N
Potentilla fruticosa (shrubby cinquefoil)	7.8	0-20	20	1.57	N
Rubus arcticus (dwarf raspberry)	1.1	0-3	60	0.63	N
Rubus chamaemorus (cloudberry)	0.5	0-0.5	7	0.03	N
Rubus pedatus (dwarf bramble)	0.5	0-0.5	7	0.03	N
Salix barclayi (Barclay's willow)	30.0	0-30	13	4.00	N
Salix barrattiana (Barratt's willow)	0.5	0-0.5	7	0.03	N
Salix brachycarpa (short-capsuled willow)	0.5	0-0.5	7	0.03	N
Salix farriae (Farr's willow)	20.0	0-20	7	1.33	N
Salix glauca (smooth willow)	50.0	30-90	100	50.00	N
Salix maccalliana (velvet-fruited willow)	14.0	0-40	27	3.73	N
Salix myrtillifolia (myrtle-leaved willow)	20.6	0-30	33	6.87	N

Table 310. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Vaccinium vitis-idaea (bog cranberry)	0.5	0-0.5	7	0.03	N
Graminoids (N = 26)					
Agropyron dasystachyum (northern wheat grass)	3.0	0-3	7	0.20	N
Agropyron smithii (western wheat grass)	0.5	0-0.5	7	0.03	N
Agropyron spp. (wheat grass)	0.5	0-0.5	7	0.03	B
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	7	0.03	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	7	0.03	N
Calamagrostis canadensis (marsh reed grass)	15.0	0-20	13	2.00	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	13	1.33	N
Carex aquatilis (water sedge)	33.3	10-80	100	33.33	N
Carex atherodes (awned sedge)	10.0	0-10	7	0.67	N
Carex diandra (two-stamened sedge)	10.0	0-10	7	0.67	N
Carex gynocrates (northern bog sedge)	0.5	0-0.5	20	0.10	N
Carex pauciflora (few-flowered sedge)	0.5	0-0.5	7	0.03	N
Carex scirpoidea (rush-like sedge)	3.0	0-3	7	0.20	N
Carex spp. (sedge)	3.0	0-3	7	0.20	N
Carex utriculata (beaked sedge)	33.3	0-70	20	6.67	N
Carex vaginata (sheathed sedge)	1.3	0-3	20	0.27	N
Danthonia californica (California oat grass)	3.0	0-3	7	0.20	N
Deschampsia cespitosa (tufted hair grass)	8.1	0-40	53	4.33	N
Elymus innovatus (hairy wild rye)	0.5	0-0.5	13	0.07	N
Eriophorum polystachion (narrowleaf cotton grass)	0.5	0-0.5	7	0.03	N
Eriophorum scheuchzeri (one-spike cotton grass)	0.5	0-0.5	13	0.07	N
Festuca rubra (red fescue)	3.0	0-3	7	0.20	B
Juncus balticus (wire rush)	0.5	0-0.5	13	0.07	N
Juncus spp. (rush)	0.5	0-0.5	7	0.03	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	13	0.07	N
Phleum commutatum (mountain timothy)	3.0	0-3	7	0.20	N
Forbs (N = 51)					
Achillea millefolium (common yarrow)	0.5	0-0.5	33	0.17	N
Antennaria pulcherrima (showy everlasting)	0.5	0-0.5	7	0.03	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	13	0.07	N
Castilleja raupii (purple paintbrush)	0.5	0-0.5	7	0.03	N
Cornus canadensis (bunchberry)	0.5	0-0.5	7	0.03	N
Delphinium glaucum (tall larkspur)	4.8	0-10	27	1.27	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	33	0.17	N
Equisetum arvense (common horsetail)	4.1	0-10	27	1.10	N
Equisetum fluviatile (swamp horsetail)	3.0	0-3	7	0.20	N
Equisetum scirpoides (dwarf scouring-rush)	3.0	0-3	7	0.20	N
Equisetum sylvaticum (woodland horsetail)	1.8	0-3	13	0.23	N
Equisetum variegatum (variegated horsetail)	0.5	0-0.5	7	0.03	N
Forb spp. (forb)	0.5	0-0.5	7	0.03	B
Fragaria virginiana (wild strawberry)	1.1	0-3	27	0.30	N
Galium boreale (northern bedstraw)	0.5	0-0.5	47	0.23	N

Table 310. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Geum aleppicum (yellow avens)	0.5	0-0.5	7	0.03	N
Geum rivale (purple avens)	1.3	0-3	20	0.27	N
Geum triflorum (three-flowered avens)	3.0	0-3	13	0.40	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	7	0.03	N
Hieracium umbellatum (narrow-leaved hawkweed)	3.0	0-3	7	0.20	N
Menyanthes trifoliata (buck-bean)	10.0	0-10	7	0.67	N
Mertensia paniculata (tall lungwort)	3.5	0-10	27	0.93	N
Mitella nuda (bishop's-cap)	1.8	0-3	13	0.23	N
Pedicularis bracteosa (western lousewort)	0.5	0-0.5	7	0.03	N
Pedicularis groenlandica (elephant's-head)	1.8	0-3	13	0.23	N
Pedicularis labradorica (Labrador lousewort)	0.5	0-0.5	7	0.03	N
Pedicularis parviflora (swamp lousewort)	0.5	0-0.5	7	0.03	N
Penstemon confertus (yellow beardtongue)	0.5	0-0.5	7	0.03	N
Penstemon procerus (slender blue beardtongue)	1.8	0-3	13	0.23	N
Petasites palmatus (palmate-leaved coltsfoot)	1.1	0-3	27	0.30	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	20	0.10	N
Petasites vitifolius (vine-leaved coltsfoot)	0.5	0-0.5	7	0.03	N
Polemonium acutiflorum (tall Jacob's-ladder)	0.5	0-0.5	13	0.07	N
Polemonium pulcherrimum (showy Jacob's-ladder)	0.5	0-0.5	13	0.07	N
Polygonum viviparum (alpine bistort)	1.3	0-3	20	0.27	N
Potentilla multifida (branched cinquefoil)	0.5	0-0.5	7	0.03	N
Potentilla palustris (marsh cinquefoil)	3.0	0-3	13	0.40	N
Ranunculus abortivus (small-flowered buttercup)	0.5	0-0.5	7	0.03	N
Senecio indecorus (rayless ragwort)	0.5	0-0.5	20	0.10	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	7	0.03	N
Smilacina trifolia (three-leaved Solomon's-seal)	1.8	0-3	13	0.23	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	7	0.03	N
Solidago multiradiata (alpine goldenrod)	0.5	0-0.5	7	0.03	N
Stellaria longipes (long-stalked chickweed)	1.8	0-3	13	0.23	N
Thalictrum occidentale (western meadow rue)	0.5	0-0.5	7	0.03	N
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	7	0.03	N
Triglochin maritima (seaside arrow-grass)	0.5	0-0.5	7	0.03	N
Valeriana dioica (northern valerian)	3.4	0-10	33	1.13	N
Veronica alpina (alpine speedwell)	0.5	0-0.5	7	0.03	N
Viola orbiculata (evergreen violet)	0.5	0-0.5	7	0.03	N
Zizia aptera (heart-leaved Alexanders)	3.0	0-3	7	0.20	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 311 shows the five most prominent plant species among the four lifeforms for species recorded in all seven relatively undisturbed late seral to climax stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type. *Salix glauca* (smooth willow) and *Carex aquatilis* (water sedge) are by far the most prominent species, followed far back by *Carex utriculata* (beaked sedge). No other species in these stands is more than moderately prominent.

Table 311. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (number = 7 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea mariana (black spruce)	0.50	Native
Picea glauca (white spruce)	0.07	Native
Shrubs		
Salix glauca (smooth willow)	60.00	Native
Betula pumila (dwarf birch)	4.29	Native
Salix barclayi (Barclay's willow)	4.29	Native
Salix myrtillifolia (myrtle-leaved willow)	4.29	Native
Betula glandulosa (bog birch)	2.93	Native
Graminoids		
Carex aquatilis (water sedge)	45.71	Native
Carex utriculata (beaked sedge)	14.29	Native
Calamagrostis canadensis (marsh reed grass)	2.86	Native
Carex atherodes (awned sedge)	1.43	Native
Deschampsia cespitosa (tufted hair grass)	0.57	Native
Forbs		
Equisetum arvense (common horsetail)	2.29	Native
Delphinium glaucum (tall larkspur)	0.43	Native
Equisetum scirpoides (dwarf scouring-rush)	0.43	Native
Geum triflorum (three-flowered avens)	0.43	Native
Hieracium umbellatum (narrow-leaved hawkweed)	0.43	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.
[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 312 through Table 315, break out the vegetation recorded in seven relatively undisturbed late seral to climax stands sampled of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated habitat type of incidental-to-minor occurrence across the study area.

Table 312 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type. For the 7 stands comprising the habitat type, the number of unique species was 43 with 42 (97.7 percent) of them being native species.

Table 312. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (number = 7 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2	2	0	0
Shrubs	10	10	0	0
Graminoids	13	13	0	0
Forbs	18	17	0	1
TOTAL	***43 (100.0%)***	***42 (97.7%)***	***0 (0.0%)***	***1 (2.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 313 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type. The average number of species per stand is 9.9, with native species comprising 9.8 species per stand or 99.0 percent.

Table 313. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (number = 7 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.4	0.4	0.0	0.0
Shrubs	3.1	3.1	0.0	0.0
Graminoids	3.4	3.4	0.0	0.0
Forbs	3.0	2.9	0.0	0.1
TOTAL	***9.9 (100.0%)***	***9.8 (99.0%)***	***0.0 (0.0%)***	***0.1 (1.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 314 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type. The average canopy cover per stand is 149.6 percent, with native species comprising 149.6 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 314. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (number = 7 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.6%	0.6%	0.0%	0.0%
Shrubs	77.1%	77.1%	0.0%	0.0%
Graminoids	66.2%	66.2%	0.0%	0.0%
Forbs	5.7%	5.6%	0.0%	0.1%
TOTAL	***149.6% (100.0%)***	***149.6% (100.0%)***	***0.0% (0.0%)***	***0.1% (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 315 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type. The average number of species per stand was 9.9 with an average canopy cover of 149.6 percent.

Table 315. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (number = 7 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.4	0.6%
Shrubs	3.1	77.1%
Graminoids	3.4	66.2%
Forbs	3.0	5.7%
TOTAL	***9.9***	***149.6%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 43 plant species were recorded on at least one of seven relatively undisturbed late seral to climax stands sampled of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (Table 316). Two tree species were recorded in small amounts. Of the 10 shrubs recorded, *Salix glauca* (smooth willow) was by far most prominent, and *Carex aquatilis* (water sedge) was most prominent of the 13 graminoids, followed well behind by *Carex utriculata* (beaked sedge). Of the 18 forb species recorded, none was notably prominent.

Table 316. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (number = 7 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 2)					
Picea glauca (white spruce)	0.5	0-0.5	14	0.07	N
Picea mariana (black spruce)	1.8	0-3	29	0.50	N
Shrubs (N = 10)					
Betula glandulosa (bog birch)	10.3	0-20	29	2.93	N
Betula pumila (dwarf birch)	15.0	0-20	29	4.29	N
Oxycoccus microcarpus (small bog cranberry)	0.5	0-0.5	14	0.07	N
Rubus arcticus (dwarf raspberry)	1.0	0-3	71	0.71	N
Salix barclayi (Barclay's willow)	30.0	0-30	14	4.29	N
Salix barrattiana (Barratt's willow)	0.5	0-0.5	14	0.07	N
Salix glauca (smooth willow)	60.0	30-90	100	60.00	N
Salix maccalliana (velvet-fruited willow)	3.0	0-3	14	0.43	N
Salix myrtillifolia (myrtle-leaved willow)	30.0	0-30	14	4.29	N
Vaccinium vitis-idaea (bog cranberry)	0.5	0-0.5	14	0.07	N
Graminoids (N = 13)					
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	14	0.07	N
Calamagrostis canadensis (marsh reed grass)	20.0	0-20	14	2.86	N
Carex aquatilis (water sedge)	45.7	20-80	100	45.71	N
Carex atherodes (awned sedge)	10.0	0-10	14	1.43	N
Carex gynocrates (northern bog sedge)	0.5	0-0.5	29	0.14	N
Carex scirpoidea (rush-like sedge)	3.0	0-3	14	0.43	N
Carex utriculata (beaked sedge)	33.3	0-70	43	14.29	N

Table 316. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex vaginata (sheathed sedge)	0.5	0-0.5	14	0.07	N
Deschampsia cespitosa (tufted hair grass)	1.3	0-3	43	0.57	N
Elymus innovatus (hairy wild rye)	0.5	0-0.5	14	0.07	N
Eriophorum scheuchzeri (one-spike cotton grass)	0.5	0-0.5	14	0.07	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	14	0.07	N
Phleum commutatum (mountain timothy)	3.0	0-3	14	0.43	N
Forbs (N = 18)					
Delphinium glaucum (tall larkspur)	3.0	0-3	14	0.43	N
Equisetum arvense (common horsetail)	5.3	0-10	43	2.29	N
Equisetum scirpoides (dwarf scouring-rush)	3.0	0-3	14	0.43	N
Equisetum sylvaticum (woodland horsetail)	0.5	0-0.5	14	0.07	N
Forb spp. (forb)	0.5	0-0.5	14	0.07	B
Galium boreale (northern bedstraw)	0.5	0-0.5	14	0.07	N
Geum triflorum (three-flowered avens)	3.0	0-3	14	0.43	N
Hieracium umbellatum (narrow-leaved hawkweed)	3.0	0-3	14	0.43	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	14	0.07	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	14	0.07	N
Penstemon confertus (yellow beardtongue)	0.5	0-0.5	14	0.07	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	29	0.14	N
Polemonium pulcherrimum (showy Jacob's-ladder)	0.5	0-0.5	14	0.07	N
Potentilla palustris (marsh cinquefoil)	3.0	0-3	14	0.43	N
Senecio indecorus (rayless ragwort)	0.5	0-0.5	14	0.07	N
Stellaria longipes (long-stalked chickweed)	3.0	0-3	14	0.43	N
Valeriana dioica (northern valerian)	0.5	0-0.5	14	0.07	N
Veronica alpina (alpine speedwell)	0.5	0-0.5	14	0.07	N

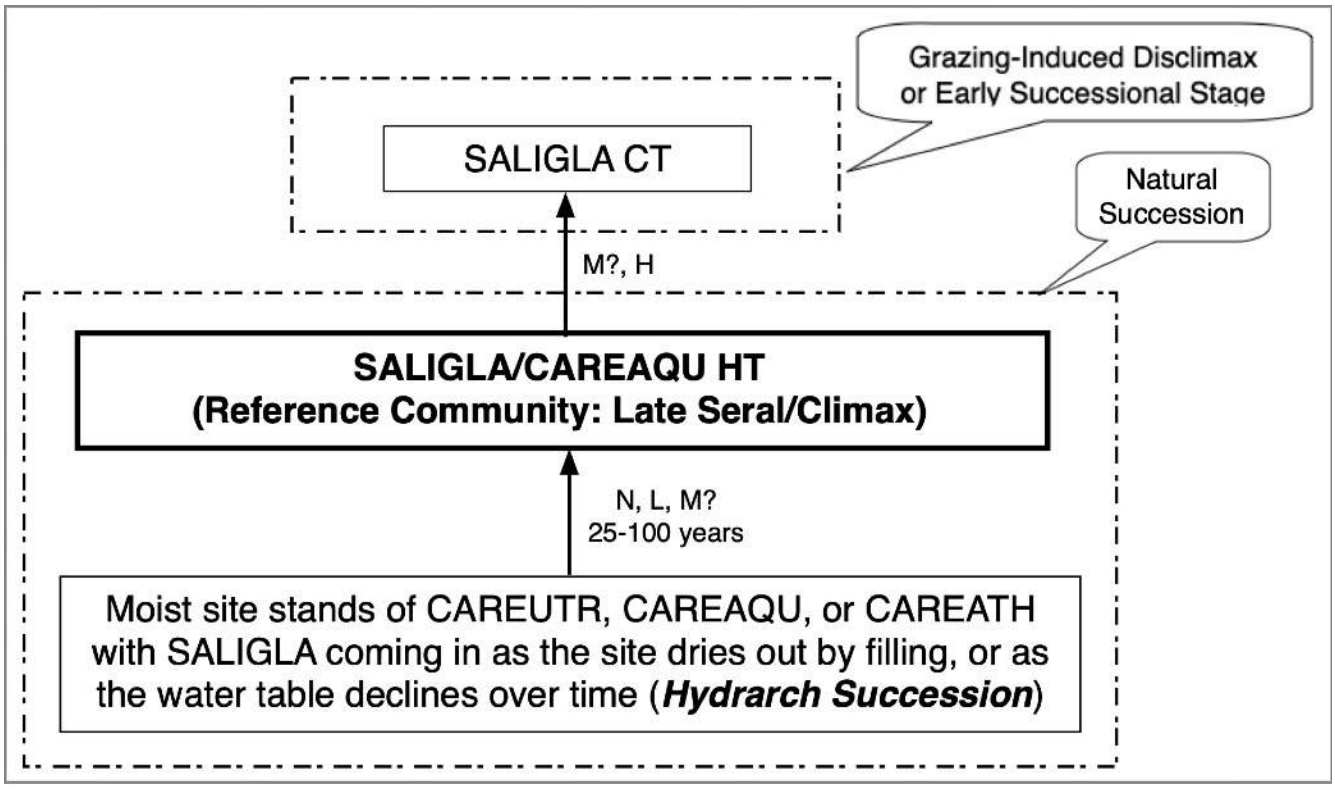
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type can develop on a site typically through two kinds of natural succession: 1) primary succession (hydrarch succession) whereby a wet meadow stand of *Carex aquatilis* (water sedge), *Carex atherodes* (awned sedge), or *Carex utriculata* (beaked sedge) located in a shallow depression gradually fills in or dries out enough for *Salix glauca* (smooth willow) to become established; and 2) secondary succession wherein aging *Populus balsamifera* (balsam poplar) stands, or beaver depleted *Populus tremuloides* (aspen) stands, have prominent in the understory both *Salix glauca* (smooth willow) and the minimum amount of the three sedges mentioned above.

Figure 66 shows a schematic diagram of vegetation successional pathways on sites of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type.



Successional Pathway of *Salix glauca/Carex aquatilis* (smooth willow/water sedge)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
SALIGLA—*Salix glauca* (smooth willow)
SALIGLA CT—*Salix glauca* (smooth willow) community type
SALIGLA/CAREAQU HT—*Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type

Figure 66. Successional pathway for sites of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 67 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

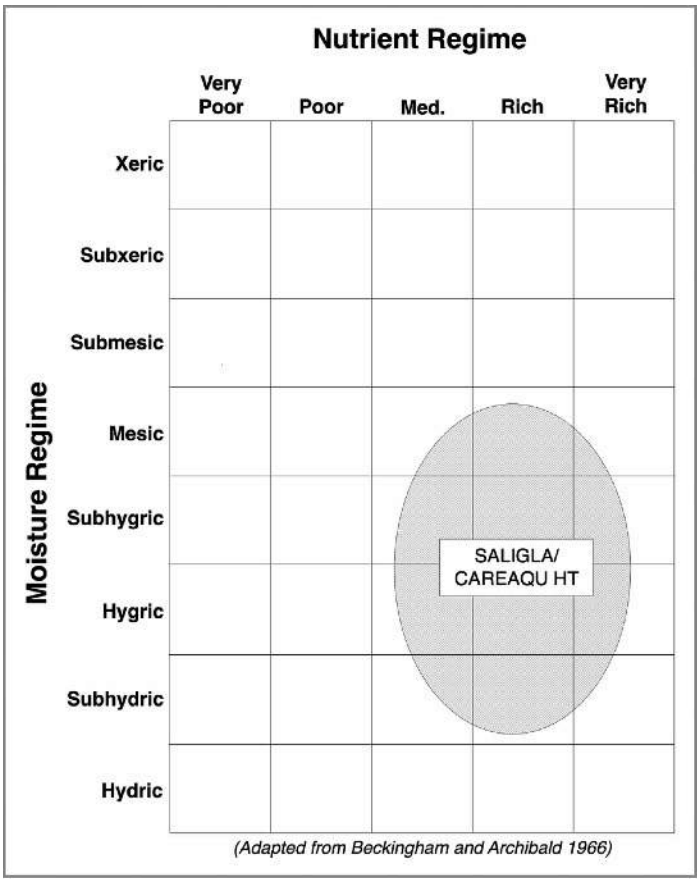


Figure 67. Edatope grid position for the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type (SALIGLA/CAREAQU HT)

SOILS

Soils information is currently unavailable for sites supporting the *Salix glauca/Carex aquatilis* (smooth willow/ water sedge) habitat type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites may support habitat types dominated by *Salix pedicellaris* (bog willow), *Salix planifolia* (flat-leaved willow), *Salix bebbiana* (beaked willow), or *Salix drummondiana* (Drummond's willow). Adjacent drier sites may be dominated by one of several *Populus tremuloides* (aspen) or *Picea glauca* (white spruce) communities

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix glauca* (smooth willow)**—*Salix glauca* (smooth willow) is common in the Foothills and Montane Natural Regions of Alberta, growing in moist woods, along rivers, on floodplains, and in bogs and muskegs (Tannas 1997a).

Salix glauca (smooth willow) is an early seral species that colonizes freshly deposited alluvium, glacial outwash, and disturbed areas with exposed mineral soil, such as road cuts and mine tailings. It is also common in *Picea* (spruce) woodlands after fire (Uchytil 1992a). The species has been observed in open, 160-year-old spruce woodlands, but it is usually displaced in such densely forested stands, due to its lack of shade tolerance (Uchytil 1992a).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is very common and widely distributed across Alberta (Tannas 1997a). It is a wetland species, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). *Carex aquatilis* (water sedge) is a native, wetland obligate, long-lived perennial. It is a sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of finer roots (Hauser 2006). It thrives on disturbed sites, is shade intolerant, and occurs in various stages of seral succession (Hauser 2006).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is common and widely distributed across Alberta. It is a wetland obligate, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). It is a long-lived perennial sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of fine roots (Johnson and others 1995).

Carex utriculata (beaked sedge) is strongly rhizomatous and colonial, typically forming a dense sod. Creeping rhizomes are long, slender or stout, and deep-seated. It grows on sites with high soil moisture, typically with the water table at or above the soil surface during the growing season. This is one of our wettest sedges. On some sites, water tables are above the soil surface all year, and rarely drop below the rooting zone. The species occurs on a range of soil types, with textures from silt loams or silty clays to loamy sands (Anderson 2008).

Carex utriculata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates with continually high water tables and persists indefinitely to form climax communities (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) is very common and widely distributed across Alberta (Tannas 1997a). The species is a wetland obligate, growing along slough margins, shorelines, in marshes, and wet meadows, often in standing water (Tannas 1997a). It is a long-lived perennial with moderate tolerance for drought, while tolerance is low for salinity, acidity, and shade. It does best on clay to clay loam soils (Hardy BBT Limited 1989).

Livestock

***Salix glauca* (smooth willow)**—*Salix glauca* (smooth willow) has good forage value (Tannas 1997a). Winter stem crude protein content is about 6.4 percent (Uchytil 1992a).

***Carex aquatilis* (water sedge)**—The livestock forage value of *Carex aquatilis* (water sedge) is rated as good (Tannas 1997a), but varies with region, season, and previous grazing use. On narrow riparian or wetland sites within large pastures, *Carex* species (sedges) are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur. In general, *Carex* species (sedges) should respond

satisfactorily to traditional grazing systems. However, on streamside sites ample residual cover should be left to protect the soil surface and trap sediments during fall rains or spring runoff. Removing cattle for at least 30 days from these streamside sites for sedge regrowth at the end of the growing season should provide sufficient residual cover (Myers 1989).

Given that *Carex aquatilis* (water sedge) grows in wet places, it is generally not grazed until late summer and fall when soils have dried (Hauser 2006). Very wet soils may deter animal use until they dry. However, if high level of grazing does occur, there will be a marked decrease in *Carex aquatilis* (water sedge) and an increase in the less palatable *Juncus balticus* (wire rush) (Tannas 1997a).

Carex utriculata **(beaked sedge)**—Livestock forage value of *Carex utriculata* (beaked sedge) is high (Tannas 1997a, Beckingham 1991). The species is palatable in the spring, but palatability declines as the plants become coarse and tough in summer (Tannas 1997a, Hansen and others 1988). Relative palatability may then increase again in fall as the sedge cures and upland forage is less attractive. *Carex utriculata* (beaked sedge) cover decreases in response to high levels of grazing pressure, and will be replaced with less productive and less palatable species, such as *Juncus balticus* (wire rush) and *Poa* species (bluegrass) (Thompson and Hansen 2003).

In general, *Carex* species (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites, residual cover should be left to protect the banks and the soil surface, and to filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days should provide time for sufficient residual cover regrowth on streamside riparian sites (Myers 1989).

Carex atherodes **(awned sedge)**—Livestock forage value of *Carex atherodes* (awned sedge) is high (Tannas 1997a, Beckingham 1991). *Carex atherodes* (awned sedge) provides good protein and a balance of other nutritional elements, while remaining palatable during the late season when upland forage is less palatable (Tannas 1997a, Hansen and others 1988). In general, *Carex* (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites residual cover should be left to protect the soil surface and filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days for sedge regrowth should provide sufficient residual cover on streamside riparian sites (Myers 1989).

Very wet soils may deter animal use until they dry, allowing the most palatable species to replenish their carbohydrate reserves and to persist in these communities. However, if high levels of grazing do occur, there will be a marked decrease in *Carex atherodes* (awned sedge) with an increase in less palatable species, such as *Juncus balticus* (wire rush). *Carex atherodes* (awned sedge) has medium palatability and medium tolerance for livestock use. Its chemical composition is similar to that of meadow grasses, upland short grass, and mixed prairie species. Seasonal declines in crude protein, phosphorous and carotene were also similar to that of native upland grasses (Hardy BBT Limited 1989).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

Salix glauca **(smooth willow)**—*Salix glauca* (smooth willow) is a moderately important moose browse in some areas, primarily due to its abundance. The species provides relatively high-quality food for wintering wild ungulates. Caribou use is thought to be moderate, and this occurs primarily in the summer. In some areas, this willow species makes up a large part of the winter diet of snowshoe hares. Thickets of this willow may provide cover for small animals, but its small stature limits its value as cover for large mammals (Uchytil 1992a).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is grazed by many ungulates, including moose, caribou, and elk, but it is not a major component of their diet. Due to the saturated habitat of the species, grazing by most ungulates is limited. *Carex aquatilis* (water sedge) habitat provides nesting and hiding cover for some birds, waterfowl, and small mammals. In riparian and wetland sites, The species is also an important source of food for a variety of waterfowl (Hauser 2006).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is grazed by moose, elk, mule deer, bison, grizzly bears, and sandhill cranes (Anderson 2008). The species is an important component of valuable breeding and feeding grounds for geese and other waterfowl. Birds commonly associated with *Carex utriculata* (beaked sedge) habitats include mallard, green-winged teal, common yellowthroat, red-winged black bird, song sparrow, and tree swallow. *Carex utriculata* (beaked sedge) stands are usually more important as feeding grounds than as nesting grounds because of their low stature, lack of structural diversity, and high water levels. Elk and moose often graze *Carex utriculata* (beaked sedge) stands when *Carex atherodes* (awned sedge) is present (Anderson 2008).

***Carex atherodes* (awned sedge)**—Wetland sedge species, such as *Carex atherodes* (awned sedge) are an important component of valuable nesting and feeding grounds for geese and other waterfowl. These stands of prolific seed producing species are usually more important as feeding grounds than as nesting grounds because of their low stature, high water level, and lack of structural diversity (Thompson and Hansen 2003).

Fisheries

***Carex aquatilis* (water sedge)**—Stands of *Carex aquatilis* (water sedge) often are adjacent to streams supporting trout fisheries. The combined tufted and rhizomatous growth habit of the species effectively stabilizes streambanks. Overhanging *Carex* species (sedges) along the banks provide valuable resting cover and shade for fish (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—The dense network of roots of the rhizomatous *Carex utriculata* (beaked sedge) is very effective in binding soil and stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish (Thompson and Hansen 2003).

***Carex atherodes* (awned sedge)**—Stands of *Carex atherodes* (awned sedge) are found more frequently in lentic situations around depressional wetlands, sloughs, potholes, wet meadows, and fens where fish habitat is not at issue (Thompson and Hansen 2003).

Fire

***Salix glauca* (smooth willow)**—*Salix glauca* (smooth willow) is a fire-adapted species. Most top killed plants sprout from the root crown after a fire. However, the abundant, wind-dispersed seeds are important for colonizing severely burned areas. Seeds that are dispersed in the fall overwinter under snow, and then germinate in the spring. Therefore, seedling establishment typically cannot begin until the second post fire year (Uchytil 1992a).

***Carex aquatilis* (water sedge)**—Sites supporting stands of *Carex aquatilis* (water sedge) seldom burn, except in periods of severe drought. When stands of the species do burn, the plants are usually top-killed by the fire and soon re-establish after the fire by seed and/or lateral spread of surviving rhizomes (Hauser 2006). The rhizomes are approximately 5 cm below the ground surface, and are somewhat protected from the heat. The wet habitat also provides protection for roots and rhizomes, although the better-drained areas are more susceptible to fires during dry periods.

Stands of *Carex aquatilis* (water sedge) are suited to prescribed fire, but exclusion of livestock during the year prior to burning is necessary. Residual cover burns well in spring, prior to the growing season. Fire will reduce

litter accumulations and temporarily increase productivity. However, species composition in the community will not drastically shift from dominance by *Carex aquatilis* (water sedge) (DeBenedetti and Parsons 1984). Care must be taken in burning along streambanks, so as to avoid impairing the excellent erosion protection provided by the species (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—Sites supporting stands of *Carex utriculata* (beaked sedge) are very wet, except at times of severe drought, and therefore they seldom burn. However, *Carex utriculata* (beaked sedge) sprouts from rhizomes, so it is often able to survive after being top-killed by fire. However, peat soils, common in these communities, can burn when dry, and the heat from such fires can penetrate the soil, destroying the sedge rhizomes. It is necessary that livestock be excluded during the year prior to burning. Caution should be used with fires along streams because of the excellent erosion protection *Carex utriculata* (beaked sedge) provides. Fires do little to change plant composition of beaked sedge communities (DeBenedetti and Parsons 1984). Fire may regress seral succession in treed or shrubby fen stands back to open sedge meadows that support little woody vegetation (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) grows on wet sites that seldom dry out enough to carry fire, but the species is adapted to light intensity fire. Residual cover should burn well in early spring, prior to the growing season. Burning will reduce litter accumulations and temporarily increase productivity (Hansen and others 1988), but care should be taken with burning to avoid damage to the excellent soil erosion protection this species provides. Under drought conditions, there is danger of burning the soil peat layer and damaging the roots (Thompson and Hansen 2003).

Rehabilitation/Restoration Considerations

***Salix glauca* (smooth willow)**—Planting of *Salix glauca* (smooth willow) stem cuttings for rehabilitation purposes has been only marginally successful, and therefore is not recommended, however seeding disturbed sites with this species may be a useful establishment measure. *Salix glauca* (smooth willow) has been observed naturally invading barrow pits and mine tailings in arctic regions (Uchytil 1992a).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) provides excellent erosion protection along streambanks, buffering against the erosive force of flood events, and filtering sediments during spring flows. Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex aquatilis* (water sedge) tends to form a dense, thick sod that is highly resistant to erosion. (Hauser 2006).

***Carex utriculata* (beaked sedge)**—Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex utriculata* (beaked sedge) has a dense network of rhizomatous roots and forms a thick sod that is highly resistant to erosion and effective in stabilizing streambanks (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) rates high in value for erosion control, and high for its persistence, once established on a site (Hardy BBT Limited 1989). Generally, due to their stronger rhizomatous roots, *Carex* species (sedges) offer better streambank protection than grasses. *Carex atherodes* (awned sedge) forms a dense, thick sod highly resistant to erosion. Along streambanks, the sod may overhang the bank and sag into the water, providing additional protection from erosion (Thompson and Hansen 2003).

Carex atherodes (awned sedge) is suited for long-term revegetation of disturbed sites and erosion control on sites with a high water table. The species can rapidly re-colonize disturbed sites by seed and rhizome extension. Its rhizomes form a dense network effective in stabilizing streambanks and preventing soil erosion (Thompson and Hansen 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type has not been described in the region.

Salix glauca Community Type
(smooth willow Community Type)

SALIGLA Community Type
Number of Stands = 17 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 11; Other Data Sets = 6)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix glauca* (smooth willow) community type is an incidental type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. Stands of this community type are fairly common in the Upper Foothills and Montane Natural Subregions of Alberta, occurring in moist woods, along river valleys, on floodplains, fens, bogs, and muskegs.

Photo 15 shows a typical stand of the *Salix glauca* (smooth willow) community type.

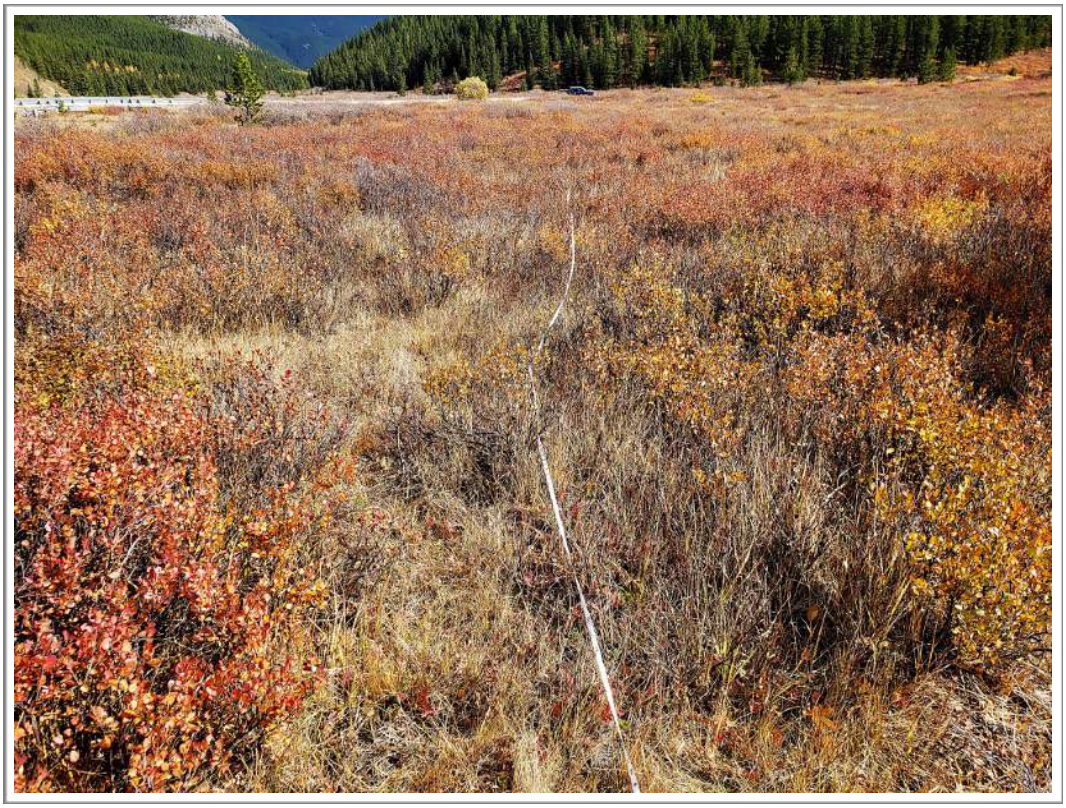


Photo 15. A stand of the *Salix glauca* (smooth willow) community type (photo provided by Hilary Baker)

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 317 shows the five most prominent plant species among the four lifeforms for species recorded in all 17 stands of the *Salix glauca* (smooth willow) community type. *Salix glauca* (smooth willow) is most prominent, followed by *Betula glandulosa* (bog birch) and *Poa pratensis* (Kentucky bluegrass), in this set of mostly disturbed stands.

Table 317. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix glauca* (smooth willow) community type (number = 17 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	0.41	Native
Pinus contorta (lodgepole pine)	0.03	Native
Shrubs		
Salix glauca (smooth willow)	38.82	Native
Betula glandulosa (bog birch)	21.77	Native
Salix myrtillifolia (myrtle-leaved willow)	3.71	Native
Salix maccalliana (velvet-fruited willow)	3.59	Native
Betula pumila (dwarf birch)	3.15	Native
Graminoids		
Poa pratensis (Kentucky bluegrass)	12.44	Introduced
Deschampsia cespitosa (tufted hair grass)	6.41	Native
Juncus balticus (wire rush)	5.94	Native
Agropyron trachycaulum (slender wheat grass)	3.24	Native
Poa palustris (fowl bluegrass)	3.00	Native
Forbs		
Fragaria virginiana (wild strawberry)	3.29	Native
Geum rivale (purple avens)	1.77	Native
Achillea millefolium (common yarrow)	1.41	Native
Geum triflorum (three-flowered avens)	1.27	Native
Geum macrophyllum (large-leaved yellow avens)	1.03	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 318 through Table 321, break out the vegetation recorded in 17 stands of the *Salix glauca* (smooth willow) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated community type of incidental-to-minor occurrence across the study area.

Table 318 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix glauca* (smooth willow) community type. For the 17 stands comprising the community type, the number of unique species was 145 with 134 (92.4 percent) of them being native species.

Table 318. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix glauca* (smooth willow) community type (number = 17 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2	2	0	0
Shrubs	21	21	0	0
Graminoids	40	35	4	1
Forbs	83	76	4	3
TOTAL	***145 (100.0%)***	***134 (92.4%)***	***8 (5.5%)***	***4 (2.8%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 319 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix glauca* (smooth willow) community type. The average number of species per stand is 25.0, with native species comprising 23.1 species per stand or 92.4 percent.

Table 319. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix glauca* (smooth willow) community type (number = 17 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.3	0.3	0.0	0.0
Shrubs	4.4	4.4	0.0	0.0
Graminoids	6.2	5.2	0.9	0.1
Forbs	14.1	13.2	0.6	0.2
TOTAL	***25.0 (100.0%)***	***23.1 (92.4%)***	***1.5 (6.0%)***	***0.3 (1.2%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 320 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix glauca* (smooth willow) community type. The average canopy cover per stand is 155.5 percent, with native species comprising 139.0 percent or 89.4 percent of the total amount of average canopy cover per stand.

Table 320. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix glauca* (smooth willow) community type (number = 17 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.4%	0.4%	0.0%	0.0%
Shrubs	83.3%	83.3%	0.0%	0.0%
Graminoids	51.4%	35.8%	15.1%	0.6%
Forbs	20.3%	19.4%	0.5%	0.4%
TOTAL	***155.5% (100.0%)***	***139.0% (89.4%)***	***15.6% (10.0%)***	***1.0% (0.6%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 321 shows the average number of species and average canopy cover by lifeform in stands of the *Salix glauca* (smooth willow) community type. The average number of species per stand was 25.0 with an average canopy cover of 155.5 percent.

Table 321. Average number of species and average canopy cover by lifeform in stands of the *Salix glauca* (smooth willow) community type (number = 17 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.3	0.4%
Shrubs	4.4	83.3%
Graminoids	6.2	51.4%
Forbs	14.1	20.3%
TOTAL	***25.0***	***155.5%***

Sampled Stands Plant Species List

A total of 146 plant species were recorded on at least one of 17 stands sampled of the *Salix glauca* (smooth willow) community type (Table 322). Two tree species were recorded in small amounts, and among the 21 shrub species, *Salix glauca* (smooth willow) was most prominent, followed by *Betula glandulosa* (bog birch). Of the 40 graminoids recorded, the disturbance indicator, *Poa pratensis* (Kentucky bluegrass), is most prominent, while among the 83 forb species none was notably prominent.

Table 322. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix glauca* (smooth willow) community type (number = 17 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 2)					
Picea glauca (white spruce)	1.8	0-3	24	0.41	N
Pinus contorta (lodgepole pine)	0.5	0-0.5	6	0.03	N
Shrubs (N = 21)					
Arctostaphylos uva-ursi (common bearberry)	0.9	0-3	35	0.32	N
Betula glandulosa (bog birch)	37.0	0-70	59	21.76	N
Betula occidentalis (water birch)	40.0	0-40	6	2.35	N
Betula pumila (dwarf birch)	10.7	0-20	29	3.15	N
Juniperus communis (ground juniper)	0.5	0-0.5	6	0.03	N
Potentilla fruticosa (shrubby cinquefoil)	3.4	0-10	65	2.18	N
Ribes hirtellum (wild gooseberry)	0.5	0-0.5	6	0.03	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	6	0.03	N
Rosa acicularis (prickly rose)	0.5	0-0.5	6	0.03	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	24	0.12	N
Rubus pubescens (dewberry)	0.5	0-0.5	6	0.03	N
Salix bebbiana (beaked willow)	30.0	0-30	6	1.76	N
Salix discolor (pussy willow)	30.0	0-30	6	1.76	N
Salix exigua (sandbar willow)	3.0	0-3	6	0.18	N
Salix glauca (smooth willow)	38.8	10-80	100	38.82	N
Salix lanata (woolly willow)	20.0	0-20	6	1.18	N
Salix lucida (shining willow)	30.0	0-30	6	1.76	N
Salix maccalliana (velvet-fruited willow)	15.3	0-50	24	3.59	N

Table 322. (cont.)

Species	Percent Canopy Cover Average	Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Salix myrtillifolia (myrtle-leaved willow)	15.8	0-40	24	3.71	N
Salix petiolaris (basket willow)	3.0	0-3	12	0.35	N
Shepherdia canadensis (Canada buffaloberry)	3.0	0-3	6	0.18	N
Graminoids (N = 40)					
Agropyron dasystachyum (northern wheat grass)	15.3	0-30	12	1.79	N
Agropyron smithii (western wheat grass)	0.5	0-0.5	12	0.06	N
Agropyron trachycaulum (slender wheat grass)	5.5	0-10	59	3.24	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	6	0.03	N
Alopecurus aequalis (short-awn meadow-foxtail)	0.5	0-0.5	6	0.03	N
Alopecurus occidentalis (alpine foxtail)	1.8	0-3	12	0.21	N
Bromus ciliatus (fringed brome)	0.5	0-0.5	12	0.06	N
Bromus inermis (smooth brome)	3.7	0-10	18	0.65	I
Calamagrostis canadensis (marsh reed grass)	10.0	0-10	12	1.18	N
Calamagrostis spp. (reed grass)	0.5	0-0.5	6	0.03	N
Calamagrostis stricta (narrow reed grass)	0.5	0-0.5	6	0.03	N
Carex bebbii (Bebb's sedge)	0.5	0-0.5	12	0.06	N
Carex capillaris (hair-like sedge)	0.5	0-0.5	6	0.03	N
Carex gynocrates (northern bog sedge)	0.5	0-0.5	6	0.03	N
Carex norvegica (Norway sedge)	0.5	0-0.5	6	0.03	N
Carex phaeocephala (head-like sedge)	0.5	0-0.5	6	0.03	N
Carex preslii (Presl sedge)	10.0	0-10	6	0.59	N
Carex raymondii (Raymond's sedge)	0.5	0-0.5	6	0.03	N
Carex scirpoidea (rush-like sedge)	15.0	0-20	12	1.76	N
Carex spp. (sedge)	2.2	0-3	18	0.38	N
Carex tincta (tinged sedge)	3.0	0-3	6	0.18	N
Danthonia californica (California oat grass)	6.5	0-10	12	0.76	N
Danthonia intermedia (timber oat grass)	25.0	0-40	12	2.94	N
Deschampsia cespitosa (tufted hair grass)	7.3	0-20	88	6.41	N
Elymus innovatus (hairy wild rye)	10.2	0-20	18	1.79	N
Festuca idahoensis (bluebunch fescue)	3.5	0-10	24	0.82	N
Festuca rubra (red fescue)	10.0	0-10	6	0.59	B
Festuca saximontana (Rocky Mountain fescue)	20.0	0-20	6	1.18	N
Festuca scabrella (rough fescue)	0.5	0-0.5	6	0.03	N
Hierochloe odorata (sweet grass)	0.5	0-0.5	18	0.09	N
Juncus balticus (wire rush)	12.6	0-30	47	5.94	N
Luzula multiflora (field wood-rush)	0.5	0-0.5	12	0.06	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	6	0.03	N
Phleum commutatum (mountain timothy)	0.5	0-0.5	6	0.03	N
Phleum pratense (timothy)	11.0	0-20	18	1.94	I
Poa palustris (fowl bluegrass)	10.2	0-20	29	3.00	N
Poa pratensis (Kentucky bluegrass)	30.2	0-80	41	12.44	I
Schizachne purpurascens (purple oat grass)	10.2	0-20	18	1.79	N
Scirpus cespitosus (tufted bulrush)	10.0	0-10	6	0.59	N
Scirpus spp. (bulrush)	10.0	0-10	6	0.59	N

Table 322. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Forbs (N = 83)					
Achillea millefolium (common yarrow)	1.8	0-3	76	1.41	N
Anemone parviflora (small wood anemone)	0.5	0-0.5	6	0.03	N
Antennaria lanata (woolly everlasting)	0.5	0-0.5	6	0.03	N
Antennaria parvifolia (small-leaved everlasting)	0.5	0-0.5	6	0.03	N
Antennaria pulcherrima (showy everlasting)	0.5	0-0.5	6	0.03	N
Arabis glabra (tower mustard)	0.5	0-0.5	12	0.06	N
Arnica angustifolia (alpine arnica)	0.5	0-0.5	6	0.03	N
Arnica fulgens (shining arnica)	0.5	0-0.5	6	0.03	N
Aster ciliolatus (Lindley's aster)	1.3	0-3	59	0.74	N
Aster laevis (smooth aster)	1.8	0-3	12	0.21	N
Aster modestus (large northern aster)	0.5	0-0.5	6	0.03	N
Aster spp. (aster)	0.5	0-0.5	18	0.09	N
Aster subspicatus (leafy-bracted aster)	0.5	0-0.5	6	0.03	N
Campanula rotundifolia (harebell)	0.5	0-0.5	6	0.03	N
Castilleja miniata (common red paintbrush)	0.5	0-0.5	6	0.03	N
Castilleja occidentalis (lance-leaved paintbrush)	0.5	0-0.5	6	0.03	N
Cerastium arvense (field mouse-ear chickweed)	3.0	0-3	6	0.18	N
Cicuta maculata (water-hemlock)	0.5	0-0.5	6	0.03	N
Cicuta virosa (narrow-leaved water-hemlock)	0.5	0-0.5	6	0.03	N
Delphinium glaucum (tall larkspur)	0.9	0-3	41	0.35	N
Epilobium angustifolium (common fireweed)	2.0	0-10	47	0.94	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	6	0.03	N
Epilobium spp. (willow-herb)	3.0	0-3	6	0.18	N
Equisetum arvense (common horsetail)	1.8	0-3	12	0.21	N
Fragaria vesca (woodland strawberry)	0.5	0-0.5	6	0.03	N
Fragaria virginiana (wild strawberry)	4.0	0-30	82	3.29	N
Galium boreale (northern bedstraw)	0.5	0-0.5	65	0.32	N
Gentianella amarella (felwort)	1.8	0-3	12	0.21	N
Geranium richardsonii (wild white geranium)	0.5	0-0.5	6	0.03	N
Geranium viscosissimum (sticky purple geranium)	2.2	0-3	18	0.38	N
Geum aleppicum (yellow avens)	0.5	0-0.5	18	0.09	N
Geum macrophyllum (large-leaved yellow avens)	2.9	0-10	35	1.03	N
Geum rivale (purple avens)	5.0	0-20	35	1.76	N
Geum triflorum (three-flowered avens)	4.3	0-10	29	1.26	N
Halenia deflexa (spurred gentian)	0.5	0-0.5	6	0.03	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	18	0.09	N
Hedysarum spp. (hedysarum)	0.5	0-0.5	6	0.03	N
Heuchera cylindrica (sticky alumroot)	0.5	0-0.5	6	0.03	N
Heuchera richardsonii (Richardson's alumroot)	1.3	0-3	18	0.24	N
Lathyrus ochroleucus (cream-colored vetchling)	1.3	0-3	18	0.24	N
Lomatium triternatum (western wild parsley)	0.5	0-0.5	6	0.03	N
Mentha arvensis (wild mint)	0.5	0-0.5	6	0.03	N

Table 322. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Mertensia paniculata (tall lungwort)	1.1	0-3	47	0.53	N
Moehringia lateriflora (blunt-leaved sandwort)	0.5	0-0.5	12	0.06	N
Oxytropis deflexa (reflexed locoweed)	0.5	0-0.5	6	0.03	N
Oxytropis splendens (showy locoweed)	0.5	0-0.5	6	0.03	N
Oxytropis spp. (locoweed)	0.5	0-0.5	6	0.03	B
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	6	0.03	N
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	29	0.15	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	12	0.06	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	12	0.06	N
Petasites vitifolius (vine-leaved coltsfoot)	1.8	0-3	12	0.21	N
Polemonium acutiflorum (tall Jacob's-ladder)	1.3	0-3	18	0.24	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	35	0.18	N
Potentilla diversifolia (mountain cinquefoil)	1.0	0-3	29	0.29	N
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	35	0.18	N
Potentilla multifida (branched cinquefoil)	0.5	0-0.5	6	0.03	N
Ranunculus abortivus (small-flowered buttercup)	0.5	0-0.5	6	0.03	N
Ranunculus acris (tall buttercup)	0.5	0-0.5	12	0.06	I
Rumex occidentalis (western dock)	0.5	0-0.5	6	0.03	N
Rumex spp. (sorrel)	3.0	0-3	6	0.18	B
Senecio conterminus (Arctic butterweed)	0.5	0-0.5	6	0.03	N
Senecio foetidus (marsh butterweed)	0.5	0-0.5	6	0.03	N
Senecio indecorus (rayless ragwort)	0.5	0-0.5	6	0.03	N
Senecio pauciflorus (few-flowered ragwort)	0.5	0-0.5	6	0.03	N
Senecio spp. (senecio)	3.0	0-3	6	0.18	B
Senecio vulgaris (common groundsel)	0.5	0-0.5	6	0.03	I
Sisyrinchium montanum (common blue-eyed grass)	0.5	0-0.5	6	0.03	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	29	0.15	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	6	0.03	N
Solidago gigantea (late goldenrod)	0.5	0-0.5	6	0.03	N
Solidago missouriensis (low goldenrod)	0.5	0-0.5	12	0.06	N
Solidago spp. (goldenrod)	10.0	0-10	6	0.59	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	12	0.06	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	6	0.03	N
Taraxacum officinale (common dandelion)	0.9	0-3	41	0.35	I
Thalictrum occidentale (western meadow rue)	3.7	0-10	18	0.65	N
Thalictrum venulosum (veiny meadow rue)	0.9	0-3	41	0.35	N
Trifolium repens (white clover)	0.5	0-0.5	6	0.03	I
Valeriana dioica (northern valerian)	1.4	0-3	47	0.68	N
Vicia americana (wild vetch)	1.5	0-3	29	0.44	N
Viola adunca (early blue violet)	0.5	0-0.5	12	0.06	N
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	35	0.18	N

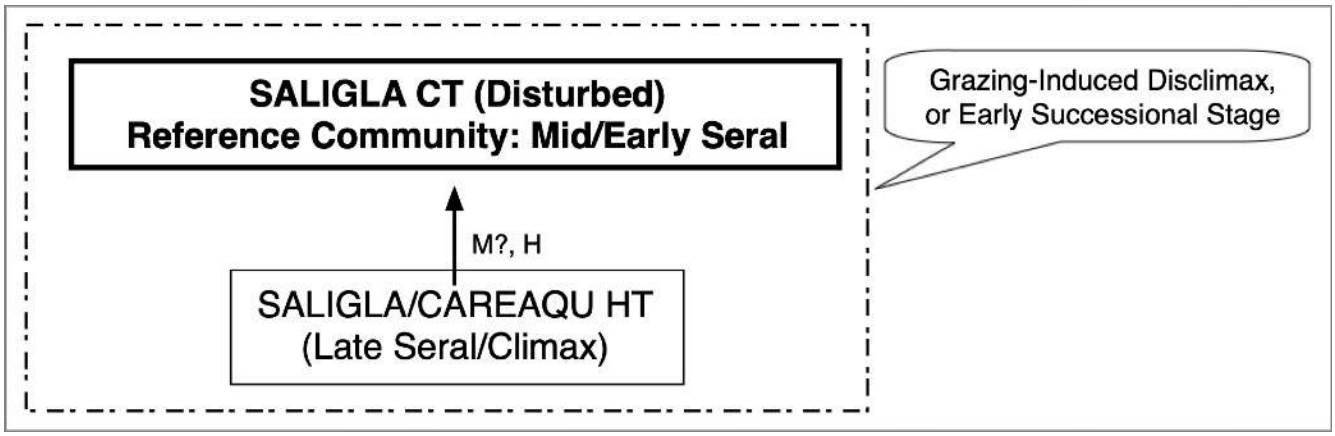
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix glauca* (smooth willow) community type is typically the result of long term grazing disturbance to stands of the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type, wherein the palatable graminoid understory is depleted and replaced by grazing increaser species, such as *Poa pratensis* (Kentucky bluegrass).

Figure 68 shows a schematic diagram of vegetation successional pathways on sites of the *Salix glauca* (smooth willow) community type.



Successional Pathway of *Salix glauca* (smooth willow) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix glauca* (smooth willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
SALIGLA/CAREAQU HT—*Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type
SALIGLA CT—*Salix glauca* (smooth willow) community type

Figure 68. Successional pathway for sites of the *Salix glauca* (smooth willow) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 69 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix glauca* (smooth willow) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

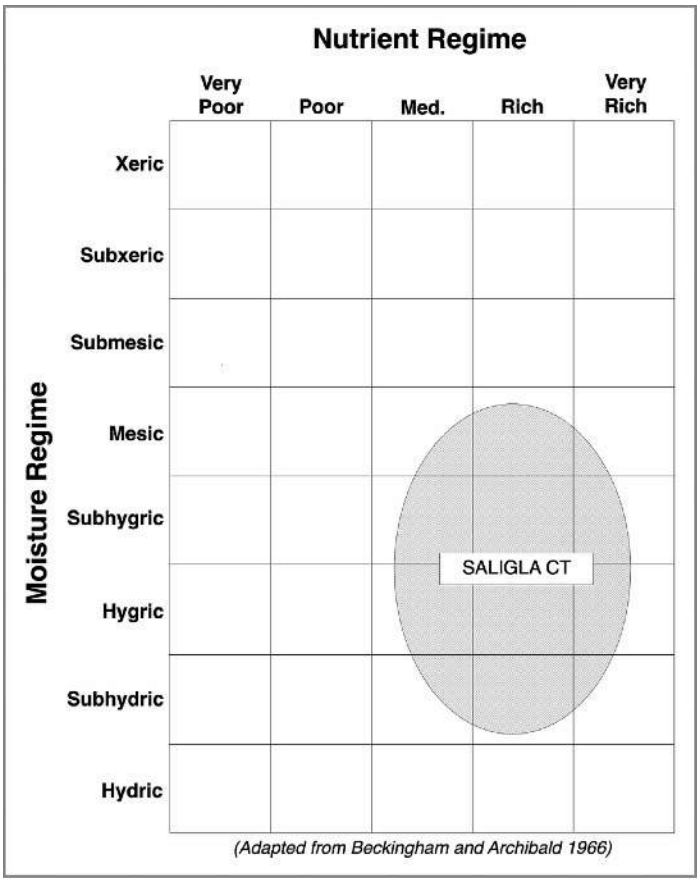


Figure 69. Edatope grid position for the *Salix glauca* (smooth willow) community type (SALIGLA CT)

SOILS

Soils information is currently unavailable for sites supporting the *Salix glauca* (smooth willow) community type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites may have habitat types dominated by *Salix pedicellaris* (bog willow), *Salix planifolia* (flat-leaved willow), *Salix bebbiana* (beaked willow), or *Salix drummondiana* (Drummond's willow). Adjacent drier sites will likely be dominated by one of several *Populus tremuloides* (aspen) or *Picea glauca* (white spruce) types.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix glauca* (smooth willow)**—*Salix glauca* (smooth willow) is common in the Foothills and Montane Natural Regions of Alberta, growing in moist woods, along rivers, on floodplains, and in bogs and muskegs (Tannas 1997a).

Salix glauca (smooth willow) is an early seral species that colonizes freshly deposited alluvium, glacial outwash, and disturbed areas with exposed mineral soil, such as road cuts and mine tailings. It is also common in *Picea* (spruce) woodlands after fire (Uchytil 1992a). The species has been observed in open, 160-year-old spruce woodlands, but it is usually displaced in such densely forested stands, due to its lack of shade tolerance (Uchytil 1992a).

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) grows along streams, in muskegs and bogs, and on moist to somewhat dry sites at higher elevations (Tannas 1997a). This species is characteristic of many mixed shrub and tussock tundra communities in northern Canada. In southwestern Canada, it often occurs on wetland sites including bogs and fens, within *Pinus contorta* (lodgepole pine), *Picea* species (spruce), or *Abies lasiocarpa* (subalpine fir) forest types, and is often associated with *Alnus* species (alders) and *Salix* species (willows) (Tollefson 2007).

Betula glandulosa (bog birch) occupies a wide variety of sites, ranging from rocky subarctic and alpine tundra to deep, organic, boreal soils. It is a wetland species occurring most commonly on moist, acidic, nutrient-poor organic sites including fens, swamps, bogs, muskegs, wet meadows, lake and stream margins, and seepage areas. The species dominates open valley bottoms in the Canadian Rocky Mountains. Although it is primarily a wetland plant, it does not appear to tolerate continuous flooding (Tollefson 2007). *Betula glandulosa* (bog birch) is shade intolerant and is often found in canopy openings within *Picea mariana* (black spruce) woodlands in northern Canada (Tollefson 2007).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is a mat-forming perennial from extensive creeping, shallow rhizomes. It grows moist meadows, riparian areas, and depressions throughout most regions of Alberta up to the subalpine (Tannas 1997a). It is widely distributed across North America growing in every Canadian province. The species is shallow rooted and is intolerant of drought. Most roots and rhizomes are within 7.5 cm of the soil surface. It is a vigorous herbaceous competitor. Not only does it spread by rhizome expansion, but it also produces abundant seed, which accounts for good seedling recruitment and establishment on disturbed sites. It grows on a wide variety of sites in numerous vegetation types, but does best and is most abundant on moist sites where the climate is cool and humid (Uchytil 1993).

Livestock

***Salix glauca* (smooth willow)**—*Salix glauca* (smooth willow) has good forage value (Tannas 1997a). Winter stem crude protein content is about 6.4 percent (Uchytil 1992a).

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) has fair nutritional value similar to that of *Alnus* species (alders), is tolerant of moderate to heavy browsing, and is an especially competitive species, forming extensive stands in western and northern rangelands (Tannas 1997a). However, the species produces carbon and nitrogen-based anti-herbivore compounds that deter browsing (Tollefson 2007).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is rated as good forage value (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, and Beckingham 1991). The species is moderately productive, and provides a significant amount of early season forage. It is highly palatable in the rapid growth phase with

palatability becoming greatly reduced during semi dormancy of late summer and winter (Tannas 1997a, Hansen and others 1995). Fall regrowth can occur if moisture is sufficient and temperatures remain above freezing. It is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). A high density of weak, low vigour tillers results under season-long grazing. Early season rest increases the vigour of individual plants. Streambanks with *Poa pratensis* (Kentucky bluegrass) stands are very susceptible to hoof shear damage and erosion The root system of *Poa pratensis* (Kentucky bluegrass) is very dense, but does not extend nearly as deep as native sedges. This results in streambanks being undercut by erosion, causing severe slumping/sloughing of the banks. In other words, it does not develop a deep, binding rootmass capable of streambank protection.

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix glauca* (smooth willow)**—*Salix glauca* (smooth willow) is a moderately important moose browse in some areas, primarily due to its abundance. The species provides relatively high-quality food for wintering wild ungulates. Caribou use is thought to be moderate, and this occurs primarily in the summer. In some areas, this willow species makes up a large part of the winter diet of snowshoe hares. Thickets of this willow may provide cover for small animals, but its small stature limits its value as cover for large mammals (Uchytil 1992a).

***Betula glandulosa* (bog birch)**—Numerous wildlife species eat *Betula glandulosa* (bog birch), including moose, mule deer, white-tailed deer, Rocky Mountain elk, mountain goats, caribou, grizzly bears, black bears, small mammals, beaver, birds, and insects (Tollefson 2007).

***Poa pratensis* (Kentucky bluegrass)**—Elk and deer make use of the grasses and forbs of this community type, especially in early spring when other forages have not yet started to grow. Waterfowl utilize *Poa pratensis* (Kentucky bluegrass) for food and cover. Upland game birds, small mammals, and small non-game birds use this type for cover (Dittberner and Olson 1983).

Fisheries

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is very poor at stabilizing streambanks (Hansen and others 1995). Bank undercutting and sloughing will likely occur, especially when soils are wet.

Fire

***Salix glauca* (smooth willow)**—*Salix glauca* (smooth willow) is a fire-adapted species. Most top killed plants sprout from the root crown after a fire. However, the abundant, wind-dispersed seeds are important for colonizing severely burned areas. Seeds that are dispersed in the fall overwinter under snow, and then germinate in the spring. Therefore, seedling establishment typically cannot begin until the second post fire year (Uchytil 1992a).

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) can survive low to moderate-severity fires. The species has deep roots and rhizomes that typically are protected from all but high-severity fires. It regenerates after fire by sprouting from the root crown and from dormant buds on the rhizomes (Tollefson 2007).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is well adapted to fire, and quickly resprouts after burning. However, it is intolerant of fire during the active growth stages and can be successfully controlled by late spring burning. Fire is an effective tool to remove excessive litter accumulations common on

rested or lightly grazed stands. Cool burns will have little effect on the species cover, but spring burns may lower tiller densities (Dix and Smeins 1967).

Rehabilitation/Restoration Considerations

***Salix glauca* (smooth willow)**—Planting of *Salix glauca* (smooth willow) stem cuttings for rehabilitation purposes has been only marginally successful, and therefore is not recommended, however seeding disturbed sites with this species may be a useful establishment measure. *Salix glauca* (smooth willow) has been observed naturally invading barrow pits and mine tailings in arctic regions (Uchytil 1992a).

***Betula glandulosa* (bog birch)**—The erosion control potential for *Betula glandulosa* (bog birch) is high, with the dense root systems important in helping to stabilize streambanks. Because it grows somewhat slowly, its short-term (1-3 years) revegetation potential is low, but the species is suitable for longer term (>3 years) revegetation of exposed mineral soil (Tollefson 2007).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) has an extensive rhizome system, but its shallow rooting habit make it only marginally effective in stabilizing streambanks. The species should not be part of any seed mix for restoring a site. The potential for erosion problems associated with this species is quite high. Managers need to pay close attention to streambanks dominated by *Poa pratensis* (Kentucky bluegrass) to detect early signs of bank failure. Once a streambank starts to degrade, with no change in management there is little that can be done to save it, short of expensive reconstructive treatments. Unless water tables are restored, these degraded sites will retain their dominant cover of introduced grasses (Hansen and others 1995).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix glauca* (smooth willow) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix glauca* (smooth willow) community type has not been described in the region.

Salix myrtillifolia/Carex aquatilis Habitat Type
(myrtle-leaved willow/water sedge Habitat Type)

SALIMYR/CAREAQU Habitat Type
Number of Stands = 14 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 14; Other Data Sets = 0)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type is an incidental type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This habitat type is found along lake shores, streambanks, floodplain thickets, fens, bogs, and muskegs.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 323 shows the five most prominent plant species among the four lifeforms for species recorded in all 14 stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type. *Salix myrtillifolia* (myrtle-leaved willow) is by far most prominent, followed by *Carex aquatilis* (water sedge) and *Betula glandulosa* (bog birch). No other species is more than moderately prominent in these stands.

Table 323. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (number = 14 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	0.36	Native
Picea mariana (black spruce)	0.11	Native
Larix laricina (tamarack)	0.04	Native
Pinus contorta (lodgepole pine)	0.04	Native
Shrubs		
Salix myrtillifolia (myrtle-leaved willow)	46.43	Native
Betula glandulosa (bog birch)	14.32	Native
Betula pumila (dwarf birch)	6.68	Native
Salix athabascensis (Athabasca willow)	3.79	Native
Salix planifolia (flat-leaved willow)	2.96	Native
Graminoids		
Carex aquatilis (water sedge)	20.71	Native
Calamagrostis canadensis (marsh reed grass)	4.54	Native
Carex utriculata (beaked sedge)	4.29	Native
Carex atherodes (awned sedge)	2.14	Native
Phalaris arundinacea (reed canary grass)	2.14	Native
Forbs		
Geum rivale (purple avens)	1.25	Native
Polemonium pulcherrimum (showy Jacob's-ladder)	0.93	Native
Delphinium glaucum (tall larkspur)	0.54	Native
Aster conspicuus (showy aster)	0.50	Native
Mitella nuda (bishop's-cap)	0.50	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 324 through Table 327, break out the vegetation recorded in all 14 stands sampled of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, moderately species rich, shrub dominated habitat type of incidental-to-minor occurrence across the study area.

Table 324 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/

water sedge) habitat type. For the 14 stands comprising the habitat type, the number of unique species was 100 with 91 (91.0 percent) of them being native species.

Table 324. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (number = 14 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	4	4	0	0
Shrubs	17	17	0	0
Graminoids	26	23	3	0
Forbs	53	47	4	2
TOTAL	***100 (100.0%)***	***91 (91.0%)***	***7 (7.0%)***	***2 (2.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 325 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type. The average number of species per stand is 17.0, with native species comprising 16.3 species per stand or 95.9 percent.

Table 325. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (number = 14 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.7	0.7	0.0	0.0
Shrubs	4.0	4.0	0.0	0.0
Graminoids	4.4	4.1	0.3	0.0
Forbs	7.9	7.5	0.3	0.1
TOTAL	***17.0 (100.0%)***	***16.3 (95.9%)***	***0.6 (3.5%)***	***0.1 (0.6%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 326 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat

type. The average canopy cover per stand is 129.8 percent, with native species comprising 128.9 percent or 99.3 percent of the total amount of average canopy cover per stand.

Table 326. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (number = 14 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.5%	0.5%	0.0%	0.0%
Shrubs	78.8%	78.8%	0.0%	0.0%
Graminoids	41.3%	40.8%	0.5%	0.0%
Forbs	9.3%	8.9%	0.3%	0.1%
TOTAL	***129.8% (100.0%)***	***128.9% (99.3%)***	***0.8% (0.6%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 327 shows the average number of species and average canopy cover by lifeform in stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type. The average number of species per stand was 17.0 with an average canopy cover of 129.8 percent.

Table 327. Average number of species and average canopy cover by lifeform in stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (number = 14 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.7	0.5%
Shrubs	4.0	78.8%
Graminoids	4.4	41.3%
Forbs	7.9	9.3%
TOTAL	***17.0***	***129.8%***

Sampled Stands Plant Species List

A total of 100 plant species were recorded on at least one of 14 stands sampled of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (Table 328). Four tree species in small amounts were recorded; and of 17 shrub species, *Salix myrtillifolia* (myrtle-leaved willow) is by far most prominent, followed well behind by *Betula glandulosa* (bog birch). *Carex aquatilis* (water sedge) dominates the list of 26 graminoids recorded, and none of the 53 forb species is very prominent.

Table 328. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (number = 14 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 4)					
Larix laricina (tamarack)	0.5	0-0.5	7	0.04	N
Picea glauca (white spruce)	1.0	0-3	36	0.36	N
Picea mariana (black spruce)	0.5	0-0.5	21	0.11	N
Pinus contorta (lodgepole pine)	0.5	0-0.5	7	0.04	N
Shrubs (N = 17)					
Betula glandulosa (bog birch)	28.6	0-70	50	14.32	N
Betula occidentalis (water birch)	1.8	0-3	14	0.25	N
Betula pumila (dwarf birch)	18.7	0-50	36	6.68	N
Cornus stolonifera (red-osier dogwood)	10.0	0-10	7	0.71	N
Potentilla fruticosa (shrubby cinquefoil)	1.3	0-3	21	0.29	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	7	0.04	N
Rubus arcticus (dwarf raspberry)	1.2	0-3	50	0.61	N
Rubus pubescens (dewberry)	0.5	0-0.5	14	0.07	N
Salix athabascensis (Athabasca willow)	17.7	0-40	21	3.79	N
Salix bebbiana (beaked willow)	10.0	0-10	7	0.71	N
Salix drummondiana (Drummond's willow)	10.0	0-10	7	0.71	N
Salix glauca (smooth willow)	3.0	0-3	7	0.21	N
Salix maccalliana (velvet-fruited willow)	10.0	0-10	7	0.71	N
Salix myrtillifolia (myrtle-leaved willow)	46.4	10-70	100	46.43	N
Salix pedicellaris (bog willow)	3.0	0-3	7	0.21	N
Salix planifolia (flat-leaved willow)	8.3	0-20	36	2.96	N
Salix pseudomonticola (false mountain willow)	0.5	0-0.5	7	0.04	N
Graminoids (N = 26)					
Agropyron repens (quack grass)	0.5	0-0.5	7	0.04	I
Agropyron trachycaulum (slender wheat grass)	10.0	0-10	7	0.71	N
Calamagrostis canadensis (marsh reed grass)	15.9	0-50	29	4.54	N
Calamagrostis stricta (narrow reed grass)	4.5	0-10	21	0.96	N
Carex aquatilis (water sedge)	24.2	0-50	86	20.71	N
Carex atherodes (awned sedge)	15.0	0-20	14	2.14	N
Carex gynocrates (northern bog sedge)	0.5	0-0.5	14	0.07	N
Carex lasiocarpa (hairy-fruited sedge)	0.5	0-0.5	7	0.04	N
Carex pauciflora (few-flowered sedge)	0.5	0-0.5	7	0.04	N
Carex preslii (Presl sedge)	3.0	0-3	7	0.21	N
Carex spp. (sedge)	1.3	0-3	21	0.29	N
Carex utriculata (beaked sedge)	15.0	0-20	29	4.29	N
Carex vaginata (sheathed sedge)	3.0	0-3	7	0.21	N
Deschampsia cespitosa (tufted hair grass)	3.3	0-10	43	1.43	N
Elymus innovatus (hairy wild rye)	6.5	0-10	14	0.93	N
Glyceria striata (fowl manna grass)	0.5	0-0.5	7	0.04	N
Hierochloe odorata (sweet grass)	0.5	0-0.5	7	0.04	N
Juncus balticus (wire rush)	4.3	0-10	36	1.54	N

Table 328. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Luzula multiflora (field wood-rush)	3.0	0-3	7	0.21	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	7	0.04	N
Phalaris arundinacea (reed canary grass)	30.0	0-30	7	2.14	N
Poa palustris (fowl bluegrass)	1.8	0-3	14	0.25	N
Poa pattersonii (Patterson's bluegrass)	0.5	0-0.5	7	0.04	N
Poa pratensis (Kentucky bluegrass)	1.8	0-3	14	0.25	I
Scirpus microcarpus (small-fruited bulrush)	0.5	0-0.5	7	0.04	N
Trisetum spicatum (spike trisetum)	0.5	0-0.5	14	0.07	N
Forbs (N = 53)					
Achillea millefolium (common yarrow)	0.9	0-3	43	0.39	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	14	0.07	N
Aster conspicuus (showy aster)	1.8	0-3	29	0.50	N
Aster puniceus (purple-stemmed aster)	1.3	0-3	21	0.29	N
Aster spp. (aster)	0.5	0-0.5	14	0.07	N
Castilleja occidentalis (lance-leaved paintbrush)	0.5	0-0.5	14	0.07	N
Cirsium arvense (Canada thistle)	0.5	0-0.5	7	0.04	I
Cynoglossum officinale (hound's-tongue)	0.5	0-0.5	7	0.04	I
Delphinium glaucum (tall larkspur)	1.5	0-3	36	0.54	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	14	0.07	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	7	0.04	N
Equisetum arvense (common horsetail)	1.3	0-3	21	0.29	N
Equisetum sylvaticum (woodland horsetail)	0.5	0-0.5	7	0.04	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	14	0.07	N
Galium boreale (northern bedstraw)	1.3	0-3	21	0.29	N
Galium labradoricum (Labrador bedstraw)	0.5	0-0.5	14	0.07	N
Galium triflorum (sweet-scented bedstraw)	0.5	0-0.5	7	0.04	N
Geranium richardsonii (wild white geranium)	0.5	0-0.5	7	0.04	N
Geum aleppicum (yellow avens)	0.5	0-0.5	14	0.07	N
Geum rivale (purple avens)	2.9	0-10	43	1.25	N
Geum spp. (avens)	0.5	0-0.5	7	0.04	N
Geum triflorum (three-flowered avens)	0.5	0-0.5	7	0.04	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	7	0.04	N
Hedysarum sulphurescens (yellow hedysarum)	0.5	0-0.5	7	0.04	N
Hieracium triste (slender hawkweed)	0.5	0-0.5	7	0.04	N
Mentha arvensis (wild mint)	0.5	0-0.5	7	0.04	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	21	0.11	N
Mitella nuda (bishop's-cap)	1.8	0-3	29	0.50	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	7	0.04	N
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	7	0.04	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	14	0.07	N
Petasites sagittatus (arrow-leaved coltsfoot)	1.0	0-3	36	0.36	N
Polemonium acutiflorum (tall Jacob's-ladder)	0.5	0-0.5	7	0.04	N
Polemonium pulcherrimum (showy Jacob's-ladder)	6.5	0-10	14	0.93	N

Table 328. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Polygonum viviparum (alpine bistort)	1.1	0-3	29	0.32	N
Potentilla gracilis (graceful cinquefoil)	3.0	0-3	7	0.21	N
Potentilla pensylvanica (prairie cinquefoil)	0.5	0-0.5	7	0.04	N
Rhinanthus minor (yellow rattle)	0.5	0-0.5	7	0.04	N
Senecio indecorus (rayless ragwort)	0.5	0-0.5	14	0.07	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	21	0.11	N
Smilacina trifolia (three-leaved Solomon's-seal)	1.8	0-3	29	0.50	N
Solidago spp. (goldenrod)	0.5	0-0.5	7	0.04	N
Sonchus arvensis (perennial sow-thistle)	0.5	0-0.5	7	0.04	I
Stellaria longifolia (long-leaved chickweed)	1.3	0-3	21	0.29	N
Taraxacum officinale (common dandelion)	3.0	0-3	7	0.21	I
Thalictrum spp. (meadow rue)	0.5	0-0.5	7	0.04	N
Thalictrum venulosum (veiny meadow rue)	1.8	0-3	14	0.25	N
Valeriana dioica (northern valerian)	1.0	0-3	36	0.36	N
Valeriana spp. (valerian)	0.5	0-0.5	7	0.04	B
Vicia americana (wild vetch)	0.5	0-0.5	14	0.07	N
Viola canadensis (western Canada violet)	0.5	0-0.5	7	0.04	N
Viola spp. (violet)	0.5	0-0.5	7	0.04	B
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	7	0.04	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 329 shows the five most prominent plant species among the four lifeforms for species recorded in all five relatively undisturbed late seral to climax stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type. *Salix myrtillifolia* (myrtle-leaved willow) is by far the most prominent species, followed

far behind by *Carex aquatilis* (water sedge) and *Calamagrostis canadensis* (marsh reed grass). No other species is more than moderately prominent in these stands.

Table 329. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (number = 5 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea mariana (black spruce)	0.10	Native
Shrubs		
Salix myrtillifolia (myrtle-leaved willow)	54.00	Native
Salix athabascensis (Athabasca willow)	8.00	Native
Betula glandulosa (bog birch)	6.10	Native
Betula pumila (dwarf birch)	4.60	Native
Salix maccalliana (velvet-fruited willow)	2.00	Native
Graminoids		
Carex aquatilis (water sedge)	22.00	Native
Calamagrostis canadensis (marsh reed grass)	10.60	Native
Carex utriculata (beaked sedge)	6.00	Native
Juncus balticus (wire rush)	2.10	Native
Calamagrostis canadensis (marsh reed grass)	0.70	Native
Forbs		
Geum rivale (purple avens)	0.20	Native
Achillea millefolium (common yarrow)	0.10	Native
Aster ciliolatus (Lindley's aster)	0.10	Native
Aster conspicuus (showy aster)	0.10	Native
Aster puniceus (purple-stemmed aster)	0.10	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 330 through Table 333, break out the vegetation recorded in five relatively undisturbed late seral to climax stands sampled of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, moderately species rich, shrub dominated habitat type of incidental-to-minor occurrence across the study area.

Table 330 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix*

myrtillifolia/Carex aquatilis (myrtle-leaved willow/water sedge) habitat type. For the 5 stands comprising the habitat type, the number of unique species was 40 with 39 (97.5 percent) of them being native species.

Table 330. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (number = 5 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	10	10	0	0
Graminoids	10	9	1	0
Forbs	19	19	0	0
TOTAL	***40 (100.0%)***	***39 (97.5%)***	***1 (2.5%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 331 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type. The average number of species per stand is 11.2, with native species comprising 11.0 species per stand or 98.2 percent.

Table 331. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (number = 5 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.2	0.2	0.0	0.0
Shrubs	3.2	3.2	0.0	0.0
Graminoids	3.8	3.6	0.2	0.0
Forbs	4.0	4.0	0.0	0.0
TOTAL	***11.2 (100.0%)***	***11.0 (98.2%)***	***0.2 (1.8%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 332 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix myrtillifolia/Carex aquatilis*

(myrtle-leaved willow/water sedge) habitat type. The average canopy cover per stand is 121.3 percent, with native species comprising 121.2 percent or 99.9 percent of the total amount of average canopy cover per stand.

Table 332. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (number = 5 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.1%	0.1%	0.0%	0.0%
Shrubs	75.7%	75.7%	0.0%	0.0%
Graminoids	43.5%	43.4%	0.1%	0.0%
Forbs	2.0%	2.0%	0.0%	0.0%
TOTAL	***121.3% (100.0%)***	***121.2% (99.9%)***	***0.1% (0.1%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 333 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type. The average number of species per stand was 11.2 with an average canopy cover of 121.3 percent.

Table 333. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (number = 5 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.2	0.1%
Shrubs	3.2	75.7%
Graminoids	3.8	43.5%
Forbs	4.0	2.0%
TOTAL	***11.2***	***121.3%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 40 plant species were recorded on at least one of five relatively undisturbed late seral to climax stands sampled of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (Table 334). A very small amount of the tree species, *Picea mariana* (black spruce), was recorded on a single plot. Of the shrubs, *Salix myrtillifolia* (myrtle-leaved willow) is the only species with high prominence, while among the 10 graminoid species, *Carex aquatilis* (water sedge) was most prominent, followed by *Calamagrostis canadensis* (marsh reed grass). Of 19 forb species recorded, none is very prominent, or recorded on more than one plot.

Table 334. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (number = 5 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 1)					
Picea mariana (black spruce)	0.5	0-0.5	20	0.10	N
Shrubs (N = 10)					
Betula glandulosa (bog birch)	15.3	0-30	40	6.10	N
Betula pumila (dwarf birch)	11.5	0-20	40	4.60	N
Potentilla fruticosa (shrubby cinquefoil)	0.5	0-0.5	20	0.10	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	20	0.10	N
Rubus pubescens (dewberry)	0.5	0-0.5	20	0.10	N
Salix athabascensis (Athabasca willow)	40.0	0-40	20	8.00	N
Salix glauca (smooth willow)	3.0	0-3	20	0.60	N
Salix maccalliana (velvet-fruited willow)	10.0	0-10	20	2.00	N
Salix myrtillifolia (myrtle-leaved willow)	54.0	40-70	100	54.00	N
Salix planifolia (flat-leaved willow)	0.5	0-0.5	20	0.10	N
Graminoids (N = 10)					
Calamagrostis canadensis (marsh reed grass)	26.5	0-50	40	10.60	N
Calamagrostis stricta (narrow reed grass)	1.8	0-3	40	0.70	N
Carex aquatilis (water sedge)	22.0	10-40	100	22.00	N
Carex preslii (Presl sedge)	3.0	0-3	20	0.60	N
Carex utriculata (beaked sedge)	15.0	0-20	40	6.00	N
Deschampsia cespitosa (tufted hair grass)	1.8	0-3	40	0.70	N
Hierochloe odorata (sweet grass)	0.5	0-0.5	20	0.10	N
Juncus balticus (wire rush)	5.3	0-10	40	2.10	N
Poa palustris (fowl bluegrass)	3.0	0-3	20	0.60	N
Poa pratensis (Kentucky bluegrass)	0.5	0-0.5	20	0.10	I
Forbs (N = 19)					
Achillea millefolium (common yarrow)	0.5	0-0.5	20	0.10	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	20	0.10	N
Aster conspicuus (showy aster)	0.5	0-0.5	20	0.10	N
Aster puniceus (purple-stemmed aster)	0.5	0-0.5	20	0.10	N
Castilleja occidentalis (lance-leaved paintbrush)	0.5	0-0.5	20	0.10	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	20	0.10	N
Equisetum arvense (common horsetail)	0.5	0-0.5	20	0.10	N
Geum rivale (purple avens)	0.5	0-0.5	40	0.20	N
Geum spp. (avens)	0.5	0-0.5	20	0.10	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	20	0.10	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	20	0.10	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	20	0.10	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	20	0.10	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	20	0.10	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	20	0.10	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	20	0.10	N

Table 334. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Valeriana dioica (northern valerian)	0.5	0-0.5	20	0.10	N
Viola canadensis (western Canada violet)	0.5	0-0.5	20	0.10	N
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	20	0.10	N

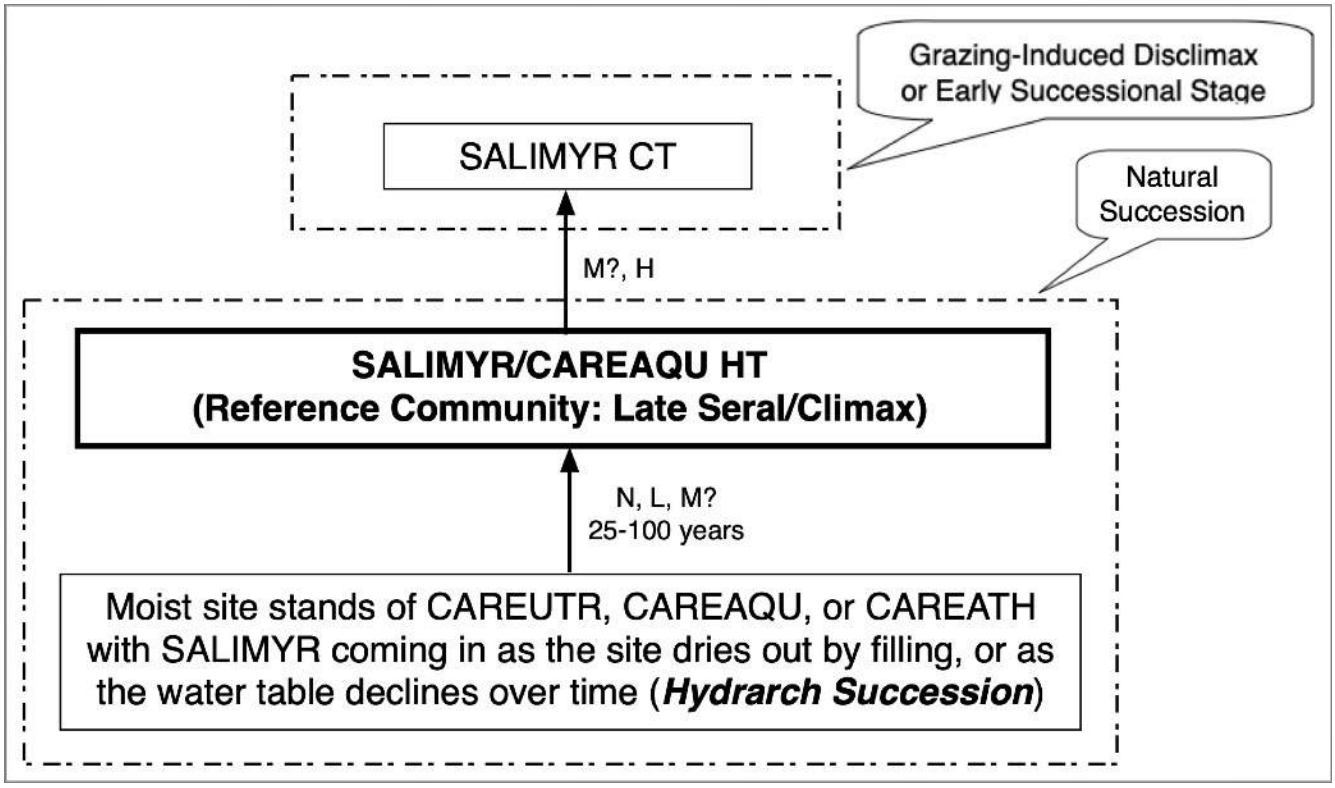
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type develops on a site typically through primary succession (hydrarch succession), whereby a wet meadow stand of *Carex aquatilis* (water sedge), *Carex atherodes* (awned sedge), or *Carex utriculata* (beaked sedge) located in a shallow depression gradually fills in or dries out enough for *Salix myrtillifolia* (myrtle-leaved willow) to become established.

Figure 70 shows a schematic diagram of vegetation successional pathways on sites of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type.



Successional Pathway of *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
SALIMYR—*Salix myrtillifolia* (myrtle-leaved willow)
SALIMYR/CAREAQU HT—*Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type
SALIMYR CT—*Salix myrtillifolia* (myrtle-leaved willow) community type

Figure 70. Successional pathway for sites of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 71 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

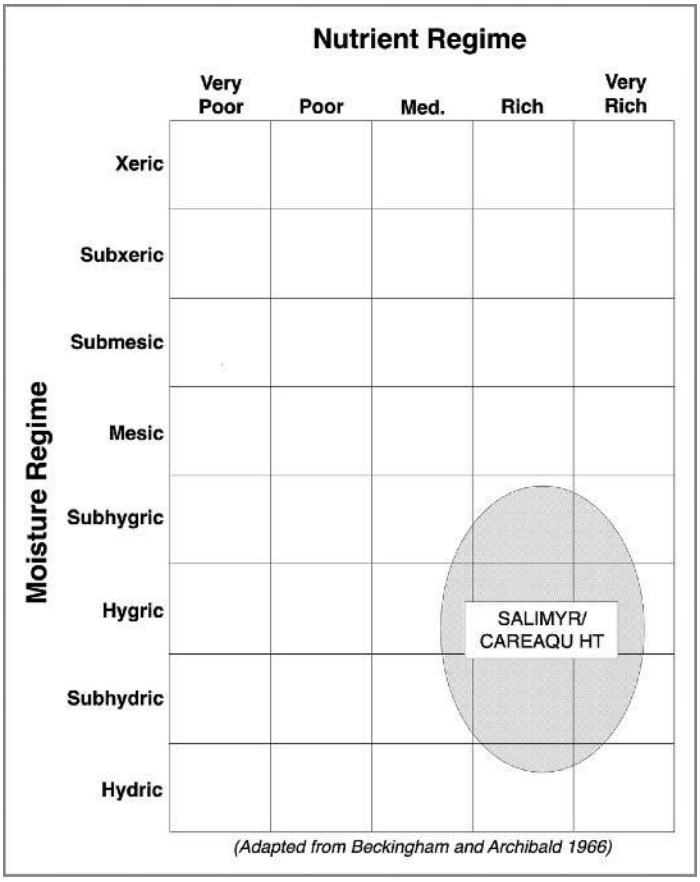


Figure 71. Edatope grid position for the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type (SALIMYR/CAREAQU HT)

SOILS

Parent material on sites supporting the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type may be alluvial, lacustrine, or undifferentiated organic. Soil drainage ranges from poorly drained to imperfectly drained (Baker and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites may support habitat types dominated by *Salix planifolia* (flat-leaved willow), *Salix bebbiana* (beaked willow), *Salix drummondiana* (Drummond's willow), or *Salix glauca* (smooth willow). Adjacent drier sites may be dominated by one of several *Populus tremuloides* (aspen) or *Picea glauca* (white spruce) communities.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix myrtillifolia* (myrtle-leaved willow)**—*Salix myrtillifolia* (myrtle-leaved willow) occurs from interior Alaska east across northern Canada to Hudson and James Bay and south to southern British Columbia and southwestern Ontario (Uchytil 1992b).

The primary mode of reproduction of *Salix myrtillifolia* (myrtle-leaved willow) is sexual through an abundance of small, lightweight seeds. It is an early seral species that becomes locally abundant after disturbance that exposes mineral soil and creates canopy openings. The species occurs also in early seral stages after fire in low-lying *Picea mariana* (black spruce) stands (Uchytil 1992b). It is a low shrub, generally shorter than 9 dm, decumbent, and rooting along the stems (CYSIP 2023).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is very common and widely distributed across Alberta (Tannas 1997a). It is a wetland species, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). *Carex aquatilis* (water sedge) is a native, wetland obligate, long-lived perennial. It is a sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of finer roots (Hauser 2006). It thrives on disturbed sites, is shade intolerant, and occurs in various stages of seral succession (Hauser 2006).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is common and widely distributed across Alberta. It is a wetland obligate, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). It is a long-lived perennial sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of fine roots (Johnson and others 1995).

Carex utriculata (beaked sedge) is strongly rhizomatous and colonial, typically forming a dense sod. Creeping rhizomes are long, slender or stout, and deep-seated. It grows on sites with high soil moisture, typically with the water table at or above the soil surface during the growing season. This is one of our wettest sedges. On some sites, water tables are above the soil surface all year, and rarely drop below the rooting zone. The species occurs on a range of soil types, with textures from silt loams or silty clays to loamy sands (Anderson 2008).

Carex utriculata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates with continually high water tables and persists indefinitely to form climax communities (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) is very common and widely distributed across Alberta (Tannas 1997a). The species is a wetland obligate, growing along slough margins, shorelines, in marshes, and wet meadows, often in standing water (Tannas 1997a). It is a long-lived perennial with moderate tolerance for drought, while tolerance is low for salinity, acidity, and shade. It does best on clay to clay loam soils (Hardy BBT Limited 1989).

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) grows along streams, in muskegs and bogs, and on moist to somewhat dry sites at higher elevations (Tannas 1997a). This species is characteristic of many mixed shrub and tussock tundra communities in northern Canada. In southwestern Canada, it often occurs on wetland sites including bogs and fens, within *Pinus contorta* (lodgepole pine), *Picea* species (spruce), or *Abies lasiocarpa* (subalpine fir) forest types, and is often associated with *Alnus* species (alders) and *Salix* species (willows) (Tollefson 2007).

Betula glandulosa (bog birch) occupies a wide variety of sites, ranging from rocky subarctic and alpine tundra to deep, organic, boreal soils. It is a wetland species occurring most commonly on moist, acidic, nutrient-poor organic sites including fens, swamps, bogs, muskegs, wet meadows, lake and stream margins, and seepage areas. The species dominates open valley bottoms in the Canadian Rocky Mountains. Although it is primarily a wetland plant, it does not appear to tolerate continuous flooding (Tollefson 2007). *Betula glandulosa* (bog birch) is shade intolerant and is often found in canopy openings within *Picea mariana* (black spruce) woodlands in northern Canada (Tollefson 2007).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

Livestock

***Carex aquatilis* (water sedge)**—The livestock forage value of *Carex aquatilis* (water sedge) is rated as good (Tannas 1997a), but varies with region, season, and previous grazing use. On narrow riparian or wetland sites within large pastures, *Carex* species (sedges) are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur. In general, *Carex* species (sedges) should respond satisfactorily to traditional grazing systems. However, on streamside sites ample residual cover should be left to protect the soil surface and trap sediments during fall rains or spring runoff. Removing cattle for at least 30 days from these streamside sites for sedge regrowth at the end of the growing season should provide sufficient residual cover (Myers 1989).

Given that *Carex aquatilis* (water sedge) grows in wet places, it is generally not grazed until late summer and fall when soils have dried (Hauser 2006). Very wet soils may deter animal use until they dry. However, if high level of grazing does occur, there will be a marked decrease in *Carex aquatilis* (water sedge) and an increase in the less palatable *Juncus balticus* (wire rush) (Tannas 1997a).

***Carex utriculata* (beaked sedge)**—Livestock forage value of *Carex utriculata* (beaked sedge) is high (Tannas 1997a, Beckingham 1991). The species is palatable in the spring, but palatability declines as the plants become coarse and tough in summer (Tannas 1997a, Hansen and others 1988). Relative palatability may then increase again in fall as the sedge cures and upland forage is less attractive. *Carex utriculata* (beaked sedge) cover decreases in response to high levels of grazing pressure, and will be replaced with less productive and less palatable species, such as *Juncus balticus* (wire rush) and *Poa* species (bluegrass) (Thompson and Hansen 2003).

In general, *Carex* species (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites, residual cover should be left to protect the banks and the soil surface, and to filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days should provide time for sufficient residual cover regrowth on streamside riparian sites (Myers 1989).

***Carex atherodes* (awned sedge)**—Livestock forage value of *Carex atherodes* (awned sedge) is high (Tannas 1997a, Beckingham 1991). *Carex atherodes* (awned sedge) provides good protein and a balance of other nutritional elements, while remaining palatable during the late season when upland forage is less palatable (Tannas 1997a, Hansen and others 1988). In general, *Carex* (sedges) respond satisfactorily to traditional grazing

systems. However, on streamside sites residual cover should be left to protect the soil surface and filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days for sedge regrowth should provide sufficient residual cover on streamside riparian sites (Myers 1989).

Very wet soils may deter animal use until they dry, allowing the most palatable species to replenish their carbohydrate reserves and to persist in these communities. However, if high levels of grazing do occur, there will be a marked decrease in *Carex atherodes* (awned sedge) with an increase in less palatable species, such as *Juncus balticus* (wire rush). *Carex atherodes* (awned sedge) has medium palatability and medium tolerance for livestock use. Its chemical composition is similar to that of meadow grasses, upland short grass, and mixed prairie species. Seasonal declines in crude protein, phosphorous and carotene were also similar to that of native upland grasses (Hardy BBT Limited 1989).

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) has fair nutritional value similar to that of *Alnus* species (alders), is tolerant of moderate to heavy browsing, and is an especially competitive species, forming extensive stands in western and northern rangelands (Tannas 1997a). However, the species produces carbon and nitrogen-based anti-herbivore compounds that deter browsing (Tollefson 2007).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix myrtillifolia* (myrtle-leaved willow)**—Although *Salix myrtillifolia* (myrtle-leaved willow) is relatively high in moisture, protein, and caloric content; depending on the region studied, moose utilization of *Salix myrtillifolia* (myrtle-leaved willow) ranges from heavy to light. Most willow species are important sources of food and building material for beaver. In spring and early summer the catkins and young leaves are eaten by many mammal and bird species (CYSIP 2023). Also, the shoots, catkins, leaves, and buds are utilized by numerous small mammals and birds (Uchytil 1992b).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is grazed by many ungulates, including moose, caribou, and elk, but it is not a major component of their diet. Due to the saturated habitat of the species, grazing by most ungulates is limited. *Carex aquatilis* (water sedge) habitat provides nesting and hiding cover for some birds, waterfowl, and small mammals. In riparian and wetland sites, The species is also an important source of food for a variety of waterfowl (Hauser 2006).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is grazed by moose, elk, mule deer, bison, grizzly bears, and sandhill cranes (Anderson 2008). The species is an important component of valuable breeding and feeding grounds for geese and other waterfowl. Birds commonly associated with *Carex utriculata* (beaked sedge) habitats include mallard, green-winged teal, common yellowthroat, red-winged black bird, song sparrow, and tree swallow. *Carex utriculata* (beaked sedge) stands are usually more important as feeding grounds than as nesting grounds because of their low stature, lack of structural diversity, and high water levels. Elk and moose

often graze *Carex utriculata* (beaked sedge) stands when *Carex atherodes* (awned sedge) is present (Anderson 2008).

***Carex atherodes* (awned sedge)**—Wetland sedge species, such as *Carex atherodes* (awned sedge) are an important component of valuable nesting and feeding grounds for geese and other waterfowl. These stands of prolific seed producing species are usually more important as feeding grounds than as nesting grounds because of their low stature, high water level, and lack of structural diversity (Thompson and Hansen 2003).

***Betula glandulosa* (bog birch)**—Numerous wildlife species eat *Betula glandulosa* (bog birch), including moose, mule deer, white-tailed deer, Rocky Mountain elk, mountain goats, caribou, grizzly bears, black bears, small mammals, beaver, birds, and insects (Tollefson 2007).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

Fisheries

***Carex aquatilis* (water sedge)**—Stands of *Carex aquatilis* (water sedge) often are adjacent to streams supporting trout fisheries. The combined tufted and rhizomatous growth habit of the species effectively stabilizes streambanks. Overhanging *Carex* species (sedges) along the banks provide valuable resting cover and shade for fish (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—The dense network of roots of the rhizomatous *Carex utriculata* (beaked sedge) is very effective in binding soil and stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish (Thompson and Hansen 2003).

***Carex atherodes* (awned sedge)**—Stands of *Carex atherodes* (awned sedge) are found more frequently in lentic situations around depressional wetlands, sloughs, potholes, wet meadows, and fens where fish habitat is not at issue (Thompson and Hansen 2003).

Fire

***Salix myrtillifolia* (myrtle-leaved willow)**—Although data is lacking, it is assumed that after top-kill by fire, *Salix myrtillifolia* (myrtle-leaved willow) sprouts from the root crown like most other willow species (Uchytil 1992b).

***Carex aquatilis* (water sedge)**—Sites supporting stands of *Carex aquatilis* (water sedge) seldom burn, except in periods of severe drought. When stands of the species do burn, the plants are usually top-killed by the fire and soon re-establish after the fire by seed and/or lateral spread of surviving rhizomes (Hauser 2006). The rhizomes are approximately 5 cm below the ground surface, and are somewhat protected from the heat. The wet habitat also provides protection for roots and rhizomes, although the better-drained areas are more susceptible to fires during dry periods.

Stands of *Carex aquatilis* (water sedge) are suited to prescribed fire, but exclusion of livestock during the year prior to burning is necessary. Residual cover burns well in spring, prior to the growing season. Fire will reduce litter accumulations and temporarily increase productivity. However, species composition in the community will not drastically shift from dominance by *Carex aquatilis* (water sedge) (DeBenedetti and Parsons 1984). Care must be taken in burning along streambanks, so as to avoid impairing the excellent erosion protection provided by the species (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—Sites supporting stands of *Carex utriculata* (beaked sedge) are very wet, except at times of severe drought, and therefore they seldom burn. However, *Carex utriculata* (beaked sedge) sprouts from rhizomes, so it is often able to survive after being top-killed by fire. However, peat soils, common in these communities, can burn when dry, and the heat from such fires can penetrate the soil, destroying the sedge rhizomes. It is necessary that livestock be excluded during the year prior to burning. Caution should be used with fires along streams because of the excellent erosion protection *Carex utriculata* (beaked sedge) provides. Fires do little to change plant composition of beaked sedge communities (DeBenedetti and Parsons 1984). Fire may regress seral succession in treed or shrubby fen stands back to open sedge meadows that support little woody vegetation (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) grows on wet sites that seldom dry out enough to carry fire, but the species is adapted to light intensity fire. Residual cover should burn well in early spring, prior to the growing season. Burning will reduce litter accumulations and temporarily increase productivity (Hansen and others 1988), but care should be taken with burning to avoid damage to the excellent soil erosion protection this species provides. Under drought conditions, there is danger of burning the soil peat layer and damaging the roots (Thompson and Hansen 2003).

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) can survive low to moderate-severity fires. The species has deep roots and rhizomes that typically are protected from all but high-severity fires. It regenerates after fire by sprouting from the root crown and from dormant buds on the rhizomes (Tollefson 2007).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

Rehabilitation/Restoration Considerations

***Salix myrtillifolia* (myrtle-leaved willow)**—Willow stem cuttings are commonly planted for restoration of wildlife habitat, streambank protection, and the reclamation of sites disturbed by mining and construction, and *Salix myrtillifolia* (myrtle-leaved willow) is apparently well suited for these purposes (Uchytil 1992b).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) provides excellent erosion protection along streambanks, buffering against the erosive force of flood events, and filtering sediments during spring flows. Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex aquatilis* (water sedge) tends to form a dense, thick sod that is highly resistant to erosion. (Hauser 2006).

***Carex utriculata* (beaked sedge)**—Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex utriculata* (beaked sedge) has a dense network of rhizomatous roots and forms a thick sod that is highly resistant to erosion and effective in stabilizing streambanks (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) rates high in value for erosion control, and high for its persistence, once established on a site (Hardy BBT Limited 1989). Generally, due to their stronger rhizomatous roots, *Carex* species (sedges) offer better streambank protection than grasses. *Carex atherodes* (awned sedge) forms a dense, thick sod highly resistant to erosion. Along streambanks, the sod may overhang the bank and sag into the water, providing additional protection from erosion (Thompson and Hansen 2003).

Carex atherodes (awned sedge) is suited for long-term revegetation of disturbed sites and erosion control on sites with a high water table. The species can rapidly re-colonize disturbed sites by seed and rhizome extension. Its rhizomes form a dense network effective in stabilizing streambanks and preventing soil erosion (Thompson and Hansen 2003).

***Betula glandulosa* (bog birch)**—The erosion control potential for *Betula glandulosa* (bog birch) is high, with the dense root systems important in helping to stabilize streambanks. Because it grows somewhat slowly, its short-term (1-3 years) revegetation potential is low, but the species is suitable for longer term (>3 years) revegetation of exposed mineral soil (Tollefson 2007).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Myrtle-leaved willow/Sedge

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type has not been described in the region.

Salix myrtillifolia Community Type
(myrtle-leaved willow Community Type)

SALIMYR Community Type
Number of Stands = 7 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 5; Other Data Sets = 2)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix myrtillifolia* (myrtle-leaved willow) community type is an incidental type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This community type is found along lake shores, streambanks, floodplain thickets, fens, bogs, and muskegs.

Photo 16 shows a typical stand of the *Salix myrtillifolia* (myrtle-leaved willow) community type.

Photo 16. A stand of the *Salix myrtillifolia* (myrtle-leaved willow) community type (photo provided by Alan Dodd)

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 335 shows the five most prominent plant species among the four lifeforms for species recorded in all seven stands of the *Salix myrtillifolia* (myrtle-leaved willow) community type. *Salix myrtillifolia* (myrtle-leaved willow) is most prominent here, followed by another shrub, *Betula glandulosa* (bog birch), and a graminoid, *Bromus ciliatus* (fringed brome). No other species is more than moderately prominent in these stands.

Table 335. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix myrtillifolia* (myrtle-leaved willow) community type (number = 7 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea mariana (black spruce)	0.43	Native
Picea glauca (white spruce)	0.14	Native
Pinus contorta (lodgepole pine)	0.07	Native
Populus balsamifera (balsam poplar)	0.07	Native
Shrubs		
Salix myrtillifolia (myrtle-leaved willow)	32.86	Native
Betula glandulosa (bog birch)	16.14	Native
Alnus crispa (green alder)	5.71	Native
Salix lucida (shining willow)	5.71	Native
Salix planifolia (flat-leaved willow)	5.71	Native
Graminoids		
Bromus ciliatus (fringed brome)	10.14	Native
Elymus innovatus (hairy wild rye)	7.29	Native
Agropyron trachycaulum (slender wheat grass)	7.21	Native
Calamagrostis stricta (narrow reed grass)	4.29	Native
Calamagrostis canadensis (marsh reed grass)	2.93	Native

Table 335. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Epilobium angustifolium (common fireweed)	4.29	Native
Geum rivale (purple avens)	3.71	Native
Achillea millefolium (common yarrow)	2.21	Native
Delphinium glaucum (tall larkspur)	2.00	Native
Mertensia paniculata (tall lungwort)	1.14	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 336 through Table 339, break out the vegetation recorded in seven stands of the *Salix myrtillifolia* (myrtle-leaved willow) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, moderately species rich, shrub dominated community type of incidental-to-minor occurrence across the study area.

Table 336 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix myrtillifolia* (myrtle-leaved willow) community type. For the 7 stands comprising the community type, the number of unique species was 94 with 87 (92.6 percent) of them being native species.

Table 336. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix myrtillifolia* (myrtle-leaved willow) community type (number = 7 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	4	4	0	0
Shrubs	13	13	0	0
Graminoids	28	24	3	1
Forbs	49	46	3	0
TOTAL	***94 (100.0%)***	***87 (92.6%)***	***6 (6.4%)***	***1 (1.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 337 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix myrtillifolia* (myrtle-leaved willow) community type. The average number of species per stand is 24.7, with native species comprising 23.1 species per stand or 93.5 percent.

Table 337. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix myrtillifolia* (myrtle-leaved willow) community type (number = 7 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.7	0.7	0.0	0.0
Shrubs	4.1	4.1	0.0	0.0
Graminoids	6.6	5.7	0.7	0.1
Forbs	13.3	12.6	0.7	0.0
TOTAL	***24.7 (100.0%)***	***23.1 (93.5%)***	***1.4 (5.7%)***	***0.1 (0.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 338 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix myrtillifolia* (myrtle-leaved willow) community type. The average canopy cover per stand is 151.1 percent, with native species comprising 148.2 percent or 98.1 percent of the total amount of average canopy cover per stand.

Table 338. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix myrtillifolia* (myrtle-leaved willow) community type (number = 7 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.7%	0.7%	0.0%	0.0%
Shrubs	83.5%	83.5%	0.0%	0.0%
Graminoids	43.7%	41.6%	0.7%	1.4%
Forbs	23.1%	22.4%	0.7%	0.0%
TOTAL	***151.1% (100.0%)***	***148.2% (98.1%)***	***1.4% (0.9%)***	***1.4% (0.9%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 339 shows the average number of species and average canopy cover by lifeform in stands of the *Salix myrtillifolia* (myrtle-leaved willow) community type. The average number of species per stand was 24.7 with an average canopy cover of 151.1 percent.

Table 339. Average number of species and average canopy cover by lifeform in stands of the *Salix myrtillifolia* (myrtle-leaved willow) community type (number = 7 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.7	0.7%
Shrubs	4.1	83.5%
Graminoids	6.6	43.7%
Forbs	13.3	23.1%
TOTAL	***24.7***	***151.1%***

Sampled Stands Plant Species List

A total of 94 plant species were recorded on at least one of seven stands sampled of the *Salix myrtillifolia* (myrtle-leaved willow) community type (Table 340). Four tree species were recorded in small amounts; while of 13 shrub species recorded, *Salix myrtillifolia* (myrtle-leaved willow) is by far most prominent, followed well behind by *Betula glandulosa* (bog birch). Of 28 graminoids recorded, *Bromus ciliatus* (fringed brome) is most prominent, followed by *Elymus innovatus* (hairy wild rye); and of 49 forbs recorded, none was notably prominent.

Table 340. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix myrtillifolia* (myrtle-leaved willow) community type (number = 7 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 4)					
Picea glauca (white spruce)	0.5	0-0.5	29	0.14	N
Picea mariana (black spruce)	3.0	0-3	14	0.43	N
Pinus contorta (lodgepole pine)	0.5	0-0.5	14	0.07	N
Populus balsamifera (balsam poplar)	0.5	0-0.5	14	0.07	N
Shrubs (N = 13)					
Alnus crispa (green alder)	40.0	0-40	14	5.71	N
Arctostaphylos uva-ursi (common bearberry)	0.5	0-0.5	14	0.07	N
Betula glandulosa (bog birch)	37.7	0-70	43	16.14	N
Betula pumila (dwarf birch)	15.0	0-20	29	4.29	N
Potentilla fruticosa (shrubby cinquefoil)	4.5	0-10	43	1.93	N
Rubus arcticus (dwarf raspberry)	7.0	0-20	43	3.00	N
Salix bebbiana (beaked willow)	20.0	0-20	14	2.86	N
Salix candida (hoary willow)	3.0	0-3	14	0.43	N
Salix glauca (smooth willow)	5.3	0-10	29	1.50	N
Salix lucida (shining willow)	40.0	0-40	14	5.71	N
Salix myrtillifolia (myrtle-leaved willow)	32.9	20-50	100	32.86	N
Salix petiolaris (basket willow)	11.5	0-20	29	3.29	N

Table 340. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Salix planifolia (flat-leaved willow)	20.0	0-30	29	5.71	N
Graminoids (N = 28)					
Agropyron trachycaulum (slender wheat grass)	16.8	0-30	43	7.21	N
Alopecurus occidentalis (alpine foxtail)	0.5	0-0.5	14	0.07	N
Bromus ciliatus (fringed brome)	17.8	0-50	57	10.14	N
Bromus inermis subsp. *pumpellianus* (northern awnless brome)	0.5	0-0.5	14	0.07	N
Calamagrostis canadensis (marsh reed grass)	10.3	0-20	29	2.93	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	43	4.29	N
Carex aquatilis (water sedge)	0.5	0-0.5	14	0.07	N
Carex athrostachya (long-bracted sedge)	10.0	0-10	14	1.43	N
Carex disperma (two-seeded sedge)	0.5	0-0.5	14	0.07	N
Carex prairea (prairie sedge)	0.5	0-0.5	14	0.07	N
Carex raymondii (Raymond's sedge)	3.0	0-3	14	0.43	N
Carex scirpoidea (rush-like sedge)	0.5	0-0.5	14	0.07	N
Carex siccata (hay sedge)	0.5	0-0.5	14	0.07	N
Carex spp. (sedge)	5.3	0-10	43	2.29	N
Carex utriculata (beaked sedge)	0.5	0-0.5	14	0.07	N
Carex vaginata (sheathed sedge)	3.0	0-3	29	0.86	N
Deschampsia cespitosa (tufted hair grass)	1.3	0-3	43	0.57	N
Elymus innovatus (hairy wild rye)	17.0	0-50	43	7.29	N
Festuca idahoensis (bluebunch fescue)	0.5	0-0.5	14	0.07	N
*Festuca rubr*a (red fescue)	10.0	0-10	14	1.43	B
Juncus balticus (wire rush)	6.5	0-10	29	1.86	N
Luzula multiflora (field wood-rush)	1.8	0-3	29	0.50	N
Muhlenbergia spp. (muhly)	0.5	0-0.5	14	0.07	N
Phleum pratense (timothy)	0.5	0-0.5	29	0.14	I
Poa palustris (fowl bluegrass)	0.5	0-0.5	14	0.07	N
Poa pattersonii (Patterson's bluegrass)	0.5	0-0.5	14	0.07	N
Poa pratensis (Kentucky bluegrass)	0.5	0-0.5	14	0.07	I
Schizachne purpurascens (purple oat grass)	10.0	0-10	14	1.43	N
Forbs (N = 49)					
Achillea millefolium (common yarrow)	2.2	0.5-10	100	2.21	N
Antennaria parvifolia (small-leaved everlasting)	0.5	0-0.5	14	0.07	N
Antennaria pulcherrima (showy everlasting)	3.0	0-3	14	0.43	N
Arabis divaricarpa (purple rock cress)	0.5	0-0.5	14	0.07	N
Arabis drummondii (Drummond's rock cress)	0.5	0-0.5	14	0.07	N
Aster ciliolatus (Lindley's aster)	1.1	0-3	57	0.64	N
Delphinium glaucum (tall larkspur)	3.5	0-10	57	2.00	N
Epilobium angustifolium (common fireweed)	5.0	0-20	86	4.29	N
Epilobium spp. (willow-herb)	0.5	0-0.5	14	0.07	N
Equisetum arvense (common horsetail)	0.5	0-0.5	14	0.07	N
Equisetum hyemale (common scouring-rush)	3.0	0-3	14	0.43	N
Equisetum scirpoides (dwarf scouring-rush)	3.0	0-3	14	0.43	N

Table 340. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Erigeron spp. (erigeron)	0.5	0-0.5	14	0.07	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	57	0.29	N
Galium boreale (northern bedstraw)	1.3	0-3	43	0.57	N
Gentiana spp. (gentian)	0.5	0-0.5	14	0.07	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	14	0.07	N
Geum rivale (purple avens)	8.7	0-20	43	3.71	N
Geum triflorum (three-flowered avens)	3.0	0-3	14	0.43	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	14	0.07	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	14	0.07	N
Lathyrus venosus (purple peavine)	0.5	0-0.5	14	0.07	N
Mertensia paniculata (tall lungwort)	1.3	0-3	86	1.14	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	14	0.07	N
Moehringia lateriflora (blunt-leaved sandwort)	0.5	0-0.5	14	0.07	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	14	0.07	N
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	14	0.07	N
Plantago patagonica (Pursh's plantain)	3.0	0-3	14	0.43	N
Polemonium pulcherrimum (showy Jacob's-ladder)	0.5	0-0.5	14	0.07	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	14	0.07	N
Potentilla diversifolia (mountain cinquefoil)	0.5	0-0.5	14	0.07	N
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	14	0.07	N
Rumex occidentalis (western dock)	0.5	0-0.5	14	0.07	N
Senecio foetidus (marsh butterweed)	0.5	0-0.5	14	0.07	N
Senecio pauciflorus (few-flowered ragwort)	1.8	0-3	29	0.50	N
Smilacina stellata (star-flowered Solomon's-seal)	1.8	0-3	29	0.50	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	14	0.07	N
Solidago gigantea (late goldenrod)	0.5	0-0.5	14	0.07	N
Solidago missouriensis (low goldenrod)	0.5	0-0.5	14	0.07	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	29	0.14	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	14	0.07	N
Taraxacum officinale (common dandelion)	1.3	0-3	43	0.57	I
Thalictrum venulosum (veiny meadow rue)	1.8	0-3	57	1.00	N
Trifolium hybridum (alsike clover)	0.5	0-0.5	14	0.07	I
Trifolium repens (white clover)	0.5	0-0.5	14	0.07	I
Valeriana dioica (northern valerian)	0.5	0-0.5	43	0.21	N
Vicia americana (wild vetch)	0.5	0-0.5	57	0.29	N
Viola adunca (early blue violet)	3.0	0-3	14	0.43	N
Zizia aptera (heart-leaved Alexanders)	1.3	0-3	43	0.57	N

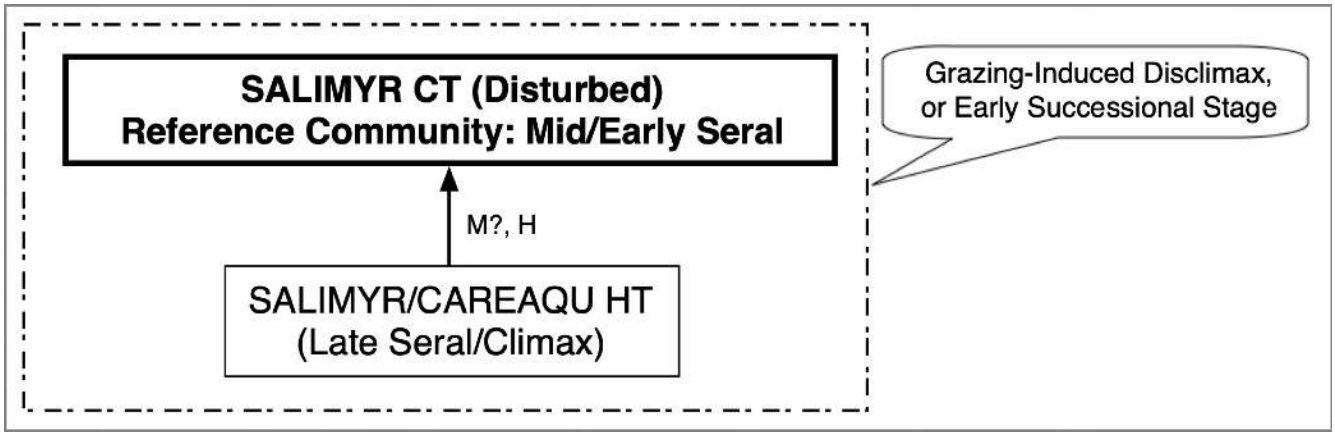
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix myrtillifolia* (myrtle-leaved willow) community type is usually the result of long term grazing disturbance to sites of the *Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type, wherein the palatable graminoid understory is depleted and replaced by grazing increaser species, such as *Poa pratensis* (Kentucky bluegrass).

Figure 72 shows a schematic diagram of vegetation successional pathways on sites of the *Salix myrtillifolia* (myrtle-leaved willow) community type.



Successional Pathway of *Salix myrtillifolia* (myrtle-leaved willow) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix myrtillifolia* (myrtle-leaved willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
SALIMYR/CAREAQU HT—*Salix myrtillifolia/Carex aquatilis* (myrtle-leaved willow/water sedge) habitat type
SALIMYR CT—*Salix myrtillifolia* (myrtle-leaved willow) community type

Figure 72. Successional pathway for sites of the *Salix myrtillifolia* (myrtle-leaved willow) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 73 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix myrtillifolia* (myrtle-leaved willow) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

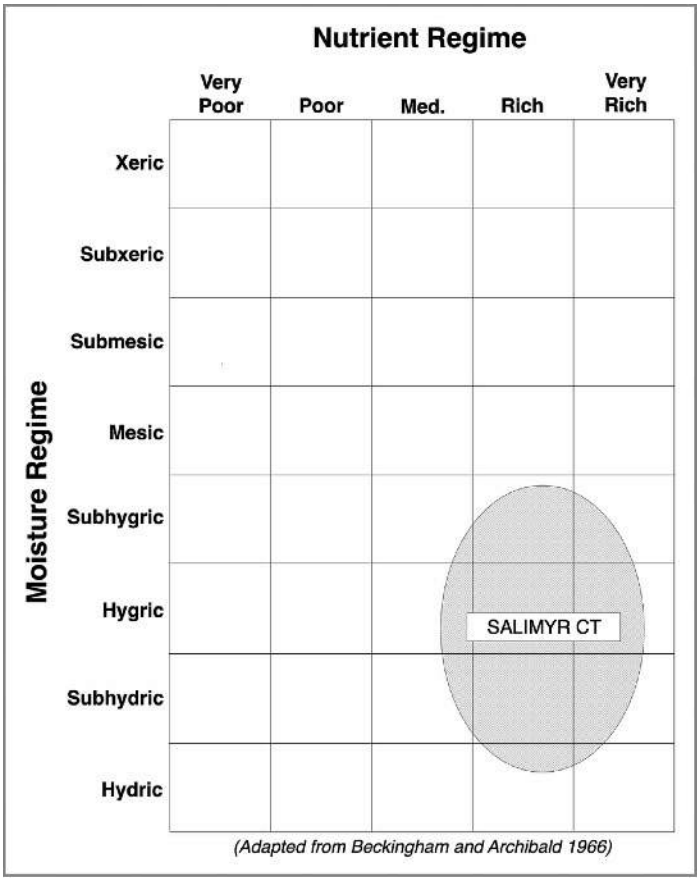


Figure 73. Edatope grid position for the *Salix myrtillifolia* (myrtle-leaved willow) community type (SALIMYR CT)

SOILS

Soils information is currently unavailable for sites supporting the *Salix myrtillifolia* (myrtle-leaved willow) community type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites may support habitat types dominated by *Salix planifolia* (flat-leaved willow), *Salix bebbiana* (beaked willow), *Salix drummondiana* (Drummond's willow), or *Salix glauca* (smooth willow). Adjacent drier sites may be dominated by one of several *Populus tremuloides* (aspen) or *Picea glauca* (white spruce) communities.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix myrtillifolia* (myrtle-leaved willow)**—*Salix myrtillifolia* (myrtle-leaved willow) occurs from interior Alaska east across northern Canada to Hudson and James Bay and south to southern British Columbia and southwestern Ontario (Uchytil 1992b).

The primary mode of reproduction of *Salix myrtillifolia* (myrtle-leaved willow) is sexual through an abundance of small, lightweight seeds. It is an early seral species that becomes locally abundant after disturbance that exposes mineral soil and creates canopy openings. The species occurs also in early seral stages after fire in low-lying *Picea mariana* (black spruce) stands (Uchytil 1992b). It is a low shrub, generally shorter than 9 dm, decumbent, and rooting along the stems (CYSIP 2023).

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) grows along streams, in muskegs and bogs, and on moist to somewhat dry sites at higher elevations (Tannas 1997a). This species is characteristic of many mixed shrub and tussock tundra communities in northern Canada. In southwestern Canada, it often occurs on wetland sites including bogs and fens, within *Pinus contorta* (lodgepole pine), *Picea* species (spruce), or *Abies lasiocarpa* (subalpine fir) forest types, and is often associated with *Alnus* species (alders) and *Salix* species (willows) (Tollefson 2007).

Betula glandulosa (bog birch) occupies a wide variety of sites, ranging from rocky subarctic and alpine tundra to deep, organic, boreal soils. It is a wetland species occurring most commonly on moist, acidic, nutrient-poor organic sites including fens, swamps, bogs, muskegs, wet meadows, lake and stream margins, and seepage areas. The species dominates open valley bottoms in the Canadian Rocky Mountains. Although it is primarily a wetland plant, it does not appear to tolerate continuous flooding (Tollefson 2007). *Betula glandulosa* (bog birch) is shade intolerant and is often found in canopy openings within *Picea mariana* (black spruce) woodlands in northern Canada (Tollefson 2007).

***Bromus ciliatus* (fringed brome)**—*Bromus ciliatus* (fringed brome) is a non-rhizomatous, native perennial, that is generally tufted with a well-developed root system. It occurs in a variety of habitats including woodlands, forest openings, thickets, grasslands, shrublands, prairies, meadows, marshes, bogs, fens, and stream and lake margins. (Esser 1994a).

Bromus ciliatus (fringed brome) grows best on moist to semi-wet soils, but is tolerant of poorly drained and sub-irrigated conditions. It grows best on loam, silty loam, and sand, but also occurs on stony or bouldery substrates as well. *Bromus ciliatus* (fringed brome) occurs in seral and climax communities. It is shade tolerant, but also grows in some open habitats (Esser 1994a).

