Cows and Fish Report

Classification and Management of

Riparian and Wetland Sites

in Alberta's Parkland Natural Region & Dry Mixedwood Natural Subregion

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Cows and Fish Report No. 020
July 2003 First Edition

Citation for this document:

Thompson, William H. and Paul L. Hansen. 2003. Classification and management of riparian and wetland sites of Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion. Bitterroot Restoration, Inc. Prepared for the Alberta Riparian Habitat Management Program-Cows and Fish, Lethbridge, Alberta. 340 pages.

Funding for this project:

We gratefully acknowledge the financial support provided to this project by the Canada-Alberta Beef Industry Development Fund (CABIDF), as well as Public Lands Division, Alberta Sustainable Resource Development, and Alberta Environmentally Sustainable Agriculture, Alberta Agriculture Food and Rural Development for the development of this riparian vegetation classification for portions of the Parkland and Boreal Natural Regions. We also wish to express our appreciation for the financial support provided by the Cows and Fish program (Alberta Riparian Habitat Management Program), especially Fish and Wildlife Division and the Rangeland Management Branch, Public Lands Division of Alberta Sustainable Resource Development, all of which were instrumental in allowing this project to take place.

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

Cows and Fish
Alberta Riparian Habitat Management Program

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada
Canada Alberta Beef Industry Development Fund
Alberta Agriculture, Food and Rural Development

Acknowledgements:

The project management team would like to thank the following individuals for providing leadership and assistance in the development of this classification and management report:

- Dr. Paul Hansen, aka " the Diet-Coke man" who's thirst for coaching, and bridging the gap between research and applied management is so much appreciated. And thanks to Bill Thompson, aka "the walk on lentic-man" who "sandaled" many northern Alberta sloughs, potholes, lakes, rivers and other associated riparian areas and wetlands to provide users with a key step in better understanding Alberta's lentic systems.
- Cows and Fish Report: Norine Ambrose, Kelsey Spicer-Rawe and Kerri O'Shaughnessy, Cows and Fish—Alberta Riparian Habitat Management Program
- Mike Willoughby, Rangeland Management Branch, Public Lands Division
- Dave Downing, Vegetation Ecologist, Timberline Inventory Consultants
- Finally, we would like to thank the Cows and Fish Partners

Cover Photo: Lorne Fitch

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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 Partners: Producers and community groups, Alberta Beef Producers, Trout Unlimited Canada, Canadian Cattlemen's Association, Alberta Agriculture, Food and Rural Development, Alberta Sustainable Resource Development, Alberta Environment, Department of Fisheries and Oceans, Prairie Farm Rehabilitation Administration, Alberta Conservation Association

Funding Associates: Alberta Environmentally Sustainable Agriculture, Canadian Adaptation and Rural Development Fund, Canada-Alberta Beef Industry Development Fund

Other Funders: Government of Canada Habitat Stewardship Program for Species at Risk

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Classification and Management of Riparian and Wetland Sites of Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion

March 2003

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ACKNOWLEDGEMENTS

The authors would like to thank the following individuals for providing assistance in the development of this draft: Gerry Ehlert, Barry Adams, Donna Lawrence, and Colin Stone (Alberta Sustainable Resource Development, Public Lands Division), Lorne Fitch (Alberta Sustainable Resource Development, Fish and Wildlife Division), Norine Ambrose (Cows and Fish, Alberta Riparian Habitat Management Program) and Greg Hale (formerly with Cows and Fish). They have provided invaluable assistance in the development of the document. The patience extended to the authors by these good people is greatly appreciated.

Special thanks go to Michael Willoughby of (Alberta Sustainable Resource Development, Public Lands Division) and to Dave Downing, Vegetation Ecologist, Timberline Inventory Consultants, for providing extensive and constructive review commentary. Acknowledgement is also due to the many dedicated workers in Alberta Forestry, Public Lands, and the private sector who have produced excellent prior classification works with which this effort must reconcile.

Finally, the authors would like to thank the Alberta Riparian Habitat Management Program (ARHMP) represented by the Alberta Beef Producers, Trout Unlimited Canada, the Canadian Cattlemen's Association, Alberta Sustainable Resource Development, Prairie Farm Rehabilitation Administration, Alberta Environment, Alberta Agriculture, Food and Rural Development-Alberta Conservation Association, and the Department of Fisheries and Oceans for providing funding for the project.

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INTRODUCTION

This work focuses within the natural landscape on riparian and wetland areas, which 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 ecosites of Alberta (Beckingham and Archibald 1996). Although there is not always a one-to-one match between a riparian and wetland type and an ecosite phase or community type, we include a section in the description of each type to identify the ecosite(s) phase(s) into which it fits.