Livestock

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) has fair nutritional value similar to that of *Alnus* species (alders), is tolerant of moderate to heavy browsing, and is an especially competitive species, forming extensive stands in western and northern rangelands (Tannas 1997a). However, the species produces carbon and nitrogen-based anti-herbivore compounds that deter browsing (Tollefson 2007).

***Bromus ciliatus* (fringed brome)**—*Bromus ciliatus* (fringed brome) is a good source of forage on western forest rangelands and is highly palatable to all classes of livestock. The species is a decreaser in response to overgrazing, and is usually found on rangelands that are in good to excellent range condition (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix myrtillifolia* (myrtle-leaved willow)**—Although *Salix myrtillifolia* (myrtle-leaved willow) is relatively high in moisture, protein, and caloric content; depending on the region studied, moose utilization of *Salix myrtillifolia* (myrtle-leaved willow) ranges from heavy to light. Most willow species are important sources of food and

building material for beaver. In spring and early summer the catkins and young leaves are eaten by many mammal and bird species (CYSIP 2023). Also, the shoots, catkins, leaves, and buds are utilized by numerous small mammals and birds (Uchytil 1992b).

***Betula glandulosa* (bog birch)**—Numerous wildlife species eat *Betula glandulosa* (bog birch), including moose, mule deer, white-tailed deer, Rocky Mountain elk, mountain goats, caribou, grizzly bears, black bears, small mammals, beaver, birds, and insects (Tollefson 2007).

***Bromus ciliatus* (fringed brome)**—*Bromus ciliatus* (fringed brome) is an important forage species for deer and elk throughout the summer. The seeds are eaten by small mammals, turkeys and other birds. Sites supporting *Bromus ciliatus* (fringed brome) provide excellent cover for small mammals and ground nesting birds (Esser 1994a).

Fire

***Salix myrtillifolia* (myrtle-leaved willow)**—Although data is lacking, it is assumed that after top-kill by fire, *Salix myrtillifolia* (myrtle-leaved willow) sprouts from the root crown like most other willow species (Uchytil 1992b).

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) can survive low to moderate-severity fires. The species has deep roots and rhizomes that typically are protected from all but high-severity fires. It regenerates after fire by sprouting from the root crown and from dormant buds on the rhizomes (Tollefson 2007).

***Bromus ciliatus* (fringed brome)**—*Bromus ciliatus* (fringed brome) has low tolerance to fires of moderate and higher intensity. Frequency and abundance of *Bromus ciliatus* (fringed brome) cover increased the third year after a spring prescribed fire in a *Symphoricarpos occidentalis* (buckbrush) shrub community in central Alberta. (Esser 1994a).

Rehabilitation/Restoration Considerations

***Salix myrtillifolia* (myrtle-leaved willow)**—Willow stem cuttings are commonly planted for restoration of wildlife habitat, streambank protection, and the reclamation of sites disturbed by mining and construction, and *Salix myrtillifolia* (myrtle-leaved willow) is apparently well suited for these purposes (Uchytil 1992b).

***Betula glandulosa* (bog birch)**—The erosion control potential for *Betula glandulosa* (bog birch) is high, with the dense root systems important in helping to stabilize streambanks. Because it grows somewhat slowly, its short-term (1-3 years) revegetation potential is low, but the species is suitable for longer term (>3 years) revegetation of exposed mineral soil (Tollefson 2007).

***Bromus ciliatus* (fringed brome)**—Erosion control and short-term revegetation potential are rated medium for *Bromus ciliatus* (fringed brome), and its long-term revegetation potential is rated high (Esser 1994a).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix myrtillifolia* (myrtle-leaved willow) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Myrtle-leaved willow/Kentucky bluegrass

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msd8a Myrtle leaved willow/Kentucky bluegrass (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix myrtillifolia* (myrtle-leaved willow) community type has not been described in the region.

Salix pedicellaris/Carex aquatilis Habitat Type
(bog willow/water sedge Habitat Type)

SALIPED/CAREAQU Habitat Type
Number of Stands = 7 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 6; Other Data Sets = 1)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. Stands of this habitat type are found on shrubby rich fen wetlands on geomorphically maturing glacial depressions that no longer have open water. The substrate is mostly organic—commonly a floating mat of plant material capable of supporting low shrubs, but not substantial enough to support trees or tall shrubs.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 341 shows the five most prominent plant species among the four lifeforms for species recorded in all seven stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type. The two type indicator species, *Salix pedicellaris* (bog willow) and *Carex aquatilis* (water sedge), are by far most prominent, followed well behind by *Carex utriculata* (beaked sedge). No other species is more than moderately prominent in these stands.

Table 341. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type (number = 7 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Larix laricina (tamarack)	0.14	Native
Betula papyrifera (white birch)	0.07	Native
Picea glauca (white spruce)	0.07	Native
Picea mariana (black spruce)	0.07	Native
Shrubs		
Salix pedicellaris (bog willow)	40.00	Native
Betula pumila (dwarf birch)	7.21	Native
Salix glauca (smooth willow)	4.29	Native
Salix myrtillifolia (myrtle-leaved willow)	3.29	Native
Salix athabascensis (Athabasca willow)	1.43	Native
Graminoids		
Carex aquatilis (water sedge)	50.00	Native
Carex utriculata (beaked sedge)	17.14	Native
Eriophorum chamissonis (russett cotton grass)	4.29	Native
Calamagrostis canadensis (marsh reed grass)	2.86	Native
Calamagrostis stricta (narrow reed grass)	2.86	Native
Forbs		
Smilacina trifolia (three-leaved Solomon's-seal)	1.50	Native
Equisetum arvense (common horsetail)	1.43	Native
Equisetum fluviatile (swamp horsetail)	1.43	Native
Potentilla palustris (marsh cinquefoil)	1.29	Native
Achillea millefolium (common yarrow)	0.86	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 342 through Table 345, break out the vegetation recorded in all seven stands sampled of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, moderately species rich, shrub dominated habitat type of incidental occurrence across the study area.

Table 342 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type. For the 7 stands comprising the habitat type, the number of unique species was 49 with 48 (98.0 percent) of them being native species.

Table 342. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type (number = 7 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	4	4	0	0
Shrubs	15	15	0	0
Graminoids	15	14	0	1
Forbs	15	15	0	0
TOTAL	***49 (100.0%)***	***48 (98.0%)***	***0 (0.0%)***	***1 (2.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 343 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type. The average number of species per stand is 11.7, with native species comprising 11.6 species per stand or 99.1 percent.

Table 343. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type (number = 7 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.7	0.7	0.0	0.0
Shrubs	4.0	4.0	0.0	0.0
Graminoids	3.4	3.3	0.0	0.1
Forbs	3.6	3.6	0.0	0.0
TOTAL	***11.7 (100.0%)***	***11.6 (99.1%)***	***0.0 (0.0%)***	***0.1 (0.9%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 344 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type. The average canopy cover per stand is 156.6 percent, with native species comprising 156.6 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 344. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type (number = 7 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.4%	0.4%	0.0%	0.0%
Shrubs	61.4%	61.4%	0.0%	0.0%
Graminoids	85.1%	85.1%	0.0%	0.1%
Forbs	9.8%	9.8%	0.0%	0.0%
TOTAL	***156.6% (100.0%)***	***156.6% (100.0%)***	***0.0% (0.0%)***	***0.1% (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 345 shows the average number of species and average canopy cover by lifeform in stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type. The average number of species per stand was 11.7 with an average canopy cover of 156.6 percent.

Table 345. Average number of species and average canopy cover by lifeform in stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type (number = 7 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.7	0.4%
Shrubs	4.0	61.4%
Graminoids	3.4	85.1%
Forbs	3.6	9.8%
TOTAL	***11.7***	***156.6%***

Sampled Stands Plant Species List

A total of 49 plant species were recorded on at least one of seven stands sampled of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type (Table 346). Four tree species were recorded in very small amounts; while of 15 shrub species recorded, *Salix pedicellaris* (bog willow) is by far most prominent. *Carex aquatilis* (water sedge) dominates the list of 26 graminoids, followed well back by *Carex utriculata* (beaked sedge). None of the 15 forb species was very prominent.

Table 346. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type (number = 7 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 4)					
Betula papyrifera (white birch)	0.5	0-0.5	14	0.07	N
Larix laricina (tamarack)	0.5	0-0.5	29	0.14	N
Picea glauca (white spruce)	0.5	0-0.5	14	0.07	N
Picea mariana (black spruce)	0.5	0-0.5	14	0.07	N
Shrubs (N = 15)					
Andromeda polifolia (bog rosemary)	0.5	0-0.5	14	0.07	N
Arctostaphylos uva-ursi (common bearberry)	0.5	0-0.5	14	0.07	N
Betula glandulosa (bog birch)	0.5	0-0.5	14	0.07	N
Betula pumila (dwarf birch)	16.8	0-30	43	7.21	N
Ledum groenlandicum (common Labrador tea)	3.0	0-3	14	0.43	N
Oxycoccus microcarpus (small bog cranberry)	0.5	0-0.5	14	0.07	N
Rubus arcticus (dwarf raspberry)	1.3	0-3	43	0.57	N
Salix athabascensis (Athabasca willow)	10.0	0-10	14	1.43	N
Salix bebbiana (beaked willow)	10.0	0-10	14	1.43	N
Salix candida (hoary willow)	0.5	0-0.5	14	0.07	N
Salix glauca (smooth willow)	30.0	0-30	14	4.29	N
Salix maccalliana (velvet-fruited willow)	2.2	0-3	43	0.93	N
Salix myrtillifolia (myrtle-leaved willow)	11.5	0-20	29	3.29	N
Salix pedicellaris (bog willow)	40.0	30-60	100	40.00	N
Salix pseudomonticola (false mountain willow)	10.0	0-10	14	1.43	N
Graminoids (N = 15)					
Agropyron spp. (wheat grass)	0.5	0-0.5	14	0.07	B
Calamagrostis canadensis (marsh reed grass)	20.0	0-20	14	2.86	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	29	2.86	N
Carex aquatilis (water sedge)	50.0	30-70	100	50.00	N
Carex chordorrhiza (prostrate sedge)	10.0	0-10	14	1.43	N
Carex diandra (two-stamened sedge)	10.0	0-10	14	1.43	N
Carex gynocrates (northern bog sedge)	0.5	0-0.5	29	0.14	N
Carex heleonastes (Hudson Bay sedge)	3.0	0-3	14	0.43	N
Carex limosa (mud sedge)	20.0	0-20	14	2.86	N
Carex sartwellii (Sartwell's sedge)	0.5	0-0.5	14	0.07	N
Carex tenera (broad-fruited sedge)	0.5	0-0.5	14	0.07	N
Carex utriculata (beaked sedge)	60.0	0-80	29	17.14	N
Eriophorum chamissonis (russett cotton grass)	30.0	0-30	14	4.29	N
Juncus balticus (wire rush)	0.5	0-0.5	14	0.07	N
Muhlenbergia glomerata (bog muhly)	10.0	0-10	14	1.43	N
Forbs (N = 15)					
Achillea millefolium (common yarrow)	3.0	0-3	29	0.86	N
Caltha palustris (marsh-marigold)	0.5	0-0.5	14	0.07	N
Epilobium angustifolium (common fireweed)	3.0	0-3	14	0.43	N
Equisetum arvense (common horsetail)	10.0	0-10	14	1.43	N

Table 346. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Equisetum fluviatile (swamp horsetail)	10.0	0-10	14	1.43	N
Galium labradoricum (Labrador bedstraw)	1.3	0-3	43	0.57	N
Menyanthes trifoliata (buck-bean)	3.0	0-3	29	0.86	N
Mertensia paniculata (tall lungwort)	3.0	0-3	14	0.43	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	29	0.14	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	43	0.21	N
Polygonum viviparum (alpine bistort)	3.0	0-3	14	0.43	N
Potentilla palustris (marsh cinquefoil)	3.0	0-3	43	1.29	N
Smilacina trifolia (three-leaved Solomon's-seal)	5.3	0-10	29	1.50	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	14	0.07	N
Triglochin maritima (seaside arrow-grass)	0.5	0-0.5	14	0.07	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 347 shows the five most prominent plant species among the four lifeforms for species recorded in all four relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type. The two type indicator species, *Salix pedicellaris* (bog willow) and *Carex aquatilis* (water sedge), are by far most prominent, followed by *Carex utriculata* (beaked sedge). No other species is more than moderately prominent in these stands.

Table 347. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type (number = 4 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Betula papyrifera (white birch)	0.13	Native
Shrubs		
Salix pedicellaris (bog willow)	47.50	Native
Salix athabascensis (Athabasca willow)	2.50	Native
Ledum groenlandicum (common Labrador tea)	0.75	Native
Salix maccalliana (velvet-fruited willow)	0.75	Native
Betula glandulosa (bog birch)	0.13	Native
Graminoids		
Carex aquatilis (water sedge)	55.00	Native
Carex utriculata (beaked sedge)	30.00	Native
Eriophorum chamissonis (russett cotton grass)	7.50	Native
Calamagrostis canadensis (marsh reed grass)	5.00	Native
Carex diandra (two-stamened sedge)	2.50	Native
Forbs		
Equisetum arvense (common horsetail)	2.50	Native
Potentilla palustris (marsh cinquefoil)	1.50	Native
Galium labradoricum (Labrador bedstraw)	0.88	Native
Menyanthes trifoliata (buck-bean)	0.75	Native
Pedicularis groenlandica (elephant's-head)	0.13	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 348 through Table 351, break out the vegetation recorded in four relatively undisturbed late seral to climax stands sampled of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, moderately species rich, shrub dominated habitat type of incidental occurrence across the study area.

Table 348 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type. For the 4 stands comprising the habitat type, the number of unique species was 19 with 19 (100.0 percent) of them being native species.

Table 348. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/ Carex aquatilis* (bog willow/water sedge) habitat type (number = 4 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	7	7	0	0
Graminoids	5	5	0	0
Forbs	6	6	0	0
TOTAL	***19 (100.0%)***	***19 (100.0%)***	***0 (0.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 349 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type. The average number of species per stand is 7.1, with native species comprising 7.1 species per stand or 100.0 percent.

Table 349. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type (number = 4 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.3	0.3	0.0	0.0
Shrubs	2.5	2.5	0.0	0.0
Graminoids	2.3	2.3	0.0	0.0
Forbs	2.0	2.0	0.0	0.0
TOTAL	***7.1 (100.0%)***	***7.1 (100.0%)***	***0.0 (0.0%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 350 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type. The average canopy cover per stand is 157.9 percent, with native species comprising 157.9 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 350. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type (number = 4 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.1%	0.1%	0.0%	0.0%
Shrubs	51.9%	51.9%	0.0%	0.0%
Graminoids	100.0%	100.0%	0.0%	0.0%
Forbs	5.9%	5.9%	0.0%	0.0%
TOTAL	***157.9% (100.0%)***	***157.9% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 351 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type. The average number of species per stand was 7.1 with an average canopy cover of 157.9 percent.

Table 351. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type (number = 4 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.3	0.1%
Shrubs	2.5	51.9%
Graminoids	2.3	100.0%
Forbs	2.0	5.9%
TOTAL	***7.1***	***157.9%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 19 plant species were recorded on at least one of four relatively undisturbed late seral to climax stands sampled of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type (Table 352). One tree species was recorded in a very small amount; while of seven shrub species, *Salix pedicellaris* (bog willow) is by far most prominent. *Carex aquatilis* (water sedge) dominates the list of five graminoids, followed well back by *Carex utriculata* (beaked sedge). None of the six forb species is very prominent.

Table 352. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type (number = 4 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 1)					
Betula papyrifera (white birch)	0.5	0-0.5	25	0.13	N
Shrubs (N = 7)					
Betula glandulosa (bog birch)	0.5	0-0.5	25	0.13	N
Betula pumila (dwarf birch)	0.5	0-0.5	25	0.13	N
Ledum groenlandicum (common Labrador tea)	3.0	0-3	25	0.75	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	25	0.13	N
Salix athabascensis (Athabasca willow)	10.0	0-10	25	2.50	N
Salix maccalliana (velvet-fruited willow)	3.0	0-3	25	0.75	N
Salix pedicellaris (bog willow)	47.5	30-60	100	47.50	N
Graminoids (N = 5)					
Calamagrostis canadensis (marsh reed grass)	20.0	0-20	25	5.00	N
Carex aquatilis (water sedge)	55.0	30-70	100	55.00	N
Carex diandra (two-stamened sedge)	10.0	0-10	25	2.50	N
Carex utriculata (beaked sedge)	60.0	0-80	50	30.00	N
Eriophorum chamissonis (russett cotton grass)	30.0	0-30	25	7.50	N
Forbs (N = 6)					
Equisetum arvense (common horsetail)	10.0	0-10	25	2.50	N
Galium labradoricum (Labrador bedstraw)	1.8	0-3	50	0.88	N
Menyanthes trifoliata (buck-bean)	3.0	0-3	25	0.75	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	25	0.13	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	25	0.13	N
Potentilla palustris (marsh cinquefoil)	3.0	0-3	50	1.50	N

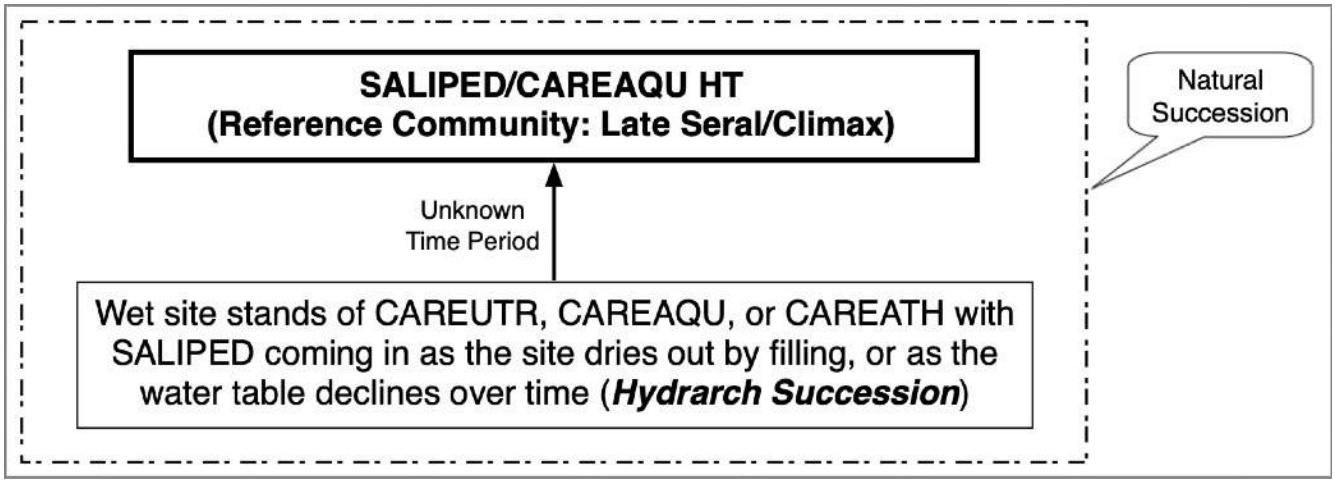
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type develops on a site typically through primary succession (hydrarch succession), whereby a wet meadow stand of *Carex aquatilis* (water sedge), *Carex atherodes* (awned sedge), or *Carex utriculata* (beaked sedge) located in a shallow depression gradually fills in or dries out enough for *Salix pedicellaris* (bog willow) to become established.

Figure 74 shows a schematic diagram of vegetation successional pathways on sites of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type.



Successional Pathway of *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
SALIPED—*Salix pedicellaris* (bog willow)
SALIPED/CAREAQU HT—*Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type

Figure 74. Successional pathway for sites of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

See the Undisturbed Late Seral/Climax Stand Characteristics Section above for a discussion on vegetation present at undisturbed late seral to climax sites.

EDATOPE

Figure 75 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

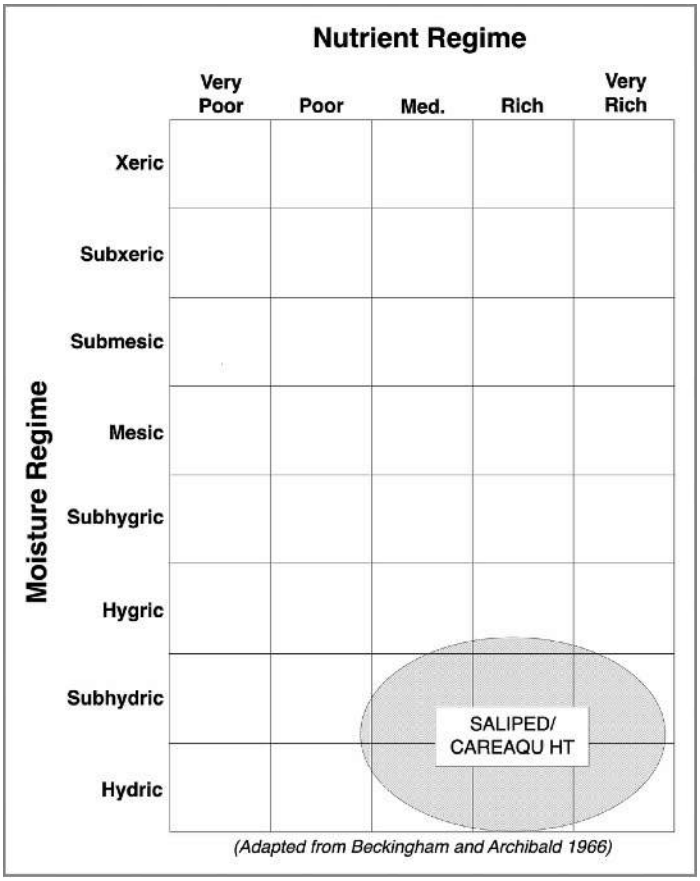


Figure 75. Edatope grid position for the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type (SALIPED/CAREAQU HT)

SOILS

Soils information is currently unavailable for sites supporting the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites are most likely to be bog, fen, or muskeg communities dominated by wetland *Carex* (sedge) species, or open water. Adjacent drier sites communities may have the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type, or have communities dominated by *Abies lasiocarpa* (subalpine fir), *Picea mariana* (black spruce), and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix pedicellaris* (bog willow)**—*Salix pedicellaris* (bog willow) is found in sphagnum bogs, fens, and muskegs in Alberta (Hitchcock and others 1969).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is very common and widely distributed across Alberta (Tannas 1997a). It is a wetland species, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). *Carex aquatilis* (water sedge) is a native, wetland obligate, long-lived perennial. It is a sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of finer roots (Hauser 2006). It thrives on disturbed sites, is shade intolerant, and occurs in various stages of seral succession (Hauser 2006).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is common and widely distributed across Alberta. It is a wetland obligate, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). It is a long-lived perennial sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of fine roots (Johnson and others 1995).

Carex utriculata (beaked sedge) is strongly rhizomatous and colonial, typically forming a dense sod. Creeping rhizomes are long, slender or stout, and deep-seated. It grows on sites with high soil moisture, typically with the water table at or above the soil surface during the growing season. This is one of our wettest sedges. On some sites, water tables are above the soil surface all year, and rarely drop below the rooting zone. The species occurs on a range of soil types, with textures from silt loams or silty clays to loamy sands (Anderson 2008).

Carex utriculata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates with continually high water tables and persists indefinitely to form climax communities (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) is very common and widely distributed across Alberta (Tannas 1997a). The species is a wetland obligate, growing along slough margins, shorelines, in marshes, and wet meadows, often in standing water (Tannas 1997a). It is a long-lived perennial with moderate tolerance for drought, while tolerance is low for salinity, acidity, and shade. It does best on clay to clay loam soils (Hardy BBT Limited 1989).

Livestock

***Salix pedicellaris* (bog willow)**—Due to saturated soil conditions of the sites, stands of *Salix pedicellaris* (bog willow) have little or no potential for livestock utilization (Thompson and Hansen 2003).

***Carex aquatilis* (water sedge)**—The livestock forage value of *Carex aquatilis* (water sedge) is rated as good (Tannas 1997a), but varies with region, season, and previous grazing use. On narrow riparian or wetland sites within large pastures, *Carex* species (sedges) are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur. In general, *Carex* species (sedges) should respond satisfactorily to traditional grazing systems. However, on streamside sites ample residual cover should be left to protect the soil surface and trap sediments during fall rains or spring runoff. Removing cattle for at least 30 days from these streamside sites for sedge regrowth at the end of the growing season should provide sufficient residual cover (Myers 1989).

Given that *Carex aquatilis* (water sedge) grows in wet places, it is generally not grazed until late summer and fall when soils have dried (Hauser 2006). Very wet soils may deter animal use until they dry. However, if high level of grazing does occur, there will be a marked decrease in *Carex aquatilis* (water sedge) and an increase in the less palatable *Juncus balticus* (wire rush) (Tannas 1997a).

***Carex utriculata* (beaked sedge)**—Livestock forage value of *Carex utriculata* (beaked sedge) is high (Tannas 1997a, Beckingham 1991). The species is palatable in the spring, but palatability declines as the plants become coarse and tough in summer (Tannas 1997a, Hansen and others 1988). Relative palatability may then increase

again in fall as the sedge cures and upland forage is less attractive. *Carex utriculata* (beaked sedge) cover decreases in response to high levels of grazing pressure, and will be replaced with less productive and less palatable species, such as *Juncus balticus* (wire rush) and *Poa* species (bluegrass) (Thompson and Hansen 2003).

In general, *Carex* species (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites, residual cover should be left to protect the banks and the soil surface, and to filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days should provide time for sufficient residual cover regrowth on streamside riparian sites (Myers 1989).

***Carex atherodes* (awned sedge)**—Livestock forage value of *Carex atherodes* (awned sedge) is high (Tannas 1997a, Beckingham 1991). *Carex atherodes* (awned sedge) provides good protein and a balance of other nutritional elements, while remaining palatable during the late season when upland forage is less palatable (Tannas 1997a, Hansen and others 1988). In general, *Carex* (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites residual cover should be left to protect the soil surface and filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days for sedge regrowth should provide sufficient residual cover on streamside riparian sites (Myers 1989).

Very wet soils may deter animal use until they dry, allowing the most palatable species to replenish their carbohydrate reserves and to persist in these communities. However, if high levels of grazing do occur, there will be a marked decrease in *Carex atherodes* (awned sedge) with an increase in less palatable species, such as *Juncus balticus* (wire rush). *Carex atherodes* (awned sedge) has medium palatability and medium tolerance for livestock use. Its chemical composition is similar to that of meadow grasses, upland short grass, and mixed prairie species. Seasonal declines in crude protein, phosphorous and carotene were also similar to that of native upland grasses (Hardy BBT Limited 1989).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix pedicellaris* (bog willow)**—Wildlife values associated with stands of *Salix pedicellaris* (bog willow) are not well understood, but it is likely that moose utilize this forage during certain seasons. Songbirds would also likely find nesting and feeding habitat among the shrubs and seed bearing graminoids present (Thompson and Hansen 2003).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is grazed by many ungulates, including moose, caribou, and elk, but it is not a major component of their diet. Due to the saturated habitat of the species, grazing by most ungulates is limited. *Carex aquatilis* (water sedge) habitat provides nesting and hiding cover for some birds, waterfowl, and small mammals. In riparian and wetland sites, The species is also an important source of food for a variety of waterfowl (Hauser 2006).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is grazed by moose, elk, mule deer, bison, grizzly bears, and sandhill cranes (Anderson 2008). The species is an important component of valuable breeding and feeding grounds for geese and other waterfowl. Birds commonly associated with *Carex utriculata* (beaked sedge) habitats include mallard, green-winged teal, common yellowthroat, red-winged black bird, song sparrow, and tree swallow. *Carex utriculata* (beaked sedge) stands are usually more important as feeding grounds than as nesting grounds because of their low stature, lack of structural diversity, and high water levels. Elk and moose often graze *Carex utriculata* (beaked sedge) stands when *Carex atherodes* (awned sedge) is present (Anderson 2008).

***Carex atherodes* (awned sedge)**—Wetland sedge species, such as *Carex atherodes* (awned sedge) are an important component of valuable nesting and feeding grounds for geese and other waterfowl. These stands of prolific seed producing species are usually more important as feeding grounds than as nesting grounds because of their low stature, high water level, and lack of structural diversity (Thompson and Hansen 2003).

Fisheries

***Carex aquatilis* (water sedge)**—Stands of *Carex aquatilis* (water sedge) often are adjacent to streams supporting trout fisheries. The combined tufted and rhizomatous growth habit of the species effectively stabilizes streambanks. Overhanging *Carex* species (sedges) along the banks provide valuable resting cover and shade for fish (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—The dense network of roots of the rhizomatous *Carex utriculata* (beaked sedge) is very effective in binding soil and stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish (Thompson and Hansen 2003).

***Carex atherodes* (awned sedge)**—Stands of *Carex atherodes* (awned sedge) are found more frequently in lentic situations around depressional wetlands, sloughs, potholes, wet meadows, and fens where fish habitat is not at issue (Thompson and Hansen 2003).

Fire

***Salix pedicellaris* (bog willow)**—Sites supporting stands of *Salix pedicellaris* (bog willow) are generally too wet to carry wildfire (Thompson and Hansen 2003).

***Carex aquatilis* (water sedge)**—Sites supporting stands of *Carex aquatilis* (water sedge) seldom burn, except in periods of severe drought. When stands of the species do burn, the plants are usually top-killed by the fire and soon re-establish after the fire by seed and/or lateral spread of surviving rhizomes (Hauser 2006). The rhizomes are approximately 5 cm below the ground surface, and are somewhat protected from the heat. The wet habitat also provides protection for roots and rhizomes, although the better-drained areas are more susceptible to fires during dry periods.

Stands of *Carex aquatilis* (water sedge) are suited to prescribed fire, but exclusion of livestock during the year prior to burning is necessary. Residual cover burns well in spring, prior to the growing season. Fire will reduce litter accumulations and temporarily increase productivity. However, species composition in the community will not drastically shift from dominance by *Carex aquatilis* (water sedge) (DeBenedetti and Parsons 1984). Care must be taken in burning along streambanks, so as to avoid impairing the excellent erosion protection provided by the species (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—Sites supporting stands of *Carex utriculata* (beaked sedge) are very wet, except at times of severe drought, and therefore they seldom burn. However, *Carex utriculata* (beaked sedge) sprouts from rhizomes, so it is often able to survive after being top-killed by fire. However, peat soils, common in these communities, can burn when dry, and the heat from such fires can penetrate the soil, destroying the sedge rhizomes. It is necessary that livestock be excluded during the year prior to burning. Caution should be used with fires along streams because of the excellent erosion protection *Carex utriculata* (beaked sedge) provides. Fires do little to change plant composition of beaked sedge communities (DeBenedetti and Parsons 1984). Fire may regress seral succession in treed or shrubby fen stands back to open sedge meadows that support little woody vegetation (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) grows on wet sites that seldom dry out enough to carry fire, but the species is adapted to light intensity fire. Residual cover should burn well in early spring, prior

to the growing season. Burning will reduce litter accumulations and temporarily increase productivity (Hansen and others 1988), but care should be taken with burning to avoid damage to the excellent soil erosion protection this species provides. Under drought conditions, there is danger of burning the soil peat layer and damaging the roots (Thompson and Hansen 2003).

Rehabilitation/Restoration Considerations

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) provides excellent erosion protection along streambanks, buffering against the erosive force of flood events, and filtering sediments during spring flows. Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex aquatilis* (water sedge) tends to form a dense, thick sod that is highly resistant to erosion. (Hauser 2006).

***Carex utriculata* (beaked sedge)**—Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex utriculata* (beaked sedge) has a dense network of rhizomatous roots and forms a thick sod that is highly resistant to erosion and effective in stabilizing streambanks (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) rates high in value for erosion control, and high for its persistence, once established on a site (Hardy BBT Limited 1989). Generally, due to their stronger rhizomatous roots, *Carex* species (sedges) offer better streambank protection than grasses. *Carex atherodes* (awned sedge) forms a dense, thick sod highly resistant to erosion. Along streambanks, the sod may overhang the bank and sag into the water, providing additional protection from erosion (Thompson and Hansen 2003).

Carex atherodes (awned sedge) is suited for long-term revegetation of disturbed sites and erosion control on sites with a high water table. The species can rapidly re-colonize disturbed sites by seed and rhizome extension. Its rhizomes form a dense network effective in stabilizing streambanks and preventing soil erosion (Thompson and Hansen 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type has not been described in the region.

Salix pedicellaris/Potentilla palustris Habitat Type
(bog willow/marsh cinquefoil Habitat Type)

SALIPED/POTEPAL Habitat Type
Number of Stands = 7 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 2; Other Data Sets = 5)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. Stands of this habitat type are found on shrubby rich fen wetlands on geomorphically maturing glacial depressions on sites that no longer have open water. The substrate is organic—commonly a floating mat of plant material capable of supporting low shrubs, but not substantial enough to support trees or tall shrubs.

Photo 17 shows a typical stand of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type.

Photo 17. A stand of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 353 shows the five most prominent plant species among the four lifeforms for species recorded in all seven stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type. *Salix pedicellaris* (bog willow) is most prominent, followed by *Carex diandra* (two-stamened sedge), *Calamagrostis canadensis* (marsh reed grass), and *Potentilla palustris* (marsh cinquefoil). No other species is more than moderately prominent in these stands.

Table 353. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (number = 7 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Betula papyrifera (white birch)	0.57	Native
Larix laricina (tamarack)	0.50	Native
Picea mariana (black spruce)	0.07	Native
Populus tremuloides (aspen)	0.07	Native
Shrubs		
Salix pedicellaris (bog willow)	41.43	Native
Betula glandulosa (bog birch)	3.71	Native
Betula pumila (dwarf birch)	2.86	Native
Salix discolor (pussy willow)	0.86	Native
Andromeda polifolia (bog rosemary)	0.43	Native
Graminoids		
Carex diandra (two-stamened sedge)	25.71	Native
Calamagrostis canadensis (marsh reed grass)	11.43	Native
Calamagrostis stricta (narrow reed grass)	8.00	Native
Carex limosa (mud sedge)	5.79	Native
Carex lasiocarpa (hairy-fruited sedge)	2.86	Native

Table 353. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Potentilla palustris (marsh cinquefoil)	10.43	Native
Menyanthes trifoliata (buck-bean)	4.79	Native
Galium labradoricum (Labrador bedstraw)	1.43	Native
Petasites frigidus (arctic sweet coltsfoot)	1.43	Native
Epilobium palustre (marsh willowherb)	0.86	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 354 through Table 357, break out the vegetation recorded in all seven stands sampled of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, moderately species rich, shrub dominated habitat type of incidental occurrence across the study area.

Table 354 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type. For the 7 stands comprising the habitat type, the number of unique species was 43 with 42 (97.7 percent) of them being native species.

Table 354. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (number = 7 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	4	4	0	0
Shrubs	7	7	0	0
Graminoids	12	12	0	0
Forbs	20	19	0	1
TOTAL	***43 (100.0%)***	***42 (97.7%)***	***0 (0.0%)***	***1 (2.3%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 355 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type. The average number of species per stand is 12.5, with native species comprising 12.4 species per stand or 99.2 percent.

Table 355. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (number = 7 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.0	1.0	0.0	0.0
Shrubs	2.3	2.3	0.0	0.0
Graminoids	4.1	4.1	0.0	0.0
Forbs	5.1	5.0	0.0	0.1
TOTAL	***12.5 (100.0%)***	***12.4 (99.2%)***	***0.0 (0.0%)***	***0.1 (0.8%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 356 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type. The average canopy cover per stand is 132.0 percent, with native species comprising 131.9 percent or 99.9 percent of the total amount of average canopy cover per stand.

Table 356. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (number = 7 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.2%	1.2%	0.0%	0.0%
Shrubs	49.4%	49.4%	0.0%	0.0%
Graminoids	59.1%	59.1%	0.0%	0.0%
Forbs	22.2%	22.1%	0.0%	0.1%
TOTAL	***132.0% (100.0%)***	***131.9% (99.9%)***	***0.0% (0.0%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 357 shows the average number of species and average canopy cover by lifeform in stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type. The average number of species per stand was 12.5 with an average canopy cover of 132.0 percent.

Table 357. Average number of species and average canopy cover by lifeform in stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (number = 7 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	1.0	1.2%
Shrubs	2.3	49.4%
Graminoids	4.1	59.1%
Forbs	5.1	22.2%
TOTAL	***12.5***	***132.0%***

Sampled Stands Plant Species List

A total of 43 plant species were recorded on at least one of seven stands sampled of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (Table 358). Four tree species in a small amounts were recorded; and of seven shrub species, *Salix pedicellaris* (bog willow) is by far most prominent. *Carex diandra* (two-stamened sedge) dominates the 12 graminoids recorded, followed well back by *Calamagrostis canadensis* (marsh reed grass). Of 20 forb species, only *Potentilla palustris* (marsh cinquefoil) is very prominent.

Table 358. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (number = 7 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 4)					
Betula papyrifera (white birch)	1.3	0-3	43	0.57	N
Larix laricina (tamarack)	1.8	0-3	29	0.50	N
Picea mariana (black spruce)	0.5	0-0.5	14	0.07	N
Populus tremuloides (aspen)	0.5	0-0.5	14	0.07	N
Shrubs (N = 7)					
Andromeda polifolia (bog rosemary)	3.0	0-3	14	0.43	N
Betula glandulosa (bog birch)	8.7	0-20	43	3.71	N
Betula pumila (dwarf birch)	20.0	0-20	14	2.86	N
Salix discolor (pussy willow)	3.0	0-3	29	0.86	N
Salix pedicellaris (bog willow)	41.4	10-60	100	41.43	N
Salix planifolia (flat-leaved willow)	0.5	0-0.5	14	0.07	N
Salix pseudomonticola (false mountain willow)	0.5	0-0.5	14	0.07	N
Graminoids (N = 12)					
Agrostis scabra (rough hair grass)	2.4	0-3	57	1.36	N
Calamagrostis canadensis (marsh reed grass)	40.0	0-70	29	11.43	N
Calamagrostis stricta (narrow reed grass)	18.7	0-50	43	8.00	N
Carex aquatilis (water sedge)	1.8	0-3	29	0.50	N

Table 358. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex chordorrhiza (prostrate sedge)	10.0	0-10	14	1.43	N
Carex curta (short sedge)	1.8	0-3	29	0.50	N
Carex diandra (two-stamened sedge)	25.7	10-60	100	25.71	N
Carex lasiocarpa (hairy-fruited sedge)	20.0	0-20	14	2.86	N
Carex limosa (mud sedge)	10.1	0-20	57	5.79	N
Carex utriculata (beaked sedge)	10.0	0-10	14	1.43	N
Eriophorum gracile (slender cotton grass)	0.5	0-0.5	14	0.07	N
Eriophorum viridi-carinatum (thin-leaved cotton grass)	0.5	0-0.5	14	0.07	N
Forbs (N = 20)					
Alisma plantago-aquatica (broad-leaved water-plantain)	0.5	0-0.5	14	0.07	N
Aster borealis (marsh aster)	0.5	0-0.5	43	0.21	N
Callitriche verna (vernal water-starwort)	3.0	0-3	14	0.43	N
Caltha palustris (marsh-marigold)	0.5	0-0.5	14	0.07	N
Epilobium palustre (marsh willowherb)	3.0	0-3	29	0.86	N
Equisetum fluviatile (swamp horsetail)	1.8	0-3	29	0.50	N
Equisetum hyemale (common scouring-rush)	0.5	0-0.5	14	0.07	N
Forb spp. (forb)	0.5	0-0.5	14	0.07	B
Fragaria virginiana (wild strawberry)	0.5	0-0.5	14	0.07	N
Galium labradoricum (Labrador bedstraw)	10.0	0-10	14	1.43	N
Galium trifidum (small bedstraw)	3.0	0-3	14	0.43	N
Mentha arvensis (wild mint)	0.5	0-0.5	14	0.07	N
Menyanthes trifoliata (buck-bean)	8.4	0-20	57	4.79	N
Pedicularis groenlandica (elephant's-head)	1.8	0-3	29	0.50	N
Petasites frigidus (arctic sweet coltsfoot)	10.0	0-10	14	1.43	N
Potentilla palustris (marsh cinquefoil)	10.4	3-20	100	10.43	N
Ranunculus circinatus (firm white water crowfoot)	0.5	0-0.5	14	0.07	N
Rumex occidentalis (western dock)	0.5	0-0.5	14	0.07	N
Scutellaria galericulata (marsh skullcap)	1.8	0-3	29	0.50	N
Triglochin maritima (seaside arrow-grass)	0.5	0-0.5	29	0.14	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The

index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 359 shows the five most prominent plant species among the four lifeforms for species recorded in all five relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type. *Salix pedicellaris* (bog willow) is most prominent here, followed by *Carex diandra* (two-stamened sedge), *Calamagrostis canadensis* (marsh reed grass), *Calamagrostis stricta* (narrow reed grass), and *Potentilla palustris* (marsh cinquefoil).

Table 359. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (number = 5 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Betula papyrifera (white birch)	0.80	Native
Larix laricina (tamarack)	0.10	Native
Picea mariana (black spruce)	0.10	Native
Populus tremuloides (aspen)	0.10	Native
Shrubs		
Salix pedicellaris (bog willow)	40.00	Native
Betula glandulosa (bog birch)	5.20	Native
Salix discolor (pussy willow)	1.20	Native
Andromeda polifolia (bog rosemary)	0.60	Native
Salix pseudomonticola (false mountain willow)	0.10	Native
Graminoids		
Carex diandra (two-stamened sedge)	26.00	Native
Calamagrostis canadensis (marsh reed grass)	16.00	Native
Calamagrostis stricta (narrow reed grass)	10.60	Native
Carex lasiocarpa (hairy-fruited sedge)	4.00	Native
Carex limosa (mud sedge)	2.10	Native
Forbs		
Potentilla palustris (marsh cinquefoil)	10.00	Native
Menyanthes trifoliata (buck-bean)	2.10	Native
Petasites frigidus (arctic sweet coltsfoot)	2.00	Native
Equisetum fluviatile (swamp horsetail)	0.70	Native
Callitriche verna (vernal water-starwort)	0.60	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.
[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 360 through Table 363, break out the vegetation recorded in five relatively undisturbed late seral to climax stands sampled of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, moderately species rich, shrub dominated habitat type of incidental occurrence across the study area.

Table 360 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type. For the 5 stands comprising the habitat type, the number of unique species was 31 with 30 (96.8 percent) of them being native species.

Table 360. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/ Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (number = 5 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	4	4	0	0
Shrubs	5	5	0	0
Graminoids	9	9	0	1
Forbs	13	12	0	0
TOTAL	***31 (100.0%)***	***30 (96.8%)***	***0 (0.0%)***	***1 (3.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 361 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type. The average number of species per stand is 11.4, with native species comprising 11.2 species per stand or 98.2 percent.

Table 361. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (number = 5 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.2	1.2	0.0	0.0
Shrubs	2.4	2.4	0.0	0.0
Graminoids	3.6	3.6	0.0	0.0
Forbs	4.2	4.0	0.0	0.2
TOTAL	***11.4 (100.0%)***	***11.2 (98.2%)***	***0.0 (0.0%)***	***0.2 (1.8%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 362 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type. The average canopy cover per stand is 126.4 percent, with native species comprising 126.3 percent or 99.9 percent of the total amount of average canopy cover per stand.

Table 362. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (number = 5 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.1%	1.1%	0.0%	0.0%
Shrubs	47.1%	47.1%	0.0%	0.0%
Graminoids	60.8%	60.8%	0.0%	0.0%
Forbs	17.4%	17.3%	0.0%	0.1%
TOTAL	***126.4% (100.0%)***	***126.3% (99.9%)***	***0.0% (0.0%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 363 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type. The average number of species per stand was 11.4 with an average canopy cover of 126.4 percent.

Table 363. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (number = 5 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	1.2	1.1%
Shrubs	2.4	47.1%
Graminoids	3.6	60.8%
Forbs	4.2	17.4%
TOTAL	***11.4***	***126.4%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 31 plant species were recorded on at least one of five relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (Table 364). Four tree species in small amounts were recorded; while of five shrub species, *Salix pedicellaris* (bog willow) is by far most prominent. Of nine graminoid species recorded, *Carex diandra* (two-stamened sedge) is dominant, followed well back by *Calamagrostis canadensis* (marsh reed grass) and *Calamagrostis stricta* (narrow reed grass). Of the 13 forb species, only *Potentilla palustris* (marsh cinquefoil) is very prominent.

Table 364. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (number = 5 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 4)					
Betula papyrifera (white birch)	1.3	0-3	60	0.80	N
Larix laricina (tamarack)	0.5	0-0.5	20	0.10	N
Picea mariana (black spruce)	0.5	0-0.5	20	0.10	N
Populus tremuloides (aspen)	0.5	0-0.5	20	0.10	N
Shrubs (N = 5)					
Andromeda polifolia (bog rosemary)	3.0	0-3	20	0.60	N
Betula glandulosa (bog birch)	8.7	0-20	60	5.20	N
Salix discolor (pussy willow)	3.0	0-3	40	1.20	N
Salix pedicellaris (bog willow)	40.0	10-60	100	40.00	N
Salix pseudomonticola (false mountain willow)	0.5	0-0.5	20	0.10	N
Graminoids (N = 9)					
Agrostis scabra (rough hair grass)	1.8	0-3	40	0.70	N
Calamagrostis canadensis (marsh reed grass)	40.0	0-70	40	16.00	N
Calamagrostis stricta (narrow reed grass)	26.5	0-50	40	10.60	N
Carex aquatilis (water sedge)	3.0	0-3	20	0.60	N
Carex curta (short sedge)	1.8	0-3	40	0.70	N
Carex diandra (two-stamened sedge)	26.0	10-60	100	26.00	N
Carex lasiocarpa (hairy-fruited sedge)	20.0	0-20	20	4.00	N

Table 364. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex limosa (mud sedge)	5.3	0-10	40	2.10	N
Eriophorum viridi-carinatum (thin-leaved cotton grass)	0.5	0-0.5	20	0.10	N
Forbs (N = 13)					
Aster borealis (marsh aster)	0.5	0-0.5	40	0.20	N
Callitriche verna (vernal water-starwort)	3.0	0-3	20	0.60	N
Equisetum fluviatile (swamp horsetail)	1.8	0-3	40	0.70	N
Forb spp. (forb)	0.5	0-0.5	20	0.10	B
Galium trifidum (small bedstraw)	3.0	0-3	20	0.60	N
Mentha arvensis (wild mint)	0.5	0-0.5	20	0.10	N
Menyanthes trifoliata (buck-bean)	5.3	0-10	40	2.10	N
Pedicularis groenlandica (elephant's-head)	3.0	0-3	20	0.60	N
Petasites frigidus (arctic sweet coltsfoot)	10.0	0-10	20	2.00	N
Potentilla palustris (marsh cinquefoil)	10.0	10-10	100	10.00	N
Rumex occidentalis (western dock)	0.5	0-0.5	20	0.10	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	20	0.10	N
Triglochin maritima (seaside arrow-grass)	0.5	0-0.5	40	0.20	N

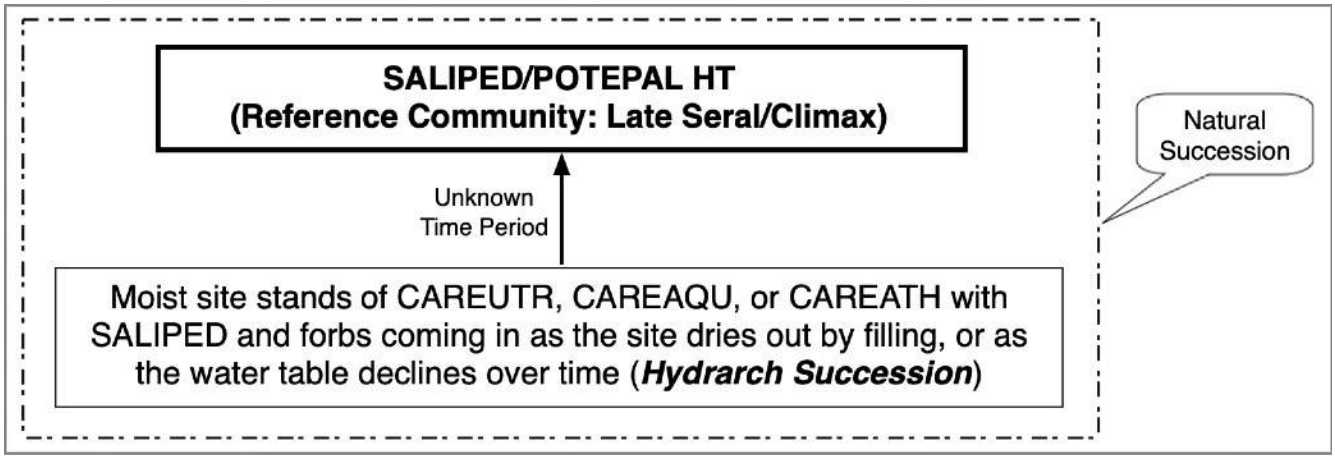
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type develops on a site typically through primary succession (hydrarch succession), whereby a wet meadow or shallow depression bog community containing *Potentilla palustris* (marsh cinquefoil) fills in or dries out enough for *Salix pedicellaris* (bog willow) to become established.

Figure 76 shows a schematic diagram of vegetation successional pathways on sites of the *Salix pedicellaris/ Potentilla palustris* (bog willow/marsh cinquefoil) habitat type.



Successional Pathway of *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
SALIPED—*Salix pedicellaris* (bog willow)
SALIPED/POTEPAL HT—*Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type

Figure 76. Successional pathway for sites of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 77 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

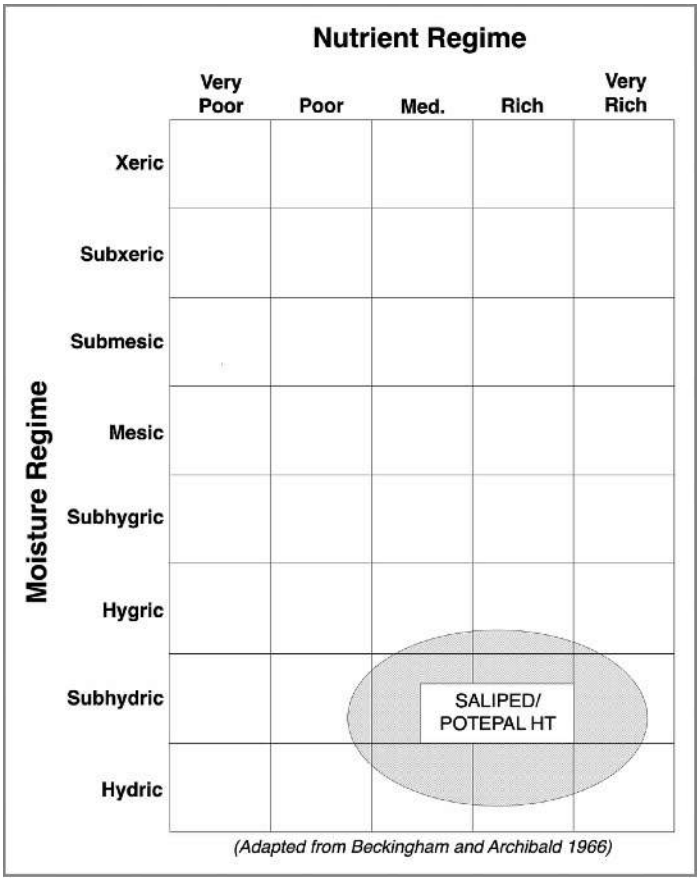


Figure 77. Edatope grid position for the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (SALIPED/POTEPAL HT)

SOILS

Soils information is currently unavailable for sites supporting the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites will most likely have the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type, or have a bog, fen, or muskeg community dominated by wetland *Carex* (sedge) species or open water. Adjacent drier sites may have communities dominated by *Abies lasiocarpa* (subalpine fir), *Picea mariana* (black spruce), and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix pedicellaris* (bog willow)**—*Salix pedicellaris* (bog willow) is found in sphagnum bogs, fens, and muskegs in Alberta (Hitchcock and others 1969).

***Potentilla palustris* (marsh cinquefoil)**—*Potentilla palustris* (marsh cinquefoil) grows in shallow, often sphagnum-dominated ponds, bogs, wet meadows, marshes, stream banks, and lake margins, mainly in boreal and low arctic habitats (Flora of North America 1993+, Hitchcock and others 1969).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

***Carex diandra* (two-stamened sedge)**—*Carex diandra* (two-stamened sedge) grows in swampy, marshy, or boggy areas, especially wet meadows, fens, muskegs, floating mats, and peaty or marly shores of lakes and ponds (Flora of North America 1993+, Hitchcock and others 1969).

Livestock

***Salix pedicellaris* (bog willow)**—Due to saturated soil conditions of the sites, stands of *Salix pedicellaris* (bog willow) have little or no potential for livestock utilization (Thompson and Hansen 2003).

***Potentilla palustris* (marsh cinquefoil)**—*Potentilla palustris* (marsh cinquefoil) is found on sites generally so wet that access to livestock is restricted, except during periods of severe drought.

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

***Carex diandra* (two-stamened sedge)**—*Carex diandra* (two-stamened sedge) grows on sites generally so wet that access to livestock is restricted, except during periods of severe drought.

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix pedicellaris* (bog willow)**—Wildlife values associated with stands of *Salix pedicellaris* (bog willow) are not well understood, but it is likely that moose utilize this forage during certain seasons. Songbirds would also likely find nesting and feeding habitat among the shrubs and seed bearing graminoids present (Thompson and Hansen 2003).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

Fire

***Salix pedicellaris* (bog willow)**—Sites supporting stands of *Salix pedicellaris* (bog willow) are generally too wet to carry wildfire (Thompson and Hansen 2003).

***Potentilla palustris* (marsh cinquefoil)**—*Potentilla palustris* (marsh cinquefoil) grows on sites that are generally too wet to carry fire, except during periods of severe drought.

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

***Carex diandra* (two-stamened sedge)**—*Carex diandra* (two-stamened sedge) grows on sites that are generally too wet to carry fire, except during periods of severe drought.

Rehabilitation/Restoration Considerations

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003).

Salix pedicellaris Community Type
(bog willow Community Type)

SALIPED Community Type
Number of Stands = 6 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 6; Other Data Sets = 0)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix pedicellaris* (bog willow) community type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. Stands of this community type are found on shrubby rich fen wetlands on geomorphically maturing glacial depressions that no longer have open water. The substrate is organic—commonly a floating mat of plant material capable of supporting low shrubs, but not substantial enough to support trees or tall shrubs.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 365 shows the five most prominent plant species among the four lifeforms for species recorded in all six stands of the *Salix pedicellaris* (bog willow) community type. *Salix pedicellaris* (bog willow) is most prominent, followed by *Carex chordorrhiza* (prostrate sedge). No other species here is more than moderately prominent.

Table 365. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix pedicellaris* (bog willow) community type (number = 6 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Larix laricina (tamarack)	0.67	Native
Shrubs		
Salix pedicellaris (bog willow)	31.67	Native
Betula pumila (dwarf birch)	8.50	Native
Andromeda polifolia (bog rosemary)	0.75	Native
Ledum groenlandicum (common Labrador tea)	0.08	Native
Oxycoccus microcarpus (small bog cranberry)	0.08	Native
Graminoids		
Carex chordorrhiza (prostrate sedge)	13.33	Native
Carex limosa (mud sedge)	8.50	Native
Carex livida (livid sedge)	5.50	Native
Scirpus hudsonianus (Hudson Bay bulrush)	5.00	Native
Carex lasiocarpa (hairy-fruited sedge)	3.83	Native
Forbs		
Equisetum fluviatile (swamp horsetail)	2.50	Native
Menyanthes trifoliata (buck-bean)	1.33	Native
Tofieldia glutinosa (sticky false asphodel)	0.67	Native
Utricularia intermedia (flat-leaved bladderwort)	0.58	Native
Equisetum scirpoides (dwarf scouring-rush)	0.50	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 366 through Table 369, break out the vegetation recorded in six stands of the *Salix pedicellaris* (bog willow) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, moderately species rich, shrub dominated community type of incidental occurrence across the study area.

Table 366 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix pedicellaris* (bog willow) community type. For the 6 stands comprising the community type, the number of unique species was 35 with 35 (100.0 percent) of them being native species.

Table 366. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix pedicellaris* (bog willow) community type (number = 6 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	5	5	0	0
Graminoids	14	14	0	0
Forbs	15	15	0	0
TOTAL	***35 (100.0%)***	***35 (100.0%)***	***0 (0.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 367 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix pedicellaris* (bog willow) community type. The average number of species per stand is 12.7, with native species comprising 12.7 species per stand or 100.0 percent.

Table 367. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix pedicellaris* (bog willow) community type (number = 6 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.5	0.5	0.0	0.0
Shrubs	2.7	2.7	0.0	0.0
Graminoids	4.2	4.2	0.0	0.0
Forbs	5.3	5.3	0.0	0.0
TOTAL	***12.7 (100.0%)***	***12.7 (100.0%)***	***0.0 (0.0%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 368 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix pedicellaris* (bog willow) community type. The average canopy cover per stand is 95.3 percent, with native species comprising 95.3 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 368. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix pedicellaris* (bog willow) community type (number = 6 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.7%	0.7%	0.0%	0.0%
Shrubs	41.1%	41.1%	0.0%	0.0%
Graminoids	45.5%	45.5%	0.0%	0.0%
Forbs	8.1%	8.1%	0.0%	0.0%
TOTAL	***95.3% (100.0%)***	***95.3% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 369 shows the average number of species and average canopy cover by lifeform in stands of the *Salix pedicellaris* (bog willow) community type. The average number of species per stand was 12.7 with an average canopy cover of 95.3 percent.

Table 369. Average number of species and average canopy cover by lifeform in stands of the *Salix pedicellaris* (bog willow) community type (number = 6 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.5	0.7%
Shrubs	2.7	41.1%
Graminoids	4.2	45.5%
Forbs	5.3	8.1%
TOTAL	***12.7***	***95.3%***

Sampled Stands Plant Species List

A total of 35 plant species were recorded on at least one of six stands sampled of the *Salix pedicellaris* (bog willow) community type (Table 370). One tree species, *Larix laricina* (tamarack), was recorded in a small amount; while of five shrub species, *Salix pedicellaris* (bog willow) is by far most prominent. Of 14 graminoid species recorded, *Carex chordorrhiza* (prostrate sedge) is most prominent; while of the 15 forb species, none is very prominent.

Table 370. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix pedicellaris* (bog willow) community type (number = 6 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 1)					
Larix laricina (tamarack)	1.3	0-3	50	0.67	N
Shrubs (N = 5)					
Andromeda polifolia (bog rosemary)	1.1	0-3	67	0.75	N
Betula pumila (dwarf birch)	12.8	0-40	67	8.50	N
Ledum groenlandicum (common Labrador tea)	0.5	0-0.5	17	0.08	N
Oxycoccus microcarpus (small bog cranberry)	0.5	0-0.5	17	0.08	N
Salix pedicellaris (bog willow)	31.7	10-90	100	31.67	N
Graminoids (N = 14)					
Carex chordorrhiza (prostrate sedge)	26.7	0-30	50	13.33	N
Carex diandra (two-stamened sedge)	10.0	0-10	17	1.67	N
Carex gynocrates (northern bog sedge)	4.5	0-10	50	2.25	N
Carex lasiocarpa (hairy-fruited sedge)	7.7	0-10	50	3.83	N
Carex limosa (mud sedge)	10.2	0-30	83	8.50	N
Carex livida (livid sedge)	16.5	0-30	33	5.50	N
Carex microptera (small-winged sedge)	20.0	0-20	17	3.33	N
Carex tenera (broad-fruited sedge)	10.0	0-10	17	1.67	N
Deschampsia cespitosa (tufted hair grass)	0.5	0-0.5	17	0.08	N
Eriophorum brachyantherum (close-sheathed cotton grass)	0.5	0-0.5	17	0.08	N
Eriophorum viridi-carinatum (thin-leaved cotton grass)	0.5	0-0.5	17	0.08	N
Muhlenbergia glomerata (bog muhly)	0.5	0-0.5	17	0.08	N
Scirpus hudsonianus (Hudson Bay bulrush)	30.0	0-30	17	5.00	N
Scirpus spp. (bulrush)	0.5	0-0.5	17	0.08	N
Forbs (N = 15)					
Drosera anglica (oblong-leaved sundew)	0.5	0-0.5	50	0.25	N
Epilobium palustre (marsh willowherb)	0.5	0-0.5	17	0.08	N
Equisetum fluviatile (swamp horsetail)	3.0	0-3	83	2.50	N
Equisetum palustre (marsh horsetail)	0.5	0-0.5	17	0.08	N
Equisetum scirpoides (dwarf scouring-rush)	3.0	0-3	17	0.50	N
Equisetum variegatum (variegated horsetail)	0.5	0-0.5	17	0.08	N
Galium labradoricum (Labrador bedstraw)	3.0	0-3	17	0.50	N
Menyanthes trifoliata (buck-bean)	1.3	0.5-3	100	1.33	N
Parnassia palustris (northern grass-of-parnassus)	0.5	0-0.5	17	0.08	N
Pedicularis labradorica (Labrador lousewort)	3.0	0-3	17	0.50	N
Pedicularis parviflora (swamp lousewort)	3.0	0-3	17	0.50	N
Smilacina trifolia (three-leaved Solomon's-seal)	0.5	0-0.5	33	0.17	N
Tofieldia glutinosa (sticky false asphodel)	1.3	0-3	50	0.67	N
Triglochin maritima (seaside arrow-grass)	0.5	0-0.5	50	0.25	N
Utricularia intermedia (flat-leaved bladderwort)	1.8	0-3	33	0.58	N

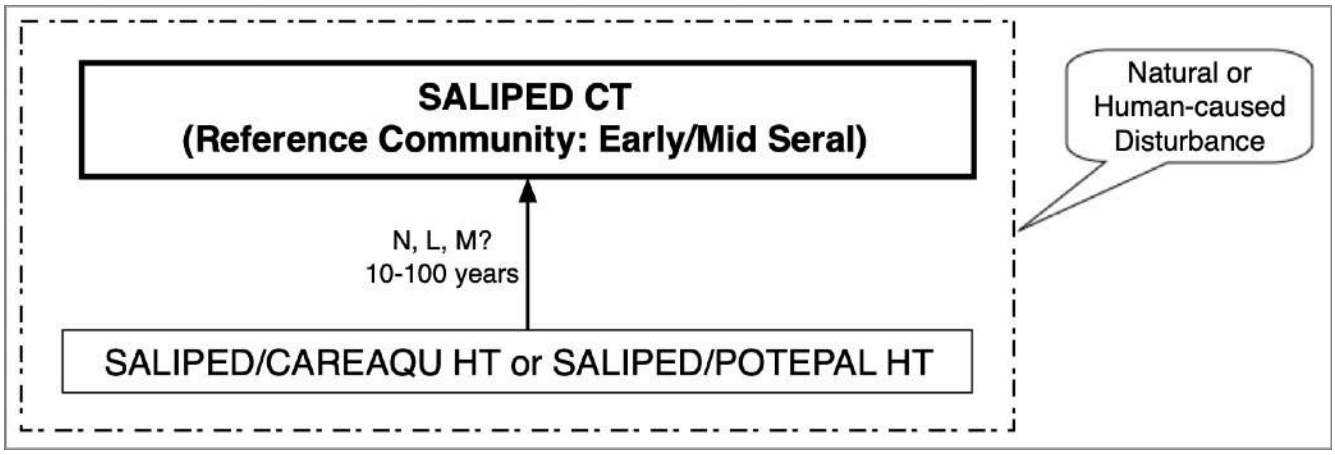
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix pedicellaris* (bog willow) community type is usually the result of intensive grazing by livestock during periods of drought, when the animals can gain access to stands of either the *Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type or the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type and deplete the palatable forage species, replacing them with disturbance species, such as *Poa pratensis* (Kentucky bluegrass).

Figure 78 shows a schematic diagram of vegetation successional pathways on sites of the *Salix pedicellaris* (bog willow) community type.



Successional Pathway of *Salix pedicellaris* (bog willow) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix pedicellaris* (bog willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
SALIPED/CAREAQU HT—*Salix pedicellaris/Carex aquatilis* (bog willow/water sedge) habitat type
SALIPED CT—*Salix pedicellaris* (bog willow) community type
SALIPED/POTEPAL HT—*Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type

Figure 78. Successional pathway for sites of the *Salix pedicellaris* (bog willow) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 79 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix pedicellaris* (bog willow) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

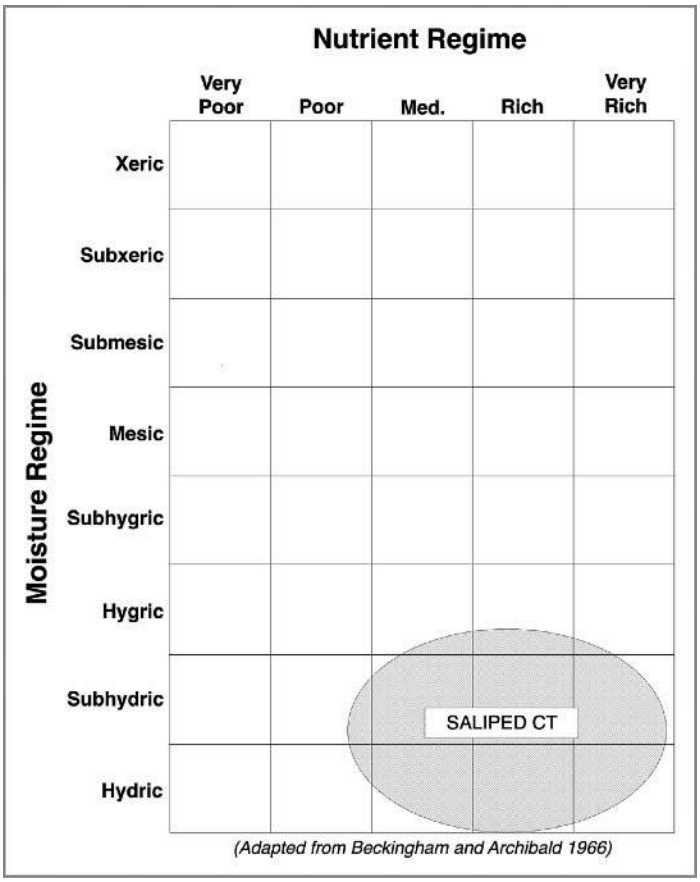


Figure 79. Edatope grid position for the *Salix pedicellaris* (bog willow) community type (SALIPED CT)

SOILS

Soils information is currently unavailable for sites supporting the *Salix pedicellaris* (bog willow) community type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites will most likely be a bog, fen, or muskeg community dominated by wetland *Carex* (sedge) species or open water. Adjacent drier sites are likely to have communities dominated by *Abies lasiocarpa* (subalpine fir), *Picea mariana* (black spruce), and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix pedicellaris* (bog willow)**—*Salix pedicellaris* (bog willow) is found in sphagnum bogs, fens, and muskegs in Alberta (Hitchcock and others 1969).

Livestock

***Salix pedicellaris* (bog willow)**—Due to saturated soil conditions of the sites, stands of *Salix pedicellaris* (bog willow) have little or no potential for livestock utilization (Thompson and Hansen 2003).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix pedicellaris* (bog willow)**—Wildlife values associated with stands of *Salix pedicellaris* (bog willow) are not well understood, but it is likely that moose utilize this forage during certain seasons. Songbirds would also likely find nesting and feeding habitat among the shrubs and seed bearing graminoids present (Thompson and Hansen 2003).

Fire

***Salix pedicellaris* (bog willow)**—Sites supporting stands of *Salix pedicellaris* (bog willow) are generally too wet to carry wildfire (Thompson and Hansen 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix pedicellaris* (bog willow) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix pedicellaris* (bog willow) community type has not been described in the region.

Salix petiolaris/Carex atherodes Habitat Type
(basket willow/awned sedge Habitat Type)

SALIPET/CAREATH Habitat Type
Number of Stands = 12 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 6; Other Data Sets = 6)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This habitat type is typically found around shallow lakeshores, sloughs, depressional wetlands, and wet meadows. It occupies sites on the wetter side of the *Salix petiolaris* (basket willow) moisture spectrum.

Photo 18 shows a typical stand of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type.

Photo 18. A stand of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 371 shows the five most prominent plant species among the four lifeforms for species recorded in all 12 stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. *Salix petiolaris* (basket willow) is by far most prominent in these stands, followed by *Carex atherodes* (awned sedge) and *Carex utriculata* (beaked sedge). No other species here is more than moderately prominent.

Table 371. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (number = 12 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus tremuloides (aspen)	0.08	Native
Shrubs		
Salix petiolaris (basket willow)	60.42	Native
Betula glandulosa (bog birch)	3.67	Native
Salix candida (hoary willow)	3.33	Native
Salix pedicellaris (bog willow)	2.50	Native
Salix planifolia (flat-leaved willow)	1.88	Native
Graminoids		
Carex atherodes (awned sedge)	19.42	Native
Carex utriculata (beaked sedge)	14.38	Native
Poa pratensis (Kentucky bluegrass)	4.17	Introduced
Alopecurus occidentalis (alpine foxtail)	3.33	Native
Carex aquatilis (water sedge)	3.33	Native
Forbs		
Aster spp. (aster)	1.92	Native
Geum rivale (purple avens)	1.71	Native
Geum macrophyllum (large-leaved yellow avens)	1.67	Native
Callitriche verna (vernal water-starwort)	0.83	Native
Cicuta maculata (water-hemlock)	0.83	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 372 through Table 375, break out the vegetation recorded in all 12 stands sampled of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated habitat type of minor occurrence across the study area.

Table 372 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. For the 12 stands comprising the habitat type, the number of unique species was 102 with 87 (85.3 percent) of them being native species.

Table 372. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (number = 12 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	19	17	0	2
Graminoids	28	22	5	1
Forbs	54	47	4	3
TOTAL	***102 (100.0%)***	***87 (85.3%)***	***9 (8.8%)***	***6 (5.9%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 373 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. The average number of species per stand is 18.3, with native species comprising 16.3 species per stand or 89.1 percent.

Table 373. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (number = 12 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.2	0.2	0.0	0.0
Shrubs	4.1	3.8	0.0	0.3
Graminoids	5.2	4.3	0.8	0.1
Forbs	8.8	8.0	0.5	0.3
TOTAL	***18.3 (100.0%)***	***16.3 (89.1%)***	***1.3 (7.1%)***	***0.7 (3.8%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 374 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. The average canopy cover per stand is 150.3 percent, with native species comprising 142.3 percent or 94.7 percent of the total amount of average canopy cover per stand.

Table 374. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (number = 12 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.1%	0.1%	0.0%	0.0%
Shrubs	75.4%	75.3%	0.0%	0.1%
Graminoids	60.0%	53.5%	6.5%	0.0%
Forbs	14.8%	13.5%	0.5%	0.9%
TOTAL	***150.3% (100.0%)***	***142.3% (94.7%)***	***6.9% (4.6%)***	***1.1% (0.7%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 375 shows the average number of species and average canopy cover by lifeform in stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. The average number of species per stand was 18.3 with an average canopy cover of 150.3 percent.

Table 375. Average number of species and average canopy cover by lifeform in stands of the *Salix petiolaris/ Carex atherodes* (basket willow/awned sedge) habitat type (number = 12 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.2	0.1%
Shrubs	4.1	75.4%
Graminoids	5.2	60.0%
Forbs	8.8	14.8%
TOTAL	***18.3***	***150.3%***

Sampled Stands Plant Species List

A total of 102 plant species were recorded on at least one of 12 stands sampled of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (Table 376). One tree species, *Populus tremuloides* (aspen), was recorded in a very small amount; while of 19 shrub species, only *Salix petiolaris* (basket willow) is highly prominent. *Carex atherodes* (awned sedge) and *Carex utriculata* (beaked sedge) dominate the 28 graminoids recorded, while of 54 forb species recorded, none is very prominent.

Table 376. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (number = 12 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
	Trees (N = 1)				
Populus tremuloides (aspen)	0.5	0-0.5	17	0.08	N
	Shrubs (N = 19)				
Betula glandulosa (bog birch)	8.8	0-20	42	3.67	N
Betula pumila (dwarf birch)	3.0	0-3	8	0.25	N
Potentilla fruticosa (shrubby cinquefoil)	3.7	0-10	25	0.92	N
Ribes oxyacanthoides (northern gooseberry)	1.1	0-3	33	0.37	N
Ribes spp. (currant)	0.5	0-0.5	8	0.04	B
Rosa spp. (rose)	0.5	0-0.5	17	0.08	B
Rubus arcticus (dwarf raspberry)	2.2	0-3	25	0.54	N
Rubus idaeus (wild red raspberry)	0.5	0-0.5	8	0.04	N
Rubus pubescens (dewberry)	0.5	0-0.5	8	0.04	N
Salix bebbiana (beaked willow)	3.0	0-3	17	0.50	N
Salix brachycarpa (short-capsuled willow)	0.5	0-0.5	8	0.04	N
Salix candida (hoary willow)	20.0	0-20	17	3.33	N
Salix lutea (yellow willow)	0.5	0-0.5	8	0.04	N
Salix maccalliana (velvet-fruited willow)	3.0	0-3	8	0.25	N
Salix pedicellaris (bog willow)	30.0	0-30	8	2.50	N
Salix petiolaris (basket willow)	60.4	30-97.5	100	60.42	N
Salix planifolia (flat-leaved willow)	3.8	0-10	50	1.88	N
Vaccinium caespitosum (dwarf bilberry)	3.0	0-3	8	0.25	N
Vaccinium spp. (bilberry)	3.0	0-3	8	0.25	N

Table 376. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Graminoids (N = 28)					
Agropyron trachycaulum (slender wheat grass)	10.0	0-10	8	0.83	N
Agrostis scabra (rough hair grass)	3.0	0-3	17	0.50	N
Agrostis stolonifera (redtop)	7.7	0-10	25	1.92	I
Alopecurus occidentalis (alpine foxtail)	10.0	0-10	33	3.33	N
Bromus ciliatus (fringed brome)	1.8	0-3	17	0.29	N
Bromus inermis (smooth brome)	0.5	0-0.5	17	0.08	I
Calamagrostis canadensis (marsh reed grass)	15.0	0-20	17	2.50	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	8	0.83	N
Carex aquatilis (water sedge)	20.0	0-30	17	3.33	N
Carex atherodes (awned sedge)	46.6	0-80	42	19.42	N
Carex praegracilis (graceful sedge)	20.0	0-20	8	1.67	N
Carex preslii (Presl sedge)	10.0	0-10	8	0.83	N
Carex spp. (sedge)	10.0	0-10	8	0.83	N
Carex utriculata (beaked sedge)	14.4	0.5-60	100	14.38	N
Deschampsia cespitosa (tufted hair grass)	0.5	0-0.5	8	0.04	N
Elymus innovatus (hairy wild rye)	1.8	0-3	17	0.29	N
Festuca idahoensis (bluebunch fescue)	0.5	0-0.5	8	0.04	N
Festuca ovina (sheep fescue)	3.0	0-3	8	0.25	I
Festuca rubra subsp. *arctica* (Richardson's fescue)	3.0	0-3	8	0.25	N
Grass spp. (Unknown grass)	0.5	0-0.5	8	0.04	B
Juncus balticus (wire rush)	4.5	0-10	25	1.13	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	17	0.08	N
Melica smithii (melic grass)	10.0	0-10	17	1.67	N
Phleum pratense (timothy)	0.5	0-0.5	8	0.04	I
Poa palustris (fowl bluegrass)	4.5	0-10	25	1.13	N
Poa pratensis (Kentucky bluegrass)	25.0	0-30	17	4.17	I
Scirpus microcarpus (small-fruited bulrush)	0.5	0-0.5	8	0.04	N
Scirpus paludosus (prairie bulrush)	0.5	0-0.5	17	0.08	N
Forbs (N = 54)					
Achillea millefolium (common yarrow)	0.5	0-0.5	42	0.21	N
Aster ciliolatus (Lindley's aster)	3.0	0-3	8	0.25	N
Aster conspicuus (showy aster)	0.5	0-0.5	8	0.04	N
Aster laevis (smooth aster)	0.5	0-0.5	17	0.08	N
Aster modestus (large northern aster)	0.5	0-0.5	8	0.04	N
Aster sibiricus (Arctic aster)	3.0	0-3	8	0.25	N
Aster spp. (aster)	7.7	0-10	25	1.92	N
Callitriche verna (vernal water-starwort)	10.0	0-10	8	0.83	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	17	0.08	N
Cicuta maculata (water-hemlock)	10.0	0-10	8	0.83	N
Cirsium arvense (Canada thistle)	1.8	0-3	17	0.29	I
Epilobium angustifolium (common fireweed)	0.5	0-0.5	50	0.25	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	8	0.04	N
Equisetum arvense (common horsetail)	0.5	0-0.5	8	0.04	N

Table 376. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Forb spp. (forb)	0.5	0-0.5	8	0.04	B
Fragaria virginiana (wild strawberry)	0.5	0-0.5	33	0.17	N
Galium boreale (northern bedstraw)	0.5	0-0.5	17	0.08	N
Galium trifidum (small bedstraw)	0.5	0-0.5	8	0.04	N
Geranium richardsonii (wild white geranium)	0.5	0-0.5	25	0.13	N
Geum aleppicum (yellow avens)	1.3	0-3	25	0.33	N
Geum macrophyllum (large-leaved yellow avens)	3.3	0-10	50	1.67	N
Geum rivale (purple avens)	6.8	0-10	25	1.71	N
Heracleum lanatum (cow parsnip)	0.5	0-0.5	8	0.04	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	17	0.08	N
Lomatium dissectum (mountain wild parsnip)	3.0	0-3	8	0.25	N
Lomatium spp. (lomatium)	0.5	0-0.5	8	0.04	N
Mentha arvensis (wild mint)	2.2	0-3	25	0.54	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	25	0.13	N
Moss spp. (moss)	10.0	0-10	8	0.83	B
Oxytropis spp. (locoweed)	0.5	0-0.5	8	0.04	B
Pedicularis groenlandica (elephant's-head)	1.8	0-3	17	0.29	N
Penstemon confertus (yellow beardtongue)	0.5	0-0.5	17	0.08	N
Polygonum amphibium (water smartweed)	0.5	0-0.5	8	0.04	N
Polygonum lapathifolium (pale persicaria)	0.5	0-0.5	8	0.04	N
Potentilla anserina (silverweed)	0.5	0-0.5	8	0.04	N
Potentilla diversifolia (mountain cinquefoil)	0.5	0-0.5	8	0.04	N
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	17	0.08	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	8	0.04	N
Potentilla palustris (marsh cinquefoil)	10.0	0-10	8	0.83	N
Rumex occidentalis (western dock)	1.3	0-3	25	0.33	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	8	0.04	N
Senecio congestus (marsh ragwort)	3.0	0-3	8	0.25	N
Senecio vulgaris (common groundsel)	0.5	0-0.5	8	0.04	I
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	8	0.04	N
Sparganium eurycarpum (giant bur-reed)	0.5	0-0.5	8	0.04	N
Stellaria calycantha (northern stitchwort)	0.5	0-0.5	17	0.08	N
Stellaria longipes (long-stalked chickweed)	1.8	0-3	17	0.29	N
Taraxacum officinale (common dandelion)	0.5	0-0.5	17	0.08	I
Thalictrum occidentale (western meadow rue)	3.0	0-3	8	0.25	N
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	42	0.21	N
Typha latifolia (common cattail)	0.5	0-0.5	8	0.04	N
Valeriana dioica (northern valerian)	0.5	0-0.5	17	0.08	N
Vicia americana (wild vetch)	0.5	0-0.5	42	0.21	N
Viola nephrophylla (bog violet)	0.5	0-0.5	8	0.04	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 377 shows the five most prominent plant species among the four lifeforms for species recorded in all three relatively undisturbed late seral to climax stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. *Salix petiolaris* (basket willow) is by far most prominent here, followed by the three sedges: *Carex utriculata* (beaked sedge), *Carex atherodes* (awned sedge), and *Carex aquatilis* (water sedge). No other species is more than moderately prominent in these stands.

Table 377. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (number = 3 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Salix petiolaris (basket willow)	69.17	Native
Salix planifolia (flat-leaved willow)	3.33	Native
Betula pumila (dwarf birch)	1.00	Native
Rubus arcticus (dwarf raspberry)	1.00	Native
Salix bebbiana (beaked willow)	1.00	Native
Graminoids		
Carex utriculata (beaked sedge)	21.17	Native
Carex atherodes (awned sedge)	14.33	Native
Carex aquatilis (water sedge)	10.00	Native
Alopecurus occidentalis (alpine foxtail)	3.33	Native
Calamagrostis stricta (narrow reed grass)	3.33	Native
Forbs		
Potentilla palustris (marsh cinquefoil)	3.33	Native
Geum macrophyllum (large-leaved yellow avens)	1.00	Native
Stellaria longipes (long-stalked chickweed)	1.00	Native
Epilobium angustifolium (common fireweed)	0.33	Native
Achillea millefolium (common yarrow)	0.17	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 378 through Table 381, break out the vegetation recorded in three relatively undisturbed late seral to climax stands sampled of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated habitat type of minor occurrence across the study area.

Table 378 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. For the 3 stands comprising the habitat type, the number of unique species was 30 with 26 (86.7 percent) of them being native species.

Table 378. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (number = 3 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	7	0	0
Shrubs	7	6	1	1
Graminoids	8	13	1	1
Forbs	15	0	0	0
TOTAL	***30 (100.0%)***	***26 (86.7%)***	***2 (6.7%)***	***2 (6.7%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 379 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. The average number of species per stand is 12.0, with native species comprising 10.7 species per stand or 89.2 percent.

Table 379. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (number = 3 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	3.0	3.0	0.0	0.0
Graminoids	3.7	3.0	0.3	0.3
Forbs	5.3	4.7	0.3	0.3
TOTAL	***12.0 (100.0%)***	***10.7 (89.2%)***	***0.6 (5.0%)***	***0.6 (5.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 380 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. The average canopy cover per stand is 137.7 percent, with native species comprising 137.0 percent or 99.5 percent of the total amount of average canopy cover per stand.

Table 380. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (number = 3 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	76.7%	76.7%	0.0%	0.0%
Graminoids	53.5%	53.2%	0.2%	0.2%
Forbs	7.5%	7.2%	0.2%	0.2%
TOTAL	***137.7% (100.0%)***	***137.0% (99.5%)***	***0.3% (0.2%)***	***0.3% (0.2%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 381 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. The average number of species per stand was 12.0 with an average canopy cover of 137.7 percent.

Table 381. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (number = 3 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	3.0	76.7%
Graminoids	3.7	53.5%
Forbs	5.3	7.5%
TOTAL	***12.0***	***137.7%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 30 plant species were recorded on at least one of three relatively undisturbed late seral to climax stands sampled of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (Table 382). No trees were recorded here, while of seven shrub species, only *Salix petiolaris* (basket willow) is highly prominent. *Carex aquatilis* (water sedge), *Carex atherodes* (awned sedge), and *Carex utriculata* (beaked sedge) are all highly prominent among the eight graminoid species recorded. Of the 15 forb species, none is very prominent.

Table 382. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (number = 3 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Shrubs (N = 7)					
Betula pumila (dwarf birch)	3.0	0-3	33	1.00	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	33	0.17	N
Rubus arcticus (dwarf raspberry)	3.0	0-3	33	1.00	N
Salix bebbiana (beaked willow)	3.0	0-3	33	1.00	N
Salix maccalliana (velvet-fruited willow)	3.0	0-3	33	1.00	N
Salix petiolaris (basket willow)	69.2	50-97.5	100	69.17	N
Salix planifolia (flat-leaved willow)	10.0	0-10	33	3.33	N
Graminoids (N = 8)					
Agrostis scabra (rough hair grass)	3.0	0-3	33	1.00	N
Alopecurus occidentalis (alpine foxtail)	10.0	0-10	33	3.33	N
Bromus inermis (smooth brome)	0.5	0-0.5	33	0.17	I
Calamagrostis stricta (narrow reed grass)	10.0	0-10	33	3.33	N
Carex aquatilis (water sedge)	30.0	0-30	33	10.00	N
Carex atherodes (awned sedge)	21.5	0-40	67	14.33	N
Carex utriculata (beaked sedge)	21.2	0.5-60	100	21.17	N
Grass spp. (Unknown grass)	0.5	0-0.5	33	0.17	B
Forbs (N = 15)					
Achillea millefolium (common yarrow)	0.5	0-0.5	33	0.17	N
Aster laevis (smooth aster)	0.5	0-0.5	33	0.17	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	67	0.33	N

Table 382. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Geum macrophyllum (large-leaved yellow avens)	3.0	0-3	33	1.00	N
Geum rivale (purple avens)	0.5	0-0.5	33	0.17	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	33	0.17	N
Oxytropis spp. (locoweed)	0.5	0-0.5	33	0.17	B
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	33	0.17	N
Potentilla palustris (marsh cinquefoil)	10.0	0-10	33	3.33	N
Rumex occidentalis (western dock)	0.5	0-0.5	33	0.17	N
Senecio vulgaris (common groundsel)	0.5	0-0.5	33	0.17	I
Stellaria longipes (long-stalked chickweed)	3.0	0-3	33	1.00	N
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	33	0.17	N
Valeriana dioica (northern valerian)	0.5	0-0.5	33	0.17	N
Viola nephrophylla (bog violet)	0.5	0-0.5	33	0.17	N

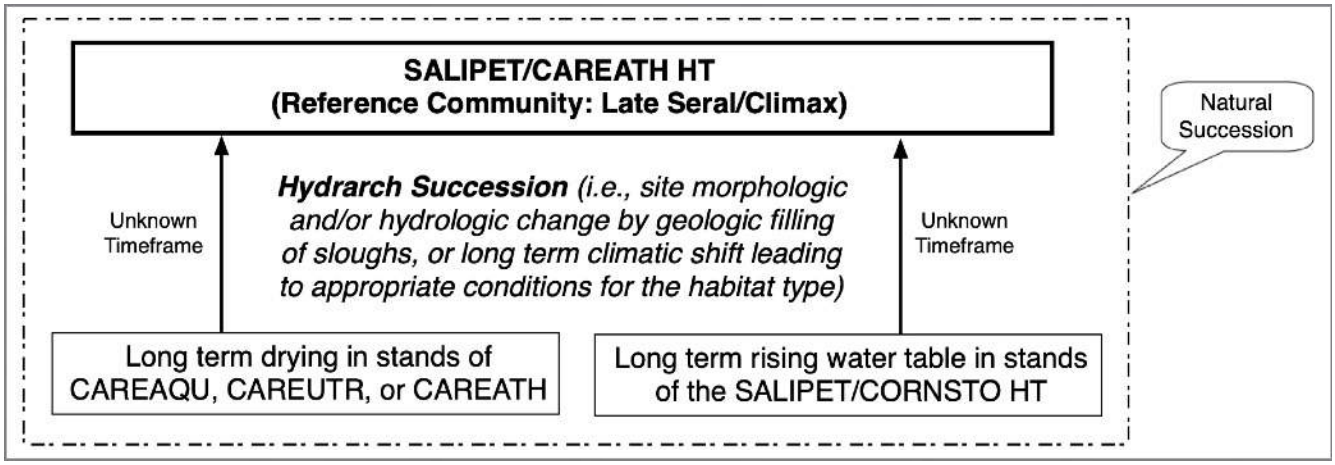
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type develops on a site typically through primary succession (hydrarch succession), whereby either a wet meadow stand of *Carex aquatilis* (water sedge), *Carex atherodes* (awned sedge), or *Carex utriculata* (beaked sedge) located in a shallow depression, or a narrow band of these sedges surrounding a small lake, gradually fills in or dries out enough for *Salix pedicellaris* (bog willow) to become established.

Figure 80 shows a schematic diagram of vegetation successional pathways on sites of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type.



Successional Pathway of *Salix petiolaris/Carex atherodes* (basket willow/awned sedge)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
SALIPET/CAREATH HT—*Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type
SALIPET/CORNSTO HT—*Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type

Figure 80. Successional pathway for sites of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 81 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

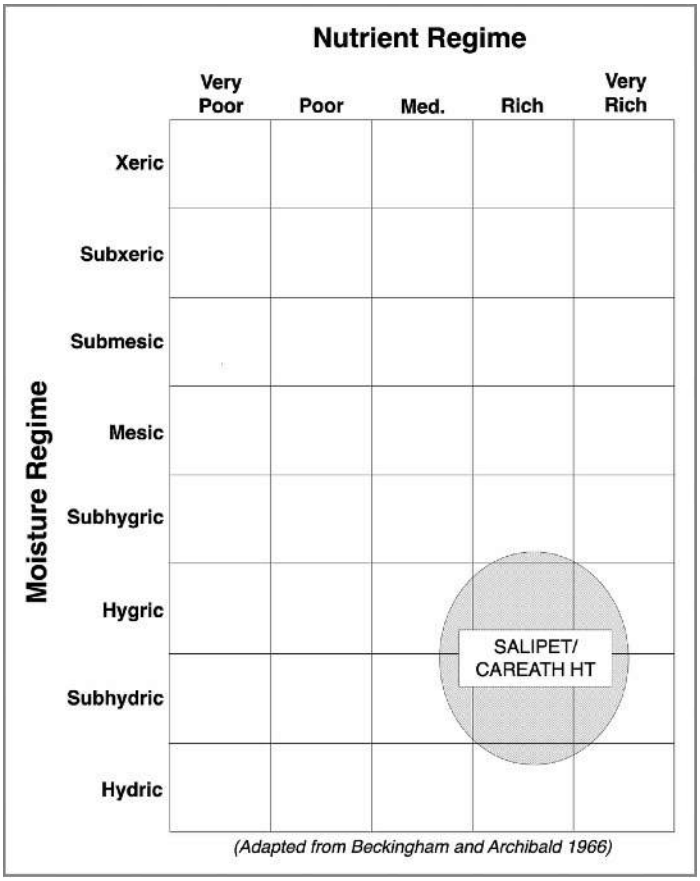


Figure 81. Edatope grid position for the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (SALIPET/CAREATH HT)

SOILS

Soils information is currently unavailable for sites supporting the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites may have communities dominated by *Salix bebbiana* (beaked willow), *Salix glauca* (smooth willow), *Salix planifolia* (flat-leaved willow), or a fen type community dominated by wetland *Carex* (sedge) species. Adjacent drier sites will often have the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type, or a community dominated by *Picea glauca* (white spruce) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix petiolaris* (basket willow)**—*Salix petiolaris* (basket willow) grows around sloughs, along shorelines, and in moist meadows, often forming extensive thickets (Tannas 1997a). It grows in moist conditions with direct

sunlight in wet meadows, fens, along streams and lakeshores, and in forest clearings. The species is associated with disturbed or earlier successional stands.

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) is very common and widely distributed across Alberta (Tannas 1997a). The species is a wetland obligate, growing along slough margins, shorelines, in marshes, and wet meadows, often in standing water (Tannas 1997a). It is a long-lived perennial with moderate tolerance for drought, while tolerance is low for salinity, acidity, and shade. It does best on clay to clay loam soils (Hardy BBT Limited 1989).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is common and widely distributed across Alberta. It is a wetland obligate, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). It is a long-lived perennial sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of fine roots (Johnson and others 1995).

Carex utriculata (beaked sedge) is strongly rhizomatous and colonial, typically forming a dense sod. Creeping rhizomes are long, slender or stout, and deep-seated. It grows on sites with high soil moisture, typically with the water table at or above the soil surface during the growing season. This is one of our wettest sedges. On some sites, water tables are above the soil surface all year, and rarely drop below the rooting zone. The species occurs on a range of soil types, with textures from silt loams or silty clays to loamy sands (Anderson 2008).

Carex utriculata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates with continually high water tables and persists indefinitely to form climax communities (Anderson 2008).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is very common and widely distributed across Alberta (Tannas 1997a). It is a wetland species, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). *Carex aquatilis* (water sedge) is a native, wetland obligate, long-lived perennial. It is a sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of finer roots (Hauser 2006). It thrives on disturbed sites, is shade intolerant, and occurs in various stages of seral succession (Hauser 2006).

Livestock

***Salix petiolaris* (basket willow)**—*Salix petiolaris* (basket willow) has good forage value, similar to other willow species. The species is palatable, but may not be heavily browsed when in the presence of more preferred species, such as *Salix bebbiana* (Bebb willow). *Salix petiolaris* (basket willow) is tolerant of high browsing pressure (Tannas 1997a).

***Carex atherodes* (awned sedge)**—Livestock forage value of *Carex atherodes* (awned sedge) is high (Tannas 1997a, Beckingham 1991). *Carex atherodes* (awned sedge) provides good protein and a balance of other nutritional elements, while remaining palatable during the late season when upland forage is less palatable (Tannas 1997a, Hansen and others 1988). In general, *Carex* (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites residual cover should be left to protect the soil surface and filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days for sedge regrowth should provide sufficient residual cover on streamside riparian sites (Myers 1989).

Very wet soils may deter animal use until they dry, allowing the most palatable species to replenish their carbohydrate reserves and to persist in these communities. However, if high levels of grazing do occur, there will be a marked decrease in *Carex atherodes* (awned sedge) with an increase in less palatable species, such as *Juncus balticus* (wire rush). *Carex atherodes* (awned sedge) has medium palatability and medium tolerance for livestock

use. Its chemical composition is similar to that of meadow grasses, upland short grass, and mixed prairie species. Seasonal declines in crude protein, phosphorous and carotene were also similar to that of native upland grasses (Hardy BBT Limited 1989).

***Carex utriculata* (beaked sedge)**—Livestock forage value of *Carex utriculata* (beaked sedge) is high (Tannas 1997a, Beckingham 1991). The species is palatable in the spring, but palatability declines as the plants become coarse and tough in summer (Tannas 1997a, Hansen and others 1988). Relative palatability may then increase again in fall as the sedge cures and upland forage is less attractive. *Carex utriculata* (beaked sedge) cover decreases in response to high levels of grazing pressure, and will be replaced with less productive and less palatable species, such as *Juncus balticus* (wire rush) and *Poa* species (bluegrass) (Thompson and Hansen 2003).

In general, *Carex* species (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites, residual cover should be left to protect the banks and the soil surface, and to filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days should provide time for sufficient residual cover regrowth on streamside riparian sites (Myers 1989).

***Carex aquatilis* (water sedge)**—The livestock forage value of *Carex aquatilis* (water sedge) is rated as good (Tannas 1997a), but varies with region, season, and previous grazing use. On narrow riparian or wetland sites within large pastures, *Carex* species (sedges) are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur. In general, *Carex* species (sedges) should respond satisfactorily to traditional grazing systems. However, on streamside sites ample residual cover should be left to protect the soil surface and trap sediments during fall rains or spring runoff. Removing cattle for at least 30 days from these streamside sites for sedge regrowth at the end of the growing season should provide sufficient residual cover (Myers 1989).

Given that *Carex aquatilis* (water sedge) grows in wet places, it is generally not grazed until late summer and fall when soils have dried (Hauser 2006). Very wet soils may deter animal use until they dry. However, if high level of grazing does occur, there will be a marked decrease in *Carex aquatilis* (water sedge) and an increase in the less palatable *Juncus balticus* (wire rush) (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix petiolaris* (basket willow)**—Stands of *Salix petiolaris* (basket willow) associated with *Carex* (sedge) meadows and topographical depressions, provide browse and good thermal and hiding cover for many wildlife species, usually in a beneficial mosaic pattern (Thompson and Hansen 2003).

***Carex atherodes* (awned sedge)**—Wetland sedge species, such as *Carex atherodes* (awned sedge) are an important component of valuable nesting and feeding grounds for geese and other waterfowl. These stands of prolific seed producing species are usually more important as feeding grounds than as nesting grounds because of their low stature, high water level, and lack of structural diversity (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is grazed by moose, elk, mule deer, bison, grizzly bears, and sandhill cranes (Anderson 2008). The species is an important component of valuable breeding and feeding grounds for geese and other waterfowl. Birds commonly associated with *Carex utriculata* (beaked sedge) habitats include mallard, green-winged teal, common yellowthroat, red-winged black bird, song sparrow, and tree swallow. *Carex utriculata* (beaked sedge) stands are usually more important as feeding grounds than as

nesting grounds because of their low stature, lack of structural diversity, and high water levels. Elk and moose often graze *Carex utriculata* (beaked sedge) stands when *Carex atherodes* (awned sedge) is present (Anderson 2008).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is grazed by many ungulates, including moose, caribou, and elk, but it is not a major component of their diet. Due to the saturated habitat of the species, grazing by most ungulates is limited. *Carex aquatilis* (water sedge) habitat provides nesting and hiding cover for some birds, waterfowl, and small mammals. In riparian and wetland sites, The species is also an important source of food for a variety of waterfowl (Hauser 2006).

Fisheries

***Carex atherodes* (awned sedge)**—Stands of *Carex atherodes* (awned sedge) are found more frequently in lentic situations around depressional wetlands, sloughs, potholes, wet meadows, and fens where fish habitat is not at issue (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—The dense network of roots of the rhizomatous *Carex utriculata* (beaked sedge) is very effective in binding soil and stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish (Thompson and Hansen 2003).

***Carex aquatilis* (water sedge)**—Stands of *Carex aquatilis* (water sedge) often are adjacent to streams supporting trout fisheries. The combined tufted and rhizomatous growth habit of the species effectively stabilizes streambanks. Overhanging *Carex* species (sedges) along the banks provide valuable resting cover and shade for fish (Thompson and Hansen 2003).

Fire

***Salix petiolaris* (basket willow)**—Little is known about the response of *Salix petiolaris* (basket willow) to fire, but like most *Salix* (willow) species, it readily sprouts from the root crown after all but the most intense fire. Under normal conditions, stands of *Salix petiolaris* (basket willow) are located in sites usually too wet to carry wildfire (Thompson and Hansen 2003).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) grows on wet sites that seldom dry out enough to carry fire, but the species is adapted to light intensity fire. Residual cover should burn well in early spring, prior to the growing season. Burning will reduce litter accumulations and temporarily increase productivity (Hansen and others 1988), but care should be taken with burning to avoid damage to the excellent soil erosion protection this species provides. Under drought conditions, there is danger of burning the soil peat layer and damaging the roots (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—Sites supporting stands of *Carex utriculata* (beaked sedge) are very wet, except at times of severe drought, and therefore they seldom burn. However, *Carex utriculata* (beaked sedge) sprouts from rhizomes, so it is often able to survive after being top-killed by fire. However, peat soils, common in these communities, can burn when dry, and the heat from such fires can penetrate the soil, destroying the sedge rhizomes. It is necessary that livestock be excluded during the year prior to burning. Caution should be used with fires along streams because of the excellent erosion protection *Carex utriculata* (beaked sedge) provides. Fires do little to change plant composition of beaked sedge communities (DeBenedetti and Parsons 1984). Fire may regress seral succession in treed or shrubby fen stands back to open sedge meadows that support little woody vegetation (Anderson 2008).

***Carex aquatilis* (water sedge)**—Sites supporting stands of *Carex aquatilis* (water sedge) seldom burn, except in periods of severe drought. When stands of the species do burn, the plants are usually top-killed by the fire and

soon re-establish after the fire by seed and/or lateral spread of surviving rhizomes (Hauser 2006). The rhizomes are approximately 5 cm below the ground surface, and are somewhat protected from the heat. The wet habitat also provides protection for roots and rhizomes, although the better-drained areas are more susceptible to fires during dry periods.

Stands of *Carex aquatilis* (water sedge) are suited to prescribed fire, but exclusion of livestock during the year prior to burning is necessary. Residual cover burns well in spring, prior to the growing season. Fire will reduce litter accumulations and temporarily increase productivity. However, species composition in the community will not drastically shift from dominance by *Carex aquatilis* (water sedge) (DeBenedetti and Parsons 1984). Care must be taken in burning along streambanks, so as to avoid impairing the excellent erosion protection provided by the species (Thompson and Hansen 2003).

Rehabilitation/Restoration Considerations

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) rates high in value for erosion control, and high for its persistence, once established on a site (Hardy BBT Limited 1989). Generally, due to their stronger rhizomatous roots, *Carex* species (sedges) offer better streambank protection than grasses. *Carex atherodes* (awned sedge) forms a dense, thick sod highly resistant to erosion. Along streambanks, the sod may overhang the bank and sag into the water, providing additional protection from erosion (Thompson and Hansen 2003).

Carex atherodes (awned sedge) is suited for long-term revegetation of disturbed sites and erosion control on sites with a high water table. The species can rapidly re-colonize disturbed sites by seed and rhizome extension. Its rhizomes form a dense network effective in stabilizing streambanks and preventing soil erosion (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex utriculata* (beaked sedge) has a dense network of rhizomatous roots and forms a thick sod that is highly resistant to erosion and effective in stabilizing streambanks (Anderson 2008).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) provides excellent erosion protection along streambanks, buffering against the erosive force of flood events, and filtering sediments during spring flows. Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex aquatilis* (water sedge) tends to form a dense, thick sod that is highly resistant to erosion. (Hauser 2006).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Basket willow/Kentucky bluegrass
- Basket willow/Sedge-Marsh reed grass

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Carex* (sedges) to the species level (i.e., *Carex* [sedges] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003); and
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001).

Salix petiolaris/Cornus stolonifera Habitat Type
(basket willow/red-osier dogwood Habitat Type)

SALIPET/CORNSTO Habitat Type
Number of Stands = 4 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 2; Other Data Sets = 2)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This habitat type typically occurs in proximity to *Populus tremuloides* (aspen) groves around sloughs, depressional wetlands, wet meadows, and occasionally along streambanks. It occupies sites on the drier side of the *Salix petiolaris* (basket willow) moisture spectrum.

Photo 19 shows a typical stand of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type.

Photo 19. A stand of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 383 shows the five most prominent plant species among the four lifeforms for species recorded in all four stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. *Salix petiolaris* (basket willow) is by far the most prominent species in these stands, followed far behind by *Poa pratensis* (Kentucky bluegrass). No other species is more than moderately prominent in these stands.

Table 383. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (number = 4 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	0.88	Native
Shrubs		
Salix petiolaris (basket willow)	77.50	Native
Betula glandulosa (bog birch)	5.00	Native
Salix bebbiana (beaked willow)	2.25	Native
Ribes oxyacanthoides (northern gooseberry)	1.00	Native
Salix candida (hoary willow)	0.75	Native
Graminoids		
Poa pratensis (Kentucky bluegrass)	17.50	Introduced
Calamagrostis canadensis (marsh reed grass)	7.50	Native
Agropyron trachycaulum (slender wheat grass)	5.13	Native
Phleum pratense (timothy)	5.00	Introduced
Schizachne purpurascens (purple oat grass)	2.50	Native
Forbs		
Aster laevis (smooth aster)	5.00	Native
Thalictrum venulosum (veiny meadow rue)	3.25	Native
Thalictrum occidentale (western meadow rue)	2.50	Native
Fragaria virginiana (wild strawberry)	2.25	Native
Achillea millefolium (common yarrow)	1.63	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 384 through Table 387, break out the vegetation recorded in all four stands sampled of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, moderately species rich, shrub dominated habitat type of minor occurrence across the study area.

Table 384 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. For the 4 stands comprising the habitat type, the number of unique species was 53 with 49 (92.5 percent) of them being native species.

Table 384. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (number = 4 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	9	9	0	0
Graminoids	15	12	3	0
Forbs	28	27	1	0
TOTAL	***53 (100.0%)***	***49 (92.5%)***	***4 (7.5%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 385 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. The average number of species per stand is 22.8, with native species comprising 20.8 species per stand or 91.2 percent.

Table 385. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (number = 4 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.5	0.5	0.0	0.0
Shrubs	4.5	4.5	0.0	0.0
Graminoids	5.8	4.3	1.5	0.0
Forbs	12.0	11.5	0.5	0.0
TOTAL	***22.8 (100.0%)***	***20.8 (91.2%)***	***2.0 (8.8%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 386 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. The average canopy cover per stand is 154.9 percent, with native species comprising 131.3 percent or 84.7 percent of the total amount of average canopy cover per stand.

Table 386. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (number = 4 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.9%	0.9%	0.0%	0.0%
Shrubs	87.9%	87.9%	0.0%	0.0%
Graminoids	39.9%	17.1%	22.8%	0.0%
Forbs	26.3%	25.4%	0.9%	0.0%
TOTAL	***154.9% (100.0%)***	***131.3% (84.7%)***	***23.6% (15.3%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 387 shows the average number of species and average canopy cover by lifeform in stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. The average number of species per stand was 22.8 with an average canopy cover of 154.9 percent.

Table 387. Average number of species and average canopy cover by lifeform in stands of the *Salix petiolaris/ Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (number = 4 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.5	0.9%
Shrubs	4.5	87.9%
Graminoids	5.8	39.9%
Forbs	12.0	26.3%
TOTAL	***22.8***	***154.9%***

Sampled Stands Plant Species List

A total of 53 plant species were recorded on at least one of four stands sampled of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (Table 388). One tree species was recorded in a small amount; while of nine shrub species, only *Salix petiolaris* (basket willow) is highly prominent. *Poa pratensis* (Kentucky bluegrass) is the only highly prominent graminoid species recorded; and of the 28 forb species recorded, none is very prominent.

Table 388. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (number = 4 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 1)					
Picea glauca (white spruce)	1.8	0-3	50	0.88	N
Shrubs (N = 9)					
Betula glandulosa (bog birch)	20.0	0-20	25	5.00	N
Ribes oxyacanthoides (northern gooseberry)	1.3	0-3	75	1.00	N
Rubus idaeus (wild red raspberry)	0.5	0-0.5	50	0.25	N
Salix bebbiana (beaked willow)	3.0	0-3	75	2.25	N
Salix candida (hoary willow)	3.0	0-3	25	0.75	N
Salix lutea (yellow willow)	3.0	0-3	25	0.75	N
Salix petiolaris (basket willow)	77.5	60-90	100	77.50	N
Salix planifolia (flat-leaved willow)	0.5	0-0.5	50	0.25	N
Vaccinium uliginosum (bog bilberry)	0.5	0-0.5	25	0.13	N
Graminoids (N = 15)					
Agropyron trachycaulum (slender wheat grass)	6.8	0-10	75	5.12	N
Alopecurus occidentalis (alpine foxtail)	0.5	0-0.5	25	0.13	N
Bromus inermis (smooth brome)	0.5	0-0.5	50	0.25	I
Calamagrostis canadensis (marsh reed grass)	15.0	0-20	50	7.50	N
Carex atherodes (awned sedge)	0.5	0-0.5	25	0.13	N
Carex chordorrhiza (prostrate sedge)	3.0	0-3	25	0.75	N
Carex praegracilis (graceful sedge)	0.5	0-0.5	50	0.25	N
Carex sprengelii (Sprengel's sedge)	0.5	0-0.5	50	0.25	N
Carex xerantica (white-scaled sedge)	0.5	0-0.5	25	0.13	N

Table 388. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Elymus innovatus (hairy wild rye)	0.5	0-0.5	25	0.13	N
Juncus balticus (wire rush)	0.5	0-0.5	25	0.13	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	25	0.13	N
Phleum pratense (timothy)	10.0	0-10	50	5.00	I
Poa pratensis (Kentucky bluegrass)	35.0	0-40	50	17.50	I
Schizachne purpurascens (purple oat grass)	10.0	0-10	25	2.50	N
Forbs (N = 28)					
Achillea millefolium (common yarrow)	2.2	0-3	75	1.63	N
Aster ciliolatus (Lindley's aster)	1.8	0-3	50	0.88	N
Aster laevis (smooth aster)	20.0	0-20	25	5.00	N
Camassia quamash (blue camas)	0.5	0-0.5	25	0.13	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	50	0.25	N
Epilobium angustifolium (common fireweed)	1.3	0-3	75	1.00	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	25	0.13	N
Fragaria virginiana (wild strawberry)	3.0	0-3	75	2.25	N
Gaillardia aristata (gaillardia)	0.5	0-0.5	25	0.13	N
Galium boreale (northern bedstraw)	0.5	0-0.5	50	0.25	N
Gentiana spp. (gentian)	0.5	0-0.5	25	0.13	N
Geum aleppicum (yellow avens)	1.8	0-3	50	0.88	N
Heracleum lanatum (cow parsnip)	1.8	0-3	50	0.88	N
Hieracium umbellatum (narrow-leaved hawkweed)	1.8	0-3	50	0.88	N
Lathyrus ochroleucus (cream-colored vetchling)	3.0	0-3	25	0.75	N
Mentha arvensis (wild mint)	0.5	0-0.5	25	0.13	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	25	0.13	N
Potentilla gracilis (graceful cinquefoil)	3.0	0-3	50	1.50	N
Potentilla paradoxa (bushy cinquefoil)	3.0	0-3	25	0.75	N
Rumex occidentalis (western dock)	0.5	0-0.5	50	0.25	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	75	0.38	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	50	0.25	N
Taraxacum officinale (common dandelion)	1.8	0-3	50	0.88	I
Thalictrum occidentale (western meadow rue)	10.0	0-10	25	2.50	N
Thalictrum venulosum (veiny meadow rue)	6.5	0-10	50	3.25	N
Urtica dioica (common nettle)	0.5	0-0.5	50	0.25	N
Valeriana dioica (northern valerian)	0.5	0-0.5	25	0.13	N
Vicia americana (wild vetch)	3.0	0-3	25	0.75	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 389 shows the five most prominent plant species among the four lifeforms for species recorded in the single relatively undisturbed late seral to climax stand sampled of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. No other species is more than moderately prominent here.

Table 389. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (number = 1 stand)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Salix petiolaris (basket willow)	90.00	Native
Salix bebbiana (beaked willow)	3.00	Native
Salix lutea (yellow willow)	3.00	Native
Graminoids		
Carex atherodes (awned sedge)	0.50	Native
Forbs		
Epilobium ciliatum (northern willowherb)	0.50	Native
Mentha arvensis (wild mint)	0.50	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 390 through Table 393, break out the vegetation recorded in one relatively undisturbed late seral to climax stand sampled of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, moderately species rich, shrub dominated habitat type of minor occurrence across the study area.

Table 390 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. For the 1 stand comprising the habitat type, the number of unique species was 6 with 6 (100.0 percent) of them being native species.

Table 390. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (number = 1 stand)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	3	3	0	0
Graminoids	1	1	0	0
Forbs	2	2	0	0
TOTAL	***6 (100.0%)***	***6 (100.0%)***	***0 (0.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 391 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. The average number of species per stand is 6.0, with native species comprising 6.0 species per stand or 100.0 percent.

Table 391. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (number = 1 stand)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	3.0	3.0	0.0	0.0
Graminoids	1.0	1.0	0.0	0.0
Forbs	2.0	2.0	0.0	0.0
TOTAL	***6.0 (100.0%)***	***6.0 (100.0%)***	***0.0 (0.0%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 392 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. The average canopy cover per stand is 97.5 percent, with native species comprising 97.5 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 392. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (number = 1 stand) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	96.0%	96.0%	0.0%	0.0%
Graminoids	0.5%	0.5%	0.0%	0.0%
Forbs	1.0%	1.0%	0.0%	0.0%
TOTAL	***97.5% (100.0%)***	***97.5% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 393 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. The average number of species per stand was 6.0 with an average canopy cover of 97.5 percent.

Table 393. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (number = 1 stand)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	3.0	96.0%
Graminoids	1.0	0.5%
Forbs	2.0	1.0%
TOTAL	***6.0***	***97.5%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of six plant species were recorded on the single relatively undisturbed late seral to climax stand sampled of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (Table 394). No tree species was recorded, while of three shrub species, only *Salix petiolaris* (basket willow) is highly prominent. Only one graminoid species was recorded in a very small amount, along with two forb species, none very prominent.

Table 394. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (number = 1 stand)

Species	Percent Canopy Cover		Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
	Average	Range			
Shrubs (N = 3)					
Salix bebbiana (beaked willow)	3.0	3-3	100	3.00	N
Salix lutea (yellow willow)	3.0	3-3	100	3.00	N
Salix petiolaris (basket willow)	90.0	90-90	100	90.00	N
Graminoids (N = 1)					
Carex atherodes (awned sedge)	0.5	0.5-0.5	100	0.50	N
Forbs (N = 2)					
Epilobium ciliatum (northern willowherb)	0.5	0.5-0.5	100	0.50	N
Mentha arvensis (wild mint)	0.5	0.5-0.5	100	0.50	N

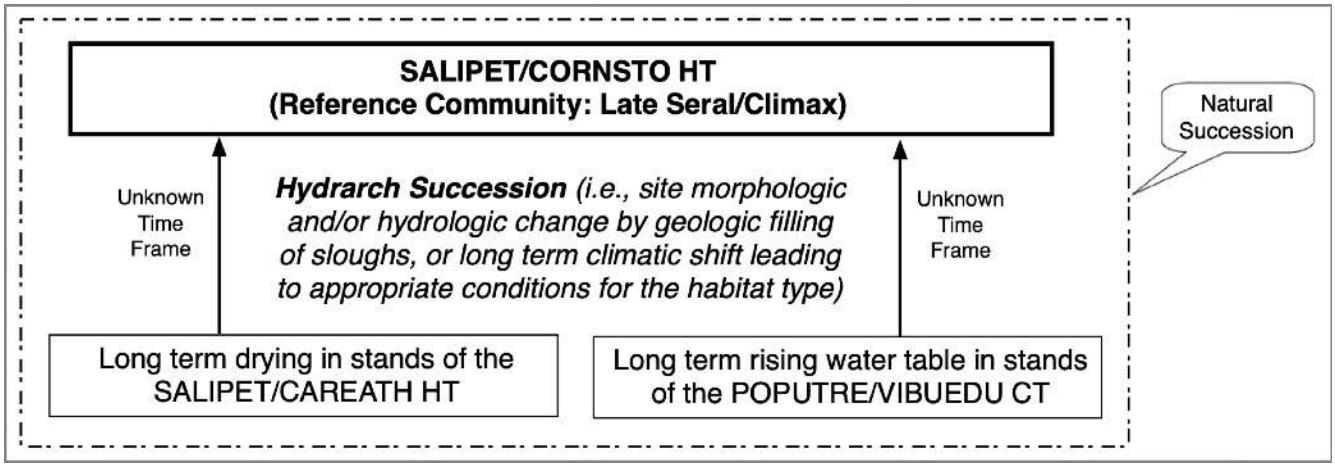
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type may result from either the drying out of stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type, or the rising of the water table in stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. It can also result from removal of *Populus tremuloides* (aspen) by beaver from stands having *Salix petiolaris* (basket willow) and *Cornus stolonifera* (red-osier dogwood) in their understory.

Figure 82 shows a schematic diagram of vegetation successional pathways on sites of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type.



Successional Pathway of *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
POPUTRE/VIBUEDU CT—*Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type
SALIPET/CAREATH HT—*Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type
SALIPET/CORNSTO HT—*Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type

Figure 82. Successional pathway for sites of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 83 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

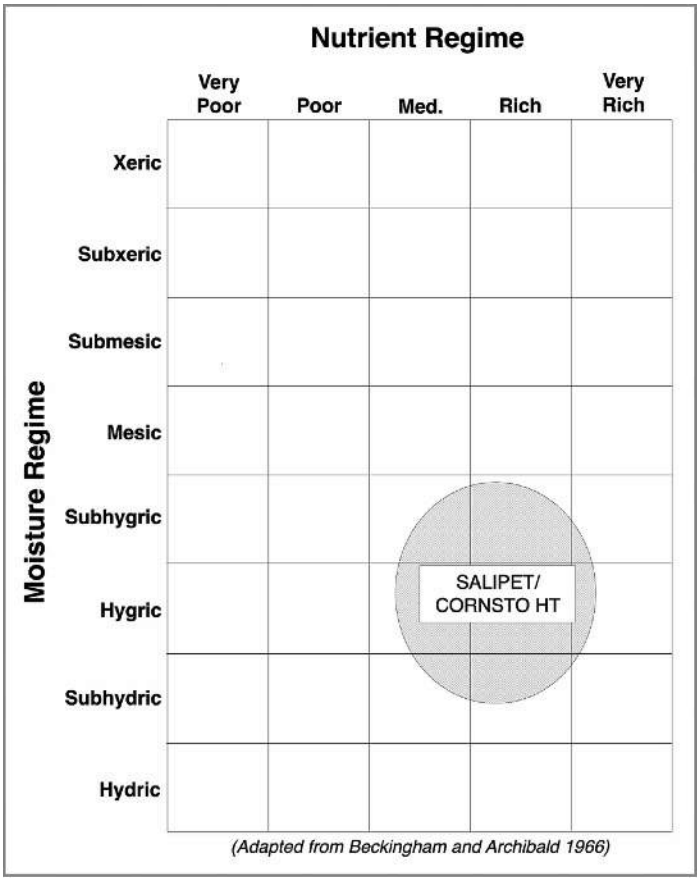


Figure 83. Edatope grid position for the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (SALIPET/CORNSTO HT)

SOILS

Soils information is currently unavailable for sites supporting the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites will likely have the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. Adjacent drier sites will often have communities dominated by *Picea glauca* (white spruce) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix petiolaris* (basket willow)**—*Salix petiolaris* (basket willow) grows around sloughs, along shorelines, and in moist meadows, often forming extensive thickets (Tannas 1997a). It grows in moist conditions with direct

sunlight in wet meadows, fens, along streams and lakeshores, and in forest clearings. The species is associated with disturbed or earlier successional stands.

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is a riparian shrub species that typically occurs along stream margins and other moist to wet sites at elevations between 500 m and 3,000 m. The species is not particularly drought tolerant, and on upland sites is generally restricted to areas receiving more than 50.8 cm of annual precipitation (Gucker 2012).

Cornus stolonifera (red-osier dogwood) is typically present throughout all stages of succession, but abundance is often greater in earlier than later stages. The species occupies open sites and also occurs beneath closed canopies, but is typically more abundance in sun than in shade (Gucker 2012).

Livestock

***Salix petiolaris* (basket willow)**—*Salix petiolaris* (basket willow) has good forage value, similar to other willow species. The species is palatable, but may not be heavily browsed when in the presence of more preferred species, such as *Salix bebbiana* (Bebb willow). *Salix petiolaris* (basket willow) is tolerant of high browsing pressure (Tannas 1997a).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is considered an "ice cream" plant by livestock and wildlife (Hansen and others 1995). In areas of Montana having experienced historic high levels of browsing by livestock, the species has been effectively eliminated from many sites.

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix petiolaris* (basket willow)**—Stands of *Salix petiolaris* (basket willow) associated with *Carex* (sedge) meadows and topographical depressions, provide browse and good thermal and hiding cover for many wildlife species, usually in a beneficial mosaic pattern (Thompson and Hansen 2003).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) provides hiding and thermal cover for small mammals and birds. The species is used for food and cover by white-tailed deer, mule deer, elk, moose, cottontail rabbits, snowshoe hares, and numerous birds (Costain 1989). Moose in particular are tall enough to reach the twigs of even the tallest plants. *Cornus stolonifera* (red-osier dogwood) fruit is low in sugar, so it is initially less attractive to wildlife and less inclined to rot than other fruits. Consequently, the fruit stays on the plant through the winter and is available when fruits of other plants are gone (Gucker 2012).

Fisheries

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is an excellent shrub for controlling erosion along streams. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

Fire

***Salix petiolaris* (basket willow)**—Little is known about the response of *Salix petiolaris* (basket willow) to fire, but like most *Salix* (willow) species, it readily sprouts from the root crown after all but the most intense fire. Under normal conditions, stands of *Salix petiolaris* (basket willow) are located in sites usually too wet to carry wildfire (Thompson and Hansen 2003).

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) generally increases following fire, and may invade recently burned areas from adjacent unburned areas. Above ground material is usually killed by fire. However, the roots can survive all but the most severe fires that remove the duff and heat the upper soil for an extended period. The species can sprout from surviving roots or stolons and from the base of aerial stems following fire (Fischer and Bradley 1987), but can be killed by severe fires that cause extended heating of the upper soil. Light fires that partially remove the duff stimulate germination of buried seed. In moist forests of British Columbia, *Cornus stolonifera* (red-osier dogwood) appears to increase in abundance following the removal of the shading canopy by logging or burning (Gucker 2012).

Rehabilitation/Restoration Considerations

***Cornus stolonifera* (red-osier dogwood)**—*Cornus stolonifera* (red-osier dogwood) is valuable for revegetation of degraded sites, as it readily establishes along stream edges by direct seeding, transplanting rooted cuttings, or planting nursery-grown seedlings. Its rapid growth can quickly stabilize deteriorated streambanks (Gucker 2012).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Basket willow/Kentucky bluegrass
- Basket willow/Sedge-Marsh reed grass

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003); and
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001).

Salix petiolaris Community Type
(basket willow Community Type)

SALIPET Community Type
Number of Stands = 5 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 4; Other Data Sets = 1)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix petiolaris* (basket willow) community type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This community type is commonly found on disturbed sites around shallow lakeshores, sloughs, depressional wetlands, wet meadows, and occasionally along streambanks.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 395 shows the five most prominent plant species among the four lifeforms for species recorded in all five stands of the *Salix petiolaris* (basket willow) community type. *Salix petiolaris* (basket willow) is by far the most prominent species in these stands, followed far behind by *Deschampsia cespitosa* (tufted hair grass) and *Poa pratensis* (Kentucky bluegrass). No other species is more than moderately prominent in these stands.

Table 395. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix petiolaris* (basket willow) community type (number = 5 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	0.10	Native
Shrubs		
Salix petiolaris (basket willow)	69.50	Native
Salix discolor (pussy willow)	6.00	Native
Betula glandulosa (bog birch)	2.60	Native
Potentilla fruticosa (shrubby cinquefoil)	0.90	Native
Rubus idaeus (wild red raspberry)	0.70	Native
Graminoids		
Deschampsia cespitosa (tufted hair grass)	14.60	Native
Poa pratensis (Kentucky bluegrass)	10.60	Introduced
Juncus balticus (wire rush)	6.20	Native
Carex lanuginosa (woolly sedge)	6.00	Native
Calamagrostis canadensis (marsh reed grass)	4.00	Native
Forbs		
Aster laevis (smooth aster)	4.70	Native
Potentilla gracilis (graceful cinquefoil)	2.30	Native
Fragaria virginiana (wild strawberry)	2.20	Native
Thalictrum venulosum (veiny meadow rue)	2.20	Native
Galium boreale (northern bedstraw)	0.80	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 396 through Table 399, break out the vegetation recorded in five stands of the *Salix petiolaris* (basket willow) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated community type of minor occurrence across the study area.

Table 396 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix petiolaris* (basket willow) community type. For the 5 stands comprising the community type, the number of unique species was 70 with 65 (92.9 percent) of them being native species.

Table 396. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix petiolaris* (basket willow) community type (number = 5 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	11	11	0	0
Graminoids	21	18	2	1
Forbs	37	35	2	0
TOTAL	***70 (100.0%)***	***65 (92.9%)***	***4 (5.7%)***	***1 (1.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 397 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix petiolaris* (basket willow) community type. The average number of species per stand is 23.6, with native species comprising 21.6 species per stand or 91.5 percent.

Table 397. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix petiolaris* (basket willow) community type (number = 5 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.2	0.2	0.0	0.0
Shrubs	4.4	4.4	0.0	0.0
Graminoids	6.8	5.6	1.0	0.2
Forbs	12.2	11.4	0.8	0.0
TOTAL	***23.6 (100.0%)***	***21.6 (91.5%)***	***1.8 (7.6%)***	***0.2 (0.8%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 398 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix petiolaris* (basket willow) community type. The average canopy cover per stand is 153.4 percent, with native species comprising 141.2 percent or 92.0 percent of the total amount of average canopy cover per stand.

Table 398. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix petiolaris* (basket willow) community type (number = 5 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.1%	0.1%	0.0%	0.0%
Shrubs	81.0%	81.0%	0.0%	0.0%
Graminoids	53.1%	41.8%	11.2%	0.1%
Forbs	19.2%	18.3%	0.9%	0.0%
TOTAL	***153.4% (100.0%)***	***141.2% (92.0%)***	***12.1% (7.9%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 399 shows the average number of species and average canopy cover by lifeform in stands of the *Salix petiolaris* (basket willow) community type. The average number of species per stand was 23.6 with an average canopy cover of 153.4 percent.

Table 399. Average number of species and average canopy cover by lifeform in stands of the *Salix petiolaris* (basket willow) community type (number = 5 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.2	0.1%
Shrubs	4.4	81.0%
Graminoids	6.8	53.1%
Forbs	12.2	19.2%
TOTAL	***23.6***	***153.4%***

Sampled Stands Plant Species List

A total of 70 plant species were recorded on at least one of five stands sampled of the *Salix petiolaris* (basket willow) community type (Table 400). One tree species, *Picea glauca* (white spruce), in a small amount was recorded; while of 11 shrub species, *Salix petiolaris* (basket willow) is by far most prominent. Of 21 graminoid species recorded, *Deschampsia cespitosa* (tufted hair grass) and *Poa pratensis* (Kentucky bluegrass) are most prominent; while of the 37 forb species, none is very prominent.

Table 400. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix petiolaris* (basket willow) community type (number = 5 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 1)					
Picea glauca (white spruce)	0.5	0-0.5	20	0.10	N
Shrubs (N = 11)					
Betula glandulosa (bog birch)	6.5	0-10	40	2.60	N
Betula pumila (dwarf birch)	3.0	0-3	20	0.60	N
Potentilla fruticosa (shrubby cinquefoil)	1.1	0-3	80	0.90	N
Ribes lacustre (bristly black currant)	0.5	0-0.5	40	0.20	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	40	0.20	N
Rubus idaeus (wild red raspberry)	1.8	0-3	40	0.70	N
Rubus pubescens (dewberry)	0.5	0-0.5	20	0.10	N
Salix candida (hoary willow)	0.5	0-0.5	20	0.10	N
Salix discolor (pussy willow)	30.0	0-30	20	6.00	N
Salix petiolaris (basket willow)	69.5	40-97.5	100	69.50	N
Vaccinium uliginosum (bog bilberry)	0.5	0-0.5	20	0.10	N
Graminoids (N = 21)					
Agropyron trachycaulum (slender wheat grass)	5.3	0-10	40	2.10	N
Alopecurus aequalis (short-awn meadow-foxtail)	0.5	0-0.5	40	0.20	N
Alopecurus occidentalis (alpine foxtail)	3.0	0-3	20	0.60	N
Calamagrostis canadensis (marsh reed grass)	20.0	0-20	20	4.00	N
Calamagrostis stricta (narrow reed grass)	0.5	0-0.5	20	0.10	N
Carex chordorrhiza (prostrate sedge)	0.5	0-0.5	20	0.10	N
Carex filifolia (thread-leaved sedge)	0.5	0-0.5	20	0.10	N
Carex lanuginosa (woolly sedge)	30.0	0-30	20	6.00	N
Carex obtusata (blunt sedge)	0.5	0-0.5	20	0.10	N
Carex praegracilis (graceful sedge)	4.5	0-10	60	2.70	N
Carex scopulorum (Holm's Rocky Mountain sedge)	0.5	0-0.5	20	0.10	N
Carex spp. (sedge)	5.3	0-10	40	2.10	N
Carex xerantica (white-scaled sedge)	0.5	0-0.5	20	0.10	N
Deschampsia cespitosa (tufted hair grass)	18.3	0-50	80	14.60	N
Deschampsia spp. (hair grass)	0.5	0-0.5	20	0.10	N
Elymus innovatus (hairy wild rye)	3.0	0-3	20	0.60	N
Festuca rubra (red fescue)	0.5	0-0.5	20	0.10	B
Juncus balticus (wire rush)	10.3	0-30	60	6.20	N
Phleum pratense (timothy)	3.0	0-3	20	0.60	I
Poa pratensis (Kentucky bluegrass)	13.3	0-30	80	10.60	I
Schizachne purpurascens (purple oat grass)	10.0	0-10	20	2.00	N
Forbs (N = 37)					
Achillea millefolium (common yarrow)	0.5	0-0.5	60	0.30	N
Allium schoenoprasum (wild chives)	0.5	0-0.5	20	0.10	N
Arnica fulgens (shining arnica)	0.5	0-0.5	20	0.10	N
Aster borealis (marsh aster)	3.0	0-3	20	0.60	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	40	0.20	N

Table 400. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Aster laevis (smooth aster)	7.8	0-20	60	4.70	N
Aster spp. (aster)	0.5	0-0.5	20	0.10	N
Camassia quamash (blue camas)	0.5	0-0.5	20	0.10	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	20	0.10	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	40	0.20	N
Epilobium angustifolium (common fireweed)	1.8	0-3	40	0.70	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	20	0.10	N
Fragaria virginiana (wild strawberry)	3.7	0-10	60	2.20	N
Galium boreale (northern bedstraw)	1.3	0-3	60	0.80	N
Gentianella amarella (felwort)	0.5	0-0.5	20	0.10	N
Geum aleppicum (yellow avens)	1.8	0-3	40	0.70	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	40	0.20	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	20	0.10	N
Hieracium umbellatum (narrow-leaved hawkweed)	0.5	0-0.5	20	0.10	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	20	0.10	N
Mertensia paniculata (tall lungwort)	1.8	0-3	40	0.70	N
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	40	0.20	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	20	0.10	N
Potentilla gracilis (graceful cinquefoil)	2.9	0-10	80	2.30	N
Rumex occidentalis (western dock)	0.5	0-0.5	20	0.10	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	20	0.10	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	20	0.10	N
Solidago missouriensis (low goldenrod)	0.5	0-0.5	20	0.10	N
Taraxacum officinale (common dandelion)	1.3	0-3	60	0.80	I
Thalictrum occidentale (western meadow rue)	0.5	0-0.5	20	0.10	N
Thalictrum venulosum (veiny meadow rue)	3.7	0-10	60	2.20	N
Trifolium repens (white clover)	0.5	0-0.5	20	0.10	I
Urtica dioica (common nettle)	0.5	0-0.5	20	0.10	N
Valeriana dioica (northern valerian)	0.5	0-0.5	20	0.10	N
Vicia americana (wild vetch)	0.5	0-0.5	60	0.30	N
Viola adunca (early blue violet)	0.5	0-0.5	20	0.10	N
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	20	0.10	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

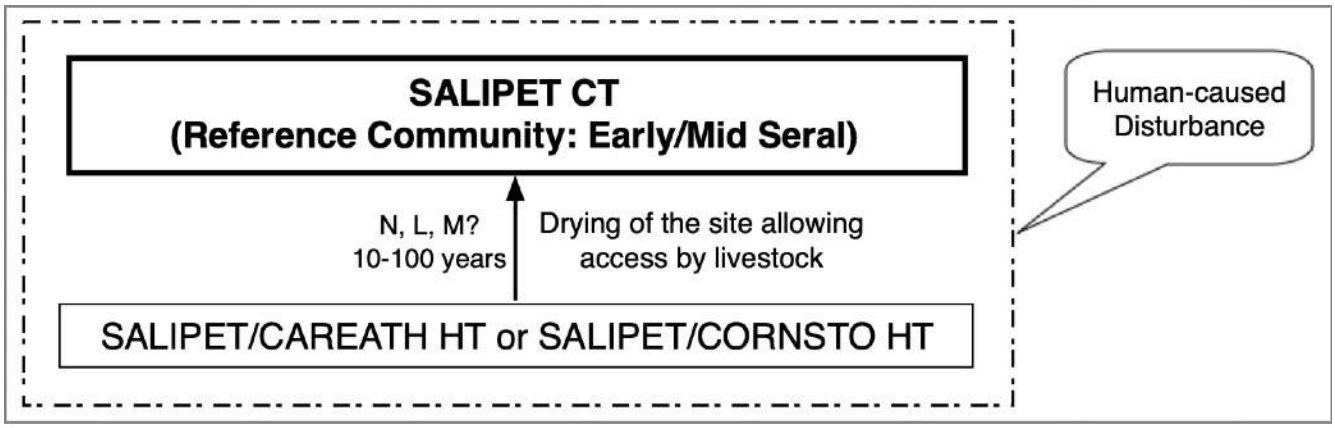
[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix petiolaris* (basket willow) community type is usually the result of long term heavy grazing by livestock on stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type or the *Salix petiolaris/*

Cornus stolonifera (basket willow/red-osier dogwood) habitat type, wherein the palatable understory species are removed and replaced by disturbance increaser species, such as *Poa pratensis* (Kentucky bluegrass).

Figure 84 shows a schematic diagram of vegetation successional pathways on sites of the *Salix petiolaris* (basket willow) community type.



Successional Pathway of *Salix petiolaris* (basket willow) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix petiolaris* (basket willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
SALIPET/CAREATH HT—*Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type
SALIPET/CORNSTO HT—*Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type
SALIPET CT—*Salix petiolaris* (basket willow) community type

Figure 84. Successional pathway for sites of the *Salix petiolaris* (basket willow) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 85 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix petiolaris* (basket willow) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

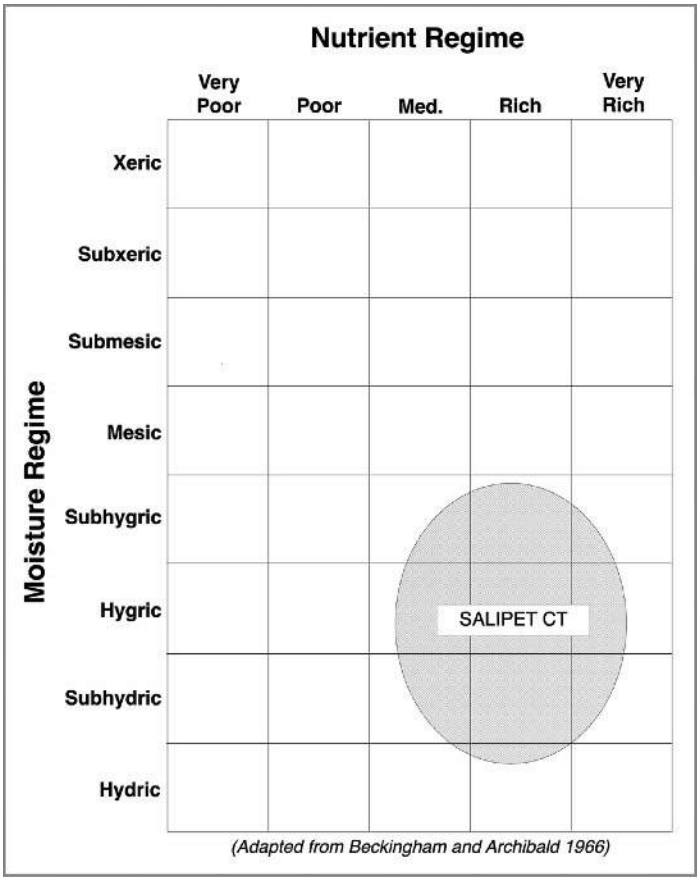


Figure 85. Edatope grid position for the *Salix petiolaris* (basket willow) community type (SALIPET CT)

SOILS

Soils information is currently unavailable for sites supporting the *Salix petiolaris* (basket willow) community type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species*.

ADJACENT COMMUNITIES

Adjacent wetter sites may have communities dominated by *Salix bebbiana* (beaked willow), *Salix glauca* (smooth willow), *Salix planifolia* (flat-leaved willow), or a fen type community dominated by wetland *Carex* (sedge) species. Adjacent drier sites will often have a community dominated by *Picea glauca* (white spruce) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix petiolaris* (basket willow)**—*Salix petiolaris* (basket willow) grows around sloughs, along shorelines, and in moist meadows, often forming extensive thickets (Tannas 1997a). It grows in moist conditions with direct sunlight in wet meadows, fens, along streams and lakeshores, and in forest clearings. The species is associated with disturbed or earlier successional stands.

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) is common throughout most natural regions of Alberta, occurring in moist meadows, along slough margins, and in boggy areas (Tannas 1997a). The species can occur as a pioneer, as well as either a component or a dominant in mid and late seral stands. It is rarely found in dense shade. It can be an aggressive colonizer on disturbed sites, particularly at higher elevation sites (Walsh 1995).

Livestock

***Salix petiolaris* (basket willow)**—*Salix petiolaris* (basket willow) has good forage value, similar to other willow species. The species is palatable, but may not be heavily browsed when in the presence of more preferred species, such as *Salix bebbiana* (Bebb willow). *Salix petiolaris* (basket willow) is tolerant of high browsing pressure (Tannas 1997a).

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) has high protein content early in the season, and is generally palatable to both livestock and wildlife throughout the season. The species is a grazing decreaser. Although cropped tufts may resprout from the base, these are relatively short lived. The species depends primarily on seed for reproduction (Tannas 1997a).

Deschampsia cespitosa (tufted hair grass) provides good to excellent forage for all classes of livestock. It is often an abundant source of forage throughout its growing season. However, it decreases with excessive grazing. Long term, intensive use reduces seed production. *Deschampsia cespitosa* (tufted hair grass) is a key indicator of condition and grazing utilization in certain mountain meadow communities (Walsh 1995).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix petiolaris* (basket willow)**—Stands of *Salix petiolaris* (basket willow) associated with *Carex* (sedge) meadows and topographical depressions, provide browse and good thermal and hiding cover for many wildlife species, usually in a beneficial mosaic pattern (Thompson and Hansen 2003).

***Deschampsia cespitosa* (tufted hair grass)**—Use of *Deschampsia cespitosa* (tufted hair grass) by wildlife species is variable, although it provides palatable forage early spring through summer. It is frequently grazed by bears, and feral horses in the foothills of western Alberta were found to graze it (Walsh 1995).

Fire

***Salix petiolaris* (basket willow)**—Little is known about the response of *Salix petiolaris* (basket willow) to fire, but like most *Salix* (willow) species, it readily sprouts from the root crown after all but the most intense fire. Under normal conditions, stands of *Salix petiolaris* (basket willow) are located in sites usually too wet to carry wildfire (Thompson and Hansen 2003).

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) generally survives all but the most severe fires. It usually sprouts from the root crown after aerial portions are burned. Tufts formed by the leaves often protect basal buds from fire damage. Within just a few years *Deschampsia cespitosa* (tufted hair grass) usually recovers to pre-fire abundance (Walsh 1995).

Rehabilitation/Restoration Considerations

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) has a broad ecological range and is useful for revegetation, particularly on disturbances at high elevation or high latitude. It grows at a

medium rate compared to other grasses and has a poor rate of spread, but it highly competitive, relative to other plants evaluated for high latitude revegetation. It has low to medium potential for short-term revegetation, but has medium to high potential for long-term revegetation, and is a valuable soil stabilizer, especially in wet, acidic sites (Walsh 1995).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix petiolaris* (basket willow) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Basket willow/Kentucky bluegrass

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msd9a Basket willow/Kentucky bluegrass (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix petiolaris* (basket willow) community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003); and
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001).

Salix planifolia/Carex aquatilis Habitat Type
(flat-leaved willow/water sedge Habitat Type)

SALIPLA/CAREAQU Habitat Type
Number of Stands = 15 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 6; Other Data Sets = 9)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type is a major type in the Lower Foothills Natural Subregion, a major type in the Upper Foothills Natural Subregion, and a major type in the Montane Natural Subregion of Alberta. This habitat type is found in wet areas adjacent to lakes, streams, and sloughs. The sites are among the wettest terrestrial sites supporting willows, often occurring in extensive stands on low lying areas around lakes. *Salix planifolia* (flat-leaved willow) is found more commonly on lentic sites with water that is less aerated (e.g., fens, sloughs, and lakeshores) than on lotic sites with faster flowing water. When found on lotic sites, this type is usually associated with extensive beaver dam complexes.

Photo 20 shows a typical stand of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type.

Photo 20. A stand of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 401 shows the five most prominent plant species among the four lifeforms for species recorded in all 15 stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type. The two type indicator species, *Salix planifolia* (flat-leaved willow) and *Carex aquatilis* (water sedge), are the only species more than moderately prominent in these stands.

Table 401. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (number = 15 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	0.70	Native
Betula papyrifera (white birch)	0.07	Native
Populus tremuloides (aspen)	0.07	Native
Picea engelmannii x glauca (Engelmann x white spruce)	0.03	Native
Pinus contorta (lodgepole pine)	0.03	Native
Shrubs		
Salix planifolia (flat-leaved willow)	36.67	Native
Salix maccalliana (velvet-fruited willow)	5.33	Native
Betula glandulosa (bog birch)	5.10	Native
Betula pumila (dwarf birch)	4.40	Native
Salix athabascensis (Athabasca willow)	4.00	Native
Graminoids		
Carex aquatilis (water sedge)	36.00	Native
Calamagrostis stricta (narrow reed grass)	4.27	Native
Calamagrostis canadensis (marsh reed grass)	2.70	Native
Poa palustris (fowl bluegrass)	2.07	Native
Juncus balticus (wire rush)	1.53	Native

Table 401. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Potentilla palustris (marsh cinquefoil)	1.77	Native
Geum macrophyllum (large-leaved yellow avens)	0.90	Native
Cicuta maculata (water-hemlock)	0.67	Native
Epilobium palustre (marsh willowherb)	0.67	Native
Moss spp. (moss)	0.67	Both

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 402 through Table 405, break out the vegetation recorded in all 15 stands sampled of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated habitat type of major occurrence across the study area.

Table 402 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type. For the 15 stands comprising the habitat type, the number of unique species was 121 with 106 (87.6 percent) of them being native species.

Table 402. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (number = 15 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	6	6	0	0
Shrubs	23	23	0	0
Graminoids	28	21	4	3
Forbs	64	56	5	3
TOTAL	***121 (100.0%)***	***106 (87.6%)***	***9 (7.4%)***	***6 (5.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 403 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type. The average number of species per stand is 16.5, with native species comprising 15.5 species per stand or 93.9 percent.

Table 403. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (number = 15 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.9	0.9	0.0	0.0
Shrubs	4.3	4.3	0.0	0.0
Graminoids	4.1	3.6	0.3	0.2
Forbs	7.2	6.7	0.3	0.2
TOTAL	***16.5 (100.0%)***	***15.5 (93.9%)***	***0.6 (3.6%)***	***0.4 (2.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 404 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type. The average canopy cover per stand is 133.4 percent, with native species comprising 128.8 percent or 96.6 percent of the total amount of average canopy cover per stand.

Table 404. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (number = 15 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.9%	0.9%	0.0%	0.0%
Shrubs	64.9%	64.9%	0.0%	0.0%
Graminoids	55.3%	52.1%	1.6%	1.6%
Forbs	12.4%	11.0%	0.7%	0.7%
TOTAL	***133.4% (100.0%)***	***128.8% (96.6%)***	***2.3% (1.7%)***	***2.3% (1.7%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 405 shows the average number of species and average canopy cover by lifeform in stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type. The average number of species per stand was 16.5 with an average canopy cover of 133.4 percent.

Table 405. Average number of species and average canopy cover by lifeform in stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (number = 15 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.9	0.9%
Shrubs	4.3	64.9%
Graminoids	4.1	55.3%
Forbs	7.2	12.4%
TOTAL	***16.5***	***133.4%***

Sampled Stands Plant Species List

A total of 121 plant species were recorded on at least one of 15 stands sampled of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (Table 406). Six tree species were recorded in small amounts, while *Salix planifolia* (flat-leaved willow) alone dominates the 23 shrub species recorded. *Carex aquatilis* (water sedge) dominates the 28 graminoids, while the 64 forbs recorded have no notably prominent species among them.

Table 406. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (number = 15 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 6)					
Betula papyrifera (white birch)	0.5	0-0.5	13	0.07	N
Picea engelmannii x glauca (Engelmann x white spruce)	0.5	0-0.5	7	0.03	N
Picea glauca (white spruce)	1.8	0-3	40	0.70	N
Pinus contorta (lodgepole pine)	0.5	0-0.5	7	0.03	N
Populus balsamifera (balsam poplar)	0.5	0-0.5	7	0.03	N
Populus tremuloides (aspen)	0.5	0-0.5	13	0.07	N
Shrubs (N = 23)					
Alnus crispa (green alder)	3.0	0-3	7	0.20	N
Betula glandulosa (bog birch)	12.8	0-40	40	5.10	N
Betula pumila (dwarf birch)	22.0	0-60	20	4.40	N
Cornus stolonifera (red-osier dogwood)	0.5	0-0.5	7	0.03	N
Linnaea borealis (twinflower)	0.5	0-0.5	7	0.03	N
Potentilla fruticosa (shrubby cinquefoil)	0.5	0-0.5	7	0.03	N
Ribes lacustre (bristly black currant)	0.5	0-0.5	7	0.03	N
Rosa acicularis (prickly rose)	3.0	0-3	7	0.20	N
Rubus arcticus (dwarf raspberry)	1.6	0-3	47	0.73	N

Table 406. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Rubus pubescens (dewberry)	0.5	0-0.5	7	0.03	N
Salix athabascensis (Athabasca willow)	30.0	0-40	13	4.00	N
Salix barrattiana (Barratt's willow)	3.0	0-3	7	0.20	N
Salix bebbiana (beaked willow)	2.9	0-10	33	0.97	N
Salix candida (hoary willow)	0.5	0-0.5	13	0.07	N
Salix glauca (smooth willow)	15.3	0-30	13	2.03	N
Salix maccalliana (velvet-fruited willow)	40.0	0-50	13	5.33	N
Salix myrtillifolia (myrtle-leaved willow)	11.5	0-20	27	3.07	N
Salix pedicellaris (bog willow)	0.5	0-0.5	13	0.07	N
Salix petiolaris (basket willow)	3.7	0-10	20	0.73	N
Salix planifolia (flat-leaved willow)	36.7	20-90	100	36.67	N
Salix pseudomonticola (false mountain willow)	1.8	0-3	13	0.23	N
Salix serissima (autumn willow)	10.0	0-10	7	0.67	N
Vaccinium vitis-idaea (bog cranberry)	0.5	0-0.5	7	0.03	N
Graminoids (N = 28)					
Agropyron repens (quack grass)	0.5	0-0.5	13	0.07	I
Agropyron spp. (wheat grass)	0.5	0-0.5	7	0.03	B
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	13	0.07	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	7	0.03	N
Alopecurus occidentalis (alpine foxtail)	3.0	0-3	7	0.20	N
Calamagrostis canadensis (marsh reed grass)	10.1	0-20	27	2.70	N
Calamagrostis stricta (narrow reed grass)	12.8	0-50	33	4.27	N
Carex aquatilis (water sedge)	36.0	10-90	100	36.00	N
Carex atherodes (awned sedge)	3.0	0-3	13	0.40	N
Carex athrostachya (long-bracted sedge)	20.0	0-20	7	1.33	N
Carex brunnescens (brownish sedge)	3.0	0-3	7	0.20	N
Carex diandra (two-stamened sedge)	10.0	0-10	7	0.67	N
Carex disperma (two-seeded sedge)	0.5	0-0.5	13	0.07	N
Carex gynocrates (northern bog sedge)	3.0	0-3	13	0.40	N
Carex limosa (mud sedge)	0.5	0-0.5	7	0.03	N
Carex prairea (prairie sedge)	0.5	0-0.5	7	0.03	N
Carex sartwellii (Sartwell's sedge)	0.5	0-0.5	7	0.03	N
Carex utriculata (beaked sedge)	0.5	0-0.5	7	0.03	N
Deschampsia cespitosa (tufted hair grass)	3.9	0-10	33	1.30	N
Festuca spp. (fescue)	20.0	0-20	7	1.33	B
Glyceria striata (fowl manna grass)	10.0	0-10	7	0.67	N
Grass spp. (Unknown grass)	3.0	0-3	7	0.20	B
Hierochloe odorata (sweet grass)	0.5	0-0.5	7	0.03	N
Juncus balticus (wire rush)	11.5	0-20	13	1.53	N
Luzula multiflora (field wood-rush)	3.0	0-3	7	0.20	N
Phleum pratense (timothy)	0.5	0-0.5	7	0.03	I
Poa palustris (fowl bluegrass)	7.8	0-20	27	2.07	N
Poa pratensis (Kentucky bluegrass)	20.0	0-20	7	1.33	I

Table 406. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Forbs (N = 64)					
Achillea millefolium (common yarrow)	1.3	0-3	20	0.27	N
Aster borealis (marsh aster)	0.5	0-0.5	7	0.03	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	20	0.10	N
Aster modestus (large northern aster)	0.5	0-0.5	7	0.03	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	7	0.03	N
Cicuta maculata (water-hemlock)	10.0	0-10	7	0.67	N
Cirsium arvense (Canada thistle)	0.5	0-0.5	7	0.03	I
Delphinium glaucum (tall larkspur)	1.8	0-3	13	0.23	N
Dodecatheon conjugens (mountain shooting star)	0.5	0-0.5	7	0.03	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	33	0.17	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	13	0.07	N
Epilobium palustre (marsh willowherb)	10.0	0-10	7	0.67	N
Equisetum arvense (common horsetail)	1.8	0-3	13	0.23	N
Equisetum fluviatile (swamp horsetail)	1.8	0-3	13	0.23	N
Fragaria virginiana (wild strawberry)	1.1	0-3	27	0.30	N
Galium boreale (northern bedstraw)	0.5	0-0.5	7	0.03	N
Galium labradoricum (Labrador bedstraw)	3.0	0-3	7	0.20	N
Galium trifidum (small bedstraw)	0.5	0-0.5	7	0.03	N
Gentianella amarella (felwort)	3.0	0-3	7	0.20	N
Geum aleppicum (yellow avens)	0.5	0-0.5	20	0.10	N
Geum macrophyllum (large-leaved yellow avens)	4.5	0-10	20	0.90	N
Geum rivale (purple avens)	1.3	0-3	20	0.27	N
Geum triflorum (three-flowered avens)	3.0	0-3	7	0.20	N
Habenaria hyperborea (northern green bog orchid)	0.5	0-0.5	7	0.03	N
Hippuris vulgaris (common mare's-tail)	0.5	0-0.5	7	0.03	N
Mentha arvensis (wild mint)	3.0	0-3	7	0.20	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	20	0.10	N
Mitella nuda (bishop's-cap)	1.8	0-3	27	0.47	N
Moss spp. (moss)	10.0	0-10	7	0.67	B
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	7	0.03	N
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	7	0.03	N
Petalostemon purpureum (purple prairie-clover)	10.0	0-10	7	0.67	N
Petasites frigidus (arctic sweet coltsfoot)	1.1	0-3	27	0.30	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	13	0.07	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	13	0.07	N
Polemonium acutiflorum (tall Jacob's-ladder)	3.0	0-3	13	0.40	N
Polemonium pulcherrimum (showy Jacob's-ladder)	0.5	0-0.5	7	0.03	N
Polygonum lapathifolium (pale persicaria)	3.0	0-3	7	0.20	N
Polygonum spp. (polygonum)	0.5	0-0.5	7	0.03	B
Polygonum viviparum (alpine bistort)	0.5	0-0.5	7	0.03	N
Polypodium virginianum (rock polypody)	0.5	0-0.5	7	0.03	N
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	7	0.03	N

Table 406. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	7	0.03	N
Potentilla palustris (marsh cinquefoil)	5.3	0-10	33	1.77	N
Pyrola asarifolia (common pink wintergreen)	3.0	0-3	7	0.20	N
Pyrola chlorantha (greenish-flowered wintergreen)	0.5	0-0.5	7	0.03	N
Ranunculus spp. (ranunculus)	0.5	0-0.5	7	0.03	B
Rumex occidentalis (western dock)	0.5	0-0.5	20	0.10	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	20	0.10	N
Senecio lugens (black-tipped groundsel)	0.5	0-0.5	7	0.03	N
Senecio pauciflorus (few-flowered ragwort)	0.5	0-0.5	7	0.03	N
Sonchus arvensis (perennial sow-thistle)	3.0	0-3	7	0.20	I
Stellaria longifolia (long-leaved chickweed)	3.0	0-3	7	0.20	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	13	0.07	N
Taraxacum officinale (common dandelion)	3.0	0-3	7	0.20	I
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	7	0.03	N
Trifolium repens (white clover)	0.5	0-0.5	7	0.03	I
Typha latifolia (common cattail)	3.0	0-3	7	0.20	N
Urtica dioica (common nettle)	0.5	0-0.5	7	0.03	N
Valeriana dioica (northern valerian)	0.5	0-0.5	13	0.07	N
Vicia americana (wild vetch)	0.5	0-0.5	20	0.10	N
Viola adunca (early blue violet)	3.0	0-3	7	0.20	N
Viola palustris (marsh violet)	0.5	0-0.5	7	0.03	N
Zizia aptera (heart-leaved Alexanders)	3.0	0-3	7	0.20	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 407 shows the five most prominent plant species among the four lifeforms for species recorded in all six relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type. The two type indicator species, *Salix planifolia* (flat-leaved willow) and *Carex aquatilis* (water sedge), are most prominent and the only species more than moderately prominent in these stands.

Table 407. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (number = 6 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	0.17	Native
Betula papyrifera (white birch)	0.08	Native
Populus tremuloides (aspen)	0.08	Native
Shrubs		
Salix planifolia (flat-leaved willow)	45.00	Native
Salix serissima (autumn willow)	1.67	Native
Betula glandulosa (bog birch)	1.00	Native
Betula pumila (dwarf birch)	0.50	Native
Salix bebbiana (beaked willow)	0.17	Native
Graminoids		
Carex aquatilis (water sedge)	58.33	Native
Calamagrostis canadensis (marsh reed grass)	1.67	Native
Carex atherodes (awned sedge)	1.00	Native
Calamagrostis stricta (narrow reed grass)	0.67	Native
Carex brunnescens (brownish sedge)	0.50	Native
Forbs		
Potentilla palustris (marsh cinquefoil)	2.67	Native
Geum macrophyllum (large-leaved yellow avens)	1.67	Native
Moss spp. (moss)	1.67	Both
Galium labradoricum (Labrador bedstraw)	0.50	Native
Geum triflorum (three-flowered avens)	0.50	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 408 through Table 411, break out the vegetation recorded in six relatively undisturbed late seral to climax stands sampled of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of

canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated habitat type of major occurrence across the study area.

Table 408 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/ Carex aquatilis* (flat-leaved willow/water sedge) habitat type. For the 6 stands comprising the habitat type, the number of unique species was 39 with 36 (92.3 percent) of them being native species.

Table 408. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (number = 6 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3	3	0	0
Shrubs	7	7	0	0
Graminoids	9	8	0	1
Forbs	20	18	1	1
TOTAL	***39 (100.0%)***	***36 (92.3%)***	***1 (2.6%)***	***2 (5.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 409 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type. The average number of species per stand is 10.3, with native species comprising 9.9 species per stand or 96.1 percent.

Table 409. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (number = 6 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.7	0.7	0.0	0.0
Shrubs	2.3	2.3	0.0	0.0
Graminoids	2.8	2.7	0.0	0.2
Forbs	4.5	4.2	0.2	0.0
TOTAL	***10.3 (100.0%)***	***9.9 (96.1%)***	***0.2 (1.9%)***	***0.4 (3.9%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 410 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type. The average canopy cover per stand is 122.1 percent, with native species comprising 119.8 percent or 98.2 percent of the total amount of average canopy cover per stand.

Table 410. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (number = 6 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.3%	0.3%	0.0%	0.0%
Shrubs	48.5%	48.5%	0.0%	0.0%
Graminoids	63.3%	62.5%	0.0%	0.5%
Forbs	9.9%	8.2%	0.1%	1.7%
TOTAL	***122.1% (100.0%)***	***119.8% (98.2%)***	***0.1% (0.1%)***	***2.2% (1.8%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 411 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type. The average number of species per stand was 10.3 with an average canopy cover of 122.1 percent.

Table 411. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (number = 6 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.7	0.3%
Shrubs	2.3	48.5%
Graminoids	2.8	63.3%
Forbs	4.5	9.9%
TOTAL	***10.3***	***122.1%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 39 plant species were recorded on at least one of six relatively undisturbed late seral to climax stands sampled of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (Table 412). Very small amounts of three tree species were recorded; while of the seven shrub species recorded, only *Salix planifolia* (flat-leaved willow) is highly prominent. Among the nine graminoids, *Carex aquatilis* (water sedge) is the only very prominent species, whereas none of the 20 forbs recorded is notably prominent.

Table 412. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (number = 6 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 3)					
Betula papyrifera (white birch)	0.5	0-0.5	17	0.08	N
Picea glauca (white spruce)	0.5	0-0.5	33	0.17	N
Populus tremuloides (aspen)	0.5	0-0.5	17	0.08	N
Shrubs (N = 7)					
Betula glandulosa (bog birch)	3.0	0-3	33	1.00	N
Betula pumila (dwarf birch)	3.0	0-3	17	0.50	N
Salix bebbiana (beaked willow)	0.5	0-0.5	33	0.17	N
Salix candida (hoary willow)	0.5	0-0.5	17	0.08	N
Salix petiolaris (basket willow)	0.5	0-0.5	17	0.08	N
Salix planifolia (flat-leaved willow)	45.0	20-90	100	45.00	N
Salix serissima (autumn willow)	10.0	0-10	17	1.67	N
Graminoids (N = 9)					
Calamagrostis canadensis (marsh reed grass)	10.0	0-10	17	1.67	N
Calamagrostis stricta (narrow reed grass)	1.3	0-3	50	0.67	N
Carex aquatilis (water sedge)	58.3	10-90	100	58.33	N
Carex atherodes (awned sedge)	3.0	0-3	33	1.00	N
Carex brunnescens (brownish sedge)	3.0	0-3	17	0.50	N
Carex utriculata (beaked sedge)	0.5	0-0.5	17	0.08	N
Deschampsia cespitosa (tufted hair grass)	3.0	0-3	17	0.50	N
Grass spp. (Unknown grass)	3.0	0-3	17	0.50	B
Poa palustris (fowl bluegrass)	0.5	0-0.5	17	0.08	N
Forbs (N = 20)					
Achillea millefolium (common yarrow)	0.5	0-0.5	17	0.08	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	17	0.08	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	33	0.17	N
Equisetum fluviatile (swamp horsetail)	0.5	0-0.5	17	0.08	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	17	0.08	N
Galium labradoricum (Labrador bedstraw)	3.0	0-3	17	0.50	N
Galium trifidum (small bedstraw)	0.5	0-0.5	17	0.08	N
Geum aleppicum (yellow avens)	0.5	0-0.5	33	0.17	N
Geum macrophyllum (large-leaved yellow avens)	10.0	0-10	17	1.67	N
Geum triflorum (three-flowered avens)	3.0	0-3	17	0.50	N
Hippuris vulgaris (common mare's-tail)	0.5	0-0.5	17	0.08	N
Moss spp. (moss)	10.0	0-10	17	1.67	B

Table 412. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Petasites frigidus (arctic sweet coltsfoot)	0.5	0-0.5	33	0.17	N
Polemonium acutiflorum (tall Jacob's-ladder)	3.0	0-3	17	0.50	N
Potentilla palustris (marsh cinquefoil)	5.3	0-10	50	2.67	N
Pyrola asarifolia (common pink wintergreen)	3.0	0-3	17	0.50	N
Rumex occidentalis (western dock)	0.5	0-0.5	33	0.17	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	33	0.17	N
Trifolium repens (white clover)	0.5	0-0.5	17	0.08	I
Typha latifolia (common cattail)	3.0	0-3	17	0.50	N

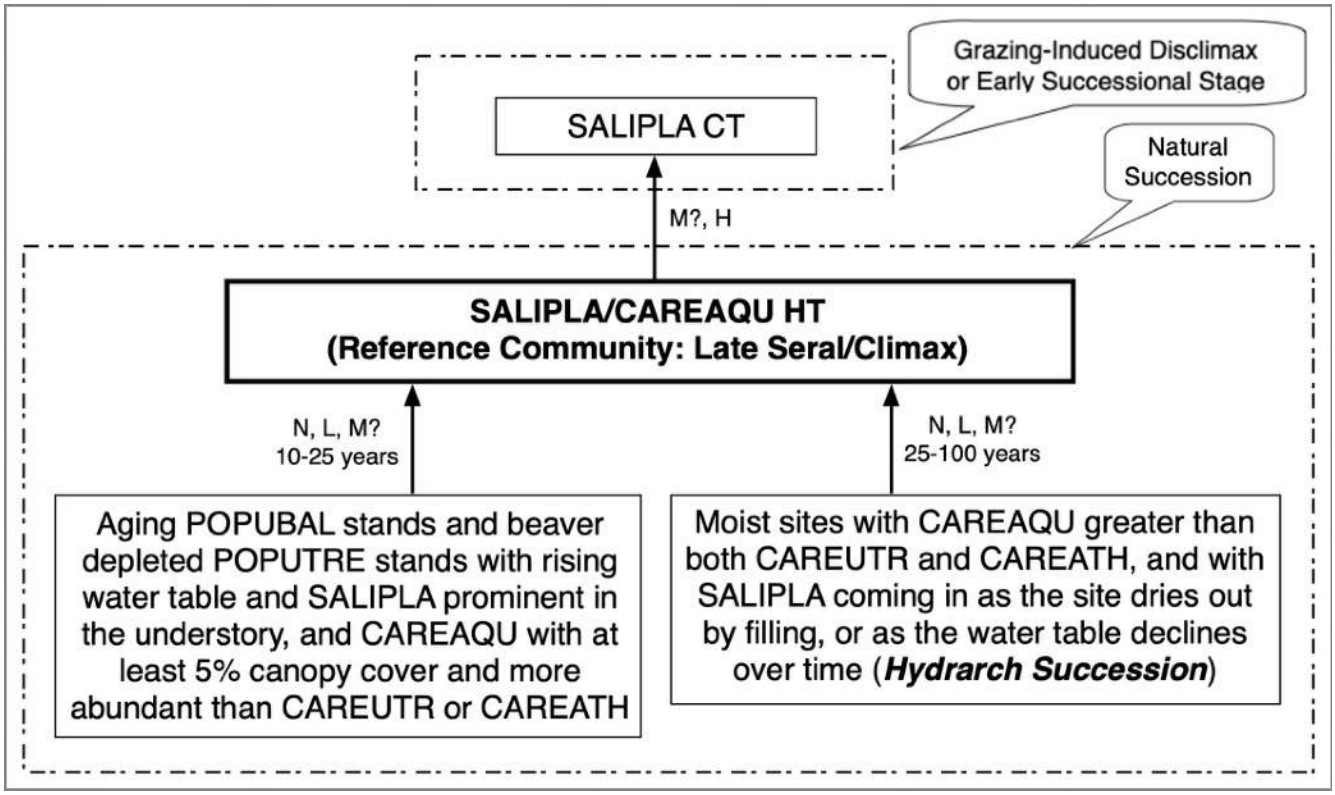
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Stands of *Salix planifolia* (flat-leaved willow) typically occur on sites hydrologically altered by beaver to create the hydrologic and edaphic conditions for which this willow is adapted. This process is a kind of primary succession known as hydrarch succession, whereby beaver ponds with very wet stands of *Carex aquatilis* (water sedge) accumulate sediment and vegetative matter over time elevating the surface far enough above the water table to support *Salix planifolia* (flat-leaved willow).

Figure 86 shows a schematic diagram of vegetation successional pathways on sites of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type.



Successional Pathway of *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUTRE—*Populus tremuloides* (aspen)
SALIPLA—*Salix planifolia* (flat-leaved willow)
SALIPLA/CAREAQU HT—*Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type
SALIPLA CT—*Salix planifolia* (flat-leaved willow) community type

Figure 86. Successional pathway for sites of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 87 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

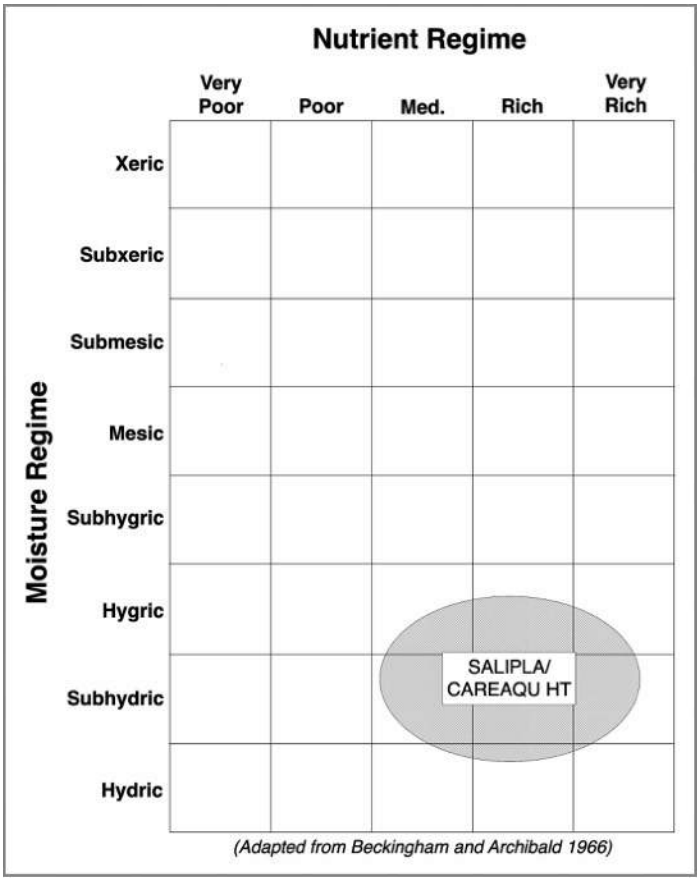


Figure 87. Edatope grid position for the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (SALIPLA/CAREAQU HT)

SOILS

Parent material on sites supporting the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type is predominantly fluvial. Soil drainage ranges from poorly drained to very poorly drained, and mineral soils typically are gleyed, with textures from sandy loam to clay covered by an organic layer of varying thickness (Baker and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites will likely have the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type or be dominated by a wetland *Carex* (sedge) species, such as *Carex utriculata* (beaked sedge) or *Carex aquatilis* (water sedge). Adjacent drier sites will often have the *Salix planifolia/Carex atherodes* (flat-

leaved willow/awned sedge) habitat type or a community dominated by *Salix bebbiana* (beaked willow), *Picea glauca* (white spruce), and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix planifolia* (flat-leaved willow)**—*Salix planifolia* (flat-leaved willow) is found in most natural regions of Alberta, growing in moist thickets, on boggy and swampy sites, and along streambanks and shorelines (Tannas 1997a).

At higher elevations, *Salix planifolia* (flat-leaved willow) grows in zones dominated by *Picea engelmannii* (Engelmann spruce), *Abies lasiocarpa* (subalpine fir), and *Pinus contorta* (lodgepole pine). Soils may be mineral or organic. At lower elevations, the species generally is found scattered within other willow-dominated communities along the banks of streams, ponds, lakes, and in wet meadows and marshes (Uchytil 1991a).

Salix planifolia (flat-leaved willow) is shade intolerant, and often forms relatively stable communities maintained by the high water table and a high elevation climate (Uchytil 1991a).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is very common and widely distributed across Alberta (Tannas 1997a). It is a wetland species, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). *Carex aquatilis* (water sedge) is a native, wetland obligate, long-lived perennial. It is a sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of finer roots (Hauser 2006). It thrives on disturbed sites, is shade intolerant, and occurs in various stages of seral succession (Hauser 2006).

Livestock

***Salix planifolia* (flat-leaved willow)**—All classes of livestock eat willows, but *Salix planifolia* (flat-leaved willow) importance in livestock diets has not been extensively reported (Uchytil 1991a). Tannas (1997a) states that livestock utilize *Salix planifolia* (flat-leaved willow) when more palatable browse becomes scarce. Most willows are palatable to both livestock and wild ungulates, and their palatability tends to increase as the growing season advances (Uchytil 1991a). Plants of this species become decadent or stunted when excessively browsed by cattle, wild ungulates, or beavers; however decadent plants recover relatively quickly when the browsing is removed (Uchytil 1991a).

***Carex aquatilis* (water sedge)**—The livestock forage value of *Carex aquatilis* (water sedge) is rated as good (Tannas 1997a), but varies with region, season, and previous grazing use. On narrow riparian or wetland sites within large pastures, *Carex* species (sedges) are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur. In general, *Carex* species (sedges) should respond satisfactorily to traditional grazing systems. However, on streamside sites ample residual cover should be left to protect the soil surface and trap sediments during fall rains or spring runoff. Removing cattle for at least 30 days from these streamside sites for sedge regrowth at the end of the growing season should provide sufficient residual cover (Myers 1989).

Given that *Carex aquatilis* (water sedge) grows in wet places, it is generally not grazed until late summer and fall when soils have dried (Hauser 2006). Very wet soils may deter animal use until they dry. However, if high level of grazing does occur, there will be a marked decrease in *Carex aquatilis* (water sedge) and an increase in the less palatable *Juncus balticus* (wire rush) (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix planifolia* (flat-leaved willow)**—*Salix planifolia* (flat-leaved willow) is highly palatable to moose and beaver, but is apparently less so to elk and deer. Consumption by elk and mule deer is generally low (Uchytil 1991a). Willows in general are a preferred food and building material of beaver. Ducks, grouse, other birds, and small mammals all eat willow shoots, catkins, buds, and leaves (Uchytil 1991a).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is grazed by many ungulates, including moose, caribou, and elk, but it is not a major component of their diet. Due to the saturated habitat of the species, grazing by most ungulates is limited. *Carex aquatilis* (water sedge) habitat provides nesting and hiding cover for some birds, waterfowl, and small mammals. In riparian and wetland sites, The species is also an important source of food for a variety of waterfowl (Hauser 2006).

Fisheries

***Salix planifolia* (flat-leaved willow)**—The dense network of roots from the *Salix* (willows) and grass are effective in stabilizing streambanks. Immediately adjacent to the stream, the banks become undercut and sag into the water providing excellent hiding cover for fish. The *Salix* (willows) provides valuable overhanging stream cover and shade. The importance of *Salix* (willows) in streambank protection, cover, and thermal protection for fisheries cannot be over emphasized (Thompson and Hansen 2003).

***Carex aquatilis* (water sedge)**—Stands of *Carex aquatilis* (water sedge) often are adjacent to streams supporting trout fisheries. The combined tufted and rhizomatous growth habit of the species effectively stabilizes streambanks. Overhanging *Carex* species (sedges) along the banks provide valuable resting cover and shade for fish (Thompson and Hansen 2003).

Fire

***Salix planifolia* (flat-leaved willow)**—The wet meadow and stream side habitats occupied by *Salix planifolia* (flat-leaved willow) rarely burn. In fact, these riparian wet areas frequently act as fire breaks. However, under dry conditions, riparian habitats can burn severely. Most willow species sprout from the root crown after being top-killed by fire, however *Salix* (willows) on organic soils may be killed by severe fires which burn deep into the soil, char the roots, and prevent sprouting (Uchytil 1991a).

***Carex aquatilis* (water sedge)**—Sites supporting stands of *Carex aquatilis* (water sedge) seldom burn, except in periods of severe drought. When stands of the species do burn, the plants are usually top-killed by the fire and soon re-establish after the fire by seed and/or lateral spread of surviving rhizomes (Hauser 2006). The rhizomes are approximately 5 cm below the ground surface, and are somewhat protected from the heat. The wet habitat also provides protection for roots and rhizomes, although the better-drained areas are more susceptible to fires during dry periods.

Stands of *Carex aquatilis* (water sedge) are suited to prescribed fire, but exclusion of livestock during the year prior to burning is necessary. Residual cover burns well in spring, prior to the growing season. Fire will reduce litter accumulations and temporarily increase productivity. However, species composition in the community will not drastically shift from dominance by *Carex aquatilis* (water sedge) (DeBenedetti and Parsons 1984). Care must be taken in burning along streambanks, so as to avoid impairing the excellent erosion protection provided by the species (Thompson and Hansen 2003).

Rehabilitation/Restoration Considerations

***Salix planifolia* (flat-leaved willow)**—*Salix planifolia* (flat-leaved willow) is recommended for revegetating disturbed riparian sites, and is especially useful for streambank stabilization. It may be planted as rooted or unrooted stem cuttings, but the rooted cuttings have higher survival rates than unrooted cuttings (Uchytil 1991a).

For use in revegetating disturbed streambanks, cuttings should be first rooted then grown in a nursery to increase survival rates. Cut stems of *Salix planifolia* (flat-leaved willow) produce low to moderate numbers of roots, located along the entire length of stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30 cm to 50 cm long and greater than 1 cm in diameter produce best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting (Hansen and others 1995).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) provides excellent erosion protection along streambanks, buffering against the erosive force of flood events, and filtering sediments during spring flows. Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex aquatilis* (water sedge) tends to form a dense, thick sod that is highly resistant to erosion. (Hauser 2006).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Flat-leaved willow/Horsetail/Sedge
- Willow/Sedge

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003).

Salix planifolia/Carex atherodes Habitat Type
(flat-leaved willow/awned sedge Habitat Type)

SALIPLA/CAREATH Habitat Type
Number of Stands = 6 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 0; Other Data Sets = 6)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. This habitat type is found in wet areas adjacent to lakes, streams, and sloughs. The sites are among the wettest terrestrial sites supporting willows, often occurring in extensive stands on low lying land around lakes. *Salix planifolia* (flat-leaved willow) is found more commonly on lentic sites with water that is less aerated (e.g., fens, sloughs, and lakeshores) than on lotic sites with faster flowing water. When found on lotic sites, this type is usually associated with extensive beaver dam complexes.

Photo 21 shows a typical stand of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type.

Photo 21. A stand of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (photo provided by Hilary Baker)

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 413 shows the five most prominent plant species among the four lifeforms for species recorded in all six stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type. *Carex atherodes* (awned sedge) is most prominent, followed by *Salix planifolia* (flat-leaved willow), and farther back by *Calamagrostis canadensis* (marsh reed grass). No other species is more than moderately prominent here.

Table 413. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (number = 6 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	0.08	Native
Populus balsamifera (balsam poplar)	0.08	Native
Populus tremuloides (aspen)	0.08	Native
Shrubs		
Salix planifolia (flat-leaved willow)	28.33	Native
Salix pseudomonticola (false mountain willow)	5.00	Native
Salix bebbiana (beaked willow)	4.33	Native
Rubus arcticus (dwarf raspberry)	1.67	Native
Lonicera involucrata (bracted honeysuckle)	0.58	Native
Graminoids		
Carex atherodes (awned sedge)	40.00	Native
Calamagrostis canadensis (marsh reed grass)	18.33	Native
Carex aquatilis (water sedge)	5.00	Native
Carex deweyana (Dewey's sedge)	5.00	Native
Poa pratensis (Kentucky bluegrass)	4.42	Introduced

Table 413. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Geum rivale (purple avens)	1.67	Native
Trifolium repens (white clover)	1.67	Introduced
Geum macrophyllum (large-leaved yellow avens)	1.08	Native
Galium trifidum (small bedstraw)	0.75	Native
Callitriche verna (vernal water-starwort)	0.58	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 414 through Table 417, break out the vegetation recorded in all six stands sampled of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated habitat type of minor-to-incidental occurrence across the study area.

Table 414 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type. For the 6 stands comprising the habitat type, the number of unique species was 79 with 72 (91.1 percent) of them being native species.

Table 414. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (number = 6 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3	3	0	0
Shrubs	16	16	0	0
Graminoids	22	19	3	0
Forbs	38	34	4	0
TOTAL	***79 (100.0%)***	***72 (91.1%)***	***7 (8.9%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 415 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type. The average number of species per stand is 19.7, with native species comprising 17.7 species per stand or 89.8 percent.

Table 415. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (number = 6 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.5	0.5	0.0	0.0
Shrubs	4.2	4.2	0.0	0.0
Graminoids	6.0	5.0	1.0	0.0
Forbs	9.0	8.0	1.0	0.0
TOTAL	***19.7 (100.0%)***	***17.7 (89.8%)***	***2.0 (10.2%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 416 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type. The average canopy cover per stand is 139.2 percent, with native species comprising 131.7 percent or 94.6 percent of the total amount of average canopy cover per stand.

Table 416. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (number = 6 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.3%	0.3%	0.0%	0.0%
Shrubs	42.2%	42.2%	0.0%	0.0%
Graminoids	82.8%	77.8%	5.0%	0.0%
Forbs	13.9%	11.4%	2.5%	0.0%
TOTAL	***139.2% (100.0%)***	***131.7% (94.6%)***	***7.5% (5.4%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 417 shows the average number of species and average canopy cover by lifeform in stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type. The average number of species per stand was 19.7 with an average canopy cover of 139.2 percent.

Table 417. Average number of species and average canopy cover by lifeform in stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (number = 6 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.5	0.3%
Shrubs	4.2	42.2%
Graminoids	6.0	82.8%
Forbs	9.0	13.9%
TOTAL	***19.7***	***139.2%***

Sampled Stands Plant Species List

A total of 79 plant species were recorded on at least one of six stands sampled of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (Table 418). Three tree species were recorded in very small amounts; while *Salix planifolia* (flat-leaved willow) alone dominates the 16 shrubs recorded. *Carex atherodes* (awned sedge), followed by *Calamagrostis canadensis* (marsh reed grass), are most prominent of the 22 graminoids; while none of the 38 forb species are very prominent.

Table 418. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (number = 6 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 3)					
Picea glauca (white spruce)	0.5	0-0.5	17	0.08	N
Populus balsamifera (balsam poplar)	0.5	0-0.5	17	0.08	N
Populus tremuloides (aspen)	0.5	0-0.5	17	0.08	N
Shrubs (N = 16)					
Betula glandulosa (bog birch)	0.5	0-0.5	17	0.08	N
Lonicera involucrata (bracted honeysuckle)	1.8	0-3	33	0.58	N
Potentilla fruticosa (shrubby cinquefoil)	3.0	0-3	17	0.50	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	17	0.08	N
Ribes triste (wild red currant)	0.5	0-0.5	17	0.08	N
Rosa acicularis (prickly rose)	0.5	0-0.5	33	0.17	N
Rubus arcticus (dwarf raspberry)	10.0	0-10	17	1.67	N
Rubus idaeus (wild red raspberry)	0.5	0-0.5	17	0.08	N
Rubus pubescens (dewberry)	0.5	0-0.5	17	0.08	N
Salix bebbiana (beaked willow)	8.7	0-20	50	4.33	N
Salix boothii (Booth's willow)	0.5	0-0.5	17	0.08	N
Salix glauca (smooth willow)	3.0	0-3	17	0.50	N
Salix petiolaris (basket willow)	3.0	0-3	17	0.50	N

Table 418. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Salix planifolia (flat-leaved willow)	28.3	20-40	100	28.33	N
Salix pseudomonticola (false mountain willow)	0.5	0-0.5	17	0.08	N
Salix pseudomyrsinites (firm leaf willow)	30.0	0-30	17	5.00	N
Graminoids (N = 22)					
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	17	0.08	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	17	0.08	N
Alopecurus pratensis (meadow foxtail)	0.5	0-0.5	17	0.08	I
Beckmannia syzigachne (slough grass)	10.0	0-10	17	1.67	N
Bromus ciliatus (fringed brome)	0.5	0-0.5	17	0.08	N
Calamagrostis canadensis (marsh reed grass)	27.5	0-50	67	18.33	N
Calamagrostis stricta (narrow reed grass)	0.5	0-0.5	17	0.08	N
Carex aquatilis (water sedge)	15.0	0-20	33	5.00	N
Carex atherodes (awned sedge)	40.0	20-70	100	40.00	N
Carex bebbii (Bebb's sedge)	0.5	0-0.5	17	0.08	N
Carex deweyana (Dewey's sedge)	30.0	0-30	17	5.00	N
Carex scirpoidea (rush-like sedge)	0.5	0-0.5	17	0.08	N
Carex utriculata (beaked sedge)	0.5	0-0.5	33	0.17	N
Deschampsia cespitosa (tufted hair grass)	10.0	0-10	17	1.67	N
Festuca saximontana (Rocky Mountain fescue)	3.0	0-3	17	0.50	N
Glyceria grandis (common tall manna grass)	0.5	0-0.5	17	0.08	N
Glyceria striata (fowl manna grass)	3.0	0-3	17	0.50	N
Koeleria macrantha (June grass)	0.5	0-0.5	17	0.08	N
Luzula spicata (spiked wood-rush)	3.0	0-3	17	0.50	N
Phleum pratense (timothy)	3.0	0-3	17	0.50	I
Poa palustris (fowl bluegrass)	11.5	0-20	33	3.83	N
Poa pratensis (Kentucky bluegrass)	6.6	0-20	67	4.42	I
Forbs (N = 38)					
Achillea millefolium (common yarrow)	0.5	0-0.5	33	0.17	N
Achillea sibirica (many-flowered yarrow)	3.0	0-3	17	0.50	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	17	0.08	N
Aster laevis (smooth aster)	0.5	0-0.5	17	0.08	N
Aster modestus (large northern aster)	0.5	0-0.5	17	0.08	N
Aster puniceus (purple-stemmed aster)	0.5	0-0.5	17	0.08	N
Callitriche verna (vernal water-starwort)	1.8	0-3	33	0.58	N
Cerastium arvense (field mouse-ear chickweed)	1.8	0-3	33	0.58	N
Epilobium palustre (marsh willowherb)	1.8	0-3	33	0.58	N
Equisetum arvense (common horsetail)	0.5	0-0.5	17	0.08	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	33	0.17	N
Galium trifidum (small bedstraw)	1.1	0-3	67	0.75	N
Geum aleppicum (yellow avens)	0.5	0-0.5	17	0.08	N
Geum macrophyllum (large-leaved yellow avens)	2.2	0-3	50	1.08	N
Geum rivale (purple avens)	10.0	0-10	17	1.67	N
Heuchera cylindrica (sticky alumroot)	0.5	0-0.5	17	0.08	N
Hieracium umbellatum (narrow-leaved hawkweed)	3.0	0-3	17	0.50	N

Table 418. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	17	0.08	N
Mentha arvensis (wild mint)	1.8	0-3	33	0.58	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	17	0.08	N
Moehringia lateriflora (blunt-leaved sandwort)	0.5	0-0.5	17	0.08	N
Petasites frigidus (arctic sweet coltsfoot)	1.8	0-3	33	0.58	N
Petasites sagittatus (arrow-leaved coltsfoot)	1.8	0-3	33	0.58	N
Polygonum lapathifolium (pale persicaria)	0.5	0-0.5	33	0.17	N
Potentilla norvegica (rough cinquefoil)	1.8	0-3	33	0.58	N
Ranunculus pedatifidus (northern buttercup)	3.0	0-3	17	0.50	N
Rumex occidentalis (western dock)	0.5	0-0.5	17	0.08	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	17	0.08	N
Senecio pauciflorus (few-flowered ragwort)	0.5	0-0.5	17	0.08	N
Sium suave (water parsnip)	3.0	0-3	17	0.50	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	17	0.08	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	17	0.08	N
Taraxacum officinale (common dandelion)	1.8	0-3	33	0.58	I
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	17	0.08	N
Trifolium hybridum (alsike clover)	0.5	0-0.5	17	0.08	I
Trifolium repens (white clover)	10.0	0-10	17	1.67	I
Urtica dioica (common nettle)	0.5	0-0.5	17	0.08	N
Vicia americana (wild vetch)	0.5	0-0.5	17	0.08	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 419 shows the five most prominent plant species among the four lifeforms for species recorded in all three relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type. *Carex atherodes* (awned sedge) is most prominent, followed by *Salix planifolia* (flat-leaved willow) and *Calamagrostis canadensis* (marsh reed grass). No other species is more than moderately prominent in these stands.

Table 419. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (number = 3 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Salix planifolia (flat-leaved willow)	30.00	Native
Salix bebbiana (beaked willow)	1.00	Native
Salix petiolaris (basket willow)	1.00	Native
Salix boothii (Booth's willow)	0.17	Native
Salix pseudomonticola (false mountain willow)	0.17	Native
Graminoids		
Carex atherodes (awned sedge)	43.33	Native
Calamagrostis canadensis (marsh reed grass)	23.33	Native
Beckmannia syzigachne (slough grass)	3.33	Native
Carex aquatilis (water sedge)	3.33	Native
Poa palustris (fowl bluegrass)	1.00	Native
Forbs		
Galium trifidum (small bedstraw)	1.33	Native
Epilobium palustre (marsh willowherb)	1.00	Native
Geum macrophyllum (large-leaved yellow avens)	1.00	Native
Hieracium umbellatum (narrow-leaved hawkweed)	1.00	Native
Mentha arvensis (wild mint)	1.00	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 420 through Table 423, break out the vegetation recorded in three relatively undisturbed late seral to climax stands sampled of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated habitat type of minor-to-incidental occurrence across the study area.

Table 420 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/*

Carex atherodes (flat-leaved willow/awned sedge) habitat type. For the 3 stands comprising the habitat type, the number of unique species was 30 with 28 (93.3 percent) of them being native species.

Table 420. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (number = 3 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	5	5	0	0
Graminoids	11	10	1	0
Forbs	14	13	1	0
TOTAL	***30 (100.0%)***	***28 (93.3%)***	***2 (6.7%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 421 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type. The average number of species per stand is 13.0, with native species comprising 12.0 species per stand or 92.3 percent.

Table 421. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (number = 3 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	2.3	2.3	0.0	0.0
Graminoids	5.0	4.7	0.3	0.0
Forbs	5.7	5.0	0.7	0.0
TOTAL	***13.0 (100.0%)***	***12.0 (92.3%)***	***1.0 (7.7%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 422 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex atherodes* (flat-

leaved willow/awned sedge) habitat type. The average canopy cover per stand is 117.3 percent, with native species comprising 116.0 percent or 98.9 percent of the total amount of average canopy cover per stand.

Table 422. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (number = 3 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	32.3%	32.3%	0.0%	0.0%
Graminoids	76.3%	75.3%	1.0%	0.0%
Forbs	8.7%	8.3%	0.3%	0.0%
TOTAL	***117.3% (100.0%)***	***116.0% (98.9%)***	***1.3% (1.1%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 423 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type. The average number of species per stand was 13.0 with an average canopy cover of 117.3 percent.

Table 423. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (number = 3 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	2.3	32.3%
Graminoids	5.0	76.3%
Forbs	5.7	8.7%
TOTAL	***13.0***	***117.3%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 30 plant species were recorded on at least one of three relatively undisturbed late seral to climax stands sampled of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (Table 424). No trees were recorded here, and *Salix planifolia* (flat-leaved willow) was most prominent of the five shrub species recorded. Among the 11 graminoids recorded, two species were prominent: *Carex atherodes* (awned sedge) followed by *Calamagrostis canadensis* (marsh reed grass); while none of the 14 forb species is very prominent.

Table 424. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (number = 3 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Shrubs (N = 5)					
Salix bebbiana (beaked willow)	3.0	0-3	33	1.00	N
Salix boothii (Booth's willow)	0.5	0-0.5	33	0.17	N
Salix petiolaris (basket willow)	3.0	0-3	33	1.00	N
Salix planifolia (flat-leaved willow)	30.0	20-40	100	30.00	N
Salix pseudomonticola (false mountain willow)	0.5	0-0.5	33	0.17	N
Graminoids (N = 11)					
Agrostis scabra (rough hair grass)	0.5	0-0.5	33	0.17	N
Beckmannia syzigachne (slough grass)	10.0	0-10	33	3.33	N
Calamagrostis canadensis (marsh reed grass)	35.0	0-50	67	23.33	N
Calamagrostis stricta (narrow reed grass)	0.5	0-0.5	33	0.17	N
Carex aquatilis (water sedge)	10.0	0-10	33	3.33	N
Carex atherodes (awned sedge)	43.3	20-70	100	43.33	N
Carex bebbii (Bebb's sedge)	0.5	0-0.5	33	0.17	N
Carex utriculata (beaked sedge)	0.5	0-0.5	67	0.33	N
Glyceria grandis (common tall manna grass)	0.5	0-0.5	33	0.17	N
Poa palustris (fowl bluegrass)	3.0	0-3	33	1.00	N
Poa pratensis (Kentucky bluegrass)	3.0	0-3	33	1.00	I
Forbs (N = 14)					
Aster modestus (large northern aster)	0.5	0-0.5	33	0.17	N
Callitriche verna (vernal water-starwort)	0.5	0-0.5	33	0.17	N
Epilobium palustre (marsh willowherb)	3.0	0-3	33	1.00	N
Galium trifidum (small bedstraw)	1.3	0.5-3	100	1.33	N
Geum aleppicum (yellow avens)	0.5	0-0.5	33	0.17	N
Geum macrophyllum (large-leaved yellow avens)	3.0	0-3	33	1.00	N
Hieracium umbellatum (narrow-leaved hawkweed)	3.0	0-3	33	1.00	N
Mentha arvensis (wild mint)	3.0	0-3	33	1.00	N
Petasites frigidus (arctic sweet coltsfoot)	3.0	0-3	33	1.00	N
Polygonum lapathifolium (pale persicaria)	0.5	0-0.5	67	0.33	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	33	0.17	N
Rumex occidentalis (western dock)	0.5	0-0.5	33	0.17	N
Sium suave (water parsnip)	3.0	0-3	33	1.00	N
Urtica dioica (common nettle)	0.5	0-0.5	33	0.17	N

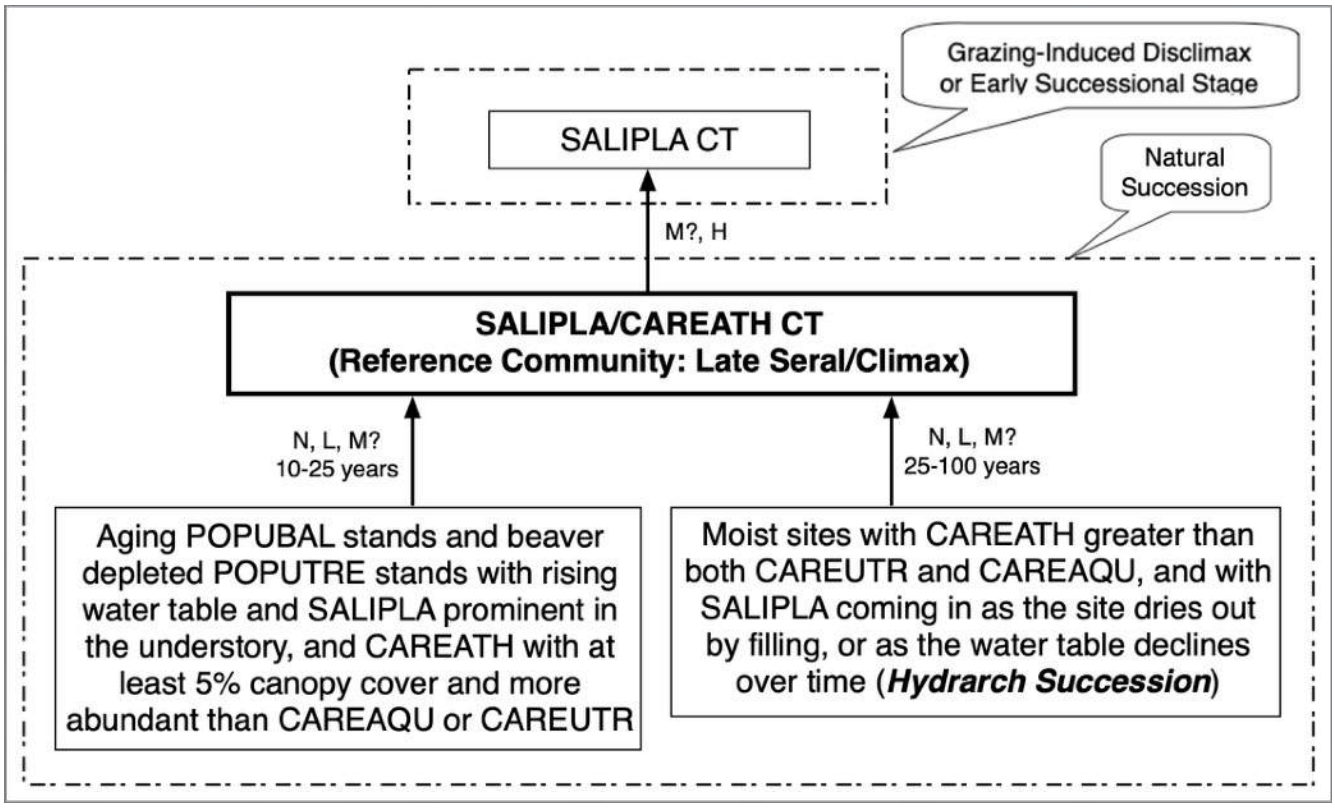
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Stands of *Salix planifolia* (flat-leaved willow) typically occur on sites hydrologically altered by beaver to create the hydrologic and edaphic conditions for which this willow is adapted. This process is a kind of primary succession known as hydrarch succession, whereby beaver ponds with very wet stands of *Carex aquatilis* (water sedge) accumulate sediment and vegetative matter over time elevating the surface far enough above the water table to support *Salix planifolia* (flat-leaved willow).

Figure 88 shows a schematic diagram of vegetation successional pathways on sites of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type.



Successional Pathway of *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUTRE—*Populus tremuloides* (aspen)
SALIPLA—*Salix planifolia* (flat-leaved willow)

SALIPLA/CAREATH HT—*Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type
SALIPLA CT—*Salix planifolia* (flat-leaved willow) community type

Figure 88. Successional pathway for sites of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 89 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

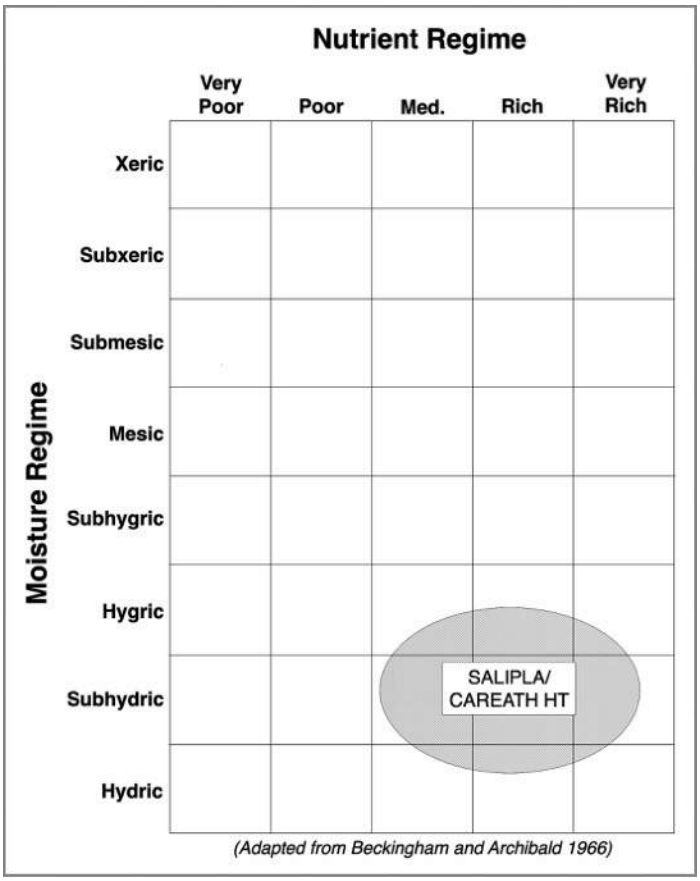


Figure 89. Edatope grid position for the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type (SALIPLA/CAREATH HT)

SOILS

Parent material on sites supporting the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type is predominantly fluvial. Soil drainage ranges from poorly drained to very poorly drained, and mineral soils typically are gleyed, with textures from sandy loam to clay covered by an organic layer of varying thickness (Baker and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites will likely have either the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type, the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type, or will be dominated by a wetland *Carex* (sedge) species, such as *Carex utriculata* (beaked sedge) or *Carex aquatilis* (water sedge). Adjacent drier sites will often have a community dominated by *Salix bebbiana* (beaked willow), *Picea glauca* (white spruce), and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix planifolia* (flat-leaved willow)**—*Salix planifolia* (flat-leaved willow) is found in most natural regions of Alberta, growing in moist thickets, on boggy and swampy sites, and along streambanks and shorelines (Tannas 1997a).

At higher elevations, *Salix planifolia* (flat-leaved willow) grows in zones dominated by *Picea engelmannii* (Engelmann spruce), *Abies lasiocarpa* (subalpine fir), and *Pinus contorta* (lodgepole pine). Soils may be mineral or organic. At lower elevations, the species generally is found scattered within other willow-dominated communities along the banks of streams, ponds, lakes, and in wet meadows and marshes (Uchytil 1991a).

Salix planifolia (flat-leaved willow) is shade intolerant, and often forms relatively stable communities maintained by the high water table and a high elevation climate (Uchytil 1991a).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) is very common and widely distributed across Alberta (Tannas 1997a). The species is a wetland obligate, growing along slough margins, shorelines, in marshes, and wet meadows, often in standing water (Tannas 1997a). It is a long-lived perennial with moderate tolerance for drought, while tolerance is low for salinity, acidity, and shade. It does best on clay to clay loam soils (Hardy BBT Limited 1989).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

Livestock

***Salix planifolia* (flat-leaved willow)**—All classes of livestock eat willows, but *Salix planifolia* (flat-leaved willow) importance in livestock diets has not been extensively reported (Uchytil 1991a). Tannas (1997a) states that livestock utilize *Salix planifolia* (flat-leaved willow) when more palatable browse becomes scarce. Most willows are palatable to both livestock and wild ungulates, and their palatability tends to increase as the growing season advances (Uchytil 1991a). Plants of this species become decadent or stunted when excessively browsed by cattle, wild ungulates, or beavers; however decadent plants recover relatively quickly when the browsing is removed (Uchytil 1991a).

***Carex atherodes* (awned sedge)**—Livestock forage value of *Carex atherodes* (awned sedge) is high (Tannas 1997a, Beckingham 1991). *Carex atherodes* (awned sedge) provides good protein and a balance of other nutritional elements, while remaining palatable during the late season when upland forage is less palatable (Tannas 1997a, Hansen and others 1988). In general, *Carex* (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites residual cover should be left to protect the soil surface and filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days for sedge regrowth should provide sufficient residual cover on streamside riparian sites (Myers 1989).

Very wet soils may deter animal use until they dry, allowing the most palatable species to replenish their carbohydrate reserves and to persist in these communities. However, if high levels of grazing do occur, there will be a marked decrease in *Carex atherodes* (awned sedge) with an increase in less palatable species, such as *Juncus balticus* (wire rush). *Carex atherodes* (awned sedge) has medium palatability and medium tolerance for livestock use. Its chemical composition is similar to that of meadow grasses, upland short grass, and mixed prairie species. Seasonal declines in crude protein, phosphorous and carotene were also similar to that of native upland grasses (Hardy BBT Limited 1989).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix planifolia* (flat-leaved willow)**—*Salix planifolia* (flat-leaved willow) is highly palatable to moose and beaver, but is apparently less so to elk and deer. Consumption by elk and mule deer is generally low (Uchytil 1991a). Willows in general are a preferred food and building material of beaver. Ducks, grouse, other birds, and small mammals all eat willow shoots, catkins, buds, and leaves (Uchytil 1991a).

***Carex atherodes* (awned sedge)**—Wetland sedge species, such as *Carex atherodes* (awned sedge) are an important component of valuable nesting and feeding grounds for geese and other waterfowl. These stands of prolific seed producing species are usually more important as feeding grounds than as nesting grounds because of their low stature, high water level, and lack of structural diversity (Thompson and Hansen 2003).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

Fisheries

***Salix planifolia* (flat-leaved willow)**—The dense network of roots from the *Salix* (willows) and grass are effective in stabilizing streambanks. Immediately adjacent to the stream, the banks become undercut and sag into the water providing excellent hiding cover for fish. The *Salix* (willows) provides valuable overhanging stream cover and shade. The importance of *Salix* (willows) in streambank protection, cover, and thermal protection for fisheries cannot be over emphasized (Thompson and Hansen 2003).

***Carex atherodes* (awned sedge)**—Stands of *Carex atherodes* (awned sedge) are found more frequently in lentic situations around depressional wetlands, sloughs, potholes, wet meadows, and fens where fish habitat is not at issue (Thompson and Hansen 2003).

Fire

***Salix planifolia* (flat-leaved willow)**—The wet meadow and stream side habitats occupied by *Salix planifolia* (flat-leaved willow) rarely burn. In fact, these riparian wet areas frequently act as fire breaks. However, under dry conditions, riparian habitats can burn severely. Most willow species sprout from the root crown after being top-killed by fire, however *Salix* (willows) on organic soils may be killed by severe fires which burn deep into the soil, char the roots, and prevent sprouting (Uchytil 1991a).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) grows on wet sites that seldom dry out enough to carry fire, but the species is adapted to light intensity fire. Residual cover should burn well in early spring, prior to the growing season. Burning will reduce litter accumulations and temporarily increase productivity (Hansen and others 1988), but care should be taken with burning to avoid damage to the excellent soil erosion protection this species provides. Under drought conditions, there is danger of burning the soil peat layer and damaging the roots (Thompson and Hansen 2003).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

Rehabilitation/Restoration Considerations

***Salix planifolia* (flat-leaved willow)**—*Salix planifolia* (flat-leaved willow) is recommended for revegetating disturbed riparian sites, and is especially useful for streambank stabilization. It may be planted as rooted or unrooted stem cuttings, but the rooted cuttings have higher survival rates than unrooted cuttings (Uchytil 1991a).

For use in revegetating disturbed streambanks, cuttings should be first rooted then grown in a nursery to increase survival rates. Cut stems of *Salix planifolia* (flat-leaved willow) produce low to moderate numbers of roots, located along the entire length of stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30 cm to 50 cm long and greater than 1 cm in diameter produce best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting (Hansen and others 1995).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) rates high in value for erosion control, and high for its persistence, once established on a site (Hardy BBT Limited 1989). Generally, due to their stronger rhizomatous roots, *Carex* species (sedges) offer better streambank protection than grasses. *Carex atherodes* (awned sedge) forms a dense, thick sod highly resistant to erosion. Along streambanks, the sod may overhang the bank and sag into the water, providing additional protection from erosion (Thompson and Hansen 2003).

Carex atherodes (awned sedge) is suited for long-term revegetation of disturbed sites and erosion control on sites with a high water table. The species can rapidly re-colonize disturbed sites by seed and rhizome extension. Its

rhizomes form a dense network effective in stabilizing streambanks and preventing soil erosion (Thompson and Hansen 2003).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Flat-leaved willow/Horsetail/Sedge
- Willow/Sedge

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type has not been described in the region.

Salix planifolia/Carex utriculata Habitat Type
(flat-leaved willow/beaked sedge Habitat Type)

SALIPLA/CAREUTR Habitat Type
Number of Stands = 12 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 3; Other Data Sets = 9)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type is a major type in the Lower Foothills Natural Subregion, a major type in the Upper Foothills Natural Subregion, and a major type in the Montane Natural Subregion of Alberta. This habitat type is found in wet areas adjacent to lakes, streams, and sloughs. The sites are among the wettest terrestrial sites supporting willows, often occurring in extensive stands on low lying land around lakes. *Salix planifolia* (flat-leaved willow) is found more commonly on lentic sites with water that is less aerated (e.g., fens, sloughs, and lakeshores) than on lotic sites with faster flowing water. When found on lotic sites, this type is usually associated with extensive beaver dam complexes.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 425 shows the five most prominent plant species among the four lifeforms for species recorded in all 12 stands of the Sa*lix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type. The two type indicator species, *Salix planifolia* (flat-leaved willow) and *Carex utriculata* (beaked sedge), are the only species in these stands more than moderately prominent.

Table 425. The five most prominent plant species among the four lifeforms for species recorded in stands of the Sa*lix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (number = 12 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus balsamifera (balsam poplar)	0.29	Native
Picea glauca (white spruce)	0.17	Native
Betula papyrifera (white birch)	0.04	Native
Picea engelmannii (Engelmann spruce)	0.04	Native
Populus tremuloides (aspen)	0.04	Native
Shrubs		
Salix planifolia (flat-leaved willow)	40.00	Native
Salix maccalliana (velvet-fruited willow)	4.17	Native
Betula glandulosa (bog birch)	3.38	Native
Salix bebbiana (beaked willow)	3.29	Native
Salix myrtillifolia (myrtle-leaved willow)	2.50	Native
Graminoids		
Carex utriculata (beaked sedge)	27.50	Native
Calamagrostis canadensis (marsh reed grass)	5.42	Native
Carex aquatilis (water sedge)	3.00	Native
Carex atherodes (awned sedge)	3.00	Native
Carex lanuginosa (woolly sedge)	2.50	Native
Forbs		
Equisetum arvense (common horsetail)	4.25	Native
Epilobium angustifolium (common fireweed)	2.17	Native
Equisetum fluviatile (swamp horsetail)	1.67	Native
Geum aleppicum (yellow avens)	1.42	Native
Potentilla palustris (marsh cinquefoil)	1.33	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 426 through Table 429, break out the vegetation recorded in all 12 stands sampled of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated habitat type of major occurrence across the study area.

Table 426 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/

beaked sedge) habitat type. For the 12 stands comprising the habitat type, the number of unique species was 100 with 89 (89.0 percent) of them being native species.

Table 426. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (number = 12 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	5	5	0	0
Shrubs	27	25	0	2
Graminoids	21	19	2	0
Forbs	47	40	6	1
TOTAL	***100 (100.0%)***	***89 (89.0%)***	***8 (8.0%)***	***3 (3.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 427 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type. The average number of species per stand is 20.6, with native species comprising 18.7 species per stand or 90.8 percent.

Table 427. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (number = 12 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.8	0.8	0.0	0.0
Shrubs	5.6	5.2	0.0	0.4
Graminoids	5.7	5.2	0.5	0.0
Forbs	8.5	7.5	0.9	0.1
TOTAL	***20.6 (100.0%)***	***18.7 (90.8%)***	***1.4 (6.8%)***	***0.5 (2.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 428 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type.

The average canopy cover per stand is 136.6 percent, with native species comprising 132.3 percent or 96.8 percent of the total amount of average canopy cover per stand.

Table 428. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (number = 12 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.6%	0.6%	0.0%	0.0%
Shrubs	60.7%	60.3%	0.0%	0.4%
Graminoids	54.3%	52.0%	2.3%	0.0%
Forbs	21.1%	19.4%	0.9%	0.8%
TOTAL	***136.6% (100.0%)***	***132.3% (96.8%)***	***3.1% (2.3%)***	***1.3% (0.9%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 429 shows the average number of species and average canopy cover by lifeform in stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type. The average number of species per stand was 20.6 with an average canopy cover of 136.6 percent.

Table 429. Average number of species and average canopy cover by lifeform in stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (number = 12 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.8	0.6%
Shrubs	5.6	60.7%
Graminoids	5.7	54.3%
Forbs	8.5	21.1%
TOTAL	***20.6***	***136.6%***

Sampled Stands Plant Species List

A total of 100 plant species were recorded on at least one of 12 stands sampled of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (Table 430). Five tree species were recorded in small amounts, and *Salix planifolia* (flat-leaved willow) overwhelmingly dominates the 27 shrub species recorded. *Carex utriculata* (beaked sedge) dominates the 21 graminoid species, while none of the 47 forb species recorded is notably prominent.

Table 430. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (number = 12 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 5)					
Betula papyrifera (white birch)	0.5	0-0.5	8	0.04	N
Picea engelmannii (Engelmann spruce)	0.5	0-0.5	8	0.04	N
Picea glauca (white spruce)	0.5	0-0.5	33	0.17	N
Populus balsamifera (balsam poplar)	1.8	0-3	17	0.29	N
Populus tremuloides (aspen)	0.5	0-0.5	8	0.04	N
Shrubs (N = 27)					
Betula glandulosa (bog birch)	13.5	0-20	25	3.38	N
Cornus stolonifera (red-osier dogwood)	0.5	0-0.5	8	0.04	N
Linnaea borealis (twinflower)	0.5	0-0.5	17	0.08	N
Lonicera involucrata (bracted honeysuckle)	1.8	0-3	17	0.29	N
Potentilla fruticosa (shrubby cinquefoil)	1.8	0-3	17	0.29	N
Ribes oxyacanthoides (northern gooseberry)	1.1	0-3	33	0.37	N
Ribes spp. (currant)	0.5	0-0.5	17	0.08	B
Ribes triste (wild red currant)	0.5	0-0.5	17	0.08	N
Rosa acicularis (prickly rose)	0.5	0-0.5	8	0.04	N
Rosa spp. (rose)	1.3	0-3	25	0.33	B
Rubus arcticus (dwarf raspberry)	2.4	0-3	33	0.79	N
Rubus idaeus (wild red raspberry)	0.5	0-0.5	8	0.04	N
Salix bebbiana (beaked willow)	6.6	0-20	50	3.29	N
Salix boothii (Booth's willow)	10.0	0-10	8	0.83	N
Salix drummondiana (Drummond's willow)	0.5	0-0.5	25	0.13	N
Salix exigua (sandbar willow)	0.5	0-0.5	8	0.04	N
Salix lucida (shining willow)	10.0	0-10	8	0.83	N
Salix lutea (yellow willow)	1.8	0-3	17	0.29	N
Salix maccalliana (velvet-fruited willow)	25.0	0-30	17	4.17	N
Salix myrtillifolia (myrtle-leaved willow)	15.0	0-20	17	2.50	N
Salix pedicellaris (bog willow)	0.5	0-0.5	8	0.04	N
Salix petiolaris (basket willow)	6.8	0-10	25	1.71	N
Salix planifolia (flat-leaved willow)	40.0	20-80	100	40.00	N
Salix pseudomonticola (false mountain willow)	5.3	0-10	17	0.88	N
Salix serissima (autumn willow)	0.5	0-0.5	8	0.04	N
Vaccinium scoparium (grouseberry)	0.5	0-0.5	8	0.04	N
Viburnum edule (low-bush cranberry)	0.5	0-0.5	17	0.08	N
Graminoids (N = 21)					
Agrostis exarata (spike redtop)	0.5	0-0.5	8	0.04	N
Agrostis scabra (rough hair grass)	1.8	0-3	33	0.58	N
Alopecurus occidentalis (alpine foxtail)	1.3	0-3	25	0.33	N
Bromus ciliatus (fringed brome)	0.5	0-0.5	25	0.13	N
Calamagrostis canadensis (marsh reed grass)	9.3	0-40	58	5.42	N
Calamagrostis stricta (narrow reed grass)	6.8	0-10	25	1.71	N
Carex aquatilis (water sedge)	7.2	0-10	42	3.00	N

Table 430. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex atherodes (awned sedge)	9.0	0-20	33	3.00	N
Carex diandra (two-stamened sedge)	10.0	0-10	8	0.83	N
Carex disperma (two-seeded sedge)	1.8	0-3	17	0.29	N
Carex lanuginosa (woolly sedge)	30.0	0-30	8	2.50	N
Carex sartwellii (Sartwell's sedge)	10.0	0-10	17	1.67	N
Carex utriculata (beaked sedge)	27.5	10-90	100	27.50	N
Deschampsia cespitosa (tufted hair grass)	3.0	0-3	17	0.50	N
Glyceria striata (fowl manna grass)	1.1	0-3	33	0.37	N
Hordeum jubatum (foxtail barley)	0.5	0-0.5	8	0.04	N
Juncus balticus (wire rush)	10.0	0-10	17	1.67	N
Phleum pratense (timothy)	3.0	0-3	8	0.25	I
Poa palustris (fowl bluegrass)	7.7	0-10	25	1.92	N
Poa pratensis (Kentucky bluegrass)	4.8	0-10	42	2.00	I
Scirpus microcarpus (small-fruited bulrush)	3.0	0-3	17	0.50	N
Forbs (N = 47)					
Achillea sibirica (many-flowered yarrow)	0.5	0-0.5	8	0.04	N
Angelica arguta (white angelica)	0.5	0-0.5	25	0.13	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	17	0.08	N
Aster hesperius (western willow aster)	0.5	0-0.5	8	0.04	N
Aster laevis (smooth aster)	0.5	0-0.5	17	0.08	N
Aster modestus (large northern aster)	3.0	0-3	8	0.25	N
Aster puniceus (purple-stemmed aster)	0.5	0-0.5	8	0.04	N
Aster subspicatus (leafy-bracted aster)	1.8	0-3	17	0.29	N
Cicuta maculata (water-hemlock)	3.0	0-3	8	0.25	N
Cirsium arvense (Canada thistle)	1.3	0-3	25	0.33	I
Epilobium angustifolium (common fireweed)	8.7	0-20	25	2.17	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	8	0.04	N
Equisetum arvense (common horsetail)	5.7	0-30	75	4.25	N
Equisetum fluviatile (swamp horsetail)	20.0	0-20	8	1.67	N
Erigeron philadelphicus (Philadelphia fleabane)	0.5	0-0.5	8	0.04	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	25	0.13	N
Galium trifidum (small bedstraw)	10.0	0-10	8	0.83	N
Geranium richardsonii (wild white geranium)	0.5	0-0.5	8	0.04	N
Geum aleppicum (yellow avens)	3.4	0-10	42	1.42	N
Geum macrophyllum (large-leaved yellow avens)	1.8	0-3	50	0.88	N
Heracleum lanatum (cow parsnip)	0.5	0-0.5	8	0.04	N
Lysimachia thyrsiflora (tufted loosestrife)	1.8	0-3	17	0.29	N
Mentha arvensis (wild mint)	6.5	0-10	17	1.08	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	17	0.08	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	17	0.08	N
Moehringia lateriflora (blunt-leaved sandwort)	0.5	0-0.5	17	0.08	N
Moss spp. (moss)	10.0	0-10	8	0.83	B
Pedicularis spp. (lousewort)	0.5	0-0.5	17	0.08	N
Petasites frigidus (arctic sweet coltsfoot)	0.5	0-0.5	33	0.17	N

Table 430. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	8	0.04	N
Plantago major (common plantain)	0.5	0-0.5	17	0.08	I
Polygonum amphibium (water smartweed)	3.0	0-3	8	0.25	N
Potentilla palustris (marsh cinquefoil)	5.3	0-10	25	1.33	N
Ranunculus acris (tall buttercup)	0.5	0-0.5	17	0.08	I
Rorippa palustris (marsh yellow cress)	0.5	0-0.5	8	0.04	N
Rumex occidentalis (western dock)	1.1	0-3	33	0.37	N
Scutellaria galericulata (marsh skullcap)	1.8	0-3	17	0.29	N
Sisymbrium loeselii (tall hedge mustard)	0.5	0-0.5	8	0.04	I
Sium suave (water parsnip)	0.5	0-0.5	8	0.04	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	8	0.04	N
Solidago canadensis (Canada goldenrod)	5.3	0-10	17	0.88	N
Sonchus arvensis (perennial sow-thistle)	3.0	0-3	8	0.25	I
Stellaria longipes (long-stalked chickweed)	2.1	0-10	50	1.04	N
Taraxacum officinale (common dandelion)	0.5	0-0.5	17	0.08	I
Urtica dioica (common nettle)	0.5	0-0.5	8	0.04	N
Vicia americana (wild vetch)	0.5	0-0.5	25	0.13	N
Viola palustris (marsh violet)	1.8	0-3	17	0.29	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 431 shows the five most prominent plant species among the four lifeforms for species recorded in all four relatively undisturbed late seral to climax stands of the Sa*lix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type. *Carex utriculata* (beaked sedge) is most prominent, with *Salix planifolia* (flat-leaved

willow) not far behind, and *Salix maccalliana* (velvet-fruited willow) farther back. No other species is more than moderately prominent here.

Table 431. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (number = 4 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea glauca (white spruce)	0.25	Native
Picea engelmannii (Engelmann spruce)	0.13	Native
Shrubs		
Salix planifolia (flat-leaved willow)	37.50	Native
Salix maccalliana (velvet-fruited willow)	12.50	Native
Salix bebbiana (beaked willow)	5.00	Native
Salix lucida (shining willow)	2.50	Native
Salix petiolaris (basket willow)	2.50	Native
Graminoids		
Carex utriculata (beaked sedge)	50.00	Native
Carex sartwellii (Sartwell's sedge)	5.00	Native
Carex atherodes (awned sedge)	3.25	Native
Deschampsia cespitosa (tufted hair grass)	1.50	Native
Agrostis scabra (rough hair grass)	1.00	Native
Forbs		
Equisetum arvense (common horsetail)	3.25	Native
Geum macrophyllum (large-leaved yellow avens)	0.88	Native
Potentilla palustris (marsh cinquefoil)	0.75	Native
Rumex occidentalis (western dock)	0.25	Native
Stellaria longipes (long-stalked chickweed)	0.25	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 432 through Table 435, break out the vegetation recorded in four relatively undisturbed late seral to climax stands sampled of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated habitat type of major occurrence across the study area.

Table 432 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type. For the 4 stands comprising the habitat type, the number of unique species was 33 with 31 (93.9 percent) of them being native species.

Table 432. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (number = 4 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2	2	0	0
Shrubs	11	10	0	1
Graminoids	10	9	1	0
Forbs	10	10	0	0
TOTAL	***33 (100.0%)***	***31 (93.9%)***	***1 (3.0%)***	***1 (3.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 433 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type. The average number of species per stand is 14.1, with native species comprising 13.4 species per stand or 95.0 percent.

Table 433. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (number = 4 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.8	0.8	0.0	0.0
Shrubs	4.0	3.8	0.0	0.3
Graminoids	5.8	5.3	0.5	0.0
Forbs	3.5	3.5	0.0	0.0
TOTAL	***14.1 (100.0%)***	***13.4 (95.0%)***	***0.5 (3.5%)***	***0.3 (2.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 434 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type. The average canopy cover per stand is 130.5 percent, with native species comprising 130.1 percent or 99.7 percent of the total amount of average canopy cover per stand.

Table 434. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (number = 4 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.4%	0.4%	0.0%	0.0%
Shrubs	61.5%	61.4%	0.0%	0.1%
Graminoids	62.6%	62.4%	0.3%	0.0%
Forbs	6.0%	6.0%	0.0%	0.0%
TOTAL	***130.5% (100.0%)***	***130.1% (99.7%)***	***0.3% (0.2%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 435 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type. The average number of species per stand was 14.1 with an average canopy cover of 130.5 percent.

Table 435. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (number = 4 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.8	0.4%
Shrubs	4.0	61.5%
Graminoids	5.8	62.6%
Forbs	3.5	6.0%
TOTAL	***14.1***	***130.5%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 33 plant species were recorded on at least one of four relatively undisturbed late seral to climax stands sampled of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (Table 436). Two tree species were recorded in very small amounts on these four stands; while *Salix planifolia* (flat-leaved willow) is most prominent among the 11 shrubs, followed by *Salix maccalliana* (velvet-fruited willow). Of 10 graminoids

recorded, *Carex utriculata* (beaked sedge) is the only one very prominent; and among 10 forbs recorded, no species is more than moderately prominent.

Table 436. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (number = 4 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 2)					
Picea engelmannii (Engelmann spruce)	0.5	0-0.5	25	0.13	N
Picea glauca (white spruce)	0.5	0-0.5	50	0.25	N
Shrubs (N = 11)					
Betula glandulosa (bog birch)	0.5	0-0.5	25	0.13	N
Cornus stolonifera (red-osier dogwood)	0.5	0-0.5	25	0.13	N
Ribes oxyacanthoides (northern gooseberry)	1.8	0-3	50	0.88	N
Ribes spp. (currant)	0.5	0-0.5	25	0.13	B
Salix bebbiana (beaked willow)	20.0	0-20	25	5.00	N
Salix drummondiana (Drummond's willow)	0.5	0-0.5	25	0.13	N
Salix lucida (shining willow)	10.0	0-10	25	2.50	N
Salix maccalliana (velvet-fruited willow)	25.0	0-30	50	12.50	N
Salix petiolaris (basket willow)	10.0	0-10	25	2.50	N
Salix planifolia (flat-leaved willow)	37.5	20-50	100	37.50	N
Vaccinium scoparium (grouseberry)	0.5	0-0.5	25	0.13	N
Graminoids (N = 10)					
Agrostis scabra (rough hair grass)	1.3	0-3	75	1.00	N
Alopecurus occidentalis (alpine foxtail)	0.5	0-0.5	50	0.25	N
Calamagrostis canadensis (marsh reed grass)	0.5	0-0.5	75	0.38	N
Carex aquatilis (water sedge)	3.0	0-3	25	0.75	N
Carex atherodes (awned sedge)	6.5	0-10	50	3.25	N
Carex sartwellii (Sartwell's sedge)	10.0	0-10	50	5.00	N
Carex utriculata (beaked sedge)	50.0	20-90	100	50.00	N
Deschampsia cespitosa (tufted hair grass)	3.0	0-3	50	1.50	N
Glyceria striata (fowl manna grass)	0.5	0-0.5	50	0.25	N
Poa pratensis (Kentucky bluegrass)	0.5	0-0.5	50	0.25	I
Forbs (N = 10)					
Aster puniceus (purple-stemmed aster)	0.5	0-0.5	25	0.13	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	25	0.13	N
Equisetum arvense (common horsetail)	6.5	0-10	50	3.25	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	25	0.13	N
Geum macrophyllum (large-leaved yellow avens)	1.8	0-3	50	0.88	N
Lysimachia thyrsiflora (tufted loosestrife)	0.5	0-0.5	25	0.13	N
Petasites frigidus (arctic sweet coltsfoot)	0.5	0-0.5	25	0.13	N
Potentilla palustris (marsh cinquefoil)	3.0	0-3	25	0.75	N
Rumex occidentalis (western dock)	0.5	0-0.5	50	0.25	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	50	0.25	N

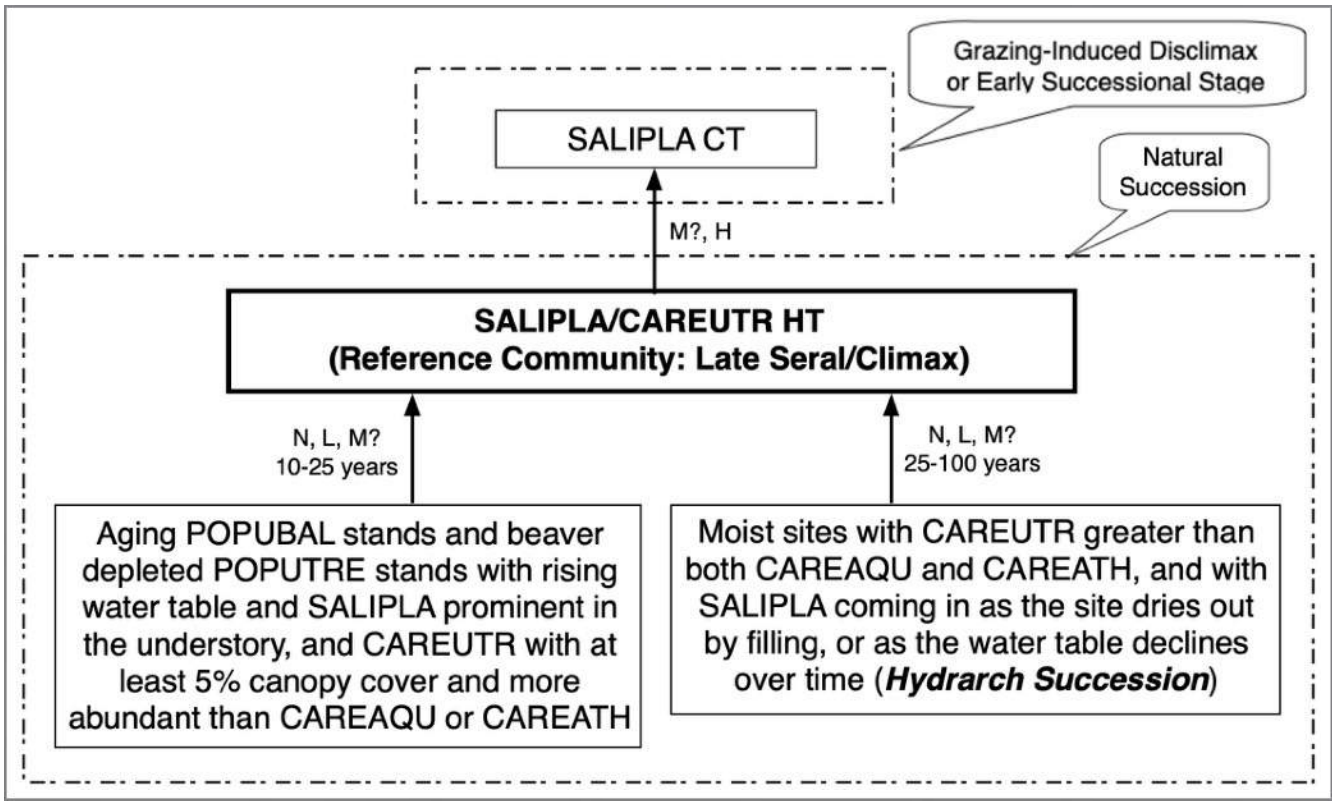
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Stands of *Salix planifolia* (flat-leaved willow) typically occur on sites hydrologically altered by beaver to create the hydrologic and edaphic conditions for which this willow is adapted. This process is a kind of primary succession known as hydrarch succession, whereby beaver ponds with very wet stands of *Carex utriculata* (beaked sedge) accumulate sediment and vegetative matter over time elevating the surface far enough above the water table to support *Salix planifolia* (flat-leaved willow).

Figure 90 shows a schematic diagram of vegetation successional pathways on sites of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type.



Successional Pathway of *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES

CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)

CAREUTR—*Carex utriculata* (beaked sedge)
POPUBAL—*Populus balsamifera* (balsam poplar)
POPUTRE—*Populus tremuloides* (aspen)
SALIPLA—*Salix planifolia* (flat-leaved willow)
SALIPLA/CAREUTR HT—*Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type
SALIPLA CT—*Salix planifolia* (flat-leaved willow) community type

Figure 90. Successional pathway for sites of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 91 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

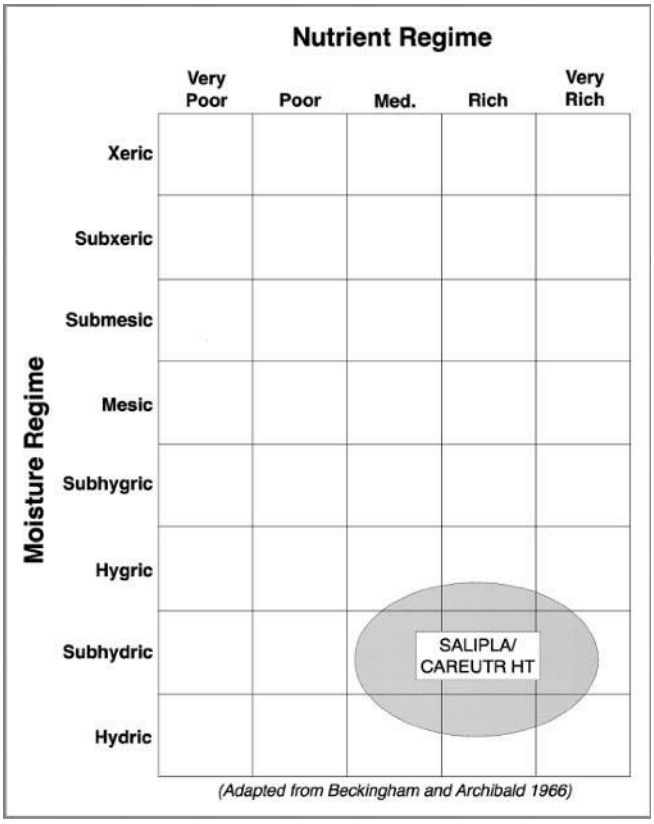


Figure 91. Edatope grid position for the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type (SALIPLA/CAREUTR HT)

SOILS

Parent material on sites supporting the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type is predominantly fluvial. Soil drainage ranges from poorly drained to very poorly drained, and mineral soils typically are gleyed, with textures from sandy loam to clay covered by an organic layer of varying thickness (Baker and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites will likely be dominated by a wetland *Carex* (sedge) species, such as *Carex utriculata* (beaked sedge) or *Carex aquatilis* (water sedge), or open water. Adjacent drier sites will often have the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type, the *Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type, or a community dominated by *Salix bebbiana* (beaked willow), *Picea glauca* (white spruce), and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix planifolia* (flat-leaved willow)**—*Salix planifolia* (flat-leaved willow) is found in most natural regions of Alberta, growing in moist thickets, on boggy and swampy sites, and along streambanks and shorelines (Tannas 1997a).

At higher elevations, *Salix planifolia* (flat-leaved willow) grows in zones dominated by *Picea engelmannii* (Engelmann spruce), *Abies lasiocarpa* (subalpine fir), and *Pinus contorta* (lodgepole pine). Soils may be mineral or organic. At lower elevations, the species generally is found scattered within other willow-dominated communities along the banks of streams, ponds, lakes, and in wet meadows and marshes (Uchytil 1991a).

Salix planifolia (flat-leaved willow) is shade intolerant, and often forms relatively stable communities maintained by the high water table and a high elevation climate (Uchytil 1991a).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is common and widely distributed across Alberta. It is a wetland obligate, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). It is a long-lived perennial sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of fine roots (Johnson and others 1995).

Carex utriculata (beaked sedge) is strongly rhizomatous and colonial, typically forming a dense sod. Creeping rhizomes are long, slender or stout, and deep-seated. It grows on sites with high soil moisture, typically with the water table at or above the soil surface during the growing season. This is one of our wettest sedges. On some sites, water tables are above the soil surface all year, and rarely drop below the rooting zone. The species occurs on a range of soil types, with textures from silt loams or silty clays to loamy sands (Anderson 2008).

Carex utriculata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates with continually high water tables and persists indefinitely to form climax communities (Anderson 2008).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

Livestock

***Salix planifolia* (flat-leaved willow)**—All classes of livestock eat willows, but *Salix planifolia* (flat-leaved willow) importance in livestock diets has not been extensively reported (Uchytil 1991a). Tannas (1997a) states that livestock utilize *Salix planifolia* (flat-leaved willow) when more palatable browse becomes scarce. Most willows are palatable to both livestock and wild ungulates, and their palatability tends to increase as the growing season advances (Uchytil 1991a). Plants of this species become decadent or stunted when excessively browsed by cattle, wild ungulates, or beavers; however decadent plants recover relatively quickly when the browsing is removed (Uchytil 1991a).

***Carex utriculata* (beaked sedge)**—Livestock forage value of *Carex utriculata* (beaked sedge) is high (Tannas 1997a, Beckingham 1991). The species is palatable in the spring, but palatability declines as the plants become coarse and tough in summer (Tannas 1997a, Hansen and others 1988). Relative palatability may then increase again in fall as the sedge cures and upland forage is less attractive. *Carex utriculata* (beaked sedge) cover decreases in response to high levels of grazing pressure, and will be replaced with less productive and less palatable species, such as *Juncus balticus* (wire rush) and *Poa* species (bluegrass) (Thompson and Hansen 2003).

In general, *Carex* species (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites, residual cover should be left to protect the banks and the soil surface, and to filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days should provide time for sufficient residual cover regrowth on streamside riparian sites (Myers 1989).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix planifolia* (flat-leaved willow)**—*Salix planifolia* (flat-leaved willow) is highly palatable to moose and beaver, but is apparently less so to elk and deer. Consumption by elk and mule deer is generally low (Uchytil 1991a). Willows in general are a preferred food and building material of beaver. Ducks, grouse, other birds, and small mammals all eat willow shoots, catkins, buds, and leaves (Uchytil 1991a).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is grazed by moose, elk, mule deer, bison, grizzly bears, and sandhill cranes (Anderson 2008). The species is an important component of valuable breeding and feeding grounds for geese and other waterfowl. Birds commonly associated with *Carex utriculata* (beaked sedge) habitats include mallard, green-winged teal, common yellowthroat, red-winged black bird, song sparrow, and tree swallow. *Carex utriculata* (beaked sedge) stands are usually more important as feeding grounds than as nesting grounds because of their low stature, lack of structural diversity, and high water levels. Elk and moose often graze *Carex utriculata* (beaked sedge) stands when *Carex atherodes* (awned sedge) is present (Anderson 2008).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

Fisheries

***Salix planifolia* (flat-leaved willow)**—The dense network of roots from the *Salix* (willows) and grass are effective in stabilizing streambanks. Immediately adjacent to the stream, the banks become undercut and sag into the water providing excellent hiding cover for fish. The *Salix* (willows) provides valuable overhanging stream cover and shade. The importance of *Salix* (willows) in streambank protection, cover, and thermal protection for fisheries cannot be over emphasized (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—The dense network of roots of the rhizomatous *Carex utriculata* (beaked sedge) is very effective in binding soil and stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish (Thompson and Hansen 2003).

Fire

***Salix planifolia* (flat-leaved willow)**—The wet meadow and stream side habitats occupied by *Salix planifolia* (flat-leaved willow) rarely burn. In fact, these riparian wet areas frequently act as fire breaks. However, under dry conditions, riparian habitats can burn severely. Most willow species sprout from the root crown after being top-killed by fire, however *Salix* (willows) on organic soils may be killed by severe fires which burn deep into the soil, char the roots, and prevent sprouting (Uchytil 1991a).

***Carex utriculata* (beaked sedge)**—Sites supporting stands of *Carex utriculata* (beaked sedge) are very wet, except at times of severe drought, and therefore they seldom burn. However, *Carex utriculata* (beaked sedge) sprouts from rhizomes, so it is often able to survive after being top-killed by fire. However, peat soils, common in these communities, can burn when dry, and the heat from such fires can penetrate the soil, destroying the sedge rhizomes. It is necessary that livestock be excluded during the year prior to burning. Caution should be used with fires along streams because of the excellent erosion protection *Carex utriculata* (beaked sedge) provides. Fires do little to change plant composition of beaked sedge communities (DeBenedetti and Parsons 1984). Fire may regress seral succession in treed or shrubby fen stands back to open sedge meadows that support little woody vegetation (Anderson 2008).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

Rehabilitation/Restoration Considerations

***Salix planifolia* (flat-leaved willow)**—*Salix planifolia* (flat-leaved willow) is recommended for revegetating disturbed riparian sites, and is especially useful for streambank stabilization. It may be planted as rooted or unrooted stem cuttings, but the rooted cuttings have higher survival rates than unrooted cuttings (Uchytil 1991a).

For use in revegetating disturbed streambanks, cuttings should be first rooted then grown in a nursery to increase survival rates. Cut stems of *Salix planifolia* (flat-leaved willow) produce low to moderate numbers of roots, located along the entire length of stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30 cm to 50 cm long and greater than 1 cm in diameter produce best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting (Hansen and others 1995).

***Carex utriculata* (beaked sedge)**—Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex utriculata* (beaked sedge) has a dense network of rhizomatous roots and forms a thick sod that is highly resistant to erosion and effective in stabilizing streambanks (Anderson 2008).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Flat-leaved willow/Horsetail/Sedge
- Willow/Sedge

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002).

Salix planifolia Community Type
(flat-leaved willow Community Type)

SALIPLA Community Type
Number of Stands = 16 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 3; Other Data Sets = 13)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix planifolia* (flat-leaved willow) community type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This community type is commonly found on disturbed sites in wet areas adjacent to lakes, streams, and sloughs. The sites are among the wettest terrestrial sites supporting willows, often occurring in extensive stands on low lying land around lakes. *Salix planifolia* (flat-leaved willow) is found more commonly on lentic sites with water that is less aerated (e.g., fens, sloughs, and lakeshores) than on lotic sites with faster flowing water. When found on lotic sites, this type is usually associated with extensive beaver dam complexes.

Photo 22 shows a typical stand of the *Salix planifolia* (flat-leaved willow) community type.

Photo 22. A stand of the *Salix planifolia* (flat-leaved willow) community type

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 437 shows the five most prominent plant species among the four lifeforms for species recorded in all 16 stands of the *Salix planifolia* (flat-leaved willow) community type. Only *Salix planifolia* (flat-leaved willow) is more than moderately prominent in these mostly disturbed stands.

Table 437. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix planifolia* (flat-leaved willow) community type (number = 16 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus balsamifera (balsam poplar)	0.59	Native
Picea glauca (white spruce)	0.28	Native
Betula papyrifera (white birch)	0.13	Native
Populus tremuloides (aspen)	0.09	Native
Betula neoalaskana (Alaska birch)	0.03	Native
Shrubs		
Salix planifolia (flat-leaved willow)	43.13	Native
Salix bebbiana (beaked willow)	3.91	Native
Salix petiolaris (basket willow)	3.31	Native
Salix pseudomonticola (false mountain willow)	2.84	Native
Salix lutea (yellow willow)	2.53	Native
Graminoids		
Poa pratensis (Kentucky bluegrass)	7.47	Introduced
Calamagrostis canadensis (marsh reed grass)	5.41	Native
Agropyron repens (quack grass)	2.53	Introduced
Glyceria grandis (common tall manna grass)	1.88	Native
Juncus balticus (wire rush)	1.44	Native

Table 437. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Equisetum arvense (common horsetail)	4.06	Native
Fragaria virginiana (wild strawberry)	1.72	Native
Epilobium angustifolium (common fireweed)	1.56	Native
Trifolium repens (white clover)	1.25	Introduced
Geum macrophyllum (large-leaved yellow avens)	0.88	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 438 through Table 441, break out the vegetation recorded in 16 stands of the *Salix planifolia* (flat-leaved willow) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species rich, shrub dominated community type of minor occurrence across the study area.

Table 438 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix planifolia* (flat-leaved willow) community type. For the 16 stands comprising the community type, the number of unique species was 161 with 136 (84.5 percent) of them being native species.

Table 438. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix planifolia* (flat-leaved willow) community type (number = 16 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	5	5	0	0
Shrubs	40	37	0	3
Graminoids	37	29	5	3
Forbs	79	65	11	3
TOTAL	***161 (100.0%)***	***136 (84.5%)***	***16 (9.9%)***	***9 (5.6%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 439 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix planifolia* (flat-leaved willow) community type. The average number of species per stand is 21.9, with native species comprising 19.0 species per stand or 86.8 percent.

Table 439. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix planifolia* (flat-leaved willow) community type (number = 16 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.0	1.0	0.0	0.0
Shrubs	6.5	6.1	0.0	0.4
Graminoids	4.6	3.5	0.9	0.2
Forbs	9.8	8.4	1.1	0.3
TOTAL	***21.9 (100.0%)***	***19.0 (86.8%)***	***2.0 (9.1%)***	***0.9 (4.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 440 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix planifolia* (flat-leaved willow) community type. The average canopy cover per stand is 129.2 percent, with native species comprising 113.3 percent or 87.7 percent of the total amount of average canopy cover per stand.

Table 440. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix planifolia* (flat-leaved willow) community type (number = 16 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.1%	1.1%	0.0%	0.0%
Shrubs	79.1%	78.8%	0.0%	0.3%
Graminoids	29.7%	17.2%	11.1%	1.5%
Forbs	19.3%	16.2%	2.9%	0.2%
TOTAL	***129.2% (100.0%)***	***113.3% (87.7%)***	***13.9% (10.8%)***	***2.0% (1.5%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 441 shows the average number of species and average canopy cover by lifeform in stands of the *Salix planifolia* (flat-leaved willow) community type. The average number of species per stand was 21.9 with an average canopy cover of 129.2 percent.

Table 441. Average number of species and average canopy cover by lifeform in stands of the *Salix planifolia* (flat-leaved willow) community type (number = 16 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	1.0	1.1%
Shrubs	6.5	79.1%
Graminoids	4.6	29.7%
Forbs	9.8	19.3%
TOTAL	***21.9***	***129.2%***

Sampled Stands Plant Species List

A total of 161 plant species were recorded on at least one of 16 stands sampled of the *Salix planifolia* (flat-leaved willow) community type (Table 442). These stands are in an early seral or disturbed state, and fail to key out to one of the habitat types described above. Five tree species were recorded in small amounts, while *Salix planifolia* (flat-leaved willow) alone dominates the 40 shrub species recorded. The grazing disturbance indicator, *Poa pratensis* (Kentucky bluegrass), leads the list of 37 graminoids. Among the 79 forbs recorded, no single species is notably prominent.