A major portion of the study area for this project is the Parkland Natural Region, which was not included in prior ecosite descriptions for Alberta.

Riparian and wetland areas[1] in central and northern Alberta are the areas that are supplied with more available moisture than surrounding the uplands in the vicinity. 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 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 that is available. It can be thought of as water that is 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. They 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 amounts of use and conflict than usually occurs 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 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

[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.

Canada. It is estimated that by 1976 a total of 1.2 million ha (3 million ac) of wetland had been converted to agriculture, representing a loss of over 70 percent of prairie wetlands in Canada (Environment Canada 1986).

The pothole region of the Canadian prairie provinces has been estimated to produce five of every eight ducks shot by hunters in North America, while this same area in 1969 was producing 98 of every 100 bushels of Canadian wheat (Lodge 1969). These facts indicate the importance of this part of the prairie landscape, and this example illustrates just one of the myriad conflicts of interest that can arise. Since 1969, many more prairie wetlands have been converted to the economically important production of small grains.

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 the 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* (Adams and Fitch 1998), a guidebook for ranchers and livestock producers on how to manage most effectively the riparian areas within their rangelands, and *Managing Saskatchewan Wetlands—a landowner's guide* (Huel 2000), another fine resource for understanding how humans can better live and work in harmony with the wetlands on our region.

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 (Adams and Fitch 1998). 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 (Adams and Fitch 1998, 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 instream ecosystems. Streambanks provide habitat edge with high diversity, hiding cover, and shading for fish (Adams and Fitch 1998). 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 instream 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 vigour 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 (Adams and Fitch 1998). 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 (Adams and Fitch 1998, 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 (Adams and Fitch 1998, 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 and wetland areas 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 resources (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 (Adams and Fitch 1998). *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.

In the areas of rich, dark soil where groves of *Populus tremuloides* (aspen) and *Salix* (willow) were once found around every depressional wetland, these wooded lands 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,*** an indicator 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 (Adams and Fitch 1998).

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 may take place simultaneously or sequentially that enhance or negate each other. 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 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 colour. 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 colour 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 colour (a higher Munsell colour 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 WITHIN THE STUDY AREA

The following descriptions and map of Alberta Natural Regions and Subregions within the study area (see Figure 1) are taken from the Alberta government internet website (Government of Alberta 1999).

Topography and Landform

Central Parkland Subregion—The Central Parkland Subregion extends in a broad arc up to 200 km wide, north of the Grassland Natural Region and south of the Boreal Forest Natural Region. Surficial deposits range intermediate-textured hummocky and ground moraines to fine-textured glaciolacustrine deposits and coarse outwash, kame moraine, and dune field

materials. Moraines are most widespread, with kame moraines locally extensive in eastern portions. The Neutral Hills are an excellent example of ice-thrust bedrock ridges.

Elevations range from just over 500 m where the Battle River enters Saskatchewan to around 1,100 m in western portions. Numerous permanent streams, all part of the Saskatchewan River system, cut across the Subregion. Numerous lakes are scattered throughout the Subregion as well as a wide variety of permanent wetlands. Many of the lakes and wetlands are slightly to strongly saline.

Peace River Parkland Subregion—The Peace River Parkland is characterized by broad, gently rolling plains with scattered upland and deeply incised, steep-sided river valleys. Mass wasting is common along stream valleys and widens many valleys considerably.

The main part of the Peace River Parkland is in the Grande Prairie and Peace River areas but smaller areas occur further north as far as Fort Vermilion. Most of the extensive grasslands of this Subregion have been cultivated and only small, scattered remnants are still in native cover.

Cretaceous shales, siltstones, and sandstones outcrop along major rivers. However, because of extensive slumping, outcrops are not common since most of the valleys are covered with colluvial, slumped materials. Surficial deposits are predominantly glaciolacustrine silts and clays.

Dry Mixedwood Subregion—The Dry Mixedwood Subregion is characterized by low relief and level to undulating terrain. Surficial materials are mostly till as ground moraine and hummocky moraine landforms with some areas of aeolian dunes and sandy outwash plain. The Subregion includes two main areas: the southern edge of the Boreal Forest Natural Region from Cold Lake west to about Barrhead and south along the western edge of the Central Parkland Subregion to about Gull Lake and a broad band from Lesser Slave Lake to Grande Prairie then north along the Peace River to Fort Vermilion. The Cooking Lake moraine east of Edmonton is a disjunct portion of this Subregion.

Drainage is to both the Saskatchewan and Mackenzie River systems via numerous rivers and small streams.