Table 442. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix planifolia* (flat-leaved willow) community type (number = 16 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 5)					
Betula neoalaskana (Alaska birch)	0.5	0-0.5	6	0.03	N
Betula papyrifera (white birch)	0.5	0-0.5	25	0.13	N
Picea glauca (white spruce)	1.1	0-3	25	0.28	N
Populus balsamifera (balsam poplar)	2.4	0-3	25	0.59	N
Populus tremuloides (aspen)	0.5	0-0.5	19	0.09	N
Shrubs (N = 40)					
Alnus tenuifolia (river alder)	3.0	0-3	6	0.19	N
Amelanchier alnifolia (Saskatoon)	3.0	0-3	6	0.19	N
Betula glandulosa (bog birch)	9.0	0-20	25	2.25	N
Betula occidentalis (water birch)	0.5	0-0.5	6	0.03	N
Betula pumila (dwarf birch)	0.5	0-0.5	6	0.03	N
Cornus stolonifera (red-osier dogwood)	2.2	0-3	19	0.41	N
Linnaea borealis (twinflower)	0.5	0-0.5	6	0.03	N
Lonicera dioica (twining honeysuckle)	0.5	0-0.5	13	0.06	N
Lonicera involucrata (bracted honeysuckle)	1.8	0-3	13	0.22	N
Lonicera utahensis (red twinberry)	3.0	0-3	6	0.19	N

Table 442. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Potentilla fruticosa (shrubby cinquefoil)	1.3	0-3	19	0.25	N
Ribes hudsonianum (northern black currant)	10.0	0-10	6	0.63	N
Ribes oxyacanthoides (northern gooseberry)	5.7	0-20	44	2.50	N
Ribes spp. (currant)	3.0	0-3	6	0.19	B
Ribes triste (wild red currant)	0.5	0-0.5	6	0.03	N
Rosa acicularis (prickly rose)	0.5	0-0.5	13	0.06	N
Rosa spp. (rose)	0.5	0-0.5	25	0.13	B
Rubus arcticus (dwarf raspberry)	2.2	0-3	19	0.41	N
Rubus idaeus (wild red raspberry)	0.5	0-0.5	6	0.03	N
Rubus pubescens (dewberry)	1.1	0-3	25	0.28	N
Salix arbusculoides (shrubby willow)	20.0	0-20	6	1.25	N
Salix bebbiana (beaked willow)	7.8	0-20	50	3.91	N
Salix boothii (Booth's willow)	7.7	0-10	19	1.44	N
Salix candida (hoary willow)	3.0	0-3	6	0.19	N
Salix discolor (pussy willow)	3.0	0-3	6	0.19	N
Salix drummondiana (Drummond's willow)	40.0	0-40	6	2.50	N
Salix exigua (sandbar willow)	0.5	0-0.5	6	0.03	N
Salix lucida (shining willow)	5.3	0-10	13	0.66	N
Salix lutea (yellow willow)	13.5	0-20	19	2.53	N
Salix maccalliana (velvet-fruited willow)	40.0	0-40	6	2.50	N
Salix myrtillifolia (myrtle-leaved willow)	13.3	0-20	19	2.50	N
Salix petiolaris (basket willow)	10.6	0-20	31	3.31	N
Salix planifolia (flat-leaved willow)	43.1	10-70	100	43.13	N
Salix pseudomonticola (false mountain willow)	5.7	0-20	50	2.84	N
Salix pyrifolia (balsam willow)	20.0	0-20	6	1.25	N
Salix scouleriana (Scouler's willow)	40.0	0-40	6	2.50	N
Salix spp. (willow)	0.5	0-0.5	6	0.03	B
Sorbus scopulina (western mountain-ash)	0.5	0-0.5	6	0.03	N
Symphoricarpos occidentalis (buckbrush)	3.0	0-3	6	0.19	N
Viburnum edule (low-bush cranberry)	0.5	0-0.5	6	0.03	N
Graminoids (N = 37)					
Agropyron repens (quack grass)	20.3	0-40	13	2.53	I
Agropyron trachycaulum (slender wheat grass)	1.8	0-3	13	0.22	N
Agrostis stolonifera (redtop)	3.0	0-3	6	0.19	I
Alopecurus spp. (foxtail)	3.0	0-3	6	0.19	B
Bromus anomalus (nodding brome)	3.0	0-3	6	0.19	N
Bromus ciliatus (fringed brome)	0.5	0-0.5	25	0.13	N
Bromus inermis (smooth brome)	0.5	0-0.5	6	0.03	I
Calamagrostis canadensis (marsh reed grass)	12.4	0-40	44	5.41	N
Calamagrostis spp. (reed grass)	3.0	0-3	13	0.38	N
Calamagrostis stricta (narrow reed grass)	0.5	0-0.5	6	0.03	N
Carex aquatilis (water sedge)	1.1	0-3	25	0.28	N
Carex atherodes (awned sedge)	0.5	0-0.5	19	0.09	N

Table 442. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex curta (short sedge)	1.8	0-3	13	0.22	N
Carex diandra (two-stamened sedge)	20.0	0-20	6	1.25	N
Carex disperma (two-seeded sedge)	3.0	0-3	6	0.19	N
Carex praegracilis (graceful sedge)	0.5	0-0.5	6	0.03	N
Carex scirpoidea (rush-like sedge)	20.0	0-20	6	1.25	N
Carex spp. (sedge)	1.8	0-3	13	0.22	N
Carex torreyi (Torrey's sedge)	0.5	0-0.5	6	0.03	N
Carex utriculata (beaked sedge)	1.5	0-3	31	0.47	N
Carex viridula (green sedge)	10.0	0-10	6	0.63	N
Eleocharis palustris (creeping spike-rush)	3.0	0-3	6	0.19	N
Elymus innovatus (hairy wild rye)	0.5	0-0.5	6	0.03	N
Festuca spp. (fescue)	0.5	0-0.5	6	0.03	B
Glyceria grandis (common tall manna grass)	30.0	0-30	6	1.88	N
Glyceria striata (fowl manna grass)	3.0	0-3	6	0.19	N
Juncus alpinoarticulatus (alpine rush)	10.0	0-10	6	0.63	N
Juncus balticus (wire rush)	11.5	0-20	13	1.44	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	6	0.03	N
Oryzopsis asperifolia (white-grained mountain rice grass)	10.0	0-10	6	0.63	N
Phalaris arundinacea (reed canary grass)	3.0	0-3	6	0.19	N
Phleum pratense (timothy)	4.5	0-10	19	0.84	I
Poa palustris (fowl bluegrass)	4.5	0-10	19	0.84	N
Poa pratensis (Kentucky bluegrass)	17.1	0-60	44	7.47	I
Poa spp. (bluegrass)	20.0	0-20	6	1.25	B
Scirpus microcarpus (small-fruited bulrush)	0.5	0-0.5	19	0.09	N
Sphenopholis obtusata (prairie wedge grass)	0.5	0-0.5	6	0.03	N
Forbs (N = 79)					
Achillea millefolium (common yarrow)	1.1	0-3	25	0.28	N
Achillea sibirica (many-flowered yarrow)	0.5	0-0.5	6	0.03	N
Actaea rubra (red and white baneberry)	1.8	0-3	13	0.22	N
Angelica arguta (white angelica)	1.3	0-3	19	0.25	N
Antennaria parvifolia (small-leaved everlasting)	3.0	0-3	6	0.19	N
Aster borealis (marsh aster)	0.5	0-0.5	25	0.13	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	6	0.03	N
Aster conspicuus (showy aster)	0.5	0-0.5	6	0.03	N
Aster hesperius (western willow aster)	0.5	0-0.5	13	0.06	N
Aster laevis (smooth aster)	0.5	0-0.5	6	0.03	N
Aster modestus (large northern aster)	0.5	0-0.5	6	0.03	N
Aster subspicatus (leafy-bracted aster)	1.8	0-3	13	0.22	N
Athyrium filix-femina (lady fern)	0.5	0-0.5	6	0.03	N
Callitriche verna (vernal water-starwort)	1.8	0-3	13	0.22	N
Cirsium arvense (Canada thistle)	0.5	0-0.5	25	0.13	I
Cornus canadensis (bunchberry)	10.0	0-10	6	0.63	N
Delphinium glaucum (tall larkspur)	3.0	0-3	6	0.19	N

Table 442. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Epilobium angustifolium (common fireweed)	4.2	0-20	38	1.56	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	6	0.03	N
Equisetum arvense (common horsetail)	8.1	0-30	50	4.06	N
Equisetum fluviatile (swamp horsetail)	0.5	0-0.5	6	0.03	N
Equisetum sylvaticum (woodland horsetail)	3.0	0-3	6	0.19	N
Equisetum variegatum (variegated horsetail)	0.5	0-0.5	6	0.03	N
Erigeron philadelphicus (Philadelphia fleabane)	0.5	0-0.5	19	0.09	N
Forb spp. (forb)	0.5	0-0.5	6	0.03	B
Fragaria virginiana (wild strawberry)	3.9	0-10	44	1.72	N
Galeopsis tetrahit (hemp-nettle)	0.5	0-0.5	6	0.03	I
Galium boreale (northern bedstraw)	0.5	0-0.5	13	0.06	N
Galium trifidum (small bedstraw)	1.8	0-3	13	0.22	N
Galium triflorum (sweet-scented bedstraw)	0.5	0-0.5	6	0.03	N
Geranium richardsonii (wild white geranium)	1.8	0-3	13	0.22	N
Geranium spp. (geranium)	0.5	0-0.5	6	0.03	B
Geum aleppicum (yellow avens)	0.5	0-0.5	25	0.13	N
Geum macrophyllum (large-leaved yellow avens)	3.5	0-10	25	0.88	N
Habenaria spp. (bog orchid)	0.5	0-0.5	19	0.09	B
Heracleum lanatum (cow parsnip)	0.5	0-0.5	6	0.03	N
Hippuris vulgaris (common mare's-tail)	0.5	0-0.5	6	0.03	N
Medicago lupulina (black medick)	0.5	0-0.5	6	0.03	I
Melilotus officinalis (yellow sweet-clover)	3.0	0-3	6	0.19	I
Mentha arvensis (wild mint)	0.5	0-0.5	6	0.03	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	13	0.06	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	6	0.03	N
Penstemon spp. (beardtongue)	0.5	0-0.5	6	0.03	N
Petasites frigidus (arctic sweet coltsfoot)	1.1	0-3	25	0.28	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	6	0.03	N
Petasites sagittatus (arrow-leaved coltsfoot)	3.0	0-3	6	0.19	N
Plantago major (common plantain)	0.5	0-0.5	6	0.03	I
Polygonum lapathifolium (pale persicaria)	3.0	0-3	6	0.19	N
Potentilla anserina (silverweed)	1.3	0-3	19	0.25	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	13	0.06	N
Potentilla rivalis (brook cinquefoil)	0.5	0-0.5	6	0.03	N
Pyrola asarifolia (common pink wintergreen)	2.4	0-3	25	0.59	N
Ranunculus acris (tall buttercup)	0.5	0-0.5	6	0.03	I
Rumex occidentalis (western dock)	0.5	0-0.5	6	0.03	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	25	0.13	N
Senecio pauperculus (balsam groundsel)	0.5	0-0.5	6	0.03	N
Senecio pseudaureus (thin-leaved ragwort)	0.5	0-0.5	6	0.03	N
Senecio triangularis (brook ragwort)	0.5	0-0.5	6	0.03	N
Sisyrinchium montanum (common blue-eyed grass)	0.5	0-0.5	6	0.03	N
Sium suave (water parsnip)	3.0	0-3	6	0.19	N

Table 442. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	31	0.16	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	6	0.03	N
Solidago gigantea (late goldenrod)	3.0	0-3	6	0.19	N
Solidago spp. (goldenrod)	0.5	0-0.5	6	0.03	N
Sonchus arvensis (perennial sow-thistle)	1.8	0-3	13	0.22	I
Sonchus arvensis subsp. *uliginosus* (smooth perennial sow-thistle)	0.5	0-0.5	6	0.03	I
Stachys palustris (marsh hedge-nettle)	0.5	0-0.5	6	0.03	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	13	0.06	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.5	0-0.5	13	0.06	N
Taraxacum officinale (common dandelion)	3.0	0-3	25	0.75	I
Thalictrum occidentale (western meadow rue)	0.5	0-0.5	13	0.06	N
Trifolium repens (white clover)	20.0	0-20	6	1.25	I
Triglochin maritima (seaside arrow-grass)	0.5	0-0.5	6	0.03	N
Typha latifolia (common cattail)	0.5	0-0.5	6	0.03	N
Urtica dioica (common nettle)	2.9	0-10	25	0.72	N
Veratrum eschscholtzii (green false hellebore)	0.5	0-0.5	6	0.03	N
Vicia americana (wild vetch)	0.5	0-0.5	31	0.16	N
Viola canadensis (western Canada violet)	0.5	0-0.5	6	0.03	N
Viola palustris (marsh violet)	5.3	0-10	13	0.66	N

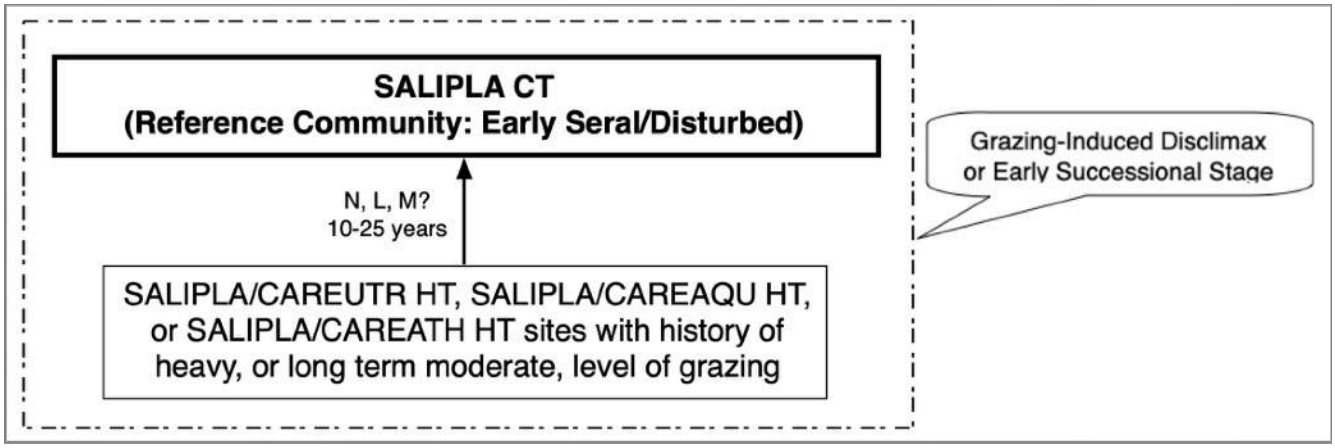
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix planifolia* (flat-leaved willow) community type is in most cases the result of heavy grazing pressure on stands of one of the *Salix planifolia* (flat-leaved willow) habitat types described above that, due to prolonged drought or other cause, have dried out enough to allow livestock access. The palatable graminoids in the understory are depleted and replaced by disturbance increaser species, such as *Poa pratensis* (Kentucky bluegrass).

Figure 92 shows a schematic diagram of the most common successional pathways of the *Salix planifolia* (flat-leaved willow) community type.



Successional Pathway of *Salix planifolia* (flat-leaved willow) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix planifolia* (flat-leaved willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
SALIPLA/CAREAQU HT—*Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type
SALIPLA/CAREATH HT—*Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type
SALIPLA/CAREUTR HT—*Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type
SALIPLA CT—*Salix planifolia* (flat-leaved willow) community type

Figure 92. Successional pathway for sites of the *Salix planifolia* (flat-leaved willow) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 93 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix planifolia* (flat-leaved willow) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

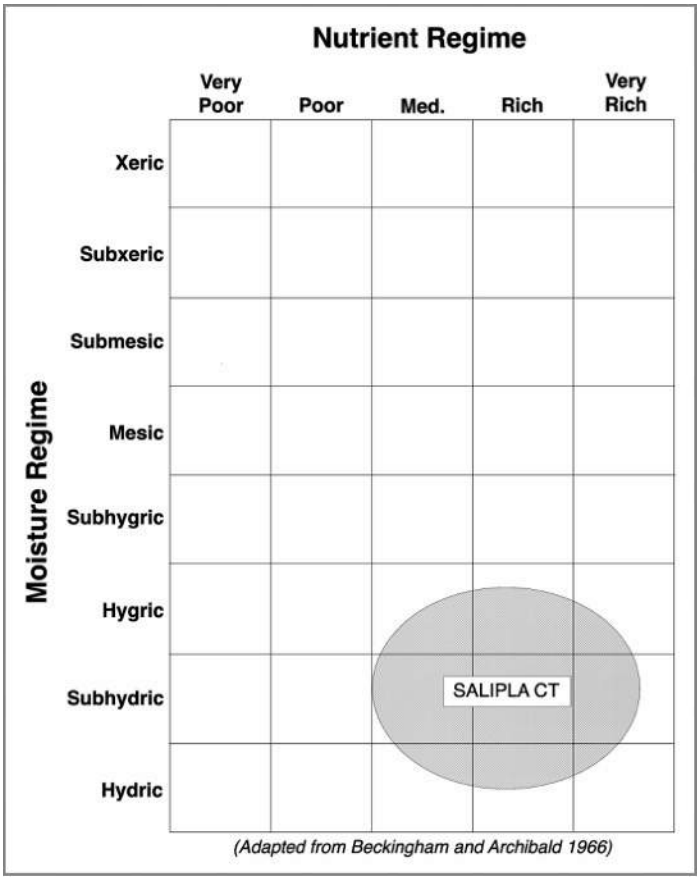


Figure 93. Edatope grid position for the *Salix planifolia* (flat-leaved willow) community type (SALIPLA CT)

SOILS

Parent material on sites supporting the *Salix planifolia* (flat-leaved willow) community type is predominantly fluvial. Soil drainage ranges from poorly drained to very poorly drained, and mineral soils typically are gleyed, with textures from sandy loam to clay covered by an organic layer of varying thickness (Baker and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites will likely be dominated by a wetland *Carex* (sedge) species, such as *Carex utriculata* (beaked sedge) or *Carex aquatilis* (water sedge), or open water. Adjacent drier sites will likely have a community dominated by *Salix bebbiana* (beaked willow), *Picea glauca* (white spruce), and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix planifolia* (flat-leaved willow)**—*Salix planifolia* (flat-leaved willow) is found in most natural regions of Alberta, growing in moist thickets, on boggy and swampy sites, and along streambanks and shorelines (Tannas 1997a).

At higher elevations, *Salix planifolia* (flat-leaved willow) grows in zones dominated by *Picea engelmannii* (Engelmann spruce), *Abies lasiocarpa* (subalpine fir), and *Pinus contorta* (lodgepole pine). Soils may be mineral or organic. At lower elevations, the species generally is found scattered within other willow-dominated communities along the banks of streams, ponds, lakes, and in wet meadows and marshes (Uchytil 1991a).

Salix planifolia (flat-leaved willow) is shade intolerant, and often forms relatively stable communities maintained by the high water table and a high elevation climate (Uchytil 1991a).

Livestock

***Salix planifolia* (flat-leaved willow)**—All classes of livestock eat willows, but *Salix planifolia* (flat-leaved willow) importance in livestock diets has not been extensively reported (Uchytil 1991a). Tannas (1997a) states that livestock utilize *Salix planifolia* (flat-leaved willow) when more palatable browse becomes scarce. Most willows are palatable to both livestock and wild ungulates, and their palatability tends to increase as the growing season advances (Uchytil 1991a). Plants of this species become decadent or stunted when excessively browsed by cattle, wild ungulates, or beavers; however decadent plants recover relatively quickly when the browsing is removed (Uchytil 1991a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix planifolia* (flat-leaved willow)**—*Salix planifolia* (flat-leaved willow) is highly palatable to moose and beaver, but is apparently less so to elk and deer. Consumption by elk and mule deer is generally low (Uchytil 1991a). Willows in general are a preferred food and building material of beaver. Ducks, grouse, other birds, and small mammals all eat willow shoots, catkins, buds, and leaves (Uchytil 1991a).

Fisheries

***Salix planifolia* (flat-leaved willow)**—The dense network of roots from the *Salix* (willows) and grass are effective in stabilizing streambanks. Immediately adjacent to the stream, the banks become undercut and sag into the water providing excellent hiding cover for fish. The *Salix* (willows) provides valuable overhanging stream cover and shade. The importance of *Salix* (willows) in streambank protection, cover, and thermal protection for fisheries cannot be over emphasized (Thompson and Hansen 2003).

Fire

***Salix planifolia* (flat-leaved willow)**—The wet meadow and stream side habitats occupied by *Salix planifolia* (flat-leaved willow) rarely burn. In fact, these riparian wet areas frequently act as fire breaks. However, under dry conditions, riparian habitats can burn severely. Most willow species sprout from the root crown after being top-killed by fire, however *Salix* (willows) on organic soils may be killed by severe fires which burn deep into the soil, char the roots, and prevent sprouting (Uchytil 1991a).

Rehabilitation/Restoration Considerations

***Salix planifolia* (flat-leaved willow)**—*Salix planifolia* (flat-leaved willow) is recommended for revegetating disturbed riparian sites, and is especially useful for streambank stabilization. It may be planted as rooted or unrooted stem cuttings, but the rooted cuttings have higher survival rates than unrooted cuttings (Uchytil 1991a).

For use in revegetating disturbed streambanks, cuttings should be first rooted then grown in a nursery to increase survival rates. Cut stems of *Salix planifolia* (flat-leaved willow) produce low to moderate numbers of roots, located along the entire length of stem. Best results are obtained from cuttings taken in the spring from dormant

two to four year old wood. Cuttings 30 cm to 50 cm long and greater than 1 cm in diameter produce best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting (Hansen and others 1995).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix planifolia* (flat-leaved willow) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix planifolia* (flat-leaved willow) community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002); and
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003).

Salix scouleriana Community Type
(Scouler's willow Community Type)

SALISCO Community Type
Number of Stands = 23 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 3; Other Data Sets = 20)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of willow species and/or sedge species not identified to the species level (approximately 33 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix scouleriana* (Scouler's willow) community type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. *Salix scouleriana* (Scouler's willow) can grow on wet sites, but is more commonly found on moist-to-mesic sites along intermittent drainages and along the shallow edges of lakes. The species has a broad range of adaptation to soil and moisture conditions.

Photo 23 shows a typical stand of the *Salix scouleriana* (Scouler's willow) community type.

Photo 23. A stand of the *Salix scouleriana* (Scouler's willow) community type

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 443 shows the five most prominent plant species among the four lifeforms for species recorded in all 23 stands of the *Salix scouleriana* (Scouler's willow) community type. *Salix scouleriana* (Scouler's willow) is by far most prominent, followed far behind by *Calamagrostis canadensis* (marsh reed grass). No other species is more than moderately prominent in these stands.

Table 443. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Salix scouleriana* (Scouler's willow) community type (number = 23 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Betula papyrifera (white birch)	0.44	Native
Populus balsamifera (balsam poplar)	0.33	Native
Picea glauca (white spruce)	0.07	Native
Populus tremuloides (aspen)	0.04	Native
Abies lasiocarpa (subalpine fir)	0.02	Native
Shrubs		
Salix scouleriana (Scouler's willow)	60.87	Native
Alnus crispa (green alder)	5.35	Native
Cornus stolonifera (red-osier dogwood)	5.15	Native
Rubus idaeus (wild red raspberry)	3.24	Native
Alnus tenuifolia (river alder)	1.87	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	14.37	Native
Carex atherodes (awned sedge)	3.44	Native
Cinna latifolia (drooping wood-reed)	1.22	Native
Glyceria striata (fowl manna grass)	0.57	Native
Poa palustris (fowl bluegrass)	0.54	Native

Table 443. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Equisetum arvense (common horsetail)	7.35	Native
Urtica dioica (common nettle)	5.33	Native
Callitriche verna (vernal water-starwort)	2.46	Native
Impatiens spp. (touch-me-not)	2.02	Native
Forb spp. (forb)	1.30	Both

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 444 through Table 447, break out the vegetation recorded in 23 stands of the *Salix planifolia* (flat-leaved willow) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species rich, shrub dominated community type of incidental occurrence across the study area.

Table 444 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix scouleriana* (Scouler's willow) community type. For the 23 stands comprising the community type, the number of unique species was 152 with 142 (93.4 percent) of them being native species.

Table 444. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Salix scouleriana* (Scouler's willow) community type (number = 23 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	6	6	0	0
Shrubs	36	36	0	0
Graminoids	23	22	1	0
Forbs	87	78	7	2
TOTAL	***152 (100.0%)***	***142 (93.4%)***	***8 (5.3%)***	***2 (1.3%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 445 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix scouleriana* (Scouler's willow) community type. The average number of species per stand is 20.7, with native species comprising 20.0 species per stand or 96.6 percent.

Table 445. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix scouleriana* (Scouler's willow) community type (number = 23 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.7	0.7	0.0	0.0
Shrubs	6.3	6.3	0.0	0.0
Graminoids	2.7	2.7	0.0	0.0
Forbs	11.0	10.3	0.5	0.1
TOTAL	***20.7 (100.0%)***	***20.0 (96.6%)***	***0.5 (2.4%)***	***0.1 (0.5%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 446 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Salix scouleriana* (Scouler's willow) community type. The average canopy cover per stand is 144.5 percent, with native species comprising 142.2 percent or 98.4 percent of the total amount of average canopy cover per stand.

Table 446. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Salix scouleriana* (Scouler's willow) community type (number = 23 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.9%	0.9%	0.0%	0.0%
Shrubs	88.1%	88.1%	0.0%	0.0%
Graminoids	23.2%	23.1%	0.0%	0.0%
Forbs	32.3%	30.1%	0.9%	1.3%
TOTAL	***144.5% (100.0%)***	***142.2% (98.4%)***	***0.9% (0.6%)***	***1.3% (0.9%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 447 shows the average number of species and average canopy cover by lifeform in stands of the *Salix scouleriana* (Scouler's willow) community type. The average number of species per stand was 20.7 with an average canopy cover of 144.5 percent.

Table 447. Average number of species and average canopy cover by lifeform in stands of the *Salix scouleriana* (Scouler's willow) community type (number = 23 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.7	0.9%
Shrubs	6.3	88.1%
Graminoids	2.7	23.2%
Forbs	11.0	32.3%
TOTAL	***20.7***	***144.5%***

Sampled Stands Plant Species List

A total of 152 plant species were recorded on at least one of 23 stands sampled of the *Salix scouleriana* (Scouler's willow) community type (Table 448). Six tree species were recorded in small amounts, while *Salix scouleriana* (Scouler's willow) overwhelmingly dominates the 36 shrubs recorded. *Calamagrostis canadensis* (marsh reed grass) is most prominent of the 23 graminoids recorded, but none of the 87 forb species recorded is more than moderately prominent.

Table 448. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Salix scouleriana* (Scouler's willow) community type (number = 23 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 6)					
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	4	0.02	N
Betula papyrifera (white birch)	2.0	0-3	22	0.43	N
Picea glauca (white spruce)	0.5	0-0.5	13	0.07	N
Pinus contorta (lodgepole pine)	0.5	0-0.5	4	0.02	N
Populus balsamifera (balsam poplar)	1.5	0-3	22	0.33	N
Populus tremuloides (aspen)	0.5	0-0.5	9	0.04	N
Shrubs (N = 36)					
Alnus crispa (green alder)	41.0	0-80	13	5.35	N
Alnus tenuifolia (river alder)	10.8	0-20	17	1.87	N
Amelanchier alnifolia (Saskatoon)	1.8	0-3	9	0.15	N
Betula glandulosa (bog birch)	40.0	0-40	4	1.74	N
Clematis occidentalis (purple clematis)	0.5	0-0.5	4	0.02	N
Cornus stolonifera (red-osier dogwood)	7.4	0-30	70	5.15	N
Corylus cornuta (beaked hazelnut)	0.5	0-0.5	9	0.04	N
Ledum groenlandicum (common Labrador tea)	0.5	0-0.5	9	0.04	N
Linnaea borealis (twinflower)	3.0	0-3	9	0.26	N
Lonicera dioica (twining honeysuckle)	0.5	0-0.5	13	0.07	N

Table 448. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Lonicera involucrata (bracted honeysuckle)	3.3	0-10	52	1.74	N
Lonicera utahensis (red twinberry)	3.0	0-3	4	0.13	N
Menziesia ferruginea (false azalea)	0.5	0-0.5	4	0.02	N
Potentilla fruticosa (shrubby cinquefoil)	3.0	0-3	4	0.13	N
Prunus virginiana (choke cherry)	0.5	0-0.5	4	0.02	N
Ribes americanum (wild black currant)	1.8	0-3	9	0.15	N
Ribes hirtellum (wild gooseberry)	3.0	0-3	4	0.13	N
Ribes hudsonianum (northern black currant)	6.5	0-10	9	0.57	N
Ribes lacustre (bristly black currant)	4.5	0-10	13	0.59	N
Ribes oxyacanthoides (northern gooseberry)	1.0	0-3	22	0.22	N
Ribes triste (wild red currant)	2.2	0-3	13	0.28	N
Rosa acicularis (prickly rose)	5.8	0-20	26	1.50	N
Rubus idaeus (wild red raspberry)	5.3	0-20	61	3.24	N
Rubus parviflorus (thimbleberry)	10.0	0-10	4	0.43	N
Rubus pubescens (dewberry)	1.1	0-3	57	0.61	N
Salix bebbiana (beaked willow)	1.8	0-3	9	0.15	N
Salix boothii (Booth's willow)	0.5	0-0.5	4	0.02	N
Salix petiolaris (basket willow)	1.8	0-3	9	0.15	N
Salix planifolia (flat-leaved willow)	1.8	0-3	9	0.15	N
Salix pseudomonticola (false mountain willow)	10.3	0-20	9	0.89	N
Salix scouleriana (Scouler's willow)	60.9	10-90	100	60.87	N
Shepherdia canadensis (Canada buffaloberry)	0.5	0-0.5	4	0.02	N
Sorbus scopulina (western mountain-ash)	0.5	0-0.5	4	0.02	N
Spiraea betulifolia (white meadowsweet)	1.8	0-3	9	0.15	N
*Symphoricarpos occidentali*s (buckbrush)	1.3	0-3	13	0.17	N
Viburnum edule (low-bush cranberry)	6.0	0-20	17	1.04	N
Graminoids (N = 23)					
Agropyron trachycaulum (slender wheat grass)	5.3	0-10	9	0.46	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	4	0.02	N
Bromus ciliatus (fringed brome)	0.5	0-0.5	17	0.09	N
Calamagrostis canadensis (marsh reed grass)	20.7	0-97.5	70	14.37	N
Carex aquatilis (water sedge)	0.5	0-0.5	4	0.02	N
Carex atherodes (awned sedge)	8.8	0-60	39	3.43	N
Carex bebbii (Bebb's sedge)	10.0	0-10	4	0.43	N
Carex curta (short sedge)	3.0	0-3	4	0.13	N
Carex deweyana (Dewey's sedge)	0.5	0-0.5	4	0.02	N
Carex diandra (two-stamened sedge)	10.0	0-10	4	0.43	N
Carex disperma (two-seeded sedge)	0.5	0-0.5	4	0.02	N
Carex spp. (sedge)	0.5	0-0.5	9	0.04	N
Carex utriculata (beaked sedge)	1.8	0-3	9	0.15	N
Cinna latifolia (drooping wood-reed)	4.0	0-20	30	1.22	N
Deschampsia cespitosa (tufted hair grass)	10.0	0-10	4	0.43	N
Deschampsia elongata (slender hair grass)	0.5	0-0.5	4	0.02	N
Elymus glaucus (smooth wild rye)	3.0	0-3	4	0.13	N

Table 448. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Elymus innovatus (hairy wild rye)	10.0	0-10	4	0.43	N
Festuca scabrella (rough fescue)	0.5	0-0.5	4	0.02	N
Glyceria grandis (common tall manna grass)	3.0	0-3	4	0.13	N
Glyceria striata (fowl manna grass)	6.5	0-10	9	0.57	N
Poa palustris (fowl bluegrass)	2.5	0-3	22	0.54	N
Poa pratensis (Kentucky bluegrass)	0.5	0-0.5	4	0.02	I
Forbs (N = 87)					
Achillea millefolium (common yarrow)	0.5	0-0.5	9	0.04	N
Actaea rubra (red and white baneberry)	0.5	0-0.5	13	0.07	N
Adoxa moschatellina (moschatel)	0.5	0-0.5	4	0.02	N
Agoseris glauca (yellow false dandelion)	3.0	0-3	4	0.13	N
Angelica arguta (white angelica)	3.0	0-3	4	0.13	N
Aralia nudicaulis (wild sarsaparilla)	2.1	0-10	26	0.54	N
Arnica chamissonis (leafy arnica)	0.5	0-0.5	4	0.02	N
Arnica cordifolia (heart-leaved arnica)	0.5	0-0.5	4	0.02	N
Aster conspicuus (showy aster)	0.5	0-0.5	26	0.13	N
Aster hesperius (western willow aster)	0.5	0-0.5	4	0.02	N
Aster modestus (large northern aster)	0.5	0-0.5	4	0.02	N
Aster puniceus (purple-stemmed aster)	1.8	0-3	9	0.15	N
Aster subspicatus (leafy-bracted aster)	0.5	0-0.5	4	0.02	N
Athyrium filix-femina (lady fern)	3.0	0-3	9	0.26	N
Callitriche verna (vernal water-starwort)	9.4	0-30	26	2.46	N
Campanula rotundifolia (harebell)	0.5	0-0.5	4	0.02	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	4	0.02	N
Cicuta maculata (water-hemlock)	2.2	0-3	13	0.28	N
Circaea alpina (small enchanter's nightshade)	2.3	0-10	35	0.80	N
Cirsium arvense (Canada thistle)	0.5	0-0.5	13	0.07	I
Clintonia uniflora (corn lily)	0.5	0-0.5	4	0.02	N
Cornus canadensis (bunchberry)	4.1	0-10	17	0.72	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	4	0.02	N
Disporum trachycarpum (fairybells)	0.5	0-0.5	9	0.04	N
Dryopteris carthusiana (narrow spinulose shield fern)	1.8	0-3	9	0.15	N
Epilobium angustifolium (common fireweed)	1.1	0-3	39	0.41	N
Epilobium ciliatum (northern willowherb)	2.5	0-3	22	0.54	N
Equisetum arvense (common horsetail)	11.3	0-60	65	7.35	N
Forb spp. (forb)	15.0	0-20	9	1.30	B
Fragaria vesca (woodland strawberry)	0.5	0-0.5	4	0.02	N
Fragaria virginiana (wild strawberry)	3.5	0-10	17	0.61	N
Galeopsis tetrahit (hemp-nettle)	1.8	0-3	9	0.15	I
Galium boreale (northern bedstraw)	0.5	0-0.5	17	0.09	N
Galium trifidum (small bedstraw)	0.5	0-0.5	13	0.07	N
Galium triflorum (sweet-scented bedstraw)	1.3	0-3	65	0.87	N
Geranium richardsonii (wild white geranium)	0.5	0-0.5	4	0.02	N

Table 448. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Geum aleppicum (yellow avens)	1.1	0-3	39	0.41	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	9	0.04	N
Gymnocarpium dryopteris (oak fern)	0.5	0-0.5	9	0.04	N
Habenaria spp. (bog orchid)	0.5	0-0.5	4	0.02	B
Heracleum lanatum (cow parsnip)	1.5	0-3	22	0.33	N
Impatiens spp. (touch-me-not)	9.3	0-30	22	2.02	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	13	0.07	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	4	0.02	N
Mentha arvensis (wild mint)	2.9	0-10	30	0.89	N
Mertensia paniculata (tall lungwort)	1.3	0-3	26	0.35	N
Mimulus spp. (monkey flower)	3.0	0-3	4	0.13	N
Mitella nuda (bishop's-cap)	0.9	0-3	30	0.26	N
Orthilia secunda (one-sided wintergreen)	0.5	0-0.5	4	0.02	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	1.8	0-3	9	0.15	N
Osmorhiza depauperata (spreading sweet cicely)	0.5	0-0.5	9	0.04	N
Pedicularis bracteosa (western lousewort)	3.0	0-3	4	0.13	N
Pedicularis groenlandica (elephant's-head)	3.0	0-3	4	0.13	N
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	4	0.02	N
Petasites frigidus (arctic sweet coltsfoot)	0.9	0-3	26	0.24	N
Petasites palmatus (palmate-leaved coltsfoot)	3.0	0-3	4	0.13	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	4	0.02	N
Polygonum lapathifolium (pale persicaria)	10.0	0-10	4	0.43	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	4	0.02	N
Potentilla glandulosa (sticky cinquefoil)	0.5	0-0.5	4	0.02	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	4	0.02	N
Pyrola asarifolia (common pink wintergreen)	1.1	0-3	17	0.20	N
Rumex maritimus (golden dock)	3.0	0-3	4	0.13	N
Rumex occidentalis (western dock)	0.5	0-0.5	4	0.02	N
Scutellaria galericulata (marsh skullcap)	4.6	0-20	26	1.20	N
Senecio pauciflorus (few-flowered ragwort)	0.5	0-0.5	4	0.02	N
Senecio triangularis (brook ragwort)	10.0	0-10	4	0.43	N
Sium suave (water parsnip)	0.5	0-0.5	4	0.02	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	4	0.02	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	13	0.07	N
Solidago multiradiata (alpine goldenrod)	0.5	0-0.5	4	0.02	N
Sonchus arvensis (perennial sow-thistle)	0.5	0-0.5	9	0.04	I
Sparganium spp. (sparganium)	0.5	0-0.5	4	0.02	N
Stellaria calycantha (northern stitchwort)	0.5	0-0.5	4	0.02	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	4	0.02	N
Stenanthium occidentale (bronzebells)	0.5	0-0.5	4	0.02	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.5	0-0.5	13	0.07	N
Taraxacum officinale (common dandelion)	0.5	0-0.5	9	0.04	I
Thalictrum venulosum (veiny meadow rue)	1.1	0-3	17	0.20	N

Table 448. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trientalis borealis (northern starflower)	0.5	0-0.5	4	0.02	N
Trifolium repens (white clover)	0.5	0-0.5	4	0.02	I
Typha latifolia (common cattail)	10.0	0-10	4	0.43	N
Urtica dioica (common nettle)	8.8	0-60	61	5.33	N
Vaccaria pyramidata (cow cockle)	3.0	0-3	4	0.13	I
Vicia americana (wild vetch)	0.5	0-0.5	26	0.13	N
Viola canadensis (western Canada violet)	0.5	0-0.5	4	0.02	N
Viola renifolia (kidney-leaved violet)	0.5	0-0.5	4	0.02	N

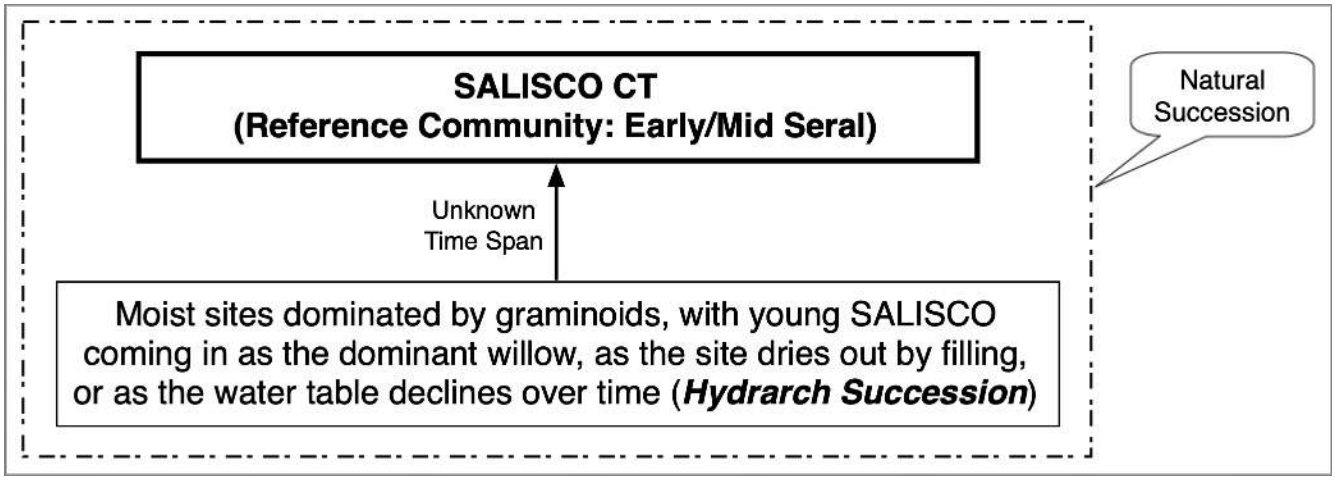
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Salix scouleriana* (Scouler's willow) community type is usually the result of herbaceous wet meadow sites drying out due to lowering water table or filling in of a shallow depression and allowing the *Salix scouleriana* (Scouler's willow) to become the dominant overstory species—a process known as hydrarch succession. These stands may persist for a few decades; but in the absence of wildfire, late seral, shade tolerant conifer trees will likely invade and reveal the true potential of the site.

Figure 94 shows a schematic diagram of vegetation successional pathways on sites of the *Salix scouleriana* (Scouler's willow) community type.



Successional Pathway of *Salix scouleriana* (Scouler's willow) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Salix scouleriana* (Scouler's willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
SALISCO—*Salix scouleriana* (Scouler's willow)
SALISCO CT—*Salix scouleriana* (Scouler's willow) community type

Figure 94. Successional pathway for sites of the *Salix scouleriana* (Scouler's willow) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 95 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Salix scouleriana* (Scouler's willow) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

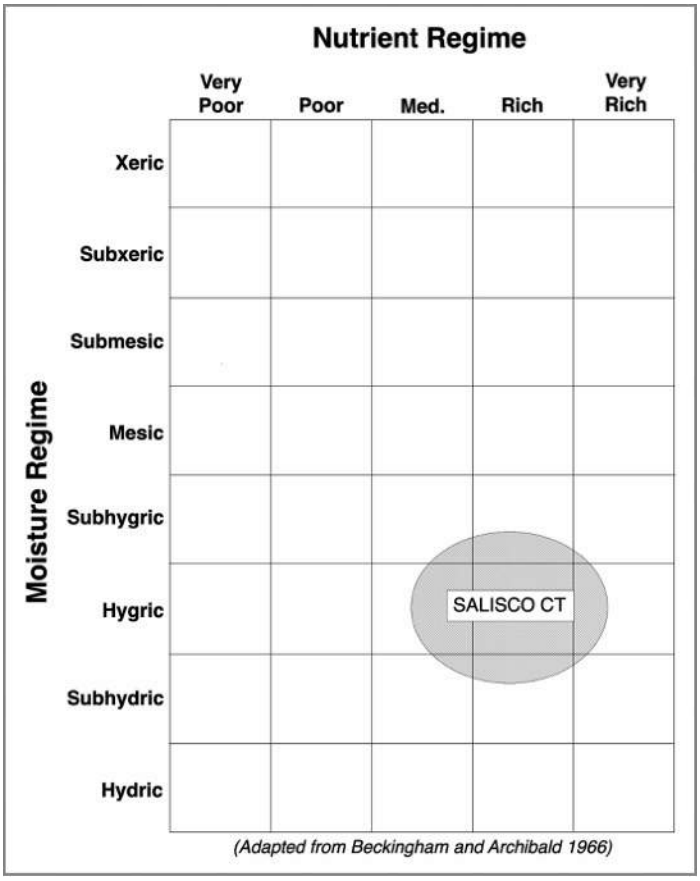


Figure 95. Edatope grid position for the *Salix scouleriana* (Scouler's willow) community type (SALISCO CT)

SOILS

Soils on sites supporting the *Salix scouleriana* (Scouler's willow) community type commonly have an organic layer from 5 cm to 30 cm thick overlaying mineral substrate with textures from sandy loam to sand. Water tables are usually within 1 m of the soil surface throughout summer. Redoximorphic features (mottles or gleyed soil) are common within 1 m of the soil surface on sites of this type (Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites will likely have a community dominated by willows, such as *Salix bebbiana* (beaked willow) or *Salix glauca* (smooth willow). Adjacent drier sites will often have a community dominated by *Picea mariana* (black spruce), *Abies lasiocarpa* (subalpine fir) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Salix scouleriana* (Scouler's willow)**—*Salix scouleriana* (Scouler's willow) is found in all natural regions of Alberta, except the Mixed Grass Prairie. It may be found in rather dry upland forests, but also occurs on moister sites on shorelines, floodplains, and along stream banks (Tannas 1997a).

Salix scouleriana (Scouler's willow) can grow on wet sites, but is more commonly found on moist sites or along intermittent watercourses. It is found on shallow to moderately deep soils and tolerates a range of soil moisture conditions (Anderson 2001). The species is shade intolerant, but remains as a persistent seral understory component in a variety of forest types. However, it tends to increase after disturbances, such as timber harvest, prescribed burning, and wildfire (Anderson 2001).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

Livestock

***Salix scouleriana* (Scouler's willow)**—*Salix scouleriana* (Scouler's willow) has good forage value. The foliage and twigs are quite nutritious and this species is considered among the most palatable of willows. Utilization is often high by both livestock and wild ungulates (Tannas 1997a), and this willow is an important browse species for domestic livestock and wildlife ungulates, providing critical winter and spring forage (Anderson 2001).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Salix scouleriana* (Scouler's willow)**—*Salix scouleriana* (Scouler's willow) is heavily browsed by moose throughout the year. The plants are frequently so extensively browsed as to reduce the species population on a site (Tannas 1997a). Like most willows, *Salix scouleriana* (Scouler's willow) is moderately to highly palatable for white-tailed deer, mule deer, and elk. It is of intermediate quality and high palatability for moose, and moderately palatable for beaver (Anderson 2001).

Upland game birds, ducks, and other birds feed on willow buds, leaves, twigs, and seeds, and *Salix scouleriana* (Scouler's willow) provides nesting and feeding habitat for small birds. Its buds provide an important winter food source for grouse, Clark's nutcracker, and the Rocky Mountain jay (Anderson 2001).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

Fire

***Salix scouleriana* (Scouler's willow)**— *Salix scouleriana* (Scouler's willow) resprouts vigorously from a subterranean root crown in response to disturbance, including fire, flooding, and mechanical damage (Anderson 2001). *Salix scouleriana* (Scouler's willow) sprouts typically have a tall, fast growth response, and as a survivor and off-site colonizer (by prolific wind-blown seed), it can be abundant following fire. It is adapted to fire by rapidly resprouting from the root crown, and establishes readily from seed on severely burned sites. Stand replacing fires favor regeneration of this species, and good response of *Salix scouleriana* (Scouler's willow) seedlings can be expected on sites where fire exposes the mineral soil (Anderson 2001).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

Rehabilitation/Restoration Considerations

***Salix scouleriana* (Scouler's willow)**—*Salix scouleriana* (Scouler's willow) is useful for stabilizing steep, erodible banks on drier sties above river courses, and is recommended for riparian revegetation projects. (Anderson 2001).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Salix scouleriana* (Scouler's willow) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) to the species level (i.e., *Salix* [willows] were only identified to the genus level)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Green alder-Scouler's willow

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msd5 Green alder-Scouler's willow (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Salix scouleriana* (Scouler's willow) community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003).

Alnus crispa Community Type
(green alder Community Type)

ALNUCRI Community Type
Number of Stands = 5 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 2; Other Data Sets = 3)

LOCATION AND ASSOCIATED LANDFORMS

The *Alnus crispa* (green alder) community type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. This community type is typically found in moist or boggy woods, along streams, around pond margins, lakeshores, and moist montane slopes.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 449 shows the five most prominent plant species among the four lifeforms for species recorded in all five stands of the *Alnus crispa* (green alder) community type. *Alnus crispa* (green alder) is by far the most prominent species, followed well behind by *Athyrium filix-femina* (lady fern), which is the only other species more than moderately prominent in stands sampled of this community type.

Table 449. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Alnus crispa* (green alder) community type (number = 5 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea engelmannii (Engelmann spruce)	0.70	Native
Abies lasiocarpa (subalpine fir)	0.20	Native
Betula papyrifera (white birch)	0.10	Native
Pinus contorta (lodgepole pine)	0.10	Native
Populus tremuloides (aspen)	0.10	Native
Shrubs		
Alnus crispa (green alder)	74.00	Native
Sambucus racemosa (red elderberry)	4.00	Native
Oplopanax horridum (devil's-club)	2.00	Native
Rubus pubescens (dewberry)	2.00	Native
Ribes lacustre (bristly black currant)	0.80	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	8.00	Native
Festuca rubra (red fescue)	8.00	Both
Bromus spp. (brome grass)	0.60	Both
Elymus innovatus (hairy wild rye)	0.60	Native
Poa pratensis (Kentucky bluegrass)	0.60	Introduced
Forbs		
Athyrium filix-femina (lady fern)	14.10	Native
Epilobium angustifolium (common fireweed)	8.10	Native
Heracleum lanatum (cow parsnip)	6.60	Native
Arnica cordifolia (heart-leaved arnica)	4.10	Native
Disporum hookeri (Oregon fairybells)	4.00	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 450 through Table 453, break out the vegetation recorded in five stands sampled of the *Alnus crispa* (green alder) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated community type of incidental occurrence across the study area.

Table 450 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Alnus crispa* (green alder) community type. For the 5

stands comprising the community type, the number of unique species was 72 with 66 (91.7 percent) of them being native species.

Table 450. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Alnus crispa* (green alder) community type (number = 5 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	5	5	0	0
Shrubs	17	16	0	1
Graminoids	8	5	1	2
Forbs	42	40	1	1
TOTAL	***72 (100.0%)***	***66 (91.7%)***	***2 (2.8%)***	***4 (5.6%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 451 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Alnus crispa* (green alder) community type. The average number of species per stand is 18.4, with native species comprising 17.2 species per stand or 93.5 percent.

Table 451. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Alnus crispa* (green alder) community type (number = 5 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.4	1.4	0.0	0.0
Shrubs	4.8	4.4	0.0	0.2
Graminoids	1.6	1.0	0.2	0.4
Forbs	10.8	10.4	0.2	0.2
TOTAL	***18.4 (100.0%)***	***17.2 (93.5%)***	***0.4 (2.2%)***	***0.8 (4.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 452 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Alnus crispa* (green alder) community type. The average canopy cover per stand is 164.2 percent, with native species comprising 150.3 percent or 91.5 percent of the total amount of average canopy cover per stand.

Table 452. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Alnus crispa* (green alder) community type (number = 5 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.2%	1.2%	0.0%	0.0%
Shrubs	87.5%	86.9%	0.0%	0.6%
Graminoids	18.1%	8.9%	0.6%	8.6%
Forbs	57.4%	53.3%	4.0%	0.1%
TOTAL	***164.2% (100.0%)***	***150.3% (91.5%)***	***4.6% (2.8%)***	***9.3% (5.7%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 453 shows the average number of species and average canopy cover by lifeform in stands of the *Alnus crispa* (green alder) community type. The average number of species per stand was 18.4 with an average canopy cover of 164.2 percent.

Table 453. Average number of species and average canopy cover by lifeform in stands of the *Alnus crispa* (green alder) community type (number = 5 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	1.4	1.2%
Shrubs	4.6	87.5%
Graminoids	1.6	18.1%
Forbs	10.8	57.4%
TOTAL	***18.4***	***164.2%***

Sampled Stands Plant Species List

A total of 72 plant species were recorded on at least one of the five stands sampled of the *Alnus crispa* (green alder) community type (Table 454). Five tree species were recorded in small amounts with low prominence on these five stands. Of 17 shrub species recorded, only *Alnus crispa* (green alder) was very prominent. Among the eight graminoid species recorded, none was more than moderately prominent; while among the 42 forbs, only *Athyrium filix-femina* (lady fern) was very prominent, but this species occurred on only two of the five plots and had a large amount of canopy cover on only one of those plots.

Table 454. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Alnus crispa* (green alder) community type (number = 5 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 5)					
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	40	0.20	N
Betula papyrifera (white birch)	0.5	0-0.5	20	0.10	N
Picea engelmannii (Engelmann spruce)	1.8	0-3	40	0.70	N
Pinus contorta (lodgepole pine)	0.5	0-0.5	20	0.10	N
Populus tremuloides (aspen)	0.5	0-0.5	20	0.10	N
Shrubs (N = 17)					
Acer glabrum (mountain maple)	0.5	0-0.5	20	0.10	N
Alnus crispa (green alder)	74.0	50-90	100	74.00	N
Cornus stolonifera (red-osier dogwood)	0.5	0-0.5	20	0.10	N
Linnaea borealis (twinflower)	3.0	0-3	20	0.60	N
Lonicera involucrata (bracted honeysuckle)	3.0	0-3	20	0.60	N
Oplopanax horridum (devil's-club)	10.0	0-10	20	2.00	N
Ribes lacustre (bristly black currant)	1.3	0-3	60	0.80	N
Rosa acicularis (prickly rose)	3.0	0-3	20	0.60	N
Rubus idaeus (wild red raspberry)	3.0	0-3	20	0.60	N
Rubus pubescens (dewberry)	10.0	0-10	20	2.00	N
Salix scouleriana (Scouler's willow)	3.0	0-3	20	0.60	N
Salix spp. (willow)	3.0	0-3	20	0.60	B
Sambucus racemosa (red elderberry)	20.0	0-20	20	4.00	N
Spiraea betulifolia (white meadowsweet)	0.5	0-0.5	20	0.10	N
Vaccinium caespitosum (dwarf bilberry)	0.5	0-0.5	20	0.10	N
Vaccinium vitis-idaea (bog cranberry)	3.0	0-3	20	0.60	N
Viburnum edule (low-bush cranberry)	0.5	0-0.5	20	0.10	N
Graminoids (N = 8)					
Bromus spp. (brome grass)	3.0	0-3	20	0.60	B
Calamagrostis canadensis (marsh reed grass)	40.0	0-40	20	8.00	N
Elymus glaucus (smooth wild rye)	0.5	0-0.5	20	0.10	N
Elymus innovatus (hairy wild rye)	3.0	0-3	20	0.60	N
Festuca occidentalis (western fescue)	0.5	0-0.5	20	0.10	N
Festuca rubra (red fescue)	40.0	0-40	20	8.00	B
Poa pratensis (Kentucky bluegrass)	3.0	0-3	20	0.60	I
Trisetum spicatum (spike trisetum)	0.5	0-0.5	20	0.10	N
Forbs (N = 42)					
Achillea millefolium (common yarrow)	0.5	0-0.5	20	0.10	N
Actaea rubra (red and white baneberry)	3.0	0-3	20	0.60	N
Anaphalis margaritacea (pearly everlasting)	0.5	0-0.5	20	0.10	N
Angelica dawsonii (yellow angelica)	3.0	0-3	20	0.60	N
Antennaria neglecta (broad-leaved everlasting)	0.5	0-0.5	20	0.10	N
Arnica cordifolia (heart-leaved arnica)	10.3	0-20	40	4.10	N
Aster ciliolatus (Lindley's aster)	5.3	0-10	40	2.10	N
Aster conspicuus (showy aster)	3.0	0-3	20	0.60	N

Table 454. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Athyrium filix-femina (lady fern)	35.3	0-70	40	14.10	N
Cornus canadensis (bunchberry)	3.0	0-3	20	0.60	N
Disporum hookeri (Oregon fairybells)	20.0	0-20	20	4.00	N
Epilobium angustifolium (common fireweed)	13.5	0-30	60	8.10	N
Equisetum arvense (common horsetail)	3.0	0-3	20	0.60	N
Equisetum sylvaticum (woodland horsetail)	0.5	0-0.5	20	0.10	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	40	0.20	N
Galium triflorum (sweet-scented bedstraw)	0.5	0-0.5	60	0.30	N
Gymnocarpium dryopteris (oak fern)	10.0	0-10	20	2.00	N
Habenaria saccata (slender bog orchid)	0.5	0-0.5	20	0.10	N
Heracleum lanatum (cow parsnip)	16.5	0-30	40	6.60	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	20	0.10	N
Lycopodium annotinum (stiff club-moss)	3.0	0-3	20	0.60	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	20	0.10	N
Mitella breweri (Brewer's bishop's-cap)	0.5	0-0.5	20	0.10	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	20	0.10	N
Mitella spp. (miterwort)	0.5	0-0.5	20	0.10	N
Moneses uniflora (one-flowered wintergreen)	3.0	0-3	20	0.60	N
Orthilia secunda (one-sided wintergreen)	0.5	0-0.5	20	0.10	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	3.0	0-3	20	0.60	N
Petasites palmatus (palmate-leaved coltsfoot)	1.8	0-3	40	0.70	N
Pyrola asarifolia (common pink wintergreen)	3.0	0-3	20	0.60	N
Pyrola minor (lesser wintergreen)	3.0	0-3	20	0.60	N
Senecio triangularis (brook ragwort)	0.5	0-0.5	20	0.10	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	20	0.10	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.5	0-0.5	60	0.30	N
Thalictrum occidentale (western meadow rue)	0.5	0-0.5	20	0.10	N
Thalictrum venulosum (veiny meadow rue)	3.0	0-3	20	0.60	N
Tiarella trifoliata (laceflower)	10.0	0-10	20	2.00	N
Trifolium pratense (red clover)	20.0	0-20	20	4.00	I
Veratrum eschscholtzii (green false hellebore)	3.0	0-3	20	0.60	N
Vicia americana (wild vetch)	0.5	0-0.5	20	0.10	N
Viola renifolia (kidney-leaved violet)	0.5	0-0.5	20	0.10	N
Viola spp. (violet)	0.5	0-0.5	20	0.10	B

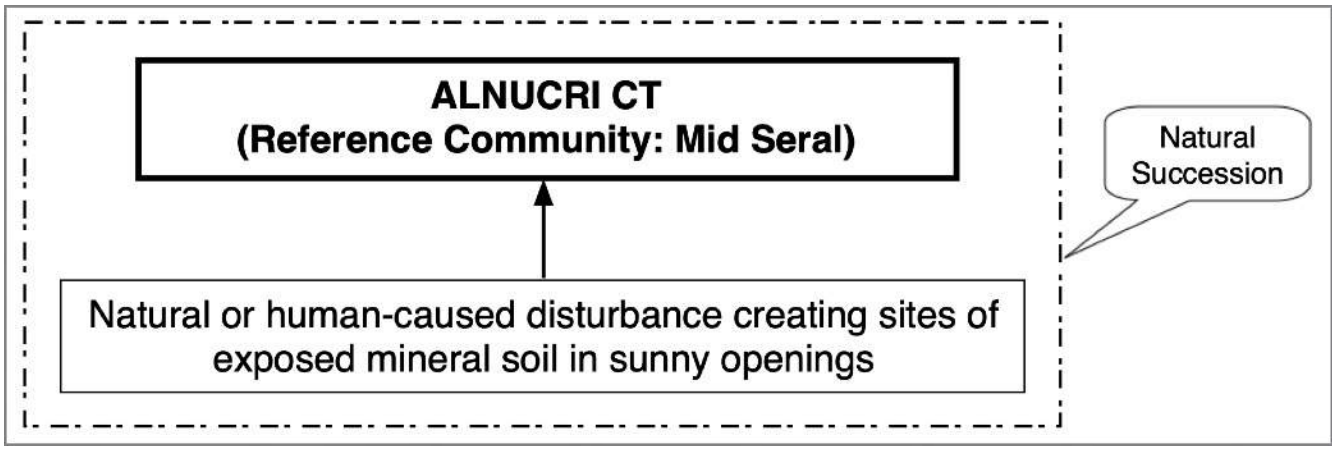
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Alnus crispa* (green alder) community type is an early seral, pioneer, community type that establishes quickly on moist sites of recently deposited or exposed mineral substrate. These stands will in most cases yield dominance of the site to later seral, shade tolerant, species, such as conifer trees.

Figure 96 shows a schematic diagram of vegetation successional pathways on sites of the *Alnus crispa* (green alder) community type.



Successional Pathway of *Alnus crispa* (green alder) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Alnus crispa* (green alder) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
ALNUCRI CT—*Alnus crispa* (green alder) community type

Figure 96. Successional pathway for sites of the *Alnus crispa* (green alder) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 97 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Alnus crispa* (green alder) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

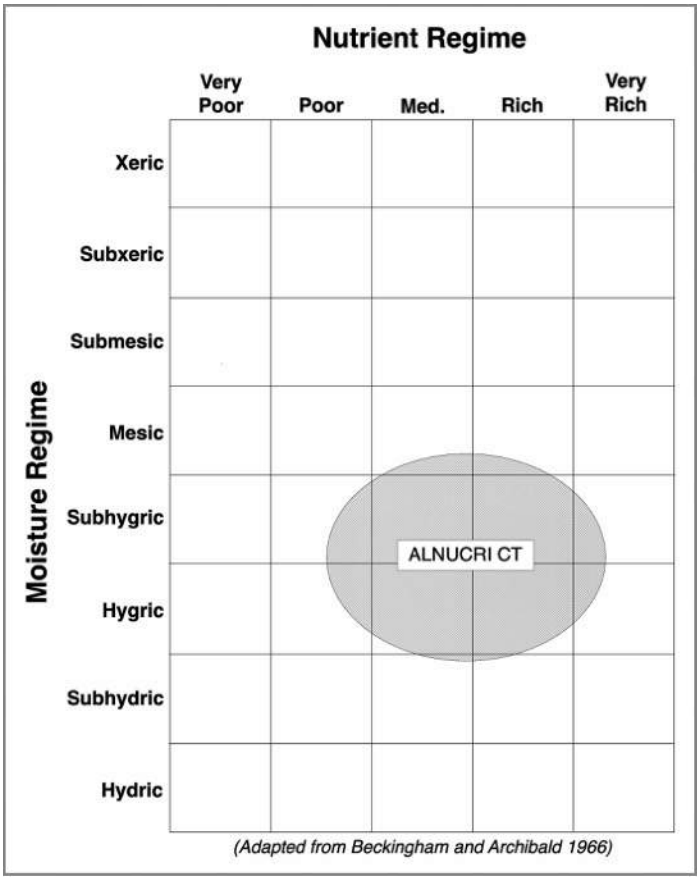


Figure 97. Edatope grid position for the *Alnus crispa* (green alder) community type (ALNUCRI CT)

SOILS

Soils information is currently unavailable for sites supporting the *Alnus crispa* (green alder) community type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites will likely be dominated by willows, such as *Salix bebbiana* (beaked willow), *Salix planifolia* (flat-leaved willow), or *Salix pedicellaris* (bog willow). Adjacent drier sites will often have a community dominated by *Picea glauca* (white spruce) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) is found in woodlands and thickets, in moist or boggy woods, along streams, in coniferous forests, and sometimes in sandy woods (Tannas 1997a). The species is a valuable understory component, protecting the soil along water courses and as a pioneer species on disturbed mineral soil. It improves the soil by adding organic matter and by fixing nitrogen (Tannas 1997a).

Alnus crispa (green alder) is a semi-shade tolerant pioneer, or seral, species. It invades and inhabits terraces above the floodplain that are subject to occasional flooding (Matthews 1992).

***Athyrium filix-femina* (lady fern)**—*Athyrium filix-femina* (lady fern) is a rhizomatous perennial fern that grows in meadows, open thickets, and moist woods. It commonly grows in the understory of stands of *Pseudotsuga menziesii* (Douglas-fir), *Picea glauca* (white spruce), and *Picea mariana* (black spruce) (Walkup 1991).

Livestock

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) provides fair to poor forage value. Although the leaves and twigs are thought to be nutritious and to have a fairly high protein content, the species ranks quite low in palatability, and is used only sparingly by both livestock and wild ungulates (Tannas 1997a). *Alnus crispa* (green alder) is considered an increaser in response to grazing, reproducing rapidly by both rhizomes and seed, while being fairly resistant to browsing (Tannas 1997a).

***Athyrium filix-femina* (lady fern)**—*Athyrium filix-femina* (lady fern) contains filicic acid, and therefore may be poisonous to some classes of livestock (Walkup 1991).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Alnus crispa* (green alder)**—*Alnus crispa* (green alder) leaves and young growth are readily eaten in severe weather and when other food supplies are scarce, primarily on elk and moose winter range in the upper foothills. Furthermore, the species provides important cover and habitat for wildlife, and is an important source of food for beaver (Tannas 1997a). Muskrat, beaver, cottontail, and snowshoe hares feed on alder twigs and foliage (Matthews 1992). Many birds eat alder seeds, buds, and catkins. The species is also an important component of white-tailed ptarmigan winter forage (Matthews 1992).

***Athyrium filix-femina* (lady fern)**—*Athyrium filix-femina* (lady fern) is listed as fair quality elk and deer forage in certain areas, and the fronds are known to be eaten by grizzly bears (Walkup 1991).

Fire

***Alnus crispa* (green alder)**—Following fire, *Alnus crispa* (green alder) resprouts from the root crowns and establishes by seed from plants in nearby unburned areas. The bare mineral soil created by fire provides prime sites for *Alnus crispa* (green alder) establishment. The species does not burn easily, and dense stands can sometimes prevent fire spread. These shrubs provide shade that reduces soil temperatures, allowing spruce and other conifer trees to become established (Matthews 1992).

***Athyrium filix-femina* (lady fern)**—*Athyrium filix-femina* (lady fern) often occurs on wet sites that do not burn often, but top-killed plants often sprout from surviving rhizomes after a fire. Fire decreases the species cover and abundance on drier sites, but sprouting is more likely on subhygric sites (Walkup 1991).

Rehabilitation/Restoration Considerations

***Alnus crispa* (green alder)**—The major value of *Alnus crispa* (green alder) in rehabilitation is its ability to invade sterile soil, thereby increasing the organic matter content and by nitrogen fixation (Matthews 1992). The species was noted for its ability to colonize tailings at the Discovery Mine in Northwest Territories (Matthews 1992).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Alnus crispa* (green alder) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- C7. Alder/marsh reed grass

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Alnus crispa* (green alder) community type was previously described in the region for the following geographic location(s):

- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995); and
- *Forest Habitat Types of Northern Idaho: A Second Approximation* (Cooper and others 1991).

Alnus tenuifolia Community Type
(river alder Community Type)

ALNUTEN Community Type
Number of Stands = 15 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 1; Other Data Sets = 14)

LOCATION AND ASSOCIATED LANDFORMS

The *Alnus tenuifolia* (river alder) community type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. This community type occurs on moist fluvial sites as small dense thickets and narrow bands along streams, riverbanks, and lakeshores. It often represents the transition from *Salix* (willow) stands to the *Populus balsamifera* (balsam poplar) forest (Raup 1946).

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 455 shows the five most prominent plant species among the four lifeforms for species recorded in all 15 stands of the *Alnus tenuifolia* (river alder) community type. *Alnus tenuifolia* (river alder) is by far the most prominent species in stands sampled of this community type, followed well behind by *Calamagrostis* canadensis (marsh reed grass) and *Phalaris arundinacea* (reed canary grass).

Table 455. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Alnus tenuifolia* (river alder) community type (number = 15 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus balsamifera (balsam poplar)	0.40	Native
Picea engelmannii (Engelmann spruce)	0.27	Native
Pseudotsuga menziesii (Douglas-fir)	0.07	Native
Abies lasiocarpa (subalpine fir)	0.03	Native
Shrubs		
Alnus tenuifolia (river alder)	63.83	Native
Symphoricarpos occidentalis (buckbrush)	3.33	Native
Cornus stolonifera (red-osier dogwood)	2.00	Native
Rubus pubescens (dewberry)	0.70	Native
Salix drummondiana (Drummond's willow)	0.60	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	14.20	Native
Phalaris arundinacea (reed canary grass)	10.00	Native
Agrostis stolonifera (redtop)	7.40	Introduced
Bromus inermis (smooth brome)	3.33	Introduced
Carex utriculata (beaked sedge)	3.33	Native
Forbs		
Athyrium filix-femina (lady fern)	4.10	Native
Galeopsis tetrahit (hemp-nettle)	4.00	Introduced
Equisetum pratense (meadow horsetail)	3.20	Native
Heracleum lanatum (cow parsnip)	2.63	Native
Equisetum arvense (common horsetail)	2.03	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 456 through Table 459, break out the vegetation recorded in 15 stands sampled of the *Alnus tenuifolia* (river alder) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated community type of incidental occurrence across the study area.

Table 456 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Alnus tenuifolia* (river alder) community type. For the 15 stands comprising the community type, the number of unique species was 138 with 118 (85.5 percent) of them being native species.

Table 456. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Alnus tenuifolia* (river alder) community type (number = 15 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	4	4	0	0
Shrubs	28	27	0	1
Graminoids	26	21	5	0
Forbs	80	66	11	3
TOTAL	***138 (100.0%)***	***118 (85.5%)***	***16 (11.6%)***	***4 (2.9%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 457 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Alnus tenuifolia* (river alder) community type. The average number of species per stand is 19.0, with native species comprising 16.4 species per stand or 86.3 percent.

Table 457. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Alnus tenuifolia* (river alder) community type (number = 15 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.5	0.5	0.0	0.0
Shrubs	4.7	4.7	0.0	0.1
Graminoids	3.5	2.6	0.9	0.0
Forbs	10.3	8.6	1.3	0.3
TOTAL	***19.0 (100.0%)***	***16.4 (86.3%)***	***2.2 (11.6%)***	***0.4 (2.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 458 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Alnus tenuifolia* (river alder) community type. The average canopy cover per stand is 159.7 percent, with native species comprising 141.0 percent or 88.3 percent of the total amount of average canopy cover per stand.

Table 458. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Alnus tenuifolia* (river alder) community type (number = 15 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.8%	0.8%	0.0%	0.0%
Shrubs	73.1%	73.0%	0.0%	0.0%
Graminoids	50.4%	38.4%	12.0%	0.0%
Forbs	35.5%	28.8%	6.4%	0.3%
TOTAL	***159.7% (100.0%)***	***141.0% (88.3%)***	***18.3% (11.5%)***	***0.4% (0.2%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 459 shows the average number of species and average canopy cover by lifeform in stands of the *Alnus tenuifolia* (river alder) community type. The average number of species per stand was 19.0 with an average canopy cover of 159.7 percent.

Table 459. Average number of species and average canopy cover by lifeform in stands of the *Alnus tenuifolia* (river alder) community type (number = 15 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.5	0.8%
Shrubs	4.7	73.1%
Graminoids	3.5	50.4%
Forbs	10.3	35.5%
TOTAL	***19.0***	***159.7%***

Sampled Stands Plant Species List

A total of 138 plant species were recorded on at least one of the 15 stands sampled of the *Alnus tenuifolia* (river alder) community type (Table 460). Four tree species were recorded in small amounts, but none occurred on more than three of the stands. *Alnus tenuifolia* (river alder) was overwhelmingly most prominent among the 28 shrub species recorded. Of the 26 graminoids recorded, *Calamagrostis canadensis* (marsh reed grass) was most prominent, followed by *Phalaris arundinacea* (reed canary grass). None of the 80 forb species recorded is notably prominent, and *Equisetum pratense* (meadow horsetail) is the only one occurring in more than half the plots.

Table 460. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Alnus tenuifolia* (river alder) community type (number = 15 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 4)					
Abies lasiocarpa (subalpine fir)	0.5	0-0.5	7	0.03	N
Picea engelmannii (Engelmann spruce)	1.3	0-3	20	0.27	N
Populus balsamifera (balsam poplar)	3.0	0-3	13	0.40	N
Pseudotsuga menziesii (Douglas-fir)	0.5	0-0.5	13	0.07	N
Shrubs (N = 28)					
Acer glabrum (mountain maple)	0.5	0-0.5	13	0.07	N
Alnus tenuifolia (river alder)	63.8	20-97.5	100	63.83	N
Amelanchier alnifolia (Saskatoon)	0.5	0-0.5	13	0.07	N
Berberis repens (creeping mahonia)	0.5	0-0.5	7	0.03	N
Betula glandulosa (bog birch)	0.5	0-0.5	7	0.03	N
Cornus stolonifera (red-osier dogwood)	4.3	0-10	47	2.00	N
Juniperus communis (ground juniper)	0.5	0-0.5	7	0.03	N
Lonicera involucrata (bracted honeysuckle)	1.8	0-3	13	0.23	N
Menziesia ferruginea (false azalea)	0.5	0-0.5	7	0.03	N
Rhamnus alnifolia (alder-leaved buckthorn)	0.5	0-0.5	27	0.13	N
Ribes aureum (golden currant)	0.5	0-0.5	7	0.03	N
Ribes hudsonianum (northern black currant)	0.5	0-0.5	7	0.03	N
Ribes lacustre (bristly black currant)	1.3	0-3	20	0.27	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	7	0.03	N
Rosa spp. (rose)	0.5	0-0.5	7	0.03	B
Rosa woodsii (common wild rose)	0.5	0-0.5	20	0.10	N
Rubus idaeus (wild red raspberry)	1.3	0-3	40	0.53	N
Rubus pubescens (dewberry)	5.3	0-10	13	0.70	N
Salix bebbiana (beaked willow)	1.3	0-3	20	0.27	N
Salix boothii (Booth's willow)	0.5	0-0.5	7	0.03	N
Salix drummondiana (Drummond's willow)	3.0	0-3	20	0.60	N
Salix exigua (sandbar willow)	0.5	0-0.5	7	0.03	N
Salix lutea (yellow willow)	0.5	0-0.5	7	0.03	N
Salix planifolia (flat-leaved willow)	1.8	0-3	13	0.23	N
Spiraea densiflora (pink meadowsweet)	3.0	0-3	7	0.20	N
Symphoricarpos albus (snowberry)	0.5	0-0.5	20	0.10	N
Symphoricarpos occidentalis (buckbrush)	50.0	0-50	7	3.33	N
Vaccinium spp. (bilberry)	0.5	0-0.5	7	0.03	N
Graminoids (N = 26)					
Agropyron repens (quack grass)	1.8	0-3	13	0.23	I
Agrostis scabra (rough hair grass)	1.3	0-3	20	0.27	N
Agrostis stolonifera (redtop)	22.2	0-60	33	7.40	I
Bromus ciliatus (fringed brome)	0.5	0-0.5	7	0.03	N
Bromus inermis (smooth brome)	50.0	0-50	7	3.33	I
Calamagrostis canadensis (marsh reed grass)	42.6	0-80	33	14.20	N
Calamagrostis stricta (narrow reed grass)	5.3	0-10	13	0.70	N

Table 460. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex diandra (two-stamened sedge)	3.0	0-3	7	0.20	N
Carex haydeniana (Hayden's sedge)	0.5	0-0.5	7	0.03	N
Carex lanuginosa (woolly sedge)	0.5	0-0.5	7	0.03	N
Carex parryana (Parry's sedge)	30.0	0-30	7	2.00	N
Carex scirpoidea (rush-like sedge)	3.0	0-3	7	0.20	N
Carex simulata (analogue sedge)	10.0	0-10	7	0.67	N
Carex utriculata (beaked sedge)	50.0	0-50	7	3.33	N
Carex vesicaria (blister sedge)	3.0	0-3	7	0.20	N
Cinna latifolia (drooping wood-reed)	7.8	0-20	27	2.07	N
Elymus glaucus (smooth wild rye)	0.5	0-0.5	27	0.13	N
Glyceria elata (tufted tall manna grass)	10.0	0-10	7	0.67	N
Glyceria grandis (common tall manna grass)	0.5	0-0.5	7	0.03	N
Glyceria striata (fowl manna grass)	5.3	0-10	13	0.70	N
Luzula parviflora (small-flowered wood-rush)	0.5	0-0.5	7	0.03	N
Phalaris arundinacea (reed canary grass)	50.0	0-80	20	10.00	N
Phleum pratense (timothy)	1.1	0-3	27	0.30	I
Poa palustris (fowl bluegrass)	14.5	0-40	20	2.90	N
Poa pratensis (Kentucky bluegrass)	5.3	0-10	13	0.70	I
Scirpus microcarpus (small-fruited bulrush)	0.5	0-0.5	7	0.03	N
Forbs (N = 80)					
Achillea millefolium (common yarrow)	0.5	0-0.5	20	0.10	N
Achillea sibirica (many-flowered yarrow)	0.5	0-0.5	7	0.03	N
Actaea rubra (red and white baneberry)	0.5	0-0.5	7	0.03	N
Anaphalis margaritacea (pearly everlasting)	0.5	0-0.5	7	0.03	N
Angelica arguta (white angelica)	0.5	0-0.5	13	0.07	N
Angelica dawsonii (yellow angelica)	0.5	0-0.5	7	0.03	N
Aralia nudicaulis (wild sarsaparilla)	0.5	0-0.5	13	0.07	N
Arnica longifolia (long-leaved arnica)	0.5	0-0.5	7	0.03	N
Aster conspicuus (showy aster)	0.5	0-0.5	7	0.03	N
Aster eatonii (Eaton's aster)	0.5	0-0.5	7	0.03	N
Aster hesperius (western willow aster)	1.8	0-3	13	0.23	N
Aster laevis (smooth aster)	0.5	0-0.5	7	0.03	N
Aster modestus (large northern aster)	10.0	0-10	7	0.67	N
Aster subspicatus (leafy-bracted aster)	1.1	0-3	27	0.30	N
Athyrium filix-femina (lady fern)	12.3	0-50	33	4.10	N
Callitriche verna (vernal water-starwort)	3.0	0-3	13	0.40	N
Carduus nutans (nodding thistle)	0.5	0-0.5	7	0.03	I
Cerastium vulgatum (common mouse-ear chickweed)	0.5	0-0.5	7	0.03	I
Chrysanthemum leucanthemum (ox-eye daisy)	0.5	0-0.5	7	0.03	I
Cicuta maculata (water-hemlock)	0.5	0-0.5	7	0.03	N
Circaea alpina (small enchanter's nightshade)	0.5	0-0.5	7	0.03	N
Cirsium arvense (Canada thistle)	3.3	0-10	40	1.33	I
Cornus canadensis (bunchberry)	7.0	0-20	20	1.40	N

Table 460. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Crepis runcinata (scapose hawk's-beard)	0.5	0-0.5	7	0.03	N
Delphinium glaucum (tall larkspur)	3.0	0-3	7	0.20	N
Dryopteris cristata (crested shield fern)	0.5	0-0.5	7	0.03	N
Epilobium anagallidifolium (alpine willowherb)	0.5	0-0.5	7	0.03	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	7	0.03	N
Epilobium ciliatum (northern willowherb)	1.1	0-3	27	0.30	N
Epilobium paniculatum (annual willowherb)	0.5	0-0.5	7	0.03	N
Epilobium spp. (willow-herb)	0.5	0-0.5	7	0.03	N
Equisetum arvense (common horsetail)	15.3	0-30	13	2.03	N
Equisetum hyemale (common scouring-rush)	0.5	0-0.5	13	0.07	N
Equisetum laevigatum (smooth scouring-rush)	0.5	0-0.5	7	0.03	N
Equisetum pratense (meadow horsetail)	6.0	0-20	53	3.20	N
Equisetum sylvaticum (woodland horsetail)	30.0	0-30	7	2.00	N
Fragaria vesca (woodland strawberry)	0.5	0-0.5	7	0.03	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	13	0.07	N
Galeopsis tetrahit (hemp-nettle)	30.0	0-50	13	4.00	I
Galium boreale (northern bedstraw)	1.8	0-3	13	0.23	N
Galium spp. (bedstraw)	0.5	0-0.5	7	0.03	B
Galium triflorum (sweet-scented bedstraw)	2.2	0-10	47	1.03	N
Geranium carolinianum (Carolina wild geranium)	0.5	0-0.5	7	0.03	N
Geranium richardsonii (wild white geranium)	0.5	0-0.5	7	0.03	N
Geum macrophyllum (large-leaved yellow avens)	2.5	0-10	40	1.00	N
Geum rivale (purple avens)	0.5	0-0.5	7	0.03	N
Gymnocarpium dryopteris (oak fern)	3.0	0-3	7	0.20	N
Habenaria dilatata (tall white bog orchid)	0.5	0-0.5	13	0.07	N
Habenaria spp. (bog orchid)	0.5	0-0.5	7	0.03	B
Heracleum lanatum (cow parsnip)	7.9	0-30	33	2.63	N
Lactuca pulchella (common blue lettuce)	3.0	0-3	7	0.20	N
Lupinus argenteus (silvery perennial lupine)	0.5	0-0.5	7	0.03	N
Mentha arvensis (wild mint)	4.6	0-20	40	1.83	N
Mertensia paniculata (tall lungwort)	20.0	0-20	7	1.33	N
Moehringia lateriflora (blunt-leaved sandwort)	0.5	0-0.5	7	0.03	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	0.5	0-0.5	20	0.10	N
Polygonum lapathifolium (pale persicaria)	0.5	0-0.5	7	0.03	N
Potentilla anserina (silverweed)	0.5	0-0.5	7	0.03	N
Potentilla diversifolia (mountain cinquefoil)	0.5	0-0.5	7	0.03	N
Potentilla norvegica (rough cinquefoil)	3.0	0-3	13	0.40	N
Potentilla palustris (marsh cinquefoil)	5.3	0-10	13	0.70	N
Ranunculus abortivus (small-flowered buttercup)	0.5	0-0.5	7	0.03	N
Scutellaria galericulata (marsh skullcap)	3.0	0-3	7	0.20	N
Senecio pseudaureus (thin-leaved ragwort)	0.5	0-0.5	7	0.03	N
Senecio triangularis (brook ragwort)	1.8	0-3	13	0.23	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	7	0.03	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	13	0.07	N

Table 460. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	27	0.13	N
Sonchus arvensis (perennial sow-thistle)	5.3	0-10	13	0.70	I
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	7	0.03	N
Streptopus amplexifolius (clasping-leaved twisted-stalk)	0.5	0-0.5	7	0.03	N
Tanacetum vulgare (common tansy)	0.5	0-0.5	7	0.03	I
Taraxacum officinale (common dandelion)	0.5	0-0.5	20	0.10	I
Thalictrum occidentale (western meadow rue)	20.0	0-20	7	1.33	N
Typha latifolia (common cattail)	3.0	0-3	7	0.20	N
Urtica dioica (common nettle)	2.0	0-3	33	0.67	N
Vaccaria pyramidata (cow cockle)	0.5	0-0.5	7	0.03	I
Verbascum thapsus (common mullein)	0.5	0-0.5	7	0.03	I
Viola orbiculata (evergreen violet)	0.5	0-0.5	7	0.03	N
Viola spp. (violet)	1.3	0-3	20	0.27	B

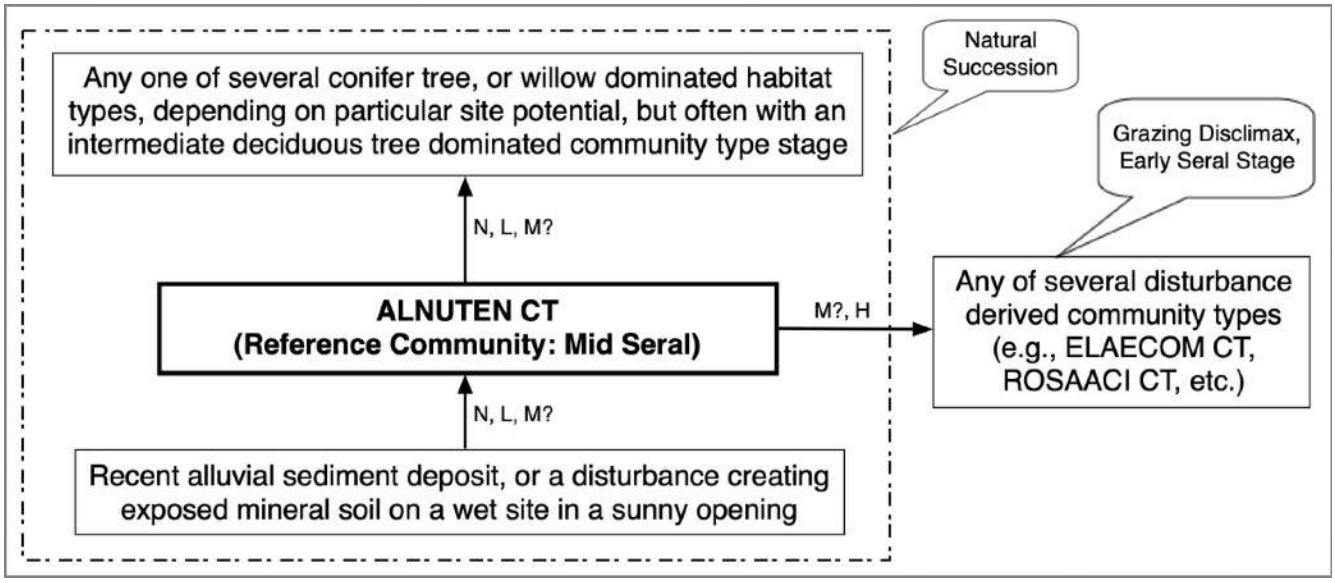
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Alnus tenuifolia* (river alder) community type is an early seral, pioneer, community type that establishes quickly on moist sites of recently deposited or exposed mineral substrate, usually along stream or river banks. These stands will in most cases eventually yield dominance of the site to later seral, shade tolerant, species, such as conifer trees.

Figure 98 shows a schematic diagram of vegetation successional pathways on sites of the *Alnus tenuifolia* (river alder) community type.



Successional Pathway of *Alnus tenuifolia* (river alder) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Alnus tenuifolia* (river alder) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
ALNUTEN CT—*Alnus tenuifolia* (river alder) community type
ELAECOM CT—*Elaeagnus commutata* (silverberry) community type
ROSAACI CT—*Rosa acicularis* (prickly rose) community type

Figure 98. Successional pathway for sites of the *Alnus tenuifolia* (river alder) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 99 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Alnus tenuifolia* (river alder) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

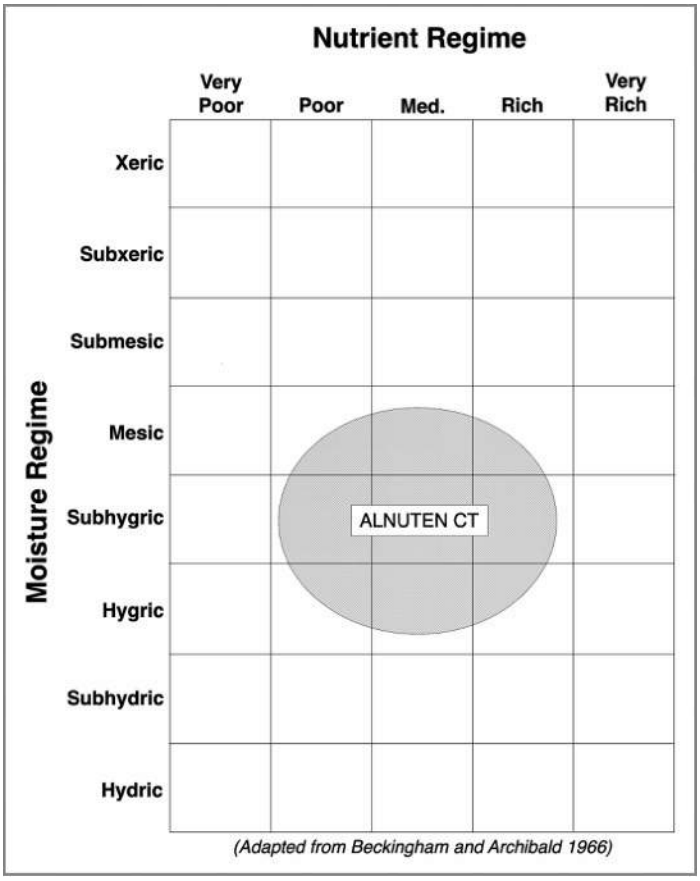


Figure 99. Edatope grid position for the *Alnus tenuifolia* (river alder) community type (ALNUTEN CT)

SOILS

On sites supporting the *Alnus tenuifolia* (river alder) community type, soils are commonly thin, coarse textured Regosols with little or no development. Mineral soil textures on sampled stands ranged from sand to loam. Sites are often poorly drained, and water tables are usually within 1 m of the soil surface throughout summer. Redoximorphic features (mottles or gleyed soil) are not common in the soil profile of these sites due to the relatively rapid movement of aerated water (Baker and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites will likely be dominated by willows, such as *Salix bebbiana* (beaked willow), *Salix planifolia* (flat-leaved willow), or *Salix glauca* (smooth willow). Adjacent drier sites will often have a community dominated by *Picea glauca* (white spruce) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Alnus tenuifolia* (river alder)**—*Alnus tenuifolia* (river alder) is found along streams, on lake shores, and in river valleys in all natural regions of Alberta, except the Mixed Grass Prairie (Tannas 1997a). The species is a frequent component of stream side vegetation throughout mountainous regions of western North America (Fryer

2011).This species grows on a variety of soil textures and nutrient levels. It is considered an indicator of moist to wet soils in sub-boreal spruce (*Picea* species) stands. Riparian sites with *Alnus tenuifolia* (river alder) may experience frequent flooding and/or scouring (Fryer 2011).

Alnus tenuifolia (river alder) tolerates full sun to light shade. The species is an important colonizer in primary succession. It is also successionally important after such stand-replacing events as fire or timber harvest, and in canopy gap succession. Its ability to fix nitrogen helps to enhance site quality for later seral species (Fryer 2011).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

***Phalaris arundinacea* (reed canary grass)**—*Phalaris arundinacea* (reed canary grass) is common and widely distributed on moist sites across Alberta. It occurs along shores, streambanks, in depressions, marshes, and swamps (Tannas 1997a). *Phalaris arundinacea* (reed canary grass) prefers full sunlight, and although it can grow in shade, its abundance decreases. There is evidence indicating that the species establishes, persists and may spread in stands of early to late seral stage (Waggy 2010).

Livestock

***Alnus tenuifolia* (river alder)**—*Alnus tenuifolia* (river alder) is generally considered unpalatable to cattle and horses (Fryer 2011).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

***Phalaris arundinacea* (reed canary grass)**—Herbage production from the *Phalaris arundinacea* (reed canary grass) habitat type is high. However, palatability of the coarse grass is only low to moderate. It is most palatable when actively growing, and becomes less palatable later in the season. It is very tolerant of grazing, except in the early growth stage. Increased alkaloid and fibre content with maturity causes a gradual decline in palatability. Grazing should begin as soon as soils have dried enough to minimize trampling damage (Hansen and others 1995). These stands should be grazed using intense stocking and a short rotation plan that leaves at least a 5 cm to 8 cm stubble height. One option may include mowing stands once a year and fencing to force cattle to use this species. To maintain dense stands, plants should not be grazed to less than 10 cm in height (Alberta Agriculture 1981).

This species is also suitable for hay production. However, harvest must usually be delayed until late in the season when soils are dry and plants mature. Nutritive quality at this time is low, especially where *Phalaris arundinacea* (reed canary grass) completely dominates the stand (Tannas 1997a, Hansen and others 1988).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Alnus tenuifolia* (river alder)**—*Alnus tenuifolia* (river alder) palatability is rated poor to fair for big game animals and is generally considered unpalatable to wild ungulates (Fryer 2011).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

***Phalaris arundinacea* (reed canary grass)**—On many sites, the *Phalaris arundinacea* (reed canary grass) is inundated long enough to provide some nesting habitat for waterfowl and cover for muskrats. *Phalaris arundinacea* (reed canary grass) forage value is considered fair for upland game birds and several songbirds. A variety of ungulates, particularly moose and elk, and to a lesser extent, mule deer, and white-tailed deer, use it as forage (Waggy 2010).

Fire

***Alnus tenuifolia* (river alder)**—*Alnus tenuifolia* (river alder) sprouts from the root crown after top-kill by fire, and stem density may increase after fire due to multiple sprouts arising from single root crowns. Fire responses of British Columbian shrubs indicates that *Alnus tenuifolia* (river alder) is set back by moderate or severe fires (Fryer 2011).

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

***Phalaris arundinacea* (reed canary grass)**—High water tables during the growing season make burning difficult. However, burning during the non-growing season may be feasible. A fire management strategy of a two to three year burn rotation has shown limited success in controlling the spread of *Phalaris arundinace*a (reed canary grass). Early April fires may cause increases in the species, while mid to late May burns can prevent it from producing seed. Stands of *Phalaris arundinacea* (reed canary grass) can be burned in winter, when the ice is 23 cm to 30 cm thick to reduce plant density and improve wildlife feeding areas (Hansen and others 1995).

Phalaris arundinacea (reed canary grass) rhizomes likely will survive most low to moderate severity fires, but may be killed by a high severity fire. It establishes rapidly after fire on sites where it was present in the pre fire plant community, suggesting that the species is adapted to survive and regenerate after burning (Waggy 2010).

Rehabilitation/Restoration Considerations

***Alnus tenuifolia* (river alder)**—*Alnus tenuifolia* (river alder) helps protect and stabilize streambanks and other riparian areas and is useful for erosion control. Banks stabilized with this species can withstand relatively severe spring run-off events. Its symbiotic relationship with nitrogen-fixing bacteria makes it a good selection for planting in nitrogen-depleted soils (Fryer 2011).

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

***Phalaris arundinacea* (reed canary grass)**—*Phalaris arundinacea* (reed canary grass) has been used for erosion control, shoreline stabilization, and pollutant filtration. The species has been recommended for revegetation of disturbed sites such as pipeline corridors, fire lines, and recently burned areas. However, because it can dominate sites and negatively affect ecosystems, its continued use in revegetation projects may be unwise. For example, when it was seeded along with a mixture of native species to restore a Wisconsin prairie community, the *Phalaris arundinacea* (reed canary grass) dominated the site with over 95 percent cover within 6 years (Waggy 2010).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Alnus tenuifolia* (river alder) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- River alder/Marsh reed grass

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msd22 River alder/Marsh reedgrass (Montane Southern Ecosection)
- Mnb9 River alder/Thimbleberry (Montane Northern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Alnus tenuifolia* (river alder) community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003).

Betula glandulosa/Carex aquatilis Habitat Type
(bog birch/water sedge Habitat Type)

BETUGLA/CAREAQU Habitat Type
Number of Stands = 14 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 9; Other Data Sets = 5)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of sedge species not identified to the species level (approximately 29 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type is an incidental type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. *Betula glandulosa* (bog birch) grows along low gradient streams, in muskegs, bogs, fens, and on moist to somewhat dry sites at higher elevations. Stands of this habitat type are found on the wetter side of the *Betula glandulosa* (bog birch) moisture spectrum.

Photo 24 shows a typical stand of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type.

Photo 24. A stand of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (photo provided by Hilary Baker)

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 461 shows the five most prominent plant species among the four lifeforms for species recorded in all 14 stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type. The two indicator species, *Betula glandulosa* (bog birch) and *Carex aquatilis* (water sedge), are the only species more than moderately prominent in stands sampled of this habitat type.

Table 461. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (number = 14 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Larix laricina (tamarack)	0.46	Native
Picea glauca (white spruce)	0.04	Native
Picea mariana (black spruce)	0.04	Native
Shrubs		
Betula glandulosa (bog birch)	36.43	Native
Potentilla fruticosa (shrubby cinquefoil)	3.61	Native
Arctostaphylos uva-ursi (common bearberry)	1.43	Native
Ledum groenlandicum (common Labrador tea)	0.75	Native
Salix pedicellaris (bog willow)	0.64	Native
Graminoids		
Carex aquatilis (water sedge)	24.29	Native
Juncus balticus (wire rush)	7.36	Native
Deschampsia cespitosa (tufted hair grass)	5.75	Native
Carex simulata (analogue sedge)	5.71	Native
Calamagrostis canadensis (marsh reed grass)	5.04	Native

Table 461. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Triglochin maritima (seaside arrow-grass)	2.43	Native
Galium boreale (northern bedstraw)	2.29	Native
Antennaria anaphaloides (tall everlasting)	1.14	Native
Antennaria parvifolia (small-leaved everlasting)	0.71	Native
Equisetum fluviatile (swamp horsetail)	0.71	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 462 through Table 465, break out the vegetation recorded in all 14 stands sampled of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated habitat type of incidental-to-minor occurrence across the study area.

Table 462 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type. For the 14 stands comprising the habitat type, the number of unique species was 119 with 113 (95.0 percent) of them being native species.

Table 462. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (number = 14 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3	3	0	0
Shrubs	15	14	0	1
Graminoids	40	37	3	0
Forbs	61	59	0	2
TOTAL	***119 (100.0%)***	***113 (95.0%)***	***3 (2.5%)***	***3 (2.5%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 463 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type. The average number of species per stand is 17.2, with native species comprising 16.8 species per stand or 97.7 percent.

Table 463. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (number = 14 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.4	0.4	0.0	0.0
Shrubs	3.3	3.2	0.0	0.1
Graminoids	6.1	5.9	0.2	0.0
Forbs	7.4	7.3	0.0	0.1
TOTAL	***17.2 (100.0%)***	***16.8 (97.7%)***	***0.2 (1.2%)***	***0.2 (1.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 464 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type. The average canopy cover per stand is 125.9 percent, with native species comprising 124.9 percent or 99.1 percent of the total amount of average canopy cover per stand.

Table 464. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (number = 14 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.5%	0.5%	0.0%	0.0%
Shrubs	45.1%	45.0%	0.0%	0.0%
Graminoids	63.0%	62.0%	1.0%	0.0%
Forbs	17.3%	17.3%	0.0%	0.1%
TOTAL	***125.9% (100.0%)***	***124.9% (99.1%)***	***1.0% (0.8%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 465 shows the average number of species and average canopy cover by lifeform in stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type. The average number of species per stand was 17.2 with an average canopy cover of 125.9 percent.

Table 465. Average number of species and average canopy cover by lifeform in stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (number = 14 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.4	0.5%
Shrubs	3.3	45.1%
Graminoids	6.1	63.0%
Forbs	7.4	17.3%
TOTAL	***17.2***	***125.9%***

Sampled Stands Plant Species List

A total of 119 plant species were recorded on at least one of the 14 stands sampled of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (Table 466). Three tree species were recorded in small amounts on these 14 stands. Of the 15 shrubs recorded, *Betula glandulosa* (bog birch) is by far most prominent, and *Carex aquatilis* (water sedge) is most prominent of the 40 graminoids recorded. Of the 61 forbs recorded, none was notably prominent, or occurred in as many as half the plots sampled.

Table 466. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (number = 14 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 3)					
Larix laricina (tamarack)	2.2	0-3	21	0.46	N
Picea glauca (white spruce)	0.5	0-0.5	7	0.04	N
Picea mariana (black spruce)	0.5	0-0.5	7	0.04	N
Shrubs (N = 15)					
Arctostaphylos uva-ursi (common bearberry)	20.0	0-20	7	1.43	N
Betula glandulosa (bog birch)	36.4	10-80	100	36.43	N
Ledum groenlandicum (common Labrador tea)	5.3	0-10	14	0.75	N
Oxycoccus microcarpus (small bog cranberry)	0.5	0-0.5	14	0.07	N
Potentilla fruticosa (shrubby cinquefoil)	12.6	0-30	29	3.61	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	50	0.25	N
Salix arbusculoides (shrubby willow)	3.0	0-3	7	0.21	N
Salix athabascensis (Athabasca willow)	3.0	0-3	7	0.21	N
Salix barclayi (Barclay's willow)	1.8	0-3	14	0.25	N
Salix bebbiana (beaked willow)	3.0	0-3	14	0.43	N
Salix brachycarpa (short-capsuled willow)	3.0	0-3	7	0.21	N
Salix candida (hoary willow)	1.8	0-3	29	0.50	N
Salix pedicellaris (bog willow)	3.0	0-3	21	0.64	N

Table 466. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Salix planifolia (flat-leaved willow)	0.5	0-0.5	7	0.04	N
Salix spp. (willow)	0.5	0-0.5	7	0.04	B
Graminoids (N = 40)					
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	14	0.07	N
Agrostis stolonifera (redtop)	10.0	0-10	7	0.71	I
Bromus carinatus (keeled brome)	3.0	0-3	7	0.21	N
Bromus ciliatus (fringed brome)	0.5	0-0.5	7	0.04	N
Calamagrostis canadensis (marsh reed grass)	14.1	0-20	36	5.04	N
Calamagrostis stricta (narrow reed grass)	6.5	0-10	14	0.93	N
Carex aquatilis (water sedge)	26.2	0-70	93	24.29	N
Carex aurea (golden sedge)	0.5	0-0.5	14	0.07	N
Carex brunnescens (brownish sedge)	1.8	0-3	14	0.25	N
Carex buxbaumii (brown sedge)	3.0	0-3	7	0.21	N
Carex chordorrhiza (prostrate sedge)	0.5	0-0.5	7	0.04	N
Carex diandra (two-stamened sedge)	10.0	0-10	7	0.71	N
Carex disperma (two-seeded sedge)	0.5	0-0.5	14	0.07	N
Carex gynocrates (northern bog sedge)	5.3	0-10	14	0.75	N
Carex limosa (mud sedge)	0.5	0-0.5	7	0.04	N
Carex livida (livid sedge)	15.3	0-30	14	2.18	N
Carex macloviana (thick-spike sedge)	0.5	0-0.5	7	0.04	N
Carex microptera (small-winged sedge)	0.5	0-0.5	7	0.04	N
Carex norvegica (Norway sedge)	0.5	0-0.5	7	0.04	N
Carex paupercula (bog sedge)	0.5	0-0.5	7	0.04	N
Carex prairea (prairie sedge)	2.2	0-3	21	0.46	N
Carex sartwellii (Sartwell's sedge)	0.5	0-0.5	7	0.04	N
Carex scirpoidea (rush-like sedge)	11.5	0-20	14	1.64	N
Carex simulata (analogue sedge)	26.7	0-40	21	5.71	N
Carex tenera (broad-fruited sedge)	0.5	0-0.5	7	0.04	N
Carex utriculata (beaked sedge)	13.3	0-20	21	2.86	N
Carex viridula (green sedge)	3.0	0-3	14	0.43	N
Deschampsia cespitosa (tufted hair grass)	10.1	0-20	57	5.75	N
Eleocharis palustris (creeping spike-rush)	0.5	0-0.5	7	0.04	N
Eleocharis quinqueflora (few-flowered spike-rush)	3.0	0-3	7	0.21	N
Elymus innovatus (hairy wild rye)	0.5	0-0.5	7	0.04	N
Eriophorum viridi-carinatum (thin-leaved cotton grass)	3.0	0-3	7	0.21	N
Festuca saximontana (Rocky Mountain fescue)	0.5	0-0.5	7	0.04	N
Juncus balticus (wire rush)	20.6	0-60	36	7.36	N
Juncus longistylis (long-styled rush)	0.5	0-0.5	7	0.04	N
Luzula multiflora (field wood-rush)	0.5	0-0.5	7	0.04	N
Muhlenbergia glomerata (bog muhly)	4.5	0-10	21	0.96	N
Muhlenbergia richardsonis (mat muhly)	4.5	0-10	21	0.96	N
Phleum pratense (timothy)	3.0	0-3	7	0.21	I
Poa glauca (timberline bluegrass)	3.0	0-3	7	0.21	N

Table 466. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Forbs (N = 61)					
Achillea millefolium (common yarrow)	0.9	0-3	43	0.39	N
Aconitum delphinifolium (monkshood)	3.0	0-3	7	0.21	N
Agoseris glauca (yellow false dandelion)	0.5	0-0.5	7	0.04	N
Allium schoenoprasum (wild chives)	1.3	0-3	21	0.29	N
Antennaria anaphaloides (tall everlasting)	5.3	0-10	21	1.14	N
Antennaria parvifolia (small-leaved everlasting)	10.0	0-10	7	0.71	N
Aster borealis (marsh aster)	2.4	0-3	29	0.68	N
Aster ciliolatus (Lindley's aster)	3.0	0-3	7	0.21	N
Aster laevis (smooth aster)	0.5	0-0.5	7	0.04	N
Astragalus alpinus (alpine milk vetch)	0.5	0-0.5	7	0.04	N
Caltha palustris (marsh-marigold)	0.5	0-0.5	7	0.04	N
Cerastium arvense (field mouse-ear chickweed)	3.0	0-3	7	0.21	N
Crepis runcinata (scapose hawk's-beard)	0.5	0-0.5	7	0.04	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	14	0.07	N
Dodecatheon pulchellum (saline shooting star)	1.8	0-3	14	0.25	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	14	0.07	N
Equisetum fluviatile (swamp horsetail)	10.0	0-10	7	0.71	N
Equisetum scirpoides (dwarf scouring-rush)	3.0	0-3	7	0.21	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	14	0.07	N
Galium boreale (northern bedstraw)	6.4	0-20	36	2.29	N
Galium labradoricum (Labrador bedstraw)	0.5	0-0.5	7	0.04	N
Gentiana spp. (gentian)	0.5	0-0.5	14	0.07	N
Gentianella amarella (felwort)	0.5	0-0.5	7	0.04	N
Geum aleppicum (yellow avens)	10.0	0-10	7	0.71	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	14	0.07	N
Geum rivale (purple avens)	1.8	0-3	14	0.25	N
Geum triflorum (three-flowered avens)	1.8	0-3	14	0.25	N
Habenaria hyperborea (northern green bog orchid)	0.5	0-0.5	7	0.04	N
Maianthemum canadense (wild lily-of-the-valley)	0.5	0-0.5	7	0.04	N
Menyanthes trifoliata (buck-bean)	3.0	0-3	7	0.21	N
Mertensia paniculata (tall lungwort)	1.3	0-3	21	0.29	N
Mitella nuda (bishop's-cap)	1.8	0-3	14	0.25	N
Orchis rotundifolia (round-leaved orchid)	0.5	0-0.5	7	0.04	N
Oxytropis spp. (locoweed)	0.5	0-0.5	7	0.04	B
Parnassia palustris (northern grass-of-parnassus)	0.5	0-0.5	14	0.07	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	7	0.04	N
Pedicularis labradorica (Labrador lousewort)	3.0	0-3	7	0.21	N
Penstemon procerus (slender blue beardtongue)	1.3	0-3	21	0.29	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	14	0.07	N
Petasites sagittatus (arrow-leaved coltsfoot)	2.2	0-3	21	0.46	N
Petasites vitifolius (vine-leaved coltsfoot)	0.5	0-0.5	7	0.04	N
Polemonium acutiflorum (tall Jacob's-ladder)	1.8	0-3	14	0.25	N
Polemonium spp. (Jacob's-ladder)	0.5	0-0.5	7	0.04	N

Table 466. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Polygonum viviparum (alpine bistort)	0.5	0-0.5	21	0.11	N
Potentilla diversifolia (mountain cinquefoil)	0.5	0-0.5	7	0.04	N
Potentilla palustris (marsh cinquefoil)	3.0	0-3	14	0.43	N
Rumex acetosa (green sorrel)	3.0	0-3	7	0.21	N
Rumex spp. (sorrel)	0.5	0-0.5	7	0.04	B
Smilacina trifolia (three-leaved Solomon's-seal)	1.8	0-3	14	0.25	N
Solidago missouriensis (low goldenrod)	10.0	0-10	7	0.71	N
Solidago multiradiata (alpine goldenrod)	0.5	0-0.5	7	0.04	N
Stellaria crassifolia (fleshy stitchwort)	0.5	0-0.5	7	0.04	N
Stellaria longifolia (long-leaved chickweed)	3.0	0-3	7	0.21	N
Thalictrum venulosum (veiny meadow rue)	10.0	0-10	7	0.71	N
Triglochin maritima (seaside arrow-grass)	6.8	0-20	36	2.43	N
Triglochin palustris (slender arrow-grass)	0.5	0-0.5	7	0.04	N
Valeriana dioica (northern valerian)	0.5	0-0.5	7	0.04	N
Veronica alpina (alpine speedwell)	0.5	0-0.5	7	0.04	N
Viola adunca (early blue violet)	0.5	0-0.5	7	0.04	N
Viola nephrophylla (bog violet)	1.8	0-3	14	0.25	N
Zigadenus elegans (white camas)	3.0	0-3	7	0.21	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 467 shows the five most prominent plant species among the four lifeforms for species recorded in all five relatively undisturbed late seral to climax stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type. The two indicator species, *Betula glandulosa* (bog birch) and *Carex aquatilis* (water sedge), are the only species more than moderately prominent in late seral stands sampled of this habitat type.

Table 467. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (number = 5 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Larix laricina (tamarack)	0.60	Native
Shrubs		
Betula glandulosa (bog birch)	48.00	Native
Ledum groenlandicum (common Labrador tea)	2.00	Native
Salix barclayi (Barclay's willow)	0.70	Native
Salix arbusculoides (shrubby willow)	0.60	Native
Salix athabascensis (Athabasca willow)	0.60	Native
Graminoids		
Carex aquatilis (water sedge)	38.00	Native
Calamagrostis canadensis (marsh reed grass)	6.10	Native
Deschampsia cespitosa (tufted hair grass)	6.10	Native
Calamagrostis stricta (narrow reed grass)	2.00	Native
Carex utriculata (beaked sedge)	2.00	Native
Forbs		
Geum aleppicum (yellow avens)	2.00	Native
Petasites sagittatus (arrow-leaved coltsfoot)	1.30	Native
Geum rivale (purple avens)	0.70	Native
Aconitum delphinifolium (monkshood)	0.60	Native
Aster borealis (marsh aster)	0.60	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 468 through Table 471, break out the vegetation recorded in five relatively undisturbed late seral to climax stands sampled of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated habitat type of incidental-to-minor occurrence across the study area.

Table 468 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type. For the 5 stands comprising the habitat type, the number of unique species was 52 with 50 (96.2 percent) of them being native species.

Table 468. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula glandulosa/ Carex aquatilis* (bog birch/water sedge) habitat type (number = 5 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	10	9	0	1
Graminoids	13	13	0	0
Forbs	28	27	0	1
TOTAL	***52 (100.0%)***	***50 (96.2%)***	***0 (0.0%)***	***2 (3.8%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 469 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type. The average number of species per stand is 15.4, with native species comprising 15.0 species per stand or 97.4 percent.

Table 469. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (number = 5 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.2	0.2	0.0	0.0
Shrubs	3.8	3.6	0.0	0.2
Graminoids	4.4	4.4	0.0	0.0
Forbs	7.0	6.8	0.0	0.2
TOTAL	***15.4 (100.0%)***	***15.0 (97.4%)***	***0.0 (0.0%)***	***0.4 (2.6%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 470 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type. The average canopy cover per stand is 120.8 percent, with native species comprising 120.6 percent or 99.8 percent of the total amount of average canopy cover per stand.

Table 470. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (number = 5 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.6%	0.6%	0.0%	0.0%
Shrubs	53.8%	53.7%	0.0%	0.1%
Graminoids	56.0%	56.0%	0.0%	0.0%
Forbs	10.4%	10.3%	0.0%	0.1%
TOTAL	***120.8% (100.0%)***	***120.6% (99.8%)***	***0.0% (0.0%)***	***0.2% (0.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 471 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type. The average number of species per stand was 15.4 with an average canopy cover of 120.8 percent.

Table 471. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (number = 5 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.2	0.6%
Shrubs	3.8	53.8%
Graminoids	4.4	56.0%
Forbs	7.0	10.4%
TOTAL	***15.4***	***120.8%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 52 plant species were recorded on at least one of the five relatively undisturbed late seral to climax stands sampled of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (Table 472). One tree species, *Larix laricina* (tamarack), was recorded in a small amount on one stand. *Betula glandulosa* (bog birch) is the only very prominent one of 10 shrubs recorded, and *Carex aquatilis* (water sedge) is most prominent of the 13 graminoids. Of the 28 forbs recorded, none is notably prominent.

Table 472. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (number = 5 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 1)					
Larix laricina (tamarack)	3.0	0-3	20	0.60	N
Shrubs (N = 10)					
Betula glandulosa (bog birch)	48.0	30-80	100	48.00	N
Ledum groenlandicum (common Labrador tea)	10.0	0-10	20	2.00	N
Oxycoccus microcarpus (small bog cranberry)	0.5	0-0.5	20	0.10	N
Rubus arcticus (dwarf raspberry)	0.5	0.5-0.5	100	0.50	N
Salix arbusculoides (shrubby willow)	3.0	0-3	20	0.60	N
Salix athabascensis (Athabasca willow)	3.0	0-3	20	0.60	N
Salix barclayi (Barclay's willow)	1.8	0-3	40	0.70	N
Salix brachycarpa (short-capsuled willow)	3.0	0-3	20	0.60	N
Salix pedicellaris (bog willow)	3.0	0-3	20	0.60	N
Salix spp. (willow)	0.5	0-0.5	20	0.10	B
Graminoids (N = 13)					
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	20	0.10	N
Calamagrostis canadensis (marsh reed grass)	10.2	0-20	60	6.10	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	20	2.00	N
Carex aquatilis (water sedge)	38.0	10-70	100	38.00	N
Carex brunnescens (brownish sedge)	3.0	0-3	20	0.60	N
Carex disperma (two-seeded sedge)	0.5	0-0.5	20	0.10	N
Carex gynocrates (northern bog sedge)	0.5	0-0.5	20	0.10	N
Carex norvegica (Norway sedge)	0.5	0-0.5	20	0.10	N
Carex paupercula (bog sedge)	0.5	0-0.5	20	0.10	N
Carex prairea (prairie sedge)	3.0	0-3	20	0.60	N
Carex tenera (broad-fruited sedge)	0.5	0-0.5	20	0.10	N
Carex utriculata (beaked sedge)	10.0	0-10	20	2.00	N
Deschampsia cespitosa (tufted hair grass)	7.6	0-10	80	6.10	N
Forbs (N = 28)					
Achillea millefolium (common yarrow)	0.5	0-0.5	60	0.30	N
Aconitum delphinifolium (monkshood)	3.0	0-3	20	0.60	N
Aster borealis (marsh aster)	3.0	0-3	20	0.60	N
Aster ciliolatus (Lindley's aster)	3.0	0-3	20	0.60	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	20	0.10	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	20	0.10	N
Fragaria virginiana (wild strawberry)	0.5	0-0.5	20	0.10	N
Galium boreale (northern bedstraw)	3.0	0-3	20	0.60	N
Gentianella amarella (felwort)	0.5	0-0.5	20	0.10	N
Geum aleppicum (yellow avens)	10.0	0-10	20	2.00	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	40	0.20	N
Geum rivale (purple avens)	1.8	0-3	40	0.70	N
Geum triflorum (three-flowered avens)	0.5	0-0.5	20	0.10	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	20	0.10	N

Table 472. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Mitella nuda (bishop's-cap)	3.0	0-3	20	0.60	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	20	0.10	N
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	20	0.10	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	20	0.10	N
Petasites sagittatus (arrow-leaved coltsfoot)	2.2	0-3	60	1.30	N
Petasites vitifolius (vine-leaved coltsfoot)	0.5	0-0.5	20	0.10	N
Polemonium acutiflorum (tall Jacob's-ladder)	3.0	0-3	20	0.60	N
Polemonium spp. (Jacob's-ladder)	0.5	0-0.5	20	0.10	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	40	0.20	N
Rumex spp. (sorrel)	0.5	0-0.5	20	0.10	B
Smilacina trifolia (three-leaved Solomon's-seal)	0.5	0-0.5	20	0.10	N
Stellaria crassifolia (fleshy stitchwort)	0.5	0-0.5	20	0.10	N
Stellaria longifolia (long-leaved chickweed)	3.0	0-3	20	0.60	N
Veronica alpina (alpine speedwell)	0.5	0-0.5	20	0.10	N

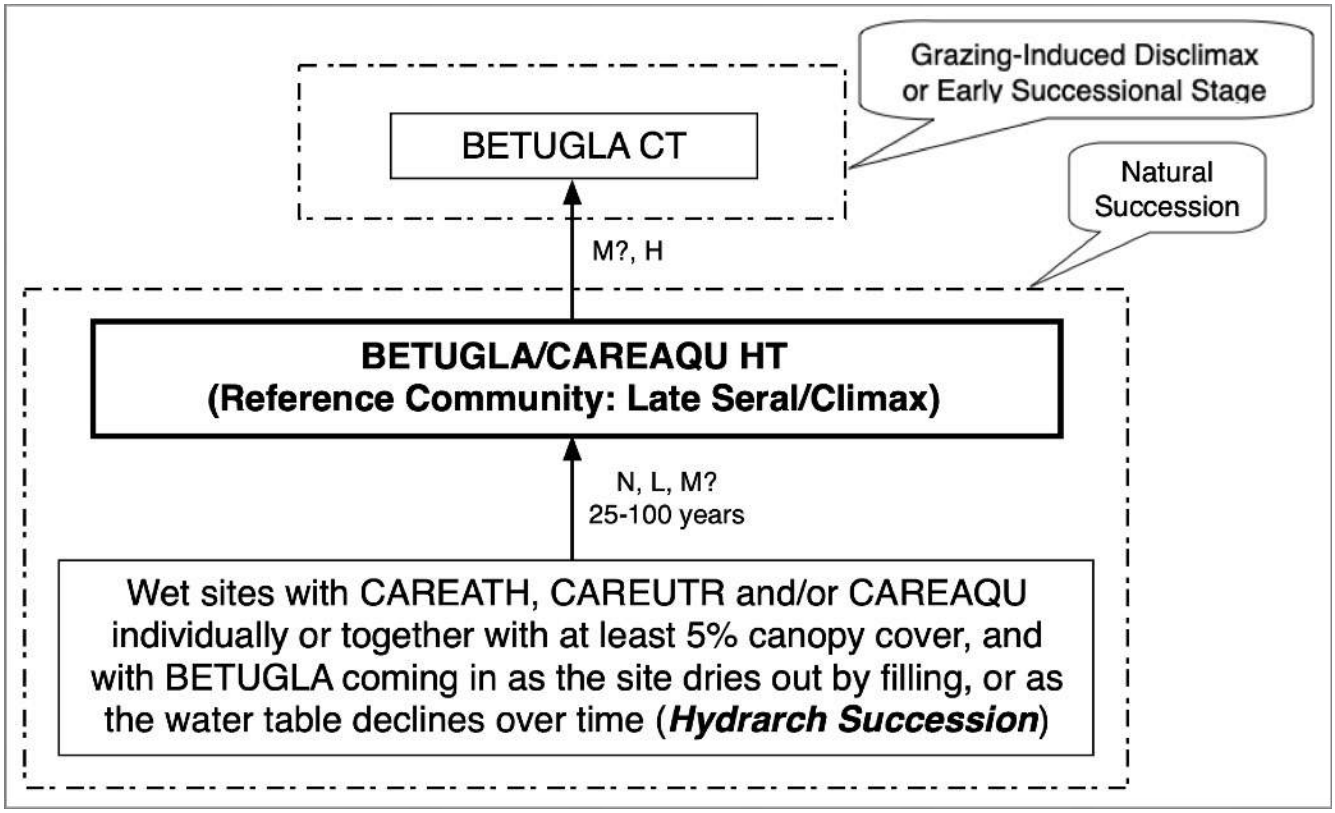
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type typically develops on a site through primary succession (hydrarch succession), wherein a wet meadow stand of *Carex aquatilis* (water sedge), *Carex atherodes* (awned sedge), or *Carex utriculata* (beaked sedge) located in a shallow depression gradually fills in or dries out enough for *Betula glandulosa* (bog birch) to become established.

Figure 100 shows a schematic diagram of vegetation successional pathways on sites of the *Betula glandulosa/ Carex aquatilis* (bog birch/water sedge) habitat type.



Successional Pathway of *Betula glandulosa/Carex aquatilis* (bog birch/water sedge)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)
BETUGLA—*Betula glandulosa* (bog birch)
BETUGLA/CAREAQU HT—*Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type
BETUGLA CT—*Betula glandulosa* (bog birch) community type

Figure 100. Successional pathway for sites of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 101 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

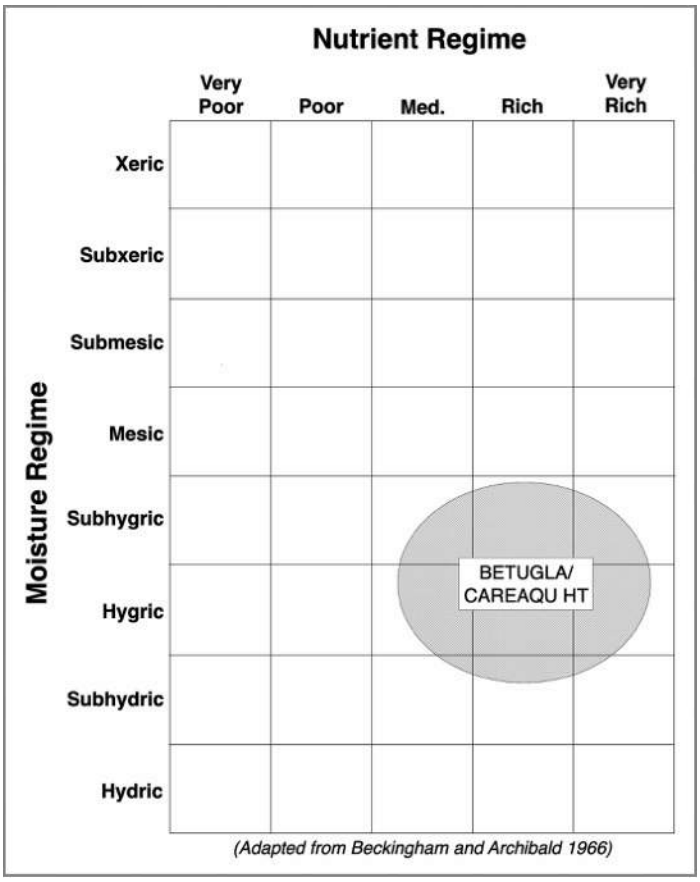


Figure 101. Edatope grid position for the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type (BETUGLA/CAREAQU HT)

SOILS

Parent material on sites supporting the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type is predominantly fluvial, glaciofluvial, and lacustrine. Soil subgroups are mostly regosols, mesisols, and brunisols. Soil drainage ranges from very poorly drained to rapidly drained, with surface texture ranging from clay loam to silt, with some fibric. Organic thickness is mostly 0 cm to 5 cm thick (France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites will likely have a community dominated by willows, such as *Salix pedicellaris* (bog willow), *Salix planifolia* (flat-leaved willow), or *Salix myrtillifolia* (myrtle-leaved willow). Adjacent drier sites will often have a community dominated by *Picea mariana* (black spruce), *Abies lasiocarpa* (subalpine fir) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) grows along streams, in muskegs and bogs, and on moist to somewhat dry sites at higher elevations (Tannas 1997a). This species is characteristic of many mixed shrub and tussock tundra communities in northern Canada. In southwestern Canada, it often occurs on wetland sites including bogs and fens, within *Pinus contorta* (lodgepole pine), *Picea* species (spruce), or *Abies lasiocarpa* (subalpine fir) forest types, and is often associated with *Alnus* species (alders) and *Salix* species (willows) (Tollefson 2007).

Betula glandulosa (bog birch) occupies a wide variety of sites, ranging from rocky subarctic and alpine tundra to deep, organic, boreal soils. It is a wetland species occurring most commonly on moist, acidic, nutrient-poor organic sites including fens, swamps, bogs, muskegs, wet meadows, lake and stream margins, and seepage areas. The species dominates open valley bottoms in the Canadian Rocky Mountains. Although it is primarily a wetland plant, it does not appear to tolerate continuous flooding (Tollefson 2007). *Betula glandulosa* (bog birch) is shade intolerant and is often found in canopy openings within *Picea mariana* (black spruce) woodlands in northern Canada (Tollefson 2007).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is very common and widely distributed across Alberta (Tannas 1997a). It is a wetland species, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). *Carex aquatilis* (water sedge) is a native, wetland obligate, long-lived perennial. It is a sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of finer roots (Hauser 2006). It thrives on disturbed sites, is shade intolerant, and occurs in various stages of seral succession (Hauser 2006).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is common and widely distributed across Alberta. It is a wetland obligate, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). It is a long-lived perennial sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of fine roots (Johnson and others 1995).

Carex utriculata (beaked sedge) is strongly rhizomatous and colonial, typically forming a dense sod. Creeping rhizomes are long, slender or stout, and deep-seated. It grows on sites with high soil moisture, typically with the water table at or above the soil surface during the growing season. This is one of our wettest sedges. On some sites, water tables are above the soil surface all year, and rarely drop below the rooting zone. The species occurs on a range of soil types, with textures from silt loams or silty clays to loamy sands (Anderson 2008).

Carex utriculata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates with continually high water tables and persists indefinitely to form climax communities (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) is very common and widely distributed across Alberta (Tannas 1997a). The species is a wetland obligate, growing along slough margins, shorelines, in marshes, and wet meadows, often in standing water (Tannas 1997a). It is a long-lived perennial with moderate tolerance for drought, while tolerance is low for salinity, acidity, and shade. It does best on clay to clay loam soils (Hardy BBT Limited 1989).

Livestock

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) has fair nutritional value similar to that of *Alnus* species (alders), is tolerant of moderate to heavy browsing, and is an especially competitive species, forming

extensive stands in western and northern rangelands (Tannas 1997a). However, the species produces carbon and nitrogen-based anti-herbivore compounds that deter browsing (Tollefson 2007).

***Carex aquatilis* (water sedge)**—The livestock forage value of *Carex aquatilis* (water sedge) is rated as good (Tannas 1997a), but varies with region, season, and previous grazing use. On narrow riparian or wetland sites within large pastures, *Carex* species (sedges) are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur. In general, *Carex* species (sedges) should respond satisfactorily to traditional grazing systems. However, on streamside sites ample residual cover should be left to protect the soil surface and trap sediments during fall rains or spring runoff. Removing cattle for at least 30 days from these streamside sites for sedge regrowth at the end of the growing season should provide sufficient residual cover (Myers 1989).

Given that *Carex aquatilis* (water sedge) grows in wet places, it is generally not grazed until late summer and fall when soils have dried (Hauser 2006). Very wet soils may deter animal use until they dry. However, if high level of grazing does occur, there will be a marked decrease in *Carex aquatilis* (water sedge) and an increase in the less palatable *Juncus balticus* (wire rush) (Tannas 1997a).

***Carex utriculata* (beaked sedge)**—Livestock forage value of *Carex utriculata* (beaked sedge) is high (Tannas 1997a, Beckingham 1991). The species is palatable in the spring, but palatability declines as the plants become coarse and tough in summer (Tannas 1997a, Hansen and others 1988). Relative palatability may then increase again in fall as the sedge cures and upland forage is less attractive. *Carex utriculata* (beaked sedge) cover decreases in response to high levels of grazing pressure, and will be replaced with less productive and less palatable species, such as *Juncus balticus* (wire rush) and *Poa* species (bluegrass) (Thompson and Hansen 2003).