Climate

Central Parkland Subregion—The mean annual temperature for the Central Parkland Subregion is 2 degrees Celsius with a May - September average of 13 degrees Celsius. The frost-free period averages 95 days. Mean annual precipitation is 350-450 mm, and May through September precipitation averages 300 mm.

Peace River Parkland Subregion—The mean annual precipitation of the Peace River Parkland is 350-440 mm. The mean May - September temperature is 13 degrees Celsius and the frost-free period averages 95 days. The climate of this Subregion has shorter, cooler summer and longer, colder winters than the other parkland Subregions. It also has higher precipitation, less wind and lower evaporation.

Dry Mixedwood Subregion—The climate of this Subregion is subhumid, continental with short, cool summers and long, cold winters. The mean May through September temperature is about 13 degrees Celsius and the growing period is about 90 days. Annual precipitation averages about 350 mm with June and July the wettest months. Winters are relatively dry with about 60 mm of precipitation. Overall, the climate is somewhat drier and warmer than the Central Mixedwood Subregion with somewhat higher moisture deficits.

Soils

Central Parkland Subregion—Black and Dark Brown Chernozems predominate under grassland vegetation while under the moister aspen woodlands Dark Gray Chernozems and Luvisolics are most common. Dark Brown Chernozems occur under woodland vegetation on sandy parent materials. A strip of Brown Solonetz soils runs through the centre of the Subregion from Vegreville, through Beaverhill Lake and into the Sullivan and Dowling lakes areas.

Peace River Parkland Subregion—The soils of the grasslands are mostly Solonetzic while those of the forested portion are mostly Luvisolics. The Solonetzic soils are an important factor in maintaining the grasslands here with fire and, possibly, climate playing a secondary role.

Dry Mixedwood Subregion—Soils are typically Gray Luvisols in well drained, upland till sites and Eutric Brunisols in coarse-textured sandy uplands. Organics and Gleysolics occur on wet depressional sites.