In general, *Carex* species (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites, residual cover should be left to protect the banks and the soil surface, and to filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days should provide time for sufficient residual cover regrowth on streamside riparian sites (Myers 1989).

***Carex atherodes* (awned sedge)**—Livestock forage value of *Carex atherodes* (awned sedge) is high (Tannas 1997a, Beckingham 1991). *Carex atherodes* (awned sedge) provides good protein and a balance of other nutritional elements, while remaining palatable during the late season when upland forage is less palatable (Tannas 1997a, Hansen and others 1988). In general, *Carex* (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites residual cover should be left to protect the soil surface and filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days for sedge regrowth should provide sufficient residual cover on streamside riparian sites (Myers 1989).

Very wet soils may deter animal use until they dry, allowing the most palatable species to replenish their carbohydrate reserves and to persist in these communities. However, if high levels of grazing do occur, there will be a marked decrease in *Carex atherodes* (awned sedge) with an increase in less palatable species, such as *Juncus balticus* (wire rush). *Carex atherodes* (awned sedge) has medium palatability and medium tolerance for livestock use. Its chemical composition is similar to that of meadow grasses, upland short grass, and mixed prairie species. Seasonal declines in crude protein, phosphorous and carotene were also similar to that of native upland grasses (Hardy BBT Limited 1989).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Betula glandulosa* (bog birch)**—Numerous wildlife species eat *Betula glandulosa* (bog birch), including moose, mule deer, white-tailed deer, Rocky Mountain elk, mountain goats, caribou, grizzly bears, black bears, small mammals, beaver, birds, and insects (Tollefson 2007).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is grazed by many ungulates, including moose, caribou, and elk, but it is not a major component of their diet. Due to the saturated habitat of the species, grazing by most ungulates is limited. *Carex aquatilis* (water sedge) habitat provides nesting and hiding cover for some birds, waterfowl, and small mammals. In riparian and wetland sites, The species is also an important source of food for a variety of waterfowl (Hauser 2006).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is grazed by moose, elk, mule deer, bison, grizzly bears, and sandhill cranes (Anderson 2008). The species is an important component of valuable breeding and feeding grounds for geese and other waterfowl. Birds commonly associated with *Carex utriculata* (beaked sedge) habitats include mallard, green-winged teal, common yellowthroat, red-winged black bird, song sparrow, and tree swallow. *Carex utriculata* (beaked sedge) stands are usually more important as feeding grounds than as nesting grounds because of their low stature, lack of structural diversity, and high water levels. Elk and moose often graze *Carex utriculata* (beaked sedge) stands when *Carex atherodes* (awned sedge) is present (Anderson 2008).

***Carex atherodes* (awned sedge)**—Wetland sedge species, such as *Carex atherodes* (awned sedge) are an important component of valuable nesting and feeding grounds for geese and other waterfowl. These stands of prolific seed producing species are usually more important as feeding grounds than as nesting grounds because of their low stature, high water level, and lack of structural diversity (Thompson and Hansen 2003).

Fisheries

***Carex aquatilis* (water sedge)**—Stands of *Carex aquatilis* (water sedge) often are adjacent to streams supporting trout fisheries. The combined tufted and rhizomatous growth habit of the species effectively stabilizes streambanks. Overhanging *Carex* species (sedges) along the banks provide valuable resting cover and shade for fish (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—The dense network of roots of the rhizomatous *Carex utriculata* (beaked sedge) is very effective in binding soil and stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish (Thompson and Hansen 2003).

***Carex atherodes* (awned sedge)**—Stands of *Carex atherodes* (awned sedge) are found more frequently in lentic situations around depressional wetlands, sloughs, potholes, wet meadows, and fens where fish habitat is not at issue (Thompson and Hansen 2003).

Fire

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) can survive low to moderate-severity fires. The species has deep roots and rhizomes that typically are protected from all but high-severity fires. It regenerates after fire by sprouting from the root crown and from dormant buds on the rhizomes (Tollefson 2007).

***Carex aquatilis* (water sedge)**—Sites supporting stands of *Carex aquatilis* (water sedge) seldom burn, except in periods of severe drought. When stands of the species do burn, the plants are usually top-killed by the fire and soon re-establish after the fire by seed and/or lateral spread of surviving rhizomes (Hauser 2006). The rhizomes are approximately 5 cm below the ground surface, and are somewhat protected from the heat. The wet habitat also

provides protection for roots and rhizomes, although the better-drained areas are more susceptible to fires during dry periods.

Stands of *Carex aquatilis* (water sedge) are suited to prescribed fire, but exclusion of livestock during the year prior to burning is necessary. Residual cover burns well in spring, prior to the growing season. Fire will reduce litter accumulations and temporarily increase productivity. However, species composition in the community will not drastically shift from dominance by *Carex aquatilis* (water sedge) (DeBenedetti and Parsons 1984). Care must be taken in burning along streambanks, so as to avoid impairing the excellent erosion protection provided by the species (Thompson and Hansen 2003).

Carex utriculata **(beaked sedge)**—Sites supporting stands of *Carex utriculata* (beaked sedge) are very wet, except at times of severe drought, and therefore they seldom burn. However, *Carex utriculata* (beaked sedge) sprouts from rhizomes, so it is often able to survive after being top-killed by fire. However, peat soils, common in these communities, can burn when dry, and the heat from such fires can penetrate the soil, destroying the sedge rhizomes. It is necessary that livestock be excluded during the year prior to burning. Caution should be used with fires along streams because of the excellent erosion protection *Carex utriculata* (beaked sedge) provides. Fires do little to change plant composition of beaked sedge communities (DeBenedetti and Parsons 1984). Fire may regress seral succession in treed or shrubby fen stands back to open sedge meadows that support little woody vegetation (Anderson 2008).

Carex atherodes **(awned sedge)**—*Carex atherodes* (awned sedge) grows on wet sites that seldom dry out enough to carry fire, but the species is adapted to light intensity fire. Residual cover should burn well in early spring, prior to the growing season. Burning will reduce litter accumulations and temporarily increase productivity (Hansen and others 1988), but care should be taken with burning to avoid damage to the excellent soil erosion protection this species provides. Under drought conditions, there is danger of burning the soil peat layer and damaging the roots (Thompson and Hansen 2003).

Rehabilitation/Restoration Considerations

Betula glandulosa **(bog birch)**—The erosion control potential for *Betula glandulosa* (bog birch) is high, with the dense root systems important in helping to stabilize streambanks. Because it grows somewhat slowly, its short-term (1-3 years) revegetation potential is low, but the species is suitable for longer term (>3 years) revegetation of exposed mineral soil (Tollefson 2007).

Carex aquatilis **(water sedge)**—*Carex aquatilis* (water sedge) provides excellent erosion protection along streambanks, buffering against the erosive force of flood events, and filtering sediments during spring flows. Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex aquatilis* (water sedge) tends to form a dense, thick sod that is highly resistant to erosion. (Hauser 2006).

Carex utriculata **(beaked sedge)**—Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex utriculata* (beaked sedge) has a dense network of rhizomatous roots and forms a thick sod that is highly resistant to erosion and effective in stabilizing streambanks (Anderson 2008).

Carex atherodes **(awned sedge)**—*Carex atherodes* (awned sedge) rates high in value for erosion control, and high for its persistence, once established on a site (Hardy BBT Limited 1989). Generally, due to their stronger rhizomatous roots, *Carex* species (sedges) offer better streambank protection than grasses. *Carex atherodes* (awned sedge) forms a dense, thick sod highly resistant to erosion. Along streambanks, the sod may overhang the bank and sag into the water, providing additional protection from erosion (Thompson and Hansen 2003).

Carex atherodes (awned sedge) is suited for long-term revegetation of disturbed sites and erosion control on sites with a high water table. The species can rapidly re-colonize disturbed sites by seed and rhizome extension. Its rhizomes form a dense network effective in stabilizing streambanks and preventing soil erosion (Thompson and Hansen 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Carex* (sedges) to the species level (i.e., *Carex* [sedges] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Bog birch-Clover/Foothills rough fescue-Kentucky bluegrass
- Bog birch/Foothills rough fescue/Bearberry
- Sb-Lt/Bog birch-Willow/Sedge/Golden moss
- Willow-Bog birch/Sedge-Slender wheat grass
- Willow-Bog birch/Water sedge/Golden moss

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) and/or *Carex* (sedges) to the species level (i.e., *Salix* [willows] and/or *Carex* [sedges] were only identified to the genus level)

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) and/or *Carex* (sedges) to the species level (i.e., *Salix* [willows] and/or *Carex* [sedges] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type has not been described in the region.

Betula glandulosa/Deschampsia cespitosa Habitat Type
(bog birch/tufted hair grass Habitat Type)

BETUGLA/DESCCES Habitat Type
Number of Stands = 4 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 4; Other Data Sets = 0)

LOCATION AND ASSOCIATED LANDFORMS

The *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. *Betula glandulosa* (bog birch) grows along streams, in muskegs, bogs, fens, and on moist to somewhat dry sites at higher elevations. Stands of this habitat type are found on the drier side of the *Betula glandulosa* (bog birch) moisture gradient.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 473 shows the five most prominent plant species among the four lifeforms for species recorded in all four stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type. The two indicator species, *Betula glandulosa* (bog birch) and *Deschampsia cespitosa* (tufted hair grass), are the only species more than moderately prominent in stands sampled of this habitat type.

Table 473. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (number = 4 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Betula glandulosa (bog birch)	25.00	Native
Potentilla fruticosa (shrubby cinquefoil)	1.00	Native
Salix maccalliana (velvet-fruited willow)	0.75	Native
Salix spp. (willow)	0.75	Both
Rubus arcticus (dwarf raspberry)	0.25	Native
Graminoids		
Deschampsia cespitosa (tufted hair grass)	35.00	Native
Carex preslii (Presl sedge)	7.50	Native
Agropyron trachycaulum (slender wheat grass)	2.75	Native
Calamagrostis canadensis (marsh reed grass)	2.63	Native
Bromus inermis (smooth brome)	2.50	Introduced
Forbs		
*Aster ciliolatu*s (Lindley's aster)	6.63	Native
Fragaria virginiana (wild strawberry)	5.75	Native
Achillea millefolium (common yarrow)	3.38	Native
Potentilla gracilis (graceful cinquefoil)	1.63	Native
Penstemon procerus (slender blue beardtongue)	1.00	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 474 through Table 477, break out the vegetation recorded in all 4 stands sampled of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, species rich, shrub dominated habitat type of incidental occurrence across the study area.

Table 474 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type. For the 4 stands comprising the habitat type, the number of unique species was 69 with 63 (91.3 percent) of them being native species.

Table 474. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (number = 4 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	9	8	0	1
Graminoids	21	18	2	1
Forbs	39	37	2	0
TOTAL	***69 (100.0%)***	***63 (91.3%)***	***4 (5.8%)***	***2 (2.9%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 475 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type. The average number of species per stand is 26.6, with native species comprising 25.0 species per stand or 94.0 percent.

Table 475. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (number = 4 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	3.8	3.5	0.0	0.3
Graminoids	7.8	7.0	0.5	0.3
Forbs	15.0	14.5	0.5	0.0
TOTAL	***26.6 (100.0%)***	***25.0 (94.0%)***	***1.0 (3.8%)***	***0.6 (2.3%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 476 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type. The average canopy cover per stand is 119.5 percent, with native species comprising 115.8 percent or 96.9 percent of the total amount of average canopy cover per stand.

Table 476. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (number = 4 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	28.3%	27.5%	0.0%	0.8%
Graminoids	64.8%	62.0%	2.6%	0.1%
Forbs	26.5%	26.3%	0.3%	0.0%
TOTAL	***119.5% (100.0%)***	***115.8% (96.9%)***	***2.9% (2.4%)***	***0.9% (0.7%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 477 shows the average number of species and average canopy cover by lifeform in stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type. The average number of species per stand was 26.6 with an average canopy cover of 119.5 percent.

Table 477. Average number of species and average canopy cover by lifeform in stands of the *Betula glandulosa/ Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (number = 4 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	3.8	28.3%
Graminoids	7.8	64.8%
Forbs	15.0	26.5%
TOTAL	***26.6***	***119.5%***

Sampled Stands Plant Species List

A total of 69 plant species were recorded on at least one of the four stands sampled of the *Betula glandulosa/ Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (Table 478). No trees were recorded on these stands. Of nine shrubs recorded, only *Betula glandulosa* (bog birch) was highly prominent. *Deschampsia cespitosa* (tufted hair grass) was the only prominent graminoid among 21 species recorded; and among the 39 forbs recorded, a few were moderately prominent, but only *Aster ciliolatu*s (Lindley's aster) occurred on all plots sampled.

Table 478. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Betula glandulosa/ Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (number = 4 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Shrubs (N = 9)					
Arctostaphylos rubra (alpine bearberry)	0.5	0-0.5	25	0.13	N
Betula glandulosa (bog birch)	25.0	10-40	100	25.00	N
Dryas integrifolia (northern white mountain avens)	0.5	0-0.5	25	0.13	N
Juniperus horizontalis (creeping juniper)	0.5	0-0.5	25	0.13	N
Potentilla fruticosa (shrubby cinquefoil)	1.3	0-3	75	1.00	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	50	0.25	N
Salix lanata (woolly willow)	0.5	0-0.5	25	0.13	N
Salix maccalliana (velvet-fruited willow)	3.0	0-3	25	0.75	N
Salix spp. (willow)	3.0	0-3	25	0.75	B
Graminoids (N = 21)					
Agropyron trachycaulum (slender wheat grass)	3.7	0-10	75	2.75	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	25	0.13	N
Bromus ciliatus (fringed brome)	0.5	0-0.5	25	0.13	N
Bromus inermis (smooth brome)	10.0	0-10	25	2.50	I
Calamagrostis canadensis (marsh reed grass)	5.3	0-10	50	2.63	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	25	2.50	N
Carex aenea (silvery-flowered sedge)	0.5	0-0.5	25	0.13	N
Carex flava (yellow sedge)	10.0	0-10	25	2.50	N
Carex preslii (Presl sedge)	15.0	0-20	50	7.50	N
Carex scirpoidea (rush-like sedge)	10.0	0-10	25	2.50	N
Carex utriculata (beaked sedge)	0.5	0-0.5	25	0.13	N
Danthonia californica (California oat grass)	1.8	0-3	50	0.88	N
Deschampsia cespitosa (tufted hair grass)	35.0	30-50	100	35.00	N
Elymus innovatus (hairy wild rye)	3.0	0-3	25	0.75	N
Festuca rubra (red fescue)	0.5	0-0.5	25	0.13	B
Festuca saximontana (Rocky Mountain fescue)	0.5	0-0.5	25	0.13	N
Juncus balticus (wire rush)	1.3	0-3	75	1.00	N
Kobresia myosuroides (bog-sedge)	3.0	0-3	25	0.75	N
Poa pratensis (Kentucky bluegrass)	0.5	0-0.5	25	0.13	I
Schizachne purpurascens (purple oat grass)	10.0	0-10	25	2.50	N
Scirpus cespitosus (tufted bulrush)	0.5	0-0.5	25	0.13	N
Forbs (N = 39)					
Achillea millefolium (common yarrow)	4.5	0-10	75	3.38	N
Agoseris glauca (yellow false dandelion)	0.5	0-0.5	25	0.13	N
Antennaria parvifolia (small-leaved everlasting)	3.0	0-3	25	0.75	N
Antennaria pulcherrima (showy everlasting)	0.5	0-0.5	25	0.13	N
Arnica chamissonis (leafy arnica)	0.5	0-0.5	25	0.13	N
Arnica mollis (cordilleran arnica)	0.5	0-0.5	25	0.13	N
*Aster ciliolatu*s (Lindley's aster)	6.6	0.5-20	100	6.63	N
Aster laevis (smooth aster)	0.5	0-0.5	25	0.13	N
Aster subspicatus (leafy-bracted aster)	0.5	0-0.5	25	0.13	N

Table 478. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Campanula rotundifolia (harebell)	0.5	0-0.5	25	0.13	N
Delphinium glaucum (tall larkspur)	3.0	0-3	25	0.75	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	25	0.13	N
Fragaria virginiana (wild strawberry)	11.5	0-20	50	5.75	N
Galium boreale (northern bedstraw)	0.5	0-0.5	75	0.38	N
Geum rivale (purple avens)	0.5	0-0.5	50	0.25	N
Geum triflorum (three-flowered avens)	0.5	0-0.5	25	0.13	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	75	0.38	N
Moehringia lateriflora (blunt-leaved sandwort)	0.5	0-0.5	25	0.13	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	25	0.13	N
Penstemon procerus (slender blue beardtongue)	1.3	0-3	75	1.00	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	25	0.13	N
Petasites vitifolius (vine-leaved coltsfoot)	0.5	0-0.5	25	0.13	N
Polemonium pulcherrimum (showy Jacob's-ladder)	0.5	0-0.5	25	0.13	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	50	0.25	N
Potentilla gracilis (graceful cinquefoil)	2.2	0-3	75	1.63	N
Ranunculus cardiophyllus (heart-leaved buttercup)	0.5	0-0.5	25	0.13	N
Rumex acetosa (green sorrel)	0.5	0-0.5	25	0.13	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	25	0.13	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	25	0.13	N
Taraxacum officinale (common dandelion)	0.5	0-0.5	25	0.13	I
Thalictrum venulosum (veiny meadow rue)	1.3	0-3	75	1.00	N
Tofieldia pusilla (dwarf false asphodel)	0.5	0-0.5	25	0.13	N
Trifolium repens (white clover)	0.5	0-0.5	25	0.13	I
Valeriana dioica (northern valerian)	0.5	0-0.5	50	0.25	N
Veronica alpina (alpine speedwell)	0.5	0-0.5	25	0.13	N
Vicia americana (wild vetch)	0.5	0-0.5	75	0.38	N
Viola adunca (early blue violet)	0.5	0-0.5	25	0.13	N
Zigadenus elegans (white camas)	3.0	0-3	25	0.75	N
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	25	0.13	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 479 shows the five most prominent plant species among the four lifeforms for species recorded in the two relatively undisturbed late seral to climax stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type. The two indicator species, *Betula glandulosa* (bog birch) and *Deschampsia cespitosa* (tufted hair grass), are the only species more than moderately prominent in late seral stands sampled of this habitat type.

Table 479. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (number = 2 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Betula glandulosa (bog birch)	25.00	Native
Potentilla fruticosa (shrubby cinquefoil)	1.50	Native
Salix maccalliana (velvet-fruited willow)	1.50	Native
Arctostaphylos rubra (alpine bearberry)	0.25	Native
Dryas integrifolia (northern white mountain avens)	0.25	Native
Graminoids		
Deschampsia cespitosa (tufted hair grass)	40.00	Native
Calamagrostis stricta (narrow reed grass)	5.00	Native
Carex flava (yellow sedge)	5.00	Native
Carex scirpoidea (rush-like sedge)	5.00	Native
Kobresia myosuroides (bog-sedge)	1.50	Native
Forbs		
Aster ciliolatus (Lindley's aster)	1.75	Native
Achillea millefolium (common yarrow)	1.50	Native
Delphinium glaucum (tall larkspur)	1.50	Native
Potentilla gracilis (graceful cinquefoil)	1.50	Native
Zigadenus elegans (white camas)	1.50	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 480 through Table 483, break out the vegetation recorded in two relatively undisturbed late seral to climax stands sampled of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted

hair grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, species rich, shrub dominated habitat type of incidental occurrence across the study area.

Table 480 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type. For the 2 stands comprising the habitat type, the number of unique species was 39 with 38 (97.4 percent) of them being native species.

Table 480. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula glandulosa/ Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (number = 2 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	7	7	0	0
Graminoids	11	11	0	0
Forbs	21	20	1	0
TOTAL	***39 (100.0%)***	***38 (97.4%)***	***1 (2.6%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 481 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type. The average number of species per stand is 21.0, with native species comprising 20.5 species per stand or 97.6 percent.

Table 481. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (number = 2 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	4.0	4.0	0.0	0.0
Graminoids	6.0	6.0	0.0	0.0
Forbs	11.0	10.5	0.5	0.0
TOTAL	***21.0 (100.0%)***	***20.5 (97.6%)***	***0.5 (2.4%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 482 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type. The average canopy cover per stand is 98.8 percent, with native species comprising 98.5 percent or 99.7 percent of the total amount of average canopy cover per stand.

Table 482. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (number = 2 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	29.0%	29.0%	0.0%	0.0%
Graminoids	58.0%	58.0%	0.0%	0.0%
Forbs	11.8%	11.5%	0.3%	0.0%
TOTAL	***98.8% (100.0%)***	***98.5% (99.7%)***	***0.3% (0.3%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 483 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type. The average number of species per stand was 21.0 with an average canopy cover of 98.8 percent.

Table 483. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (number = 2 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	4.0	29.0%
Graminoids	6.0	58.0%
Forbs	11.0	11.8%
TOTAL	***21.0***	***98.8%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 39 plant species were recorded on at least one of the two relatively undisturbed late seral to climax stands sampled of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (Table 484). No trees were recorded on either of the two stands sampled, and of the seven shrubs recorded, only *Betula glandulosa* (bog birch) was highly prominent. *Deschampsia cespitosa* (tufted hair grass) was the only prominent graminoid among 11 species recorded. Among the 21 forbs recorded, none was notably prominent.

Table 484. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (number = 2 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Shrubs (N = 7)					
Arctostaphylos rubra (alpine bearberry)	0.5	0-0.5	50	0.25	N
Betula glandulosa (bog birch)	25.0	20-30	100	25.00	N
Dryas integrifolia (northern white mountain avens)	0.5	0-0.5	50	0.25	N
Juniperus horizontalis (creeping juniper)	0.5	0-0.5	50	0.25	N
Potentilla fruticosa (shrubby cinquefoil)	3.0	0-3	50	1.50	N
Salix lanata (woolly willow)	0.5	0-0.5	50	0.25	N
Salix maccalliana (velvet-fruited willow)	3.0	0-3	50	1.50	N
Graminoids (N = 11)					
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	50	0.25	N
Bromus ciliatus (fringed brome)	0.5	0-0.5	50	0.25	N
Calamagrostis stricta (narrow reed grass)	10.0	0-10	50	5.00	N
Carex aenea (silvery-flowered sedge)	0.5	0-0.5	50	0.25	N
Carex flava (yellow sedge)	10.0	0-10	50	5.00	N
Carex scirpoidea (rush-like sedge)	10.0	0-10	50	5.00	N
Carex utriculata (beaked sedge)	0.5	0-0.5	50	0.25	N
Deschampsia cespitosa (tufted hair grass)	40.0	30-50	100	40.00	N
Juncus balticus (wire rush)	0.5	0-0.5	50	0.25	N
Kobresia myosuroides (bog-sedge)	3.0	0-3	50	1.50	N
Scirpus cespitosus (tufted bulrush)	0.5	0-0.5	50	0.25	N
Forbs (N = 21)					
Achillea millefolium (common yarrow)	3.0	0-3	50	1.50	N
Antennaria pulcherrima (showy everlasting)	0.5	0-0.5	50	0.25	N
Arnica chamissonis (leafy arnica)	0.5	0-0.5	50	0.25	N
Arnica mollis (cordilleran arnica)	0.5	0-0.5	50	0.25	N
Aster ciliolatus (Lindley's aster)	1.8	0.5-3	100	1.75	N
Aster subspicatus (leafy-bracted aster)	0.5	0-0.5	50	0.25	N
Delphinium glaucum (tall larkspur)	3.0	0-3	50	1.50	N
Galium boreale (northern bedstraw)	0.5	0-0.5	50	0.25	N
Geum rivale (purple avens)	0.5	0-0.5	50	0.25	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	50	0.25	N
Moehringia lateriflora (blunt-leaved sandwort)	0.5	0-0.5	50	0.25	N
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	50	0.25	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	50	0.25	N

Table 484. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Potentilla gracilis (graceful cinquefoil)	3.0	0-3	50	1.50	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	50	0.25	N
Taraxacum officinale (common dandelion)	0.5	0-0.5	50	0.25	I
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	50	0.25	N
Tofieldia pusilla (dwarf false asphodel)	0.5	0-0.5	50	0.25	N
Valeriana dioica (northern valerian)	0.5	0-0.5	50	0.25	N
Vicia americana (wild vetch)	0.5	0-0.5	50	0.25	N
Zigadenus elegans (white camas)	3.0	0-3	50	1.50	N

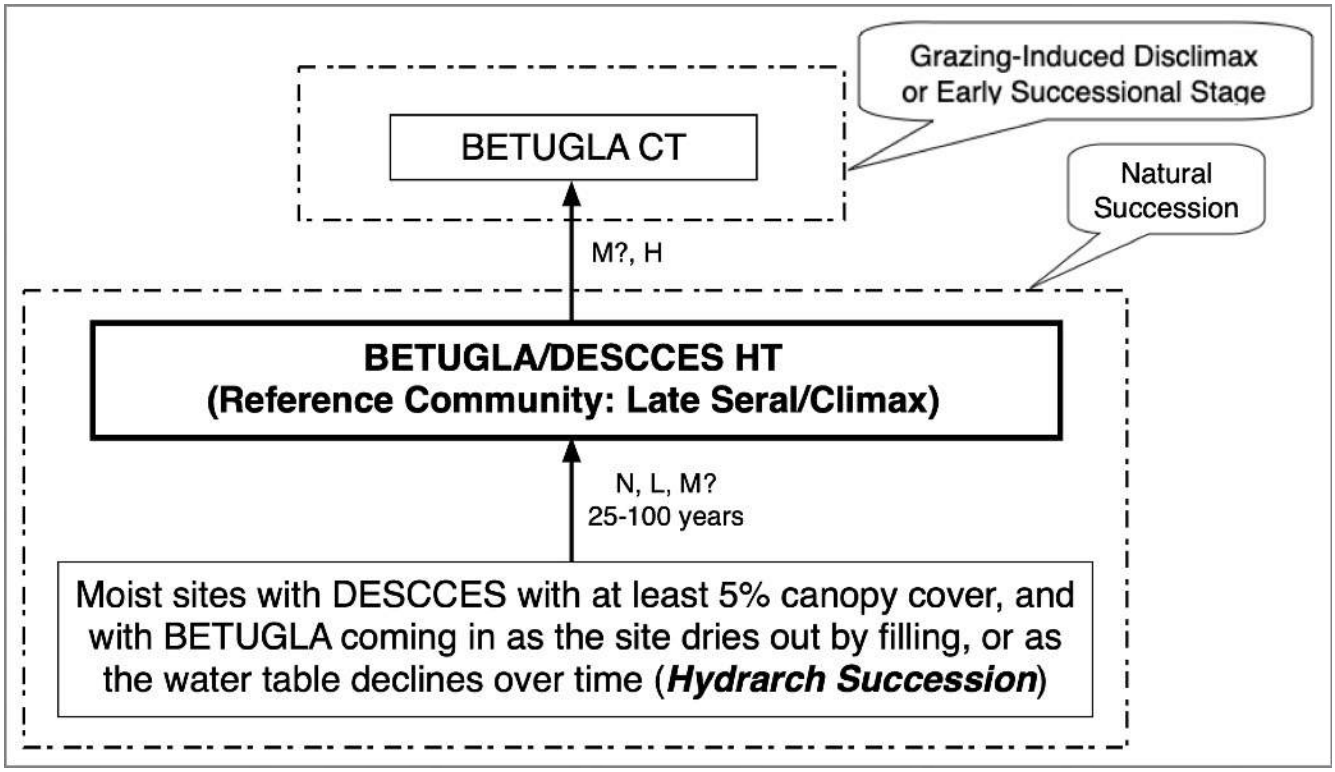
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Potential for the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type may develop on a site via primary succession (hydrarch succession), whereby the gradual filling of a shallow depression allows stands of *Deschampsia cespitosa* (tufted hair grass) to develop the required conditions to support *Betula glandulosa* (bog birch) in the stand.

Figure 102 shows a schematic diagram of vegetation successional pathways on sites of the *Betula glandulosa/ Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type.



Successional Pathway of *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
BETUGLA—*Betula glandulosa* (bog birch)
BETUGLA CT—*Betula glandulosa* (bog birch) community type
BETUGLA/DESCCES HT—*Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type
DESCCES—*Deschampsia cespitosa* (tufted hair grass)

Figure 102. Successional pathway for sites of the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 103 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Betula glandulosa/Deschampsia cespitosa*

(bog birch/tufted hair grass) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

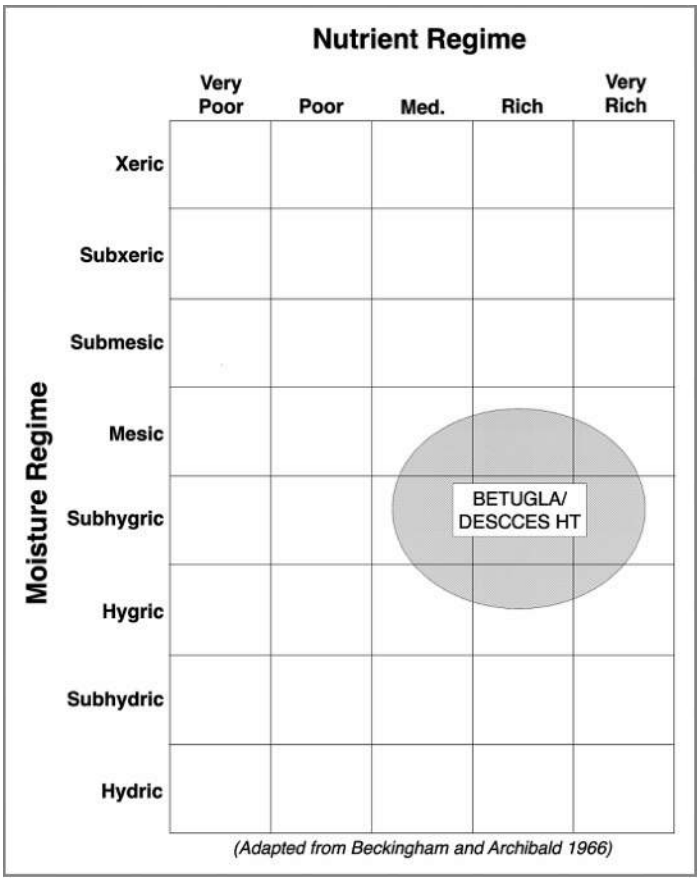


Figure 103. Edatope grid position for the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type (BETUGLA/DESCCES HT)

SOILS

Parent material on sites supporting the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type is predominantly fluvial and undifferentiated organic. Soil subgroups are mostly regosols, gleysols, and fibrisols. Soil drainage ranges from well drained to poorly drained, with surface textures of fibric and silt loam. Organic thickness is mostly 0 cm to 5 cm thick, but some sites having as much as 80 cm organic layer (France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites will likely have the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type or a community dominated by a wetland *Carex* (sedge) species, such as *Carex utriculata* (beaked sedge) or *Carex aquatilis* (water sedge). Adjacent drier sites will often have a community dominated by *Picea mariana* (black spruce), *Abies lasiocarpa* (subalpine fir) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) grows along streams, in muskegs and bogs, and on moist to somewhat dry sites at higher elevations (Tannas 1997a). This species is characteristic of many mixed shrub and tussock tundra communities in northern Canada. In southwestern Canada, it often occurs on wetland sites including bogs and fens, within *Pinus contorta* (lodgepole pine), *Picea* species (spruce), or *Abies lasiocarpa* (subalpine fir) forest types, and is often associated with *Alnus* species (alders) and *Salix* species (willows) (Tollefson 2007).

Betula glandulosa (bog birch) occupies a wide variety of sites, ranging from rocky subarctic and alpine tundra to deep, organic, boreal soils. It is a wetland species occurring most commonly on moist, acidic, nutrient-poor organic sites including fens, swamps, bogs, muskegs, wet meadows, lake and stream margins, and seepage areas. The species dominates open valley bottoms in the Canadian Rocky Mountains. Although it is primarily a wetland plant, it does not appear to tolerate continuous flooding (Tollefson 2007). *Betula glandulosa* (bog birch) is shade intolerant and is often found in canopy openings within *Picea mariana* (black spruce) woodlands in northern Canada (Tollefson 2007).

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) is common throughout most natural regions of Alberta, occurring in moist meadows, along slough margins, and in boggy areas (Tannas 1997a). The species can occur as a pioneer, as well as either a component or a dominant in mid and late seral stands. It is rarely found in dense shade. It can be an aggressive colonizer on disturbed sites, particularly at higher elevation sites (Walsh 1995).

Livestock

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) has fair nutritional value similar to that of *Alnus* species (alders), is tolerant of moderate to heavy browsing, and is an especially competitive species, forming extensive stands in western and northern rangelands (Tannas 1997a). However, the species produces carbon and nitrogen-based anti-herbivore compounds that deter browsing (Tollefson 2007).

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) has high protein content early in the season, and is generally palatable to both livestock and wildlife throughout the season. The species is a grazing decreaser. Although cropped tufts may resprout from the base, these are relatively short lived. The species depends primarily on seed for reproduction (Tannas 1997a).

Deschampsia cespitosa (tufted hair grass) provides good to excellent forage for all classes of livestock. It is often an abundant source of forage throughout its growing season. However, it decreases with excessive grazing. Long term, intensive use reduces seed production. *Deschampsia cespitosa* (tufted hair grass) is a key indicator of condition and grazing utilization in certain mountain meadow communities (Walsh 1995).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Betula glandulosa* (bog birch)**—Numerous wildlife species eat *Betula glandulosa* (bog birch), including moose, mule deer, white-tailed deer, Rocky Mountain elk, mountain goats, caribou, grizzly bears, black bears, small mammals, beaver, birds, and insects (Tollefson 2007).

***Deschampsia cespitosa* (tufted hair grass)**—Use of *Deschampsia cespitosa* (tufted hair grass) by wildlife species is variable, although it provides palatable forage early spring through summer. It is frequently grazed by bears, and feral horses in the foothills of western Alberta were found to graze it (Walsh 1995).

Fire

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) can survive low to moderate-severity fires. The species has deep roots and rhizomes that typically are protected from all but high-severity fires. It regenerates after fire by sprouting from the root crown and from dormant buds on the rhizomes (Tollefson 2007).

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) generally survives all but the most severe fires. It usually sprouts from the root crown after aerial portions are burned. Tufts formed by the leaves often protect basal buds from fire damage. Within just a few years *Deschampsia cespitosa* (tufted hair grass) usually recovers to pre-fire abundance (Walsh 1995).

Rehabilitation/Restoration Considerations

***Betula glandulosa* (bog birch)**—The erosion control potential for *Betula glandulosa* (bog birch) is high, with the dense root systems important in helping to stabilize streambanks. Because it grows somewhat slowly, its short-term (1-3 years) revegetation potential is low, but the species is suitable for longer term (>3 years) revegetation of exposed mineral soil (Tollefson 2007).

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) has a broad ecological range and is useful for revegetation, particularly on disturbances at high elevation or high latitude. It grows at a medium rate compared to other grasses and has a poor rate of spread, but it highly competitive, relative to other plants evaluated for high latitude revegetation. It has low to medium potential for short-term revegetation, but has medium to high potential for long-term revegetation, and is a valuable soil stabilizer, especially in wet, acidic sites (Walsh 1995).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Willow-Bog birch/Tufted hair grass-Sedge

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type due to the document not identifying *Salix* (willows) and/or *Carex* (sedges) to the species level (i.e., *Salix* [willows] and/or *Carex* [sedges] were only identified to the genus level)

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) and/or *Carex* (sedges) to the species level (i.e., *Salix* [willows] and/or *Carex* [sedges] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type has not been described in the region.

Betula glandulosa Community Type
(bog birch Community Type)

BETUGLA Community Type
Number of Stands = 6 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 4; Other Data Sets = 2)

LOCATION AND ASSOCIATED LANDFORMS

The *Betula glandulosa* (bog birch) community type is an incidental type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. *Betula glandulosa* (bog birch) grows along streams, in muskegs, bogs, fens, and on moist to somewhat dry sites at higher elevations. Stands of this community type may be found anywhere within the range of the species.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 485 shows the five most prominent plant species among the four lifeforms for species recorded in all six stands of the *Betula glandulosa* (bog birch) community type. *Betula glandulosa* (bog birch) is the only species more than moderately prominent in stands sampled of this community type.

Table 485. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Betula glandulosa* (bog birch) community type (number = 6 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Pinus contorta (lodgepole pine)	0.50	Native
Populus tremuloides (aspen)	0.50	Native
Pinus contorta (lodgepole pine)	0.17	Native

Table 485. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Betula glandulosa (bog birch)	41.67	Native
Arctostaphylos uva-ursi (common bearberry)	3.83	Native
Potentilla fruticosa (shrubby cinquefoil)	1.83	Native
Ribes lacustre (bristly black currant)	0.50	Native
Salix glauca (smooth willow)	0.50	Native
Graminoids		
Scirpus spp. (bulrush)	10.00	Native
Carex simulata (analogue sedge)	5.00	Native
Carex buxbaumii (brown sedge)	3.33	Native
Juncus balticus (wire rush)	3.33	Native
Muhlenbergia richardsonis (mat muhly)	3.33	Native
Forbs		
Galium boreale (northern bedstraw)	2.42	Native
Triglochin maritima (seaside arrow-grass)	1.67	Native
Achillea millefolium (common yarrow)	1.17	Native
Fragaria virginiana (wild strawberry)	1.17	Native
Geum macrophyllum (large-leaved yellow avens)	0.67	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 486 through Table 489, break out the vegetation recorded in 6 stands sampled of the *Betula glandulosa* (bog birch) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, species rich, shrub dominated community type of incidental-to-minor occurrence across the study area.

Table 486 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula glandulosa* (bog birch) community type. For the 6 stands comprising the community type, the number of unique species was 90 with 84 (93.3 percent) of them being native species.

Table 486. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Betula glandulosa* (bog birch) community type (number = 6 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3	3	0	0
Shrubs	11	10	0	1
Graminoids	26	24	2	0
Forbs	50	47	1	2
TOTAL	***90 (100.0%)***	***84 (93.3%)***	***3 (3.3%)***	***3 (3.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 487 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula glandulosa* (bog birch) community type. The average number of species per stand is 22.0, with native species comprising 21.1 species per stand or 95.9 percent.

Table 487. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Betula glandulosa* (bog birch) community type (number = 6 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.7	0.7	0.0	0.0
Shrubs	3.3	3.2	0.0	0.2
Graminoids	5.5	5.2	0.3	0.0
Forbs	12.5	12.0	0.2	0.3
TOTAL	***22.0 (100.0%)***	***21.1 (95.9%)***	***0.5 (2.3%)***	***0.5 (2.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 488 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula glandulosa* (bog birch) community type. The average canopy cover per stand is 103.1 percent, with native species comprising 102.6 percent or 99.5 percent of the total amount of average canopy cover per stand.

Table 488. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Betula glandulosa* (bog birch) community type (number = 6 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1.2%	1.2%	0.0%	0.0%
Shrubs	49.3%	49.3%	0.0%	0.1%
Graminoids	36.9%	36.8%	0.2%	0.0%
Forbs	15.7%	15.4%	0.1%	0.2%
TOTAL	***103.1% (100.0%)***	***102.6% (99.5%)***	***0.3% (0.2%)***	***0.3% (0.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 489 shows the average number of species and average canopy cover by lifeform in stands of the *Betula glandulosa* (bog birch) community type. The average number of species per stand was 22.0 with an average canopy cover of 103.1 percent.

Table 489. Average number of species and average canopy cover by lifeform in stands of the *Betula glandulosa* (bog birch) community type (number = 6 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.7	1.2%
Shrubs	3.3	49.3%
Graminoids	5.5	36.9%
Forbs	12.5	15.7%
TOTAL	***22.0***	***103.1%***

Sampled Stands Plant Species List

A total of 90 plant species were recorded on at least one of six stands sampled of the *Betula glandulosa* (bog birch) community type (Table 490). Three tree species were recorded in small amounts, and *Betula glandulosa* (bog birch) is the only shrub species recorded with high prominence. Of the 26 graminoid and 50 forb species recorded, none was more than moderately prominent.

Table 490. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Betula glandulosa* (bog birch) community type (number = 6 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 3)					
Picea glauca (white spruce)	0.5	0-0.5	33	0.17	N
Pinus contorta (lodgepole pine)	3.0	0-3	17	0.50	N
Populus tremuloides (aspen)	3.0	0-3	17	0.50	N
Shrubs (N = 11)					
Arctostaphylos uva-ursi (common bearberry)	11.5	0-20	33	3.83	N
Betula glandulosa (bog birch)	41.7	30-60	100	41.67	N
Potentilla fruticosa (shrubby cinquefoil)	3.7	0-10	50	1.83	N
Ribes lacustre (bristly black currant)	3.0	0-3	17	0.50	N
Rubus chamaemorus (cloudberry)	0.5	0-0.5	17	0.08	N
Salix candida (hoary willow)	0.5	0-0.5	33	0.17	N
Salix exigua (sandbar willow)	0.5	0-0.5	17	0.08	N
Salix glauca (smooth willow)	3.0	0-3	17	0.50	N
Salix lutea (yellow willow)	3.0	0-3	17	0.50	N
Salix spp. (willow)	0.5	0-0.5	17	0.08	B
Shepherdia canadensis (Canada buffaloberry)	0.5	0-0.5	17	0.08	N
Graminoids (N = 26)					
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	17	0.08	N
Bromus ciliatus (fringed brome)	0.5	0-0.5	33	0.17	N
Carex aquatilis (water sedge)	0.5	0-0.5	17	0.08	N
Carex buxbaumii (brown sedge)	20.0	0-20	17	3.33	N
Carex interior (inland sedge)	0.5	0-0.5	17	0.08	N
Carex livida (livid sedge)	0.5	0-0.5	17	0.08	N
Carex sartwellii (Sartwell's sedge)	3.0	0-3	17	0.50	N
Carex simulata (analogue sedge)	30.0	0-30	17	5.00	N
Carex spp. (sedge)	0.5	0-0.5	33	0.17	N
Carex vaginata (sheathed sedge)	10.0	0-10	17	1.67	N
Carex viridula (green sedge)	3.0	0-3	17	0.50	N
Danthonia californica (California oat grass)	0.5	0-0.5	17	0.08	N
Deschampsia cespitosa (tufted hair grass)	0.5	0-0.5	33	0.17	N
Eleocharis quinqueflora (few-flowered spike-rush)	10.0	0-10	17	1.67	N
Elymus innovatus (hairy wild rye)	2.9	0-10	67	1.92	N
Festuca saximontana (Rocky Mountain fescue)	0.5	0-0.5	17	0.08	N
Juncus balticus (wire rush)	20.0	0-20	17	3.33	N
Kobresia myosuroides (bog-sedge)	0.5	0-0.5	17	0.08	N
Luzula multiflora (field wood-rush)	0.5	0-0.5	17	0.08	N
Muhlenbergia glomerata (bog muhly)	3.0	0-3	17	0.50	N
Muhlenbergia richardsonis (mat muhly)	20.0	0-20	17	3.33	N
Phleum commutatum (mountain timothy)	0.5	0-0.5	17	0.08	N
Poa pratensis (Kentucky bluegrass)	0.5	0-0.5	17	0.08	I
Schizachne purpurascens (purple oat grass)	10.0	0-10	33	3.33	N
Scirpus acutus (great bulrush)	3.0	0-3	17	0.50	N

Table 490. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Scirpus spp. (bulrush)	60.0	0-60	17	10.00	N
Forbs (N = 50)					
Achillea millefolium (common yarrow)	1.8	0-3	67	1.17	N
Allium schoenoprasum (wild chives)	0.5	0-0.5	17	0.08	N
Androsace chamaejasme (sweet-flowered androsace)	3.0	0-3	17	0.50	N
Anemone parviflora (small wood anemone)	3.0	0-3	17	0.50	N
Antennaria anaphaloides (tall everlasting)	0.5	0-0.5	33	0.17	N
Antennaria rosea (rosy everlasting)	0.5	0-0.5	17	0.08	N
Antennaria spp. (everlastings)	0.5	0-0.5	17	0.08	N
Aster borealis (marsh aster)	0.5	0-0.5	17	0.08	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	33	0.17	N
Aster modestus (large northern aster)	0.5	0-0.5	17	0.08	N
Aster spp. (aster)	0.5	0-0.5	17	0.08	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	17	0.08	N
Circaea alpina (small enchanter's nightshade)	3.0	0-3	17	0.50	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	33	0.17	N
Epilobium angustifolium (common fireweed)	1.8	0-3	33	0.58	N
Fragaria virginiana (wild strawberry)	1.8	0-3	67	1.17	N
Galium boreale (northern bedstraw)	2.9	0-10	83	2.42	N
Gentiana spp. (gentian)	0.5	0-0.5	17	0.08	N
Geranium richardsonii (wild white geranium)	0.5	0-0.5	17	0.08	N
Geum aleppicum (yellow avens)	0.5	0-0.5	17	0.08	N
Geum macrophyllum (large-leaved yellow avens)	1.3	0-3	50	0.67	N
Geum triflorum (three-flowered avens)	0.5	0-0.5	17	0.08	N
Hedysarum boreale (northern hedysarum)	0.5	0-0.5	17	0.08	N
Hedysarum sulphurescens (yellow hedysarum)	0.5	0-0.5	17	0.08	N
Lathyrus ochroleucus (cream-colored vetchling)	1.3	0-3	50	0.67	N
Lilium philadelphicum (western wood lily)	0.5	0-0.5	17	0.08	N
Lobelia kalmii (Kalm's lobelia)	0.5	0-0.5	17	0.08	N
Mertensia paniculata (tall lungwort)	1.3	0-3	50	0.67	N
Oxytropis spp. (locoweed)	0.5	0-0.5	17	0.08	B
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	17	0.08	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	33	0.17	N
Polemonium acutiflorum (tall Jacob's-ladder)	0.5	0-0.5	17	0.08	N
Polemonium pulcherrimum (showy Jacob's-ladder)	0.5	0-0.5	17	0.08	N
Polygonum viviparum (alpine bistort)	3.0	0-3	17	0.50	N
Potentilla arguta (white cinquefoil)	0.5	0-0.5	17	0.08	N
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	17	0.08	N
Ranunculus abortivus (small-flowered buttercup)	0.5	0-0.5	17	0.08	N
Rumex acetosa (green sorrel)	0.5	0-0.5	17	0.08	N
Rumex spp. (sorrel)	0.5	0-0.5	17	0.08	B
Smilacina stellata (star-flowered Solomon's-seal)	3.0	0-3	17	0.50	N
Solidago spp. (goldenrod)	0.5	0-0.5	17	0.08	N

Table 490. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	17	0.08	N
Taraxacum officinale (common dandelion)	0.5	0-0.5	17	0.08	I
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	50	0.25	N
Triglochin maritima (seaside arrow-grass)	10.0	0-10	17	1.67	N
Triglochin palustris (slender arrow-grass)	0.5	0-0.5	17	0.08	N
Valeriana dioica (northern valerian)	0.5	0-0.5	17	0.08	N
Vicia americana (wild vetch)	0.5	0-0.5	50	0.25	N
Viola nephrophylla (bog violet)	0.5	0-0.5	17	0.08	N
Zizia aptera (heart-leaved Alexanders)	3.0	0-3	17	0.50	N

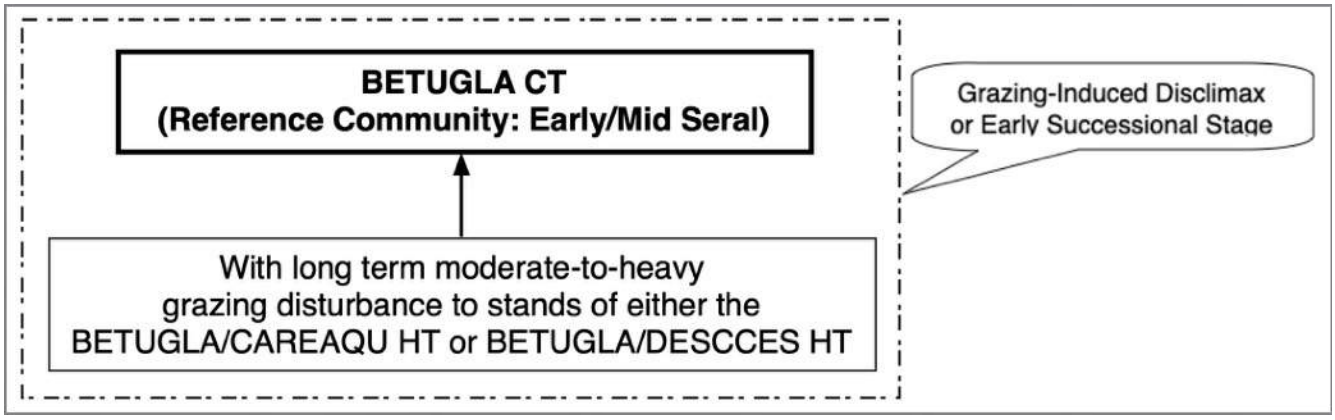
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Betula glandulosa* (bog birch) community type is usually the result of intensive grazing by livestock during periods of drought, when the animals can gain access to stands of either the *Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type or the *Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type, depleting the palatable graminoids and introducing disturbance species, such as *Poa pratensis* (Kentucky bluegrass).

Figure 104 shows a schematic diagram of vegetation successional pathways on sites of the *Betula glandulosa* (bog birch) community type.



Successional Pathway of *Betula glandulosa* (bog birch) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Betula glandulosa* (bog birch) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES

BETUGLA/CAREAQU HT—*Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type
BETUGLA CT—*Betula glandulosa* (bog birch) community type
BETUGLA/DESCCES HT—*Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type

Figure 104. Successional pathway for sites of the *Betula glandulosa* (bog birch) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 105 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Betula glandulosa* (bog birch) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

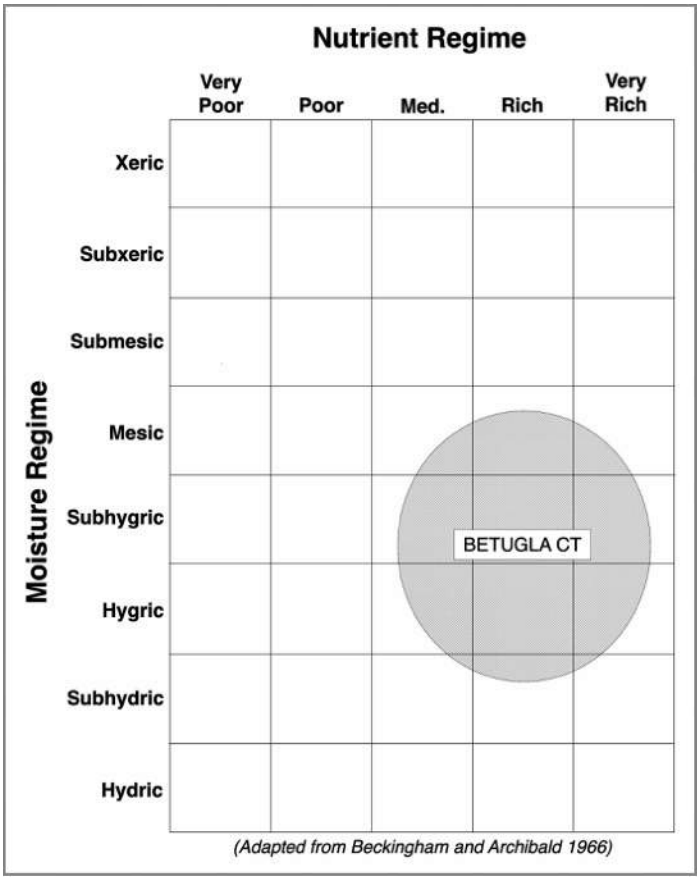


Figure 105. Edatope grid position for the *Betula glandulosa* (bog birch) community type (BETUGLA CT)

SOILS

Parent material on sites supporting the *Betula glandulosa* (bog birch) community type is predominantly fluvial, glaciofluvial, and morainal. Soil subgroups are mostly regosols, gleysols, and regosols. Soil drainage ranges from well drained to poorly drained, with surface textures ranging from sand to silt loam. Organic thickness is mostly 0 cm to 5 cm thick (France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter sites will likely have a community dominated by willows, such as *Salix pedicellaris* (bog willow), *Salix planifolia* (flat-leaved willow), or *Salix myrtillifolia* (myrtle-leaved willow). Adjacent drier sites will often have a community dominated by *Picea mariana* (black spruce), *Abies lasiocarpa* (subalpine fir) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) grows along streams, in muskegs and bogs, and on moist to somewhat dry sites at higher elevations (Tannas 1997a). This species is characteristic of many mixed shrub and tussock tundra communities in northern Canada. In southwestern Canada, it often occurs on wetland

sites including bogs and fens, within *Pinus contorta* (lodgepole pine), *Picea* species (spruce), or *Abies lasiocarpa* (subalpine fir) forest types, and is often associated with *Alnus* species (alders) and *Salix* species (willows) (Tollefson 2007).

Betula glandulosa (bog birch) occupies a wide variety of sites, ranging from rocky subarctic and alpine tundra to deep, organic, boreal soils. It is a wetland species occurring most commonly on moist, acidic, nutrient-poor organic sites including fens, swamps, bogs, muskegs, wet meadows, lake and stream margins, and seepage areas. The species dominates open valley bottoms in the Canadian Rocky Mountains. Although it is primarily a wetland plant, it does not appear to tolerate continuous flooding (Tollefson 2007). *Betula glandulosa* (bog birch) is shade intolerant and is often found in canopy openings within *Picea mariana* (black spruce) woodlands in northern Canada (Tollefson 2007).

Livestock

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) has fair nutritional value similar to that of *Alnus* species (alders), is tolerant of moderate to heavy browsing, and is an especially competitive species, forming extensive stands in western and northern rangelands (Tannas 1997a). However, the species produces carbon and nitrogen-based anti-herbivore compounds that deter browsing (Tollefson 2007).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Betula glandulosa* (bog birch)**—Numerous wildlife species eat *Betula glandulosa* (bog birch), including moose, mule deer, white-tailed deer, Rocky Mountain elk, mountain goats, caribou, grizzly bears, black bears, small mammals, beaver, birds, and insects (Tollefson 2007).

Fire

***Betula glandulosa* (bog birch)**—*Betula glandulosa* (bog birch) can survive low to moderate-severity fires. The species has deep roots and rhizomes that typically are protected from all but high-severity fires. It regenerates after fire by sprouting from the root crown and from dormant buds on the rhizomes (Tollefson 2007).

Rehabilitation/Restoration Considerations

***Betula glandulosa* (bog birch)**—The erosion control potential for *Betula glandulosa* (bog birch) is high, with the dense root systems important in helping to stabilize streambanks. Because it grows somewhat slowly, its short-term (1-3 years) revegetation potential is low, but the species is suitable for longer term (>3 years) revegetation of exposed mineral soil (Tollefson 2007).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Betula glandulosa* (bog birch) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Willow-Bog birch

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type due to the document not identifying *Salix* (willows) and/or *Carex* (sedges) to the species level (i.e., *Salix* [willows] and/or *Carex* [sedges] were only identified to the genus level)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Betula glandulosa* (bog birch) community type has not been described in the region.

Betula pumila/Carex aquatilis Habitat Type
(dwarf birch/water sedge Habitat Type)

BETUPUM/CAREAQU Habitat Type
Number of Stands = 6 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 6; Other Data Sets = 0)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of sedge species not identified to the species level (approximately 29 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. Stands of *Betula pumila* (dwarf birch) occur commonly in marshes, bogs, swamps, and fens from valley bottoms to lower montane sites on wet, organic soils (Tannas 1997a).

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 491 shows the five most prominent plant species among the four lifeforms for species recorded in all six stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type. *Betula pumila* (dwarf birch) is the most prominent species in stands sampled of this habitat type, followed by *Carex aquatilis* (water sedge).

Table 491. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (number = 6 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Larix laricina (tamarack)	0.50	Native
Picea mariana (black spruce)	0.25	Native
Shrubs		
Betula pumila (dwarf birch)	36.67	Native
Potentilla fruticosa (shrubby cinquefoil)	1.08	Native
Salix glauca (smooth willow)	1.00	Native
Ledum groenlandicum (common Labrador tea)	0.50	Native
Salix athabascensis (Athabasca willow)	0.50	Native
Graminoids		
Carex aquatilis (water sedge)	16.67	Native
Scirpus cespitosus (tufted bulrush)	8.92	Native
Deschampsia cespitosa (tufted hair grass)	1.00	Native
Carex gynocrates (northern bog sedge)	0.67	Native
Poa palustris (fowl bluegrass)	0.58	Native
Forbs		
Smilacina trifolia (three-leaved Solomon's-seal)	2.33	Native
Equisetum fluviatile (swamp horsetail)	1.67	Native
Caltha palustris (marsh-marigold)	0.50	Native
Equisetum variegatum (variegated horsetail)	0.50	Native
Menyanthes trifoliata (buck-bean)	0.50	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 492 through Table 495, break out the vegetation recorded in all 6 stands sampled of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, moderately species rich, shrub dominated habitat type of incidental occurrence across the study area.

Table 492 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type. For the 6 stands comprising the habitat type, the number of unique species was 43 with 42 (97.7 percent) of them being native species.

Table 492. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (number = 6 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2	2	0	0
Shrubs	14	13	0	1
Graminoids	10	10	0	0
Forbs	17	17	0	0
TOTAL	***43 (100.0%)***	***42 (97.7%)***	***0 (0.0%)***	***1 (2.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 493 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type. The average number of species per stand is 12.2, with native species comprising 12.1 species per stand or 99.2 percent.

Table 493. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (number = 6 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.7	0.7	0.0	0.0
Shrubs	4.3	4.2	0.0	0.2
Graminoids	3.7	3.7	0.0	0.0
Forbs	3.5	3.5	0.0	0.0
TOTAL	***12.2 (100.0%)***	***12.1 (99.2%)***	***0.0 (0.0%)***	***0.2 (1.6%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 494 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type. The average canopy cover per stand is 79.8 percent, with native species comprising 79.8 percent or 99.9 percent of the total amount of average canopy cover per stand.

Table 494. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (number = 6 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.8%	0.8%	0.0%	0.0%
Shrubs	42.5%	42.4%	0.0%	0.1%
Graminoids	28.8%	28.8%	0.0%	0.0%
Forbs	7.8%	7.8%	0.0%	0.0%
TOTAL	***79.8% (100.0%)***	***79.8% (99.9%)***	***0.0% (0.0%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 495 shows the average number of species and average canopy cover by lifeform in stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type. The average number of species per stand was 12.2 with an average canopy cover of 79.8 percent.

Table 495. Average number of species and average canopy cover by lifeform in stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (number = 6 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.7	0.8%
Shrubs	4.3	42.5%
Graminoids	3.7	28.8%
Forbs	3.5	7.8%
TOTAL	***12.2***	***79.8%***

Sampled Stands Plant Species List

A total of 43 plant species were recorded on at least one of the six stands sampled of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (Table 496). Two tree species were recorded in small amounts, and among the 14 shrub species recorded, only *Betula pumila* (dwarf birch) is very prominent. *Carex aquatilis* (water sedge) is the most prominent of 10 graminoid species recorded, and of the 17 forbs recorded, none is notably prominent.

Table 496. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (number = 6 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 2)					
Larix laricina (tamarack)	3.0	0-3	17	0.50	N
Picea mariana (black spruce)	0.5	0-0.5	50	0.25	N
Shrubs (N = 14)					
Andromeda polifolia (bog rosemary)	0.5	0-0.5	17	0.08	N
Betula pumila (dwarf birch)	36.7	20-60	100	36.67	N
Ledum groenlandicum (common Labrador tea)	3.0	0-3	17	0.50	N
Oxycoccus microcarpus (small bog cranberry)	0.5	0-0.5	33	0.17	N
Potentilla fruticosa (shrubby cinquefoil)	2.2	0-3	50	1.08	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	67	0.33	N
Rubus pubescens (dewberry)	0.5	0-0.5	17	0.08	N
Salix athabascensis (Athabasca willow)	3.0	0-3	17	0.50	N
Salix candida (hoary willow)	3.0	0-3	17	0.50	N
Salix glauca (smooth willow)	3.0	0-3	33	1.00	N
Salix maccalliana (velvet-fruited willow)	3.0	0-3	17	0.50	N
Salix myrtillifolia (myrtle-leaved willow)	3.0	0-3	17	0.50	N
Salix pedicellaris (bog willow)	3.0	0-3	17	0.50	N
Salix spp. (willow)	0.5	0-0.5	17	0.08	B
Graminoids (N = 10)					
Carex aquatilis (water sedge)	16.7	10-20	100	16.67	N
Carex gynocrates (northern bog sedge)	1.3	0-3	50	0.67	N
Carex limosa (mud sedge)	0.5	0-0.5	33	0.17	N
Deschampsia cespitosa (tufted hair grass)	3.0	0-3	33	1.00	N
Eriophorum viridi-carinatum (thin-leaved cotton grass)	0.5	0-0.5	17	0.08	N
Muhlenbergia glomerata (bog muhly)	0.5	0-0.5	17	0.08	N
Poa palustris (fowl bluegrass)	1.8	0-3	33	0.58	N
Scirpus cespitosus (tufted bulrush)	17.8	0-50	50	8.92	N
Scirpus hudsonianus (Hudson Bay bulrush)	3.0	0-3	17	0.50	N
Scirpus spp. (bulrush)	0.5	0-0.5	17	0.08	N
Forbs (N = 17)					
Achillea millefolium (common yarrow)	0.5	0-0.5	17	0.08	N
Caltha palustris (marsh-marigold)	3.0	0-3	17	0.50	N
Equisetum fluviatile (swamp horsetail)	10.0	0-10	17	1.67	N
Equisetum variegatum (variegated horsetail)	3.0	0-3	17	0.50	N
Galium labradoricum (Labrador bedstraw)	0.5	0-0.5	33	0.17	N
Geum rivale (purple avens)	0.5	0-0.5	17	0.08	N
Habenaria hyperborea (northern green bog orchid)	0.5	0-0.5	17	0.08	N
Menyanthes trifoliata (buck-bean)	3.0	0-3	17	0.50	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	17	0.08	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	17	0.08	N
Pedicularis labradorica (Labrador lousewort)	3.0	0-3	17	0.50	N

Table 496. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Petasites sagittatus (arrow-leaved coltsfoot)	3.0	0-3	17	0.50	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	17	0.08	N
Rumex occidentalis (western dock)	0.5	0-0.5	17	0.08	N
Senecio integerrimus (entire-leaved groundsel)	3.0	0-3	17	0.50	N
Smilacina trifolia (three-leaved Solomon's-seal)	3.5	0-10	67	2.33	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	17	0.08	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 497 shows the five most prominent plant species among the four lifeforms for species recorded in all four relatively undisturbed late seral to climax stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type. *Betula pumila* (dwarf birch) is the most prominent species in stands sampled of this habitat type, followed by *Carex aquatilis* (water sedge).

Table 497. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (number = 4 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Picea mariana (black spruce)	0.25	Native
Shrubs		
Betula pumila (dwarf birch)	42.50	Native
Salix glauca (smooth willow)	1.50	Native
Potentilla fruticosa (shrubby cinquefoil)	0.88	Native
Salix athabascensis (Athabasca willow)	0.75	Native
Salix maccalliana (velvet-fruited willow)	0.75	Native
Graminoids		
Carex aquatilis (water sedge)	17.50	Native
Deschampsia cespitosa (tufted hair grass)	1.50	Native
Poa palustris (fowl bluegrass)	0.88	Native
Scirpus cespitosus (tufted bulrush)	0.88	Native
Scirpus hudsonianus (Hudson Bay bulrush)	0.75	Native
Forbs		
Equisetum fluviatile (swamp horsetail)	2.50	Native
Smilacina trifolia (three-leaved Solomon's-seal)	1.00	Native
Equisetum variegatum (variegated horsetail)	0.75	Native
Menyanthes trifoliata (buck-bean)	0.75	Native
Petasites sagittatus (arrow-leaved coltsfoot)	0.75	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 498 through Table 501, break out the vegetation recorded in four relatively undisturbed late seral to climax stands sampled of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, moderately species rich, shrub dominated habitat type of incidental occurrence across the study area.

Table 498 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type. For the 4 stands comprising the habitat type, the number of unique species was 34 with 34 (100.0 percent) of them being native species.

Table 498. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (number = 4 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	11	11	0	0
Graminoids	9	9	0	0
Forbs	13	13	0	0
TOTAL	***34 (100.0%)***	***34 (100.0%)***	***0 (0.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 499 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type. The average number of species per stand is 13.4, with native species comprising 13.4 species per stand or 100.0 percent.

Table 499. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (number = 4 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.5	0.5	0.0	0.0
Shrubs	4.8	4.8	0.0	0.0
Graminoids	4.3	4.3	0.0	0.0
Forbs	3.8	3.8	0.0	0.0
TOTAL	***13.4 (100.0%)***	***13.4 (100.0%)***	***0.0 (0.0%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 500 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type. The average canopy cover per stand is 78.6 percent, with native species comprising 78.6 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 500. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (number = 4 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.3%	0.3%	0.0%	0.0%
Shrubs	48.8%	48.8%	0.0%	0.0%
Graminoids	22.3%	22.3%	0.0%	0.0%
Forbs	7.4%	7.4%	0.0%	0.0%
TOTAL	***78.6% (100.0%)***	***78.6% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 501 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type. The average number of species per stand was 13.4 with an average canopy cover of 78.6 percent.

Table 501. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (number = 4 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.5	0.3%
Shrubs	4.8	48.8%
Graminoids	4.3	22.3%
Forbs	3.8	7.4%
TOTAL	***13.4***	***78.6%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 34 plant species were recorded on at least one of the four relatively undisturbed late seral to climax stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (Table 502). One tree species, *Picea mariana* (black spruce), was recorded in a very small amount on one stand. Among the 11 shrub species recorded, only *Betula pumila* (dwarf birch) is very prominent; and likewise, *Carex aquatilis* (water sedge) is the most prominent of 9 graminoid species. Of the 13 forbs recorded, none is more than moderately prominent.

Table 502. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (number = 4 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 1)					
Picea mariana (black spruce)	0.5	0-0.5	50	0.25	N
Shrubs (N = 11)					
Andromeda polifolia (bog rosemary)	0.5	0-0.5	25	0.13	N
Betula pumila (dwarf birch)	42.5	30-60	100	42.50	N
Oxycoccus microcarpus (small bog cranberry)	0.5	0-0.5	25	0.13	N
Potentilla fruticosa (shrubby cinquefoil)	1.8	0-3	50	0.88	N
Rubus arcticus (dwarf raspberry)	0.5	0.5-0.5	100	0.50	N
Rubus pubescens (dewberry)	0.5	0-0.5	25	0.13	N
Salix athabascensis (Athabasca willow)	3.0	0-3	25	0.75	N
Salix glauca (smooth willow)	3.0	0-3	50	1.50	N
Salix maccalliana (velvet-fruited willow)	3.0	0-3	25	0.75	N
Salix myrtillifolia (myrtle-leaved willow)	3.0	0-3	25	0.75	N
Salix pedicellaris (bog willow)	3.0	0-3	25	0.75	N
Graminoids (N = 9)					
Carex aquatilis (water sedge)	17.5	10-20	100	17.50	N
Carex gynocrates (northern bog sedge)	0.5	0-0.5	50	0.25	N
Carex limosa (mud sedge)	0.5	0-0.5	50	0.25	N
Deschampsia cespitosa (tufted hair grass)	3.0	0-3	50	1.50	N
Eriophorum viridi-carinatum (thin-leaved cotton grass)	0.5	0-0.5	25	0.13	N
Poa palustris (fowl bluegrass)	1.8	0-3	50	0.88	N
Scirpus cespitosus (tufted bulrush)	1.8	0-3	50	0.88	N
Scirpus hudsonianus (Hudson Bay bulrush)	3.0	0-3	25	0.75	N
Scirpus spp. (bulrush)	0.5	0-0.5	25	0.13	N
Forbs (N = 13)					
Achillea millefolium (common yarrow)	0.5	0-0.5	25	0.13	N
Equisetum fluviatile (swamp horsetail)	10.0	0-10	25	2.50	N
Equisetum variegatum (variegated horsetail)	3.0	0-3	25	0.75	N
Galium labradoricum (Labrador bedstraw)	0.5	0-0.5	25	0.13	N
Geum rivale (purple avens)	0.5	0-0.5	25	0.13	N
Habenaria hyperborea (northern green bog orchid)	0.5	0-0.5	25	0.13	N
Menyanthes trifoliata (buck-bean)	3.0	0-3	25	0.75	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	25	0.13	N
Petasites sagittatus (arrow-leaved coltsfoot)	3.0	0-3	25	0.75	N
Polygonum viviparum (alpine bistort)	0.5	0-0.5	25	0.13	N
Rumex occidentalis (western dock)	0.5	0-0.5	25	0.13	N
Senecio integerrimus (entire-leaved groundsel)	3.0	0-3	25	0.75	N
Smilacina trifolia (three-leaved Solomon's-seal)	1.3	0-3	75	1.00	N

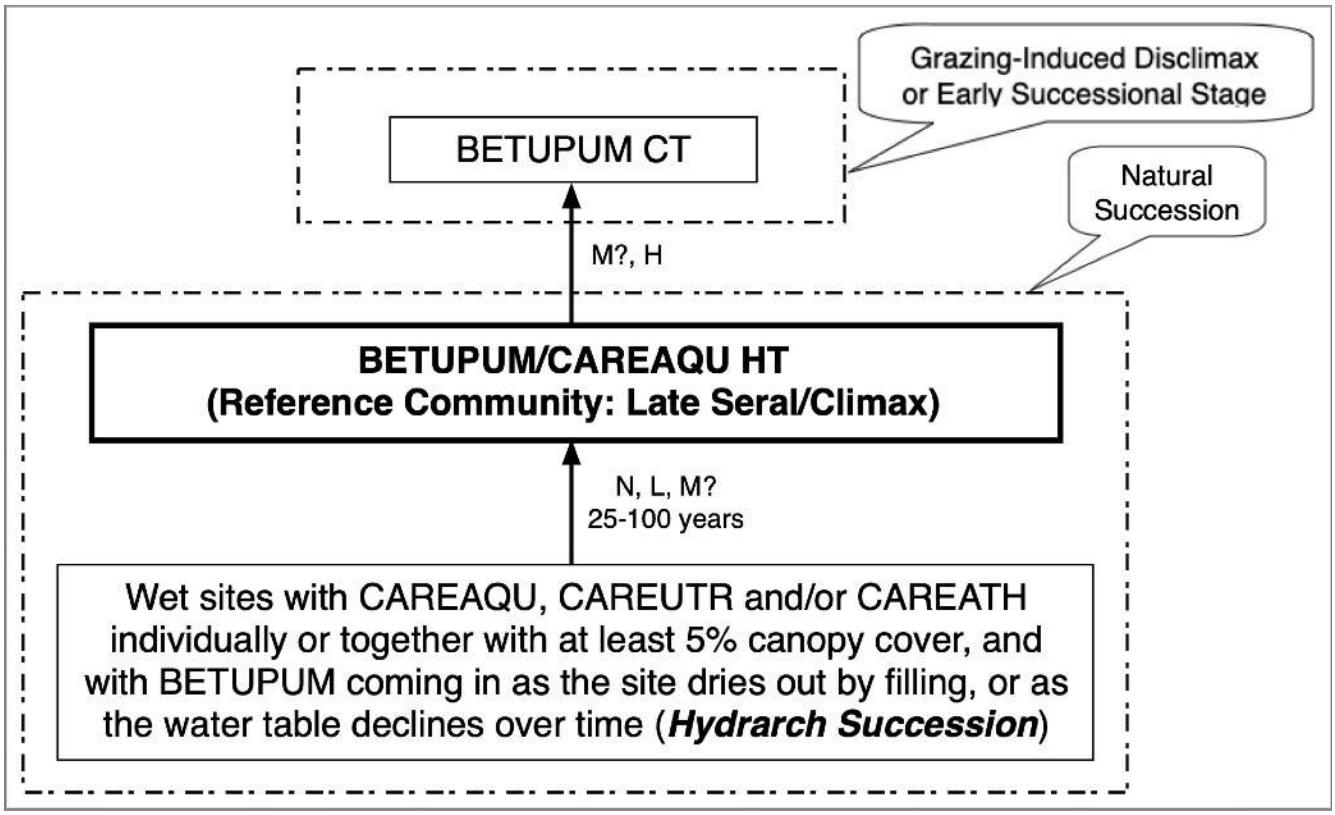
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type typically develops on a site through primary succession (hydrarch succession), wherein a wet meadow stand of *Carex aquatilis* (water sedge), *Carex atherodes* (awned sedge), or *Carex utriculata* (beaked sedge) located in a shallow depression gradually fills in or dries out enough for *Betula pumila* (dwarf birch) to become established.

Figure 106 shows a schematic diagram of vegetation successional pathways on sites of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type.



Successional Pathway of *Betula pumila/Carex aquatilis* (dwarf birch/water sedge)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES

CAREAQU—*Carex aquatilis* (water sedge)
CAREATH—*Carex atherodes* (awned sedge)
CAREUTR—*Carex utriculata* (beaked sedge)

BETUPUM—*Betula pumila* (dwarf birch)
BETUPUM/CAREAQU HT—*Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type
BETUPUM CT—*Betula pumila* (dwarf birch) community type

Figure 106. Successional pathway for sites of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 107 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

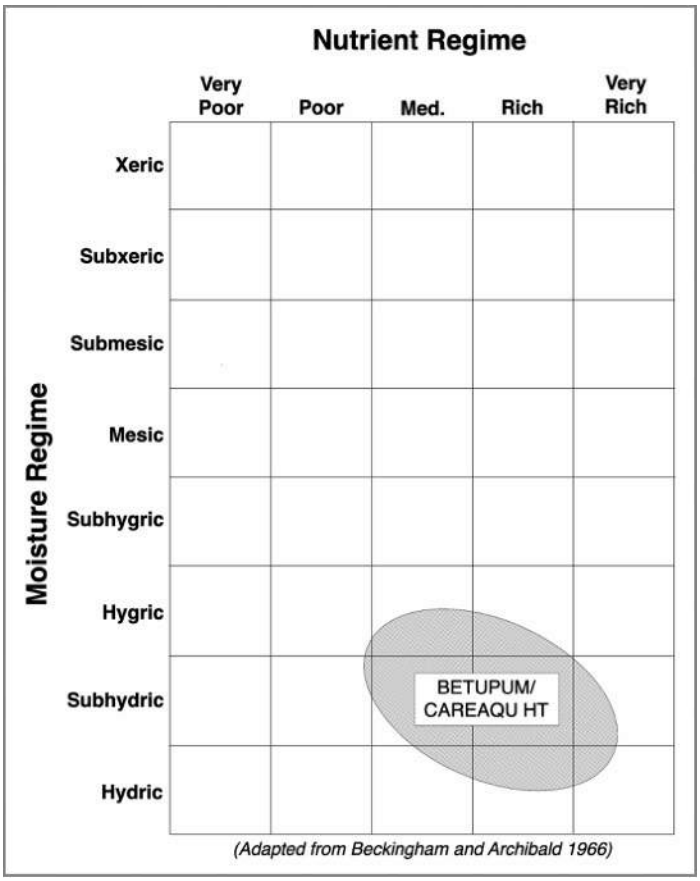


Figure 107. Edatope grid position for the *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type (BETUPUM/CAREAQU HT)

SOILS

Soils information is currently unavailable for sites supporting the *Betula pumila/Carex aquatilis* (dwarf birch/ water sedge) habitat type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites will likely have a community dominated by willows, such as *Salix pedicellaris* (bog willow) or *Salix myrtillifolia* (myrtle-leaved willow). Adjacent drier sites will often have a community dominated by *Picea mariana* (black spruce), *Abies lasiocarpa* (subalpine fir) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Betula pumila* (dwarf birch)**—*Betula pumila* (dwarf birch) occurs commonly in northern Alberta, growing in marshes, bogs, and swampy woods (Tannas 1997a). The species is found on wet, organic soil of swamps, fens; valleys to lower montane sites (Lesica 2012).

In Alberta, *Betula pumila* (dwarf birch) occurs in Boreal, Parkland, and Foothills natural regions on clayey, loamy, and sandy soils. It is found on poorly to moderately drained sites, and tolerates wet to moist conditions with full sun exposure (AWES 2022).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is very common and widely distributed across Alberta (Tannas 1997a). It is a wetland species, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). *Carex aquatilis* (water sedge) is a native, wetland obligate, long-lived perennial. It is a sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of finer roots (Hauser 2006). It thrives on disturbed sites, is shade intolerant, and occurs in various stages of seral succession (Hauser 2006).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is common and widely distributed across Alberta. It is a wetland obligate, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). It is a long-lived perennial sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of fine roots (Johnson and others 1995).

Carex utriculata (beaked sedge) is strongly rhizomatous and colonial, typically forming a dense sod. Creeping rhizomes are long, slender or stout, and deep-seated. It grows on sites with high soil moisture, typically with the water table at or above the soil surface during the growing season. This is one of our wettest sedges. On some sites, water tables are above the soil surface all year, and rarely drop below the rooting zone. The species occurs on a range of soil types, with textures from silt loams or silty clays to loamy sands (Anderson 2008).

Carex utriculata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates with continually high water tables and persists indefinitely to form climax communities (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) is very common and widely distributed across Alberta (Tannas 1997a). The species is a wetland obligate, growing along slough margins, shorelines, in marshes, and wet meadows, often in standing water (Tannas 1997a). It is a long-lived perennial with moderate tolerance for

drought, while tolerance is low for salinity, acidity, and shade. It does best on clay to clay loam soils (Hardy BBT Limited 1989).

Livestock

***Betula pumila* (dwarf birch)**—*Betula pumila* (dwarf birch) has fair nutritional value similar to that of *Alnus* species (alders) and is tolerant of moderate to heavy browsing (Tannas 1997a).

***Carex aquatilis* (water sedge)**—The livestock forage value of *Carex aquatilis* (water sedge) is rated as good (Tannas 1997a), but varies with region, season, and previous grazing use. On narrow riparian or wetland sites within large pastures, *Carex* species (sedges) are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur. In general, *Carex* species (sedges) should respond satisfactorily to traditional grazing systems. However, on streamside sites ample residual cover should be left to protect the soil surface and trap sediments during fall rains or spring runoff. Removing cattle for at least 30 days from these streamside sites for sedge regrowth at the end of the growing season should provide sufficient residual cover (Myers 1989).

Given that *Carex aquatilis* (water sedge) grows in wet places, it is generally not grazed until late summer and fall when soils have dried (Hauser 2006). Very wet soils may deter animal use until they dry. However, if high level of grazing does occur, there will be a marked decrease in *Carex aquatilis* (water sedge) and an increase in the less palatable *Juncus balticus* (wire rush) (Tannas 1997a).

***Carex utriculata* (beaked sedge)**—Livestock forage value of *Carex utriculata* (beaked sedge) is high (Tannas 1997a, Beckingham 1991). The species is palatable in the spring, but palatability declines as the plants become coarse and tough in summer (Tannas 1997a, Hansen and others 1988). Relative palatability may then increase again in fall as the sedge cures and upland forage is less attractive. *Carex utriculata* (beaked sedge) cover decreases in response to high levels of grazing pressure, and will be replaced with less productive and less palatable species, such as *Juncus balticus* (wire rush) and *Poa* species (bluegrass) (Thompson and Hansen 2003).

In general, *Carex* species (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites, residual cover should be left to protect the banks and the soil surface, and to filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days should provide time for sufficient residual cover regrowth on streamside riparian sites (Myers 1989).

***Carex atherodes* (awned sedge)**—Livestock forage value of *Carex atherodes* (awned sedge) is high (Tannas 1997a, Beckingham 1991). *Carex atherodes* (awned sedge) provides good protein and a balance of other nutritional elements, while remaining palatable during the late season when upland forage is less palatable (Tannas 1997a, Hansen and others 1988). In general, *Carex* (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites residual cover should be left to protect the soil surface and filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days for sedge regrowth should provide sufficient residual cover on streamside riparian sites (Myers 1989).

Very wet soils may deter animal use until they dry, allowing the most palatable species to replenish their carbohydrate reserves and to persist in these communities. However, if high levels of grazing do occur, there will be a marked decrease in *Carex atherodes* (awned sedge) with an increase in less palatable species, such as *Juncus balticus* (wire rush). *Carex atherodes* (awned sedge) has medium palatability and medium tolerance for livestock use. Its chemical composition is similar to that of meadow grasses, upland short grass, and mixed prairie species. Seasonal declines in crude protein, phosphorous and carotene were also similar to that of native upland grasses (Hardy BBT Limited 1989).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is grazed by many ungulates, including moose, caribou, and elk, but it is not a major component of their diet. Due to the saturated habitat of the species, grazing by most ungulates is limited. *Carex aquatilis* (water sedge) habitat provides nesting and hiding cover for some birds, waterfowl, and small mammals. In riparian and wetland sites, The species is also an important source of food for a variety of waterfowl (Hauser 2006).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is grazed by moose, elk, mule deer, bison, grizzly bears, and sandhill cranes (Anderson 2008). The species is an important component of valuable breeding and feeding grounds for geese and other waterfowl. Birds commonly associated with *Carex utriculata* (beaked sedge) habitats include mallard, green-winged teal, common yellowthroat, red-winged black bird, song sparrow, and tree swallow. *Carex utriculata* (beaked sedge) stands are usually more important as feeding grounds than as nesting grounds because of their low stature, lack of structural diversity, and high water levels. Elk and moose often graze *Carex utriculata* (beaked sedge) stands when *Carex atherodes* (awned sedge) is present (Anderson 2008).

***Carex atherodes* (awned sedge)**—Wetland sedge species, such as *Carex atherodes* (awned sedge) are an important component of valuable nesting and feeding grounds for geese and other waterfowl. These stands of prolific seed producing species are usually more important as feeding grounds than as nesting grounds because of their low stature, high water level, and lack of structural diversity (Thompson and Hansen 2003).

Fisheries

***Carex aquatilis* (water sedge)**—Stands of *Carex aquatilis* (water sedge) often are adjacent to streams supporting trout fisheries. The combined tufted and rhizomatous growth habit of the species effectively stabilizes streambanks. Overhanging *Carex* species (sedges) along the banks provide valuable resting cover and shade for fish (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—The dense network of roots of the rhizomatous *Carex utriculata* (beaked sedge) is very effective in binding soil and stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish (Thompson and Hansen 2003).

***Carex atherodes* (awned sedge)**—Stands of *Carex atherodes* (awned sedge) are found more frequently in lentic situations around depressional wetlands, sloughs, potholes, wet meadows, and fens where fish habitat is not at issue (Thompson and Hansen 2003).

Fire

***Carex aquatilis* (water sedge)**—Sites supporting stands of *Carex aquatilis* (water sedge) seldom burn, except in periods of severe drought. When stands of the species do burn, the plants are usually top-killed by the fire and soon re-establish after the fire by seed and/or lateral spread of surviving rhizomes (Hauser 2006). The rhizomes are approximately 5 cm below the ground surface, and are somewhat protected from the heat. The wet habitat also provides protection for roots and rhizomes, although the better-drained areas are more susceptible to fires during dry periods.

Stands of *Carex aquatilis* (water sedge) are suited to prescribed fire, but exclusion of livestock during the year prior to burning is necessary. Residual cover burns well in spring, prior to the growing season. Fire will reduce

litter accumulations and temporarily increase productivity. However, species composition in the community will not drastically shift from dominance by *Carex aquatilis* (water sedge) (DeBenedetti and Parsons 1984). Care must be taken in burning along streambanks, so as to avoid impairing the excellent erosion protection provided by the species (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—Sites supporting stands of *Carex utriculata* (beaked sedge) are very wet, except at times of severe drought, and therefore they seldom burn. However, *Carex utriculata* (beaked sedge) sprouts from rhizomes, so it is often able to survive after being top-killed by fire. However, peat soils, common in these communities, can burn when dry, and the heat from such fires can penetrate the soil, destroying the sedge rhizomes. It is necessary that livestock be excluded during the year prior to burning. Caution should be used with fires along streams because of the excellent erosion protection *Carex utriculata* (beaked sedge) provides. Fires do little to change plant composition of beaked sedge communities (DeBenedetti and Parsons 1984). Fire may regress seral succession in treed or shrubby fen stands back to open sedge meadows that support little woody vegetation (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) grows on wet sites that seldom dry out enough to carry fire, but the species is adapted to light intensity fire. Residual cover should burn well in early spring, prior to the growing season. Burning will reduce litter accumulations and temporarily increase productivity (Hansen and others 1988), but care should be taken with burning to avoid damage to the excellent soil erosion protection this species provides. Under drought conditions, there is danger of burning the soil peat layer and damaging the roots (Thompson and Hansen 2003).

Rehabilitation/Restoration Considerations

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) provides excellent erosion protection along streambanks, buffering against the erosive force of flood events, and filtering sediments during spring flows. Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex aquatilis* (water sedge) tends to form a dense, thick sod that is highly resistant to erosion. (Hauser 2006).

***Carex utriculata* (beaked sedge)**—Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex utriculata* (beaked sedge) has a dense network of rhizomatous roots and forms a thick sod that is highly resistant to erosion and effective in stabilizing streambanks (Anderson 2008).

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) rates high in value for erosion control, and high for its persistence, once established on a site (Hardy BBT Limited 1989). Generally, due to their stronger rhizomatous roots, *Carex* species (sedges) offer better streambank protection than grasses. *Carex atherodes* (awned sedge) forms a dense, thick sod highly resistant to erosion. Along streambanks, the sod may overhang the bank and sag into the water, providing additional protection from erosion (Thompson and Hansen 2003).

Carex atherodes (awned sedge) is suited for long-term revegetation of disturbed sites and erosion control on sites with a high water table. The species can rapidly re-colonize disturbed sites by seed and rhizome extension. Its rhizomes form a dense network effective in stabilizing streambanks and preventing soil erosion (Thompson and Hansen 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type due to the document not identifying *Carex* (sedges) to the species level (i.e., *Carex* [sedges] were only identified to the genus level)

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type has not been described in the region.

Betula pumila Community Type
(dwarf birch Community Type)

BETUPUM Community Type
Number of Stands = 4 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 2; Other Data Sets = 2)

LOCATION AND ASSOCIATED LANDFORMS

The *Betula pumila* (dwarf birch) community type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. Stands of *Betula pumila* (dwarf birch) occur commonly in marshes, bogs, swamps, and fens from valley bottoms to lower montane sites on wet, organic soils (Tannas 1997a).

Photo 25 shows a typical stand of the *Betula pumila* (dwarf birch) community type.

Photo 25. A stand of the *Betula pumila* (dwarf birch) community type (photo provided by Alan Dodd)

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The

index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 503 shows the five most prominent plant species among the four lifeforms for species recorded in all four stands of the *Betula pumila* (dwarf birch) community type. *Betula pumila* (dwarf birch) is by far the most prominent species recorded in stands of this community type, followed well behind by *Calamagrostis canadensis* (marsh reed grass).

Table 503. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Betula pumila* (dwarf birch) community type (number = 4 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Larix laricina (tamarack)	1.00	Native
Picea glauca (white spruce)	0.88	Native
Picea mariana (black spruce)	0.25	Native
Pinus contorta (lodgepole pine)	0.25	Native
Populus tremuloides (aspen)	0.13	Native
Shrubs		
Betula pumila (dwarf birch)	47.50	Native
Vaccinium vitis-idaea (bog cranberry)	2.50	Native
Salix pedicellaris (bog willow)	2.25	Native
Andromeda polifolia (bog rosemary)	0.25	Native
Rubus arcticus (dwarf raspberry)	0.25	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	13.25	Native
Carex canescens (hoary sedge)	7.50	Native
Muhlenbergia glomerata (bog muhly)	7.50	Native
Carex gynocrates (northern bog sedge)	2.63	Native
Carex diandra (two-stamened sedge)	2.50	Native
Forbs		
Equisetum fluviatile (swamp horsetail)	2.50	Native
Potentilla palustris (marsh cinquefoil)	1.50	Native
Epilobium palustre (marsh willowherb)	0.75	Native
Equisetum palustre (marsh horsetail)	0.75	Native
Parnassia palustris (northern grass-of-parnassus)	0.75	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 504 through Table 507, break out the vegetation recorded in four stands sampled of the *Betula pumila* (dwarf birch) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is an uncommon, moderately species rich, shrub dominated community type of incidental occurrence across the study area.

Table 504 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula pumila* (dwarf birch) community type. For the 4 stands comprising the community type, the number of unique species was 47 with 47 (100.0 percent) of them being native species.

Table 504. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Betula pumila* (dwarf birch) community type (number = 4 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	5	5	0	0
Shrubs	11	11	0	0
Graminoids	14	14	0	0
Forbs	17	17	0	0
TOTAL	***47 (100.0%)***	***47 (100.0%)***	***0 (0.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 505 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula pumila* (dwarf birch) community type. The average number of species per stand is 17.0, with native species comprising 17.0 species per stand or 100.0 percent.

Table 505. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Betula pumila* (dwarf birch) community type (number = 4 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.5	2.5	0.0	0.0
Shrubs	5.0	5.0	0.0	0.0
Graminoids	4.5	4.5	0.0	0.0
Forbs	5.0	5.0	0.0	0.0
TOTAL	***17.0 (100.0%)***	***17.0 (100.0%)***	***0.0 (0.0%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 506 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Betula pumila* (dwarf birch) community type. The average canopy cover per stand is 101.4 percent, with native species comprising 101.4 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 506. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Betula pumila* (dwarf birch) community type (number = 4 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2.5%	2.5%	0.0%	0.0%
Shrubs	53.8%	53.8%	0.0%	0.0%
Graminoids	36.5%	36.5%	0.0%	0.0%
Forbs	8.6%	8.6%	0.0%	0.0%
TOTAL	***101.4% (100.0%)***	***101.4% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 507 shows the average number of species and average canopy cover by lifeform in stands of the *Betula pumila* (dwarf birch) community type. The average number of species per stand was 17.0 with an average canopy cover of 101.4 percent.

Table 507. Average number of species and average canopy cover by lifeform in stands of the *Betula pumila* (dwarf birch) community type (number = 4 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	2.5	2.5%
Shrubs	5.0	53.8%
Graminoids	4.5	36.5%
Forbs	5.0	8.6%
TOTAL	***17.0***	***101.4%***

Sampled Stands Plant Species List

A total of 47 plant species were recorded on at least one of four stands sampled of the *Betula glandulosa* (bog birch) community type (Table 508). Five tree species were recorded in small amounts, and 11 shrub species were recorded, with only *Betula pumila* (dwarf birch) being very prominent. *Calamagrostis canadensis* (marsh reed grass) was the most prominent of the 14 graminoid species recorded, while none of the 17 forbs was more than moderately prominent.

Table 508. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Betula pumila* (dwarf birch) community type (number = 4 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trees (N = 5)					
Larix laricina (tamarack)	1.3	0-3	75	1.00	N
Picea glauca (white spruce)	1.8	0-3	50	0.88	N
Picea mariana (black spruce)	0.5	0-0.5	50	0.25	N
Pinus contorta (lodgepole pine)	0.5	0-0.5	50	0.25	N
Populus tremuloides (aspen)	0.5	0-0.5	25	0.13	N
Shrubs (N = 11)					
Andromeda polifolia (bog rosemary)	0.5	0-0.5	50	0.25	N
Betula pumila (dwarf birch)	47.5	20-90	100	47.50	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	25	0.13	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	50	0.25	N
Salix bebbiana (beaked willow)	0.5	0-0.5	25	0.13	N
Salix candida (hoary willow)	0.5	0-0.5	50	0.25	N
Salix glauca (smooth willow)	0.5	0-0.5	25	0.13	N
Salix pedicellaris (bog willow)	3.0	0-3	75	2.25	N
Salix planifolia (flat-leaved willow)	0.5	0-0.5	50	0.25	N
Vaccinium myrtilloides (common blueberry)	0.5	0-0.5	25	0.13	N
Vaccinium vitis-idaea (bog cranberry)	10.0	0-10	25	2.50	N
Graminoids (N = 14)					
Calamagrostis canadensis (marsh reed grass)	26.5	0-50	50	13.25	N
Carex aquatilis (water sedge)	3.0	0-3	25	0.75	N
Carex canescens (hoary sedge)	30.0	0-30	25	7.50	N

Table 508. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Carex diandra (two-stamened sedge)	10.0	0-10	25	2.50	N
Carex gynocrates (northern bog sedge)	5.3	0-10	50	2.63	N
Carex lasiocarpa (hairy-fruited sedge)	1.8	0-3	50	0.88	N
Carex parryana (Parry's sedge)	0.5	0-0.5	25	0.13	N
Carex sartwellii (Sartwell's sedge)	0.5	0-0.5	25	0.13	N
Carex spp. (sedge)	0.5	0-0.5	25	0.13	N
Carex vaginata (sheathed sedge)	0.5	0-0.5	25	0.13	N
Eriophorum chamissonis (russett cotton grass)	3.0	0-3	25	0.75	N
Eriophorum viridi-carinatum (thin-leaved cotton grass)	0.5	0-0.5	25	0.13	N
Muhlenbergia glomerata (bog muhly)	15.0	0-20	50	7.50	N
Scirpus microcarpus (small-fruited bulrush)	0.5	0-0.5	25	0.13	N
Forbs (N = 17)					
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	25	0.13	N
Epilobium palustre (marsh willowherb)	3.0	0-3	25	0.75	N
Equisetum fluviatile (swamp horsetail)	10.0	0-10	25	2.50	N
Equisetum palustre (marsh horsetail)	3.0	0-3	25	0.75	N
Galium labradoricum (Labrador bedstraw)	0.5	0-0.5	50	0.25	N
Geum aleppicum (yellow avens)	0.5	0-0.5	25	0.13	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	25	0.13	N
Lysimachia thyrsiflora (tufted loosestrife)	0.5	0-0.5	25	0.13	N
Menyanthes trifoliata (buck-bean)	0.5	0-0.5	50	0.25	N
Parnassia palustris (northern grass-of-parnassus)	3.0	0-3	25	0.75	N
Pedicularis labradorica (Labrador lousewort)	0.5	0-0.5	25	0.13	N
Polygonum amphibium (water smartweed)	0.5	0-0.5	25	0.13	N
Potentilla palustris (marsh cinquefoil)	3.0	0-3	50	1.50	N
Ranunculus macounii (Macoun's buttercup)	0.5	0-0.5	25	0.13	N
Rumex occidentalis (western dock)	0.5	0-0.5	25	0.13	N
Triglochin maritima (seaside arrow-grass)	3.0	0-3	25	0.75	N
Typha latifolia (common cattail)	0.5	0-0.5	25	0.13	N

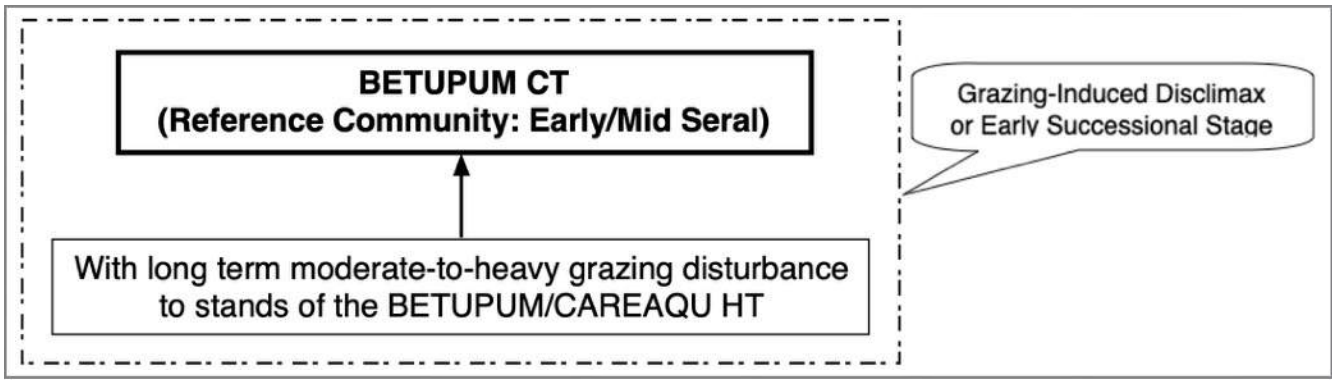
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Betula pumila* (dwarf birch) community type is usually the result of intensive grazing by livestock during periods of drought, when the animals can gain access to stands of the normally saturated *Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type, depleting the palatable graminoids and introducing disturbance species, such as *Poa pratensis* (Kentucky bluegrass).

Figure 108 shows a schematic diagram of vegetation successional pathways on sites of the *Betula pumila* (dwarf birch) community type.



Successional Pathway of *Betula pumila* (dwarf birch) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Betula pumila* (dwarf birch) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
BETUPUM/CAREAQU HT—*Betula pumila/Carex aquatilis* (dwarf birch/water sedge) habitat type
BETUPUM CT—*Betula pumila* (dwarf birch) community type

Figure 108. Successional pathway for sites of the *Betula pumila* (dwarf birch) community type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 109 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Betula pumila* (dwarf birch) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

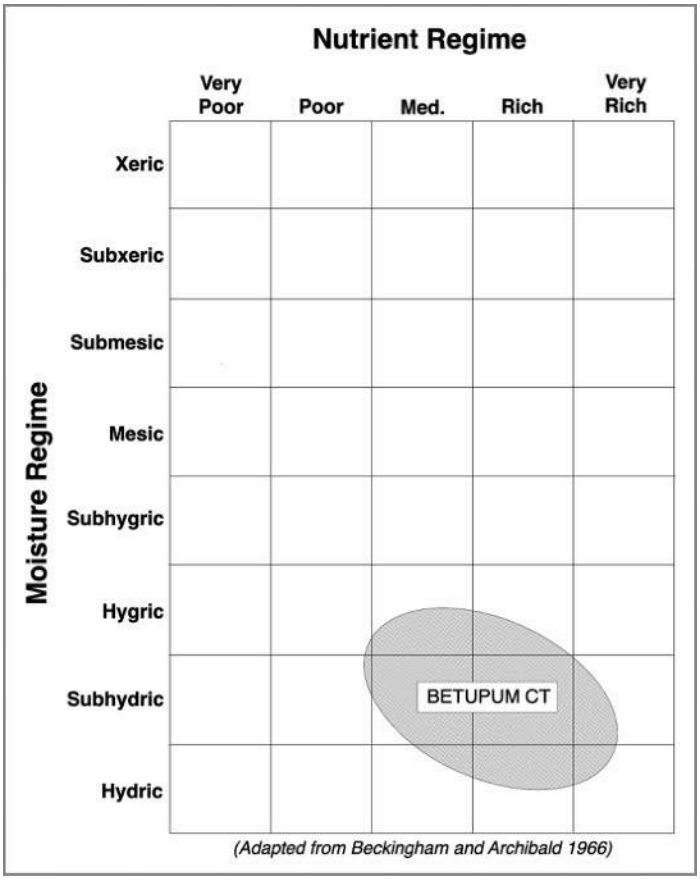


Figure 109. Edatope grid position for the *Betula pumila* (dwarf birch) community type (BETUPUM CT)

SOILS

Soils information is currently unavailable for sites supporting the *Betula pumila* (dwarf birch) community type. The only soil information available is for individual species of this type, which can be found in the *Management Information* section (below), in the sub-heading *Ecology of Major Plant Species.*

ADJACENT COMMUNITIES

Adjacent wetter sites will likely have a community dominated by willows, such as *Salix pedicellaris* (bog willow) or *Salix myrtillifolia* (myrtle-leaved willow). Adjacent drier sites will often have a community dominated by *Picea mariana* (black spruce), *Abies lasiocarpa* (subalpine fir) and/or *Populus tremuloides* (aspen).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Betula pumila* (dwarf birch)**—*Betula pumila* (dwarf birch) occurs commonly in northern Alberta, growing in marshes, bogs, and swampy woods (Tannas 1997a). The species is found on wet, organic soil of swamps, fens; valleys to lower montane sites (Lesica 2012).

In Alberta, *Betula pumila* (dwarf birch) occurs in Boreal, Parkland, and Foothills natural regions on clayey, loamy, and sandy soils. It is found on poorly to moderately drained sites, and tolerates wet to moist conditions with full sun exposure (AWES 2022).

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

Livestock

***Betula pumila* (dwarf birch)**—*Betula pumila* (dwarf birch) has fair nutritional value similar to that of *Alnus* species (alders) and is tolerant of moderate to heavy browsing (Tannas 1997a).

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

Fire

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

Rehabilitation/Restoration Considerations

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Betula pumila* (dwarf birch) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Betula pumila* (dwarf birch) community type has not been described in the region.

Elaeagnus commutata Community Type
(silverberry Community Type)

ELAECOM Community Type
Number of Stands = 19 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 4; Other Data Sets = 15)

LOCATION AND ASSOCIATED LANDFORMS

The *Elaeagnus commutata* (silverberry) community type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. *Elaeagnus commutata* (silverberry) grows on grasslands, shrubby slopes, along streams, and on sandy soils wherever moisture is adequate (Tannas 1997a). This species grows on a variety of sites from warm, open, sunny slopes to cooler, forested areas and woodland thickets. It is often found on moist sites along streams and near springs and seeps (Esser 1994).

Photo 26 shows a typical stand of the *Elaeagnus commutata* (silverberry) community type.

Photo 26. A stand of the *Elaeagnus commutata* (silverberry) community type (photo provided by Hilary Baker)

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 509 shows the five most prominent plant species among the four lifeforms for species recorded in all 19 stands of the *Elaeagnus commutata* (silverberry) community type. *Elaeagnus commutata* (silverberry) is by far the most prominent species recorded in stands of this community type, followed far behind by two introduced grasses, *Poa pratensis* (Kentucky bluegrass) and *Bromus inermis* (smooth brome).

Table 509. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Elaeagnus commutata* (silverberry) community type (number = 19 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus balsamifera (balsam poplar)	0.37	Native
Picea glauca (white spruce)	0.24	Native
Populus tremuloides (aspen)	0.21	Native
Shrubs		
Elaeagnus commutata (silverberry)	54.21	Native
Symphoricarpos occidentalis (buckbrush)	8.74	Native
Rosa woodsii (common wild rose)	4.92	Native
Rosa acicularis (prickly rose)	4.79	Native
Juniperus horizontalis (creeping juniper)	1.37	Native
Graminoids		
Poa pratensis (Kentucky bluegrass)	18.97	Introduced
Bromus inermis (smooth brome)	11.34	Introduced
Calamagrostis stricta (narrow reed grass)	3.68	Native
Juncus balticus (wire rush)	3.32	Native
Agropyron smithii (western wheat grass)	2.63	Native

Table 509. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Trifolium repens (white clover)	2.29	Introduced
Cirsium arvense (Canada thistle)	1.82	Introduced
Taraxacum officinale (common dandelion)	1.76	Introduced
Achillea millefolium (common yarrow)	1.45	Native
Fragaria virginiana (wild strawberry)	1.45	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 510 through Table 513, break out the vegetation recorded in 19 stands sampled of the *Elaeagnus commutata* (silverberry) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, shrub dominated community type of minor occurrence across the study area.

Table 510 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Elaeagnus commutata* (silverberry) community type. For the 19 stands comprising the community type, the number of unique species was 138 with 120 (87.0 percent) of them being native species.

Table 510. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Elaeagnus commutata* (silverberry) community type (number = 19 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3	3	0	0
Shrubs	24	24	0	0
Graminoids	37	31	6	0
Forbs	74	62	11	1
TOTAL	***138 (100.0%)***	***120 (87.0%)***	***17 (12.3%)***	***1 (0.7%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 511 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Elaeagnus commutata* (silverberry) community type. The average number of species per stand is 17.1, with native species comprising 13.4 species per stand or 78.4 percent.

Table 511. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Elaeagnus commutata* (silverberry) community type (number = 19 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.6	0.6	0.0	0.0
Shrubs	3.8	3.8	0.0	0.0
Graminoids	4.4	2.5	1.9	0.0
Forbs	8.3	6.5	1.7	0.1
TOTAL	***17.1 (100.0%)***	***13.4 (78.4%)***	***3.6 (21.1%)***	***0.1 (0.6%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 512 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Elaeagnus commutata* (silverberry) community type. The average canopy cover per stand is 148.8 percent, with native species comprising 107.6 percent or 72.3 percent of the total amount of average canopy cover per stand.

Table 512. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Elaeagnus commutata* (silverberry) community type (number = 19 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.8%	0.8%	0.0%	0.0%
Shrubs	79.6%	79.6%	0.0%	0.0%
Graminoids	48.6%	15.6%	33.1%	0.0%
Forbs	19.8%	11.6%	8.1%	0.0%
TOTAL	***148.8% (100.0%)***	***107.6% (72.3%)***	***41.2% (27.7%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 513 shows the average number of species and average canopy cover by lifeform in stands of the *Elaeagnus commutata* (silverberry) community type. The average number of species per stand was 17.1 with an average canopy cover of 148.8 percent.

Table 513. Average number of species and average canopy cover by lifeform in stands of the *Elaeagnus commutata* (silverberry) community type (number = 19 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.6	0.8%
Shrubs	3.8	79.6%
Graminoids	4.4	48.6%
Forbs	8.3	19.8%
TOTAL	***17.1***	***148.8%***

Sampled Stands Plant Species List

A total of 138 plant species were recorded on at least one of 19 stands sampled of the *Elaeagnus commutata* (silverberry) community type (Table 514). Three tree species were recorded in small amounts, and among the 24 shrub species recorded, only *Elaeagnus commutata* (silverberry) is very prominent. *Poa pratensis* (Kentucky bluegrass) is most prominent of the 37 graminoid species recorded, and of the 74 forbs recorded, none is more than moderately prominent.

Table 514. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Elaeagnus commutata* (silverberry) community type (number = 19 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 3)					
Picea glauca (white spruce)	1.1	0-3	21	0.24	N
Populus balsamifera (balsam poplar)	1.8	0-3	21	0.37	N
Populus tremuloides (aspen)	1.3	0-3	16	0.21	N
Shrubs (N = 24)					
Amelanchier alnifolia (Saskatoon)	6.0	0-20	21	1.26	N
Arctostaphylos uva-ursi (common bearberry)	0.5	0-0.5	5	0.03	N
Berberis repens (creeping mahonia)	20.0	0-20	5	1.05	N
Betula glandulosa (bog birch)	0.5	0-0.5	5	0.03	N
Clematis ligusticifolia (western clematis)	3.0	0-3	5	0.16	N
Dryas drummondii (yellow mountain avens)	20.0	0-20	5	1.05	N
Elaeagnus commutata (silverberry)	54.2	20-90	100	54.21	N
Juniperus communis (ground juniper)	0.5	0-0.5	5	0.03	N
Juniperus horizontalis (creeping juniper)	8.7	0-20	16	1.37	N
Potentilla fruticosa (shrubby cinquefoil)	1.5	0-3	26	0.39	N
Prunus pensylvanica (pin cherry)	0.5	0-0.5	5	0.03	N
Prunus virginiana (choke cherry)	0.5	0-0.5	5	0.03	N
Rhus radicans (poison ivy)	3.0	0-3	5	0.16	N

Table 514. (cont.)

Species	Percent Canopy Cover Average	Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Ribes lacustre (bristly black currant)	3.0	0-3	5	0.16	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	5	0.03	N
Rosa acicularis (prickly rose)	11.4	0-30	42	4.79	N
Rosa arkansana (prairie rose)	3.0	0-3	5	0.16	N
Rosa woodsii (common wild rose)	18.7	0-40	26	4.92	N
Rubus idaeus (wild red raspberry)	0.5	0-0.5	5	0.03	N
Rubus pubescens (dewberry)	10.0	0-10	5	0.53	N
Salix bebbiana (beaked willow)	3.0	0-3	11	0.32	N
Salix exigua (sandbar willow)	0.5	0-0.5	5	0.03	N
Shepherdia canadensis (Canada buffaloberry)	3.0	0-3	5	0.16	N
Symphoricarpos occidentalis (buckbrush)	15.1	0-30	58	8.74	N
Graminoids (N = 37)					
Agropyron dasystachyum (northern wheat grass)	10.0	0-10	5	0.53	N
Agropyron repens (quack grass)	3.0	0-3	16	0.47	I
Agropyron smithii (western wheat grass)	50.0	0-50	5	2.63	N
Agropyron trachycaulum (slender wheat grass)	1.0	0-3	26	0.26	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	5	0.03	N
Agrostis stolonifera (redtop)	0.5	0-0.5	5	0.03	I
Beckmannia syzigachne (slough grass)	0.5	0-0.5	5	0.03	N
Bouteloua gracilis (blue grama)	0.5	0-0.5	5	0.03	N
Bromus anomalus (nodding brome)	0.5	0-0.5	5	0.03	N
Bromus carinatus (keeled brome)	10.0	0-10	5	0.53	N
Bromus inermis (smooth brome)	19.6	0-90	58	11.34	I
Bromus inermis subsp. *pumpellianus* (northern awnless brome)	0.5	0-0.5	5	0.03	N
Calamagrostis canadensis (marsh reed grass)	5.3	0-10	11	0.55	N
Calamagrostis montanensis (plains reed grass)	0.5	0-0.5	5	0.03	N
Calamagrostis stricta (narrow reed grass)	70.0	0-70	5	3.68	N
Carex filifolia (thread-leaved sedge)	0.5	0-0.5	5	0.03	N
Carex lanuginosa (woolly sedge)	3.0	0-3	5	0.16	N
Carex obtusata (blunt sedge)	0.5	0-0.5	5	0.03	N
Carex pensylvanica (sun-loving sedge)	3.0	0-3	5	0.16	N
Carex raynoldsii (Raynold's sedge)	0.5	0-0.5	5	0.03	N
Carex sprengelii (Sprengel's sedge)	0.5	0-0.5	5	0.03	N
Deschampsia cespitosa (tufted hair grass)	10.0	0-10	5	0.53	N
Elymus innovatus (hairy wild rye)	3.0	0-3	5	0.16	N
Elymus virginicus (Virginia wild rye)	3.0	0-3	5	0.16	N
Festuca idahoensis (bluebunch fescue)	0.5	0-0.5	5	0.03	N
Festuca rubra subsp. *arctica* (Richardson's fescue)	6.5	0-10	11	0.68	N
Festuca scabrella (rough fescue)	0.5	0-0.5	5	0.03	N
Juncus balticus (wire rush)	12.6	0-20	26	3.32	N
Koeleria macrantha (June grass)	7.0	0-20	16	1.11	N
Phleum pratense (timothy)	7.8	0-20	26	2.05	I
Poa compressa (Canada bluegrass)	1.8	0-3	11	0.18	I

Table 514. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Poa palustris (fowl bluegrass)	0.5	0-0.5	11	0.05	N
Poa pratensis (Kentucky bluegrass)	25.8	0-60	74	18.97	I
Stipa columbiana (Columbia needle grass)	3.0	0-3	5	0.16	N
Stipa richardsonii (Richardson needle grass)	0.5	0-0.5	5	0.03	N
Stipa spp. (needle grass)	0.5	0-0.5	5	0.03	N
Stipa viridula (green needle grass)	2.0	0-3	26	0.53	N
Forbs (N = 74)					
Achillea millefolium (common yarrow)	2.5	0-10	58	1.45	N
Allium cernuum (nodding onion)	0.5	0-0.5	5	0.03	N
Anemone multifida (cut-leaved anemone)	3.0	0-3	5	0.16	N
Antennaria parvifolia (small-leaved everlasting)	3.0	0-3	5	0.16	N
Arctium minus (lesser burdock)	3.0	0-3	5	0.16	I
Arnica fulgens (shining arnica)	0.5	0-0.5	5	0.03	N
Artemisia frigida (pasture sagewort)	0.5	0-0.5	5	0.03	N
Artemisia ludoviciana (prairie sagewort)	1.8	0-3	11	0.18	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	11	0.05	N
Aster ericoides (tufted white prairie aster)	2.4	0-3	21	0.50	N
Aster falcatus (creeping white prairie aster)	0.5	0-0.5	5	0.03	N
Aster hesperius (western willow aster)	0.5	0-0.5	5	0.03	N
Aster laevis (smooth aster)	0.5	0-0.5	11	0.05	N
Astragalus spp. (milk vetch)	0.5	0-0.5	5	0.03	B
Campanula rotundifolia (harebell)	0.5	0-0.5	5	0.03	N
Carduus nutans (nodding thistle)	0.5	0-0.5	5	0.03	I
Cirsium arvense (Canada thistle)	5.8	0-20	32	1.82	I
Cirsium flodmanii (Flodman's thistle)	3.0	0-3	5	0.16	N
Cirsium hookerianum (white thistle)	0.5	0-0.5	5	0.03	N
Cirsium undulatum (wavy-leaved thistle)	3.7	0-10	16	0.58	N
Comandra umbellata (bastard toadflax)	0.5	0-0.5	5	0.03	N
Epilobium angustifolium (common fireweed)	10.0	0-10	5	0.53	N
Equisetum arvense (common horsetail)	2.2	0-3	16	0.34	N
Equisetum variegatum (variegated horsetail)	0.5	0-0.5	5	0.03	N
Erigeron caespitosus (tufted fleabane)	0.5	0-0.5	5	0.03	N
Erigeron flagellaris (creeping fleabane)	0.5	0-0.5	5	0.03	N
Erigeron glabellus (smooth fleabane)	0.5	0-0.5	5	0.03	N
Fragaria virginiana (wild strawberry)	3.9	0-10	37	1.45	N
Galium boreale (northern bedstraw)	1.0	0-3	26	0.26	N
Gaura coccinea (scarlet butterflyweed)	0.5	0-0.5	5	0.03	N
Geranium richardsonii (wild white geranium)	3.0	0-3	5	0.16	N
Geranium viscosissimum (sticky purple geranium)	1.8	0-3	11	0.18	N
Geum aleppicum (yellow avens)	0.5	0-0.5	5	0.03	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	11	0.05	N
Geum triflorum (three-flowered avens)	1.8	0-3	11	0.18	N
Glycyrrhiza lepidota (wild licorice)	0.5	0-0.5	11	0.05	N
Hedysarum spp. (hedysarum)	0.5	0-0.5	5	0.03	N

Table 514. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Helianthus nuttallii (common tall sunflower)	0.5	0-0.5	5	0.03	N
Lathyrus ochroleucus (cream-colored vetchling)	1.8	0-3	11	0.18	N
Liatris punctata (dotted blazingstar)	0.5	0-0.5	5	0.03	N
Linum lewisii (wild blue flax)	0.5	0-0.5	16	0.08	N
Lithospermum ruderale (woolly gromwell)	0.5	0-0.5	5	0.03	N
Medicago lupulina (black medick)	1.8	0-3	11	0.18	I
Melilotus alba (white sweet-clover)	0.5	0-0.5	11	0.05	I
Mertensia paniculata (tall lungwort)	0.5	0-0.5	5	0.03	N
Minuartia rubella (red-seeded sandwort)	0.5	0-0.5	5	0.03	N
Monarda fistulosa (wild bergamot)	0.5	0-0.5	11	0.05	N
Oxytropis deflexa (reflexed locoweed)	6.5	0-10	11	0.68	N
Oxytropis sericea (early yellow locoweed)	0.5	0-0.5	5	0.03	N
Oxytropis splendens (showy locoweed)	0.5	0-0.5	5	0.03	N
Petasites palmatus (palmate-leaved coltsfoot)	0.5	0-0.5	5	0.03	N
Potentilla anserina (silverweed)	3.0	0-3	5	0.16	N
Potentilla gracilis (graceful cinquefoil)	1.8	0-3	21	0.37	N
Potentilla pensylvanica (prairie cinquefoil)	0.5	0-0.5	5	0.03	N
Ranunculus acris (tall buttercup)	1.8	0-3	11	0.18	I
Selaginella densa (prairie selaginella)	0.5	0-0.5	5	0.03	N
Senecio canus (prairie groundsel)	0.5	0-0.5	5	0.03	N
Senecio indecorus (rayless ragwort)	0.5	0-0.5	5	0.03	N
Sisyrinchium montanum (common blue-eyed grass)	1.8	0-3	11	0.18	N
Smilacina stellata (star-flowered Solomon's-seal)	1.8	0-10	47	0.87	N
Solidago canadensis (Canada goldenrod)	1.3	0-3	16	0.21	N
Solidago gigantea (late goldenrod)	5.3	0-10	16	0.84	N
Solidago missouriensis (low goldenrod)	3.0	0-3	5	0.16	N
Sonchus arvensis (perennial sow-thistle)	10.0	0-10	5	0.53	I
Sonchus arvensis subsp. *uliginosus* (smooth perennial sow-thistle)	10.3	0-20	11	1.08	I
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	5	0.03	N
Taraxacum officinale (common dandelion)	3.7	0-10	47	1.76	I
Thermopsis rhombifolia (golden bean)	0.5	0-0.5	11	0.05	N
Tragopogon dubius (common goat's-beard)	0.5	0-0.5	11	0.05	I
Trifolium repens (white clover)	8.7	0-20	26	2.29	I
Urtica dioica (common nettle)	1.8	0-3	11	0.18	N
Vicia americana (wild vetch)	0.5	0-0.5	32	0.16	N
Viola adunca (early blue violet)	3.0	0-3	5	0.16	N
Viola renifolia (kidney-leaved violet)	0.5	0-0.5	5	0.03	N

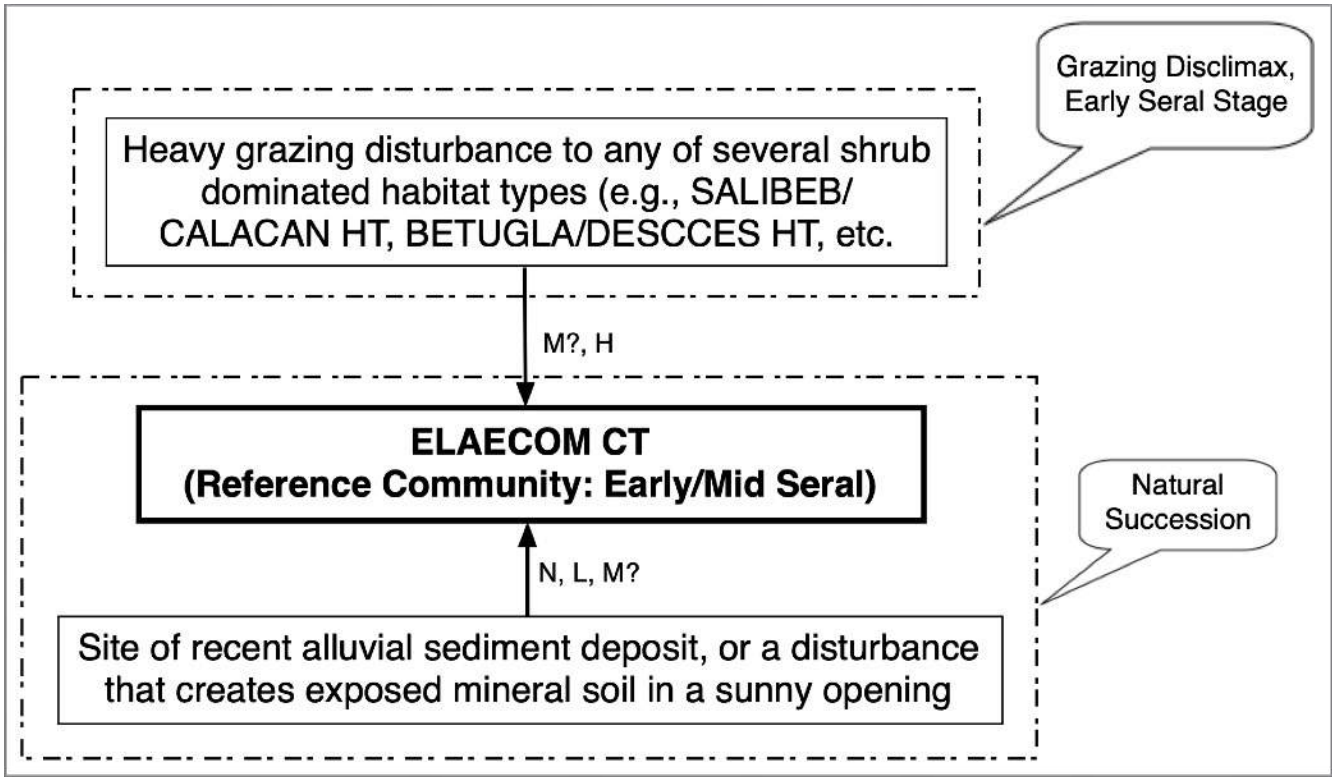
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Elaeagnus commutata* (silverberry) community type is an early seral, pioneering type, that colonizes recently deposited or exposed mineral substrate. *Elaeagnus commutata* (silverberry) is a rhizomatous shrub that can survive light-to-moderate fire and typically increases in response to grazing disturbance. Once established, the *Elaeagnus commutata* (silverberry) community type may for all practical purposes represent a grazing disclimax.

Figure 110 shows a schematic diagram of vegetation successional pathways on sites of the *Elaeagnus commutata* (silverberry) community type.



Successional Pathway of *Elaeagnus commutata* (silverberry) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Elaeagnus commutata* (silverberry) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
BETUGLA/DESCCES HT—*Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type
ELAECOM CT—*Elaeagnus commutata* (silverberry) community type
SALIBEB/CALACAN HT—*Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type

Figure 110. Successional pathway for sites of the *Elaeagnus commutata* (silverberry) community type

Note: The *Elaeagnus commutata* (silverberry) community type on riparian sites seems to result from grazing disturbance on a variety of mesic riparian tree and shrub types. *Elaeagnus commutata* (silverberry) dominates

upland sites as well, and it is unclear at this time whether the species represents site potential in some cases, or a seral stage to another potential natural community.