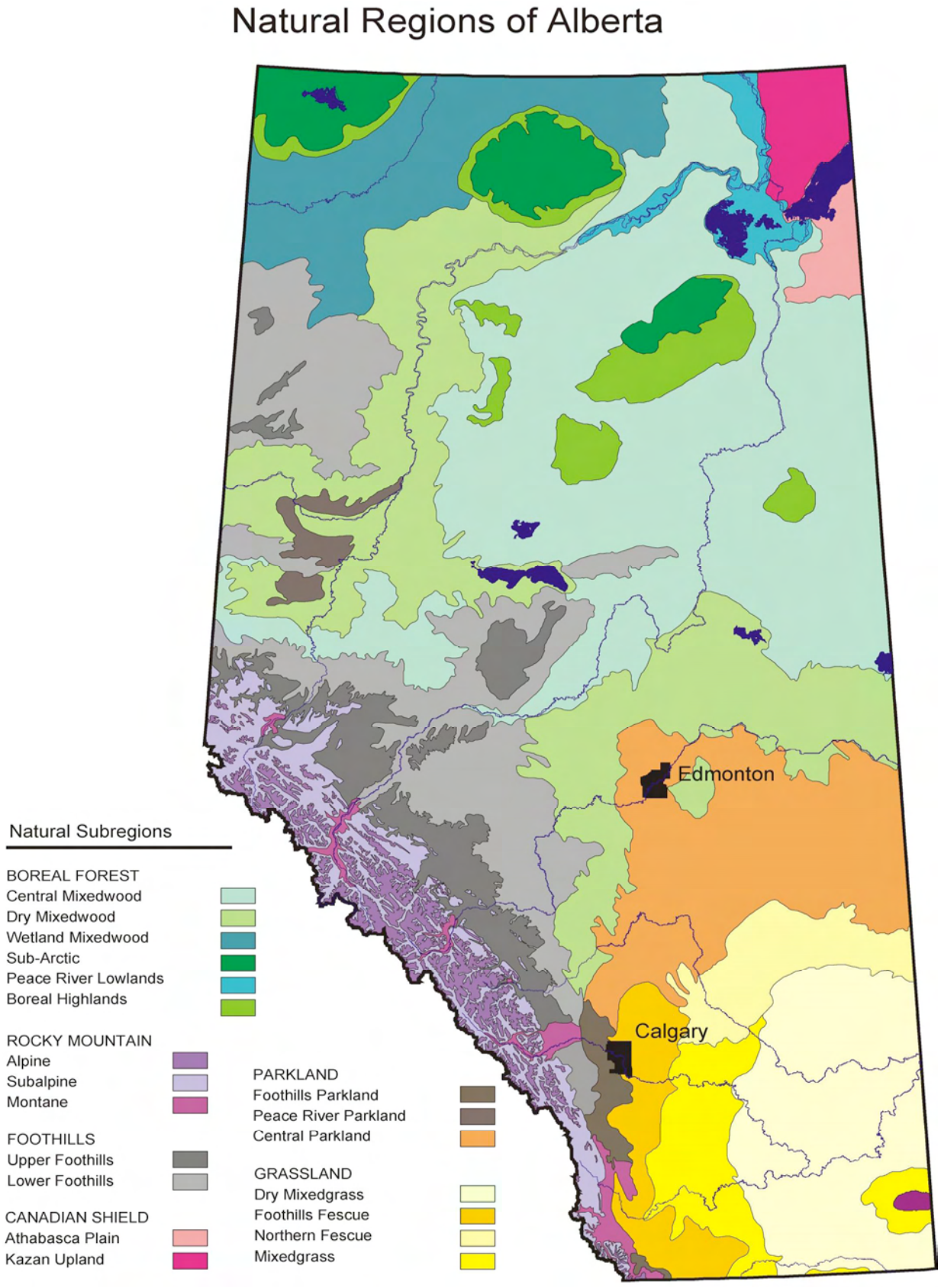


Figure 1. Natural regions of Alberta (Government of Alberta 1999)

DEVELOPMENT OF A VEGETATION BASED ECOLOGICAL SITE CLASSIFICATION

Background

This classification of riparian and wetland sites in the Parkland Natural Region and the Dry Mixedwood Subregion of the Boreal Natural Region of Alberta is a continuation of the work began while working at the Riparian and Wetland Research Program at the University of Montana. At the beginning of the second season of field work (2001), the authors left the University of Montana to join Bitterroot Restoration, Inc. (Corvallis, Montana) (BRI), from where the work was continued.

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. The reader then is given a clear idea of the kind of site it is, the potential vegetation and the current vegetation.
2. The habitat type approach is primarily a vegetation-based, ecological site classification that does not 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 colour, 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.

The ecosite approach has been extensively used to classify the forests of Alberta (i.e., Beckingham and Archibald 1996, Archibald and others 1996, Beckingham and others 1996). This approach is appropriate for classifying large areas occupied by vegetation of limited variability and wide ecological amplitude, such as the upland boreal forest. In these areas of upland boreal forests where the vegetation is less diverse, where individual species tend to have broader ranges and be less specific in their environmental tolerances, and where much of the vegetation has been recently disturbed, a classification based purely on vegetation may prove unsatisfactory (Kimmins 1987). Such areas are subject to largely homogeneous forces such as climate and fire that affect large areas at once. The vegetation mosaics formed may be complex, but occur at a far greater scale than that of the typical human management unit of grazing lease or cut block.

METHODS

Field Methods

The database for development of this classification consists of 814 sample plots within northern and central Alberta and central Saskatchewan. The following groups of data were included in the classification analysis for this second draft:

1. 394 stands sampled in the study area by Bitterroot Restoration, Inc. in the summers of 2001, 2002, and by Riparian and Wetland Research Program at the University of Montana in 2000;
2. 64 stands sampled by O'Leary and Downing in Grande Prairie County in 1986;
3. 32 stands from the data set used by Michael Willoughby (2000) in the Dry and Central Mixedwood Subregions;
4. 145 stands sampled by Riparian and Wetland Research Program at the University of Montana in southern Alberta in 1998 and 1999; and
5. 179 stands sampled by Riparian and Wetland Research Program at the University of Montana in Saskatchewan during 1998 and 1999.

Selection of stands for sampling was based on subjective sampling without preconceived bias as described by Mueller-Dombois and Ellenberg (1974). Plots were selected to reflect the apparent range of environmental and successional conditions and the homogeneity of the vegetation, rather than any eventual placement of the stand within a classification

system. In practice, field observers chose stands of vegetation to sample that they saw as being dominated by particular species occurring repeatedly across the landscape within the study area.

For sampling herbaceous communities (graminoids and forbs) we used plots 5 m by 10 m, total area of 50 m^2 (Platts and others 1987, Tuhy and Jensen 1982, Youngblood and others 1985a, Youngblood and others 1985b). For long stringers of these communities, plot width was reduced and length was increased to maintain a constant plot size of 50 m^2. This plot size was considered adequate to include most species of a community, yet small enough for the sampler to see the entire plot. Each plot was located within a stand at least twice the area of the plot to avoid sampling ecotones between communities. When sampling communities dominated by trees or tall shrubs, a 375 m^2 circular plot was used. Again, for communities in long stringers the plot shape was adjusted.

Canopy cover (Daubenmire 1959) by species is ocularly estimated within each plot. Plants not identified in the field are collected for identification later. Data regarding successional relationships and adjacent communities are also collected. Data regarding physical site features are collected for each plot and include soil morphology, litter/duff accumulation, geomorphology, human modifications, elevation, and natural and human-caused disturbances.

Office Methods

Development of this site classification followed the general procedures and timetable 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. Association tables were created for each grouping (type) using species constancy of occurrence (frequency) and canopy cover (abundance) values. Stand groupings were rearranged several times to locate them into sets with the greatest vegetation similarities. Plot-to-plot similarity, plot-to-set similarity, and set-to-set similarity were analysed 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. Most types representing major presence on the landscape in the study area were divided into late seral, or relatively undisturbed and early seral, or disturbed subsets. Separate tables were created to show average canopy cover, canopy cover range, and constancy values for both subsets. ***Average canopy cover*** is the averages cover of a species in those plots having it present, ***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 range is zero. To aid interpretation of the distribution and importance of a species in a type, it is given a ***prominence index*** value useful for ranking species importance within a type. The ***prominence index*** is the square root of the product of ***average canopy cover*** and ***constancy.***
5. A dichotomous key to the types was 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 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 second draft classification for the Parkland Natural Region and the Dry Mixedwood Subregion of the Boreal Natural Region of Alberta is provided for interim use and field-testing in 2002. Further revisions will then be incorporated into a final draft in 2003 using comment from reviewers and additional data collected during the year 2002.

Other authors in the general region that includes the study area have defined a number of vegetation community types that occur on riparian and wetland sites. These authors include Michael G. Willoughby and others (2000), Lane and others (2000), Thompson and Hansen (2000), Beckingham and others (1996), Beckingham and Archibald (1996), Downing and Karpuk (1992), and O'Leary and Downing (1986). In this classification, we have attempted to adopt previously defined types whenever possible. However, many of the types described by others are not equivalent for reasons of being written for a different ecologic zone, for a different purpose or usage, or at a different landscape scale. Therefore, we adopted from those works the types that best fit the ecological conditions observed in the study area, or we defined new types. At the end of each type description in a section called OTHER STUDIES, we list similar types described by other workers in the general region.

Taxonomic Considerations

Taxonomic nomenclature follows Moss (1959), as revised by Packer (1983).

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 *Rosa acicularis* (prickly rose) community type includes all combinations of *Rosa acicularis* (prickly rose) and *Rosa woodsii* (common wild rose).
2. The *Calamagrostis inexpansa* (northern reed grass) Community Type includes all combinations of *Calamagrostis inexpansa* (northern reed grass) and *Calamagrostis stricta* (narrow reed grass).
3. The *Typha latifolia* (common cattail) habitat type includes all combinations of *Typha latifolia* (common cattail) and *Typha angustifolia* (narrow-leaved cattail).
4. The *Scirpus acutus* (great bulrush) habitat type includes all combinations of *Scirpus acutus* (great bulrush) and *Scirpus validus* (common great bulrush).
5. The *Sparganium eurycarpum* (giant bur-reed) community type includes all combinations of *Sparganium eurycarpum* (giant bur-reed) and *Sparganium angustifolium* (narrow-leaved bur-reed).

Ecological Terms and Concepts

This kind of 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 exerts sufficient influence to produce a self-perpetuating, steady state of 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 because of high use by animals. ***Fire climax*** is apparently stable vegetation, which is distinctive because 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.

Doubts have been expressed that a mature, self-perpetuating community exists in the Boreal Forest of western Canada (Beckingham 1991), and whether due to frequent fires that a climax community is possible to determine (Dix and Swan 1971). 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) in his work.

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 have been used in numerous studies of vegetation-based ecological site classification (habitat types) (Daubenmire 1952, Daubenmire and Daubenmire 1968, Daubenmire 1970, Hoffman and Alexander 1980, Hoffman and Alexander 1983, Hoffman and Alexander 1987, Pfister and others 1977, Jorgensen 1979, Mueggler and Stewart 1980, Pfister and Arno 1980, Steele and others 1981, Hironaka and others 1983, Hanks and others 1983, Cooper 1981, Cooper and Pfister 1985, Hansen and others 1984, Hansen and Hoffman 1988, Hansen and others 1995, Hansen and Hall 2002, Youngblood and Mauk 1985, DeVelice and others 1986, Cooper and others 1991, Kovalchik 1987, Tiedeman and others 1987). For a review of vegetation-based ecological site classifications (habitat types), see Ferguson and others (1989) and Pfister (1989).