EDATOPE

Figure 111 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Elaeagnus commutata* (silverberry) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

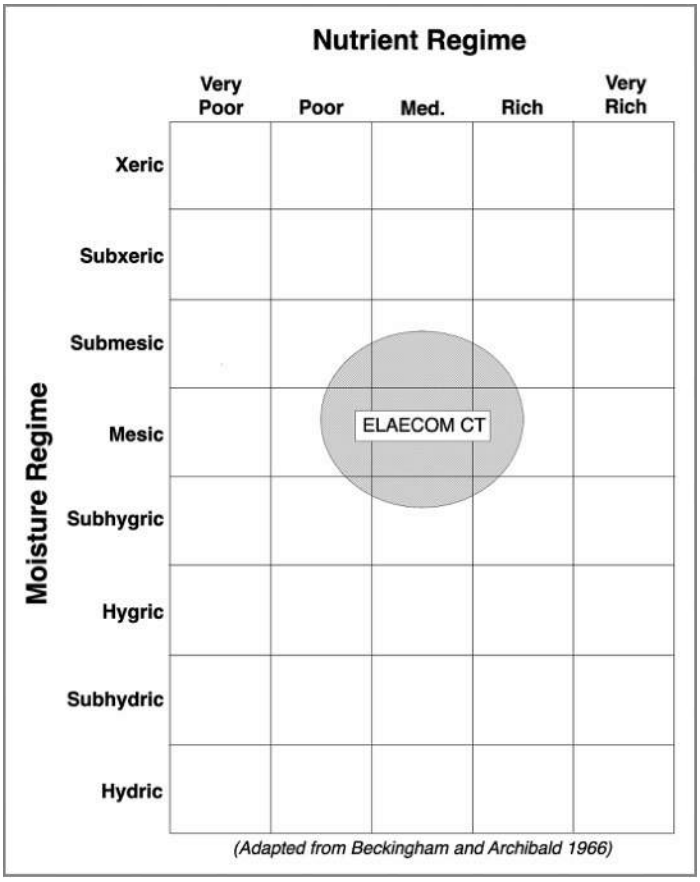


Figure 111. Edatope grid position for the *Elaeagnus commutata* (silverberry) community type (ELAECOM CT)

SOILS

On sites supporting the *Elaeagnus commutata* (silverberry) community type, soil subgroups include Regosols and Chernozems. This community type occurs on virtually all soil textures, ranging from sand to clay. This community type is tolerant of imperfectly drained soils and short duration floods, but is intolerant of prolonged floods and permanent high water tables. The species grows best in loamy soils, but is commonly found in dry, sandy, or gravelly soils on exposed hillsides. It is adapted to soils with high susceptibility to erosion. It can tolerate moderately alkaline soils and is somewhat drought resistant (Baker and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter communities may include the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type, or the *Alnus tenuifolia* (river alder) community type. Adjacent drier sites are usually dominated by upland communities.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Elaeagnus commutata* (silverberry)**—*Elaeagnus commutata* (silverberry) grows in grasslands, on shrubby slopes, in ravines, along streams, and on sandy soils wherever moisture is adequate (Tannas 1997a). It grows on a variety of sites from warm, open, sunny grasslands to cooler, forested areas and woodland thickets, often in moist areas along streams and near springs and seeps (Esser 1994).

The species produces seed, but reproduces mainly by rhizomes; and typically spreads by underground stems from which aerial stems arise (Esser 1994). It is a shade intolerant species of sparse woods and open areas, where often there is evidence of past soil disturbance (Esser 1994). *Elaeagnus commutata* (silverberry) is a nitrogen fixing species (Esser 1994).

***Bromus inermis* (smooth brome)**—*Bromus inermis* (smooth brome) is an exotic, cool-season, introduced perennial grass that produces extensive rhizomes with the ability to aggressively invade and persist on native rangelands sites with adequate moisture (Tannas 1997a, Howard 1996a). The species is widely adapted to a variety of site conditions; and is commonly found in riparian zones, valley bottoms, and dryland sites. It is adapted to all soil textures, although it may not thrive as well on sand or heavy clay (Howard 1996a).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is a mat-forming perennial from extensive creeping, shallow rhizomes. It grows moist meadows, riparian areas, and depressions throughout most regions of Alberta up to the subalpine (Tannas 1997a). It is widely distributed across North America growing in every Canadian province. The species is shallow rooted and is intolerant of drought. Most roots and rhizomes are within 7.5 cm of the soil surface. It is a vigorous herbaceous competitor. Not only does it spread by rhizome expansion, but it also produces abundant seed, which accounts for good seedling recruitment and establishment on disturbed sites. It grows on a wide variety of sites in numerous vegetation types, but does best and is most abundant on moist sites where the climate is cool and humid (Uchytil 1993).

Livestock

***Elaeagnus commutata* (silverberry)**—Forage production in dense, monospecific stands of *Elaeagnus commutata* (silverberry) is low. As stands open, forage production increases due to the presence of grasses, such as *Bromus inermis* (awnless brome) and *Poa pratensis* (Kentucky bluegrass). The palatability of *Elaeagnus commutata* (silverberry) is rated as fair to poor (Stone and Lawrence 2000, Tannas 1997, Beckingham 1991).

***Bromus inermis* (smooth brome)**—*Bromus inermis* (smooth brome) cultivars have been bred for nutritional quality and adaptation to selected climates. This has made it one of the most important exotic forage grasses in the Canada and the United States. It has been widely planted in pastures and rangelands from Texas to Alaska and Yukon Territory (Howard 1996a). Forage value is good early in the season, with protein content about 20 percent in May, but dropping to 4 percent to 6 percent by September (Tannas 1997a).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is rated as good forage value (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, and Beckingham 1991). The species is moderately productive, and provides a significant amount of early season forage. It is highly palatable in the rapid growth phase with palatability becoming greatly reduced during semi dormancy of late summer and winter (Tannas 1997a, Hansen and others 1995). Fall regrowth can occur if moisture is sufficient and temperatures remain above freezing. It is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). A high density of weak, low vigour tillers results under season-long grazing. Early season rest increases the vigour of individual plants. Streambanks with *Poa pratensis* (Kentucky bluegrass) stands are very susceptible to hoof shear damage and erosion The root system of *Poa pratensis* (Kentucky bluegrass) is very dense, but does not extend nearly as deep as native sedges. This results in streambanks being undercut by erosion, causing severe slumping/sloughing of the banks. In other words, it does not develop a deep, binding rootmass capable of streambank protection.

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Elaeagnus commutata* (silverberry)**—*Elaeagnus commutata* (silverberry) has fair forage value for wild ungulates. Protein levels are favorable in summer, but decrease later in the season. Palatability is rated as moderate, and the species is used primarily as winter browse by deer, elk, and moose (Tannas 1997a). The moderate structural diversity of the *Elaeagnus commutata* (silverberry) community type provides thermal and hiding cover for big game and upland bird species. (Esser 1994).

***Bromus inermis* (smooth brome)**—Foraging wildlife utilize *Bromus inermis* (smooth brome) to varying degrees, depending upon wildlife species and *Bromus inermis* (smooth brome) quality. Elk use it as a winter forage, but deer use is generally moderate. Geese and small mammals also consume it. *Bromus inermis* (smooth brome) provides cover for birds and small mammals. Ducks, gray partridge, American bittern, northern harrier, and short-eared owl use it for nesting cover (Howard 1996a).

***Poa pratensis* (Kentucky bluegrass)**—Elk and deer make use of the grasses and forbs of this community type, especially in early spring when other forages have not yet started to grow. Waterfowl utilize *Poa pratensis* (Kentucky bluegrass) for food and cover. Upland game birds, small mammals, and small non-game birds use this type for cover (Dittberner and Olson 1983).

Fisheries

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is very poor at stabilizing streambanks (Hansen and others 1995). Bank undercutting and sloughing will likely occur, especially when soils are wet.

Fire

***Elaeagnus commutata* (silverberry)**—*Elaeagnus commutata* (silverberry) sprouts from rhizomes after fire, and may establish from seed, if a seed source is nearby. However, the species does not recover quickly after fire. Numbers of *Elaeagnus commutata* (silverberry) plants may increase soon after fire, but canopy cover usually is decreased and recovers slowly. In the Canadian Great Plains, *Elaeagnus commutata* (silverberry) is listed as a species that is seriously harmed by spring and fall burns (Esser 1994).

***Bromus inermis* (smooth brome)**—*Bromus inermis* (smooth brome) is rhizomatous, and survives light to moderate fire by sprouting from rhizomes. Early spring (late March-April) or late-season (late summer-fall) fire

can increase smooth brome productivity, especially if it had become sod-bound. Late spring fire generally damages cool season grasses, such as *Bromus inermis* (smooth brome) (Howard 1996a).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is well adapted to fire, and quickly resprouts after burning. However, it is intolerant of fire during the active growth stages and can be successfully controlled by late spring burning. Fire is an effective tool to remove excessive litter accumulations common on rested or lightly grazed stands. Cool burns will have little effect on the species cover, but spring burns may lower tiller densities (Dix and Smeins 1967).

Rehabilitation/Restoration Considerations

***Elaeagnus commutata* (silverberry)**—*Elaeagnus commutata* (silverberry) grows in dense colonial stands, making it suitable for revegetating disturbed land, but there are usually better species to choose from the standpoint of forage and wildlife value. Once established, it grows at a moderate rate and spreads rapidly by root sprouts. It has been used for rehabilitating mine spoils in British Columbia and Alberta, and adapts well to disturbed sites (Esser 1994).

***Bromus inermis* (smooth brome)**—*Bromus inermis* (smooth brome) can be an effective species for erosion control and site stabilization, but it is not recommended for restoration on native rangelands due to its invasive and persistent nature (Tannas 1997a).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) has an extensive rhizome system, but its shallow rooting habit make it only marginally effective in stabilizing streambanks. The species should not be part of any seed mix for restoring a site. The potential for erosion problems associated with this species is quite high. Managers need to pay close attention to streambanks dominated by *Poa pratensis* (Kentucky bluegrass) to detect early signs of bank failure. Once a streambank starts to degrade, with no change in management there is little that can be done to save it, short of expensive reconstructive treatments. Unless water tables are restored, these degraded sites will retain their dominant cover of introduced grasses (Hansen and others 1995).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Elaeagnus commutata* (silverberry) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Silverberry-Saskatoon/Kentucky bluegrass

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msd15 Silverberry-Saskatoon/Kentucky bluegrass (Montane Southern Ecosection)
- Msd15a Silverberry-Saskatoon (Montane Southern Ecosection)
- Mcb5 Silverberry/Kentucky bluegrass (Montane Cypress Hills Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Elaeagnus commutata* (silverberry) community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003);
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001); and
- *Classification and Management of Upland, Riparian, and Wetland Sites of USDI Bureau of Land Management's Miles City Field Office, Eastern Montana USA* (Hansen and others 2008).

Rosa acicularis Community Type
(prickly rose Community Type)

ROSAACI Community Type
Number of Stands = 20 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 12; Other Data Sets = 8)

LOCATION AND ASSOCIATED LANDFORMS

The *Rosa acicularis* (prickly rose) community type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. This community type may occur on alluvial terraces along streams and rivers and in moist forest openings created by removal of both the forest canopy and other, more palatable shrub species. Stands of this type may also be found in V-shaped ravines and swale-like depressions where overland flows provide additional moisture, or they may be located on hillsides around a spring or seep area.

Photo 27 shows a typical stand of the *Rosa acicularis* (prickly rose) community type.

Photo 27. A stand of the *Rosa acicularis* (prickly rose) community type

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 515 shows the five most prominent plant species among the four lifeforms for species recorded in all 20 stands of the *Rosa acicularis* (prickly rose) community type. This is a heavily disturbed community type located own sites readily accessible to livestock grazing. The greatest prominence here is shared by *Rosa acicularis* (prickly rose), *Rosa woodsii* (common wild rose), and *Poa pratensis* (Kentucky bluegrass), with *Symphoricarpos occidentalis* (buckbrush) also being fairly highly prominent.

Table 515. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Rosa acicularis* (prickly rose) community type (number = 20 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus tremuloides (aspen)	0.03	Native
Shrubs		
Rosa acicularis (prickly rose)	20.00	Native
Rosa woodsii (common wild rose)	19.50	Native
Symphoricarpos occidentalis (buckbrush)	11.30	Native
Symphoricarpos albus (snowberry)	1.65	Native
Potentilla fruticosa (shrubby cinquefoil)	0.73	Native
Graminoids		
Poa pratensis (Kentucky bluegrass)	19.20	Introduced
Phleum pratense (timothy)	7.80	Introduced
Bromus inermis (smooth brome)	3.53	Introduced
Calamagrostis canadensis (marsh reed grass)	2.00	Native
Agropyron trachycaulum (slender wheat grass)	1.63	Native

Table 515. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Taraxacum officinale (common dandelion)	1.95	Introduced
Artemisia frigida (pasture sagewort)	1.65	Native
Cirsium arvense (Canada thistle)	1.65	Introduced
Fragaria virginiana (wild strawberry)	1.63	Native
Achillea millefolium (common yarrow)	1.55	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 516 through Table 519, break out the vegetation recorded in 20 stands sampled of the *Rosa acicularis* (prickly rose) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, moderately species rich, shrub dominated community type of incidental occurrence across the study area.

Table 516 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Rosa acicularis* (prickly rose) community type. For the 20 stands comprising the community type, the number of unique species was 148 with 121 (81.8 percent) of them being native species.

Table 516. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Rosa acicularis* (prickly rose) community type (number = 20 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	18	18	0	0
Graminoids	40	27	8	5
Forbs	89	75	9	5
TOTAL	***148 (100.0%)***	***121 (81.8%)***	***17 (11.5%)***	***10 (6.8%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 517 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Rosa acicularis* (prickly rose) community type. The average number of species per stand is 19.9, with native species comprising 16.0 species per stand or 80.4 percent.

Table 517. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Rosa acicularis* (prickly rose) community type (number = 20 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.1	0.1	0.0	0.0
Shrubs	3.0	3.0	0.0	0.0
Graminoids	4.8	2.6	1.9	0.3
Forbs	12.0	10.3	1.4	0.4
TOTAL	***19.9 (100.0%)***	***16.0 (80.4%)***	***3.3 (16.6%)***	***0.7 (3.5%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 518 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Rosa acicularis* (prickly rose) community type. The average canopy cover per stand is 127.0 percent, with native species comprising 87.0 percent or 68.5 percent of the total amount of average canopy cover per stand.

Table 518. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Rosa acicularis* (prickly rose) community type (number = 20 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	55.0%	55.0%	0.0%	0.0%
Graminoids	43.5%	9.2%	33.7%	0.7%
Forbs	28.4%	22.8%	4.7%	0.9%
TOTAL	***127.0% (100.0%)***	***87.0% (68.5%)***	***38.4% (30.2%)***	***1.6% (1.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 519 shows the average number of species and average canopy cover by lifeform in stands of the *Rosa acicularis* (prickly rose) community type. The average number of species per stand was 19.9 with an average canopy cover of 127.0 percent.

Table 519. Average number of species and average canopy cover by lifeform in stands of the *Rosa acicularis* (prickly rose) community type (number = 20 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.1	0.0%
Shrubs	3.0	55.0%
Graminoids	4.8	43.5%
Forbs	12.0	28.4%
TOTAL	***19.9***	***127.0%***

Sampled Stands Plant Species List

A total of 148 plant species were recorded on at least one of 20 stands sampled of the *Rosa acicularis* (prickly rose) community type (Table 520). One tree species, *Populus tremuloides* (aspen), was recorded in a very small amount on one of 20 stands sampled. Among the 18 shrub species recorded, *Rosa acicularis* (prickly rose) and *Rosa woodsii* (common wild rose) are almost equally the most prominent, although *Rosa acicularis* (prickly rose) occurs more frequently but in lower amount than does *Rosa woodsii* (common wild rose). *Poa pratensis* (Kentucky bluegrass) is most prominent of the 40 graminoid species here, and of the 89 forb species recorded, none is more than moderately prominent.

Table 520. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Rosa acicularis* (prickly rose) community type (number = 20 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 1)					
Populus tremuloides (aspen)	0.5	0-0.5	5	0.03	N
Shrubs (N = 18)					
Amelanchier alnifolia (Saskatoon)	3.0	0-3	15	0.45	N
Cornus stolonifera (red-osier dogwood)	0.5	0-0.5	10	0.05	N
Elaeagnus commutata (silverberry)	1.3	0-3	15	0.20	N
Potentilla fruticosa (shrubby cinquefoil)	2.9	0-10	25	0.73	N
Prunus virginiana (choke cherry)	0.5	0-0.5	5	0.03	N
Ribes oxyacanthoides (northern gooseberry)	1.8	0-3	10	0.18	N
Rosa acicularis (prickly rose)	30.8	0-80	65	20.00	N
Rosa woodsii (common wild rose)	55.7	0-80	35	19.50	N
Rubus idaeus (wild red raspberry)	1.3	0-3	15	0.20	N
Rubus pubescens (dewberry)	3.0	0-3	5	0.15	N
Salix bebbiana (beaked willow)	3.0	0-3	5	0.15	N
Salix exigua (sandbar willow)	1.8	0-3	10	0.18	N
Salix lutea (yellow willow)	0.5	0-0.5	5	0.03	N

Table 520. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Salix petiolaris (basket willow)	0.5	0-0.5	5	0.03	N
Shepherdia canadensis (Canada buffaloberry)	3.0	0-3	5	0.15	N
Spiraea betulifolia (white meadowsweet)	0.5	0-0.5	5	0.03	N
Symphoricarpos albus (snowberry)	11.0	0-20	15	1.65	N
Symphoricarpos occidentalis (buckbrush)	22.6	0-50	50	11.30	N
Graminoids (N = 40)					
Agropyron dasystachyum (northern wheat grass)	0.5	0-0.5	10	0.05	N
Agropyron repens (quack grass)	6.6	0-20	20	1.33	I
Agropyron smithii (western wheat grass)	3.0	0-3	5	0.15	N
Agropyron spp. (wheat grass)	3.0	0-3	5	0.15	B
Agropyron trachycaulum (slender wheat grass)	4.6	0-20	35	1.63	N
Agrostis scabra (rough hair grass)	1.8	0-3	10	0.18	N
Agrostis stolonifera (redtop)	6.5	0-10	10	0.65	I
Bromus biebersteinii (meadow brome)	3.0	0-3	5	0.15	I
Bromus carinatus (keeled brome)	0.5	0-0.5	5	0.03	N
Bromus ciliatus (fringed brome)	3.0	0-3	5	0.15	N
Bromus inermis (smooth brome)	14.1	0-30	25	3.53	I
Calamagrostis canadensis (marsh reed grass)	20.0	0-20	10	2.00	N
Calamagrostis montanensis (plains reed grass)	0.5	0-0.5	5	0.03	N
Calamagrostis rubescens (pine reed grass)	10.0	0-10	5	0.50	N
Carex lanuginosa (woolly sedge)	0.5	0-0.5	5	0.03	N
Carex parryana (Parry's sedge)	0.5	0-0.5	5	0.03	N
Carex spp. (sedge)	2.4	0-10	25	0.60	N
Dactylis glomerata (orchard grass)	10.0	0-10	5	0.50	I
Danthonia parryi (Parry oat grass)	3.7	0-10	15	0.55	N
Deschampsia cespitosa (tufted hair grass)	5.3	0-10	10	0.53	N
Elymus canadensis (Canada wild rye)	0.5	0-0.5	5	0.03	N
Elymus glaucus (smooth wild rye)	0.5	0-0.5	5	0.03	N
Elymus innovatus (hairy wild rye)	1.8	0-3	10	0.18	N
Elymus spp. (wild rye)	0.5	0-0.5	5	0.03	B
Festuca idahoensis (bluebunch fescue)	0.5	0-0.5	5	0.03	N
Festuca rubra (red fescue)	10.0	0-10	5	0.50	B
Festuca scabrella (rough fescue)	0.5	0-0.5	10	0.05	N
Festuca spp. (fescue)	0.5	0-0.5	5	0.03	B
Hordeum jubatum (foxtail barley)	0.5	0-0.5	5	0.03	N
Juncus balticus (wire rush)	0.5	0-0.5	10	0.05	N
Juncus spp. (rush)	0.5	0-0.5	5	0.03	N
Koeleria macrantha (June grass)	1.1	0-3	20	0.23	N
Phleum pratense (timothy)	15.6	0-40	50	7.80	I
Poa compressa (Canada bluegrass)	10.0	0-10	5	0.50	I
Poa palustris (fowl bluegrass)	3.7	0-10	15	0.55	N
Poa pratensis (Kentucky bluegrass)	27.4	0-90	70	19.20	I
Poa spp. (bluegrass)	0.5	0-0.5	5	0.03	B
Schizachne purpurascens (purple oat grass)	20.0	0-20	5	1.00	N

Table 520. (cont.)

Species	Percent Canopy Cover Average	Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Stipa columbiana (Columbia needle grass)	5.3	0-10	10	0.53	N
Stipa viridula (green needle grass)	0.5	0-0.5	5	0.03	N
Forbs (N = 89)					
Achillea millefolium (common yarrow)	2.2	0-10	70	1.55	N
Agoseris glauca (yellow false dandelion)	0.5	0-0.5	10	0.05	N
Allium cernuum (nodding onion)	0.5	0-0.5	20	0.10	N
Allium schoenoprasum (wild chives)	0.5	0-0.5	5	0.03	N
Allium textile (prairie onion)	0.5	0-0.5	5	0.03	N
Androsace septentrionalis (northern fairy candelabra)	0.5	0-0.5	10	0.05	N
Anemone multifida (cut-leaved anemone)	0.5	0-0.5	15	0.08	N
Antennaria parvifolia (small-leaved everlasting)	10.0	0-10	5	0.50	N
Antennaria spp. (everlastings)	0.5	0-0.5	5	0.03	N
Artemisia campestris (plains wormwood)	0.5	0-0.5	5	0.03	N
Artemisia frigida (pasture sagewort)	16.5	0-30	10	1.65	N
Artemisia ludoviciana (prairie sagewort)	0.9	0-3	30	0.28	N
Artemisia michauxiana (Michaux's sagewort)	3.0	0-3	5	0.15	N
Aster ciliolatus (Lindley's aster)	3.4	0-10	25	0.85	N
Aster conspicuus (showy aster)	1.3	0-3	15	0.20	N
Aster laevis (smooth aster)	3.5	0-10	20	0.70	N
Astragalus spp. (milk vetch)	1.8	0-3	10	0.18	B
Astragalus striatus (ascending purple milk vetch)	0.5	0-0.5	5	0.03	N
Botrychium simplex (dwarf grape fern)	0.5	0-0.5	5	0.03	N
Campanula rotundifolia (harebell)	0.5	0-0.5	30	0.15	N
Castilleja miniata (common red paintbrush)	0.5	0-0.5	5	0.03	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	20	0.10	N
Cirsium arvense (Canada thistle)	4.1	0-20	40	1.65	I
Comandra umbellata (bastard toadflax)	1.8	0-3	10	0.18	N
Cynoglossum officinale (hound's-tongue)	0.5	0-0.5	5	0.03	I
Delphinium glaucum (tall larkspur)	0.5	0-0.5	5	0.03	N
Epilobium angustifolium (common fireweed)	2.9	0-10	25	0.73	N
Epilobium glaberrimum (willowherb)	0.5	0-0.5	5	0.03	N
Equisetum arvense (common horsetail)	7.0	0-20	15	1.05	N
Equisetum laevigatum (smooth scouring-rush)	0.5	0-0.5	5	0.03	N
Erigeron caespitosus (tufted fleabane)	0.5	0-0.5	5	0.03	N
Erigeron compositus (compound-leaved fleabane)	10.3	0-20	10	1.03	N
Erysimum cheiranthoides (wormseed mustard)	3.0	0-3	5	0.15	N
Fragaria virginiana (wild strawberry)	2.7	0-10	60	1.62	N
Gaillardia aristata (gaillardia)	2.2	0-3	15	0.33	N
Galium boreale (northern bedstraw)	1.2	0-3	55	0.65	N
Gentiana spp. (gentian)	0.5	0-0.5	5	0.03	N
Gentianella amarella (felwort)	0.5	0-0.5	5	0.03	N
Geranium richardsonii (wild white geranium)	1.1	0-3	20	0.23	N
Geranium viscosissimum (sticky purple geranium)	7.6	0-10	20	1.53	N

Table 520. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Geum aleppicum (yellow avens)	1.8	0-3	10	0.18	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	10	0.05	N
Geum triflorum (three-flowered avens)	0.5	0-0.5	5	0.03	N
Glycyrrhiza lepidota (wild licorice)	6.5	0-10	10	0.65	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	5	0.03	N
Heracleum lanatum (cow parsnip)	3.0	0-3	5	0.15	N
Heuchera richardsonii (Richardson's alumroot)	1.8	0-3	10	0.18	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	35	0.18	N
Lithospermum ruderale (woolly gromwell)	0.5	0-0.5	5	0.03	N
Lupinus sericeus (silky perennial lupine)	1.3	0-3	15	0.20	N
Mentha arvensis (wild mint)	10.0	0-10	5	0.50	N
Mertensia lanceolata (lance-leaved lungwort)	0.5	0-0.5	5	0.03	N
Monarda fistulosa (wild bergamot)	1.8	0-3	30	0.53	N
Osmorhiza depauperata (spreading sweet cicely)	0.5	0-0.5	5	0.03	N
Oxytropis cusickii (alpine locoweed)	11.5	0-20	10	1.15	N
Oxytropis monticola (late yellow locoweed)	0.5	0-0.5	5	0.03	N
Oxytropis sericea (early yellow locoweed)	0.5	0-0.5	5	0.03	N
Plantago major (common plantain)	0.5	0-0.5	10	0.05	I
Potentilla anserina (silverweed)	0.5	0-0.5	5	0.03	N
Potentilla glandulosa (sticky cinquefoil)	0.5	0-0.5	5	0.03	N
Potentilla gracilis (graceful cinquefoil)	2.4	0-10	25	0.60	N
Potentilla hippiana (woolly cinquefoil)	0.5	0-0.5	5	0.03	N
Potentilla spp. (cinquefoil)	0.5	0-0.5	10	0.05	B
Rhinanthus minor (yellow rattle)	0.5	0-0.5	5	0.03	N
Sanicula marilandica (snakeroot)	0.5	0-0.5	5	0.03	N
Senecio canus (prairie groundsel)	0.5	0-0.5	5	0.03	N
Senecio indecorus (rayless ragwort)	0.5	0-0.5	5	0.03	N
Senecio spp. (senecio)	0.5	0-0.5	5	0.03	B
Sisymbrium altissimum (tumbling mustard)	3.0	0-3	5	0.15	I
Sisyrinchium montanum (common blue-eyed grass)	0.5	0-0.5	10	0.05	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	5	0.03	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	30	0.15	N
Solanum dulcamara (climbing nightshade)	3.0	0-3	5	0.15	I
Solidago canadensis (Canada goldenrod)	4.1	0-10	20	0.83	N
Solidago gigantea (late goldenrod)	10.0	0-10	5	0.50	N
Solidago missouriensis (low goldenrod)	0.5	0-0.5	10	0.05	N
Sonchus arvensis (perennial sow-thistle)	5.3	0-10	10	0.53	I
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	5	0.03	N
Taraxacum officinale (common dandelion)	3.9	0-20	50	1.95	I
Thalictrum occidentale (western meadow rue)	3.0	0-3	5	0.15	N
Thalictrum venulosum (veiny meadow rue)	0.5	0-0.5	25	0.13	N
Trifolium repens (white clover)	0.5	0-0.5	10	0.05	I
Trifolium spp. (clover)	3.0	0-3	5	0.15	B

Table 520. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Urtica dioica (common nettle)	10.3	0-20	10	1.03	N
Vicia americana (wild vetch)	1.4	0-10	70	0.95	N
Viola adunca (early blue violet)	0.5	0-0.5	5	0.03	N
Viola canadensis (western Canada violet)	0.5	0-0.5	5	0.03	N
Viola spp. (violet)	10.0	0-10	5	0.50	B
Zizia aptera (heart-leaved Alexanders)	3.0	0-3	5	0.15	N

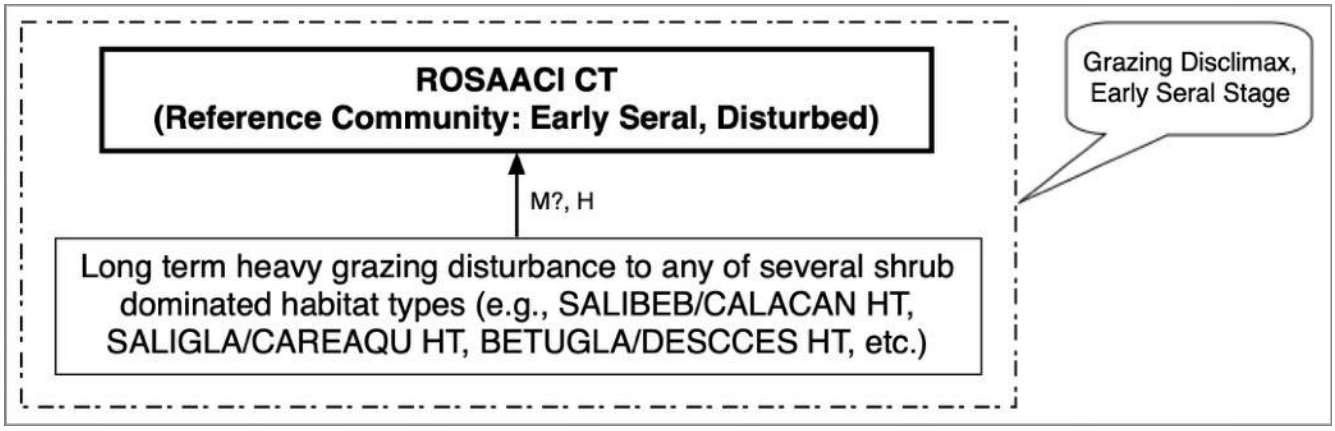
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Rosa acicularis* (prickly rose) community type is typically the result of long term grazing disturbance that has eliminated the taller canopy of late seral shrubs from any one of several different shrub dominated habitat types that also contain *Rosa acicularis* (prickly rose) or *Rosa woodsii* (common wild rose) in the community.

Figure 112 shows a schematic diagram of vegetation successional pathways on sites of the *Rosa acicularis* (prickly rose) community type.



Successional Pathway of *Rosa acicularis* (prickly rose) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Rosa acicularis* (prickly rose) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES

BETUGLA/DESCCES HT—*Betula glandulosa/Deschampsia cespitosa* (bog birch/tufted hair grass) habitat type
ROSAACI CT—*Rosa acicularis* (prickly rose) community type

SALIBEB/CALACAN HT—*Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type
SALIGLA/CAREAQU HT—*Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type

Figure 112. Successional pathway for sites of the *Rosa acicularis* (prickly rose) community type

Note: The *Rosa acicularis* (prickly rose) community type on riparian sites seems usually to be the result of grazing disturbance to any of several shrub types that normally have the palatable understory species removed by high use.

EDATOPE

Figure 113 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Rosa acicularis* (prickly rose) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

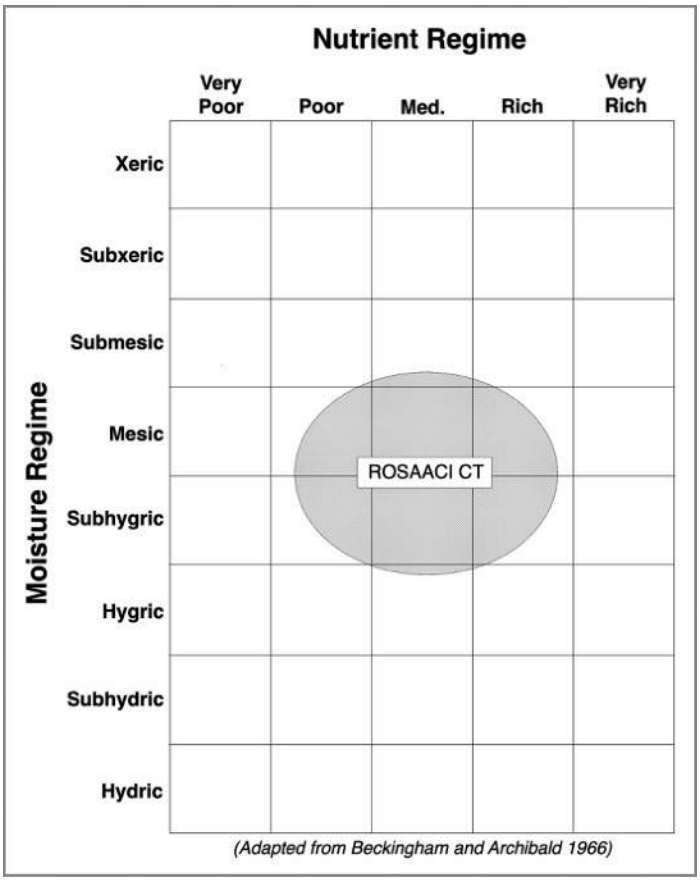


Figure 113. Edatope grid position for the *Rosa acicularis* (prickly rose) community type (ROSAACI CT)

SOILS

The *Rosa acicularis* (prickly rose) community type does best on soils derived from alluvium that may be seasonally flooded. Mineral soil textures range from silty sand to clay. However, *Rosa acicularis* (prickly rose)

does not do well on peats or in basins with restricted drainage, but does do well on a variety of soil textures and soil moisture regimes (Thompson and Hansen 2003, France and others 2020).

ADJACENT COMMUNITIES

Adjacent wetter communities may include the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, the *Populus tremuloides*/*Viburnum edule* (aspen/low-bush cranberry) community type, or the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type. Adjacent drier sites are usually dominated by upland communities.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Rosa acicularis* (prickly rose)**—*Rosa acicularis* (prickly rose) is commonly found in most natural region of Alberta s. It grows in open woods, shrubby thickets, moist grasslands, and along streams (Tannas 1997a).

Rosa acicularis (prickly rose) is very common in northern deciduous forests composed of *Betula papyrifera* (paper birch), *Populus tremuloides* (aspen), and *Populus* species (cottonwood) trees; and is also found in transitional zones between *Betula* species (birch) and *Picea* species (spruce) forest (Crane 1990).

***Rosa woodsii* (woods rose)**—*Rosa woodsii (woods rose)* is found frequently in Alberta in most natural regions. It grows in open woods, shrubby thickets, moist grasslands, and along streams (Tannas 1997a).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is a mat-forming perennial from extensive creeping, shallow rhizomes. It grows moist meadows, riparian areas, and depressions throughout most regions of Alberta up to the subalpine (Tannas 1997a). It is widely distributed across North America growing in every Canadian province. The species is shallow rooted and is intolerant of drought. Most roots and rhizomes are within 7.5 cm of the soil surface. It is a vigorous herbaceous competitor. Not only does it spread by rhizome expansion, but it also produces abundant seed, which accounts for good seedling recruitment and establishment on disturbed sites. It grows on a wide variety of sites in numerous vegetation types, but does best and is most abundant on moist sites where the climate is cool and humid (Uchytil 1993).

***Symphoricarpos occidentalis* (buckbrush)**—*Symphoricarpos occidentalis* (buckbrush) is common throughout Alberta, occurring in open woodlands and thickets and forming large colonies in grasslands (Tannas 1997a).

Symphoricarpos occidentalis (buckbrush) may be found in climax stands, but it generally occurs in seral communities on immature soils and in transition zones between grasslands and forests. It is most commonly found in full or nearly full sunlight, but is also frequently found at forest edges where it can survive in partial shade. The species thrives after disturbances, such as fire, logging, and animal activity (Hauser 2007).

Livestock

***Rosa acicularis* (prickly rose)**—*Rosa acicularis* (prickly rose) has fair forage value, and the spiny branches of young growth provide no major deterrent to browsing animals. All specie of *Rosa* (rose) found in Alberta are considered increasers in response to heavy grazing use (Tannas 1997a). Forage production from dense thickets of the *Rosa acicularis* (prickly rose) community type is low. Stands may be so dense that they exclude most livestock use. However, *Rosa acicularis* (prickly rose) is considered fair livestock forage (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991).

***Rosa woodsii* (woods rose)**—*Rosa woodsii (woods rose)* has fair forage value, and the spiny branches of young growth provide no major deterrent to browsing animals. All specie of *Rosa* (rose) found in Alberta are considered increasers in response to heavy grazing use (Tannas 1997a). Forage production from dense thickets of *Rosa woodsii* (woods rose) is low. However, the leaves are considered fair to fairly good livestock forage, particularly for sheep (Hauser 2006a).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is rated as good forage value (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, and Beckingham 1991). The species is moderately productive, and provides a significant amount of early season forage. It is highly palatable in the rapid growth phase with palatability becoming greatly reduced during semi dormancy of late summer and winter (Tannas 1997a, Hansen and others 1995). Fall regrowth can occur if moisture is sufficient and temperatures remain above freezing. It is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). A high density of weak, low vigour tillers results under season-long grazing. Early season rest increases the vigour of individual plants. Streambanks with *Poa pratensis* (Kentucky bluegrass) stands are very susceptible to hoof shear damage and erosion The root system of *Poa pratensis* (Kentucky bluegrass) is very dense, but does not extend nearly as deep as native sedges. This results in streambanks being undercut by erosion, causing severe slumping/sloughing of the banks. In other words, it does not develop a deep, binding rootmass capable of streambank protection.

***Symphoricarpos occidentalis* (buckbrush)**—*Symphoricarpos occidentalis* (buckbrush) forage value is poor, with nutrient levels being fairly good in spring and summer, but dropping in quality by fall. Palatability is poor for both livestock and for wild ungulates, but can vary in relation to the local availability of better forage (Tannas 1997a). This species is an aggressive increaser, gaining abundance under high grazing pressure, due to both rhizomatous vegetative spread and by abundant seed production (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Rosa acicularis* (prickly rose)**— Stands of *Rosa acicularis* (prickly rose) provide good structural diversity for thermal and hiding cover. Browsing use of the species is often heavy by deer and elk (Tannas 1997a). Thickets of it also provide excellent nesting sites and protective cover for birds, as well as shelter for small mammals. In Montana, the species is considered to provide good thermal and feeding cover for mule deer and white-tailed deer and fair cover for elk, upland game birds, and small birds and mammals (Crane 1990). The persistent fruit (hips) provides fall and winter food for birds, small mammals, and bears, which disperse the seeds. *Rosa acicularis* (prickly rose) is strongly grazing tolerant but can be dwarfed and thinned by intense browsing or defoliation during season long use (Thompson and Hansen 2003).

***Rosa woodsii* (woods rose)**—Stands of *Rosa woodsii* (woods rose) provide good structural diversity for both thermal and hiding cover. Deer and elk may browse heavily on the species, while the persistent fruit (rose hips) provides fall and winter food for birds, small mammals, and bears, which then disperse the seeds (Hauser 2006a). *Rosa woodsii* (woods rose) is strongly grazing tolerant, but can be dwarfed and thinned by intense browsing.

***Poa pratensis* (Kentucky bluegrass)**—Elk and deer make use of the grasses and forbs of this community type, especially in early spring when other forages have not yet started to grow. Waterfowl utilize *Poa pratensis* (Kentucky bluegrass) for food and cover. Upland game birds, small mammals, and small non-game birds use this type for cover (Dittberner and Olson 1983).

***Symphoricarpos occidentalis* (buckbrush)**—*Symphoricarpos occidentalis* (buckbrush) is an important forage species for elk, mule deer, white-tailed deer, pronghorn, bighorn sheep, and moose. Palatability for deer and elk is rated as good (Hauser 2007). The fruits of the species are an important source of food for some small mammals and birds. Upland game birds heavily utilize these fruits, since they persist on the plant through the winter (Hauser 2007). Snowberry stands provide cover for a variety of animals, particularly small mammals and birds (Hauser 2007).

Fisheries

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is very poor at stabilizing streambanks (Hansen and others 1995). Bank undercutting and sloughing will likely occur, especially when soils are wet.

Fire

***Rosa acicularis* (prickly rose)**—Wild roses are moderately fire resistant. *Rosa acicularis* (prickly rose) can sprout from the base of fire-killed aerial stems or from subsurface rhizomes. Although its recovery after fire is primarily vegetative, roses germinate from seeds as well. The seeds are fire resistant, and germination may be stimulated by fire. This sprouting capability makes it a good soil stabilizer, which is especially important given the severe disturbance common to areas colonized by wild rose species (Crane 1990).

***Rosa woodsii* (woods rose)**—*Rosa woodsii* (woods rose) is strongly fire tolerant, except for smoldering fires burning in heavy fuel. The species has shallow, much branched rhizomatous roots that readily sprout and sucker. This sprouting capability makes it a good soil stabilizer (Hauser 2006a).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is well adapted to fire, and quickly resprouts after burning. However, it is intolerant of fire during the active growth stages and can be successfully controlled by late spring burning. Fire is an effective tool to remove excessive litter accumulations common on rested or lightly grazed stands. Cool burns will have little effect on the species cover, but spring burns may lower tiller densities (Dix and Smeins 1967).

***Symphoricarpos occidentalis* (buckbrush)**—*Symphoricarpos occidentalis* (buckbrush) is fire-tolerant and top-killed plants sprouts after light to moderate burns. While the stems are sensitive to fire, the rhizomes and stem bases can often survive fire due to their depth in the soil (Hauser 2007).

Rehabilitation/Restoration Considerations

***Rosa acicularis* (prickly rose)**—*Rosa acicularis* (prickly rose) is recommended for revegetation on moist to wet sites in Alberta (Crane 1990). It is a good choice for erosion control, especially since the prickly stems may discourage excessive browsing. It is tolerant of acidic soils and is adapted to a wide range of soil textures and moisture regimes, rapidly covers an area, and is moderately tolerant of crude oil (Watson and others 1980). It has shown good drought tolerance on amended oil sand tailings in Alberta and competes effectively with seeded grasses (Fedkenheuer and others 1980).

***Rosa woodsii* (woods rose)**—*Rosa woodsii* (woods rose) is valuable for revegetating disturbed sites along streambanks and seeps. It is easily established from nursery grown stock, root cuttings, or transplanted materials. The most important criteria for rehabilitation/restoration success requires the use of native plant material that is site specific (i.e., adapted to local site conditions) and source identified (i.e., the actual location of the material is known). Nursery grown containerized stock will have the greatest survival rates and growth rates (Hauser 2006a).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) has an extensive rhizome system, but its shallow rooting habit make it only marginally effective in stabilizing streambanks. The species should not be

part of any seed mix for restoring a site. The potential for erosion problems associated with this species is quite high. Managers need to pay close attention to streambanks dominated by *Poa pratensis* (Kentucky bluegrass) to detect early signs of bank failure. Once a streambank starts to degrade, with no change in management there is little that can be done to save it, short of expensive reconstructive treatments. Unless water tables are restored, these degraded sites will retain their dominant cover of introduced grasses (Hansen and others 1995).

***Symphoricarpos occidentalis* (buckbrush)**—*Symphoricarpos occidentalis* (buckbrush) is a good species choice for restoring disturbed sites, because the plant produces an extensive rhizome/root system, making it an excellent soil binder to prevent erosion (Hauser 2007).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Rosa acicularis* (prickly rose) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Rose/Hairy wild rye (harvested)

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Mnb1 Rose-Snowberry-Saskatoon (Montane Northern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Rosa acicularis* (prickly rose) community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003).

Symphoricarpos occidentalis Community Type
(buckbrush Community Type)

SYMPOCC Community Type
Number of Stands = 12 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 4; Other Data Sets = 8)

LOCATION AND ASSOCIATED LANDFORMS

The *Symphoricarpos occidentalis* (buckbrush) community type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. This community type occurs on floodplain terraces along streams and rivers, in V-shaped ravines and swale-like depressions where overland flows provide additional moisture. Stands may also be found on slopes around a spring or seep area.

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 521 shows the five most prominent plant species among the four lifeforms for species recorded in all 12 stands of the generally disturbed *Symphoricarpos occidentalis* (buckbrush) community type. *Symphoricarpos occidentalis* (buckbrush) is by far the most prominent species in stands sampled of this community type, followed by the introduced *Poa pratensis* (Kentucky bluegrass).

Table 521. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Symphoricarpos occidentalis* (buckbrush) community type (number = 12 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Symphoricarpos occidentalis (buckbrush)	50.83	Native
Symphoricarpos albus (snowberry)	7.50	Native
Crataegus douglasii (Douglas hawthorn)	1.67	Native
Rosa woodsii (common wild rose)	0.92	Native
Amelanchier alnifolia (Saskatoon)	0.83	Native
Graminoids		
Poa pratensis (Kentucky bluegrass)	21.75	Introduced
Phleum pratense (timothy)	4.17	Introduced
Schizachne purpurascens (purple oat grass)	2.50	Native
Agropyron repens (quack grass)	1.75	Introduced
Juncus balticus (wire rush)	1.71	Native
Forbs		
Taraxacum officinale (common dandelion)	4.21	Introduced
Heracleum lanatum (cow parsnip)	3.58	Native
Cirsium arvense (Canada thistle)	2.88	Introduced
Fragaria virginiana (wild strawberry)	2.00	Native
Geum triflorum (three-flowered avens)	1.67	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 522 through Table 525, break out the vegetation recorded in 12 stands sampled of the *Symphoricarpos occidentalis* (buckbrush) community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, moderately species rich, shrub dominated community type of incidental occurrence across the study area.

Table 522 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Symphoricarpos occidentalis* (buckbrush) community type. For the 12 stands comprising the community type, the number of unique species was 102 with 84 (82.4 percent) of them being native species.

Table 522. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Symphoricarpos occidentalis* (buckbrush) community type (number = 12 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	11	11	0	0
Graminoids	24	20	4	0
Forbs	67	53	14	0
TOTAL	***102 (100.0%)***	***84 (82.4%)***	***18 (17.6%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 523 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Symphoricarpos occidentalis* (buckbrush) community type. The average number of species per stand is 18.6, with native species comprising 13.9 species per stand or 74.7 percent.

Table 523. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Symphoricarpos occidentalis* (buckbrush) community type (number = 12 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	2.4	2.4	0.0	0.0
Graminoids	5.1	2.9	2.2	0.0
Forbs	11.1	8.6	2.5	0.0
TOTAL	***18.6 (100.0%)***	***13.9 (74.7%)***	***4.7 (25.3%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 524 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Symphoricarpos occidentalis* (buckbrush) community type. The average canopy cover per stand is 131.5 percent, with native species comprising 94.5 percent or 71.9 percent of the total amount of average canopy cover per stand.

Table 524. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Symphoricarpos occidentalis* (buckbrush) community type (number = 12 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	62.5%	62.5%	0.0%	0.0%
Graminoids	41.0%	12.8%	28.3%	0.0%
Forbs	28.0%	19.3%	8.7%	0.0%
TOTAL	***131.5% (100.0%)***	***94.5% (71.9%)***	***37.0% (28.1%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 525 shows the average number of species and average canopy cover by lifeform in stands of the *Symphoricarpos occidentalis* (buckbrush) community type. The average number of species per stand was 18.6 with an average canopy cover of 131.5 percent.

Table 525. Average number of species and average canopy cover by lifeform in stands of the *Symphoricarpos occidentalis* (buckbrush) community type (number = 12 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	2.4	62.5%
Graminoids	5.1	41.0%
Forbs	11.1	28.0%
TOTAL	***18.6***	***131.5%***

Sampled Stands Plant Species List

A total of 102 plant species were recorded on at least one of 20 stands sampled of the *Symphoricarpos occidentalis* (buckbrush) community type (Table 526). No trees were recorded on 12 stands sampled of the community type. Only *Symphoricarpos occidentalis* (buckbrush) was highly prominent shrub, and *Poa pratensis* (Kentucky bluegrass) was the only highly prominent graminoid species, indicating a high level of grazing disturbance among stands sampled. Among the 67 forbs recorded, none is notably prominent.

Table 526. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Symphoricarpos occidentalis* (buckbrush) community type (number = 12 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Shrubs (N = 11)					
Amelanchier alnifolia (Saskatoon)	10.0	0-10	8	0.83	N
Berberis repens (creeping mahonia)	0.5	0-0.5	8	0.04	N
Crataegus douglasii (Douglas hawthorn)	20.0	0-20	8	1.67	N
Lonicera dioica (twining honeysuckle)	0.5	0-0.5	8	0.04	N
Potentilla fruticosa (shrubby cinquefoil)	1.8	0-3	17	0.29	N
Prunus virginiana (choke cherry)	0.5	0-0.5	8	0.04	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	8	0.04	N
Rosa acicularis (prickly rose)	1.8	0-3	17	0.29	N
Rosa woodsii (common wild rose)	1.6	0-3	58	0.92	N
Symphoricarpos albus (snowberry)	90.0	0-90	8	7.50	N
Symphoricarpos occidentalis (buckbrush)	55.5	0-80	92	50.83	N
Graminoids (N = 24)					
Agropyron repens (quack grass)	5.3	0-10	33	1.75	I
Agropyron smithii (western wheat grass)	3.0	0-3	8	0.25	N
Agropyron trachycaulum (slender wheat grass)	1.1	0-3	33	0.37	N
Bromus carinatus (keeled brome)	0.5	0-0.5	17	0.08	N
Bromus ciliatus (fringed brome)	3.5	0-10	33	1.17	N
Bromus inermis (smooth brome)	1.8	0-3	33	0.58	I
Carex lanuginosa (woolly sedge)	10.0	0-10	17	1.67	N
Carex obtusata (blunt sedge)	1.8	0-3	17	0.29	N
Carex praegracilis (graceful sedge)	5.3	0-10	17	0.88	N
Carex raymondii (Raymond's sedge)	0.5	0-0.5	8	0.04	N
Danthonia parryi (Parry oat grass)	0.5	0-0.5	8	0.04	N
Deschampsia cespitosa (tufted hair grass)	0.5	0-0.5	8	0.04	N
Festuca idahoensis (bluebunch fescue)	0.5	0-0.5	8	0.04	N
Festuca scabrella (rough fescue)	10.0	0-10	8	0.83	N
Juncus balticus (wire rush)	6.8	0-10	25	1.71	N
Koeleria macrantha (June grass)	0.5	0-0.5	8	0.04	N
Muhlenbergia richardsonis (mat muhly)	3.0	0-3	8	0.25	N
Phleum pratense (timothy)	8.3	0-40	50	4.17	I
Poa palustris (fowl bluegrass)	3.0	0-3	17	0.50	N
Poa pratensis (Kentucky bluegrass)	21.8	0.5-60	100	21.75	I
Schizachne purpurascens (purple oat grass)	30.0	0-30	8	2.50	N
Stipa spp. (needle grass)	1.8	0-3	17	0.29	N
Stipa viridula (green needle grass)	10.3	0-20	17	1.71	N
Trisetum canescens (tall trisetum)	0.5	0-0.5	8	0.04	N
Forbs (N = 67)					
Achillea millefolium (common yarrow)	2.4	0-3	67	1.58	N
Agoseris glauca (yellow false dandelion)	0.5	0-0.5	17	0.08	N
Anemone canadensis (Canada anemone)	3.0	0-3	8	0.25	N
Antennaria parvifolia (small-leaved everlasting)	0.5	0-0.5	8	0.04	N

Table 526. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Arctium lappa (great burdock)	0.5	0-0.5	8	0.04	I
Arnica chamissonis (leafy arnica)	0.5	0-0.5	8	0.04	N
Artemisia frigida (pasture sagewort)	0.5	0-0.5	8	0.04	N
Artemisia ludoviciana (prairie sagewort)	0.5	0-0.5	25	0.13	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	17	0.08	N
Aster ericoides (tufted white prairie aster)	3.0	0-3	8	0.25	N
Aster laevis (smooth aster)	0.5	0-0.5	8	0.04	N
Aster modestus (large northern aster)	0.5	0-0.5	8	0.04	N
Astragalus flexuosus (slender milk vetch)	0.5	0-0.5	8	0.04	N
Campanula rotundifolia (harebell)	0.5	0-0.5	17	0.08	N
Carum carvi (caraway)	0.5	0-0.5	8	0.04	I
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	8	0.04	N
Cerastium vulgatum (common mouse-ear chickweed)	0.5	0-0.5	8	0.04	I
Cirsium arvense (Canada thistle)	5.8	0-20	50	2.88	I
Delphinium glaucum (tall larkspur)	0.5	0-0.5	8	0.04	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	8	0.04	N
Equisetum sylvaticum (woodland horsetail)	0.5	0-0.5	8	0.04	N
Erigeron speciosus (showy fleabane)	0.5	0-0.5	8	0.04	N
Erysimum cheiranthoides (wormseed mustard)	0.5	0-0.5	8	0.04	N
Fragaria vesca (woodland strawberry)	0.5	0-0.5	8	0.04	N
Fragaria virginiana (wild strawberry)	4.8	0-10	42	2.00	N
Galium aparine (cleavers)	3.0	0-3	8	0.25	N
Galium boreale (northern bedstraw)	1.2	0-3	58	0.71	N
Geranium richardsonii (wild white geranium)	3.0	0-3	17	0.50	N
Geranium viscosissimum (sticky purple geranium)	1.1	0-3	33	0.37	N
Geum aleppicum (yellow avens)	0.5	0-0.5	17	0.08	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	25	0.13	N
Geum rivale (purple avens)	0.5	0-0.5	8	0.04	N
Geum triflorum (three-flowered avens)	10.0	0-10	17	1.67	N
Glycyrrhiza lepidota (wild licorice)	0.5	0-0.5	8	0.04	N
Hackelia jessicae (Jessica's stickseed)	0.5	0-0.5	8	0.04	N
Heracleum lanatum (cow parsnip)	21.5	0-40	17	3.58	N
Lactuca serriola (prickly lettuce)	10.0	0-10	8	0.83	I
Lathyrus ochroleucus (cream-colored vetchling)	10.0	0-10	8	0.83	N
Lupinus sericeus (silky perennial lupine)	3.0	0-3	8	0.25	N
Medicago lupulina (black medick)	0.5	0-0.5	8	0.04	I
Mertensia paniculata (tall lungwort)	0.5	0-0.5	8	0.04	N
Monarda fistulosa (wild bergamot)	0.5	0-0.5	8	0.04	N
Nepeta cataria (catnip)	0.5	0-0.5	8	0.04	I
Oxytropis splendens (showy locoweed)	0.5	0-0.5	8	0.04	N
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	8	0.04	N
Perideridia gairdneri (squawroot)	0.5	0-0.5	17	0.08	N
Polygonum douglasii (Douglas knotweed)	0.5	0-0.5	8	0.04	N

Table 526. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Potentilla gracilis (graceful cinquefoil)	2.9	0-10	50	1.46	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	8	0.04	N
Ranunculus acris (tall buttercup)	0.5	0-0.5	8	0.04	I
Rumex occidentalis (western dock)	0.5	0-0.5	8	0.04	N
Scutellaria galericulata (marsh skullcap)	0.5	0-0.5	8	0.04	N
Senecio canus (prairie groundsel)	0.5	0-0.5	8	0.04	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	33	0.17	N
Solanum dulcamara (climbing nightshade)	0.5	0-0.5	8	0.04	I
Solidago canadensis (Canada goldenrod)	3.7	0-10	25	0.92	N
Solidago missouriensis (low goldenrod)	0.5	0-0.5	8	0.04	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	8	0.04	N
Taraxacum officinale (common dandelion)	5.6	0-20	75	4.21	I
Thalictrum occidentale (western meadow rue)	0.5	0-0.5	8	0.04	N
Thalictrum venulosum (veiny meadow rue)	1.5	0-3	42	0.63	N
Thlaspi arvense (stinkweed)	0.5	0-0.5	17	0.08	I
Tragopogon dubius (common goat's-beard)	0.5	0-0.5	17	0.08	I
Trifolium repens (white clover)	1.8	0-3	17	0.29	I
Vicia americana (wild vetch)	2.9	0-10	42	1.21	N
Viola adunca (early blue violet)	0.5	0-0.5	8	0.04	N
Viola canadensis (western Canada violet)	10.0	0-10	8	0.83	N

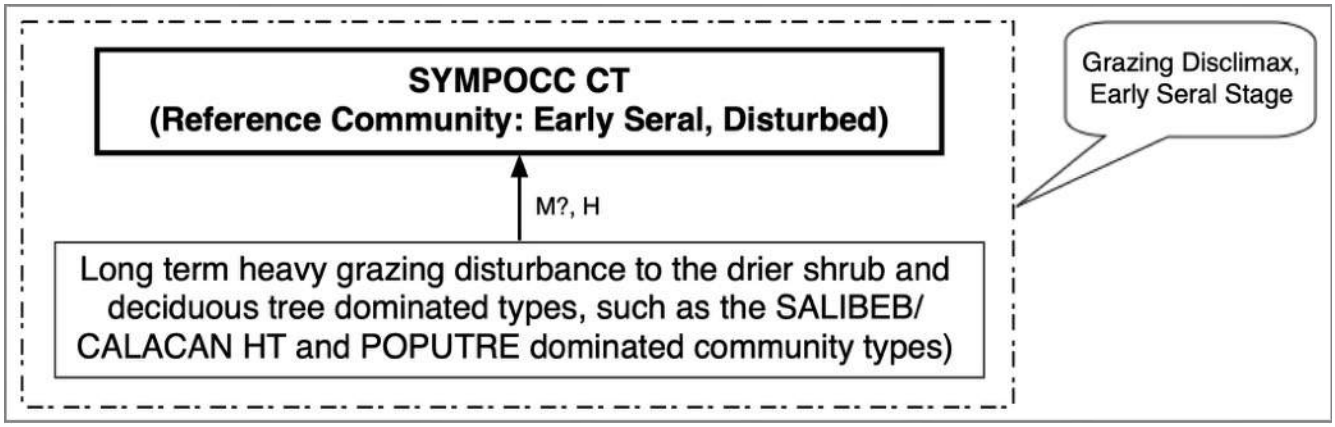
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

The *Symphoricarpos occidentalis* (buckbrush) community type is typically the result of long term grazing disturbance that has eliminated the taller canopy of late seral shrubs from any one of several different shrub dominated habitat types that also contain *Symphoricarpos occidentalis* (buckbrush) or *Symphoricarpos albus* (snowberry) in the community.

Figure 114 shows a schematic diagram of vegetation successional pathways on sites of the *Symphoricarpos occidentalis* (buckbrush) community type.



Successional Pathway of *Symphoricarpos occidentalis* (buckbrush) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Symphoricarpos occidentalis* (buckbrush) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
POPUTRE—*Populus tremuloides* (aspen)
SALIBEB/CALACAN HT—*Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type
SYMPOCC CT—*Symphoricarpos occidentalis* (buckbrush) community type

Figure 114. Successional pathway for sites of the *Symphoricarpos occidentalis* (buckbrush) community type

Note: The *Symphoricarpos occidentalis* (buckbrush) community type on riparian sites seems usually to be the result of grazing disturbance to any of several mesic riparian tree and shrub types that normally have palatable browse species as a major natural component of the understory.

EDATOPE

Figure 115 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Symphoricarpos occidentalis* (buckbrush) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

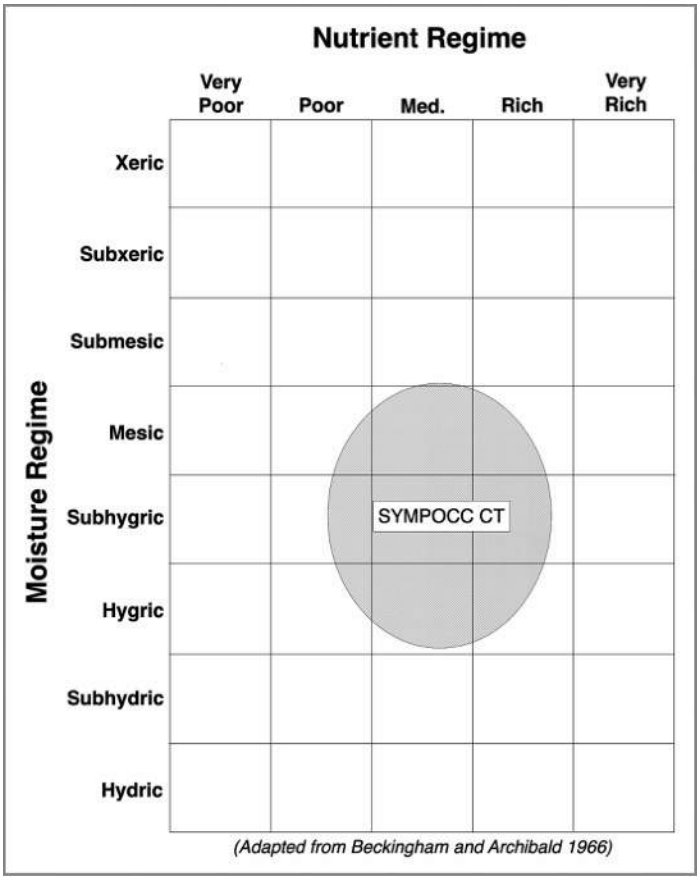


Figure 115. Edatope grid position for the *Symphoricarpos occidentalis* (buckbrush) community type (SYMPOCC CT)

SOILS

The *Symphoricarpos occidentalis* (buckbrush) community type occurs on virtually all soil textures except sand. *Symphoricarpos occidentalis* (buckbrush) thickets occur on various exposures and substrates, ranging from fine-textured alluvial soils to coarse, gravelly substrates. This community type is also tolerant of imperfect drainages and short duration floods, but is intolerant of prolonged floods or permanently high water tables (Thompson and Hansen 2002).

ADJACENT COMMUNITIES

Adjacent wetter communities may include the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, the *Populus tremuloides*/*Viburnum edule* (aspen/low-bush cranberry) community type, or the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type. Adjacent drier sites are usually dominated by upland communities.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Symphoricarpos occidentalis* (buckbrush)**—*Symphoricarpos occidentalis* (buckbrush) is common throughout Alberta, occurring in open woodlands and thickets and forming large colonies in grasslands (Tannas 1997a).

Symphoricarpos occidentalis (buckbrush) may be found in climax stands, but it generally occurs in seral communities on immature soils and in transition zones between grasslands and forests. It is most commonly found in full or nearly full sunlight, but is also frequently found at forest edges where it can survive in partial shade. The species thrives after disturbances, such as fire, logging, and animal activity (Hauser 2007).

***Symphoricarpos albus* (snowberry)**—*Symphoricarpos albus* (snowberry) is common through most of Alberta, occurring in open woodlands, thickets, and slopes (Tannas 1997a). Although the species produces rhizomes, it typically occurs as scattered individual plants as a woodland understory component (Johnson and others 1995).

Symphoricarpos albus (snowberry) may be found in both climax and earlier seral communities, but it generally occurs in seral communities on immature soils and in transition zones between grasslands and forests. It is most commonly found in full or nearly full sunlight, but is also often found at forest edges where it can survive in partial shade. The species thrives after disturbances, such as fire, logging, and animal activity (McWilliams 2000).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is a mat-forming perennial from extensive creeping, shallow rhizomes. It grows moist meadows, riparian areas, and depressions throughout most regions of Alberta up to the subalpine (Tannas 1997a). It is widely distributed across North America growing in every Canadian province. The species is shallow rooted and is intolerant of drought. Most roots and rhizomes are within 7.5 cm of the soil surface. It is a vigorous herbaceous competitor. Not only does it spread by rhizome expansion, but it also produces abundant seed, which accounts for good seedling recruitment and establishment on disturbed sites. It grows on a wide variety of sites in numerous vegetation types, but does best and is most abundant on moist sites where the climate is cool and humid (Uchytil 1993).

Livestock

***Symphoricarpos occidentalis* (buckbrush)**—*Symphoricarpos occidentalis* (buckbrush) forage value is poor, with nutrient levels being fairly good in spring and summer, but dropping in quality by fall. Palatability is poor for both livestock and for wild ungulates, but can vary in relation to the local availability of better forage (Tannas 1997a). This species is an aggressive increaser, gaining abundance under high grazing pressure, due to both rhizomatous vegetative spread and by abundant seed production (Tannas 1997a).

***Symphoricarpos albus* (snowberry)**—*Symphoricarpos albus* (snowberry) forage value is poor, with nutrient levels being fairly good in spring and summer, but dropping in quality by fall. Palatability is poor for both livestock and for wild ungulates, but can vary in relation to the local availability of better forage. The species is a moderately aggressive increaser under livestock grazing, though less aggressive than *Symphoricarpos occidentalis* (buckbrush) (Tannas 1997a).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is rated as good forage value (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, and Beckingham 1991). The species is moderately productive, and provides a significant amount of early season forage. It is highly palatable in the rapid growth phase with palatability becoming greatly reduced during semi dormancy of late summer and winter (Tannas 1997a, Hansen and others 1995). Fall regrowth can occur if moisture is sufficient and temperatures remain above freezing. It is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). A high density of weak, low vigour tillers results under season-long grazing. Early season rest increases the vigour of individual plants. Streambanks with *Poa pratensis* (Kentucky bluegrass) stands are very susceptible to hoof shear damage and erosion The root system of *Poa pratensis* (Kentucky bluegrass) is very dense, but does not extend nearly as deep as native sedges. This results in streambanks being undercut by erosion, causing severe slumping/sloughing of the banks. In other words, it does not develop a deep, binding rootmass capable of streambank protection.

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Symphoricarpos occidentalis* (buckbrush)**—*Symphoricarpos occidentalis* (buckbrush) is an important forage species for elk, mule deer, white-tailed deer, pronghorn, bighorn sheep, and moose. Palatability for deer and elk is rated as good (Hauser 2007). The fruits of the species are an important source of food for some small mammals and birds. Upland game birds heavily utilize these fruits, since they persist on the plant through the winter (Hauser 2007). Snowberry stands provide cover for a variety of animals, particularly small mammals and birds (Hauser 2007).

***Symphoricarpos albus* (snowberry)**—A variety of big game wildlife are reported to utilize *Symphoricarpos albus* (snowberry), with variable indications of palatability and degree of use (McWilliams 2000).

Symphoricarpos albus (snowberry) fruits are an important source of food for some small mammals and birds. Upland game birds heavily utilize the fruits, since they persist on the plant through the winter. The species is important as both cover and food for bird and small mammal populations (McWilliams 2000).

***Poa pratensis* (Kentucky bluegrass)**—Elk and deer make use of the grasses and forbs of this community type, especially in early spring when other forages have not yet started to grow. Waterfowl utilize *Poa pratensis* (Kentucky bluegrass) for food and cover. Upland game birds, small mammals, and small non-game birds use this type for cover (Dittberner and Olson 1983).

Fisheries

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is very poor at stabilizing streambanks (Hansen and others 1995). Bank undercutting and sloughing will likely occur, especially when soils are wet.

Fire

***Symphoricarpos occidentalis* (buckbrush)**—*Symphoricarpos occidentalis* (buckbrush) is fire-tolerant and top-killed plants sprouts after light to moderate burns. While the stems are sensitive to fire, the rhizomes and stem bases can often survive fire due to their depth in the soil (Hauser 2007).

***Symphoricarpos albus* (snowberry)**—*Symphoricarpos albus* (snowberry) has high resistance to fire. After fire has killed the top of the plant, new growth sprouts from the underground rhizomes. As a rhizomatous sprouter, *Symphoricarpos albus* (snowberry) is among the first to recolonize a burned site (McWilliams 2000).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is well adapted to fire, and quickly resprouts after burning. However, it is intolerant of fire during the active growth stages and can be successfully controlled by late spring burning. Fire is an effective tool to remove excessive litter accumulations common on rested or lightly grazed stands. Cool burns will have little effect on the species cover, but spring burns may lower tiller densities (Dix and Smeins 1967).

Rehabilitation/Restoration Considerations

***Symphoricarpos occidentalis* (buckbrush)**—*Symphoricarpos occidentalis* (buckbrush) is a good species choice for restoring disturbed sites, because the plant produces an extensive rhizome/root system, making it an excellent soil binder to prevent erosion (Hauser 2007).

***Symphoricarpos albus* (snowberry)**—Because *Symphoricarpos albus* (snowberry) has great ecological amplitude, it has been widely used in restoring disturbed sites. It has been used extensively in rehabilitation of riparian sites and has excellent streambank stabilizing properties (McWilliams 2000).

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) has an extensive rhizome system, but its shallow rooting habit make it only marginally effective in stabilizing streambanks. The species should not be part of any seed mix for restoring a site. The potential for erosion problems associated with this species is quite high. Managers need to pay close attention to streambanks dominated by *Poa pratensis* (Kentucky bluegrass) to detect early signs of bank failure. Once a streambank starts to degrade, with no change in management there is little that can be done to save it, short of expensive reconstructive treatments. Unless water tables are restored, these degraded sites will retain their dominant cover of introduced grasses (Hansen and others 1995).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Symphoricarpos occidentalis* (buckbrush) community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Snowberry/Cow parsnip-Veiny meadow rue

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msc11 Snowberry-Rose/Kentucky bluegrass (Montane Southern Ecosection)
- Msb6a Snowberry-Rose-Saskatoon (Montane Southern Ecosection)
- Mcb2 Snowberry-Rose/Kentucky bluegrass (Montane Cypress Hills Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Symphoricarpos occidentalis* (buckbrush) community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995);
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001); and
- *Classification and Management of Upland, Riparian, and Wetland Sites of USDI Bureau of Land Management's Miles City Field Office, Eastern Montana USA* (Hansen and others 2008).

Carex aquatilis Habitat Type (water sedge Habitat Type)

CAREAQU Habitat Type
Number of Stands = 25 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 14; Other Data Sets = 11)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of sedge species not identified to the species level (approximately 29 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Carex aquatilis* (water sedge) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This habitat type occurs in wet meadows, along valley bottoms, in shallow depressions, often near open water. The type may grade into the *Carex atherodes* (awned sedge) habitat type or the *Carex utriculata* (beaked sedge) habitat type, reflecting a slight increase in water table depth or duration. Like the *Carex atherodes* (awned sedge) and *Carex utriculata* (beaked sedge) habitat types, stands are often located in silted-in beaver ponds, old oxbow sloughs, or as narrow bands along small streams.

Photo 28 shows a typical stand of the *Carex aquatilis* (water sedge) habitat type.

Photo 28. A stand of the *Carex aquatilis* (water sedge) habitat type (photo provided by Alan Dodd)

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 527 shows the five most prominent plant species among the four lifeforms for species recorded in all 25 stands of the *Carex aquatilis* (water sedge) habitat type. *Carex aquatilis* (water sedge) is by far the most prominent species recorded in stands of this habitat type, followed well behind by *Carex utriculata* (beaked sedge). No other species here is more than moderately prominent.

Table 527. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Carex aquatilis* (water sedge) habitat type (number = 25 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Betula papyrifera (white birch)	0.02	Native
Larix laricina (tamarack)	0.02	Native
Picea mariana (black spruce)	0.02	Native
Shrubs		
Betula pumila (dwarf birch)	0.24	Native
Salix bebbiana (beaked willow)	0.12	Native
Salix serissima (autumn willow)	0.12	Native
Salix planifolia (flat-leaved willow)	0.08	Native
Rubus arcticus (dwarf raspberry)	0.04	Native
Graminoids		
Carex aquatilis (water sedge)	63.80	Native
Carex utriculata (beaked sedge)	12.64	Native
Poa pratensis (Kentucky bluegrass)	4.80	Introduced
Calamagrostis stricta (narrow reed grass)	2.52	Native
Carex atherodes (awned sedge)	1.44	Native

Table 527. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Equisetum fluviatile (swamp horsetail)	4.08	Native
Potentilla palustris (marsh cinquefoil)	2.28	Native
Galium trifidum (small bedstraw)	1.60	Native
Scutellaria galericulata (marsh skullcap)	1.38	Native
Equisetum arvense (common horsetail)	1.22	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 528 through Table 531, break out the vegetation recorded in all 25 stands sampled of the *Carex aquatilis* (water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, moderately species poor, herbaceous habitat type of minor occurrence across the study area.

Table 528 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Carex aquatilis* (water sedge) habitat type. For the 25 stands comprising the habitat type, the number of unique species was 104 with 95 (91.3 percent) of them being native species.

Table 528. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Carex aquatilis* (water sedge) habitat type (number = 25 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	3	3	0	0
Shrubs	13	13	0	0
Graminoids	31	27	3	1
Forbs	57	52	3	2
TOTAL	***104 (100.0%)***	***95 (91.3%)***	***6 (5.8%)***	***3 (2.9%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 529 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Carex aquatilis* (water sedge) habitat type. The average number of species per stand is 8.5, with native species comprising 7.8 species per stand or 91.8 percent.

Table 529. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Carex aquatilis* (water sedge) habitat type (number = 25 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.1	0.1	0.0	0.0
Shrubs	0.7	0.7	0.0	0.0
Graminoids	3.4	3.1	0.2	0.0
Forbs	4.3	3.9	0.3	0.1
TOTAL	***8.5 (100.0%)***	***7.8 (91.8%)***	***0.5 (5.9%)***	***0.1 (1.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 530 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Carex aquatilis* (water sedge) habitat type. The average canopy cover per stand is 114.3 percent, with native species comprising 105.7 percent or 92.5 percent of the total amount of average canopy cover per stand.

Table 530. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Carex aquatilis* (water sedge) habitat type (number = 25 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.1%	0.1%	0.0%	0.0%
Shrubs	0.8%	0.8%	0.0%	0.0%
Graminoids	92.7%	86.6%	6.0%	0.1%
Forbs	20.7%	18.3%	2.3%	0.1%
TOTAL	***114.3% (100.0%)***	***105.7% (92.5%)***	***8.3% (7.3%)***	***0.3% (0.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 531 shows the average number of species and average canopy cover by lifeform in stands of the *Carex aquatilis* (water sedge) habitat type. The average number of species per stand was 8.5 with an average canopy cover of 114.3 percent.

Table 531. Average number of species and average canopy cover by lifeform in stands of the *Carex aquatilis* (water sedge) habitat type (number = 25 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.1	0.1%
Shrubs	0.7	0.8%
Graminoids	3.4	92.7%
Forbs	4.3	20.7%
TOTAL	***8.5***	***114.3%***

Sampled Stands Plant Species List

A total of 104 plant species were recorded on at least one of 25 stands sampled of the *Carex aquatilis* (water sedge) habitat type (Table 532). Three tree species were recorded in very small amounts, each occurring on only one of the 25 sampled stands of the habitat type. None of the 13 shrub species recorded is at all prominent or recorded with more than a small amount of canopy cover on any sampled plot. *Carex aquatilis* (water sedge) is overwhelmingly the most prominent of 31 graminoid species, followed distantly by *Carex utriculata* (beaked sedge). None of the 57 forb species recorded is either notably prominent or frequently occurring.

Table 532. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Carex aquatilis* (water sedge) habitat type (number = 25 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 3)					
Betula papyrifera (white birch)	0.5	0-0.5	4	0.02	N
Larix laricina (tamarack)	0.5	0-0.5	4	0.02	N
Picea mariana (black spruce)	0.5	0-0.5	4	0.02	N
Shrubs (N = 13)					
Betula glandulosa (bog birch)	0.5	0-0.5	4	0.02	N
Betula pumila (dwarf birch)	3.0	0-3	8	0.24	N
Kalmia polifolia (northern laurel)	0.5	0-0.5	4	0.02	N
Ledum groenlandicum (common Labrador tea)	0.5	0-0.5	4	0.02	N
Linnaea borealis (twinflower)	0.5	0-0.5	4	0.02	N
Oxycoccus microcarpus (small bog cranberry)	0.5	0-0.5	4	0.02	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	8	0.04	N
Salix arbusculoides (shrubby willow)	0.5	0-0.5	4	0.02	N
Salix bebbiana (beaked willow)	3.0	0-3	4	0.12	N
Salix candida (hoary willow)	0.5	0-0.5	4	0.02	N
Salix planifolia (flat-leaved willow)	0.5	0-0.5	16	0.08	N
Salix pseudomonticola (false mountain willow)	0.5	0-0.5	4	0.02	N

Table 532. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Salix serissima (autumn willow)	3.0	0-3	4	0.12	N
Graminoids (N = 31)					
Agropyron trachycaulum (slender wheat grass)	10.0	0-10	8	0.80	N
Agrostis scabra (rough hair grass)	1.8	0-3	16	0.28	N
Beckmannia syzigachne (slough grass)	0.5	0-0.5	4	0.02	N
Bromus inermis (smooth brome)	20.0	0-20	4	0.80	I
Calamagrostis canadensis (marsh reed grass)	6.5	0-10	8	0.52	N
Calamagrostis stricta (narrow reed grass)	21.0	0-50	12	2.52	N
Carex aquatilis (water sedge)	63.8	30-97.5	100	63.80	N
Carex atherodes (awned sedge)	9.0	0-20	16	1.44	N
Carex brunnescens (brownish sedge)	0.5	0-0.5	4	0.02	N
Carex diandra (two-stamened sedge)	0.5	0-0.5	4	0.02	N
Carex interior (inland sedge)	15.3	0-30	8	1.22	N
Carex lacustris (lakeshore sedge)	3.0	0-3	4	0.12	N
Carex lasiocarpa (hairy-fruited sedge)	3.0	0-3	4	0.12	N
Carex limosa (mud sedge)	30.0	0-30	4	1.20	N
Carex paupercula (bog sedge)	0.5	0-0.5	4	0.02	N
Carex prairea (prairie sedge)	10.0	0-10	4	0.40	N
Carex preslii (Presl sedge)	10.0	0-10	4	0.40	N
Carex spp. (sedge)	0.5	0-0.5	8	0.04	N
Carex utriculata (beaked sedge)	21.1	0-40	60	12.64	N
Carex vaginata (sheathed sedge)	3.0	0-3	4	0.12	N
Danthonia californica (California oat grass)	3.0	0-3	4	0.12	N
Deschampsia cespitosa (tufted hair grass)	0.5	0-0.5	4	0.02	N
Elymus innovatus (hairy wild rye)	0.5	0-0.5	4	0.02	N
Grass spp. (Unknown grass)	3.0	0-3	4	0.12	B
Juncus balticus (wire rush)	10.0	0-10	4	0.40	N
Muhlenbergia glomerata (bog muhly)	0.5	0-0.5	4	0.02	N
Phleum pratense (timothy)	5.3	0-10	8	0.42	I
Poa palustris (fowl bluegrass)	0.5	0-0.5	8	0.04	N
Poa pratensis (Kentucky bluegrass)	40.0	0-70	12	4.80	I
Schizachne purpurascens (purple oat grass)	3.0	0-3	4	0.12	N
Scirpus hudsonianus (Hudson Bay bulrush)	3.0	0-3	4	0.12	N
Forbs (N = 57)					
Achillea millefolium (common yarrow)	3.7	0-10	12	0.44	N
Anemone canadensis (Canada anemone)	0.5	0-0.5	4	0.02	N
Antennaria neglecta (broad-leaved everlasting)	0.5	0-0.5	4	0.02	N
Aster ciliolatus (Lindley's aster)	3.0	0-3	4	0.12	N
Brassica spp. (mustard)	0.5	0-0.5	4	0.02	I
Callitriche verna (vernal water-starwort)	20.0	0-20	4	0.80	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	4	0.02	N
Cerastium spp. (mouse-ear chickweed)	3.0	0-3	4	0.12	B
Cicuta bulbifera (bulb-bearing water-hemlock)	0.5	0-0.5	8	0.04	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	4	0.02	N

Table 532. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Dodecatheon pulchellum (saline shooting star)	0.5	0-0.5	4	0.02	N
Drosera linearis (slender-leaved sundew)	0.5	0-0.5	4	0.02	N
Drosera rotundifolia (round-leaved sundew)	20.0	0-20	4	0.80	N
Equisetum arvense (common horsetail)	15.3	0-30	8	1.22	N
Equisetum fluviatile (swamp horsetail)	14.6	0-50	28	4.08	N
Equisetum scirpoides (dwarf scouring-rush)	0.5	0-0.5	4	0.02	N
Equisetum sylvaticum (woodland horsetail)	30.0	0-30	4	1.20	N
Eriogonum androsaceum (cushion umbrella-plant)	3.0	0-3	4	0.12	N
Fragaria virginiana (wild strawberry)	1.8	0-3	8	0.14	N
Galium boreale (northern bedstraw)	3.0	0-3	8	0.24	N
Galium trifidum (small bedstraw)	5.7	0-20	28	1.60	N
Gentianella amarella (felwort)	0.5	0-0.5	4	0.02	N
Geum aleppicum (yellow avens)	1.3	0-3	12	0.16	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	4	0.02	N
Habenaria hyperborea (northern green bog orchid)	0.5	0-0.5	8	0.04	N
Hippuris vulgaris (common mare's-tail)	0.5	0-0.5	4	0.02	N
Lysimachia thyrsiflora (tufted loosestrife)	10.0	0-10	4	0.40	N
Menyanthes trifoliata (buck-bean)	11.5	0-20	8	0.92	N
Mertensia paniculata (tall lungwort)	10.0	0-10	4	0.40	N
Mitella nuda (bishop's-cap)	0.5	0-0.5	4	0.02	N
Orchis rotundifolia (round-leaved orchid)	3.0	0-3	4	0.12	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	8	0.04	N
Penstemon procerus (slender blue beardtongue)	0.5	0-0.5	4	0.02	N
Petasites frigidus (arctic sweet coltsfoot)	1.3	0-3	12	0.16	N
Polygonum spp. (polygonum)	0.5	0-0.5	4	0.02	B
Polygonum viviparum (alpine bistort)	0.5	0-0.5	4	0.02	N
Potamogeton natans (floating-leaf pondweed)	0.5	0-0.5	4	0.02	N
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	4	0.02	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	8	0.04	N
Potentilla palustris (marsh cinquefoil)	8.1	0-30	28	2.28	N
Pyrola asarifolia (common pink wintergreen)	3.0	0-3	4	0.12	N
Rumex acetosa (green sorrel)	0.5	0-0.5	4	0.02	N
Rumex occidentalis (western dock)	0.5	0-0.5	20	0.10	N
Scutellaria galericulata (marsh skullcap)	5.8	0-20	24	1.38	N
Sium suave (water parsnip)	0.5	0-0.5	12	0.06	N
Smilacina trifolia (three-leaved Solomon's-seal)	0.5	0-0.5	4	0.02	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	4	0.02	N
Stellaria longipes (long-stalked chickweed)	3.0	0-3	8	0.24	N
Taraxacum officinale (common dandelion)	6.6	0-20	16	1.06	I
Thalictrum venulosum (veiny meadow rue)	3.0	0-3	4	0.12	N
Tofieldia glutinosa (sticky false asphodel)	0.5	0-0.5	4	0.02	N
Trifolium repens (white clover)	15.3	0-30	8	1.22	I
Triglochin maritima (seaside arrow-grass)	3.0	0-3	4	0.12	N

Table 532. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Typha latifolia (common cattail)	0.5	0-0.5	8	0.04	N
Utricularia intermedia (flat-leaved bladderwort)	3.0	0-3	8	0.24	N
Vicia americana (wild vetch)	3.0	0-3	4	0.12	N
Viola nephrophylla (bog violet)	0.5	0-0.5	4	0.02	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 533 shows the five most prominent plant species among the four lifeforms for species recorded in all 10 relatively undisturbed late seral to climax stands of the *Carex aquatilis* (water sedge) habitat type. *Carex aquatilis* (water sedge) is by far the most prominent species recorded in stands of this habitat type, followed well behind by *Carex utriculata* (beaked sedge). No other species here is more than moderately prominent.

Table 533. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Carex aquatilis* (water sedge) habitat type (number = 10 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Betula pumila (dwarf birch)	0.30	Native
Betula glandulosa (bog birch)	0.05	Native
Salix pseudomonticola (false mountain willow)	0.05	Native
Graminoids		
Carex aquatilis (water sedge)	83.50	Native
Carex utriculata (beaked sedge)	19.00	Native
Calamagrostis canadensis (marsh reed grass)	1.30	Native
Carex atherodes (awned sedge)	0.60	Native
Agrostis scabra (rough hair grass)	0.35	Native
Forbs		
Equisetum fluviatile (swamp horsetail)	4.30	Native
Potentilla palustris (marsh cinquefoil)	3.30	Native
Callitriche verna (vernal water-starwort)	2.00	Native
Rumex occidentalis (western dock)	0.10	Native
Geum aleppicum (yellow avens)	0.05	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 534 through Table 537, break out the vegetation recorded in 10 relatively undisturbed late seral to climax stands sampled of the *Carex aquatilis* (water sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a common, moderately species poor, herbaceous, habitat type of minor occurrence across the study area.

Table 534 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex aquatilis* (water sedge) habitat type. For the 10 stands comprising the habitat type, the number of unique species was 18 with 18 (100.0 percent) of them being native species.

Table 534. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex aquatilis* (water sedge) habitat type (number = 10 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	3	3	0	0
Graminoids	7	7	0	0
Forbs	8	8	0	0
TOTAL	***18 (100.0%)***	***18 (100.0%)***	***0 (0.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 535 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex aquatilis* (water sedge) habitat type. The average number of species per stand is 4.1, with native species comprising 4.1 species per stand or 100.0 percent.

Table 535. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex aquatilis* (water sedge) habitat type (number = 10 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.3	0.3	0.0	0.0
Graminoids	2.6	2.6	0.0	0.0
Forbs	1.2	1.2	0.0	0.0
TOTAL	***4.1 (100.0%)***	***4.1 (100.0%)***	***0.0 (0.0%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 536 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex aquatilis* (water sedge) habitat type. The average canopy cover per stand is 115.2 percent, with native species comprising 115.2 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 536. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex aquatilis* (water sedge) habitat type (number = 10 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.4%	0.4%	0.0%	0.0%
Graminoids	104.9%	104.9%	0.0%	0.0%
Forbs	9.9%	9.9%	0.0%	0.0%
TOTAL	***115.2% (100.0%)***	***115.2% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 537 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Carex aquatilis* (water sedge) habitat type. The average number of species per stand was 4.1 with an average canopy cover of 115.2 percent.

Table 537. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Carex aquatilis* (water sedge) habitat type (number = 10 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.3	0.4%
Graminoids	2.6	104.9%
Forbs	1.2	9.9%
TOTAL	***4.1***	***115.2%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 18 plant species were recorded on at least one of 10 relatively undisturbed late seral to climax stands sampled of the *Carex aquatilis* (water sedge) habitat type (Table 538). No trees were recorded on these stands, although three shrub species were present in small amounts, each occurring only on one of the 10 plots sampled. Of seven graminoid species recorded, *Carex aquatilis* (water sedge) was by far most prominent, followed far behind by *Carex utriculata* (beaked sedge). Eight forb species were recorded, but none is more than moderately prominent.

Table 538. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Carex aquatilis* (water sedge) habitat type (number = 10 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Shrubs (N = 3)					
Betula glandulosa (bog birch)	0.5	0-0.5	10	0.05	N
Betula pumila (dwarf birch)	3.0	0-3	10	0.30	N
Salix pseudomonticola (false mountain willow)	0.5	0-0.5	10	0.05	N
Graminoids (N = 7)					
Agrostis scabra (rough hair grass)	1.8	0-3	20	0.35	N
Calamagrostis canadensis (marsh reed grass)	6.5	0-10	20	1.30	N
Carex aquatilis (water sedge)	83.5	70-97.5	100	83.50	N
Carex atherodes (awned sedge)	3.0	0-3	20	0.60	N
Carex brunnescens (brownish sedge)	0.5	0-0.5	10	0.05	N
Carex utriculata (beaked sedge)	27.1	0-40	70	19.00	N
Poa palustris (fowl bluegrass)	0.5	0-0.5	20	0.10	N
Forbs (N = 8)					
Callitriche verna (vernal water-starwort)	20.0	0-20	10	2.00	N
Equisetum fluviatile (swamp horsetail)	14.3	0-30	30	4.30	N
Geum aleppicum (yellow avens)	0.5	0-0.5	10	0.05	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	10	0.05	N
Petasites frigidus (arctic sweet coltsfoot)	0.5	0-0.5	10	0.05	N
Potentilla palustris (marsh cinquefoil)	16.5	0-30	20	3.30	N
Rumex acetosa (green sorrel)	0.5	0-0.5	10	0.05	N
Rumex occidentalis (western dock)	0.5	0-0.5	20	0.10	N

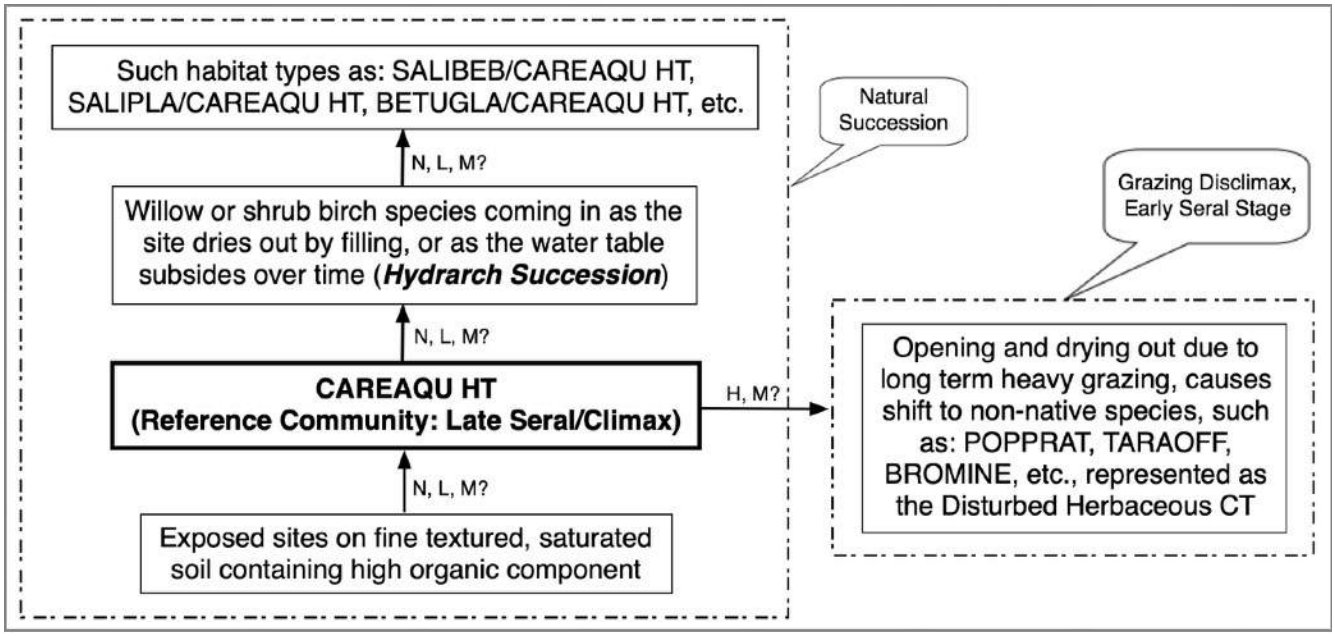
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

New stands of the *Carex aquatilis* (water sedge) habitat type typically develop through primary succession (hydrarch succession), wherein shallow depressions, such as riverine sloughs, fill in over time; or the local water table rises near the surface, creating suitable sites for *Carex aquatilis* (water sedge). Heavy grazing disturbance during periods of drought may be severe enough to alter the community to the Disturbed Herbaceous community type.

Figure 116 shows a schematic diagram of vegetation successional pathways on sites of the *Carex aquatilis* (water sedge) habitat type.



Successional Pathway of *Carex aquatilis* (water sedge) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Carex aquatilis* (water sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES

BETUGLA/CAREAQU HT—*Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type
BROMINE—*Bromus inermis* (smooth brome)
CAREAQU HT—*Carex aquatilis* (water sedge) habitat type
Disturbed Herbaceous CT—Disturbed Herbaceous community type
POAPRAT—*Poa pratensis* (Kentucky bluegrass)
SALIBEB/CAREAQU HT—*Salix bebbiana/Carex aquatilis* (beaked willow/water sedge) habitat type
SALIPLA/CAREAQU HT—*Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type
TARAOFF—*Taraxacum officinale* (common dandelion)

Figure 116. Successional pathway for sites of the *Carex aquatilis* (water sedge) habitat type

Note: A change to a wetter hydrologic regime on a *Carex aquatilis* (water sedge) habitat type would likely result in a change of potential of the site to the *Typha latifolia* (common cattail) habitat type or the *Scirpus acutus* (great bulrush) habitat type. A drier hydrologic regime would likely change the site potential to a shrub type.

EDATOPE

Figure 117 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Carex aquatilis* (water sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

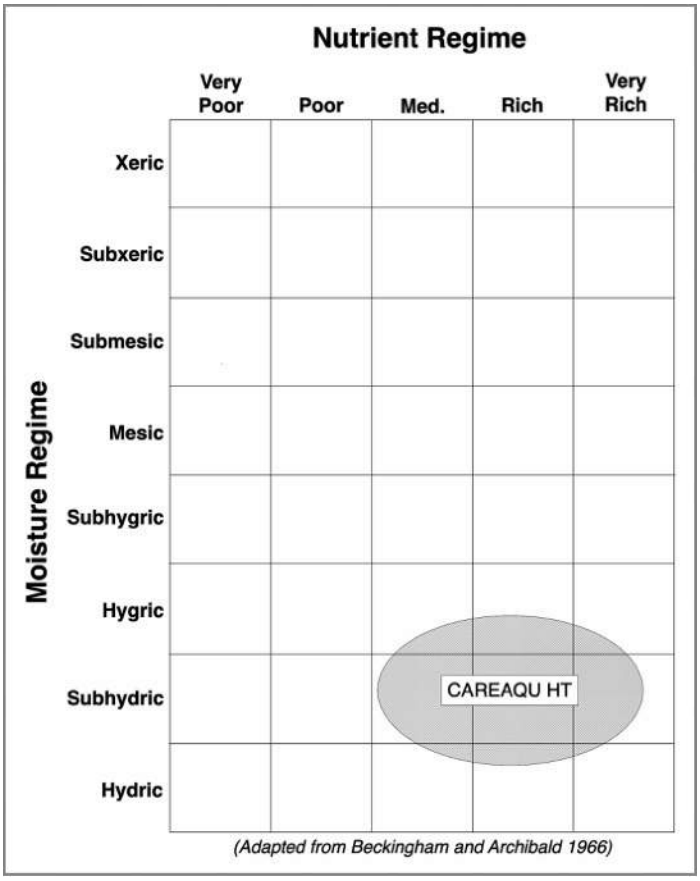


Figure 117. Edatope grid position for the *Carex aquatilis* (water sedge) habitat type (CAREAQU HT)

SOILS

Parent material on sites supporting the *Carex aquatilis* (water sedge) habitat type is often fluvial, with soil drainage ranging from poorly drained to well drained. Mineral soil textures range from loam to clay. Water tables are at or near the surface most of the year, although they can fall below 1 m by mid-summer. Soil subgroups are typically organic (fibrisols, mesisols, and humisols).The ground water table is usually at or near the surface throughout the year (France and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites can include such types as the *Carex utriculata* (beaked sedge) habitat type, the *Typha latifolia* (common cattail) habitat type, and the *Scirpus acutus* (great bulrush) habitat type. Adjacent drier sites may have such types as the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type, the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type, and the *Calamagrostis canadensis* (marsh reed grass) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is very common and widely distributed across Alberta (Tannas 1997a). It is a wetland species, growing along slough margins, shorelines, in marshes and boggy

areas, and sometimes in shallow water (Tannas 1997a). *Carex aquatilis* (water sedge) is a native, wetland obligate, long-lived perennial. It is a sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of finer roots (Hauser 2006). It thrives on disturbed sites, is shade intolerant, and occurs in various stages of seral succession (Hauser 2006).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is common and widely distributed across Alberta. It is a wetland obligate, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). It is a long-lived perennial sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of fine roots (Johnson and others 1995).

Carex utriculata (beaked sedge) is strongly rhizomatous and colonial, typically forming a dense sod. Creeping rhizomes are long, slender or stout, and deep-seated. It grows on sites with high soil moisture, typically with the water table at or above the soil surface during the growing season. This is one of our wettest sedges. On some sites, water tables are above the soil surface all year, and rarely drop below the rooting zone. The species occurs on a range of soil types, with textures from silt loams or silty clays to loamy sands (Anderson 2008).

Carex utriculata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates with continually high water tables and persists indefinitely to form climax communities (Anderson 2008).

Livestock

***Carex aquatilis* (water sedge)**—The livestock forage value of *Carex aquatilis* (water sedge) is rated as good (Tannas 1997a), but varies with region, season, and previous grazing use. On narrow riparian or wetland sites within large pastures, *Carex* species (sedges) are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur. In general, *Carex* species (sedges) should respond satisfactorily to traditional grazing systems. However, on streamside sites ample residual cover should be left to protect the soil surface and trap sediments during fall rains or spring runoff. Removing cattle for at least 30 days from these streamside sites for sedge regrowth at the end of the growing season should provide sufficient residual cover (Myers 1989).

Given that *Carex aquatilis* (water sedge) grows in wet places, it is generally not grazed until late summer and fall when soils have dried (Hauser 2006). Very wet soils may deter animal use until they dry. However, if high level of grazing does occur, there will be a marked decrease in *Carex aquatilis* (water sedge) and an increase in the less palatable *Juncus balticus* (wire rush) (Tannas 1997a).

***Carex utriculata* (beaked sedge)**—Livestock forage value of *Carex utriculata* (beaked sedge) is high (Tannas 1997a, Beckingham 1991). The species is palatable in the spring, but palatability declines as the plants become coarse and tough in summer (Tannas 1997a, Hansen and others 1988). Relative palatability may then increase again in fall as the sedge cures and upland forage is less attractive. *Carex utriculata* (beaked sedge) cover decreases in response to high levels of grazing pressure, and will be replaced with less productive and less palatable species, such as *Juncus balticus* (wire rush) and *Poa* species (bluegrass) (Thompson and Hansen 2003).

In general, *Carex* species (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites, residual cover should be left to protect the banks and the soil surface, and to filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days should provide time for sufficient residual cover regrowth on streamside riparian sites (Myers 1989).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is grazed by many ungulates, including moose, caribou, and elk, but it is not a major component of their diet. Due to the saturated habitat of the species, grazing by most ungulates is limited. *Carex aquatilis* (water sedge) habitat provides nesting and hiding cover for some birds, waterfowl, and small mammals. In riparian and wetland sites, The species is also an important source of food for a variety of waterfowl (Hauser 2006).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is grazed by moose, elk, mule deer, bison, grizzly bears, and sandhill cranes (Anderson 2008). The species is an important component of valuable breeding and feeding grounds for geese and other waterfowl. Birds commonly associated with *Carex utriculata* (beaked sedge) habitats include mallard, green-winged teal, common yellowthroat, red-winged black bird, song sparrow, and tree swallow. *Carex utriculata* (beaked sedge) stands are usually more important as feeding grounds than as nesting grounds because of their low stature, lack of structural diversity, and high water levels. Elk and moose often graze *Carex utriculata* (beaked sedge) stands when *Carex atherodes* (awned sedge) is present (Anderson 2008).

Fisheries

***Carex aquatilis* (water sedge)**—Stands of *Carex aquatilis* (water sedge) often are adjacent to streams supporting trout fisheries. The combined tufted and rhizomatous growth habit of the species effectively stabilizes streambanks. Overhanging *Carex* species (sedges) along the banks provide valuable resting cover and shade for fish (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—The dense network of roots of the rhizomatous *Carex utriculata* (beaked sedge) is very effective in binding soil and stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish (Thompson and Hansen 2003).

Fire

***Carex aquatilis* (water sedge)**—Sites supporting stands of *Carex aquatilis* (water sedge) seldom burn, except in periods of severe drought. When stands of the species do burn, the plants are usually top-killed by the fire and soon re-establish after the fire by seed and/or lateral spread of surviving rhizomes (Hauser 2006). The rhizomes are approximately 5 cm below the ground surface, and are somewhat protected from the heat. The wet habitat also provides protection for roots and rhizomes, although the better-drained areas are more susceptible to fires during dry periods.

Stands of *Carex aquatilis* (water sedge) are suited to prescribed fire, but exclusion of livestock during the year prior to burning is necessary. Residual cover burns well in spring, prior to the growing season. Fire will reduce litter accumulations and temporarily increase productivity. However, species composition in the community will not drastically shift from dominance by *Carex aquatilis* (water sedge) (DeBenedetti and Parsons 1984). Care must be taken in burning along streambanks, so as to avoid impairing the excellent erosion protection provided by the species (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—Sites supporting stands of *Carex utriculata* (beaked sedge) are very wet, except at times of severe drought, and therefore they seldom burn. However, *Carex utriculata* (beaked sedge) sprouts from rhizomes, so it is often able to survive after being top-killed by fire. However, peat soils, common in these communities, can burn when dry, and the heat from such fires can penetrate the soil, destroying the sedge

rhizomes. It is necessary that livestock be excluded during the year prior to burning. Caution should be used with fires along streams because of the excellent erosion protection *Carex utriculata* (beaked sedge) provides. Fires do little to change plant composition of beaked sedge communities (DeBenedetti and Parsons 1984). Fire may regress seral succession in treed or shrubby fen stands back to open sedge meadows that support little woody vegetation (Anderson 2008).

Rehabilitation/Restoration Considerations

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) provides excellent erosion protection along streambanks, buffering against the erosive force of flood events, and filtering sediments during spring flows. Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex aquatilis* (water sedge) tends to form a dense, thick sod that is highly resistant to erosion. (Hauser 2006).

***Carex utriculata* (beaked sedge)**—Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex utriculata* (beaked sedge) has a dense network of rhizomatous roots and forms a thick sod that is highly resistant to erosion and effective in stabilizing streambanks (Anderson 2008).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Carex aquatilis* (water sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- B8. Wet sedge meadow

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Sedge-Tufted hair grass

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Water-Small bottle sedge

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msb12 Water-Small bottle sedge (Montane Southern Ecosection)
- Mca15 Sedge meadows (Montane Cypress Hills Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Carex aquatilis* (water sedge) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995);
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001); and
- *Classification and Management of Upland, Riparian, and Wetland Sites of USDI Bureau of Land Management's Miles City Field Office, Eastern Montana USA* (Hansen and others 2008).

Carex atherodes Habitat Type
(awned sedge Habitat Type)

CAREATH Habitat Type
Number of Stands = 17 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 2; Other Data Sets = 15)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of sedge species not identified to the species level (approximately 29 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Carex atherodes* (awned sedge) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. This habitat occurs on sites ranging from standing water to those that become relatively dry during the later part of the growing season. Stands may be located in wet meadows, in shallow depressions, sometimes near open water. The type may grade into the *Carex aquatilis* (water sedge) habitat type or the *Carex utriculata* (beaked sedge) habitat type, reflecting a slight difference in water table depth or duration. Like the *Carex aquatilis* (water sedge) and *Carex utriculata* (beaked sedge) habitat types, stands are often located in silted-in beaver ponds, old oxbow sloughs, or as narrow bands along small streams.

Photo 29 shows a typical stand of the *Carex atherodes* (awned sedge) habitat type.

Photo 29. A stand of the *Carex atherodes* (awned sedge) habitat type

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 539 shows the five most prominent plant species among the four lifeforms for species recorded in all 17 stands of the *Carex atherodes* (awned sedge) habitat type. *Carex atherodes* (awned sedge) is the only highly prominent species in stands sampled of this habitat type.

Table 539. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Carex atherodes* (awned sedge) habitat type (number = 17 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Salix bebbiana (beaked willow)	0.06	Native
Rosa woodsii (common wild rose)	0.03	Native
Salix planifolia (flat-leaved willow)	0.03	Native
Graminoids		
Carex atherodes (awned sedge)	90.29	Native
Carex utriculata (beaked sedge)	3.50	Native
Carex aquatilis (water sedge)	1.85	Native
Scirpus microcarpus (small-fruited bulrush)	1.38	Native
Calamagrostis canadensis (marsh reed grass)	0.59	Native
Forbs		
Scutellaria galericulata (marsh skullcap)	0.65	Native
Petasites frigidus (arctic sweet coltsfoot)	0.62	Native
Mentha arvensis (wild mint)	0.38	Native
Polygonum amphibium (water smartweed)	0.24	Native
Galium trifidum (small bedstraw)	0.21	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 540 through Table 543, break out the vegetation recorded in all 17 stands sampled of the *Carex atherodes* (awned sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species poor, herbaceous habitat type of minor-to-incidental occurrence across the study area.

Table 540 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Carex atherodes* (awned sedge) habitat type. For the 17 stands comprising the habitat type, the number of unique species was 31 with 30 (96.8 percent) of them being native species.

Table 540. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Carex atherodes* (awned sedge) habitat type (number = 17 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	3	3	0	0
Graminoids	11	11	0	0
Forbs	17	16	1	0
TOTAL	***31 (100.0%)***	***30 (96.8%)***	***1 (3.2%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 541 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Carex atherodes* (awned sedge) habitat type. The average number of species per stand is 4.3, with native species comprising 4.2 species per stand or 97.7 percent.

Table 541. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Carex atherodes* (awned sedge) habitat type (number = 17 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.2	0.2	0.0	0.0
Graminoids	2.2	2.2	0.0	0.0
Forbs	1.9	1.8	0.1	0.0
TOTAL	***4.3 (100.0%)***	***4.2 (97.7%)***	***0.1 (2.3%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 542 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Carex atherodes* (awned sedge) habitat type. The average canopy cover per stand is 101.2 percent, with native species comprising 101.1 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 542. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Carex atherodes* (awned sedge) habitat type (number = 17 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.1%	0.1%	0.0%	0.0%
Graminoids	98.3%	98.3%	0.0%	0.0%
Forbs	2.8%	2.8%	0.0%	0.0%
TOTAL	***101.2% (100.0%)***	***101.1% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 543 shows the average number of species and average canopy cover by lifeform in stands of the *Carex atherodes* (awned sedge) habitat type. The average number of species per stand was 4.3 with an average canopy cover of 101.2 percent.

Table 543. Average number of species and average canopy cover by lifeform in stands of the *Carex atherodes* (awned sedge) habitat type (number = 17 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.2	0.1%
Graminoids	2.2	98.3%
Forbs	1.9	2.8%
TOTAL	***4.3***	***101.2%***

Sampled Stands Plant Species List

A total of 31 plant species were recorded on at least one of 17 stands sampled of the *Carex atherodes* (awned sedge) habitat type (Table 544). No trees were present on these 17 stands, but three shrub species were recorded in very small amounts on one or two plots each. This habitat type is truly dominated by a single species: *Carex atherodes* (awned sedge). Seventeen forbs were recorded, all with extremely low prominence.

Table 544. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Carex atherodes* (awned sedge) habitat type (number = 17 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Shrubs (N = 3)					
Rosa woodsii (common wild rose)	0.5	0-0.5	6	0.03	N
Salix bebbiana (beaked willow)	0.5	0-0.5	12	0.06	N
Salix planifolia (flat-leaved willow)	0.5	0-0.5	6	0.03	N
Graminoids (N = 11)					
Alopecurus aequalis (short-awn meadow-foxtail)	0.5	0-0.5	6	0.03	N
Calamagrostis canadensis (marsh reed grass)	10.0	0-10	6	0.59	N
Calamagrostis stricta (narrow reed grass)	0.5	0-0.5	6	0.03	N
Carex aquatilis (water sedge)	7.9	0-30	24	1.85	N
Carex atherodes (awned sedge)	90.3	60-97.5	100	90.29	N
Carex utriculata (beaked sedge)	9.9	0-40	35	3.50	N
Juncus balticus (wire rush)	3.0	0-3	6	0.18	N
Phalaris arundinacea (reed canary grass)	0.5	0-0.5	6	0.03	N
Poa palustris (fowl bluegrass)	1.8	0-3	12	0.21	N
Scirpus microcarpus (small-fruited bulrush)	7.8	0-20	18	1.38	N
Scolochloa festucacea (spangletop)	3.0	0-3	6	0.18	N
Forbs (N = 17)					
Aster modestus (large northern aster)	0.5	0-0.5	6	0.03	N
Callitriche verna (vernal water-starwort)	3.0	0-3	6	0.18	N
Cicuta maculata (water-hemlock)	0.5	0-0.5	18	0.09	N
Cirsium arvense (Canada thistle)	0.5	0-0.5	6	0.03	I
Equisetum fluviatile (swamp horsetail)	0.5	0-0.5	12	0.06	N
Galium trifidum (small bedstraw)	1.8	0-3	12	0.21	N
Geum aleppicum (yellow avens)	0.5	0-0.5	6	0.03	N
Mentha arvensis (wild mint)	2.2	0-3	18	0.38	N
Petasites frigidus (arctic sweet coltsfoot)	5.3	0-10	12	0.62	N
Polygonum amphibium (water smartweed)	1.3	0-3	18	0.24	N
Polygonum coccineum (water smartweed)	0.5	0-0.5	6	0.03	N
Rumex occidentalis (western dock)	0.5	0-0.5	29	0.15	N
Scutellaria galericulata (marsh skullcap)	3.7	0-10	18	0.65	N
Sium suave (water parsnip)	0.5	0-0.5	6	0.03	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	6	0.03	N
Stachys palustris (marsh hedge-nettle)	0.5	0-0.5	6	0.03	N
Urtica dioica (common nettle)	0.5	0-0.5	6	0.03	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 545 shows the five most prominent plant species among the four lifeforms for species recorded in all 11 relatively undisturbed late seral to climax stands of the *Carex atherodes* (awned sedge) habitat type. *Carex atherodes* (awned sedge) is the only highly prominent species in late seral stands sampled of this habitat type.

Table 545. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Carex atherodes* (awned sedge) habitat type (number = 11 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Salix bebbiana (beaked willow)	0.09	Native
Graminoids		
Carex atherodes (awned sedge)	96.82	Native
Scirpus microcarpus (small-fruited bulrush)	2.14	Native
Carex utriculata (beaked sedge)	1.50	Native
Scolochloa festucacea (spangletop)	0.27	Native
Carex aquatilis (water sedge)	0.05	Native
Forbs		
Galium trifidum (small bedstraw)	0.27	Native
Rumex occidentalis (western dock)	0.18	Native
Equisetum fluviatile (swamp horsetail)	0.09	Native
Polygonum amphibium (water smartweed)	0.09	Native
Cicuta maculata (water-hemlock)	0.05	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.
[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 546 through Table 549, break out the vegetation recorded in 11 relatively undisturbed late seral to climax stands sampled of the *Carex atherodes* (awned sedge) habitat type into the four

vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species poor, herbaceous habitat type of minor-to-incidental occurrence across the study area.

Table 546 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex atherodes* (awned sedge) habitat type. For the 11 stands comprising the habitat type, the number of unique species was 15 with 15 (100.0 percent) of them being native species.

Table 546. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex atherodes* (awned sedge) habitat type (number = 11 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	1	1	0	0
Graminoids	5	5	0	0
Forbs	9	9	0	0
TOTAL	***15 (100.0%)***	***15 (100.0%)***	***0 (0.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 547 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex atherodes* (awned sedge) habitat type. The average number of species per stand is 3.3, with native species comprising 3.3 species per stand or 100.0 percent.

Table 547. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex atherodes* (awned sedge) habitat type (number = 11 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.2	0.2	0.0	0.0
Graminoids	1.8	1.8	0.0	0.0
Forbs	1.3	1.3	0.0	0.0
TOTAL	***3.3 (100.0%)***	***3.3 (100.0%)***	***0.0 (0.0%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 548 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex atherodes* (awned sedge) habitat type. The average canopy cover per stand is 101.7 percent, with native species comprising 101.7 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 548. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex atherodes* (awned sedge) habitat type (number = 11 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.1%	0.1%	0.0%	0.0%
Graminoids	100.8%	100.8%	0.0%	0.0%
Forbs	0.9%	0.9%	0.0%	0.0%
TOTAL	***101.7% (100.0%)***	***101.7% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 549 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Carex atherodes* (awned sedge) habitat type. The average number of species per stand was 3.3 with an average canopy cover of 101.7 percent.

Table 549. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Carex atherodes* (awned sedge) habitat type (number = 11 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.2	0.1%
Graminoids	1.8	100.8%
Forbs	1.3	0.9%
TOTAL	***3.3***	***101.7%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 15 plant species were recorded on at least one of 11 relatively undisturbed late seral to climax stands sampled of the *Carex atherodes* (awned sedge) habitat type (Table 550). No trees were recorded on these stands, and only one shrub species, *Salix bebbiana* (beaked willow), was recorded in very small amounts on 2 of the 11 plots. This habitat type is truly dominated by a single species: *Carex atherodes* (awned sedge). Nine forb species were recorded, all with extremely low prominence.

Table 550. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Carex atherodes* (awned sedge) habitat type (number = 11 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Shrubs (N = 1)					
Salix bebbiana (beaked willow)	0.5	0-0.5	18	0.09	N
Graminoids (N = 5)					
Carex aquatilis (water sedge)	0.5	0-0.5	9	0.05	N
Carex atherodes (awned sedge)	96.8	90-97.5	100	96.82	N
Carex utriculata (beaked sedge)	4.1	0-10	36	1.50	N
Scirpus microcarpus (small-fruited bulrush)	7.8	0-20	27	2.14	N
Scolochloa festucacea (spangletop)	3.0	0-3	9	0.27	N
Forbs (N = 9)					
Cicuta maculata (water-hemlock)	0.5	0-0.5	9	0.05	N
Equisetum fluviatile (swamp horsetail)	0.5	0-0.5	18	0.09	N
Galium trifidum (small bedstraw)	3.0	0-3	9	0.27	N
Geum aleppicum (yellow avens)	0.5	0-0.5	9	0.05	N
Polygonum amphibium (water smartweed)	0.5	0-0.5	18	0.09	N
Polygonum coccineum (water smartweed)	0.5	0-0.5	9	0.05	N
Rumex occidentalis (western dock)	0.5	0-0.5	36	0.18	N
Stachys palustris (marsh hedge-nettle)	0.5	0-0.5	9	0.05	N
Urtica dioica (common nettle)	0.5	0-0.5	9	0.05	N

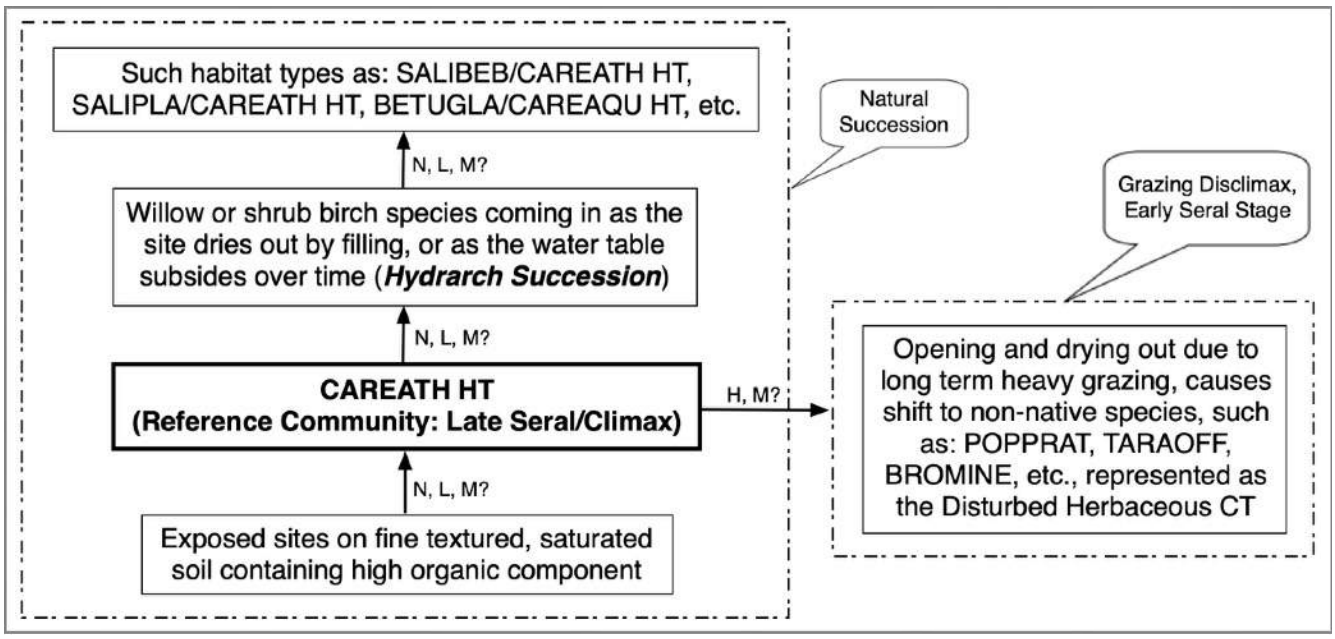
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

New stands of the *Carex atherodes* (awned sedge) habitat type typically develop through primary succession (hydrarch succession), wherein shallow water depressions fill in over time, or the local water table rises near the surface, creating suitable sites for *Carex atherodes* (awned sedge). Heavy grazing disturbance during periods of drought may be severe enough to alter the community to the Disturbed Herbaceous community type.

Figure 118 shows a schematic diagram of vegetation successional pathways on sites of the *Carex atherodes* (awned sedge) habitat type.



Successional Pathway of *Carex atherodes* (awned sedge) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Carex atherodes* (awned sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
BETUGLA/CAREAQU HT—*Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type
BROMINE—*Bromus inermis* (smooth brome)
CAREATH HT—*Carex atherodes* (awned sedge) habitat type
Disturbed Herbaceous CT—Disturbed Herbaceous community type
POAPRAT—*Poa pratensis* (Kentucky bluegrass)
SALIBEB/CAREATH HT—*Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type
SALIPLA/CAREATH HT—*Salix planifolia/Carex atherodes* (flat-leaved willow/awned sedge) habitat type
TARAOFF—*Taraxacum officinale* (common dandelion)

Figure 118. Successional pathway for sites of the *Carex atherodes* (awned sedge) habitat type

Note: A change to a wetter hydrologic regime on a *Carex atherodes* (awned sedge) habitat type would likely result in a change of potential of the site to the *Typha latifolia* (common cattail) habitat type or the *Scirpus acutus* (great bulrush) habitat type. A drier hydrologic regime would likely change the site potential to a shrub type.

EDATOPE

Figure 119 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Carex atherodes* (awned sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

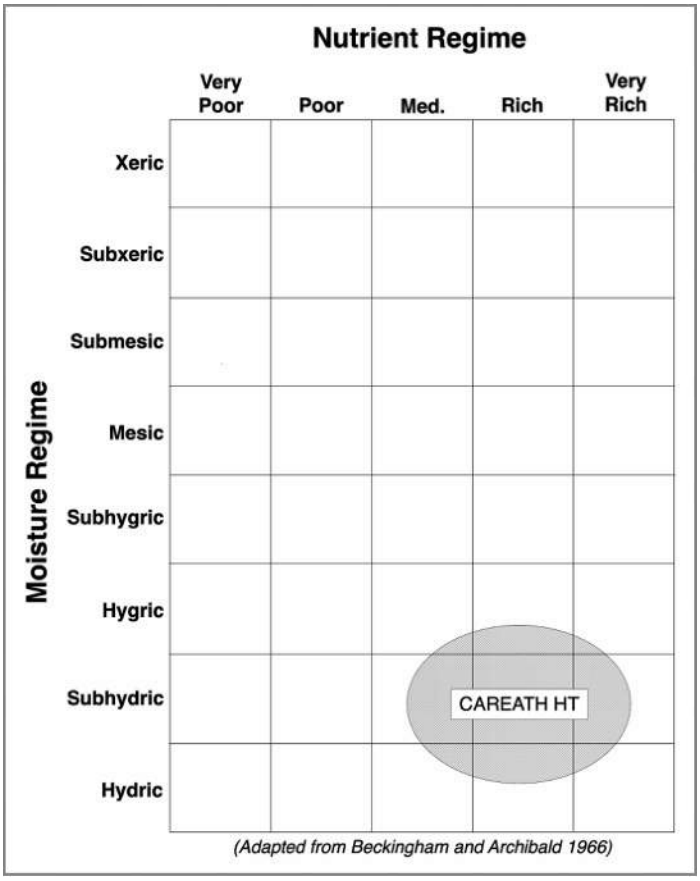


Figure 119. Edatope grid position for the *Carex atherodes* (awned sedge) habitat type (CAREATH HT)

SOILS

The *Carex atherodes* (awned sedge) habitat type is one of the wetter terrestrial plant communities, occurring often on fluvial or fen parent materials. Stands may tolerate water as much as one meter deep for extended periods. A wide range of soil subgroups is associated with this type, but a thick organic layer at the surface is a common feature. These sites are characterized by drainage ranging from poor to very poor. Mineral soil textures range from sand to clay. Redoximorphic features (mottling or gleying) are common. Water tables are typically at or above the soil surface throughout the growing season (Baker and others 2020, France and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites may include the *Carex utriculata* (beaked sedge) habitat type, the *Carex aquatilis* (water sedge) habitat type, the *Typha latifolia* (common cattail) habitat type, or the *Scirpus acutus* (great bulrush) habitat type. Adjacent drier sites may have such communities as the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type, the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type, and the *Calamagrostis canadensis* (marsh reed grass) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) is very common and widely distributed across Alberta (Tannas 1997a). The species is a wetland obligate, growing along slough margins, shorelines, in marshes, and wet meadows, often in standing water (Tannas 1997a). It is a long-lived perennial with moderate tolerance for drought, while tolerance is low for salinity, acidity, and shade. It does best on clay to clay loam soils (Hardy BBT Limited 1989).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is common and widely distributed across Alberta. It is a wetland obligate, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). It is a long-lived perennial sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of fine roots (Johnson and others 1995).

Carex utriculata (beaked sedge) is strongly rhizomatous and colonial, typically forming a dense sod. Creeping rhizomes are long, slender or stout, and deep-seated. It grows on sites with high soil moisture, typically with the water table at or above the soil surface during the growing season. This is one of our wettest sedges. On some sites, water tables are above the soil surface all year, and rarely drop below the rooting zone. The species occurs on a range of soil types, with textures from silt loams or silty clays to loamy sands (Anderson 2008).

Carex utriculata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates with continually high water tables and persists indefinitely to form climax communities (Anderson 2008).

Livestock

***Carex atherodes* (awned sedge)**—Livestock forage value of *Carex atherodes* (awned sedge) is high (Tannas 1997a, Beckingham 1991). *Carex atherodes* (awned sedge) provides good protein and a balance of other nutritional elements, while remaining palatable during the late season when upland forage is less palatable (Tannas 1997a, Hansen and others 1988). In general, *Carex* (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites residual cover should be left to protect the soil surface and filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days for sedge regrowth should provide sufficient residual cover on streamside riparian sites (Myers 1989).