In addition, this methodology and approach to riparian and wetland classification have been applied in western Canada previously in similar work in the Grasslands Natural Region of southern Alberta (Thompson and Hansen 2002) and in southern Saskatchewan (Thompson and Hansen 2001).

A ***habitat type*** is defined as the land area that supports, or has the potential of supporting, the same climax vegetation type (association). 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 condition such as drying and filling of lakes and sloughs, or deposition of alluvium on floodplains sufficient to create a drier site over time, can result in a different the site potential, and therefore the habitat type. Cyclical changes that do not change long-term site conditions do not alter site potential; therefore, the habitat type remains unchanged.

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. Kovalchik (1987) uses the term ***riparian association*** as a vegetation type representing the last (most advanced, most mature) successional stage attainable on a specific hydrologically influenced surface. Because it is the end result of plant succession, the riparian association reflects the most meaningful integration of environmental factors affecting a site.

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 petiolaris/Carex atherodes* (basket willow/awned sedge) association occur. The units of land on which these occur (currently or potentially) represent the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. Some riparian and wetland 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 atherodes* [awned 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 similar in many ways to a habitat type, except that it ***only represents a seral or disclimax community.*** Like a habitat type, it 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 *Betula papyrifera* (white birch) community type. A community type does not specify the vegetation potential of the site supporting it, although it does carry a lot of information about the site. Many seral community types (e.g., the *Salix exigua* [sandbar willow] community type) occur on sites with differing potentials, especially depending on geographic location. A recent alluvial bar with a dense stand of *Salix exigua* (sandbar willow) may be pioneering an *Acer negundo/Prunus virginiana* (Manitoba maple/chokecherry) habitat type in southeast Alberta, a *Fraxinus pensylvanica* (green ash/chokecherry) habitat type in Saskatchewan or Montana, a *Picea glauca/Cornus stolonifera* (white birch/red-osier dogwood) habitat type in the southwestern Alberta foothills, or the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type along the Battle or the Beaver Rivers.

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 riparian 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, community type B/C-2 represents a grazing disclimax that extends over two or more habitat types occurring on sites currently providing insufficient evidence to distinguish which habitat type (column). In association D, our present knowledge of the site only allows us to identify one seral stage, such 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 plant association) is reached directly and quickly. Examples of association E include *Carex atherodes* (awned sedge) and *Typha latifolia* (common cattail) where the pioneering species is an ecologically strong native species with ability to be climax vegetation for the site.

The time frame for site-successional processes varies greatly, depending upon type and location. For example, a beaver pond may silt-in within a few years, decades, or centuries. In contrast, some high elevation meadows have remained stable for thousands of years (Windell and others 1986). Fluvial sites along river or stream floodplains typically progress through a series of stages from an early seral, pioneer community through one or more discernible intermediate seral stages as shade intolerant species yield to shade tolerant species and finally to late seral, climax species. This process can take many decades on some sites, and be compounded by subtle changes to site potential as the fluvial surface aggrades with deposition.

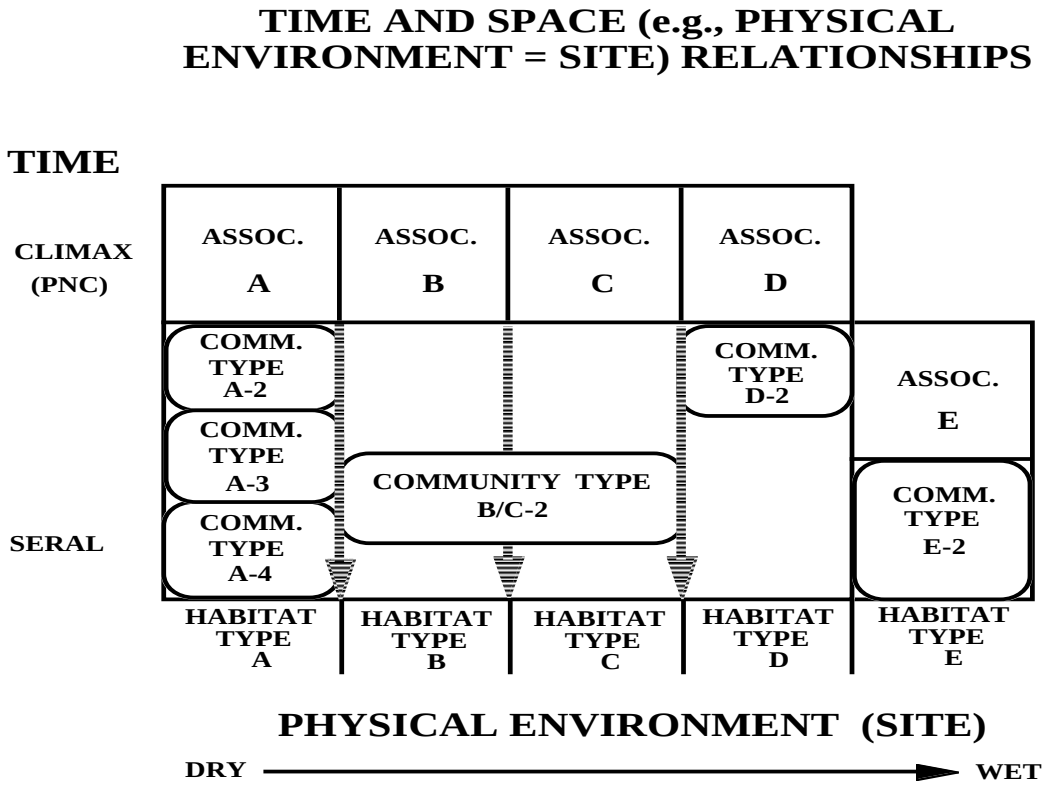


Figure 2. Illustration of the terminology as it relates to time and space (e.g., physical environment = site) for riparian and wetland sites.

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 vegetation community as an integrated expression of the environmental factors affecting species reproduction and plant community dynamics.

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.

Other Studies

Several other studies have been conducted in parts of the study area that have classified the natural vegetation to some extent. These have included works done at smaller local scales, larger scales focusing on the upland forests, and works designed for other purposes, such as production of timber products or livestock forage. None of these has done what is attempted in this document, which is to classify riparian and wetland sites by vegetation potential and vegetation community in a successional context. However, some of these fine works did help immensely in providing a great deal of insight and information on the very communities that are the subject of this study. Stand sample data from their wetter stands was incorporated from work by O'Leary and Downing (1986), Downing and Karpuk (1992), and Willoughby (2000).

Areas Not Included in the Study

Bog Wetlands—Within the Dry Mixedwood Subregion of the Boreal Natural Region are some areas of bog wetland with communities dominated by species such as *Picea mariana* (black spruce) and *Larix laricina* (tamarack). Sites with these communities were not sampled for this study.

Tame Pastures—Many areas within stream riparian zones, in close proximity of lakeshores, and in other lentic wetland areas have high potential for agricultural development. One such kind of development is the clearing of the natural wild vegetation and replacement of it with tame pasture species. Many such sites will key out to one of the habitat types or community types described in this document because the wild, natural vegetation will often re-establish presence by resprouting from remaining root stocks or invasion from adjoining sites. A site with more than 50 percent canopy cover of introduced forage species, such as *Bromus inermis* (awnless brome), *Festuca rubra* (creeping red fescue), *Agropyron repens* (quack grass), *Phleum pratense* (timothy), *Poa pratensis* (Kentucky bluegrass), *Medicago satvia* (alfalfa), and *Trifolium* species (clover). Tame Pasture sites may be assessed for functional health by using the Tame Pasture Health Assessment (Adams and Ehlert 2003).

Cropland—Some sites that would support riparian/wetland natural communities have been ploughed for crop production. These cannot be keyed to natural habitat type or community type unless the natural community has re-established to a degree that the key can be followed.

Some Recently Exposed Lakeshores and Recently Deposited River Bars—These sites were not omitted from the study, but in many cases they lack sufficiently developed vegetation to be keyed to any described habitat type or community type. They may be so newly exposed or deposited that they lack any plant growth; or they may simply be vegetated with very early pioneer species. Such sites may drop through the key into the "Unclassified Wetland Type."

LIST OF TYPES

Geographic Distribution of Types Described

Table 1 lists the geographic distribution and relative abundance of riparian and wetland habitat types and community types in the Central and Peace River Subregions of the Parkland Natural Region, and the Dry Mixedwood Subregion of the Boreal Natural Region of Alberta. Categories of distribution and relative abundance are major, minor, and incidental. A ***major*** type occupies extensive acreages in a least some portion of the riparian or wetland zone; a ***minor*** type seldom occupies large acreages but may be common on smaller areas within the riparian or wetland zone; and an ***incidental*** type rarely occurs within the region, or is limited to narrow site conditions and/or very localized occurrence. A dash indicates that the type is essentially absent from that particular subregion. Subregion delineations follow Government of Alberta (1999) *Natural Regions and Subregions of Alberta* (Figure 1).