Very wet soils may deter animal use until they dry, allowing the most palatable species to replenish their carbohydrate reserves and to persist in these communities. However, if high levels of grazing do occur, there will be a marked decrease in *Carex atherodes* (awned sedge) with an increase in less palatable species, such as *Juncus balticus* (wire rush). *Carex atherodes* (awned sedge) has medium palatability and medium tolerance for livestock use. Its chemical composition is similar to that of meadow grasses, upland short grass, and mixed prairie species. Seasonal declines in crude protein, phosphorous and carotene were also similar to that of native upland grasses (Hardy BBT Limited 1989).

***Carex utriculata* (beaked sedge)**—Livestock forage value of *Carex utriculata* (beaked sedge) is high (Tannas 1997a, Beckingham 1991). The species is palatable in the spring, but palatability declines as the plants become coarse and tough in summer (Tannas 1997a, Hansen and others 1988). Relative palatability may then increase again in fall as the sedge cures and upland forage is less attractive. *Carex utriculata* (beaked sedge) cover decreases in response to high levels of grazing pressure, and will be replaced with less productive and less palatable species, such as *Juncus balticus* (wire rush) and *Poa* species (bluegrass) (Thompson and Hansen 2003).

In general, *Carex* species (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites, residual cover should be left to protect the banks and the soil surface, and to filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days should provide time for sufficient residual cover regrowth on streamside riparian sites (Myers 1989).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Carex atherodes* (awned sedge)**—Wetland sedge species, such as *Carex atherodes* (awned sedge) are an important component of valuable nesting and feeding grounds for geese and other waterfowl. These stands of prolific seed producing species are usually more important as feeding grounds than as nesting grounds because of their low stature, high water level, and lack of structural diversity (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is grazed by moose, elk, mule deer, bison, grizzly bears, and sandhill cranes (Anderson 2008). The species is an important component of valuable breeding and feeding grounds for geese and other waterfowl. Birds commonly associated with *Carex utriculata* (beaked sedge) habitats include mallard, green-winged teal, common yellowthroat, red-winged black bird, song sparrow, and tree swallow. *Carex utriculata* (beaked sedge) stands are usually more important as feeding grounds than as nesting grounds because of their low stature, lack of structural diversity, and high water levels. Elk and moose often graze *Carex utriculata* (beaked sedge) stands when *Carex atherodes* (awned sedge) is present (Anderson 2008).

Fisheries

***Carex atherodes* (awned sedge)**—Stands of *Carex atherodes* (awned sedge) are found more frequently in lentic situations around depressional wetlands, sloughs, potholes, wet meadows, and fens where fish habitat is not at issue (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—The dense network of roots of the rhizomatous *Carex utriculata* (beaked sedge) is very effective in binding soil and stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish (Thompson and Hansen 2003).

Fire

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) grows on wet sites that seldom dry out enough to carry fire, but the species is adapted to light intensity fire. Residual cover should burn well in early spring, prior to the growing season. Burning will reduce litter accumulations and temporarily increase productivity (Hansen and others 1988), but care should be taken with burning to avoid damage to the excellent soil erosion protection this species provides. Under drought conditions, there is danger of burning the soil peat layer and damaging the roots (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—Sites supporting stands of *Carex utriculata* (beaked sedge) are very wet, except at times of severe drought, and therefore they seldom burn. However, *Carex utriculata* (beaked sedge) sprouts from rhizomes, so it is often able to survive after being top-killed by fire. However, peat soils, common in these communities, can burn when dry, and the heat from such fires can penetrate the soil, destroying the sedge rhizomes. It is necessary that livestock be excluded during the year prior to burning. Caution should be used with fires along streams because of the excellent erosion protection *Carex utriculata* (beaked sedge) provides. Fires do little to change plant composition of beaked sedge communities (DeBenedetti and Parsons 1984). Fire may

regress seral succession in treed or shrubby fen stands back to open sedge meadows that support little woody vegetation (Anderson 2008).

Rehabilitation/Restoration Considerations

***Carex atherodes* (awned sedge)**—*Carex atherodes* (awned sedge) rates high in value for erosion control, and high for its persistence, once established on a site (Hardy BBT Limited 1989). Generally, due to their stronger rhizomatous roots, *Carex* species (sedges) offer better streambank protection than grasses. *Carex atherodes* (awned sedge) forms a dense, thick sod highly resistant to erosion. Along streambanks, the sod may overhang the bank and sag into the water, providing additional protection from erosion (Thompson and Hansen 2003).

Carex atherodes (awned sedge) is suited for long-term revegetation of disturbed sites and erosion control on sites with a high water table. The species can rapidly re-colonize disturbed sites by seed and rhizome extension. Its rhizomes form a dense network effective in stabilizing streambanks and preventing soil erosion (Thompson and Hansen 2003).

***Carex utriculata* (beaked sedge)**—Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex utriculata* (beaked sedge) has a dense network of rhizomatous roots and forms a thick sod that is highly resistant to erosion and effective in stabilizing streambanks (Anderson 2008).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Carex atherodes* (awned sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Sedge-Tufted hair grass

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Water-Small bottle sedge

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Mca15 Sedge meadows (Montane Cypress Hills Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Carex atherodes* (awned sedge) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003); and
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001).

Carex utriculata Habitat Type
(beaked sedge Habitat Type)

CAREUTR Habitat Type
Number of Stands = 30 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 13; Other Data Sets = 17)

NOTE: The number of stands analyzed for this type is not necessarily indicative of the abundance of this type in the study area. The number of stands analyzed for this type was limited due to a large number of sedge species not identified to the species level (approximately 29 percent of the stands) in the Alberta Government Ecological Information System (ECOSYS) data, resulting in the data from these stands being unusable for analysis of this type.

LOCATION AND ASSOCIATED LANDFORMS

The *Carex utriculata* (beaked sedge) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This habitat type occurs on rich graminoid fens with saturated substrates of organic soil or peat on a filled-in lake, or often on a floating mat of organic matter. Stands may be located in wet meadows, in shallow depressions, often near open water. The type may grade into the *Carex aquatilis* (water sedge) habitat type or the *Carex atherodes* (awned sedge) habitat type, reflecting a slight difference in water table depth or duration. Like the *Carex aquatilis* (water sedge) and *Carex atherodes* (awned sedge) habitat types, stands are often located in silted-in beaver ponds, old oxbow sloughs, or as narrow bands along small streams.

Photo 30 shows a typical stand of the *Carex utriculata* (beaked sedge) habitat type.

Photo 30. A stand of the *Carex utriculata* (beaked sedge) habitat type

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 551 shows the five most prominent plant species among the four lifeforms for species recorded in all 30 stands of the *Carex utriculata* (beaked sedge) habitat type. *Carex utriculata* (beaked sedge) is the only highly prominent species in stands sampled of this habitat type.

Table 551. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Carex utriculata* (beaked sedge) habitat type (number = 30 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Cornus stolonifera (red-osier dogwood)	0.10	Native
Salix bebbiana (beaked willow)	0.07	Native
Salix spp. (willow)	0.03	Both
Lonicera involucrata (bracted honeysuckle)	0.02	Native
Salix brachycarpa (short-capsuled willow)	0.02	Native
Graminoids		
Carex utriculata (beaked sedge)	78.33	Native
Carex aquatilis (water sedge)	9.13	Native
Scirpus microcarpus (small-fruited bulrush)	1.72	Native
Calamagrostis canadensis (marsh reed grass)	1.70	Native
Poa pratensis (Kentucky bluegrass)	1.03	Introduced
Forbs		
Taraxacum officinale (common dandelion)	1.12	Introduced
Thalictrum venulosum (veiny meadow rue)	1.00	Native
Equisetum fluviatile (swamp horsetail)	0.87	Native
Polygonum amphibium (water smartweed)	0.78	Native
Geum rivale (purple avens)	0.68	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 552 through Table 555, break out the vegetation recorded in all 30 stands sampled of the *Carex utriculata* (beaked sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species poor, herbaceous habitat type of minor occurrence across the study area.

Table 552 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Carex utriculata* (beaked sedge) habitat type. For the 30 stands comprising the habitat type, the number of unique species was 104 with 88 (84.6 percent) of them being native species.

Table 552. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Carex utriculata* (beaked sedge) habitat type (number = 30 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	7	6	0	1
Graminoids	31	27	4	0
Forbs	66	55	10	1
TOTAL	***104 (100.0%)***	***88 (84.6%)***	***14 (13.5%)***	***2 (1.9%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 553 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Carex utriculata* (beaked sedge) habitat type. The average number of species per stand is 7.4, with native species comprising 6.4 species per stand or 86.5 percent.

Table 553. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Carex utriculata* (beaked sedge) habitat type (number = 30 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.4	0.3	0.0	0.1
Graminoids	3.5	3.2	0.2	0.0
Forbs	3.5	2.9	0.5	0.0
TOTAL	***7.4 (100.0%)***	***6.4 (86.5%)***	***0.7 (9.5%)***	***0.1 (1.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 554 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Carex utriculata* (beaked sedge) habitat type. The average canopy cover per stand is 110.4 percent, with native species comprising 105.9 percent or 95.9 percent of the total amount of average canopy cover per stand.

Table 554. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Carex utriculata* (beaked sedge) habitat type (number = 30 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.3%	0.2%	0.0%	0.0%
Graminoids	101.1%	98.6%	2.5%	0.0%
Forbs	9.0%	7.0%	1.9%	0.1%
TOTAL	***110.4% (100.0%)***	***105.9% (95.9%)***	***4.4% (4.0%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 555 shows the average number of species and average canopy cover by lifeform in stands of the *Carex utriculata* (beaked sedge) habitat type. The average number of species per stand was 7.4 with an average canopy cover of 110.4 percent.

Table 555. Average number of species and average canopy cover by lifeform in stands of the *Carex utriculata* (beaked sedge) habitat type (number = 30 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.4	0.3%
Graminoids	3.5	101.1%
Forbs	3.5	9.0%
TOTAL	***7.4***	***110.4%***

Sampled Stands Plant Species List

A total of 104 plant species were recorded on at least one of 30 stands sampled of the *Carex utriculata* (beaked sedge) habitat type (Table 556). No trees were recorded on these stands, but seven shrub species were recorded, all with extremely low prominence. Among the 31 graminoid species recorded, *Carex utriculata* (beaked sedge) is by far most prominent, followed distantly by *Carex aquatilis* (water sedge). Of the 66 forb species recorded, none is more than moderately prominent.

Table 556. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Carex utriculata* (beaked sedge) habitat type (number = 30 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Shrubs (N = 7)					
Cornus stolonifera (red-osier dogwood)	3.0	0-3	3	0.10	N
Lonicera involucrata (bracted honeysuckle)	0.5	0-0.5	3	0.02	N
Salix bebbiana (beaked willow)	0.5	0-0.5	13	0.07	N
Salix brachycarpa (short-capsuled willow)	0.5	0-0.5	3	0.02	N
Salix exigua (sandbar willow)	0.5	0-0.5	3	0.02	N
Salix planifolia (flat-leaved willow)	0.5	0-0.5	3	0.02	N
Salix spp. (willow)	0.5	0-0.5	7	0.03	B
Graminoids (N = 31)					
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	3	0.02	N
Agrostis stolonifera (redtop)	30.0	0-30	3	1.00	I
Alopecurus occidentalis (alpine foxtail)	0.5	0-0.5	7	0.03	N
Beckmannia syzigachne (slough grass)	0.5	0-0.5	13	0.07	N
Bromus inermis (smooth brome)	10.0	0-10	3	0.33	I
Calamagrostis canadensis (marsh reed grass)	12.8	0-40	13	1.70	N
Calamagrostis stricta (narrow reed grass)	4.8	0-10	17	0.80	N
Carex aquatilis (water sedge)	17.1	0-30	53	9.13	N
Carex atherodes (awned sedge)	10.0	0-10	7	0.67	N
Carex capillaris (hair-like sedge)	30.0	0-30	3	1.00	N
Carex flava (yellow sedge)	0.5	0-0.5	3	0.02	N
Carex lanuginosa (woolly sedge)	10.0	0-10	3	0.33	N
Carex microglochin (short-awned sedge)	0.5	0-0.5	3	0.02	N
Carex pensylvanica (sun-loving sedge)	0.5	0-0.5	3	0.02	N
Carex saxatilis (rocky-ground sedge)	30.0	0-30	3	1.00	N
Carex spp. (sedge)	3.0	0-3	7	0.20	N
Carex utriculata (beaked sedge)	78.3	10-97.5	100	78.33	N
Carex vesicaria (blister sedge)	15.0	0-20	7	1.00	N
Catabrosa aquatica (brook grass)	3.0	0-3	3	0.10	N
Deschampsia cespitosa (tufted hair grass)	5.3	0-10	7	0.35	N
Eleocharis palustris (creeping spike-rush)	10.0	0-10	3	0.33	N
Glyceria grandis (common tall manna grass)	3.9	0-10	17	0.65	N
Juncus alpinoarticulatus (alpine rush)	0.5	0-0.5	3	0.02	N
Juncus balticus (wire rush)	6.0	0-20	13	0.80	N
Juncus mertensianus (slender-stemmed rush)	3.0	0-3	3	0.10	N
Juncus vaseyi (big-head rush)	3.0	0-3	3	0.10	N

Table 556. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Phalaris arundinacea (reed canary grass)	0.5	0-0.5	3	0.02	N
Phleum pratense (timothy)	1.8	0-3	7	0.12	I
Poa palustris (fowl bluegrass)	1.8	0-3	7	0.12	N
Poa pratensis (Kentucky bluegrass)	10.3	0-30	10	1.03	I
Scirpus microcarpus (small-fruited bulrush)	12.9	0-50	13	1.72	N
Forbs (N = 66)					
Achillea millefolium (common yarrow)	5.3	0-10	7	0.35	N
Aster borealis (marsh aster)	0.5	0-0.5	7	0.03	N
Aster ciliolatus (Lindley's aster)	0.5	0-0.5	3	0.02	N
Aster hesperius (western willow aster)	0.5	0-0.5	3	0.02	N
Aster modestus (large northern aster)	0.5	0-0.5	3	0.02	N
Aster spp. (aster)	3.0	0-3	3	0.10	N
Cardamine umbellata (mountain cress)	0.5	0-0.5	3	0.02	N
Castilleja occidentalis (lance-leaved paintbrush)	0.5	0-0.5	3	0.02	N
Chrysanthemum leucanthemum (ox-eye daisy)	0.5	0-0.5	3	0.02	I
Cicuta maculata (water-hemlock)	0.5	0-0.5	7	0.03	N
Cirsium arvense (Canada thistle)	1.3	0-3	10	0.13	I
Delphinium glaucum (tall larkspur)	3.0	0-3	3	0.10	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	3	0.02	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	13	0.07	N
Equisetum arvense (common horsetail)	0.9	0-3	20	0.18	N
Equisetum fluviatile (swamp horsetail)	8.7	0-20	10	0.87	N
Equisetum pratense (meadow horsetail)	0.5	0-0.5	7	0.03	N
Equisetum variegatum (variegated horsetail)	3.0	0-3	3	0.10	N
Forb spp. (forb)	3.0	0-3	3	0.10	B
Fragaria virginiana (wild strawberry)	0.5	0-0.5	7	0.03	N
Galeopsis tetrahit (hemp-nettle)	0.5	0-0.5	3	0.02	I
Galium boreale (northern bedstraw)	10.0	0-10	3	0.33	N
Galium trifidum (small bedstraw)	0.5	0-0.5	3	0.02	N
Galium triflorum (sweet-scented bedstraw)	0.5	0-0.5	3	0.02	N
Geum aleppicum (yellow avens)	0.5	0-0.5	3	0.02	N
Geum macrophyllum (large-leaved yellow avens)	2.2	0-3	10	0.22	N
Geum rivale (purple avens)	10.3	0-20	7	0.68	N
Habenaria dilatata (tall white bog orchid)	0.5	0-0.5	3	0.02	N
Heracleum lanatum (cow parsnip)	0.5	0-0.5	3	0.02	N
Hippuris vulgaris (common mare's-tail)	3.0	0-3	3	0.10	N
Lathyrus ochroleucus (cream-colored vetchling)	3.0	0-3	3	0.10	N
Lysimachia thyrsiflora (tufted loosestrife)	0.5	0-0.5	3	0.02	N
Mentha arvensis (wild mint)	1.4	0-3	27	0.38	N
Mertensia paniculata (tall lungwort)	3.0	0-3	3	0.10	N
Mimulus guttatus (yellow monkeyflower)	0.5	0-0.5	3	0.02	N
Parnassia parviflora (small northern grass-of-parnassus)	0.5	0-0.5	3	0.02	N
Pedicularis groenlandica (elephant's-head)	3.0	0-3	3	0.10	N

Table 556. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Petasites frigidus (arctic sweet coltsfoot)	3.0	0-3	3	0.10	N
Petasites sagittatus (arrow-leaved coltsfoot)	0.5	0-0.5	3	0.02	N
Polygonum amphibium (water smartweed)	7.8	0-20	10	0.78	N
Polygonum coccineum (water smartweed)	0.5	0-0.5	3	0.02	N
Polygonum lapathifolium (pale persicaria)	0.5	0-0.5	3	0.02	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	3	0.02	N
Potentilla palustris (marsh cinquefoil)	0.5	0-0.5	3	0.02	N
Ranunculus acris (tall buttercup)	3.0	0-3	3	0.10	I
Ranunculus inamoenus (graceful buttercup)	3.0	0-3	3	0.10	N
Ranunculus repens (creeping buttercup)	0.5	0-0.5	3	0.02	I
Rumex crispus (curled dock)	6.5	0-10	7	0.43	I
Rumex occidentalis (western dock)	0.5	0-0.5	10	0.05	N
Sium suave (water parsnip)	3.0	0-3	3	0.10	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	3	0.02	N
Stachys palustris (marsh hedge-nettle)	0.5	0-0.5	3	0.02	N
Stellaria longipes (long-stalked chickweed)	1.8	0-3	7	0.12	N
Taraxacum officinale (common dandelion)	11.2	0-30	10	1.12	I
Thalictrum venulosum (veiny meadow rue)	30.0	0-30	3	1.00	N
Tofieldia glutinosa (sticky false asphodel)	0.5	0-0.5	3	0.02	N
Trifolium hybridum (alsike clover)	0.5	0-0.5	3	0.02	I
Trifolium pratense (red clover)	0.5	0-0.5	3	0.02	I
Triglochin maritima (seaside arrow-grass)	0.5	0-0.5	3	0.02	N
Typha latifolia (common cattail)	1.8	0-3	7	0.12	N
Urtica dioica (common nettle)	0.5	0-0.5	3	0.02	N
Veronica americana (American brooklime)	0.5	0-0.5	3	0.02	N
Veronica scutellata (marsh speedwell)	3.0	0-3	3	0.10	N
Vicia americana (wild vetch)	3.0	0-3	3	0.10	N
Viola nephrophylla (bog violet)	0.5	0-0.5	7	0.03	N
Viola palustris (marsh violet)	1.8	0-3	7	0.12	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 557 shows the five most prominent plant species among the four lifeforms for species recorded in all 12 relatively undisturbed late seral to climax stands of the *Carex utriculata* (beaked sedge) habitat type. *Carex utriculata* (beaked sedge) is the only highly prominent species in late seral stands sampled of this habitat type.

Table 557. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Carex utriculata* (beaked sedge) habitat type (number = 12 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Salix exigua (sandbar willow)	0.04	Native
Salix spp. (willow)	0.04	Both
Graminoids		
Carex utriculata (beaked sedge)	91.67	Native
Carex aquatilis (water sedge)	5.00	Native
Carex atherodes (awned sedge)	1.67	Native
Beckmannia syzigachne (slough grass)	0.13	Native
Calamagrostis canadensis (marsh reed grass)	0.08	Native
Forbs		
Equisetum fluviatile (swamp horsetail)	2.17	Native
Polygonum amphibium (water smartweed)	0.29	Native
Mentha arvensis (wild mint)	0.25	Native
Typha latifolia (common cattail)	0.25	Native
Cicuta maculata (water-hemlock)	0.04	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 558 through Table 561, break out the vegetation recorded in 12 relatively undisturbed late seral to climax stands sampled of the *Carex utriculata* (beaked sedge) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species poor, herbaceous habitat type of minor occurrence across the study area.

Table 558 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex*

utriculata (beaked sedge) habitat type. For the 12 stands comprising the habitat type, the number of unique species was 18 with 16 (88.9 percent) of them being native species.

Table 558. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex utriculata* (beaked sedge) habitat type (number = 12 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	2	1	0	1
Graminoids	7	7	0	0
Forbs	9	8	1	0
TOTAL	***18 (100.0%)***	***16 (88.9%)***	***1 (5.6%)***	***1 (5.6%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 559 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex utriculata* (beaked sedge) habitat type. The average number of species per stand is 3.4, with native species comprising 3.2 species per stand or 94.1 percent.

Table 559. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex utriculata* (beaked sedge) habitat type (number = 12 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.2	0.1	0.0	0.1
Graminoids	2.2	2.2	0.0	0.0
Forbs	1.0	0.9	0.1	0.0
TOTAL	***3.4 (100.0%)***	***3.2 (94.1%)***	***0.1 (2.9%)***	***0.1 (2.9%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 560 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex utriculata* (beaked sedge) habitat

type. The average canopy cover per stand is 101.9 percent, with native species comprising 101.8 percent or 99.9 percent of the total amount of average canopy cover per stand.

Table 560. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Carex utriculata* (beaked sedge) habitat type (number = 12 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.1%	0.0%	0.0%	0.0%
Graminoids	98.7%	98.7%	0.0%	0.0%
Forbs	3.2%	3.1%	0.0%	0.0%
TOTAL	***101.9% (100.0%)***	***101.8% (99.9%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 561 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Carex utriculata* (beaked sedge) habitat type. The average number of species per stand was 3.4 with an average canopy cover of 101.9 percent.

Table 561. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Carex utriculata* (beaked sedge) habitat type (number = 12 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.2	0.1%
Graminoids	2.2	98.7%
Forbs	1.0	3.2%
TOTAL	***3.4***	***101.9%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

A total of 18 plant species were recorded on at least one of the 12 relatively undisturbed late seral to climax stands sampled of the *Carex utriculata* (beaked sedge) habitat type (Table 562). No trees were recorded on these 12 stands, but two shrub species were recorded with very low prominence. Among the seven graminoid species recorded, *Carex utriculata* (beaked sedge) is by far most prominent, while of the nine forb species recorded, none is more than moderately prominent.

Table 562. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Carex utriculata* (beaked sedge) habitat type (number = 12 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Shrubs (N = 2)					
Salix exigua (sandbar willow)	0.5	0-0.5	8	0.04	N
Salix spp. (willow)	0.5	0-0.5	8	0.04	B
Graminoids (N = 7)					
Beckmannia syzigachne (slough grass)	0.5	0-0.5	25	0.13	N
Calamagrostis canadensis (marsh reed grass)	0.5	0-0.5	17	0.08	N
Carex aquatilis (water sedge)	15.0	0-20	33	5.00	N
Carex atherodes (awned sedge)	10.0	0-10	17	1.67	N
Carex utriculata (beaked sedge)	91.7	80-97.5	100	91.67	N
Glyceria grandis (common tall manna grass)	0.5	0-0.5	8	0.04	N
Scirpus microcarpus (small-fruited bulrush)	0.5	0-0.5	17	0.08	N
Forbs (N = 9)					
Cicuta maculata (water-hemlock)	0.5	0-0.5	8	0.04	N
Equisetum fluviatile (swamp horsetail)	8.7	0-20	25	2.17	N
Equisetum pratense (meadow horsetail)	0.5	0-0.5	8	0.04	N
Mentha arvensis (wild mint)	3.0	0-3	8	0.25	N
Polygonum amphibium (water smartweed)	1.8	0-3	17	0.29	N
Polygonum coccineum (water smartweed)	0.5	0-0.5	8	0.04	N
Polygonum lapathifolium (pale persicaria)	0.5	0-0.5	8	0.04	N
Potentilla palustris (marsh cinquefoil)	0.5	0-0.5	8	0.04	N
Typha latifolia (common cattail)	3.0	0-3	8	0.25	N

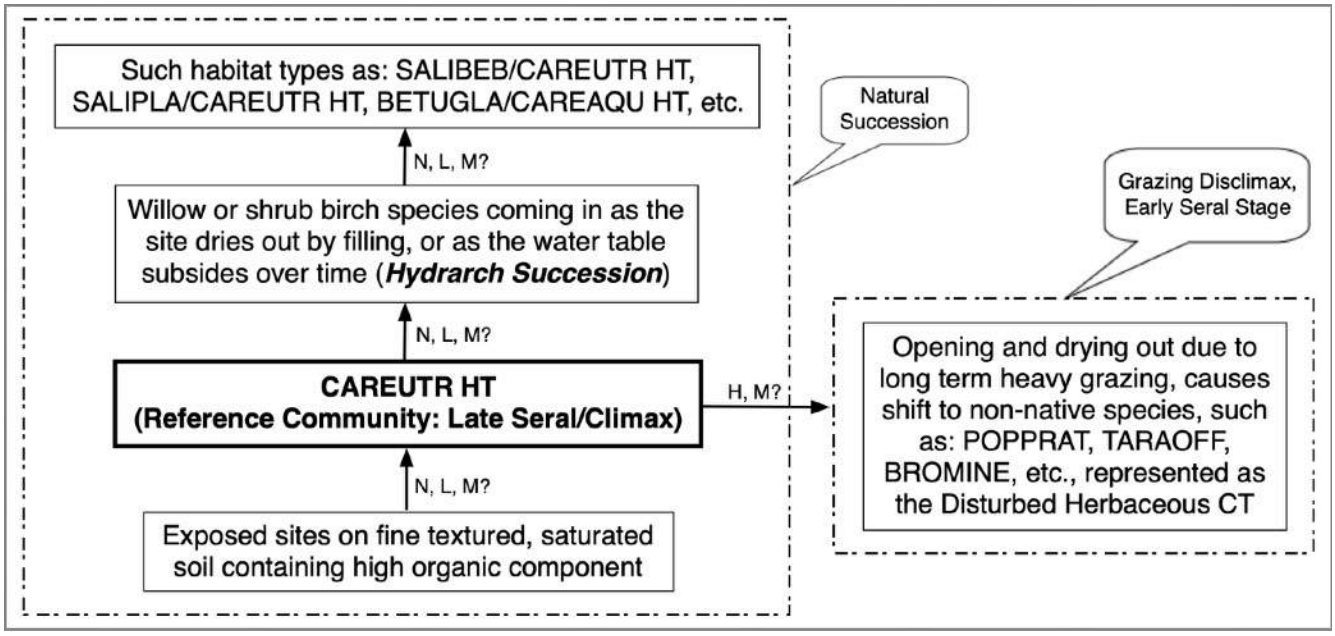
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

New stands of the *Carex utriculata* (beaked sedge) habitat type typically develop through primary succession (hydrarch succession), wherein shallow water depressions fill in over time, or the local water table rises near the surface, creating suitable sites for *Carex utriculata* (beaked sedge). Heavy grazing disturbance during periods of drought may be severe enough to alter the community to the Disturbed Herbaceous community type.

Figure 120 shows a schematic diagram of vegetation successional pathways on sites of the *Carex utriculata* (beaked sedge) habitat type.



Successional Pathway of *Carex utriculata* (beaked sedge) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Carex utriculata* (beaked sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
BETUGLA/CAREAQU HT—*Betula glandulosa/Carex aquatilis* (bog birch/water sedge) habitat type
BROMINE—*Bromus inermis* (smooth brome)
CAREUTR HT—*Carex utriculata* (beaked sedge) habitat type
Disturbed Herbaceous CT—Disturbed Herbaceous community type
POAPRAT—*Poa pratensis* (Kentucky bluegrass)
SALIBEB/CAREUTR HT—*Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type
SALIPLA/CAREUTR HT—*Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type
TARAOFF—*Taraxacum officinale* (common dandelion)

Figure 120. Successional pathway for sites of the *Carex utriculata* (beaked sedge) habitat type

Note: A change to a wetter hydrologic regime on a *Carex utriculata* (beaked sedge) habitat type would likely result in a change of potential of the site to the *Typha latifolia* (common cattail) habitat type or the *Scirpus acutus* (great bulrush) habitat type. A drier hydrologic regime would likely change the site potential to a shrub type.

EDATOPE

Figure 121 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Carex utriculata* (beaked sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

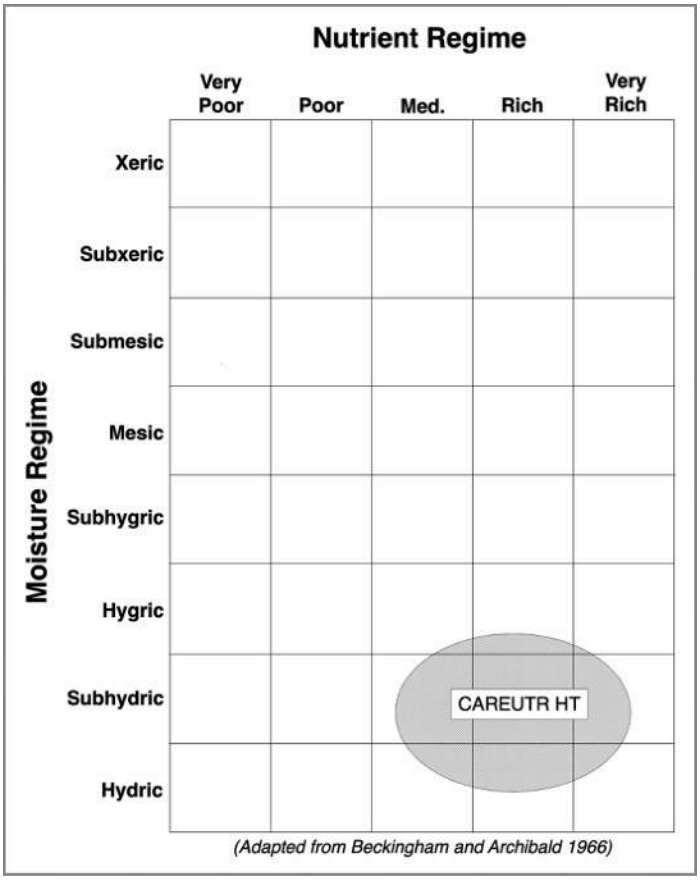


Figure 121. Edatope grid position for the *Carex utriculata* (beaked sedge) habitat type (CAREUTR HT)

SOILS

The *Carex utriculata* (beaked sedge) habitat type is one of the wetter terrestrial plant communities, occurring often on fluvial or fen parent materials. Stands may tolerate water as much as one meter deep for extended periods. A wide range of soil subgroups is associated with this type, but a thick organic layer at the surface is a common feature. These sites are characterized by drainage ranging from poor to very poor. Mineral soil textures range from sand to clay. Redoximorphic features (mottling or gleying) are common. Water tables are typically at or above the soil surface throughout the growing season (Baker and others 2020, France and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites may include such types as the *Typha latifolia* (common cattail) habitat type, the *Scirpus acutus* (great bulrush) habitat type, or be open water. Adjacent drier sites may have such types as the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type, the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type, and the *Calamagrostis canadensis* (marsh reed grass) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is common and widely distributed across Alberta. It is a wetland obligate, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). It is a long-lived perennial sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of fine roots (Johnson and others 1995).

Carex utriculata (beaked sedge) is strongly rhizomatous and colonial, typically forming a dense sod. Creeping rhizomes are long, slender or stout, and deep-seated. It grows on sites with high soil moisture, typically with the water table at or above the soil surface during the growing season. This is one of our wettest sedges. On some sites, water tables are above the soil surface all year, and rarely drop below the rooting zone. The species occurs on a range of soil types, with textures from silt loams or silty clays to loamy sands (Anderson 2008).

Carex utriculata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates with continually high water tables and persists indefinitely to form climax communities (Anderson 2008).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is very common and widely distributed across Alberta (Tannas 1997a). It is a wetland species, growing along slough margins, shorelines, in marshes and boggy areas, and sometimes in shallow water (Tannas 1997a). *Carex aquatilis* (water sedge) is a native, wetland obligate, long-lived perennial. It is a sod-forming, clonal plant, with an extensive network of vertical and horizontal long, stout rhizomes, interspersed with expansive meshes of finer roots (Hauser 2006). It thrives on disturbed sites, is shade intolerant, and occurs in various stages of seral succession (Hauser 2006).

Livestock

***Carex utriculata* (beaked sedge)**—Livestock forage value of *Carex utriculata* (beaked sedge) is high (Tannas 1997a, Beckingham 1991). The species is palatable in the spring, but palatability declines as the plants become coarse and tough in summer (Tannas 1997a, Hansen and others 1988). Relative palatability may then increase again in fall as the sedge cures and upland forage is less attractive. *Carex utriculata* (beaked sedge) cover decreases in response to high levels of grazing pressure, and will be replaced with less productive and less palatable species, such as *Juncus balticus* (wire rush) and *Poa* species (bluegrass) (Thompson and Hansen 2003).

In general, *Carex* species (sedges) respond satisfactorily to traditional grazing systems. However, on streamside sites, residual cover should be left to protect the banks and the soil surface, and to filter out sediments during fall rains or spring runoff. Removing cattle for at least 30 days should provide time for sufficient residual cover regrowth on streamside riparian sites (Myers 1989).

***Carex aquatilis* (water sedge)**—The livestock forage value of *Carex aquatilis* (water sedge) is rated as good (Tannas 1997a), but varies with region, season, and previous grazing use. On narrow riparian or wetland sites within large pastures, *Carex* species (sedges) are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur. In general, *Carex* species (sedges) should respond satisfactorily to traditional grazing systems. However, on streamside sites ample residual cover should be left to protect the soil surface and trap sediments during fall rains or spring runoff. Removing cattle for at least 30 days from these streamside sites for sedge regrowth at the end of the growing season should provide sufficient residual cover (Myers 1989).

Given that *Carex aquatilis* (water sedge) grows in wet places, it is generally not grazed until late summer and fall when soils have dried (Hauser 2006). Very wet soils may deter animal use until they dry. However, if high level of

grazing does occur, there will be a marked decrease in *Carex aquatilis* (water sedge) and an increase in the less palatable *Juncus balticus* (wire rush) (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Carex utriculata* (beaked sedge)**—*Carex utriculata* (beaked sedge) is grazed by moose, elk, mule deer, bison, grizzly bears, and sandhill cranes (Anderson 2008). The species is an important component of valuable breeding and feeding grounds for geese and other waterfowl. Birds commonly associated with *Carex utriculata* (beaked sedge) habitats include mallard, green-winged teal, common yellowthroat, red-winged black bird, song sparrow, and tree swallow. *Carex utriculata* (beaked sedge) stands are usually more important as feeding grounds than as nesting grounds because of their low stature, lack of structural diversity, and high water levels. Elk and moose often graze *Carex utriculata* (beaked sedge) stands when *Carex atherodes* (awned sedge) is present (Anderson 2008).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) is grazed by many ungulates, including moose, caribou, and elk, but it is not a major component of their diet. Due to the saturated habitat of the species, grazing by most ungulates is limited. *Carex aquatilis* (water sedge) habitat provides nesting and hiding cover for some birds, waterfowl, and small mammals. In riparian and wetland sites, The species is also an important source of food for a variety of waterfowl (Hauser 2006).

Fisheries

***Carex utriculata* (beaked sedge)**—The dense network of roots of the rhizomatous *Carex utriculata* (beaked sedge) is very effective in binding soil and stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish (Thompson and Hansen 2003).

***Carex aquatilis* (water sedge)**—Stands of *Carex aquatilis* (water sedge) often are adjacent to streams supporting trout fisheries. The combined tufted and rhizomatous growth habit of the species effectively stabilizes streambanks. Overhanging *Carex* species (sedges) along the banks provide valuable resting cover and shade for fish (Thompson and Hansen 2003).

Fire

***Carex utriculata* (beaked sedge)**—Sites supporting stands of *Carex utriculata* (beaked sedge) are very wet, except at times of severe drought, and therefore they seldom burn. However, *Carex utriculata* (beaked sedge) sprouts from rhizomes, so it is often able to survive after being top-killed by fire. However, peat soils, common in these communities, can burn when dry, and the heat from such fires can penetrate the soil, destroying the sedge rhizomes. It is necessary that livestock be excluded during the year prior to burning. Caution should be used with fires along streams because of the excellent erosion protection *Carex utriculata* (beaked sedge) provides. Fires do little to change plant composition of beaked sedge communities (DeBenedetti and Parsons 1984). Fire may regress seral succession in treed or shrubby fen stands back to open sedge meadows that support little woody vegetation (Anderson 2008).

***Carex aquatilis* (water sedge)**—Sites supporting stands of *Carex aquatilis* (water sedge) seldom burn, except in periods of severe drought. When stands of the species do burn, the plants are usually top-killed by the fire and soon re-establish after the fire by seed and/or lateral spread of surviving rhizomes (Hauser 2006). The rhizomes are approximately 5 cm below the ground surface, and are somewhat protected from the heat. The wet habitat also

provides protection for roots and rhizomes, although the better-drained areas are more susceptible to fires during dry periods.

Stands of *Carex aquatilis* (water sedge) are suited to prescribed fire, but exclusion of livestock during the year prior to burning is necessary. Residual cover burns well in spring, prior to the growing season. Fire will reduce litter accumulations and temporarily increase productivity. However, species composition in the community will not drastically shift from dominance by *Carex aquatilis* (water sedge) (DeBenedetti and Parsons 1984). Care must be taken in burning along streambanks, so as to avoid impairing the excellent erosion protection provided by the species (Thompson and Hansen 2003).

Rehabilitation/Restoration Considerations
***Carex utriculata* (beaked sedge)**—Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex utriculata* (beaked sedge) has a dense network of rhizomatous roots and forms a thick sod that is highly resistant to erosion and effective in stabilizing streambanks (Anderson 2008).

***Carex aquatilis* (water sedge)**—*Carex aquatilis* (water sedge) provides excellent erosion protection along streambanks, buffering against the erosive force of flood events, and filtering sediments during spring flows. Generally, *Carex* species (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex aquatilis* (water sedge) tends to form a dense, thick sod that is highly resistant to erosion. (Hauser 2006).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Carex utriculata* (beaked sedge) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)
- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)
- Sedge-Tufted hair grass

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)
- Small bottle sedge-Kentucky bluegrass
- Water-Small bottle sedge

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)
- Mca15 Sedge meadows (Montane Cypress Hills Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Carex utriculata* (beaked sedge) habitat type was previously described in the region for the following geographic location(s):
- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995); and
- *Classification and Management of Upland, Riparian, and Wetland Sites of USDI Bureau of Land Management's Miles City Field Office, Eastern Montana USA* (Hansen and others 2008).

Calamagrostis canadensis Habitat Type (marsh reed grass Habitat Type)

CALACAN Habitat Type
Number of Stands = 18 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 7; Other Data Sets = 11)

LOCATION AND ASSOCIATED LANDFORMS

The *Calamagrostis canadensis* (marsh reed grass) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This habitat type occurs in wet lowland sites, such as open wet meadows, filled-in or drained beaver ponds, and on low alluvial terraces or benches along low gradient streams (Tannas 1997a).

Photo 31 shows a typical stand of the *Calamagrostis canadensis* (marsh reed grass) habitat type.

Photo 31. A stand of the *Calamagrostis canadensis* (marsh reed grass) habitat type

VEGETATION

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the

plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 563 shows the five most prominent plant species among the four lifeforms for species recorded in all 18 stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type. *Calamagrostis canadensis* (marsh reed grass) often occurs in nearly monospecific stands, and is the only very prominent species recorded in this habitat type.

Table 563. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type (number = 18 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus tremuloides (aspen)	0.06	Native
Populus balsamifera (balsam poplar)	0.03	Native
Shrubs		
Rosa acicularis (prickly rose)	0.19	Native
Betula pumila (dwarf birch)	0.17	Native
Rosa spp. (rose)	0.17	Both
Salix myrtillifolia (myrtle-leaved willow)	0.17	Native
Rubus idaeus (wild red raspberry)	0.06	Native
Graminoids		
Calamagrostis canadensis (marsh reed grass)	60.69	Native
Deschampsia cespitosa (tufted hair grass)	4.44	Native
Carex atherodes (awned sedge)	3.86	Native
Poa pratensis (Kentucky bluegrass)	1.83	Introduced
Calamagrostis stricta (narrow reed grass)	1.67	Native
Forbs		
Fragaria virginiana (wild strawberry)	2.44	Native
Trifolium repens (white clover)	1.28	Introduced
Heracleum lanatum (cow parsnip)	1.11	Native
Senecio triangularis (brook ragwort)	1.11	Native
Achillea millefolium (common yarrow)	0.97	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 564 through Table 567, break out the vegetation recorded in all 18 stands sampled of the *Calamagrostis canadensis* (marsh reed grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, herbaceous habitat type of minor occurrence across the study area.

Table 564 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type. For the 18 stands comprising the habitat type, the number of unique species was 136 with 115 (84.6 percent) of them being native species.

Table 564. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Calamagrostis canadensis* (marsh reed grass) habitat type (number = 18 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	2	2	0	0
Shrubs	19	17	0	2
Graminoids	37	32	4	1
Forbs	78	64	10	4
TOTAL	***136 (100.0%)***	***115 (84.6%)***	***14 (10.3%)***	***7 (5.1%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 565 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type. The average number of species per stand is 13.5, with native species comprising 11.4 species per stand or 84.4 percent.

Table 565. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Calamagrostis canadensis* (marsh reed grass) habitat type (number = 18 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.2	0.2	0.0	0.0
Shrubs	1.2	1.1	0.0	0.1
Graminoids	4.3	3.7	0.6	0.1
Forbs	7.8	6.4	1.1	0.3
TOTAL	***13.5 (100.0%)***	***11.4 (84.4%)***	***1.7 (12.6%)***	***0.5 (3.7%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 566 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type. The average canopy cover per stand is 101.2 percent, with native species comprising 93.0 percent or 91.9 percent of the total amount of average canopy cover per stand.

Table 566. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Calamagrostis canadensis* (marsh reed grass) habitat type (number = 18 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.1%	0.1%	0.0%	0.0%
Shrubs	1.2%	1.1%	0.0%	0.2%
Graminoids	83.5%	79.2%	3.2%	1.1%
Forbs	16.4%	12.8%	2.9%	0.8%
TOTAL	***101.2% (100.0%)***	***93.0% (91.9%)***	***6.1% (6.0%)***	***2.1% (2.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 567 shows the average number of species and average canopy cover by lifeform in stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type. The average number of species per stand was 13.5 with an average canopy cover of 101.2 percent.

Table 567. Average number of species and average canopy cover by lifeform in stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type (number = 18 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.2	0.1%
Shrubs	1.2	1.2%
Graminoids	4.3	83.5%
Forbs	7.8	16.4%
TOTAL	***13.5***	***101.2%***

Sampled Stands Plant Species List

Two tree species were recorded in very small amounts on at least one of 18 sampled stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type (Table 568). Nineteen shrub species were recorded on these 18 plots, but all have very low prominence and no shrub species was found on more than two of the plots. Of the 37 graminoids recorded, only the type indicator *Calamagrostis canadensis* (marsh reed grass) has a high prominence index value. Of 78 forbs recorded, none was very prominent or occurred on more than a third of the plots.

Table 568. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type (number = 18 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 2)					
Populus balsamifera (balsam poplar)	0.5	0-0.5	6	0.03	N
Populus tremuloides (aspen)	0.5	0-0.5	11	0.06	N
Shrubs (N = 19)					
Arctostaphylos uva-ursi (common bearberry)	0.5	0-0.5	6	0.03	N
Betula pumila (dwarf birch)	3.0	0-3	6	0.17	N
Cornus stolonifera (red-osier dogwood)	0.5	0-0.5	6	0.03	N
Potentilla fruticosa (shrubby cinquefoil)	0.5	0-0.5	6	0.03	N
Prunus pensylvanica (pin cherry)	0.5	0-0.5	6	0.03	N
Rosa acicularis (prickly rose)	1.8	0-3	11	0.19	N
Rosa spp. (rose)	3.0	0-3	6	0.17	B
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	6	0.03	N
Rubus idaeus (wild red raspberry)	0.5	0-0.5	11	0.06	N
Rubus parviflorus (thimbleberry)	0.5	0-0.5	6	0.03	N
Salix bebbiana (beaked willow)	0.5	0-0.5	11	0.06	N
Salix discolor (pussy willow)	0.5	0-0.5	6	0.03	N
Salix exigua (sandbar willow)	0.5	0-0.5	6	0.03	N
Salix glauca (smooth willow)	0.5	0-0.5	6	0.03	N
Salix maccalliana (velvet-fruited willow)	0.5	0-0.5	6	0.03	N
Salix myrtillifolia (myrtle-leaved willow)	3.0	0-3	6	0.17	N
Salix planifolia (flat-leaved willow)	0.5	0-0.5	6	0.03	N
Salix spp. (willow)	0.5	0-0.5	6	0.03	B

Table 568. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Symphoricarpos occidentalis (buckbrush)	0.5	0-0.5	6	0.03	N
Graminoids (N = 37)					
Agropyron dasystachyum (northern wheat grass)	0.5	0-0.5	6	0.03	N
Agropyron trachycaulum (slender wheat grass)	1.8	0-3	11	0.19	N
Agrostis humilis (low bent grass)	0.5	0-0.5	6	0.03	N
Agrostis scabra (rough hair grass)	3.0	0-3	6	0.17	N
Agrostis stolonifera (redtop)	0.5	0-0.5	6	0.03	I
Bromus ciliatus (fringed brome)	10.0	0-10	6	0.56	N
Bromus inermis (smooth brome)	1.3	0-3	17	0.22	I
Bromus inermis subsp. *pumpellianus* (northern awnless brome)	3.0	0-3	6	0.17	N
Calamagrostis canadensis (marsh reed grass)	64.3	0-97.5	94	60.69	N
Calamagrostis stricta (narrow reed grass)	30.0	0-30	6	1.67	N
Carex aquatilis (water sedge)	1.8	0-3	11	0.19	N
Carex atherodes (awned sedge)	9.9	0-20	39	3.86	N
Carex bebbii (Bebb's sedge)	1.3	0-3	17	0.22	N
Carex franklinii (Franklin's sedge)	0.5	0-0.5	6	0.03	N
Carex norvegica (Norway sedge)	3.0	0-3	6	0.17	N
Carex prairea (prairie sedge)	0.5	0-0.5	6	0.03	N
Carex preslii (Presl sedge)	20.0	0-20	6	1.11	N
Carex spp. (sedge)	0.5	0-0.5	6	0.03	N
Carex sychnocephala (long-beaked sedge)	0.5	0-0.5	6	0.03	N
Carex utriculata (beaked sedge)	1.8	0-3	11	0.19	N
Deschampsia cespitosa (tufted hair grass)	26.7	0-40	17	4.44	N
Elymus glaucus (smooth wild rye)	30.0	0-30	6	1.67	N
Elymus innovatus (hairy wild rye)	0.5	0-0.5	6	0.03	N
Festuca rubra (red fescue)	20.0	0-20	6	1.11	B
Festuca saximontana (Rocky Mountain fescue)	0.5	0-0.5	11	0.06	N
Glyceria elata (tufted tall manna grass)	0.5	0-0.5	6	0.03	N
Glyceria grandis (common tall manna grass)	0.5	0-0.5	6	0.03	N
Hierochloe odorata (sweet grass)	0.5	0-0.5	6	0.03	N
Juncus balticus (wire rush)	6.5	0-10	11	0.72	N
Juncus spp. (rush)	0.5	0-0.5	6	0.03	N
Koeleria macrantha (June grass)	3.0	0-3	6	0.17	N
Phleum pratense (timothy)	10.0	0-10	11	1.11	I
Phragmites australis (reed)	10.0	0-10	6	0.56	N
Poa interior (inland bluegrass)	0.5	0-0.5	6	0.03	N
Poa palustris (fowl bluegrass)	5.3	0-10	28	1.47	N
Poa pratensis (Kentucky bluegrass)	8.3	0-10	22	1.83	I
Schizachne purpurascens (purple oat grass)	10.0	0-10	6	0.56	N
Forbs (N = 78)					
Achillea millefolium (common yarrow)	2.9	0-10	33	0.97	N
Agoseris glauca (yellow false dandelion)	0.5	0-0.5	6	0.03	N
Anemone multifida (cut-leaved anemone)	0.5	0-0.5	6	0.03	N

Table 568. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Anemone richardsonii (yellow anemone)	0.5	0-0.5	6	0.03	N
Antennaria umbrinella (brown-bracted mountain everlasting)	0.5	0-0.5	6	0.03	N
Aster ciliolatus (Lindley's aster)	1.8	0-3	22	0.39	N
Aster hesperius (western willow aster)	0.5	0-0.5	6	0.03	N
Aster laevis (smooth aster)	0.5	0-0.5	6	0.03	N
Aster modestus (large northern aster)	4.5	0-10	17	0.75	N
Aster subspicatus (leafy-bracted aster)	1.8	0-3	11	0.19	N
Campanula rotundifolia (harebell)	0.5	0-0.5	6	0.03	N
Castilleja miniata (common red paintbrush)	0.5	0-0.5	6	0.03	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	6	0.03	N
Cerastium vulgatum (common mouse-ear chickweed)	0.5	0-0.5	6	0.03	I
Cicuta maculata (water-hemlock)	0.5	0-0.5	11	0.06	N
Cirsium arvense (Canada thistle)	1.8	0-3	11	0.19	I
Cirsium hookerianum (white thistle)	0.5	0-0.5	6	0.03	N
Delphinium glaucum (tall larkspur)	0.5	0-0.5	11	0.06	N
Epilobium anagallidifolium (alpine willowherb)	0.5	0-0.5	6	0.03	N
Epilobium angustifolium (common fireweed)	0.5	0-0.5	11	0.06	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	6	0.03	N
Equisetum arvense (common horsetail)	5.3	0-10	11	0.58	N
Erigeron philadelphicus (Philadelphia fleabane)	0.5	0-0.5	6	0.03	N
Erysimum cheiranthoides (wormseed mustard)	0.5	0-0.5	6	0.03	N
Fragaria virginiana (wild strawberry)	7.3	0-20	33	2.44	N
Galium boreale (northern bedstraw)	0.5	0-0.5	17	0.08	N
Galium spp. (bedstraw)	0.5	0-0.5	6	0.03	B
Galium trifidum (small bedstraw)	1.8	0-3	11	0.19	N
Gentianella amarella (felwort)	0.5	0-0.5	11	0.06	N
Geranium richardsonii (wild white geranium)	0.5	0-0.5	6	0.03	N
Geum aleppicum (yellow avens)	2.4	0-10	28	0.67	N
Geum macrophyllum (large-leaved yellow avens)	1.8	0-3	11	0.19	N
Geum rivale (purple avens)	3.0	0-3	11	0.33	N
Heracleum lanatum (cow parsnip)	20.0	0-20	6	1.11	N
Impatiens spp. (touch-me-not)	0.5	0-0.5	6	0.03	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	11	0.06	N
Lupinus argenteus (silvery perennial lupine)	0.5	0-0.5	6	0.03	N
Mentha arvensis (wild mint)	1.3	0-3	17	0.22	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	17	0.08	N
Myosotis alpestris (alpine forget-me-not)	0.5	0-0.5	6	0.03	N
Pedicularis spp. (lousewort)	0.5	0-0.5	6	0.03	N
Petasites frigidus (arctic sweet coltsfoot)	3.0	0-3	6	0.17	N
Polygonum lapathifolium (pale persicaria)	3.0	0-3	6	0.17	N
Potentilla anserina (silverweed)	0.5	0-0.5	11	0.06	N
Potentilla diversifolia (mountain cinquefoil)	0.5	0-0.5	6	0.03	N

Table 568. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Potentilla gracilis (graceful cinquefoil)	0.5	0-0.5	11	0.06	N
Potentilla norvegica (rough cinquefoil)	0.5	0-0.5	11	0.06	N
Potentilla paradoxa (bushy cinquefoil)	0.5	0-0.5	6	0.03	N
Ranunculus spp. (ranunculus)	0.5	0-0.5	6	0.03	B
Rumex acetosa (green sorrel)	0.5	0-0.5	6	0.03	N
Rumex crispus (curled dock)	0.5	0-0.5	11	0.06	I
Rumex occidentalis (western dock)	0.5	0-0.5	17	0.08	N
Scutellaria galericulata (marsh skullcap)	1.8	0-3	11	0.19	N
Senecio foetidus (marsh butterweed)	0.5	0-0.5	6	0.03	N
Senecio spp. (senecio)	0.5	0-0.5	6	0.03	B
Senecio triangularis (brook ragwort)	20.0	0-20	6	1.11	N
Senecio vulgaris (common groundsel)	0.5	0-0.5	6	0.03	I
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	6	0.03	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	6	0.03	N
Solidago gigantea (late goldenrod)	0.5	0-0.5	6	0.03	N
Solidago missouriensis (low goldenrod)	0.5	0-0.5	6	0.03	N
Sonchus arvensis (perennial sow-thistle)	0.5	0-0.5	11	0.06	I
Stachys palustris (marsh hedge-nettle)	0.5	0-0.5	6	0.03	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	6	0.03	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	11	0.06	N
Taraxacum officinale (common dandelion)	2.2	0-10	39	0.86	I
Thalictrum venulosum (veiny meadow rue)	1.5	0-3	28	0.42	N
Trifolium pratense (red clover)	3.0	0-3	6	0.17	I
Trifolium repens (white clover)	11.5	0-20	11	1.28	I
Trollius albiflorus (globeflower)	3.0	0-3	6	0.17	N
Typha latifolia (common cattail)	0.5	0-0.5	6	0.03	N
Urtica dioica (common nettle)	3.7	0-10	17	0.61	N
Valeriana dioica (northern valerian)	0.5	0-0.5	11	0.06	N
Valeriana sitchensis (mountain valerian)	3.0	0-3	6	0.17	N
Veratrum eschscholtzii (green false hellebore)	0.5	0-0.5	6	0.03	N
Vicia americana (wild vetch)	1.3	0-3	17	0.22	N
Viola spp. (violet)	6.5	0-10	11	0.72	B
Zizia aptera (heart-leaved Alexanders)	0.5	0-0.5	6	0.03	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the

plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 569 shows the five most prominent plant species among the four lifeforms for species recorded in all five relatively undisturbed late seral to climax stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type. No trees or shrubs were present in these late seral stands, and only *Calamagrostis canadensis* (marsh reed grass) is highly prominent in late seral stands of this habitat type.

Table 569. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type (number = 5 stands)

Species	Prominence Value[1]	Origin Status[2]
Graminoids		
Calamagrostis canadensis (marsh reed grass)	85.00	Native
Carex atherodes (awned sedge)	4.60	Native
Poa palustris (fowl bluegrass)	2.00	Native
Carex utriculata (beaked sedge)	0.60	Native
Glyceria elata (tufted tall manna grass)	0.10	Native
Forbs		
Viola spp. (violet)	2.00	Native
Galium trifidum (small bedstraw)	0.60	Native
Mentha arvensis (wild mint)	0.60	Native
Aster subspicatus (leafy-bracted aster)	0.10	Native
Epilobium ciliatum (northern willowherb)	0.10	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 570 through Table 573, break out the vegetation recorded in five relatively undisturbed late seral to climax stands sampled of the *Calamagrostis canadensis* (marsh reed grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, herbaceous habitat type of minor occurrence across the study area.

Table 570 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type. For the 5 stands comprising the habitat type, the number of unique species was 13 with 10 (76.9 percent) of them being native species.

Table 570. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type (number = 5 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	0	0	0	0
Graminoids	5	5	0	0
Forbs	8	5	1	2
TOTAL	***13 (100.0%)***	***10 (76.9%)***	***1 (7.7%)***	***2 (15.4%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 571 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type. The average number of species per stand is 3.6, with native species comprising 3.0 species per stand or 83.3 percent.

Table 571. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type (number = 5 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.0	0.0	0.0	0.0
Graminoids	2.0	2.0	0.0	0.0
Forbs	1.6	1.0	0.2	0.4
TOTAL	***3.6 (100.0%)***	***3.0 (83.3%)***	***0.2 (5.6%)***	***0.4 (11.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 572 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type. The average canopy cover per stand is 96.0 percent, with native species comprising 93.8 percent or 97.7 percent of the total amount of average canopy cover per stand.

Table 572. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type (number = 5 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.0%	0.0%	0.0%	0.0%
Graminoids	92.3%	92.3%	0.0%	0.0%
Forbs	3.7%	1.5%	0.1%	2.1%
TOTAL	***96.0% (100.0%)***	***93.8% (97.7%)***	***0.1% (0.1%)***	***2.1% (2.2%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 573 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type. The average number of species per stand was 3.6 with an average canopy cover of 96.0 percent.

Table 573. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type (number = 5 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.0	0.0%
Graminoids	2.0	92.3%
Forbs	1.6	3.7%
TOTAL	***3.6***	***96.0%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

No trees or shrubs were recorded on the five relatively undisturbed late seral to climax sampled stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type (Table 574). Of the five graminoid species recorded, *Calamagrostis canadensis* (marsh reed grass) overwhelmingly dominates these later seral stands. Eight forb species were recorded, all with low prominence.

Table 574. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Calamagrostis canadensis* (marsh reed grass) habitat type (number = 5 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Graminoids (N = 5)					
Calamagrostis canadensis (marsh reed grass)	85.0	60-97.5	100	85.00	N
Carex atherodes (awned sedge)	11.5	0-20	40	4.60	N
Carex utriculata (beaked sedge)	3.0	0-3	20	0.60	N
Glyceria elata (tufted tall manna grass)	0.5	0-0.5	20	0.10	N
Poa palustris (fowl bluegrass)	10.0	0-10	20	2.00	N
Forbs (N = 8)					
Aster subspicatus (leafy-bracted aster)	0.5	0-0.5	20	0.10	N
Epilobium ciliatum (northern willowherb)	0.5	0-0.5	20	0.10	N
Galium spp. (bedstraw)	0.5	0-0.5	20	0.10	B
Galium trifidum (small bedstraw)	3.0	0-3	20	0.60	N
Geum macrophyllum (large-leaved yellow avens)	0.5	0-0.5	20	0.10	N
Mentha arvensis (wild mint)	3.0	0-3	20	0.60	N
Rumex crispus (curled dock)	0.5	0-0.5	20	0.10	I
Viola spp. (violet)	10.0	0-10	20	2.00	B

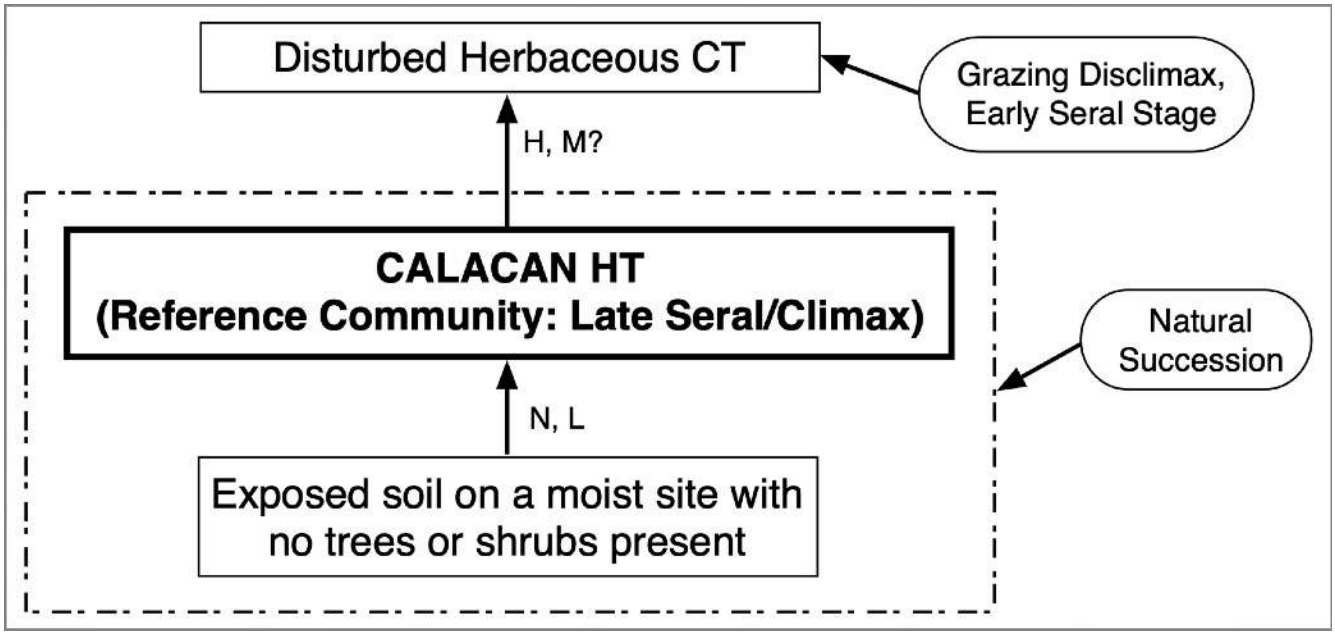
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Calamagrostis canadensis (marsh reed grass) is an aggressive colonizer of available moist sites. Once established, a very dense stand of it may persist almost indefinitely, effectively limiting invasion of woody species. Under heavy grazing pressure *Calamagrostis canadensis* (marsh reed grass) cover is reduced, allowing other herbaceous species to encroach onto the site. Severely disturbed drier sites become dominated by such graminoids as *Poa* species (bluegrass) and *Agrostis scabra* (rough hair grass); and have an abundance of forbs such as *Cirsium arvensis* (Canada thistle) and *Fragaria virginiana* (wild strawberry). Severely disturbed wetter sites generally become dominated by *Juncus balticus* (Baltic rush), *Glyceria grandis* (common tall manna grass) and such wetter forbs as *Geum* species (avens) and *Heracleum lanatum* (cow parsnip). With continued heavy grazing, stands may become the Disturbed Herbaceous community type, which may also indicate a shift to a drier hydrologic regime.

Figure 122 shows a schematic diagram of vegetation successional pathways on sites of the *Calamagrostis canadensis* (marsh reed grass) habitat type.



Successional Pathway of *Calamagrostis canadensis* (marsh reed grass)
Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Calamagrostis canadensis* (marsh reed grass) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CALACAN HT—*Calamagrostis canadensis* (marsh reed grass) habitat type
Disturbed Herbaceous CT—Disturbed Herbaceous community type

Figure 122. Successional pathway for sites of the *Calamagrostis canadensis* (marsh reed grass) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 123 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Calamagrostis canadensis* (marsh reed grass) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

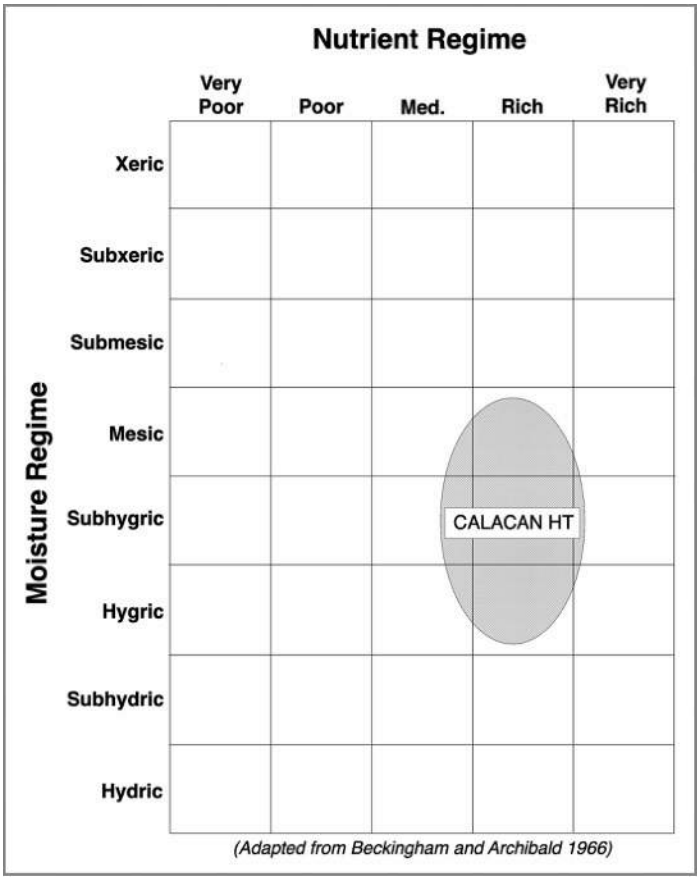


Figure 123. Edatope grid position for the *Calamagrostis canadensis* (marsh reed grass) habitat type (CALACAN HT)

SOILS

A wide range of soils may be associated with the *Calamagrostis canadensis* (marsh reed grass) habitat type due to the breadth of its successional adaptations, It may colonize sites on undeveloped coarse textured alluvial soils, or it may more commonly be found on thick organic soils on old beaver pond meadows. Mature stands may have organic accumulations greater than 1 m thick. Mineral soil textures in sampled stands range from sandy loam to clay. Redoximorphic features (mottling or gleying) are common in subsurface horizons. Water tables are typically near the soil surface through much of the growing season. (Baker and others 2020, France and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites may be dominated by *Salix* (willow) communities that have wetland *Carex* (sedge) understories, such as the *Salix bebbiana/Carex utriculata* (beaked willow/beaked sedge) habitat type or the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type. Adjacent drier sites may include such types as the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type and the *Picea glauca/ Viburnum edule* (white spruce/low-bush cranberry) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is common across Alberta, except in the Mixedgrass natural subregion. It grows in swamps, around the edges of wetlands, in moist woods, and on more moist upland sites (Tannas 1997a).

Calamagrostis canadensis (marsh reed grass) is a long-lived, native, sod-forming, perennial, cool-season grass with extensive creeping rhizomes and shallow fibrous roots. Well-developed stands may persist for as long as 100 years. The species occurs in a wide range of habitats from wet lowland sites and semi-shaded woodlands, to windswept alpine ridges, although it does best on moist sites. The species is a common constituent in a number of seral and climax communities. (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—*Calamagrostis stricta* (narrow reed grass) is common across Alberta, except in the prairies. It occurs farther north than *Calamagrostis inexpansa* (northern reed grass). It grows in swamps, around edges of wetlands, in moist woods, and on many moister upland sites (Tannas 1997a).

Livestock

***Calamagrostis canadensis* (marsh reed grass)**—Forage production and value is fair to good (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997a, Hansen and others 1988). The species is most palatable when young and succulent, but since it grows in wetter habitats, use by livestock may be limited until later in the season when sites dry out (Tesky 1992a). Continued high levels of utilization reduces production of the stand (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—*Calamagrostis stricta* (narrow reed grass) has moderate nutritional value in early spring, but which declines as the season advances. The forage is most palatable in spring, but is avoided later in the season unless other forage is unavailable (Tannas 1997a). In general, *Calamagrostis* species (reed grass) are mostly palatable and nutritious for livestock and wildlife, but are considered to be of poor quality because their foliage becomes very rough as it matures (Johnson and others 1995). Protein content is 17 percent to 19 percent in spring, but drops to 7 percent by late summer (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Calamagrostis canadensis* (marsh reed grass)**—*Calamagrostis canadensis* (marsh reed grass) is grazed lightly by deer, but makes up a major part of the winter diet of elk (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—Elk may make moderate summer use of *Calamagrostis* species (reed grass) (Kufeld 1973).

Fisheries

***Calamagrostis stricta* (narrow reed grass)**—The rhizomatous nature of *Calamagrostis* species (reed grass) will help provide bank stability for sites adjacent to streams (Thompson and Hansen 2003).

Fire

***Calamagrostis canadensis* (marsh reed grass)**—Fire will kill above ground material of *Calamagrostis canadensis* (marsh reed grass), and severe fire will also kill underground rhizomes; however, the species sprouts vigorously from surviving rhizomes after fire, which can cause dramatic increase in cover of the species (Tesky 1992a, Hansen and others 1988).

***Calamagrostis stricta* (narrow reed grass)**—Fires reducing the abundance of other associated species tend to cause dramatic increase in *Calamagrostis stricta* (narrow reed grass) and other rhizomatous species (Haeussler and Coates 1986).

Rehabilitation/Restoration Considerations

***Calamagrostis canadensis* (marsh reed grass)**—The rhizomatous nature of *Calamagrostis canadensis* (marsh reed grass) helps provide streambank stability. This is particularly important on higher gradient streams where scouring by seasonal flooding occurs. This grass is noted to be a vigorous invader of oil spill sites in the Northwest Territories (Tesky 1992a).

***Calamagrostis stricta* (narrow reed grass)**—Roads and trails should be located on adjacent uplands. *Calamagrostis stricta* (narrow reed grass) propagates by both seeds and rhizomes, making it a valuable species for stabilizing or rehabilitating suitable disturbed sites (Thompson and Hansen 2003).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Calamagrostis canadensis* (marsh reed grass) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- B7. Marsh reed grass slough

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Marsh reed grass

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Marsh reed grass

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msb25 Marsh reed grass (Montane Southern Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Calamagrostis canadensis* (marsh reed grass) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995);
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001); and
- *Classification and Management of Upland, Riparian, and Wetland Sites of USDI Bureau of Land Management's Miles City Field Office, Eastern Montana USA* (Hansen and others 2008).

Deschampsia cespitosa Habitat Type
(tufted hair grass Habitat Type)

DESCCES Habitat Type
Number of Stands = 23 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 14; Other Data Sets = 9)

LOCATION AND ASSOCIATED LANDFORMS

The *Deschampsia cespitosa* (tufted hair grass) habitat type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. This habitat type is found on a variety of landforms including moist depressions, wet meadows, nearly level stream terraces, seep areas, slough margins, and boggy areas (Tannas 1997a).

Photo 32 shows a typical stand of the *Deschampsia cespitosa* (tufted hair grass) habitat type.

Photo 32. A stand of the *Deschampsia cespitosa* (tufted hair grass) habitat type (photo provided by Hilary Baker)

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the

plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 575 shows the five most prominent plant species among the four lifeforms for species recorded in all 23 stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type. In the set of all stands sampled of this habitat type, which includes late seral, undisturbed stands and early seral, disturbed stands; only *Deschampsia cespitosa* (tufted hair grass) was very prominent.

Table 575. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type (number = 23 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus tremuloides (aspen)	0.02	Native
Shrubs		
Potentilla fruticosa (shrubby cinquefoil)	0.17	Native
Salix bebbiana (beaked willow)	0.13	Native
Rubus arcticus (dwarf raspberry)	0.04	Native
Betula glandulosa (bog birch)	0.02	Native
Betula pumila (dwarf birch)	0.02	Native
Graminoids		
Deschampsia cespitosa (tufted hair grass)	59.13	Native
Carex preslii (Presl sedge)	4.78	Native
Agropyron trachycaulum (slender wheat grass)	3.30	Native
Schizachne purpurascens (purple oat grass)	3.20	Native
Poa palustris (fowl bluegrass)	3.07	Native
Forbs		
Thalictrum venulosum (veiny meadow rue)	4.17	Native
Achillea millefolium (common yarrow)	3.39	Native
Fragaria virginiana (wild strawberry)	2.94	Native
Potentilla gracilis (graceful cinquefoil)	2.33	Native
Petasites sagittatus (arrow-leaved coltsfoot)	1.78	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 576 through Table 579, break out the vegetation recorded in all 23 stands sampled of the *Deschampsia cespitosa* (tufted hair grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, moderately species rich, herbaceous habitat type of incidental occurrence across the study area.

Table 576 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type. For the 23 stands comprising the habitat type, the number of unique species was 119 with 107 (89.9 percent) of them being native species.

Table 576. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Deschampsia cespitosa* (tufted hair grass) habitat type (number = 23 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	6	6	0	0
Graminoids	39	34	4	1
Forbs	73	66	5	2
TOTAL	***119 (100.0%)***	***107 (89.9%)***	***9 (7.6%)***	***3 (2.5%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 577 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type. The average number of species per stand is 17.3, with native species comprising 15.7 species per stand or 90.8 percent.

Table 577. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Deschampsia cespitosa* (tufted hair grass) habitat type (number = 23 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.4	0.4	0.0	0.0
Graminoids	5.8	5.1	0.7	0.0
Forbs	11.1	10.2	0.7	0.1
TOTAL	***17.3 (100.0%)***	***15.7 (90.8%)***	***1.4 (8.1%)***	***0.1 (0.6%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 578 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type. The average canopy cover per stand is 118.7 percent, with native species comprising 115.3 percent or 97.2 percent of the total amount of average canopy cover per stand.

Table 578. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Deschampsia cespitosa* (tufted hair grass) habitat type (number = 23 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.4%	0.4%	0.0%	0.0%
Graminoids	85.5%	84.0%	1.5%	0.0%
Forbs	32.7%	30.9%	1.8%	0.1%
TOTAL	***118.7% (100.0%)***	***115.3% (97.2%)***	***3.3% (2.7%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 579 shows the average number of species and average canopy cover by lifeform in stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type. The average number of species per stand was 17.3 with an average canopy cover of 118.7 percent.

Table 579. Average number of species and average canopy cover by lifeform in stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type (number = 23 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.4	0.4%
Graminoids	5.8	85.5%
Forbs	11.1	32.7%
TOTAL	***17.3***	***118.7%***

Sampled Stands Plant Species List

One tree species, *Populus tremuloides* (aspen), was recorded in a very small amount on one of the 23 stands sampled of the *Deschampsia cespitosa* (tufted hair grass) habitat type, and six shrubs were recorded also in small

amounts with very low prominence (Table 580). Of the 39 graminoid species recorded, only *Deschampsia cespitosa* (tufted hair grass) was highly prominent or recorded on all plots sampled. None of the 73 forb species recorded was more than moderately prominent.

Table 580. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type (number = 23 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 1)					
Populus tremuloides (aspen)	0.5	0-0.5	4	0.02	N
Shrubs (N = 6)					
Betula glandulosa (bog birch)	0.5	0-0.5	4	0.02	N
Betula pumila (dwarf birch)	0.5	0-0.5	4	0.02	N
Potentilla fruticosa (shrubby cinquefoil)	1.3	0-3	13	0.17	N
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	9	0.04	N
Salix barclayi (Barclay's willow)	0.5	0-0.5	4	0.02	N
Salix bebbiana (beaked willow)	3.0	0-3	4	0.13	N
Graminoids (N = 39)					
Agropyron dasystachyum (northern wheat grass)	0.5	0-0.5	4	0.02	N
Agropyron smithii (western wheat grass)	5.3	0-10	9	0.46	N
Agropyron trachycaulum (slender wheat grass)	6.3	0-20	52	3.30	N
Agrostis scabra (rough hair grass)	0.5	0-0.5	4	0.02	N
Bromus ciliatus (fringed brome)	0.5	0-0.5	9	0.04	N
Bromus inermis (smooth brome)	3.0	0-3	9	0.26	I
Bromus inermis subsp. *pumpellianus* (northern awnless brome)	0.5	0-0.5	13	0.07	N
Bromus spp. (brome grass)	0.5	0-0.5	4	0.02	B
Calamagrostis canadensis (marsh reed grass)	3.7	0-10	13	0.48	N
Calamagrostis stricta (narrow reed grass)	20.0	0-20	4	0.87	N
Carex aenea (silvery-flowered sedge)	0.5	0-0.5	4	0.02	N
Carex aquatilis (water sedge)	20.0	0-30	9	1.74	N
Carex bebbii (Bebb's sedge)	0.5	0-0.5	4	0.02	N
Carex diandra (two-stamened sedge)	10.0	0-10	4	0.43	N
Carex gynocrates (northern bog sedge)	0.5	0-0.5	4	0.02	N
Carex lanuginosa (woolly sedge)	6.5	0-10	9	0.57	N
Carex preslii (Presl sedge)	15.7	0-30	30	4.78	N
Carex raymondii (Raymond's sedge)	0.5	0-0.5	4	0.02	N
Carex siccata (hay sedge)	20.0	0-20	4	0.87	N
Carex spp. (sedge)	5.3	0-10	17	0.91	N
Danthonia californica (California oat grass)	0.5	0-0.5	17	0.09	N
Deschampsia cespitosa (tufted hair grass)	59.1	30-90	100	59.13	N
Eleocharis palustris (creeping spike-rush)	3.0	0-3	4	0.13	N
Elymus glaucus (smooth wild rye)	0.5	0-0.5	4	0.02	N
Elymus innovatus (hairy wild rye)	2.9	0-10	22	0.63	N
Festuca idahoensis (bluebunch fescue)	3.0	0-3	4	0.13	N
Festuca saximontana (Rocky Mountain fescue)	2.0	0-3	22	0.43	N

Table 580. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Festuca scabrella (rough fescue)	1.3	0-3	13	0.17	N
Hierochloe odorata (sweet grass)	10.0	0-10	4	0.43	N
Hordeum jubatum (foxtail barley)	5.9	0-10	17	1.02	N
Juncus balticus (wire rush)	2.1	0-10	39	0.83	N
Juncus spp. (rush)	0.5	0-0.5	4	0.02	N
Koeleria macrantha (June grass)	0.5	0-0.5	4	0.02	N
Phleum commutatum (mountain timothy)	0.5	0-0.5	9	0.04	N
Phleum pratense (timothy)	2.2	0-3	13	0.28	I
Poa compressa (Canada bluegrass)	0.5	0-0.5	4	0.02	I
Poa palustris (fowl bluegrass)	17.6	0-50	17	3.07	N
Poa pratensis (Kentucky bluegrass)	2.4	0-10	39	0.93	I
Schizachne purpurascens (purple oat grass)	12.3	0-30	26	3.20	N
Forbs (N = 73)					
Achillea millefolium (common yarrow)	4.9	0-20	70	3.39	N
Aconitum delphinifolium (monkshood)	0.5	0-0.5	4	0.02	N
Agoseris glauca (yellow false dandelion)	4.5	0-10	13	0.59	N
Antennaria anaphaloides (tall everlasting)	0.5	0-0.5	4	0.02	N
Antennaria rosea (rosy everlasting)	0.5	0-0.5	4	0.02	N
Arabis drummondii (Drummond's rock cress)	0.5	0-0.5	9	0.04	N
Arabis glabra (tower mustard)	0.5	0-0.5	9	0.04	N
Arnica chamissonis (leafy arnica)	1.8	0-3	9	0.15	N
Aster ciliolatus (Lindley's aster)	3.1	0-10	57	1.76	N
Aster ericoides (tufted white prairie aster)	3.0	0-3	4	0.13	N
Aster laevis (smooth aster)	5.3	0-10	9	0.46	N
Astragalus alpinus (alpine milk vetch)	0.9	0-3	26	0.24	N
Campanula rotundifolia (harebell)	0.5	0-0.5	4	0.02	N
Cerastium arvense (field mouse-ear chickweed)	0.5	0-0.5	22	0.11	N
Chenopodium fremontii (Fremont's goosefoot)	0.5	0-0.5	4	0.02	N
Chenopodium leptophyllum (narrow-leaved goosefoot)	0.5	0-0.5	4	0.02	N
Comandra umbellata (bastard toadflax)	40.0	0-40	4	1.74	N
Delphinium glaucum (tall larkspur)	1.5	0-3	22	0.33	N
Epilobium angustifolium (common fireweed)	1.1	0-3	17	0.20	N
Erigeron peregrinus (wandering daisy)	0.5	0-0.5	4	0.02	N
Fragaria vesca (woodland strawberry)	0.5	0-0.5	4	0.02	N
Fragaria virginiana (wild strawberry)	5.2	0-20	57	2.93	N
Galium boreale (northern bedstraw)	0.7	0-3	48	0.35	N
Gentianella amarella (felwort)	1.0	0-3	22	0.22	N
Geranium viscosissimum (sticky purple geranium)	3.0	0-3	4	0.13	N
Geum aleppicum (yellow avens)	3.5	0-10	35	1.22	N
Geum macrophyllum (large-leaved yellow avens)	7.3	0-20	22	1.59	N
Geum rivale (purple avens)	1.1	0-3	17	0.20	N
Geum triflorum (three-flowered avens)	0.5	0-0.5	26	0.13	N
Hedysarum spp. (hedysarum)	3.0	0-3	4	0.13	N

Table 580. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Hedysarum sulphurescens (yellow hedysarum)	0.5	0-0.5	9	0.04	N
Helenium autumnale (sneezeweed)	0.5	0-0.5	4	0.02	N
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	13	0.07	N
Lysimachia thyrsiflora (tufted loosestrife)	0.5	0-0.5	4	0.02	N
Mentha arvensis (wild mint)	3.0	0-3	4	0.13	N
Mertensia paniculata (tall lungwort)	0.5	0-0.5	35	0.17	N
Oxytropis deflexa (reflexed locoweed)	0.5	0-0.5	4	0.02	N
Oxytropis monticola (late yellow locoweed)	0.5	0-0.5	4	0.02	N
Pedicularis groenlandica (elephant's-head)	0.5	0-0.5	4	0.02	N
Penstemon confertus (yellow beardtongue)	0.5	0-0.5	4	0.02	N
Penstemon procerus (slender blue beardtongue)	1.1	0-3	35	0.39	N
Petasites palmatus (palmate-leaved coltsfoot)	3.0	0-3	4	0.13	N
Petasites sagittatus (arrow-leaved coltsfoot)	13.7	0-40	13	1.78	N
Plantago major (common plantain)	0.5	0-0.5	4	0.02	I
Polygonum viviparum (alpine bistort)	0.5	0-0.5	4	0.02	N
Potentilla anserina (silverweed)	40.0	0-40	4	1.74	N
Potentilla diversifolia (mountain cinquefoil)	0.5	0-0.5	9	0.04	N
Potentilla gracilis (graceful cinquefoil)	4.9	0-10	48	2.33	N
Ranunculus acris (tall buttercup)	1.8	0-3	9	0.15	I
Ranunculus cardiophyllus (heart-leaved buttercup)	0.5	0-0.5	9	0.04	N
Ranunculus inamoenus (graceful buttercup)	0.5	0-0.5	13	0.07	N
Ranunculus macounii (Macoun's buttercup)	30.0	0-30	4	1.30	N
Ranunculus spp. (ranunculus)	0.5	0-0.5	9	0.04	B
Rumex acetosa (green sorrel)	0.9	0-3	30	0.26	N
Rumex occidentalis (western dock)	1.1	0-3	17	0.20	N
Rumex spp. (sorrel)	0.5	0-0.5	4	0.02	B
Rumex triangulivalvis (narrow-leaved dock)	0.5	0-0.5	4	0.02	N
Senecio indecorus (rayless ragwort)	0.5	0-0.5	4	0.02	N
Senecio pseudaureus (thin-leaved ragwort)	0.5	0-0.5	4	0.02	N
Sium suave (water parsnip)	0.5	0-0.5	4	0.02	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	4	0.02	N
Solidago spp. (goldenrod)	10.0	0-10	4	0.43	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	17	0.09	N
Stellaria longipes (long-stalked chickweed)	0.5	0-0.5	4	0.02	N
Taraxacum officinale (common dandelion)	3.0	0-20	52	1.54	I
Thalictrum venulosum (veiny meadow rue)	8.0	0-30	52	4.17	N
Trifolium hybridum (alsike clover)	0.5	0-0.5	4	0.02	I
Trifolium pratense (red clover)	0.5	0-0.5	4	0.02	I
Valeriana dioica (northern valerian)	1.5	0-3	22	0.33	N
Veronica alpina (alpine speedwell)	0.5	0-0.5	4	0.02	N
Vicia americana (wild vetch)	0.8	0-3	35	0.28	N
Viola adunca (early blue violet)	0.5	0-0.5	9	0.04	N
Zizia aptera (heart-leaved Alexanders)	0.8	0-3	35	0.28	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.
[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 581 shows the five most prominent plant species among the four lifeforms for species recorded in all five relatively undisturbed late seral to climax stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type. In these late seral stands, only *Deschampsia cespitosa* (tufted hair grass) is more than moderately prominent.

Table 581. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type (number = 5 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Rubus arcticus (dwarf raspberry)	0.10	Native
Graminoids		
Deschampsia cespitosa (tufted hair grass)	84.00	Native
Hordeum jubatum (foxtail barley)	2.60	Native
Calamagrostis canadensis (marsh reed grass)	2.00	Native
Carex aquatilis (water sedge)	2.00	Native
Carex preslii (Presl sedge)	2.00	Native
Forbs		
Geum macrophyllum (large-leaved yellow avens)	4.60	Native
Aster laevis (smooth aster)	2.00	Native
Fragaria virginiana (wild strawberry)	1.30	Native
Aster ciliolatus (Lindley's aster)	0.70	Native
Taraxacum officinale (common dandelion)	0.70	Introduced

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.
[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 582 through Table 585, break out the vegetation recorded in five relatively undisturbed late seral to climax stands sampled of the *Deschampsia cespitosa* (tufted hair grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, moderately species rich, herbaceous habitat type of incidental occurrence across the study area.

Table 582 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type. For the 5 stands comprising the habitat type, the number of unique species was 30 with 27 (90.0 percent) of them being native species.

Table 582. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type (number = 5 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	1	1	0	0
Graminoids	11	10	1	0
Forbs	18	16	2	0
TOTAL	***30 (100.0%)***	***27 (90.0%)***	***3 (10.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 583 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type. The average number of species per stand is 8.4, with native species comprising 7.6 species per stand or 90.5 percent.

Table 583. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type (number = 5 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.2	0.2	0.0	0.0
Graminoids	3.2	3.0	0.2	0.0
Forbs	5.0	4.4	0.6	0.0
TOTAL	***8.4 (100.0%)***	***7.6 (90.5%)***	***0.8 (9.5%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 584 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type. The average canopy cover per stand is 108.0 percent, with native species comprising 106.6 percent or 98.7 percent of the total amount of average canopy cover per stand.

Table 584. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type (number = 5 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.1%	0.1%	0.0%	0.0%
Graminoids	96.1%	95.5%	0.6%	0.0%
Forbs	11.8%	11.0%	0.8%	0.0%
TOTAL	***108.0% (100.0%)***	***106.6% (98.7%)***	***1.4% (1.3%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 585 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type. The average number of species per stand was 8.4 with an average canopy cover of 108.0 percent.

Table 585. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type (number = 5 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.2	0.1%
Graminoids	3.2	96.1%
Forbs	5.0	11.8%
TOTAL	***8.4***	***108.0%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

No trees and only one shrub species was recorded on five relatively undisturbed late seral to climax stands sampled of the *Deschampsia cespitosa* (tufted hair grass) habitat type (Table 586). Of the 11 graminoids recorded, only *Deschampsia cespitosa* (tufted hair grass) was highly prominent, or occurred on all plots sampled, and none of the 18 forb species recorded is more than moderately prominent.

Table 586. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type (number = 5 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Shrubs (N = 1)					
Rubus arcticus (dwarf raspberry)	0.5	0-0.5	20	0.10	N
Graminoids (N = 11)					
Agropyron smithii (western wheat grass)	0.5	0-0.5	20	0.10	N
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	20	0.10	N
Calamagrostis canadensis (marsh reed grass)	10.0	0-10	20	2.00	N
Carex aquatilis (water sedge)	10.0	0-10	20	2.00	N
Carex preslii (Presl sedge)	10.0	0-10	20	2.00	N
Deschampsia cespitosa (tufted hair grass)	84.0	70-90	100	84.00	N
Festuca idahoensis (bluebunch fescue)	3.0	0-3	20	0.60	N
Hordeum jubatum (foxtail barley)	6.5	0-10	40	2.60	N
Phleum commutatum (mountain timothy)	0.5	0-0.5	20	0.10	N
Poa palustris (fowl bluegrass)	10.0	0-10	20	2.00	N
Poa pratensis (Kentucky bluegrass)	3.0	0-3	20	0.60	I
Forbs (N = 18)					
Achillea millefolium (common yarrow)	0.5	0-0.5	60	0.30	N
Antennaria anaphaloides (tall everlasting)	0.5	0-0.5	20	0.10	N
Aster ciliolatus (Lindley's aster)	1.8	0-3	40	0.70	N
Aster laevis (smooth aster)	10.0	0-10	20	2.00	N
Chenopodium fremontii (Fremont's goosefoot)	0.5	0-0.5	20	0.10	N
Chenopodium leptophyllum (narrow-leaved goosefoot)	0.5	0-0.5	20	0.10	N
Epilobium angustifolium (common fireweed)	3.0	0-3	20	0.60	N

Table 586. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Fragaria virginiana (wild strawberry)	2.2	0-3	60	1.30	N
Galium boreale (northern bedstraw)	0.5	0-0.5	20	0.10	N
Geum aleppicum (yellow avens)	0.5	0-0.5	20	0.10	N
Geum macrophyllum (large-leaved yellow avens)	11.5	0-20	40	4.60	N
Oxytropis deflexa (reflexed locoweed)	0.5	0-0.5	20	0.10	N
Plantago major (common plantain)	0.5	0-0.5	20	0.10	I
Potentilla gracilis (graceful cinquefoil)	3.0	0-3	20	0.60	N
Ranunculus inamoenus (graceful buttercup)	0.5	0-0.5	20	0.10	N
Sium suave (water parsnip)	0.5	0-0.5	20	0.10	N
Taraxacum officinale (common dandelion)	1.8	0-3	40	0.70	I
Viola adunca (early blue violet)	0.5	0-0.5	20	0.10	N

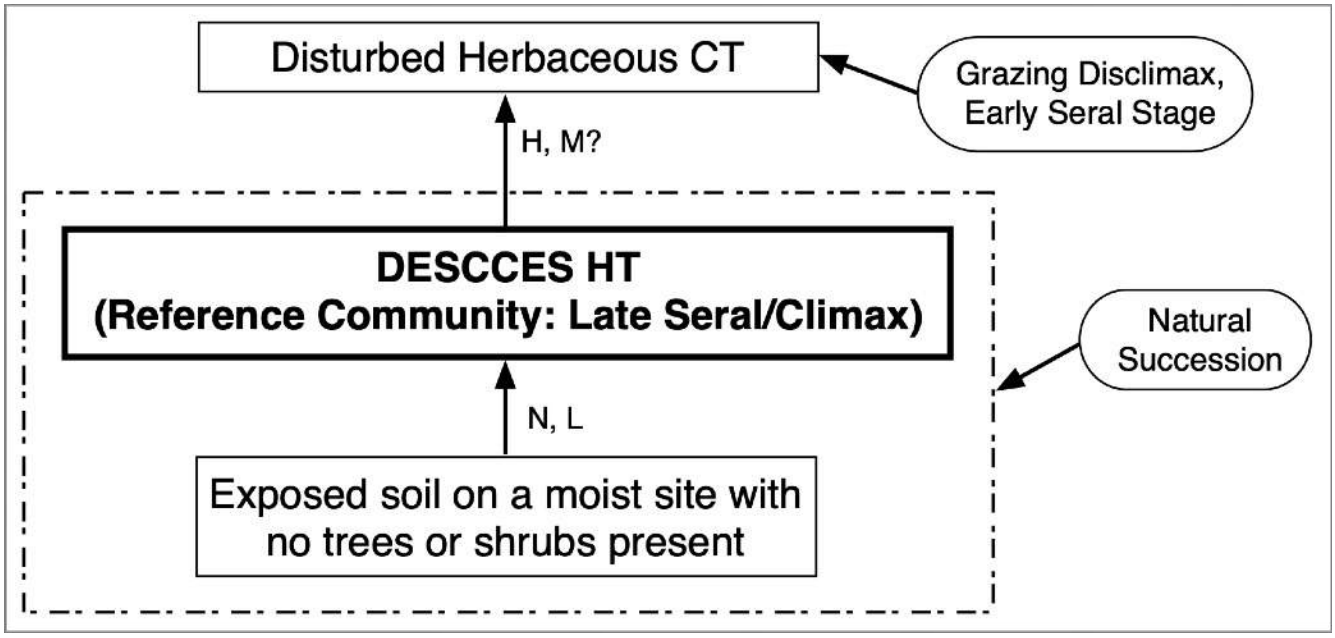
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

New stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type typically develop through primary succession (hydrarch succession), wherein shallow depressions fill in over time, and/or the local water table subsides enough to create suitable sites for *Deschampsia cespitosa* (tufted hair grass). On relatively undisturbed sites, *Deschampsia cespitosa* (tufted hairgrass) dominates over other species; but under heavy grazing pressure, *Deschampsia cespitosa* (tufted hairgrass) vigor is reduced and other herbaceous species increase their presence on the site. Severely disturbed stands often become dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Agrostis stolonifera* (redtop), *Juncus balticus* (Baltic rush), and *Taraxacum officinale* (common dandelion), thus taking on the appearance of the Disturbed Herbaceous community type.

Figure 124 shows a schematic diagram of vegetation successional pathways on sites of the *Deschampsia cespitosa* (tufted hair grass) habitat type.



Successional Pathway of *Deschampsia cespitosa* (tufted hair grass) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Deschampsia cespitosa* (tufted hair grass) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
DESCCES HT—*Deschampsia cespitosa* (tufted hair grass) habitat type
Disturbed Herbaceous CT—Disturbed Herbaceous community type

Figure 124. Successional pathway for sites of the *Deschampsia cespitosa* (tufted hair grass) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

Figure 125 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Deschampsia cespitosa* (tufted hair grass) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

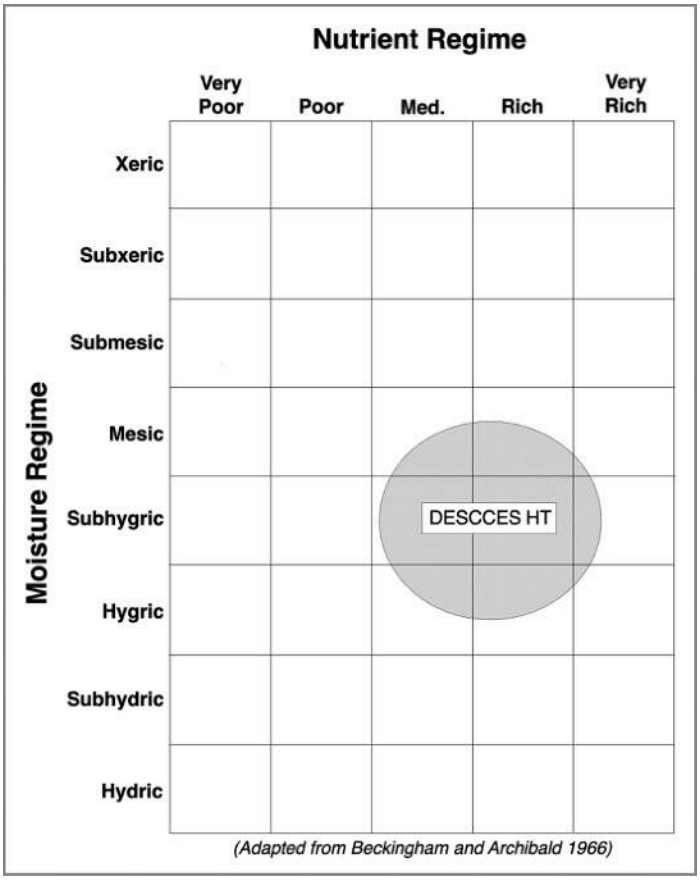


Figure 125. Edatope grid position for the *Deschampsia cespitosa* (tufted hair grass) habitat type (DESCCES HT)

SOILS

Parent material on sites supporting the *Deschampsia cespitosa* (tufted hair grass) habitat type is usually fluvial or morainal, and soils are mostly regosols, luvisols, and brunisols. Soil drainage ranges from well drained to poorly drained, with surface texture ranging from sandy loam to clay loam. Organic thickness is mostly 0 cm to 5 cm thick. The ground water table is commonly at or slightly above the surface in the spring, but often drops below one meter in summer in drier years, while wetter sites commonly have some accumulation of organic material at the surface. Redoximorphic mottles and gleying features are common on sites with seasonally high water table (Baker and others, France and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites may have *Salix* (willow) communities with *Calamagrostis canadensis* (marsh reed grass) or wetland *Carex* (sedge) understories, such as the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type or the *Salix glauca/Carex aquatilis* (smooth willow/water sedge) habitat type. Adjacent drier sites may include such types as the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type and the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) is common throughout most natural regions of Alberta, occurring in moist meadows, along slough margins, and in boggy areas (Tannas 1997a). The species can occur as a pioneer, as well as either a component or a dominant in mid and late seral stands. It is rarely found in dense shade. It can be an aggressive colonizer on disturbed sites, particularly at higher elevation sites (Walsh 1995).

Livestock

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) has high protein content early in the season, and is generally palatable to both livestock and wildlife throughout the season. The species is a grazing decreaser. Although cropped tufts may resprout from the base, these are relatively short lived. The species depends primarily on seed for reproduction (Tannas 1997a).

Deschampsia cespitosa (tufted hair grass) provides good to excellent forage for all classes of livestock. It is often an abundant source of forage throughout its growing season. However, it decreases with excessive grazing. Long term, intensive use reduces seed production. *Deschampsia cespitosa* (tufted hair grass) is a key indicator of condition and grazing utilization in certain mountain meadow communities (Walsh 1995).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Deschampsia cespitosa* (tufted hair grass)**—Use of *Deschampsia cespitosa* (tufted hair grass) by wildlife species is variable, although it provides palatable forage early spring through summer. It is frequently grazed by bears, and feral horses in the foothills of western Alberta were found to graze it (Walsh 1995).

Fire

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) generally survives all but the most severe fires. It usually sprouts from the root crown after aerial portions are burned. Tufts formed by the leaves often protect basal buds from fire damage. Within just a few years *Deschampsia cespitosa* (tufted hair grass) usually recovers to pre-fire abundance (Walsh 1995).

Rehabilitation/Restoration Considerations

***Deschampsia cespitosa* (tufted hair grass)**—*Deschampsia cespitosa* (tufted hair grass) has a broad ecological range and is useful for revegetation, particularly on disturbances at high elevation or high latitude. It grows at a medium rate compared to other grasses and has a poor rate of spread, but it highly competitive, relative to other plants evaluated for high latitude revegetation. It has low to medium potential for short-term revegetation, but has medium to high potential for long-term revegetation, and is a valuable soil stabilizer, especially in wet, acidic sites (Walsh 1995).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Deschampsia cespitosa* (tufted hair grass) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- B5. Tufted hair grass-slender wheat grass/veiny meadow rue

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Foothills rough fescue-Tufted hair grass
- Kentucky bluegrass-Tufted hair grass-Foothills rough fescue/Dandelion
- Tufted hair grass-Kentucky bluegrass
- Tufted hair grass-Sedge

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Tufted hair grass-Baltic rush

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msc16 Kentucky bluegrass-Tufted hairgrass (Montane Southern Ecosection)
- Msb13 Tufted hairgrass-Graceful sedge (Montane Southern Ecosection)
- Mna4 Tufted hair grass-Sedge (Montane Northern Ecosection)
- Mca12 Tufted hairgrass-Kentucky bluegrass (Montane Cypress Hills Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Deschampsia cespitosa* (tufted hair grass) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995);
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001); and
- *Classification and Management of Upland, Riparian, and Wetland Sites of USDI Bureau of Land Management's Miles City Field Office, Eastern Montana USA* (Hansen and others 2008).

DISTURBED HERBACEOUS Community Type
Number of Stands = 53 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 46; Other Data Sets = 7)

LOCATION AND ASSOCIATED LANDFORMS

The Disturbed Herbaceous community type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This community type is a catch-all to contain herbaceous stands dominated by disturbance increaser (usually introduced) species. These are stands from which the habitat type indicator species have been removed by long term heavy grazing pressure, and they can occur in any natural subregion where livestock are grazed.

Photo 33 shows a typical stand of the Disturbed Herbaceous community type.

Photo 33. A stand of the Disturbed Herbaceous community type (photo provided by Hilary Baker)

VEGETATION

Sampled Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the

plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 587 shows the five most prominent plant species among the four lifeforms for species recorded in all 53 stands of the Disturbed Herbaceous community type. As indicated by the community type name, this community is a broad, inclusive type that is dominated by disturbance increaser species, usually of introduced origin. Here the most prominent species by far is *Poa pratensis* (Kentucky bluegrass), followed by *Phleum pratense* (timothy), *Taraxacum officinale* (common dandelion), and *Trifolium repens* (white clover)—all introduced species.

Table 587. The five most prominent plant species among the four lifeforms for species recorded in stands of the Disturbed Herbaceous community type (number = 53 stands)

Species	Prominence Value[1]	Origin Status[2]
Trees		
Populus angustifolia (narrow-leaf cottonwood)	0.01	Native
Shrubs		
Rosa acicularis (prickly rose)	0.25	Native
Symphoricarpos occidentalis (buckbrush)	0.12	Native
Potentilla fruticosa (shrubby cinquefoil)	0.11	Native
Rosa woodsii (common wild rose)	0.06	Native
Rosa spp. (rose)	0.06	Both
Graminoids		
Poa pratensis (Kentucky bluegrass)	44.97	Introduced
Phleum pratense (timothy)	14.39	Introduced
Bromus inermis (smooth brome)	5.69	Introduced
Agropyron trachycaulum (slender wheat grass)	1.07	Native
Poa palustris (fowl bluegrass)	0.58	Native
Forbs		
Taraxacum officinale (common dandelion)	8.93	Introduced
Trifolium repens (white clover)	7.60	Introduced
Achillea millefolium (common yarrow)	3.28	Native
Cirsium arvense (Canada thistle)	1.98	Introduced
Fragaria virginiana (wild strawberry)	1.69	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 588 through Table 591, break out the vegetation recorded in all 53 stands sampled of the Disturbed Herbaceous community type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, moderately species rich, very disturbed, herbaceous community type of minor occurrence across the study area.

Table 588 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the Disturbed Herbaceous community type. For the 53 stands comprising the community type, the number of unique species was 207 with 165 (79.7 percent) of them being native species.

Table 588. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the Disturbed Herbaceous community type (number = 53 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	1	1	0	0
Shrubs	16	14	0	2
Graminoids	57	45	10	2
Forbs	133	105	24	4
TOTAL	***207 (100.0%)***	***165 (79.7%)***	***34 (16.4%)***	***8 (3.9%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 589 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the Disturbed Herbaceous community type. The average number of species per stand is 18.0, with native species comprising 13.1 species per stand or 72.8 percent.

Table 589. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the Disturbed Herbaceous community type (number = 53 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.7	0.6	0.0	0.0
Graminoids	5.5	3.2	2.2	0.1
Forbs	11.8	9.3	2.4	0.1
TOTAL	***18.0 (100.0%)***	***13.1 (72.8%)***	***4.6 (25.6%)***	***0.2 (1.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 590 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the Disturbed Herbaceous community type. The average canopy cover per stand is 115.3 percent, with native species comprising 26.5 percent or 23.0 percent of the total amount of average canopy cover per stand.

Table 590. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the Disturbed Herbaceous community type (number = 53 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.8%	0.7%	0.0%	0.1%
Graminoids	74.2%	7.8%	66.2%	0.3%
Forbs	40.2%	18.0%	22.2%	0.0%
TOTAL	***115.3% (100.0%)***	***26.5% (23.0%)***	***88.4% (76.7%)***	***0.4% (0.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 591 shows the average number of species and average canopy cover by lifeform in stands of the Disturbed Herbaceous community type. The average number of species per stand was 18.0 with an average canopy cover of 115.3 percent.

Table 591. Average number of species and average canopy cover by lifeform in stands of the Disturbed Herbaceous community type (number = 53 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.7	0.8%
Graminoids	5.5	74.2%
Forbs	11.8	40.2%
TOTAL	***18.0***	***115.3%***

Sampled Stands Plant Species List

One tree species, *Populus angustifolia* (narrow-leaf cottonwood), was recorded in a very small amount on one of the 53 stands sampled of the Disturbed Herbaceous community type (Table 592). All 16 shrub species recorded have extremely low prominence. As indicated by the title, this community type is dominated by mostly introduced, disturbance increaser, herbaceous species. Among the 57 graminoid species recorded, *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (timothy), and *Bromus inermis* (smooth brome) are by far most prominent. Of the 133 forbs recorded, *Taraxacum officinale* (common dandelion) and *Trifolium repens* (white clover) are most prominent, while *Achillea millefolium* (common yarrow) was recorded on 81 percent of stands sampled.

Table 592. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the Disturbed Herbaceous community type (number = 53 stands)

Species	Percent Canopy Cover		Constancy	Prom.	Origin
	Average	Range	(Frequency)	Index[1]	Status[2]
Trees (N = 1)					
Populus angustifolia (narrow-leaf cottonwood)	0.5	0-0.5	2	0.01	N
Shrubs (N = 16)					
Amelanchier alnifolia (Saskatoon)	0.5	0-0.5	4	0.02	N
Elaeagnus commutata (silverberry)	0.5	0-0.5	2	0.01	N
Juniperus communis (ground juniper)	0.5	0-0.5	2	0.01	N
Lonicera utahensis (red twinberry)	0.5	0-0.5	2	0.01	N
Potentilla fruticosa (shrubby cinquefoil)	0.9	0-3	13	0.11	N
Prunus virginiana (choke cherry)	0.5	0-0.5	2	0.01	N
Ribes oxyacanthoides (northern gooseberry)	0.5	0-0.5	2	0.01	N
Rosa acicularis (prickly rose)	1.2	0-3	21	0.25	N
Rosa arkansana (prairie rose)	0.5	0-0.5	4	0.02	N
Rosa spp. (rose)	3.0	0-3	2	0.06	B
Rosa woodsii (common wild rose)	3.0	0-3	2	0.06	N
Rubus idaeus (wild red raspberry)	3.0	0-3	2	0.06	N
Salix spp. (willow)	0.5	0-0.5	2	0.01	B
Symphoricarpos occidentalis (buckbrush)	2.2	0-3	6	0.12	N
Vaccinium caespitosum (dwarf bilberry)	0.5	0-0.5	2	0.01	N
Vaccinium membranaceum (tall bilberry)	3.0	0-3	2	0.06	N
Graminoids (N = 57)					
Agropyron dasystachyum (northern wheat grass)	3.5	0-10	8	0.26	N
Agropyron intermedium (intermediate wheatgrass)	0.5	0-0.5	2	0.01	I
Agropyron pectiniforme (crested wheat grass)	10.0	0-10	2	0.19	I
Agropyron repens (quack grass)	7.0	0-20	6	0.40	I
Agropyron smithii (western wheat grass)	3.0	0-3	8	0.23	N
Agropyron trachycaulum (slender wheat grass)	2.2	0-10	49	1.07	N
Agrostis scabra (rough hair grass)	3.5	0-10	8	0.26	N
Agrostis stolonifera (redtop)	10.0	0-10	2	0.19	I
Alopecurus occidentalis (alpine foxtail)	10.0	0-10	2	0.19	N
Bromus carinatus (keeled brome)	1.8	0-3	8	0.13	N
Bromus ciliatus (fringed brome)	3.5	0-10	8	0.26	N

Table 592. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Bromus inermis (smooth brome)	23.2	0-70	25	5.69	I
Bromus inermis subsp. *pumpellianus* (northern awnless brome)	5.9	0-10	8	0.44	N
Calamagrostis canadensis (marsh reed grass)	0.5	0-0.5	2	0.01	N
Calamagrostis rubescens (pine reed grass)	0.5	0-0.5	2	0.01	N
Carex aquatilis (water sedge)	3.0	0-3	2	0.06	N
Carex filifolia (thread-leaved sedge)	0.5	0-0.5	2	0.01	N
Carex microglochin (short-awned sedge)	0.5	0-0.5	2	0.01	N
Carex obtusata (blunt sedge)	1.1	0-3	8	0.08	N
Carex praegracilis (graceful sedge)	3.0	0-3	2	0.06	N
Carex prairea (prairie sedge)	0.5	0-0.5	4	0.02	N
Carex preslii (Presl sedge)	0.5	0-0.5	4	0.02	N
Carex scirpoidea (rush-like sedge)	0.5	0-0.5	2	0.01	N
Carex spp. (sedge)	1.9	0-10	23	0.43	N
Carex utriculata (beaked sedge)	5.3	0-10	6	0.30	N
Carex xerantica (white-scaled sedge)	0.5	0-0.5	2	0.01	N
Dactylis glomerata (orchard grass)	0.5	0-0.5	4	0.02	I
Danthonia californica (California oat grass)	1.3	0-3	6	0.08	N
Danthonia parryi (Parry oat grass)	1.4	0-10	25	0.35	N
Deschampsia cespitosa (tufted hair grass)	3.5	0-10	8	0.26	N
Elymus glaucus (smooth wild rye)	0.5	0-0.5	2	0.01	N
Elymus innovatus (hairy wild rye)	3.4	0-10	9	0.32	N
Elymus piperi (giant wild rye)	10.0	0-10	2	0.19	N
Festuca idahoensis (bluebunch fescue)	1.7	0-10	19	0.32	N
Festuca ovina (sheep fescue)	0.5	0-0.5	2	0.01	I
Festuca rubra (red fescue)	6.5	0-10	4	0.25	B
Festuca rubra subsp. *arctica* (Richardson's fescue)	0.5	0-0.5	2	0.01	N
Festuca scabrella (rough fescue)	2.3	0-10	23	0.52	N
Festuca spp. (fescue)	0.5	0-0.5	2	0.01	B
Helictotrichon hookeri (Hooker's oat grass)	7.0	0-20	6	0.40	N
*Hordeum jubatu*m (foxtail barley)	1.8	0-3	4	0.07	N
Juncus balticus (wire rush)	4.1	0-10	11	0.46	N
Juncus confusus (few-flowered rush)	0.5	0-0.5	2	0.01	N
Koeleria macrantha (June grass)	0.8	0-3	15	0.12	N
Melica subulata (Alaska onion grass)	0.5	0-0.5	2	0.01	N
Muhlenbergia cuspidata (plains muhly)	0.5	0-0.5	2	0.01	N
Phleum pratense (timothy)	16.9	0-70	85	14.39	I
Poa alpina (alpine bluegrass)	0.5	0-0.5	2	0.01	N
Poa compressa (Canada bluegrass)	20.0	0-20	2	0.38	I
Poa palustris (fowl bluegrass)	15.3	0-30	4	0.58	N
Poa pratensis (Kentucky bluegrass)	46.7	0-80	96	44.97	I
Schizachne purpurascens (purple oat grass)	1.8	0-3	4	0.07	N
Sphenopholis obtusata (prairie wedge grass)	0.5	0-0.5	2	0.01	N
Stipa columbiana (Columbia needle grass)	0.5	0-0.5	8	0.04	N

Table 592. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Stipa curtiseta (western porcupine grass)	0.5	0-0.5	4	0.02	N
Stipa richardsonii (Richardson needle grass)	0.5	0-0.5	4	0.02	N
Stipa viridula (green needle grass)	0.5	0-0.5	2	0.01	N
Forbs (N = 133)					
Achillea millefolium (common yarrow)	4.0	0-20	81	3.28	N
Agoseris glauca (yellow false dandelion)	0.7	0-3	30	0.20	N
Allium cernuum (nodding onion)	0.5	0-0.5	2	0.01	N
Androsace septentrionalis (northern fairy candelabra)	0.5	0-0.5	2	0.01	N
Anemone canadensis (Canada anemone)	0.5	0-0.5	2	0.01	N
Anemone multifida (cut-leaved anemone)	0.8	0-3	15	0.12	N
Anemone patens (prairie crocus)	0.5	0-0.5	4	0.02	N
Angelica dawsonii (yellow angelica)	0.5	0-0.5	4	0.02	N
Antennaria anaphaloides (tall everlasting)	0.5	0-0.5	2	0.01	N
Antennaria neglecta (broad-leaved everlasting)	0.5	0-0.5	2	0.01	N
Antennaria parvifolia (small-leaved everlasting)	0.5	0-0.5	6	0.03	N
Antennaria spp. (everlastings)	0.5	0-0.5	2	0.01	N
Antennaria umbrinella (brown-bracted mountain everlasting)	0.5	0-0.5	2	0.01	N
Aquilegia flavescens (yellow columbine)	0.5	0-0.5	2	0.01	N
Arnica chamissonis (leafy arnica)	0.5	0-0.5	4	0.02	N
Artemisia frigida (pasture sagewort)	0.5	0-0.5	4	0.02	N
Artemisia ludoviciana (prairie sagewort)	2.5	0-10	11	0.28	N
Aster ciliolatus (Lindley's aster)	4.0	0-10	30	1.20	N
Aster conspicuus (showy aster)	0.5	0-0.5	8	0.04	N
Aster ericoides (tufted white prairie aster)	3.0	0-3	2	0.06	N
Aster hesperius (western willow aster)	3.0	0-3	2	0.06	N
Aster laevis (smooth aster)	2.5	0-10	23	0.58	N
Aster modestus (large northern aster)	0.5	0-0.5	2	0.01	N
Aster spp. (aster)	0.5	0-0.5	4	0.02	N
Astragalus cicer (cicer milk vetch)	10.0	0-10	2	0.19	I
Astragalus dasyglottis (purple milk vetch)	0.5	0-0.5	2	0.01	N
Besseya wyomingensis (kittentails)	0.5	0-0.5	2	0.01	N
Campanula rotundifolia (harebell)	0.7	0-3	25	0.17	N
Castilleja cusickii (yellow paintbrush)	0.5	0-0.5	2	0.01	N
Cerastium arvense (field mouse-ear chickweed)	0.8	0-3	36	0.27	N
Cerastium vulgatum (common mouse-ear chickweed)	2.2	0-3	6	0.12	I
Chrysanthemum leucanthemum (ox-eye daisy)	10.0	0-10	2	0.19	I
Cicuta bulbifera (bulb-bearing water-hemlock)	0.5	0-0.5	2	0.01	N
Cirsium arvense (Canada thistle)	6.6	0-30	30	1.98	I
Cirsium spp. (thistle)	0.5	0-0.5	2	0.01	B
Cirsium undulatum (wavy-leaved thistle)	0.5	0-0.5	2	0.01	N
Cirsium vulgare (bull thistle)	0.5	0-0.5	2	0.01	I

Table 592. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Collomia linearis (narrow-leaved collomia)	0.5	0-0.5	2	0.01	N
Comandra umbellata (bastard toadflax)	0.5	0-0.5	2	0.01	N
Crepis tectorum (annual hawk's-beard)	0.5	0-0.5	2	0.01	I
Delphinium bicolor (low larkspur)	3.0	0-3	2	0.06	N
Delphinium glaucum (tall larkspur)	3.7	0-10	6	0.21	N
Dodecatheon conjugens (mountain shooting star)	0.5	0-0.5	8	0.04	N
Draba nemorosa (annual whitlow-grass)	0.5	0-0.5	2	0.01	N
Epilobium angustifolium (common fireweed)	2.7	0-20	19	0.51	N
Epilobium ciliatum (northern willowherb)	3.0	0-3	2	0.06	N
Equisetum arvense (common horsetail)	10.0	0-10	2	0.19	N
Equisetum scirpoides (dwarf scouring-rush)	10.0	0-10	2	0.19	N
Equisetum spp. (horsetail)	0.5	0-0.5	2	0.01	N
Erigeron caespitosus (tufted fleabane)	0.5	0-0.5	6	0.03	N
Erigeron glabellus (smooth fleabane)	0.5	0-0.5	2	0.01	N
Erigeron speciosus (showy fleabane)	0.5	0-0.5	4	0.02	N
Erigeron spp. (erigeron)	0.5	0-0.5	2	0.01	N
Erythronium grandiflorum (glacier lily)	3.0	0-3	2	0.06	N
Fragaria virginiana (wild strawberry)	3.3	0-20	51	1.69	N
Gaillardia aristata (gaillardia)	0.5	0-0.5	6	0.03	N
Galium boreale (northern bedstraw)	1.2	0-10	62	0.76	N
Gentiana spp. (gentian)	0.5	0-0.5	2	0.01	N
Gentianella amarella (felwort)	0.5	0-0.5	8	0.04	N
Geranium richardsonii (wild white geranium)	10.8	0-20	8	0.81	N
Geranium viscosissimum (sticky purple geranium)	2.5	0-10	32	0.79	N
Geum aleppicum (yellow avens)	1.1	0-3	8	0.08	N
Geum macrophyllum (large-leaved yellow avens)	2.9	0-10	9	0.27	N
Geum rivale (purple avens)	0.5	0-0.5	2	0.01	N
Geum triflorum (three-flowered avens)	3.2	0-10	17	0.54	N
Hedysarum alpinum (alpine hedysarum)	0.5	0-0.5	4	0.02	N
Hedysarum sulphurescens (yellow hedysarum)	0.5	0-0.5	6	0.03	N
Heracleum lanatum (cow parsnip)	0.5	0-0.5	4	0.02	N
Heuchera cylindrica (sticky alumroot)	0.5	0-0.5	2	0.01	N
Lathyrus ochroleucus (cream-colored vetchling)	1.5	0-10	26	0.41	N
Lepidium densiflorum (common pepper-grass)	0.5	0-0.5	2	0.01	N
Lomatium triternatum (western wild parsley)	0.5	0-0.5	6	0.03	N
Lupinus sericeus (silky perennial lupine)	0.5	0-0.5	6	0.03	N
Matricaria matricarioides (pineappleweed)	0.5	0-0.5	2	0.01	I
Medicago lupulina (black medick)	10.0	0-10	2	0.19	I
Melilotus alba (white sweet-clover)	10.0	0-10	2	0.19	I
Melilotus officinalis (yellow sweet-clover)	30.0	0-30	2	0.57	I
Mertensia paniculata (tall lungwort)	0.5	0-0.5	4	0.02	N
Monarda fistulosa (wild bergamot)	1.3	0-3	11	0.15	N
Osmorhiza chilensis (blunt-fruited sweet cicely)	0.5	0-0.5	2	0.01	N

Table 592. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
*Oxytropis monticol*a (late yellow locoweed)	0.5	0-0.5	2	0.01	N
Oxytropis sericea (early yellow locoweed)	0.5	0-0.5	4	0.02	N
Oxytropis spp. (locoweed)	0.5	0-0.5	2	0.01	B
Penstemon confertus (yellow beardtongue)	1.8	0-3	11	0.20	N
Penstemon procerus (slender blue beardtongue)	1.3	0-3	6	0.08	N
Penstemon spp. (beardtongue)	3.0	0-3	2	0.06	N
Plantago major (common plantain)	1.3	0-3	6	0.08	I
Polygonum arenastrum (common knotweed)	0.5	0-0.5	2	0.01	I
Polygonum viviparum (alpine bistort)	0.5	0-0.5	4	0.02	N
Potentilla anserina (silverweed)	10.0	0-10	2	0.19	N
Potentilla argentea (silvery cinquefoil)	1.1	0-3	8	0.08	I
Potentilla diversifolia (mountain cinquefoil)	1.6	0-3	13	0.21	N
Potentilla gracilis (graceful cinquefoil)	2.6	0-10	47	1.25	N
Potentilla hippiana (woolly cinquefoil)	0.5	0-0.5	4	0.02	N
Ranunculus acris (tall buttercup)	1.1	0-3	8	0.08	I
Ranunculus inamoenus (graceful buttercup)	0.5	0-0.5	2	0.01	N
Ranunculus spp. (ranunculus)	0.5	0-0.5	2	0.01	B
Rumex acetosa (green sorrel)	0.5	0-0.5	2	0.01	N
Rumex crispus (curled dock)	0.5	0-0.5	2	0.01	I
Rumex occidentalis (western dock)	0.5	0-0.5	6	0.03	N
Rumex spp. (sorrel)	0.5	0-0.5	2	0.01	B
Sedum stenopetalum (narrow-petaled stonecrop)	0.5	0-0.5	2	0.01	N
Senecio canus (prairie groundsel)	0.5	0-0.5	2	0.01	N
Senecio foetidus (marsh butterweed)	1.3	0-3	6	0.08	N
Senecio pseudaureus (thin-leaved ragwort)	0.5	0-0.5	2	0.01	N
Sisyrinchium montanum (common blue-eyed grass)	0.5	0-0.5	4	0.02	N
Smilacina racemosa (false Solomon's-seal)	0.5	0-0.5	2	0.01	N
Smilacina stellata (star-flowered Solomon's-seal)	0.5	0-0.5	9	0.05	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	4	0.02	N
Solidago missouriensis (low goldenrod)	0.9	0-3	13	0.11	N
Sonchus arvensis subsp. *uliginosus* (smooth perennial sow-thistle)	20.0	0-20	2	0.38	I
Stachys palustris (marsh hedge-nettle)	0.5	0-0.5	2	0.01	N
Stellaria longifolia (long-leaved chickweed)	0.5	0-0.5	2	0.01	N
Taraxacum ceratophorum (northern dandelion)	3.0	0-3	2	0.06	N
Taraxacum officinale (common dandelion)	10.1	0-30	89	8.92	I
Thalictrum occidentale (western meadow rue)	2.0	0-10	15	0.30	N
Thalictrum venulosum (veiny meadow rue)	2.1	0-10	26	0.55	N
Thermopsis rhombifolia (golden bean)	1.8	0-3	4	0.07	N
Thlaspi arvense (stinkweed)	0.5	0-0.5	4	0.02	I
Tragopogon dubius (common goat's-beard)	0.5	0-0.5	6	0.03	I
Trifolium aureum (yellow clover)	0.5	0-0.5	2	0.01	I
Trifolium hybridum (alsike clover)	9.6	0-30	15	1.45	I
Trifolium pratense (red clover)	1.8	0-3	4	0.07	I

Table 592. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Trifolium repens (white clover)	16.8	0-60	45	7.60	I
Urtica dioica (common nettle)	0.5	0-0.5	2	0.01	N
Verbascum thapsus (common mullein)	0.5	0-0.5	2	0.01	I
Vicia americana (wild vetch)	1.1	0-3	60	0.68	N
Viola adunca (early blue violet)	0.5	0-0.5	2	0.01	N
Viola canadensis (western Canada violet)	1.3	0-3	6	0.08	N
Zigadenus elegans (white camas)	0.5	0-0.5	4	0.02	N
Zigadenus spp. (unknown camas)	0.5	0-0.5	2	0.01	N
Zigadenus venenosus (death camas)	0.5	0-0.5	2	0.01	N
Zizia aptera (heart-leaved Alexanders)	1.3	0-3	6	0.08	N

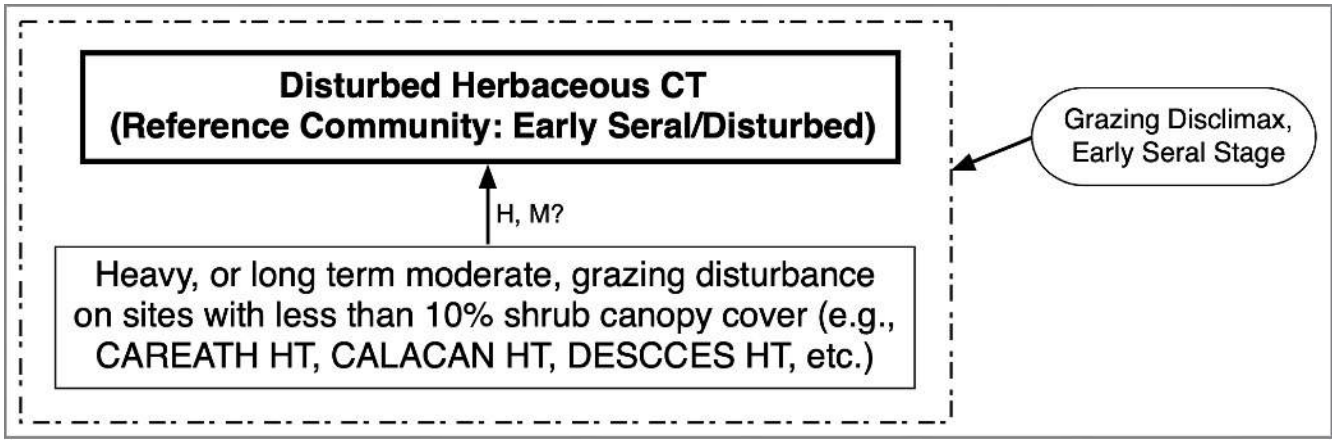
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Stands of the Disturbed Herbaceous community type lack significant tree or shrub presence, and are so altered by long term disturbance that they no longer contain sufficient presence of any late seral species by which they might be keyed to their potential habitat type. Typically, these stands are dominated by one or more disturbance increaser herbaceous (usually introduced) species, such as: *Poa pratensis* (Kentucky bluegrass), *Bromus inermis* (smooth brome), *Phleum pratense* (timothy), *Achillea millefolium* (common yarrow), *Taraxacum officinale* (common dandelion), and *Trifolium repens* (white clover).

Figure 126 shows a schematic diagram of vegetation successional pathways on sites of the Disturbed Herbaceous community type.



Successional Pathway of Disturbed Herbaceous Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = Disturbed Herbaceous community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CALACAN HT—*Calamagrostis canadensis* (marsh reed grass) habitat type
CAREATH HT—*Carex atherodes* (awned sedge) habitat type
DESCCES HT—*Deschampsia cespitosa* (tufted hair grass) habitat type
Disturbed Herbaceous CT—Disturbed Herbaceous community type

Figure 126. Successional pathway for sites of the Disturbed Herbaceous community type

NOTE: This type is the result of grazing disturbance that occurs over several decades of high use.

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the appropriate types.

EDATOPE

No edatope figure was developed for the Disturbed Herbaceous community type due to the wide variety of moisture and nutrient regimes associated with this highly disturbed type

SOILS

One of the most common herbaceous disturbance species, *Poa pratensis* (Kentucky bluegrass), thrives on moist, fertile sandy to clay soils high in organic matter. It also survives, but grows less vigorously on sands, dense clays, and thin, rocky soils when adequate moisture is available. Surface mineral soil textures range from sand to clay loam. *Poa pratensis* (Kentucky bluegrass), as well as most of the other disturbance species, is generally intolerant of prolonged flooding, seasonally high water tables, or poor drainage. (France and others 202, Baker and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites (if not too severely disturbed) may have such communities as the *Calamagrostis canadensis* (marsh reed grass) habitat type or the *Deschampsia cespitosa* (tufted hair grass) habitat type. Adjacent drier sites usually have upland types.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is a mat-forming perennial from extensive creeping, shallow rhizomes. It grows moist meadows, riparian areas, and depressions throughout most regions of Alberta up to the subalpine (Tannas 1997a). It is widely distributed across North America growing in every Canadian province. The species is shallow rooted and is intolerant of drought. Most roots and rhizomes are within 7.5 cm of the soil surface. It is a vigorous herbaceous competitor. Not only does it spread by rhizome expansion, but it also produces abundant seed, which accounts for good seedling recruitment and establishment on disturbed sites. It grows on a wide variety of sites in numerous vegetation types, but does best and is most abundant on moist sites where the climate is cool and humid (Uchytil 1993).

***Phleum pratense* (timothy)**—*Phleum pratense* (timothy) is an exotic, introduced invader perennial bunchgrass found in all regions of Alberta on sites with ample annual precipitation. It is a cool season, winter hardy, species that has poor reseeding at higher elevations, causing stands to die out after 5 or 6 years (Hardy BBT Limited 1989). *Phleum pratense* (timothy) is an invader of Eurasian origin, now common in better moisture and soil zones. It is a prolific seed producer and establishes readily on disturbed sites, often encroaching onto rangeland (Tannas 1997a).

***Bromus inermis* (smooth brome)**—*Bromus inermis* (smooth brome) is an exotic, cool-season, introduced perennial grass that produces extensive rhizomes with the ability to aggressively invade and persist on native rangelands sites with adequate moisture (Tannas 1997a, Howard 1996a). The species is widely adapted to a variety of site conditions; and is commonly found in riparian zones, valley bottoms, and dryland sites. It is adapted to all soil textures, although it may not thrive as well on sand or heavy clay (Howard 1996a).

Livestock

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is rated as good forage value (Stone and Lawrence 2000, Tannas 1997a, Thorpe 1996, and Beckingham 1991). The species is moderately productive, and provides a significant amount of early season forage. It is highly palatable in the rapid growth phase with palatability becoming greatly reduced during semi dormancy of late summer and winter (Tannas 1997a, Hansen and others 1995). Fall regrowth can occur if moisture is sufficient and temperatures remain above freezing. It is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). A high density of weak, low vigour tillers results under season-long grazing. Early season rest increases the vigour of individual plants. Streambanks with *Poa pratensis* (Kentucky bluegrass) stands are very susceptible to hoof shear damage and erosion The root system of *Poa pratensis* (Kentucky bluegrass) is very dense, but does not extend nearly as deep as native sedges. This results in streambanks being undercut by erosion, causing severe slumping/sloughing of the banks. In other words, it does not develop a deep, binding rootmass capable of streambank protection.

***Phleum pratense* (timothy)**—*Phleum pratense* (timothy) provides good early season forage with as much as 20 percent protein in early spring, but which drops rapidly at maturity to 4 to 5 percent by late fall (Tannas 1997a).

The specie is highly palatable to horses and cattle in spring, summer, and fall; and to sheep in summer (Esser 1993).

***Bromus inermis* (smooth brome)**—*Bromus inermis* (smooth brome) cultivars have been bred for nutritional quality and adaptation to selected climates. This has made it one of the most important exotic forage grasses in the Canada and the United States. It has been widely planted in pastures and rangelands from Texas to Alaska and Yukon Territory (Howard 1996a). Forage value is good early in the season, with protein content about 20 percent in May, but dropping to 4 percent to 6 percent by September (Tannas 1997a).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Poa pratensis* (Kentucky bluegrass)**—Elk and deer make use of the grasses and forbs of this community type, especially in early spring when other forages have not yet started to grow. Waterfowl utilize *Poa pratensis* (Kentucky bluegrass) for food and cover. Upland game birds, small mammals, and small non-game birds use this type for cover (Dittberner and Olson 1983).

***Phleum pratense* (timothy)**—*Phleum pratense* (timothy) is used by deer, rodents, song birds and game birds. It is an important forage for elk, mule deer, and bighorn sheep (Esser 1993). Its palatability is high for elk in the spring and summer, and high for deer in the summer (Esser 1993).

***Bromus inermis* (smooth brome)**—Foraging wildlife utilize *Bromus inermis* (smooth brome) to varying degrees, depending upon wildlife species and *Bromus inermis* (smooth brome) quality. Elk use it as a winter forage, but deer use is generally moderate. Geese and small mammals also consume it. *Bromus inermis* (smooth brome) provides cover for birds and small mammals. Ducks, gray partridge, American bittern, northern harrier, and short-eared owl use it for nesting cover (Howard 1996a).

Fisheries

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is very poor at stabilizing streambanks (Hansen and others 1995). Bank undercutting and sloughing will likely occur, especially when soils are wet.

Fire

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) is well adapted to fire, and quickly resprouts after burning. However, it is intolerant of fire during the active growth stages and can be successfully controlled by late spring burning. Fire is an effective tool to remove excessive litter accumulations common on rested or lightly grazed stands. Cool burns will have little effect on the species cover, but spring burns may lower tiller densities (Dix and Smeins 1967).

***Phleum pratense* (timothy)**—As with most perennial grasses, *Phleum pratense* (timothy) is well adapted to fire. The species has underground regenerative organs that are not harmed by moderately severe fires. It is harmed if burned when actively growing in the spring and summer, but is fairly fire tolerant when dormant (Esser 1993).

***Bromus inermis* (smooth brome)**—*Bromus inermis* (smooth brome) is rhizomatous, and survives light to moderate fire by sprouting from rhizomes. Early spring (late March-April) or late-season (late summer-fall) fire can increase smooth brome productivity, especially if it had become sod-bound. Late spring fire generally damages cool season grasses, such as *Bromus inermis* (smooth brome) (Howard 1996a).

Rehabilitation/Restoration Considerations

***Poa pratensis* (Kentucky bluegrass)**—*Poa pratensis* (Kentucky bluegrass) has an extensive rhizome system, but its shallow rooting habit make it only marginally effective in stabilizing streambanks. The species should not be part of any seed mix for restoring a site. The potential for erosion problems associated with this species is quite high. Managers need to pay close attention to streambanks dominated by *Poa pratensis* (Kentucky bluegrass) to detect early signs of bank failure. Once a streambank starts to degrade, with no change in management there is little that can be done to save it, short of expensive reconstructive treatments. Unless water tables are restored, these degraded sites will retain their dominant cover of introduced grasses (Hansen and others 1995).

***Phleum pratense* (timothy)**—The *Phleum pratense* (timothy) “Climax" cultivar produced the greatest cover on raw coal mine overburden in the Alberta foothills. *Phleum pratense* (timothy) was rated as the most promising species for rapid erosion control (Hardy BBT Limited 1989). It is widely used for rehabilitation of cutover, burned-over, and overgrazed mountain rangelands (Esser 1993).

***Bromus inermis* (smooth brome)**—*Bromus inermis* (smooth brome) can be an effective species for erosion control and site stabilization, but it is not recommended for restoration on native rangelands due to its invasive and persistent nature (Tannas 1997a).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The Disturbed Herbaceous community type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- M4. Kentucky bluegrass/Clover/Dandelion
- A16. Timothy-Creeping red fescue/Clover

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- Creeping red fescue-Kentucky bluegrass/Clover
- Kentucky bluegrass/Clover-Dandelion
- Kentucky bluegrass/Dandelion-Clover
- Kentucky bluegrass-Sedge-Foothills rough fescue
- Kentucky bluegrass-Timothy/Veiny meadow rue

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Kentucky bluegrass-Foothills rough fescue
- Kentucky bluegrass-Timothy/Dandelion
- Smooth brome-Kentucky bluegrass
- Weeds/Bare ground

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msc23 Kentucky bluegrass-Timothy/Clover (Montane Southern Ecosection)
- Msc4 Kentucky bluegrass-Timothy/Dandelion (Montane Southern Ecosection)
- Mca13 Kentucky bluegrass-Foxtail barley-Tufted hairgrass (Montane Cypress Hills Ecosection)
- Mca8 Kentucky bluegrass-Smooth brome (Montane Cypress Hills Ecosection

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The Disturbed Herbaceous community type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995);
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001); and
- *Classification and Management of Upland, Riparian, and Wetland Sites of USDI Bureau of Land Management's Miles City Field Office, Eastern Montana USA* (Hansen and others 2008).

Equisetum fluviatile Habitat Type
(swamp horsetail Habitat Type)

EQUIFLU Habitat Type
Number of Stands = 14 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 1; Other Data Sets = 13)

LOCATION AND ASSOCIATED LANDFORMS

The *Equisetum fluviatile* (swamp horsetail) habitat type is an incidental type in the Lower Foothills Natural Subregion, an incidental type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. This habitat type typically occurs on somewhat alkaline sites that are prone to yearly flooding and season-long high water table, along streams, rivers, lake margins, sloughs, and reservoirs. It occupies sites on wet ground or in shallow water up to 0.5 m deep, or along the margins of lakes and ponds, and abandoned channels of rivers and streams.

Photo 34 shows a typical stand of the *Equisetum fluviatile* (swamp horsetail) habitat type.

Photo 34. A stand of the *Equisetum fluviatile* (swamp horsetail) habitat type

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the

plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 593 shows the five most prominent plant species among the four lifeforms for species recorded in all 14 stands of the *Equisetum fluviatile* (swamp horsetail) habitat type. In this very wet community, only *Equisetum fluviatile* (swamp horsetail) is very prominent.

Table 593. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Equisetum fluviatile* (swamp horsetail) habitat type (number = 14 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Alnus tenuifolia (river alder)	0.04	Native
Rubus pubescens (dewberry)	0.04	Native
Salix exigua (sandbar willow)	0.04	Native
Salix lutea (yellow willow)	0.04	Native
Graminoids		
Eleocharis acicularis (needle spike-rush)	1.43	Native
Carex utriculata (beaked sedge)	1.00	Native
Eleocharis palustris (creeping spike-rush)	0.71	Native
Calamagrostis canadensis (marsh reed grass)	0.21	Native
Carex aquatilis (water sedge)	0.21	Native
Forbs		
Equisetum fluviatile (swamp horsetail)	85.18	Native
Epilobium palustre (marsh willowherb)	2.86	Native
Potentilla palustris (marsh cinquefoil)	1.43	Native
Typha latifolia (common cattail)	0.25	Native
Sagittaria latifolia (broad-leaved arrowhead)	0.21	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 594 through Table 597, break out the vegetation recorded in all 14 stands sampled of the *Equisetum fluviatile* (swamp horsetail) habitat type into the four vegetative lifeforms. The

lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, species poor, herbaceous habitat type of incidental occurrence across the study area.

Table 594 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Equisetum fluviatile* (swamp horsetail) habitat type. For the 14 stands comprising the habitat type, the number of unique species was 29 with 26 (89.7 percent) of them being native species.

Table 594. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Equisetum fluviatile* (swamp horsetail) habitat type (number = 14 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	4	4	0	0
Graminoids	9	9	0	0
Forbs	16	13	3	0
TOTAL	***29 (100.0%)***	***26 (89.7%)***	***3 (10.3%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 595 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Equisetum fluviatile* (swamp horsetail) habitat type. The average number of species per stand is 3.5, with native species comprising 3.3 species per stand or 94.3 percent.

Table 595. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Equisetum fluviatile* (swamp horsetail) habitat type (number = 14 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.3	0.3	0.0	0.0
Graminoids	1.1	1.1	0.0	0.0
Forbs	2.1	1.9	0.2	0.0
TOTAL	***3.5 (100.0%)***	***3.3 (94.3%)***	***0.2 (5.7%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 596 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Equisetum fluviatile* (swamp horsetail) habitat type. The average canopy cover per stand is 94.6 percent, with native species comprising 94.4 percent or 99.7 percent of the total amount of average canopy cover per stand.

Table 596. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Equisetum fluviatile* (swamp horsetail) habitat type (number = 14 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.1%	0.1%	0.0%	0.0%
Graminoids	4.0%	4.0%	0.0%	0.0%
Forbs	90.5%	90.2%	0.3%	0.0%
TOTAL	***94.6% (100.0%)***	***94.4% (99.7%)***	***0.3% (0.3%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 597 shows the average number of species and average canopy cover by lifeform in stands of the *Equisetum fluviatile* (swamp horsetail) habitat type. The average number of species per stand was 3.5 with an average canopy cover of 94.6 percent.

Table 597. Average number of species and average canopy cover by lifeform in stands of the *Equisetum fluviatile* (swamp horsetail) habitat type (number = 14 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.3	0.1%
Graminoids	1.1	4.0%
Forbs	2.1	90.5%
TOTAL	***3.5***	***94.6%***

Sampled Stands Plant Species List

No trees, and only four shrub species in very small amounts, were recorded on 14 sampled stands of the *Equisetum fluviatile* (swamp horsetail) habitat type (Table 598). Nine graminoids were recorded, all with very low prominence; and all stands sampled were heavily dominated by the type indicator, *Equisetum fluviatile* (swamp horsetail).

Table 598. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Equisetum fluviatile* (swamp horsetail) habitat type (number = 14 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Shrubs (N = 4)					
Alnus tenuifolia (river alder)	0.5	0-0.5	7	0.04	N
Rubus pubescens (dewberry)	0.5	0-0.5	7	0.04	N
Salix exigua (sandbar willow)	0.5	0-0.5	7	0.04	N
Salix lutea (yellow willow)	0.5	0-0.5	7	0.04	N
Graminoids (N = 9)					
Beckmannia syzigachne (slough grass)	0.5	0-0.5	7	0.04	N
Calamagrostis canadensis (marsh reed grass)	3.0	0-3	7	0.21	N
Carex aquatilis (water sedge)	3.0	0-3	7	0.21	N
Carex atherodes (awned sedge)	3.0	0-3	7	0.21	N
Carex utriculata (beaked sedge)	3.5	0-10	29	1.00	N
Eleocharis acicularis (needle spike-rush)	20.0	0-20	7	1.43	N
Eleocharis palustris (creeping spike-rush)	10.0	0-10	7	0.71	N
Glyceria grandis (common tall manna grass)	0.5	0-0.5	29	0.14	N
Juncus nodosus (knotted rush)	0.5	0-0.5	7	0.04	N
Forbs (N = 16)					
Cicuta maculata (water-hemlock)	0.5	0-0.5	7	0.04	N
Cirsium arvense (Canada thistle)	0.5	0-0.5	7	0.04	I
Epilobium palustre (marsh willowherb)	40.0	0-40	7	2.86	N
Equisetum fluviatile (swamp horsetail)	85.2	70-97.5	100	85.18	N
Erigeron philadelphicus (Philadelphia fleabane)	0.5	0-0.5	7	0.04	N
Hippuris vulgaris (common mare's-tail)	0.5	0-0.5	7	0.04	N
Mentha arvensis (wild mint)	0.5	0-0.5	7	0.04	N
Myosotis laxa (small forget-me-not)	0.5	0-0.5	7	0.04	N
Plantago major (common plantain)	0.5	0-0.5	7	0.04	I
Potentilla palustris (marsh cinquefoil)	20.0	0-20	7	1.43	N
Rumex occidentalis (western dock)	0.5	0-0.5	7	0.04	N
Sagittaria cuneata (arum-leaved arrowhead)	0.5	0-0.5	7	0.04	N
Sagittaria latifolia (broad-leaved arrowhead)	3.0	0-3	7	0.21	N
Sium suave (water parsnip)	0.5	0-0.5	7	0.04	N
Sonchus arvensis (perennial sow-thistle)	3.0	0-3	7	0.21	I
Typha latifolia (common cattail)	1.8	0-3	14	0.25	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 599 shows the five most prominent plant species among the four lifeforms for species recorded in all eight relatively undisturbed late seral to climax stands of the *Equisetum fluviatile* (swamp horsetail) habitat type. In this very wet community, only *Equisetum fluviatile* (swamp horsetail) is very prominent.

Table 599. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Equisetum fluviatile* (swamp horsetail) habitat type (number = 8 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Salix exigua (sandbar willow)	0.06	Native
Salix lutea (yellow willow)	0.06	Native
Graminoids		
Carex utriculata (beaked sedge)	1.69	Native
Glyceria grandis (common tall manna grass)	0.19	Native
Beckmannia syzigachne (slough grass)	0.06	Native
Forbs		
Equisetum fluviatile (swamp horsetail)	89.06	Native
Myosotis laxa (small forget-me-not)	0.06	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.
[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 600 through Table 603, break out the vegetation recorded in eight relatively undisturbed late seral to climax stands sampled of the *Equisetum fluviatile* (swamp horsetail) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each

group. This is a fairly uncommon, species poor, herbaceous habitat type of incidental occurrence across the study area.

Table 600 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Equisetum fluviatile* (swamp horsetail) habitat type. For the 8 stands comprising the habitat type, the number of unique species was 7 with 7 (100.0 percent) of them being native species.

Table 600. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Equisetum fluviatile* (swamp horsetail) habitat type (number = 8 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	2	2	0	0
Graminoids	3	3	0	0
Forbs	2	2	0	0
TOTAL	***7 (100.0%)***	***7 (100.0%)***	***0 (0.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 601 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Equisetum fluviatile* (swamp horsetail) habitat type. The average number of species per stand is 2.3, with native species comprising 2.3 species per stand or 100.0 percent.

Table 601. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Equisetum fluviatile* (swamp horsetail) habitat type (number = 8 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.3	0.3	0.0	0.0
Graminoids	0.9	0.9	0.0	0.0
Forbs	1.1	1.1	0.0	0.0
TOTAL	***2.3 (100.0%)***	***2.3 (100.0%)***	***0.0 (0.0%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 602 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Equisetum fluviatile* (swamp horsetail) habitat type. The average canopy cover per stand is 91.2 percent, with native species comprising 91.2 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 602. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Equisetum fluviatile* (swamp horsetail) habitat type (number = 8 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.1%	0.1%	0.0%	0.0%
Graminoids	1.9%	1.9%	0.0%	0.0%
Forbs	89.1%	89.1%	0.0%	0.0%
TOTAL	***91.2% (100.0%)***	***91.2% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 603 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Equisetum fluviatile* (swamp horsetail) habitat type. The average number of species per stand was 2.3 with an average canopy cover of 91.2 percent.

Table 603. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Equisetum fluviatile* (swamp horsetail) habitat type (number = 8 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.3	0.1%
Graminoids	0.9	1.9%
Forbs	1.1	89.1%
TOTAL	***2.3***	***91.2%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

No trees, and only two shrub species in very small amounts, were recorded on 8 relatively undisturbed late seral to climax sampled stands of the *Equisetum fluviatile* (swamp horsetail) habitat type (Table 604). Three graminoid species were recorded, all with very low prominence; and all stands sampled were heavily dominated by the type indicator, *Equisetum fluviatile* (swamp horsetail).

Table 604. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Equisetum fluviatile* (swamp horsetail) habitat type (number = 8 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Shrubs (N = 2)					
Salix exigua (sandbar willow)	0.5	0-0.5	13	0.06	N
Salix lutea (yellow willow)	0.5	0-0.5	13	0.06	N
Graminoids (N = 3)					
Beckmannia syzigachne (slough grass)	0.5	0-0.5	13	0.06	N
Carex utriculata (beaked sedge)	4.5	0-10	38	1.69	N
Glyceria grandis (common tall manna grass)	0.5	0-0.5	38	0.19	N
Forbs (N = 2)					
Equisetum fluviatile (swamp horsetail)	89.1	80-97.5	100	89.06	N
Myosotis laxa (small forget-me-not)	0.5	0-0.5	13	0.06	N

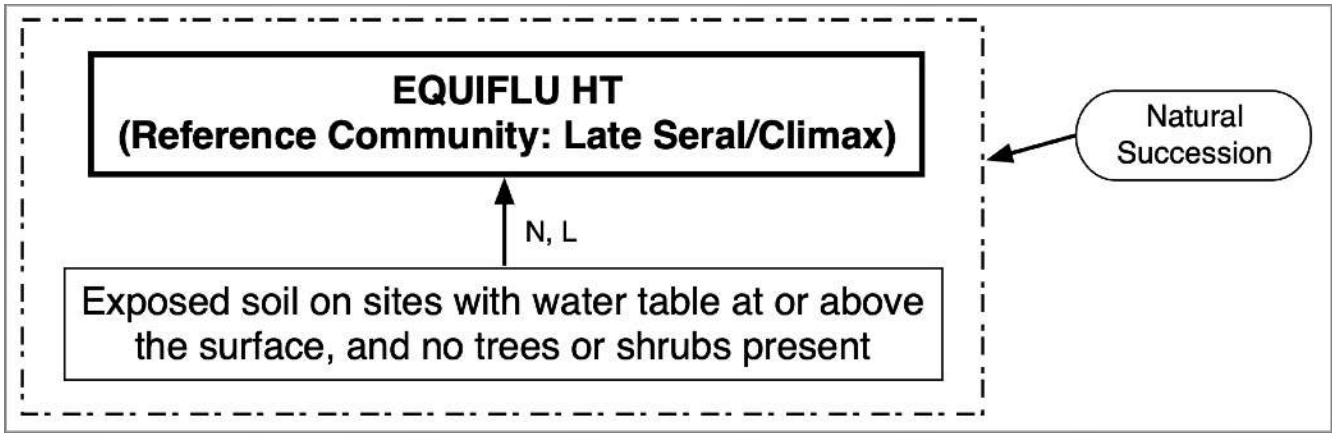
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Equisetum fluviatile (swamp horsetail) is an early colonizer of shallowly submerged sediments. This rhizomatous species can persist indefinitely on suitably wet sites if undisturbed. However, stands of this type are usually not hydrologically stable in the long term geomorphic sense. Their typical locations in riverine sloughs continually receive additional fluvial deposition during successive flood events, causing a progressive building higher in relation to the water table. Most sites with stands of this habitat type are so wet throughout the growing season that common kinds of disturbance are precluded.

Figure 127 shows a schematic diagram of vegetation successional pathways on sites of the *Equisetum fluviatile* (swamp horsetail) habitat type.



Successional Pathway of *Equisetum fluviatile* (swamp horsetail) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Equisetum fluviatile* (swamp horsetail) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
EQUIFLU HT—*Equisetum fluviatile* (swamp horsetail) habitat type

Figure 127. Successional pathway for sites of the *Equisetum fluviatile* (swamp horsetail) habitat type

Note: The above figure is based on the assumption that the general water regime remains relatively constant on the site. However, such sites usually do evolve by depositional aggradation, thus changing the water regime, and vegetation potential, over time.

EDATOPE

Figure 128 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Equisetum fluviatile* (swamp horsetail) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

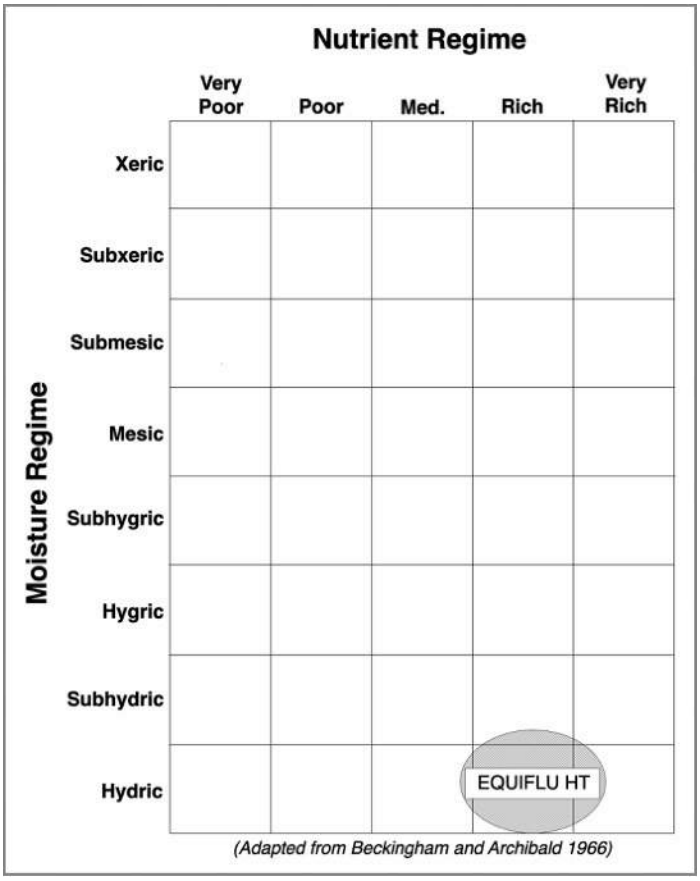


Figure 128. Edatope grid position for the *Equisetum fluviatile* (swamp horsetail) habitat type (EQUIFLU HT)

SOILS

Soils on sites supporting the *Equisetum fluviatile* (swamp horsetail) habitat type are either organic or silt mud. Mineral soils typically are fine textured silt mud and have layers of organic accumulation. Soils are poorly to very poorly drained. Standing water is usually present throughout the growing season (Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites may be dominated by *Typha* species (cattails), *Scirpus* species (bulrushes), or be open water. Adjacent drier sites may be dominated by a wide variety of species, including *Phalaris arundinacea* (reed canary grass), *Phragmites australis* (reed), *Carex* species (sedge), and *Salix* species (willow).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Equisetum fluviatile* (swamp horsetail)**—*Equisetum fluviatile* (swamp horsetail) is a rhizomatous perennial forb occurring throughout Alberta in very wet sites, including marshes, swamps, and bogs (Moss 1983).

Livestock

***Equisetum fluviatile* (swamp horsetail)**—*Equisetum fluviatile* (swamp horsetail) occurs on sites that are generally too wet for livestock access. Herbage production is moderate. However, livestock seldom graze

Equisetum fluviatile (swamp horsetail) due to its low palatability and inaccessibility. In wild hay, if in excessive quantities, *Equisetum* species (horsetails) are known to cause scours, paralysis, and occasionally death. Hay containing around 20 percent or more *Equisetum* species (horsetails) can produce poisoning symptoms in horses. Symptoms appear in 2-5 weeks, beginning with weight loss, loss of muscular control, and followed by falling, exhaustion, and possibly death. Cattle, sheep, and goats are rarely affected (Hansen and others 1995).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Equisetum fluviatile* (swamp horsetail)**—*Equisetum* species (horsetails) are favorite food of geese and other waterfowl, and possibly are also eaten by muskrats as well (CYSIP 2023). The species is seldom grazed by wildlife due to its low palatability. Waterfowl and muskrats use it for nesting and hiding cover (Thompson and Hansen 2003).

Fire

***Equisetum fluviatile* (swamp horsetail)**—*Equisetum fluviatile* (swamp horsetail) is a rhizomatous species occurring on very wet sites that seldom burn, except during severe drought. It is likely that the above ground stems would be killed, but that the plants would regenerate quickly from the buried rhizomes.

Rehabilitation/Restoration Considerations

***Equisetum fluviatile* (swamp horsetail)**—These sites are generally so wet as to preclude most development. Trampling damage and soil churning occurs readily with livestock use.

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Equisetum fluviatile* (swamp horsetail) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Equisetum fluviatile* (swamp horsetail) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003); and
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995).

Phalaris arundinacea Habitat Type
(reed canary grass Habitat Type)

PHALARU Habitat Type
Number of Stands = 12 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 0; Other Data Sets = 12)

LOCATION AND ASSOCIATED LANDFORMS

The *Phalaris arundinacea* (reed canary grass) habitat type is an incidental type in the Lower Foothills Natural Subregion, a restricted type in the Upper Foothills Natural Subregion, and a restricted type in the Montane Natural Subregion of Alberta. This habitat type occurs along streams, rivers, oxbows, lake shores, pond margins, ditches, irrigation channels, and wet meadows.

Photo 35 shows a typical stand of the *Phalaris arundinacea* (reed canary grass) habitat type.

Photo 35. A stand of the *Phalaris arundinacea* (reed canary grass) habitat type

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The

index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 605 shows the five most prominent plant species among the four lifeforms for species recorded in all 12 stands of the *Phalaris arundinacea* (reed canary grass) habitat type. The aggressive *Phalaris arundinacea* (reed canary grass) dominates stands of this habitat type, and it is the only very prominent species recorded.

Table 605. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Phalaris arundinacea* (reed canary grass) habitat type (number = 12 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Salix exigua (sandbar willow)	0.08	Native
Rubus idaeus (wild red raspberry)	0.04	Native
Symphoricarpos albus (snowberry)	0.04	Native
Graminoids		
Phalaris arundinacea (reed canary grass)	87.71	Native
Carex atherodes (awned sedge)	1.67	Native
Agrostis stolonifera (redtop)	0.88	Introduced
Festuca rubra subsp. *arctica* (Richardson's fescue)	0.83	Native
Phleum pratense (timothy)	0.83	Introduced
Forbs		
Astragalus cicer (cicer milk vetch)	2.50	Introduced
Cirsium arvense (Canada thistle)	1.96	Introduced
Equisetum arvense (common horsetail)	1.71	Native
Polygonum amphibium (water smartweed)	1.67	Native
Mentha arvensis (wild mint)	1.17	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 606 through Table 609, break out the vegetation recorded in all 12 stands sampled of the *Phalaris arundinacea* (reed canary grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e.,

native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, species poor, herbaceous habitat type of incidental-to-restricted occurrence across the study area.

Table 606 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Phalaris arundinacea* (reed canary grass) habitat type. For the 12 stands comprising the habitat type, the number of unique species was 39 with 28 (71.8 percent) of them being native species.

Table 606. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Phalaris arundinacea* (reed canary grass) habitat type (number = 12 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	3	3	0	0
Graminoids	12	10	2	0
Forbs	24	15	9	0
TOTAL	***39 (100.0%)***	***28 (71.8%)***	***11 (28.2%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 607 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Phalaris arundinacea* (reed canary grass) habitat type. The average number of species per stand is 5.1, with native species comprising 3.9 species per stand or 76.5 percent.

Table 607. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Phalaris arundinacea* (reed canary grass) habitat type (number = 12 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.3	0.3	0.0	0.0
Graminoids	2.0	1.8	0.3	0.0
Forbs	2.8	1.8	1.1	0.0
TOTAL	***5.1 (100.0%)***	***3.9 (76.5%)***	***1.4 (27.5%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 608 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Phalaris arundinacea* (reed canary grass) habitat type. The average canopy cover per stand is 104.5 percent, with native species comprising 96.8 percent or 92.6 percent of the total amount of average canopy cover per stand.

Table 608. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Phalaris arundinacea* (reed canary grass) habitat type (number = 12 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.2%	0.2%	0.0%	0.0%
Graminoids	92.4%	90.7%	1.7%	0.0%
Forbs	12.0%	5.9%	6.0%	0.0%
TOTAL	***104.5% (100.0%)***	***96.8% (92.6%)***	***7.8% (7.4%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 609 shows the average number of species and average canopy cover by lifeform in stands of the *Phalaris arundinacea* (reed canary grass) habitat type. The average number of species per stand was 5.1 with an average canopy cover of 104.5 percent.

Table 609. Average number of species and average canopy cover by lifeform in stands of the *Phalaris arundinacea* (reed canary grass) habitat type (number = 12 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.3	0.2%
Graminoids	2.0	92.4%
Forbs	2.8	12.0%
TOTAL	***5.1***	***104.5%***

Sampled Stands Plant Species List

No trees, and only three shrub species in very small amounts, were recorded on 12 sampled stands of the *Phalaris arundinacea* (reed canary grass) habitat type (Table 610). *Phalaris arundinacea* (reed canary grass) was the only highly prominent one of 12 graminoid species recorded, and none of the 24 forb species recorded was notably prominent or occurring on more than 33 percent of stands sampled.

Table 610. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Phalaris arundinacea* (reed canary grass) habitat type (number = 12 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Shrubs (N = 3)					
Rubus idaeus (wild red raspberry)	0.5	0-0.5	8	0.04	N
Salix exigua (sandbar willow)	0.5	0-0.5	17	0.08	N
Symphoricarpos albus (snowberry)	0.5	0-0.5	8	0.04	N
Graminoids (N = 12)					
Agropyron trachycaulum (slender wheat grass)	0.5	0-0.5	8	0.04	N
Agrostis stolonifera (redtop)	5.3	0-10	17	0.88	I
Carex atherodes (awned sedge)	20.0	0-20	8	1.67	N
Carex sychnocephala (long-beaked sedge)	0.5	0-0.5	8	0.04	N
Carex vesicaria (blister sedge)	0.5	0-0.5	8	0.04	N
Eleocharis palustris (creeping spike-rush)	3.0	0-3	8	0.25	N
Festuca rubra subsp. *arctica* (Richardson's fescue)	10.0	0-10	8	0.83	N
Hordeum jubatum (foxtail barley)	0.5	0-0.5	8	0.04	N
Phalaris arundinacea (reed canary grass)	87.7	50-97.5	100	87.71	N
Phleum pratense (timothy)	10.0	0-10	8	0.83	I
Scirpus acutus (great bulrush)	0.5	0-0.5	8	0.04	N
Scirpus paludosus (prairie bulrush)	0.5	0-0.5	8	0.04	N
Forbs (N = 24)					
Acorus americanus (sweet flag)	0.5	0-0.5	8	0.04	N
Apocynum cannabinum (Indian hemp)	3.0	0-3	8	0.25	N
Astragalus cicer (cicer milk vetch)	30.0	0-30	8	2.50	I
Chenopodium album (lamb's-quarters)	0.5	0-0.5	8	0.04	I
Cirsium arvense (Canada thistle)	7.8	0-20	25	1.96	I
Epilobium palustre (marsh willowherb)	0.5	0-0.5	8	0.04	N
Equisetum arvense (common horsetail)	10.3	0-20	17	1.71	N
Equisetum fluviatile (swamp horsetail)	3.0	0-3	8	0.25	N
Helenium autumnale (sneezeweed)	0.5	0-0.5	8	0.04	N
Lactuca serriola (prickly lettuce)	0.5	0-0.5	8	0.04	I
Lathyrus ochroleucus (cream-colored vetchling)	0.5	0-0.5	8	0.04	N
Mentha arvensis (wild mint)	3.5	0-10	33	1.17	N
Polygonum amphibium (water smartweed)	10.0	0-10	17	1.67	N
Potentilla anserina (silverweed)	0.5	0-0.5	17	0.08	N
Rorippa palustris (marsh yellow cress)	0.5	0-0.5	8	0.04	N
Rumex crispus (curled dock)	0.5	0-0.5	8	0.04	I
Scutellaria galericulata (marsh skullcap)	3.0	0-3	8	0.25	N
Solanum dulcamara (climbing nightshade)	0.5	0-0.5	8	0.04	I
Sonchus arvensis (perennial sow-thistle)	3.0	0-3	8	0.25	I
Taraxacum officinale (common dandelion)	1.8	0-3	17	0.29	I
Trifolium repens (white clover)	5.3	0-10	17	0.88	I
Triglochin maritima (seaside arrow-grass)	0.5	0-0.5	8	0.04	N
Urtica dioica (common nettle)	3.0	0-3	8	0.25	N

Table 610. (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Vicia americana (wild vetch)	0.5	0-0.5	8	0.04	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 611 shows the five most prominent plant species among the four lifeforms for species recorded in all seven relatively undisturbed late seral to climax stands of the *Phalaris arundinacea* (reed canary grass) habitat type. The aggressive *Phalaris arundinacea* (reed canary grass) dominates stands of this habitat type, and it is the only very prominent species recorded.

Table 611. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Phalaris arundinacea* (reed canary grass) habitat type (number = 7 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Rubus idaeus (wild red raspberry)	0.07	Native
Salix exigua (sandbar willow)	0.07	Native
Symphoricarpos albus (snowberry)	0.07	Native
Graminoids		
Phalaris arundinacea (reed canary grass)	96.43	Native
Carex atherodes (awned sedge)	2.86	Native
Agrostis stolonifera (redtop)	0.07	Introduced
Carex vesicaria (blister sedge)	0.07	Native
Scirpus paludosus (prairie bulrush)	0.07	Native

Table 611. (cont.)

Species	Prominence Value[1]	Origin Status[2]
Forbs		
Equisetum arvense (common horsetail)	2.86	Native
Mentha arvensis (wild mint)	1.50	Native
Chenopodium album (lamb's-quarters)	0.07	Introduced
Cirsium arvense (Canada thistle)	0.07	Introduced
Rumex crispus (curled dock)	0.07	Introduced

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 612 through Table 615, break out the vegetation recorded in seven relatively undisturbed late seral to climax stands sampled of the *Phalaris arundinacea* (reed canary grass) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, species poor, herbaceous habitat type of incidental-to-restricted occurrence across the study area.

Table 612 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Phalaris arundinacea* (reed canary grass) habitat type. For the 7 stands comprising the habitat type, the number of unique species was 13 with 9 (69.2 percent) of them being native species.

Table 612. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Phalaris arundinacea* (reed canary grass) habitat type (number = 7 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	3	3	0	0
Graminoids	5	4	1	0
Forbs	5	2	3	0
TOTAL	***13 (100.0%)***	***9 (69.2%)***	***4 (30.7%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 613 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Phalaris arundinacea* (reed canary grass) habitat type. The average number of species per stand is 2.9, with native species comprising 2.2 species per stand or 75.9 percent.

Table 613. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Phalaris arundinacea* (reed canary grass) habitat type (number = 7 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.4	0.4	0.0	0.0
Graminoids	1.6	1.4	0.1	0.0
Forbs	0.9	0.4	0.4	0.0
TOTAL	***2.9 (100.0%)***	***2.2 (75.9%)***	***0.5 (17.2%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 614 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Phalaris arundinacea* (reed canary grass) habitat type. The average canopy cover per stand is 104.3 percent, with native species comprising 104.0 percent or 99.7 percent of the total amount of average canopy cover per stand.

Table 614. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Phalaris arundinacea* (reed canary grass) habitat type (number = 7 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.2%	0.2%	0.0%	0.0%
Graminoids	99.5%	99.4%	0.1%	0.0%
Forbs	4.6%	4.4%	0.2%	0.0%
TOTAL	***104.3% (100.0%)***	***104.0% (99.7%)***	***0.3% (0.3%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 615 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Phalaris arundinacea* (reed canary grass) habitat type. The average number of species per stand was 2.9 with an average canopy cover of 104.3 percent.

Table 615. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Phalaris arundinacea* (reed canary grass) habitat type (number = 7 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.4	0.2%
Graminoids	1.6	99.5%
Forbs	0.9	4.6%
TOTAL	***2.9***	***104.3%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

No trees, and only three shrub species in very small amounts, were recorded on seven relatively undisturbed late seral to climax sampled stands of the *Phalaris arundinacea* (reed canary grass) habitat type (Table 616). *Phalaris arundinacea* (reed canary grass) was the only highly prominent one of five graminoid species recorded, and none of the five forb species was notably prominent.

Table 616. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Phalaris arundinacea* (reed canary grass) habitat type (number = 7 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Shrubs (N = 3)					
Rubus idaeus (wild red raspberry)	0.5	0-0.5	14	0.07	N
Salix exigua (sandbar willow)	0.5	0-0.5	14	0.07	N
Symphoricarpos albus (snowberry)	0.5	0-0.5	14	0.07	N
Graminoids (N = 5)					
Agrostis stolonifera (redtop)	0.5	0-0.5	14	0.07	I
Carex atherodes (awned sedge)	20.0	0-20	14	2.86	N
Carex vesicaria (blister sedge)	0.5	0-0.5	14	0.07	N
Phalaris arundinacea (reed canary grass)	96.4	90-97.5	100	96.43	N
Scirpus paludosus (prairie bulrush)	0.5	0-0.5	14	0.07	N
Forbs (N = 5)					
Chenopodium album (lamb's-quarters)	0.5	0-0.5	14	0.07	I
Cirsium arvense (Canada thistle)	0.5	0-0.5	14	0.07	I
Equisetum arvense (common horsetail)	20.0	0-20	14	2.86	N
Mentha arvensis (wild mint)	5.3	0-10	29	1.50	N
Rumex crispus (curled dock)	0.5	0-0.5	14	0.07	I

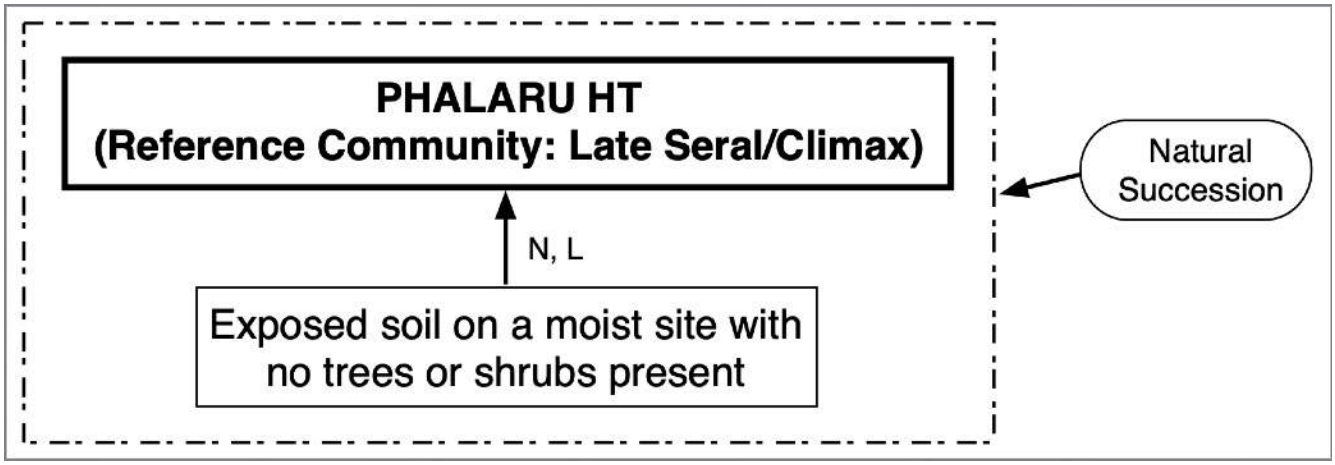
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Phalaris arundinacea (reed canary grass) is a pioneering grass species that can rapidly establish itself on new alluvial deposits and persist there as long as hydrologic conditions remain favorable. The species has a strong tolerance to grazing, except in its early growth stages. However, if stands are severely disturbed, species such as *Agrostis stolonifera* (red top), *Mentha arvensis* (wild mint), *Scirpus microcarpus* (small-fruited bulrush), *Cirsium arvense* (Canada thistle), and *Trifolium repens* (white clover) can replace the *Phalaris arundinacea* (reed canary grass).

Figure 129 shows a schematic diagram of vegetation successional pathways on sites of the *Phalaris arundinacea* (reed canary grass) habitat type.



Successional Pathway of *Phalaris arundinacea* (reed canary grass) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Phalaris arundinacea* (reed canary grass) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
PHALARU HT—*Phalaris arundinacea* (reed canary grass) habitat type

Figure 129. Successional pathway for sites of the *Phalaris arundinacea* (reed canary grass) habitat type

NOTE: The above figure may not represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic regime remains relatively constant. If the hydrologic regime changes, the potential of the site may also change. The time span is estimated for the stand to attain, under undisturbed conditions, the minimum canopy cover needed of the indicator species used for keying to the

appropriate types. This aggressive species will colonize and occupy moist banks and shores along rivers and lakes. It rapidly forms a dense monospecific stand that excludes most competition.

EDATOPE

Figure 130 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Phalaris arundinacea* (reed canary grass) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

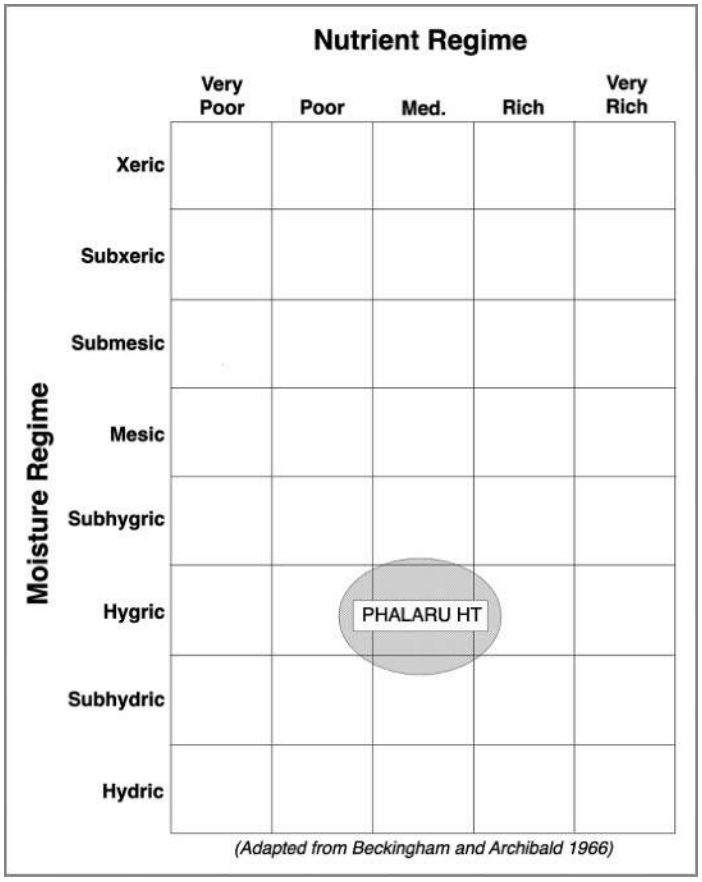


Figure 130. Edatope grid position for the *Phalaris arundinacea* (reed canary grass) habitat type (PHALARU HT)

SOILS

Soils on sites supporting the *Phalaris arundinacea* (reed canary grass) habitat type typically have medium to fine texture. Drainage is commonly poor, often with associated anaerobic conditions. Mineral soil textures range from sand to clay. Water tables may be above the soil surface for several months in spring, and soils often remain saturated throughout the growing season. *Phalaris arundinacea* (reed canary grass) tolerates prolonged periods of flooding (Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites may have the *Equisetum fluviatile* (swamp horsetail) habitat type or a wetland *Carex* (sedge) type, such as the *Carex utriculata* (beaked sedge) habitat type or the *Carex aquatilis* (water sedge) habitat type.

Adjacent drier sites can have such types as the *Picea glauca/Calamagrostis canadensis* (white spruce/marsh reed grass) habitat type, the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, the *Salix bebbiana/Calamagrostis canadensis* (beaked willow/marsh reed grass) habitat type, or the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Phalaris arundinacea* (reed canary grass)**—*Phalaris arundinacea* (reed canary grass) is common and widely distributed on moist sites across Alberta. It occurs along shores, streambanks, in depressions, marshes, and swamps (Tannas 1997a). *Phalaris arundinacea* (reed canary grass) prefers full sunlight, and although it can grow in shade, its abundance decreases. There is evidence indicating that the species establishes, persists and may spread in stands of early to late seral stage (Waggy 2010).

Livestock

***Phalaris arundinacea* (reed canary grass)**—Herbage production from the *Phalaris arundinacea* (reed canary grass) habitat type is high. However, palatability of the coarse grass is only low to moderate. It is most palatable when actively growing, and becomes less palatable later in the season. It is very tolerant of grazing, except in the early growth stage. Increased alkaloid and fibre content with maturity causes a gradual decline in palatability. Grazing should begin as soon as soils have dried enough to minimize trampling damage (Hansen and others 1995). These stands should be grazed using intense stocking and a short rotation plan that leaves at least a 5 cm to 8 cm stubble height. One option may include mowing stands once a year and fencing to force cattle to use this species. To maintain dense stands, plants should not be grazed to less than 10 cm in height (Alberta Agriculture 1981).

This species is also suitable for hay production. However, harvest must usually be delayed until late in the season when soils are dry and plants mature. Nutritive quality at this time is low, especially where *Phalaris arundinacea* (reed canary grass) completely dominates the stand (Tannas 1997a, Hansen and others 1988).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Phalaris arundinacea* (reed canary grass)**—On many sites, the *Phalaris arundinacea* (reed canary grass) is inundated long enough to provide some nesting habitat for waterfowl and cover for muskrats. *Phalaris arundinacea* (reed canary grass) forage value is considered fair for upland game birds and several songbirds. A variety of ungulates, particularly moose and elk, and to a lesser extent, mule deer, and white-tailed deer, use it as forage (Waggy 2010).

Fire

***Phalaris arundinacea* (reed canary grass)**—High water tables during the growing season make burning difficult. However, burning during the non-growing season may be feasible. A fire management strategy of a two to three year burn rotation has shown limited success in controlling the spread of *Phalaris arundinace*a (reed canary grass). Early April fires may cause increases in the species, while mid to late May burns can prevent it from producing seed. Stands of *Phalaris arundinacea* (reed canary grass) can be burned in winter, when the ice is 23 cm to 30 cm thick to reduce plant density and improve wildlife feeding areas (Hansen and others 1995).

Phalaris arundinacea (reed canary grass) rhizomes likely will survive most low to moderate severity fires, but may be killed by a high severity fire. It establishes rapidly after fire on sites where it was present in the pre fire plant community, suggesting that the species is adapted to survive and regenerate after burning (Waggy 2010).

Rehabilitation/Restoration Considerations

***Phalaris arundinacea* (reed canary grass)**—*Phalaris arundinacea* (reed canary grass) has been used for erosion control, shoreline stabilization, and pollutant filtration. The species has been recommended for revegetation of disturbed sites such as pipeline corridors, fire lines, and recently burned areas. However, because it can dominate sites and negatively affect ecosystems, its continued use in revegetation projects may be unwise. For example, when it was seeded along with a mixture of native species to restore a Wisconsin prairie community, the *Phalaris arundinacea* (reed canary grass) dominated the site with over 95 percent cover within 6 years (Waggy 2010).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Phalaris arundinacea* (reed canary grass) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- A20. Reed Canary Grass-Meadow foxtail/Clover

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- No matching plant community type

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- No matching plant community type

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Phalaris arundinacea* (reed canary grass) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995);
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001); and
- *Classification and Management of Upland, Riparian, and Wetland Sites of USDI Bureau of Land Management's Miles City Field Office, Eastern Montana USA* (Hansen and others 2008).

Scirpus acutus Habitat Type
(great bulrush Habitat Type)

SCIRACU Habitat Type
Number of Stands = 15 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 2; Other Data Sets = 13)

LOCATION AND ASSOCIATED LANDFORMS

The *Scirpus acutus* (great bulrush) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and an incidental type in the Montane Natural Subregion of Alberta. Typical locations include pond and lake margins in water up to 2 m deep. Stands can be quite extensive in shallow lake waters.

Photo 36 shows a typical stand of the *Scirpus acutus* (great bulrush) habitat type.

Photo 36. A stand of the *Scirpus acutus* (great bulrush) habitat type

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The

index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 617 shows the five most prominent plant species among the four lifeforms for species recorded in all 15 stands of the *Scirpus acutus* (great bulrush) habitat type. *Scirpus acutus* (great bulrush) is by far the most prominent species in stands of this type, followed well behind by another very wet-site obligate species, *Equisetum fluviatile* (swamp horsetail).

Table 617. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Scirpus acutus* (great bulrush) habitat type (number = 15 stands)

Species	Prominence Value[1]	Origin Status[2]
Graminoids		
Scirpus acutus (great bulrush)	69.67	Native
Eleocharis palustris (creeping spike-rush)	2.67	Native
Eleocharis spp. (spike-rush)	2.00	Native
Alopecurus aequalis (short-awn meadow-foxtail)	0.23	Native
Beckmannia syzigachne (slough grass)	0.23	Native
Forbs		
Equisetum fluviatile (swamp horsetail)	15.33	Native
Typha latifolia (common cattail)	0.70	Native
Epilobium ciliatum (northern willowherb)	0.67	Native
Lycopus asper (western water-horehound)	0.67	Native
Rumex maritimus (golden dock)	0.67	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 618 through Table 621, break out the vegetation recorded in all 15 stands sampled of the *Scirpus acutus* (great bulrush) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, species poor, herbaceous habitat type of minor-to-incidental occurrence across the study area.

Table 618 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Scirpus acutus* (great bulrush) habitat type. For the 15

stands comprising the habitat type, the number of unique species was 25 with 24 (96.0 percent) of them being native species.

Table 618. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Scirpus acutus* (great bulrush) habitat type (number = 15 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	0	0	0	0
Graminoids	9	9	0	0
Forbs	16	15	1	0
TOTAL	***25 (100.0%)***	***24 (96.0%)***	***1 (4.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 619 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Scirpus acutus* (great bulrush) habitat type. The average number of species per stand is 3.1, with native species comprising 3.0 species per stand or 96.8 percent.

Table 619. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Scirpus acutus* (great bulrush) habitat type (number = 15 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.0	0.0	0.0	0.0
Graminoids	1.7	1.7	0.0	0.0
Forbs	1.4	1.3	0.1	0.0
TOTAL	***3.1 (100.0%)***	***3.0 (96.8%)***	***0.1 (3.2%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 620 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Scirpus acutus* (great bulrush) habitat type. The average canopy cover per stand is 94.3 percent, with native species comprising 94.0 percent or 99.8 percent of the total amount of average canopy cover per stand.

Table 620. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Scirpus acutus* (great bulrush) habitat type (number = 15 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.0%	0.0%	0.0%	0.0%
Graminoids	75.0%	75.0%	0.0%	0.0%
Forbs	19.3%	19.1%	0.2%	0.0%
TOTAL	***94.3% (100.0%)***	***94.0% (99.8%)***	***0.2% (0.2%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 621 shows the average number of species and average canopy cover by lifeform in stands of the *Scirpus acutus* (great bulrush) habitat type. The average number of species per stand was 3.1 with an average canopy cover of 94.3 percent.

Table 621. Average number of species and average canopy cover by lifeform in stands of the *Scirpus acutus* (great bulrush) habitat type (number = 15 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.0	0.0%
Graminoids	1.7	75.0%
Forbs	1.4	19.3%
TOTAL	***3.1***	***94.3%***

Sampled Stands Plant Species List

No trees or shrubs were recorded on 15 sampled stands of the *Scirpus acutus* (great bulrush) habitat type (Table 622). Among the nine graminoid species recorded, only *Scirpus acutus* (great bulrush) was highly prominent or occurred on more than 2 or the 15 stands sampled. *Equisetum fluviatile* (swamp horsetail) was the only very prominent forb among the 16 species recorded.

Table 622. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Scirpus acutus* (great bulrush) habitat type (number = 15 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Graminoids (N = 9)					
Agrostis scabra (rough hair grass)	0.5	0-0.5	7	0.03	N
Alopecurus aequalis (short-awn meadow-foxtail)	1.8	0-3	13	0.23	N
Beckmannia syzigachne (slough grass)	1.8	0-3	13	0.23	N
Carex utriculata (beaked sedge)	0.5	0-0.5	13	0.07	N
Eleocharis palustris (creeping spike-rush)	40.0	0-40	7	2.67	N
Eleocharis spp. (spike-rush)	30.0	0-30	7	2.00	N
Hordeum jubatum (foxtail barley)	0.5	0-0.5	7	0.03	N
Poa palustris (fowl bluegrass)	0.5	0-0.5	7	0.03	N
Scirpus acutus (great bulrush)	69.7	40-97.5	100	69.67	N
Forbs (N = 16)					
Aster brachyactis (rayless aster)	3.0	0-3	7	0.20	N
Chenopodium rubrum (red goosefoot)	3.0	0-3	7	0.20	N
Epilobium ciliatum (northern willowherb)	10.0	0-10	7	0.67	N
Epilobium palustre (marsh willowherb)	0.5	0-0.5	7	0.03	N
Equisetum fluviatile (swamp horsetail)	76.7	0-80	20	15.33	N
Lemna minor (common duckweed)	3.0	0-3	7	0.20	N
Lycopus asper (western water-horehound)	10.0	0-10	7	0.67	N
Mentha arvensis (wild mint)	0.5	0-0.5	7	0.03	N
Polygonum lapathifolium (pale persicaria)	1.8	0-3	13	0.23	N
Polygonum ramosissimum (bushy knotweed)	3.0	0-3	7	0.20	N
Rumex maritimus (golden dock)	10.0	0-10	7	0.67	N
Sagittaria cuneata (arum-leaved arrowhead)	0.5	0-0.5	13	0.07	N
Senecio congestus (marsh ragwort)	0.5	0-0.5	7	0.03	N
Sparganium spp. (sparganium)	0.5	0-0.5	7	0.03	N
Typha latifolia (common cattail)	5.3	0-10	13	0.70	N
Urtica dioica (common nettle)	0.5	0-0.5	7	0.03	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 623 shows the five most prominent plant species among the four lifeforms for species recorded in all seven relatively undisturbed late seral to climax stands of the *Scirpus acutus* (great bulrush) habitat type. In these late seral stands, only *Scirpus acutus* (great bulrush) is highly prominent.

Table 623. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Scirpus acutus* (great bulrush) habitat type (number = 7 stands)

Species	Prominence Value[1]	Origin Status[2]
Graminoids		
Scirpus acutus (great bulrush)	82.14	Native
Forbs		
Typha latifolia (common cattail)	1.43	Native
Lemna minor (common duckweed)	0.43	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 624 through Table 627, break out the vegetation recorded in seven relatively undisturbed late seral to climax stands sampled of the *Scirpus acutus* (great bulrush) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly uncommon, species poor, herbaceous habitat type of minor-to-incidental occurrence across the study area.

Table 624 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Scirpus acutus* (great bulrush) habitat type. For the 7 stands comprising the habitat type, the number of unique species was 3 with 3 (100.0 percent) of them being native species.

Table 624. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Scirpus acutus* (great bulrush) habitat type (number = 7 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	0	0	0	0
Graminoids	1	1	0	0
Forbs	2	2	0	0
TOTAL	***3 (100.0%)***	***3 (100.0%)***	***0 (0.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 625 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Scirpus acutus* (great bulrush) habitat type. The average number of species per stand is 1.3, with native species comprising 1.3 species per stand or 100.0 percent.

Table 625. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Scirpus acutus* (great bulrush) habitat type (number = 7 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.0	0.0	0.0	0.0
Graminoids	1.0	1.0	0.0	0.0
Forbs	0.3	0.3	0.0	0.0
TOTAL	***1.3 (100.0%)***	***1.3 (100.0%)***	***0.0 (0.0%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 626 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Scirpus acutus* (great bulrush) habitat type. The average canopy cover per stand is 84.0 percent, with native species comprising 84.0 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 626. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Scirpus acutus* (great bulrush) habitat type (number = 7 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.0%	0.0%	0.0%	0.0%
Graminoids	82.1%	82.1%	0.0%	0.0%
Forbs	1.9%	1.9%	0.0%	0.0%
TOTAL	***84.0% (100.0%)***	***84.0% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 627 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Scirpus acutus* (great bulrush) habitat type. The average number of species per stand was 1.3 with an average canopy cover of 84.0 percent.

Table 627. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Scirpus acutus* (great bulrush) habitat type (number = 7 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.0	0.0%
Graminoids	1.0	82.1%
Forbs	0.3	1.9%
TOTAL	***1.3***	***84.0%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

No trees or shrubs occurred on the seven relatively undisturbed late seral to climax stands sampled of the *Scirpus acutus* (great bulrush) habitat type (Table 628). *Scirpus acutus* (great bulrush) heavily dominated these stands as the only graminoid species present. Only two forb species were recorded, each in a single stand with low prominence.

Table 628. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Scirpus acutus* (great bulrush) habitat type (number = 7 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Graminoids (N = 1)					
Scirpus acutus (great bulrush)	82.1	60-97.5	100	82.14	N
Forbs (N = 2)					
Lemna minor (common duckweed)	3.0	0-3	14	0.43	N
Typha latifolia (common cattail)	10.0	0-10	14	1.43	N

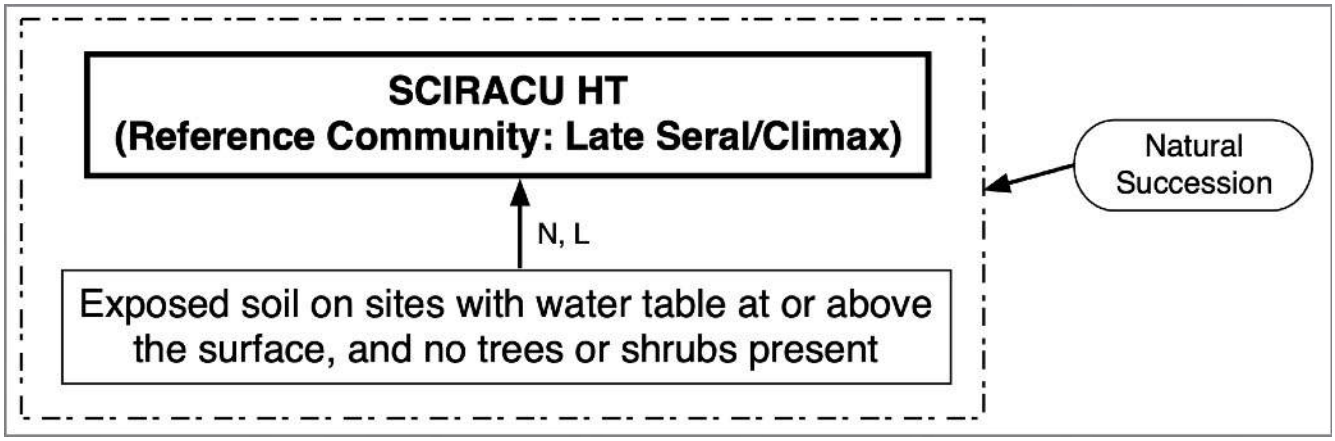
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Scirpus acutus (great bulrush) and *Scirpus validus* (common great bulrush) are early colonizers of suitable habitats, and are able to persist under continually wet conditions. Due to the continually saturated conditions and the aggressive character of *Scirpus acutus* (great bulrush), most other species are precluded from the site. Most disturbance to the *Scirpus acutus* (great bulrush) habitat type occurs during periods of severe drought, when grazing animals can gain access to the stands. Heavily disturbed stands usually have a variety of herbaceous species introduced, but these are usually drowned out when the normal precipitation cycle returns.

Figure 131 shows a schematic diagram of vegetation successional pathways on sites of the *Scirpus acutus* (great bulrush) habitat type.



Successional Pathway of *Scirpus acutus* (great bulrush) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Scirpus acutus* (great bulrush) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
SCIRACU HT—*Scirpus acutus* (great bulrush) habitat type

Figure 131. Successional pathway for sites of the *Scirpus acutus* (great bulrush) habitat type

Note: The *Scirpus acutus* (great bulrush) habitat type will colonize and occupy suitably wet sites, tolerating water up to about two meters deep. It is only during extended drought periods, it may become vulnerable to grazing disturbance.

EDATOPE

Figure 132 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Scirpus acutus* (great bulrush) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

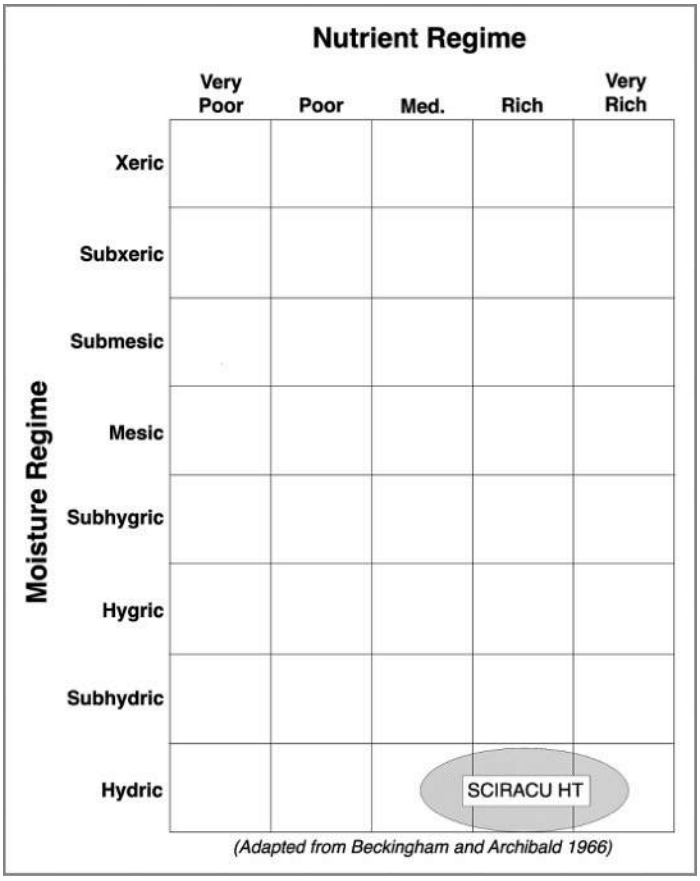


Figure 132. Edatope grid position for the *Scirpus acutus* (great bulrush) habitat type (SCIRACU HT)

SOILS

Soils on sites supporting the *Scirpus acutus* (great bulrush) habitat type are commonly fine textured humic gleysols, or occasionally organic. Mineral soil textures range from sand to silty clay. Water tables are generally at or above the soil surface throughout the growing season (Baker and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

Adjacent wetter sites may be dominated by *Typha* species (cattails) or be open water. Adjacent drier sites may be dominated by a wide variety of species including *Phalaris arundinacea* (reed canary grass), *Phragmites australis* (reed), *Carex* (sedge) species, and *Salix* (willow) species.

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Scirpus acutus* (great bulrush)**—*Scirpus acutus* (great bulrush) is a commonly occurring, widely distributed, species found along shorelines, around sloughs, in marshy areas, and on streambanks, often forming large colonies (Tannas 1997a). This is a pioneering species on saturated sites, and it can persist in dominating the site as long as wetland hydrology remains intact (Esser 1995).

***Equisetum fluviatile* (swamp horsetail)**—*Equisetum fluviatile* (swamp horsetail) is a rhizomatous perennial forb occurring throughout Alberta in very wet sites, including marshes, swamps, and bogs (Moss 1983).

Livestock

***Scirpus acutus* (great bulrush)**—*Scirpus acutus* (great bulrush) is considered to have poor forage value with low nutritional and poor palatability. However, the species is also considered a decreaser in response to grazing pressure—not from being grazed, but rather from the trampling. *Scirpus acutus* (great bulrush) stands tend to decline on sites where water levels recede annually, thus allowing livestock access (Tannas 1997a). Herbage production is high in these stands, but forage value is low. It is seldom grazed by livestock, if other forage is available. However, if upland forage becomes limited and soil conditions dry, livestock and big game animals may use it (Esser 1995, Hansen and others 1995).

***Equisetum fluviatile* (swamp horsetail)**—*Equisetum fluviatile* (swamp horsetail) occurs on sites that are generally too wet for livestock access. Herbage production is moderate. However, livestock seldom graze *Equisetum fluviatile* (swamp horsetail) due to its low palatability and inaccessibility. In wild hay, if in excessive quantities, *Equisetum* species (horsetails) are known to cause scours, paralysis, and occasionally death. Hay containing around 20 percent or more *Equisetum* species (horsetails) can produce poisoning symptoms in horses. Symptoms appear in 2-5 weeks, beginning with weight loss, loss of muscular control, and followed by falling, exhaustion, and possibly death. Cattle, sheep, and goats are rarely affected (Hansen and others 1995).

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Scirpus acutus* (great bulrush)**—*Scirpus acutus* (great bulrush) provides important habitat for wetland wildlife species (Tannas 1997a). It is a staple food for muskrat and other small mammals. The seeds are eaten by passerine birds and waterfowl (Esser 1995). Waterfowl managers often attempt to increase the proportion of *Scirpus acutus* (great bulrush) relative to *Typha* species (cattails) as a means of improving habitat.

***Equisetum fluviatile* (swamp horsetail)**—*Equisetum* species (horsetails) are favorite food of geese and other waterfowl, and possibly are also eaten by muskrats as well (CYSIP 2023). The species is seldom grazed by wildlife due to its low palatability. Waterfowl and muskrats use it for nesting and hiding cover (Thompson and Hansen 2003).

Fire

***Scirpus acutus* (great bulrush)**—*Scirpus acutus* (great bulrush) will burn in late fall or early spring if sites have dried sufficiently. After fire, the species sprouts from rhizomes and probably from the root crown as well. It also establishes from buried or windblown seed dispersed onto the burned sites (Esser 1995).

***Equisetum fluviatile* (swamp horsetail)**—*Equisetum fluviatile* (swamp horsetail) is a rhizomatous species occurring on very wet sites that seldom burn, except during severe drought. It is likely that the above ground stems would be killed, but that the plants would regenerate quickly from the buried rhizomes.

Rehabilitation/Restoration Considerations

***Scirpus acutus* (great bulrush)**—*Scirpus acutus* (great bulrush) erosion control and short-term and long-term revegetation potential are rated as medium. The species buffers wind and wave action on lakes and ponds, which can enhance the establishment of other vegetation along these shorelines (Esser 1995).

***Equisetum fluviatile* (swamp horsetail)**—These sites are generally so wet as to preclude most development. Trampling damage and soil churning occurs readily with livestock use.

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Scirpus acutus* (great bulrush) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- No matching plant community type

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- No matching plant community type

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Bulrush

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Msb19 Bulrush (Montane Southern Ecosection)
- Mca18 Great bulrush (Montane Cypress Hills Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Scirpus acutus* (great bulrush) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995);
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001); and
- *Classification and Management of Upland, Riparian, and Wetland Sites of USDI Bureau of Land Management's Miles City Field Office, Eastern Montana USA* (Hansen and others 2008).

Typha latifolia Habitat Type
(common cattail Habitat Type)

TYPHLAT Habitat Type
Number of Stands = 24 (Alberta Government Ecological Information System [ECOSYS] Data Sets = 2; Other Data Sets = 22)

LOCATION AND ASSOCIATED LANDFORMS

The *Typha latifolia* (common cattail) habitat type is a minor type in the Lower Foothills Natural Subregion, a minor type in the Upper Foothills Natural Subregion, and a minor type in the Montane Natural Subregion of Alberta. This habitat type commonly occurs along lake and pond margins, ditches, sloughs, backwater areas, and marshes in water up to 2 m deep.

Photo 37 shows a typical stand of the *Typha latifolia* (common cattail) habitat type.

Photo 37. A stand of the *Typha latifolia* (common cattail) habitat type

VEGETATION

Sampled Stands Characteristics
In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The

index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 629 shows the five most prominent plant species among the four lifeforms for species recorded in all 24 stands of the *Typha latifolia* (common cattail) habitat type. *Typha latifolia* (common cattail) is the only highly prominent species in this habitat type.

Table 629. The five most prominent plant species among the four lifeforms for species recorded in stands of the *Typha latifolia* (common cattail) habitat type (number = 24 stands)

Species	Prominence Value[1]	Origin Status[2]
Shrubs		
Salix myrtillifolia (myrtle-leaved willow)	0.13	Native
Salix scouleriana (Scouler's willow)	0.13	Native
Graminoids		
Carex utriculata (beaked sedge)	2.21	Native
Eleocharis palustris (creeping spike-rush)	1.00	Native
Carex atherodes (awned sedge)	0.67	Native
Scirpus acutus (great bulrush)	0.46	Native
Carex aquatilis (water sedge)	0.42	Native
Forbs		
Typha latifolia (common cattail)	83.85	Native
Typha angustifolia (narrow-leaved cattail)	8.13	Native
Epilobium ciliatum (northern willowherb)	0.44	Native
Polygonum lapathifolium (pale persicaria)	0.42	Native
Equisetum fluviatile (swamp horsetail)	0.25	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 630 through Table 633, break out the vegetation recorded in all 24 stands sampled of the *Typha latifolia* (common cattail) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species poor, herbaceous habitat type of minor occurrence across the study area.

Table 630 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Typha latifolia* (common cattail) habitat type. For the 24 stands comprising the habitat type, the number of unique species was 30 with 26 (86.7 percent) of them being native species.

Table 630. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) for the *Typha latifolia* (common cattail) habitat type (number = 24 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	2	2	0	0
Graminoids	12	11	0	1
Forbs	16	13	3	0
TOTAL	***30 (100.0%)***	***26 (86.7%)***	***3 (10.0%)***	***1 (3.3%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 631 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Typha latifolia* (common cattail) habitat type. The average number of species per stand is 2.9, with native species comprising 2.6 species per stand or 89.7 percent.

Table 631. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Typha latifolia* (common cattail) habitat type (number = 24 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.1	0.1	0.0	0.0
Graminoids	1.1	1.5	0.0	0.0
Forbs	1.7	0.0	0.2	0.0
TOTAL	***2.9 (100.0%)***	***2.6 (89.7%)***	***0.2 (6.9%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 632 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in stands of the *Typha latifolia* (common cattail) habitat type. The average canopy cover per stand

is 99.7 percent, with native species comprising 98.9 percent or 99.2 percent of the total amount of average canopy cover per stand.

Table 632. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) per stand for the *Typha latifolia* (common cattail) habitat type (number = 24 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.3%	0.3%	0.0%	0.0%
Graminoids	5.6%	5.5%	0.0%	0.1%
Forbs	93.9%	93.2%	0.7%	0.0%
TOTAL	***99.7% (100.0%)***	***98.9% (99.2%)***	***0.7% (0.7%)***	***0.1% (0.1%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 633 shows the average number of species and average canopy cover by lifeform in stands of the *Typha latifolia* (common cattail) habitat type. The average number of species per stand was 2.9 with an average canopy cover of 99.7 percent.

Table 633. Average number of species and average canopy cover by lifeform in stands of the *Typha latifolia* (common cattail) habitat type (number = 24 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.1	0.3%
Graminoids	1.1	5.6%
Forbs	1.7	93.9%
TOTAL	***2.9***	***99.7%***

Sampled Stands Plant Species List

No trees, and only two shrub species, each in small amount on a single plot, were recorded on 24 sampled stands of the *Typha latifolia* (common cattail) habitat type (Table 634). Twelve graminoids were recorded, none of them more than moderately prominent. Sixteen forbs were recorded, but only *Typha latifolia* (common cattail) was highly prominent, dominating the vegetation on all but two stands, which were both dominated by *Typha angustifolia* (narrow-leaved cattail), the alternative indicator of the habitat type.

Table 634. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in stands of the *Typha latifolia* (common cattail) habitat type (number = 24 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Shrubs (N = 2)					
Salix myrtillifolia (myrtle-leaved willow)	3.0	0-3	4	0.13	N
Salix scouleriana (Scouler's willow)	3.0	0-3	4	0.13	N
Graminoids (N = 12)					
Beckmannia syzigachne (slough grass)	2.2	0-3	13	0.27	N
Calamagrostis canadensis (marsh reed grass)	3.0	0-3	4	0.13	N
Carex aquatilis (water sedge)	10.0	0-10	4	0.42	N
Carex atherodes (awned sedge)	5.3	0-10	13	0.67	N
Carex utriculata (beaked sedge)	10.6	0-20	21	2.21	N
Eleocharis palustris (creeping spike-rush)	6.0	0-20	17	1.00	N
Glyceria grandis (common tall manna grass)	1.8	0-3	8	0.15	N
Grass spp. (Unknown grass)	3.0	0-3	4	0.13	B
Hordeum jubatum (foxtail barley)	3.0	0-3	4	0.13	N
Juncus nodosus (knotted rush)	0.5	0-0.5	4	0.02	N
Poa palustris (fowl bluegrass)	0.5	0-0.5	4	0.02	N
Scirpus acutus (great bulrush)	3.7	0-10	13	0.46	N
Forbs (N = 16)					
Cicuta maculata (water-hemlock)	0.5	0-0.5	4	0.02	N
Cirsium arvense (Canada thistle)	1.8	0-3	8	0.15	I
Epilobium ciliatum (northern willowherb)	5.3	0-10	8	0.44	N
Equisetum fluviatile (swamp horsetail)	3.0	0-3	8	0.25	N
Galium trifidum (small bedstraw)	0.5	0-0.5	4	0.02	N
Lycopus asper (western water-horehound)	0.5	0-0.5	4	0.02	N
Mentha arvensis (wild mint)	3.0	0-3	4	0.13	N
Polygonum lapathifolium (pale persicaria)	10.0	0-10	4	0.42	N
Rumex maritimus (golden dock)	3.0	0-3	4	0.13	N
Senecio congestus (marsh ragwort)	0.5	0-0.5	4	0.02	N
Solidago canadensis (Canada goldenrod)	0.5	0-0.5	4	0.02	N
Sparganium spp. (sparganium)	3.0	0-3	4	0.13	N
Taraxacum officinale (common dandelion)	3.0	0-3	4	0.13	I
Typha angustifolia (narrow-leaved cattail)	97.5	0-97.5	8	8.12	N
Typha latifolia (common cattail)	91.5	0-97.5	92	83.85	N
Urtica dioica (common nettle)	0.5	0-0.5	4	0.02	N

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

Relatively Undisturbed Late Seral to Climax Stands Characteristics

In most stands, a few species dominate the canopy cover, while most other species are only minimally represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the plant community, and as a way of assessing how much the community is diverged from its natural potential. The index of species prominence used here is calculated as the product of multiplying average canopy cover of the species times its constancy of occurrence (i.e., the percent of polygons having the species present).

Greater prominence value goes to species with high average canopy cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average canopy cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with low frequency. The great majority of plant canopy cover on most polygons is dominated by only a few species, but normally also present are a great number of other species (usually mostly the forbs) represented by only a few widely spaced individuals.

Table 635 shows the five most prominent plant species among the four lifeforms for species recorded in all 16 relatively undisturbed late seral to climax stands of the *Typha latifolia* (common cattail) habitat type. In these late seral stands, *Typha latifolia* (common cattail) is by far most prominent, followed well behind by the less frequently occurring alternate indicator species, *Typha angustifolia* (narrow-leaved cattail).

Table 635. The five most prominent plant species among the four lifeforms for species recorded in relatively undisturbed late seral to climax stands of the *Typha latifolia* (common cattail) habitat type (number = 16 stands)

Species	Prominence Value[1]	Origin Status[2]
Graminoids		
Carex utriculata (beaked sedge)	0.63	Native
Eleocharis palustris (creeping spike-rush)	0.22	Native
Glyceria grandis (common tall manna grass)	0.03	Native
Forbs		
Typha latifolia (common cattail)	82.81	Native
Typha angustifolia (narrow-leaved cattail)	12.19	Native
Cicuta maculata (water-hemlock)	0.03	Native

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

The following four tables, Table 636 through Table 639, break out the vegetation recorded in 16 relatively undisturbed late seral to climax stands sampled of the *Typha latifolia* (common cattail) habitat type into the four vegetative lifeforms. The lifeforms are broken out by the count of unique species in each group, and categorized into species origin (i.e., native, introduced, or both); and then by abundance of canopy cover in each group. This is a fairly common, species poor, herbaceous habitat type of minor occurrence across the study area.

Table 636 shows the number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Typha latifolia*

(common cattail) habitat type. For the 16 stands comprising the habitat type, the number of unique species was 6 with 6 (100.0 percent) of them being native species.

Table 636. Number of unique species (i.e., species richness) by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Typha latifolia* (common cattail) habitat type (number = 16 stands)

Lifeform	Number of Unique Species	Number of Unique Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0	0	0	0
Shrubs	0	0	0	0
Graminoids	3	3	0	0
Forbs	3	3	0	0
TOTAL	***6 (100.0%)***	***6 (100.0%)***	***0 (0.0%)***	***0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 637 shows the average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Typha latifolia* (common cattail) habitat type. The average number of species per stand is 1.4, with native species comprising 1.4 species per stand or 100.0 percent.

Table 637. Average number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Typha latifolia* (common cattail) habitat type (number = 16 stands)

Lifeform	Average Number of Species	Average Number of Species in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0	0.0	0.0	0.0
Shrubs	0.0	0.0	0.0	0.0
Graminoids	0.3	0.3	0.0	0.0
Forbs	1.1	1.1	0.0	0.0
TOTAL	***1.4 (100.0%)***	***1.4 (100.0%)***	***0.0 (0.0%)***	***0.0 (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 638 shows the average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Typha latifolia* (common cattail) habitat

type. The average canopy cover per stand is 95.9 percent, with native species comprising 95.9 percent or 100.0 percent of the total amount of average canopy cover per stand.

Table 638. Average canopy cover by lifeform and species origin (i.e., whether native, introduced, and both categories) in relatively undisturbed late seral to climax stands of the *Typha latifolia* (common cattail) habitat type (number = 16 stands) (Note: total average canopy cover can be greater than 100 percent due to overlap of lifeform layers; numbers in parenthesis reflect the percent of the total canopy cover occupied by either native, introduced, or both)

Lifeform	Average Canopy Cover	Average Canopy Cover in Each Origin Category		
		Native[1]	Introduced[2]	Both[3]
Trees	0.0%	0.0%	0.0%	0.0%
Shrubs	0.0%	0.0%	0.0%	0.0%
Graminoids	0.9%	0.9%	0.0%	0.0%
Forbs	95.0%	95.0%	0.0%	0.0%
TOTAL	***95.9% (100.0%)***	***95.9% (100.0%)***	***0.0% (0.0%)***	***0.0% (0.0%)***

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

Table 639 shows the average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Typha latifolia* (common cattail) habitat type. The average number of species per stand was 1.4 with an average canopy cover of 95.9 percent.

Table 639. Average number of species and average canopy cover by lifeform in relatively undisturbed late seral to climax stands of the *Typha latifolia* (common cattail) habitat type (number = 16 stands)

Lifeform	Average Number of Species	Average Canopy Cover
Trees	0.0	0.0%
Shrubs	0.0	0.0%
Graminoids	0.3	0.9%
Forbs	1.1	95.0%
TOTAL	***1.4***	***95.9%***

Relatively Undisturbed Late Seral to Climax Stands Plant Species List

No trees or shrubs were recorded on 16 relatively undisturbed late seral to climax stands sampled of the *Typha latifolia* (common cattail) habitat type (Table 640). Three graminoids were recorded, all with very low prominence. Three forbs also were recorded, but only *Typha latifolia* (common cattail) was highly prominent, with *Typha angustifolia* (narrow-leaved cattail) following well behind.

Table 640. Average canopy cover, range of canopy cover, constancy, prominence index, and species origin (i.e., whether native, introduced, and both categories) for species recorded in relatively undisturbed late seral to climax stands of the *Typha latifolia* (common cattail) habitat type (number = 16 stands)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prom. Index[1]	Origin Status[2]
Graminoids (N = 3)					
Carex utriculata (beaked sedge)	10.0	0-10	6	0.63	N
Eleocharis palustris (creeping spike-rush)	1.8	0-3	13	0.22	N
Glyceria grandis (common tall manna grass)	0.5	0-0.5	6	0.03	N
Forbs (N = 3)					
Cicuta maculata (water-hemlock)	0.5	0-0.5	6	0.03	N
Typha angustifolia (narrow-leaved cattail)	97.5	0-97.5	13	12.19	N
Typha latifolia (common cattail)	94.6	0-97.5	88	82.81	N

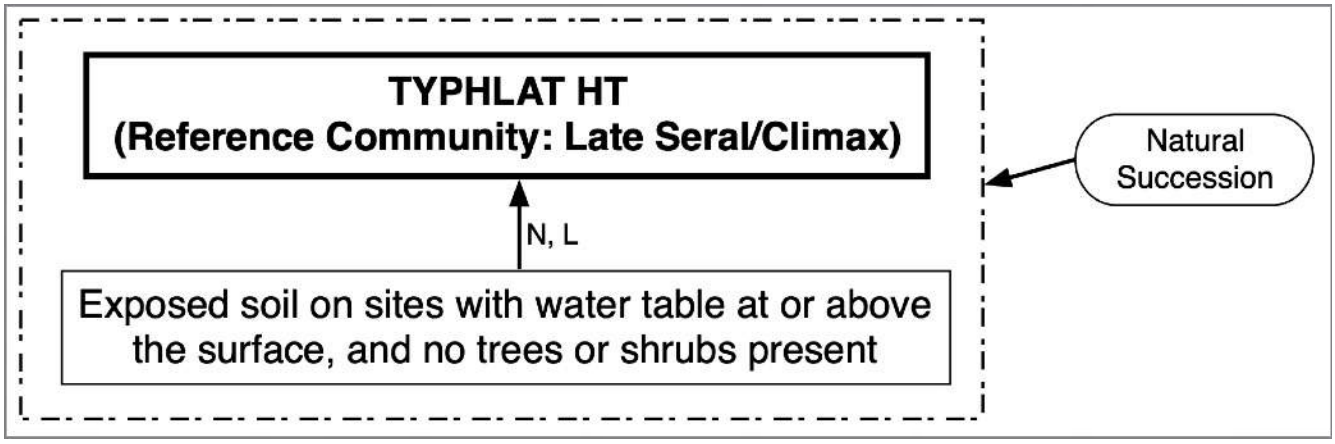
[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in stands in the set) and average canopy cover in those stands in the set having it present.

[2]Origin Status: N = native to pre-Columbian North America; I = introduced by post-Columbian human immigrants; Both = contains native and introduced species. See Methods Section for list of information sources.

SUCCESSIONAL INFORMATION

Typha latifolia (common cattail) is an early colonizer of suitably wet open sites and can persist indefinitely under stable hydrologic regime. The species is well adapted to prolonged submergence of the roots and lower stems, but some period of bare soil exposure is required for initial germination and seedling establishment. Because seed production is extremely high, the species is capable of rapid colonization of wet mineral soils. Due to saturated soils and high water levels throughout the growing season, the sites are usually not subjected to most kinds of disturbance. However, in periods of severe drought, livestock can access the sites, open the stands, and introduce non native species.

Figure 133 shows a schematic diagram of vegetation successional pathways on sites of the *Typha latifolia* (common cattail) habitat type.



Successional Pathway of *Typha latifolia* (common cattail) Sites in the Montane Natural Region and Portions of the Upper and Lower Foothills Natural Subregions
Reference Community = *Typha latifolia* (common cattail) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
TYPHLAT HT—*Typha latifolia* (common cattail) habitat type

Figure 133. Successional pathway for sites of the *Typha latifolia* (common cattail) habitat type

Note: The *Typha latifoli*a (common cattail) habitat type will colonize and occupy suitably wet sites and persist with continued wet conditions. It is vulnerable to grazing disturbance during seasonal or climatic periods of low water level.

EDATOPE

Figure 134 illustrates the edatope or moisture/nutrient grid that represents the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions of the *Typha latifolia* (common cattail) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

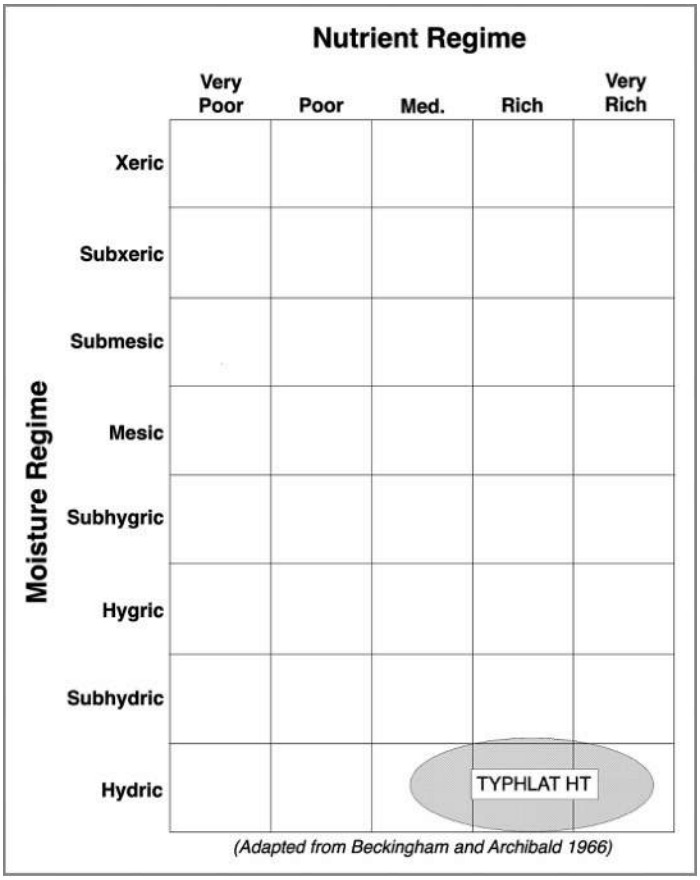


Figure 134. Edatope grid position for the *Typha latifolia* (common cattail) habitat type (TYPHLAT HT)

SOILS

Soils on sites supporting the *Typha latifolia* (common cattail) habitat type are commonly fine textured humic gleysols, or occasionally organic. Mineral soil textures range from sand to silty clay. Water tables are generally at or above the soil surface throughout the growing season. Soil drainage is generally poor (Baker and others 2020, Thompson and Hansen 2003).

ADJACENT COMMUNITIES

The *Typha latifolia* (common cattail) habitat type is the wettest habitat type described in this classification. Adjacent drier sites may be dominated by a wide variety of species including *Phalaris arundinacea* (reed canary grass), *Phragmites australis* (reed), *Carex* species (sedge), and *Salix* species (willow).

MANAGEMENT INFORMATION

Ecology of Major Plant Species

***Typha latifolia* (common cattail)**—*Typha latifolia* (common cattail) is an aquatic or semiaquatic emergent perennial that is very common throughout all natural regions of Alberta. It is a wetland species found along shorelines, in sloughs and marshy areas, in wet roadside ditches, and on river banks, often forming large monospecific colonies (Tannas 1997b). On open wetland and aquatic sites, the species is considered an early to

late-seral/climax species, depending on hydrologic condition remaining unchanged. It is shade intolerant, and its persistent seed bank likely explains the rapid colonization of disturbed sites. (Gucker 2008).

***Typha angustifolia* (narrow-leaved cattail)**—*Typha angustifolia* (narrow-leaved cattail) is an erect, rhizomatous perennial that grows 1 m to 2 m tall. It grows in marshes, wet meadows, fens, estuaries, bogs, ditches, and along lake shores. It is tolerant of saline and alkaline environments. Where *Typha angustifolia* (narrow-leaved cattail) and *Typha latifolia* (common cattail) occur together, *Typha angustifolia* (narrow-leaved cattail) usually occurs in the deeper water (Snyder 1993).

Livestock

***Typha latifolia* (common cattail)**—*Typha latifolia* (common cattail) provides poor to fair forage for grazing animals. The low utilization is mostly the result of inaccessibility into the wetlands, rather than on poor palatability, however *Typha latifolia* (common cattail) is a grazing increaser (Tannas 1997b).

Typha latifolia (common cattail) may comprise a small portion of livestock and wild ungulate diets during dry conditions, and/or when other more palatable forage is unavailable (Gucker 2008). In such cases, a wide variety of disturbance induced herbaceous species can be introduced onto the site. Generally, though, the *Typha latifolia* (common cattail) rootstocks remain to restore the original stand when water levels again rise.

***Typha angustifolia* (narrow-leaved cattail)**—*Typha angustifolia* (narrow-leaved cattail) stands are usually too wet to allow access to livestock, except during periods of drought.

For a grazing program to succeed, it must meet the basic biological requirements of the plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed for these essential biological processes to occur (Frisina 1991).

Wildlife

***Typha latifolia* (common cattail)**—*Typha latifolia* (common cattail) provides essential habitat and food for wetland wildlife, such as small mammals, blackbirds, marsh wrens, and waterfowl (Tannas 1997b). The species is an important source of shade, hiding cover, and food for these wildlife. It is a highly preferred food of muskrats (Allen and Hoffman 1984). It is also used by muskrats for construction of their huts. Waterfowl use *Typha latifolia* (common cattail) for nesting and hiding cover, if the stands are not too dense. Deer also use stands for forage and hiding cover. Stands of it also provide critical nesting and roosting cover for yellow-headed and red-winged blackbirds (Hansen and others 1995).

***Typha angustifolia* (narrow-leaved cattail)**—*Typha angustifolia* (narrow-leaved cattail) cattail is eaten by waterfowl and muskrats. Muskrats also construct their lodges with it, and blackbirds use it for perches. However, dense, extensive monospecific stands of the species are usually poor habitat for wildlife (Snyder 1993). It provides important cover for muskrats and a variety of waterfowl. White-tailed deer use it for hiding cover (Snyder 1993).

Fire

***Typha latifolia* (common cattail)**—Fires are not uncommon in *Typha latifolia* (common cattail) habitats, and often the fuel load is more than adequate to carry a fire. Fire typically only top-kills the plants, and after an established stand burns, the species usually resprouts from rhizomes almost immediately. Within one year of a fire, burned and unburned sites may differ only in the amount of litter accumulation (Gucker 2008). Dense stands of *Typha latifolia* (common cattail) can be burned in late fall or early spring in order to improve nesting season habitat for waterfowl. However, if burned in the fall, species that use the cattails for hiding cover and overwintering sites will be severely impacted by the alteration of this habitat.

***Typha angustifolia* (narrow-leaved cattail)**—*Typha angustifolia* (narrow-leaved cattail) stands seldom burn, except in periods of drought. When burned, the top-killed plants generally resprout from the rhizomes (Snyder 1993).

Rehabilitation/Restoration Considerations

***Typha latifolia* (common cattail)**—High wildlife value, potential for erosion control, and tolerance of heavy metals makes *Typha latifolia* (common cattail) a desirable species for reclamation or revegetation projects. Studies done in Ontario and western Pennsylvania found that *Typha latifolia* (common cattail) grew on industrially degraded habitats with heavy metals and high acidity (Gucker 2008).

***Typha angustifolia* (narrow-leaved cattail)**—*Typha angustifolia* (narrow-leaved cattail) is used in prairie wetland restoration projects (Snyder 1993).

RELATIONSHIP TO ALBERTA PLANT COMMUNITY GUIDES

The *Typha latifolia* (common cattail) habitat type is similar to the following types described in the four Alberta plant community documents covering the study area:

Lower Foothills Natural Subregion Plant Community Guide (Lawrence and others 2005)

- n1 marsh

Upper Foothills Natural Subregion Plant Community Guide (France and others 2020)

- marsh

South Ecosection of the Montane Natural Subregion Plant Community Guide (Baker and others 2020)

- Cattail

Montane Natural Subregion Plant Community Guide (Willoughby and others 2021)

- Mca19 Cattail (Montane Cypress Hills Ecosection)

RELATIONSHIP TO REGIONAL HABITAT TYPE CLASSIFICATION STUDIES

The *Typha latifolia* (common cattail) habitat type was previously described in the region for the following geographic location(s):

- *Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson and Hansen 2002);
- *Riparian and Wetland Sites in Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion* (Thompson and Hansen 2003);
- *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995); and
- *Classification and Management of Riparian and Wetland Sites of the Saskatchewan Prairie Ecozone and Parts of Adjacent Subregions* (Thompson and Hansen 2001).

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GLOSSARY

Abandoned Meander Channel. A former stream channel that was cut off from the rest of the river and typically lacks yearlong standing water.

Aerobic. Condition in which molecular oxygen is present in the environment.

Alkaline. Water or soil with a pH greater than 7.4.

Alluvial Soil. Sediments (clay, silt, sand, gravel, cobbles, and boulders) deposited by running water, ordinarily occurring on floodplains and at the base of ridges and slopes.

Alluvial Terrace. Deposits of alluvial soil that mark former floodplains. Typically, a floodplain may have several sets of alluvial terraces at different elevations and of different ages (the higher the elevation, the older the age).

Alluvium. An accumulation of sediments deposited by streams or rivers.

Anaerobic. Condition in which molecular oxygen is absent from the environment. This commonly occurs in wetlands where soils experience prolonged saturation by water.

Aquatic Bed (Cowardin and others 1979). A ***class*** of wetland and deepwater habitat dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years.

Aquic Conditions. These soils experience continuous or periodic saturation and reduction. Redoximorphic features indicate the presence of these conditions.

Aquic Moisture Regime (obsolete). A moisture condition associated with a seasonal reducing environment that is virtually free of dissolved oxygen because the soil is saturated by ground water or by water of the capillary fringe, as in soils in Aquic suborders and Aquic subgroups.

Available Water Capacity. The ability of a soil to hold water in a form available to plants, expressed in inches of water per inch of soil depth. Classes are: 1) Low = 0 - 0.12, 2) Moderate = 0.13 - 0.17, and 3) High = > 0.17.

Average Canopy Cover. Refers to the “average” canopy cover of a particular species for the stands in which it was recorded. For example, the number of stands sampled for a habitat type or community type may be 20. However, a particular species may only occur in 7 of the 20 stands. The average canopy cover therefore represents the “average” canopy cover of that particular species in the 7 stands.

Backwater Area. Seasonal or permanent water bodies found in the lowest parts of floodplains, typically circular or oval in shape.

Bars (Alluvial). Sediment accumulations along waterways deposited by moving water. Examples include: 1) ***point bars***—bars that are formed on the inside of a meander channel, 2) ***side bars***—bars that are formed along the edges of relatively straight sections of a river, 3) ***mid-channel bars***—these are found within the channel and generally become more noticeable during low flow periods, and 4) ***delta bars***—formed immediately downstream of the confluences of a tributary and the main river.

Beaver Dams. Dams built by beavers that span the stream channel. In general, water is still flowing through the riparian system.

Bog (Mitsch and Gosselink 1993). A sphagnum moss-dominated community whose only water source is rainwater. They are extremely low in nutrients, form acidic peats, and are a northern phenomenon generally associated with low temperatures and short growing seasons.

Browse. Shrubby and woody forage consumed by wildlife.

Canopy Coverage. The percentage of ground covered by a vertical projection of the outermost perimeter of the natural spread of foliage of plants. Small openings within the canopy are included (Daubenmire 1959, Society for Range Management 1989, USDA Natural Resources Conservation Service 1997).

Capillary Fringe. A zone immediately above the water table in which water is drawn upward from the water table by capillary action.

Carr. Wetland on organic soil with greater than 25 percent cover of shrubs. Typically, carrs are dominated by willows (*Salix* species).

Climax Community. Refers to the final or steady state plant community that is self-perpetuating and in dynamic equilibrium with its environment.

Colluvium. A deposit of unconsolidated geologic materials and soil accumulated at the base of slopes as a result of gravity.

Community (Plant Community). An assembly of plants living together, reflecting no particular ecological status.

Community Type. An aggregation of all plant communities distinguished by floristic and structural similarities in both overstory and undergrowth layers. A unit of vegetation within a classification. ***For the purposes of this document, a community type represents seral vegetation, and is never considered to be climax.***

Constancy. The percentage of sampled stands in which a species occurs.

Disclimax. Where recurring disturbances, such as grazing (e.g., zootic disclimax) or periodic burning (e.g., fire disclimax), exert the predominant influence in maintaining the structure and composition of the steady-state vegetation. Disclimaxes, such as the zootic climax or fire climax, are not the basis for recognizing habitat types.

Diversity. The kind and amount of species in a community per unit area.

Drained. A condition in which ground or surface water has been removed by artificial means.

Dominance Type (Equivalent to Cover Type). An aggregation of all stands (individual plant communities) grouped and named simply by the species with the greatest canopy coverage in the overstory or upper layer. In this classification, canopy cover of dominant species is greater than 25 percent.

Edatope. Moisture/nutrient grid that displays the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions.

Emergent Plant. A rooted herbaceous plant species that has parts extending above a water surface (i.e., sedges, cattails, bulrushes, etc.).

Emergent Wetland (Cowardin and others 1979). A ***class*** of wetland habitat characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens

Entisols. A soil order including soils of slight or recent development; common along rivers and floodplains.

Ephemeral Stream. A stream or stretch of a stream that flows only in direct response to precipitation. It receives no water from springs and no long-continued supply from melting snow or other surface source. Its stream channel is at all times above the water table. These streams do not normally flow for 30 consecutive days.

Fen (Mitsch and Gosselink 1986). A non-acidic peat-forming wetland that receives nutrients from sources other than precipitation, usually through groundwater movement.

Fibric Materials. Plant materials that show very little signs of decomposition. Plant fibre content before rubbing between fingers is at least 3/4 of the soil volume.

Flooded. A condition in which the soil surface is temporarily covered with flowing water from any source, such as streams overflowing their banks and runoff from adjacent or surrounding slopes, or any combination of sources.

Floodplain. An alluvial plain caused by the overbank deposition of alluvial material. Typically appearing as flat expanses of land bordering a stream or river. Most floodplains are accompanied by a series of alluvial terraces of varying levels.

Fluvial. Pertaining to or produced by the action of moving water.

Foliar Cover. The percentage of ground covered by the vertical projection of the aerial portion of plants. Small openings in the canopy and intraspecific overlap are excluded (Society for Range Management 1989). Foliar cover is the vertical projection of stems and leaves.

Forb. A herbaceous plant, usually broadleaved that is not a graminoid.

Forested Wetland (Cowardin and others 1979). A ***class*** of wetland habitat characterized by woody vegetation that is 6 m (20 ft) tall or taller.

Forested Wetlands. Occur near springs and seeps and in areas with naturally high water tables, such as river floodplains. Two general types of forested wetlands occur: 1) those dominated by coniferous tree species, and 2) those dominated by deciduous angiosperm tree species.

Frequently Flooded. A class of flood frequency in which flooding is common during most years (more than a 50 percent chance of flooding in any year, or more than 50 times in 100 years).

Gallery Forest. A strip of forest confined to a stream margin or floodplain in an otherwise non-forested landscape.

Gleization. A process in saturated or nearly saturated soils that involves the reduction of iron. This process tends to give gray colors (low chroma) to those parts of the soil from which the iron has been reduced or removed, and to impart rust colors (high chroma) to those where the iron has oxidized and accumulated.

Gleyed Soil (obsolete). A soil condition resulting from prolonged soil saturation, which is manifested by the presence of bluish or greenish colors through the soil mass or in mottles (spots or streaks) among other colors. Gleying occurs under reducing soil conditions resulting from soil saturation, by which iron is reduced predominantly to the ferrous state. See also redox depletions.

Graminoid. Grass or grass-like plant, such as species of the Poaceae (grasses), Cyperaceae (sedges), and Juncaceae (rushes).

Ground Water. Water occupying the interconnected pore spaces in the soil or geologic material below the water table, this water has a positive pressure.

Growing Season. The portion of the year when soil temperatures are above biologic zero (41° F [5° C]) as defined by *Soil Taxonomy*; the following growing season months are assumed for each of the soil temperature regimes: 1) thermic (February-October), 2) mesic (March-October), 3) frigid (May-September), 4) cryic (June-August), and 5) pergelic (July-August).

Habitat Type. The land area that supports, or has the potential of supporting, the same primary climax vegetation. A habitat type classification is an ecological site classification based on vegetation and the potential of the site to produce a specific plant community (plant association). It has been used to classify grasslands, shrublands, woodlands, and forests throughout western United States.

Herbaceous. Non-woody vegetation, such as graminoids and forbs.

Horizon. A distinct layer of soil, more or less parallel with soil surface, having similar properties such as color, texture, and permeability; the soil profile is subdivided into the following major horizons: 1) ***A horizon***—a surface horizon characterized by an accumulation of organic material, 2) ***E horizon***—most commonly a surface horizon, characterized by leaching of organic material, iron, and clay, 3) ***B horizon***—a subsurface horizon characterized by relative accumulation of organic matter, iron, clay, or aluminum, 4) ***C horizon***—undisturbed, unaltered parent material.

Hydrology. The science dealing with the properties, distribution, and circulation of water.

Hydrophyte. Any macrophytic plant that grows in water or on a substrate that is at least potentially deficient in oxygen as a result of excessive water content; plants typically found in wetland and other aquatic habitats.

Hydrophytic Vegetation. Plant life growing in water or on a substrate that is at least potentially deficient in oxygen as a result of excessive water content.

Incidental Type. Refers to a habitat type or community type that rarely occurs within the region, or is limited to narrow site conditions and/or very localized occurrence within the riparian or wetland zone.

Intermittent Stream. A stream or reach of stream that flows only at certain times of the year when it receives water from springs or from some surface source (e.g., melting snow). They are usually divided with respect to the source of their water into spring-fed or surface-fed intermittent streams. These streams generally flow continuously during periods of at least one month or more during the year.

Inundation. A condition in which water temporarily or permanently covers a land surface.

Irrigation Canal. Included all types of canals associated with irrigation systems.

Lacustrine System (Cowardin and others 1979). Any wetland or deepwater habitat with the following characteristics: 1) situated in a topographic depression or dammed river channel, 2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30 percent areal coverage, and 3) total area exceeds 8 ha (20 acres).

Lake. A natural topographic depression collecting a body of water covering at least 8 ha (20 acres) with surface water.

Lentic Wetland. See still water wetland.

Long Duration (Flooding). A duration class in which inundation for a single event ranges from 7 days to 1 month.

Lotic Wetland. See riparian wetland.

Major Type. Refers to a habitat type or community type that occupies extensive acreages in at least some portion of the riparian or wetland zone.

Marsh. A frequently or continually inundated wetland on often developing in shallow ponds, depressions, and river margins Marshes are dominated by herbaceous plants, such as grasses (e.g., *Phragmites*), sedges, cattails (e.g., *Typha*), and bulrushes (e.g., *Scirpus*). Waters are usually neutral to basic.

Mineral Soil. Soils composed of predominantly mineral materials (sands, silts, and clays) instead of organic materials. The soil contains less than 20 percent organic matter.

Minor Type. Refers to a habitat type or community type that seldom occupies large acreages but may be common on smaller areas within the riparian or wetland zone.

Moder. A partially decomposed humus layer that is somewhat indistinct from the mineral layer beneath.

Monotypic Stands. Stands composed primarily of a single species.

Montane. That region between the subalpine zone and the grassland zone or more broadly, mountain slopes below the alpine zone.

Mor. A poorly decomposed humus layer that is sharply distinct from the mineral layer beneath. It is generally found in somewhat acidic conditions on the forest floor.

Mottling (obsolete). Spots or blotches of different color or shades of color interspersed within the dominant color in a soil layer, usually resulting from the presence of periodic reducing soil conditions. See also redox concentrations.

Non-Hydric Soils. A soil that has developed under predominantly unsaturated soil conditions.

Non-Persistent Vegetation. Plants that break down readily after the growing season; no evidence of previous year's growth at the beginning of the next grow season.

Non-Wetland. Any area that has sufficiently dry conditions that hydrophytic vegetation, hydric soils, and/or wetland hydrology are lacking; it includes upland as well as former wetlands that are effectively drained.

Organic Soil. Soils composed of primarily organic rather than mineral material. Equivalent to **Histosols** and includes peats and mucks.

Overbank Flooding. Any situation in which inundation occurs as a result of the water level of a river or stream rising above bank level.

Overflow Channel. An abandoned channel in a floodplain that may carry water during periods of high stream or river flows.

Oxbow Lake. A meander channel of a stream or river that is formed by breaching of a meander loop during flood stage. The ends of the cut-off meander are blocked by bank sediments.

Palustrine System (Cowardin and others 1979). Any non-tidal wetland of a class dominated by trees, shrubs, persistent emergents, or emergent mosses or lichens.

Parent Material. The unconsolidated and undeveloped mineral or organic matter from which the solum (soil) is developed.

Peraquic Moisture Regime. A soil condition in which reducing conditions always occur due to the presence of ground water at or near the soil surface.

Perennial Stream. A stream or reach of a stream that flows continuously. They are generally fed in part by springs. Surface water elevations are commonly lower than water table elevations in adjacent soils.

Permanently Flooded. A water regime condition where standing water covers the land surface throughout the year (but may be absent during extreme droughts).

Permeability. The quality of the soil that enables water to move downward through the profile, measured as the number of cm (in) per hour that water moves downward through the saturated soil.

Phase. A subdivision of a habitat type or representing a characteristic variation in climax vegetation and environmental conditions.

Pioneer Species. Species that colonize bare areas (e.g., gravel bars) where there is little or no competition from other species.

Plant Association. Used to group together all those stands of climax vegetation that occur in environments so similar that there is much floristic similarity throughout all layers of the vegetation.

Playa. A periodically flooded wetland basin. Playas are common in parts of southern Alberta.

Pond. Bodies of water encircled by wetland vegetation. Wave action is minimal, allowing emergent vegetation to establish.

Ponded. A condition in which free water covers the soil surface, for example, in a closed depression. The water is removed only by percolation, evaporated, or transpiration.

Pooled Channel Stream. An intermittent stream with significant surface pool area and without flowing surface water. The water sources for the pools are springs within the channel.

Poorly Drained. Water is removed from the soil so slowly that the soil is saturated periodically during the growing season or remains wet for long periods (greater than 7 days).

Pothole. A depressional wetland community caused by glaciation and is common to portions of the Northern Great Plains. The body of water is less than 8 ha (20 acres) in size.

Primary Succession. Occurs on a bare surface not previously occupied by plants, such as a recently deposited alluvial bar.

Range of Canopy Cover. Refers to the "range" (e.g., low and high values) of canopy cover of a particular species for all the stands sampled for a habitat type or community type.

Redox Concentrations. A redoximorphic feature characterized by zones in the soil of apparent accumulation of iron and manganese oxides. These may form as nodules, concretions, soft bodies, or pore linings and vary in shape, size, and color.

Redox Depletions. A redoximorphic feature characterized by zones in the soil of low chroma (less than 3) where iron and manganese oxides alone have been removed, or where both iron/manganese oxides and clay have been removed.

Redoximorphic Features. Soil features associated with wetness and are formed as a result of the reduction and oxidation of iron and manganese compounds in the soil following saturation with water (See redox concentrations and redox depletions).

Reduced Matrix. A redoximorphic feature characterized by a soil matrix having low chroma (less than 3) in situ, but increases in hue or chroma when exposed (within 30 minutes) to air.

Reservoir. An artificial (dammed) water body with at least 8 ha (20 acres) covered by surface water.

Restricted Type. Refers to a habitat type or community type where small, isolated stands may occur in the study area.

Riparian. *adj*. Of, on, or relating to the banks of a natural course of water (Latin *riparius*, from *ripa*, bank).

Riparian Plant Association. A plant community representing the latest successional stage attainable on a specific, hydrologically influenced surface (equivalent potential natural community type).

Riparian Wetlands (Lotic Wetlands). Riparian wetlands are wetlands associated with running water systems found along rivers, streams, and drainageways. Such wetlands contain a defined channel and floodplain. The channel is an open conduit that periodically, or continuously, carries flowing water, dissolved and suspended material. Beaver ponds, seeps, springs, and wet meadows on the floodplain of, or associated with, a river or stream are part of the riparian wetland.

Riparian or Wetland Ecosystem. The ecosystem located between aquatic and terrestrial environments. Identified by hydric soil characteristics and riparian or wetland plant species that requires or tolerates free water conditions of varying duration.

Riparian or Wetland Species. Plant species occurring within the riparian or wetland zone. Obligate riparian or wetland species require the environmental conditions associated with the riparian or wetland zone. Facultative riparian or wetland species are tolerant of these environmental conditions, but also occur in uplands.

Riparian Zone. A geographically delineated portion of the riparian ecosystem based on management concerns.

River. Rivers are usually larger than streams. They flow year around, in years of normal precipitation, and when significant amounts of water are not being diverted out of them.

Riverbank. That portion of the channel bank cross-section that controls the lateral movement of water.

Riverine System (Cowardin and others 1979). Any wetland or deepwater habitat contained within a channel, with exception of wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens.

Salic Horizon. A mineral soil horizon 15 cm (6 in) or more thick enriched with secondary soluble salts.

Saline. Soil or water containing sufficient soluble salts to interfere with the growth of most plants.

Saturated. A soil condition in which all voids (pore spaces) between soil particles are filled with water.

Secondary Succession. The process of changing biotic communities that occurs following disturbances to a site that has previously been occupied by living organisms.

Seep. Groundwater discharge areas. In general, seeps have less flow than a spring.

Seral. Refers to vegetation that has not theoretically attained a steady state with its environment, and current populations of some species are being replaced by other species; a community or species that is replaced by another community or species as succession progresses.

Series. Refers to a group of habitat types having the same climax species.

Shrub. A multi-stemmed woody plant generally shorter than 4.8 m (16 ft).

Solum. The upper and most weathered part of the soil profile; the A and B horizons.

Somewhat Poorly Drained. Water is removed slowly enough that the soil is wet for significant periods during the growing season.

Spring. Groundwater discharge areas. In general, springs are considered to have more flow than seeps.

Stable Community. The condition of little or no perceived change in plant communities that are in relative equilibrium with existing environmental conditions. It describes persistent but not necessarily climax stages in plant succession.

Stand. A plant community that is relatively uniform in composition, structure, and habitat conditions; a sample unit.

Stream. A natural waterway that is defined as first to third order.

Streambank. That portion of the channel bank cross-section that controls the lateral movement of water.

Stream Order. A classification of streams according to the number of tributaries. Order 1 streams have no tributaries; a stream of order 2 or higher has 2 or more tributaries of the next lower order.

Still Water Wetlands (Lentic Wetlands). These wetlands occur in basins and lack a defined channel and floodplain. Included are permanent (e.g., perennial) or intermittent bodies of water such as lakes, reservoirs, potholes, marshes, ponds, and stockponds. Other examples include fens, bogs, wet meadows, and seeps not associated with a defined channel.

Stockpond. An artificial (dammed) body of water of less than 8 ha (20 acres) covered by surface water.

Subterranean Stream. A stream that flows underground for part of the stream reach.

Succession. The change or sequence of plant, animal, and microbial communities that successively occupy an area over a period of time. ***Primary succession*** begins on a bare surface not previously occupied by living organisms, such as a recently deposited gravel bar. ***Secondary succession*** occurs following disturbances on sites that previously supported living organisms.

Swale. A depression or topographical low area.

Sward. An expanse of grass or grass-like plants.

Tree. A single-stemmed woody plant generally taller than 4.8 m (16 ft).

Uplands. Any area that does not qualify as a wetland because the associated hydrologic regime is not sufficiently wet to elicit development of vegetation, soils, and/or hydrologic characteristics associated with wetlands. Such areas occurring in floodplains are more appropriately termed nonwetlands.

Very Long Duration (Flooding). A duration class in which inundation for a single event is greater than 1 month.

Very Poorly Drained. Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season.

Water Mark. A line on vegetation or other upright structures that represents the maximum height reached during a flood, ponding, or inundation event.

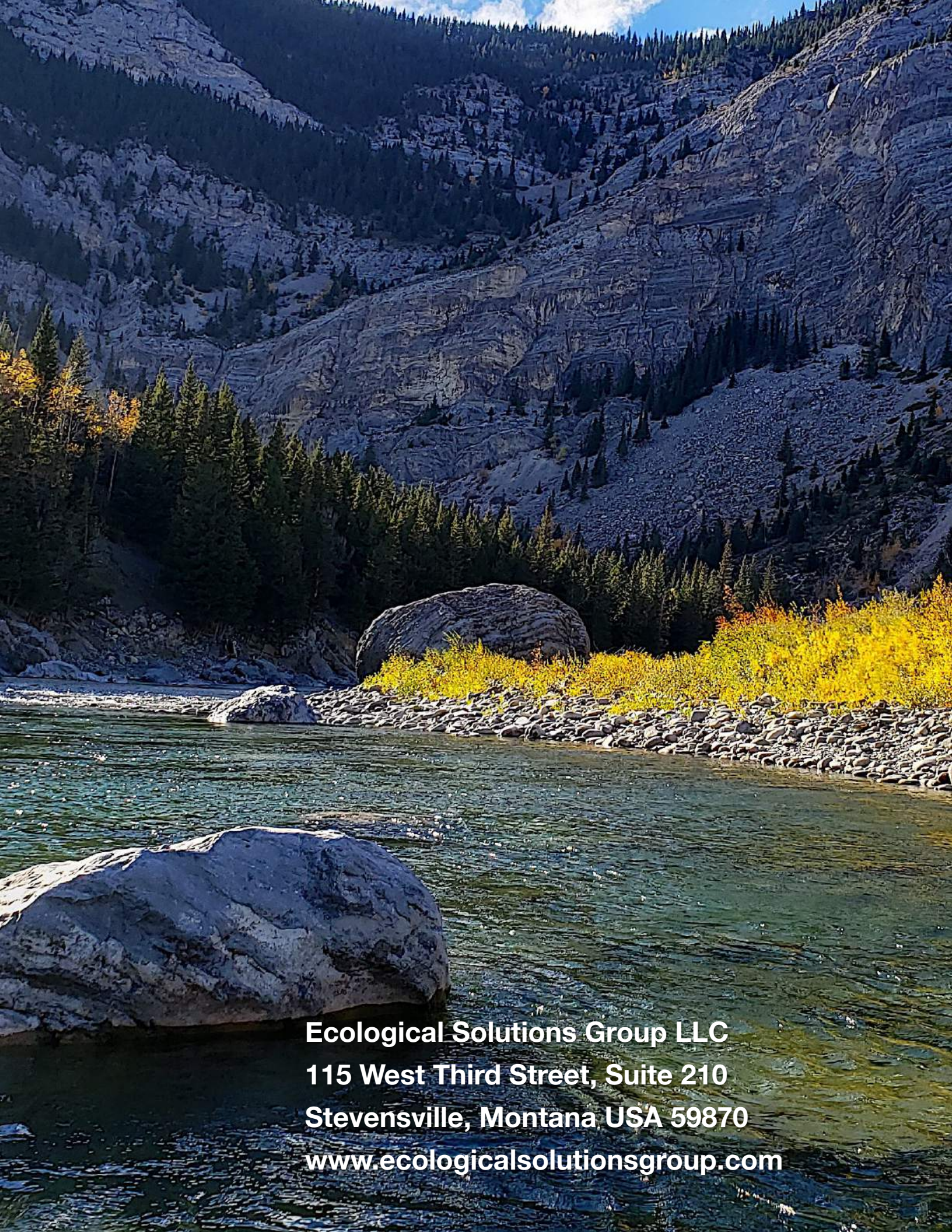
Water Table. The upper surface of the zone of saturation within the soil or geologic material.

Wet Meadow. A herbaceous wetland on mineral soil. Generally, wet meadows occur in seasonally flooded basins and flats. Soils are usually dry for part of the growing season.

Wetlands. Areas that under normal circumstances have hydrophytic vegetation, hydric soils, and wetland hydrology. It includes landscape units such as bogs, fens, carrs, marshes, and lowlands covered with shallow, and

sometimes ephemeral or intermittent waters. Wetlands are also potholes, sloughs, wet meadows, riparian zones, overflow areas, and shallow lakes and ponds having submerged and emergent vegetation. Permanent waters of streams and water deeper than 3 m (approximately 10 ft) in lakes and reservoirs are not considered wetlands.

Wetland Hydrology. Permanent or periodic inundation or prolonged soil saturation sufficient to create anaerobic conditions in the soil. Primary wetland hydrology indicators are: inundated, saturated in upper 4.7 cm (12 in), water marks, drift lines, sediment deposits, drainage patterns in wetlands. Secondary wetland hydrology indicators are: oxidized root channels in upper 4.7 cm (12 in), water-stained leaves, local soil survey data, FAC-neutral test (Environmental Laboratory, 1987).



Ecological Solutions Group LLC
115 West Third Street, Suite 210
Stevensville, Montana USA 59870
www.ecologicalsolutionsgroup.com