Table 1. Distribution of habitat types (h.t.) and community types (c.t.) in riparian and wetland sites in the study area

Type	Number of Stands	Central Parkland	Peace River Parkland	Peace Dry Mixedwood	Lower Dry Mixedwood
Coniferous Tree Types					
*Picea glauca/Equisetum arve*nse (white spruce/common horsetail) h.t.	13	—	—	Minor	Minor
Picea glauca/Viburnum edule (white spruce/low-bush cranberry) h.t.	37	Incidental	Incidental	Major	Major
Deciduous Tree Types					
Betula papyrifera (white birch) c.t.	14	—	—	Incidental	Incidental
Populus balsamifera/Cornus stolonifera (balsam poplar/red-osier dogwood) c.t.	79	Minor	Minor	Major	Major
Populus balsamifera (balsam poplar) c.t.	22	Minor	Minor	Minor	Minor
Populus tremuloides/Cornus stolonifera (aspen/red-osier dogwood) h.t.	9	Major	Major	—	—
Populus tremuloides/Viburnum edule (aspen/low-bush cranberry) c.t.	83	—	—	Major	Major
Populus tremuloides (aspen) c.t.	4	Minor	Minor	Incidental	Minor
Willow Shrub Types					
*Salix bebbiana/Carex athero*des (beaked willow/awned sedge) h.t.	21	Incidental	Incidental	Minor	Minor

Table 1 (cont.)

Type	Number of Stands	Central Parkland	Peace River Parkland	Peace Dry Mixedwood	Lower Dry Mixedwood
Salix bebbiana/Cornus stolonifera (beaked willow/red-osier dogwood) h.t.	17	Minor	Minor	Incidental	Incidental
Salix bebbiana (beaked willow) c.t.	23	Minor	Minor	Incidental	Incidental
Salix exigua (sandbar willow) c.t.	20	Minor	Minor	Minor	Minor
Salix lutea/Cornus stolonifera (yellow willow/red-osier dogwood) h.t.	20	Minor	Minor	Incidental	Incidental
Salix pedicellaris/Potentilla palustris (bog willow/marsh cinquefoil) h.t.	6	—	—	Incidental	Incidental
Salix petiolaris/Carex atherodes (basket willow/awned sedge) h.t.	16	Minor	Minor	Incidental	Incidental
Salix petiolaris/Cornus stolonifera (basket willow/red-osier dogwood) h.t.	9	Minor	Minor	Incidental	Incidental
Salix petiolaris (basket willow) c.t.	5	Incidental	Incidental	Incidental	Incidental
Salix planifolia/Calamagrostis canadensis (flat-leaved willow/bluejoint) h.t.	6	—	—	Minor	Minor
Salix planifolia/Carex aquatilis (flat-leaved willow/water sedge) h.t.	21	Incidental	Incidental	Major	Major
Salix planifolia/Cornus stolonifera (flat-leaved willow/red-osier dogwood) h.t.	8	—	—	Incidental	Incidental
Salix planifolia (flat-leaved willow) c.t.	5	Incidental	Incidental	Incidental	Incidental
Salix scouleriana (Scouler's willow) c.t.	20	—	—	Incidental	Minor
Non-Willow Shrub Types					
Alnus tenuifolia (river alder) c.t.	4	Incidental	Incidental	Incidental	Incidental
Cornus stolonifera (red-osier dogwood) c.t.	8	Incidental	Incidental	Incidental	Incidental
Elaeagnus commutata (silverberry) c.t.	16	Incidental	Incidental	Incidental	Incidental
Rosa acicularis (prickly rose) c.t.	7	Incidental	Incidental	Incidental	Incidental
Sedge Types					
Carex aquatilis (water sedge) h.t.	21	Incidental	Incidental	Minor	Minor
Carex atherodes (awned sedge) h.t.	38	Major	Major	Major	Major
Carex diandra (two-stamened sedge) h.t.	6	—	—	Incidental	Incidental
Carex utriculata (beaked sedge) h.t.	14	Incidental	Incidental	Minor	Minor
Non-Sedge Types					
Calamagrostis canadensis (bluejoint) h.t.	7	—	—	Minor	Minor
Calamagrostis inexpansa (narrow reed grass) c.t.	5	—	—	Incidental	Incidental
Equisetum fluviatile (swamp horsetail) h.t.	5	—	—	Incidental	Incidental
Glyceria grandis (common tall manna grass) c.t.	6	Incidental	Incidental	Incidental	Incidental
Hordeum jubatum (foxtail barley) c.t.	6	Incidental	Incidental	Incidental	Incidental
Phalaris arundinacea (reed canary grass) h.t.	14	Incidental	Incidental	Incidental	Incidental
Phragmites australis (reed) h.t.	9	—	—	Incidental	Incidental
Poa pratensis (Kentucky bluegrass) c.t.	5	Incidental	Incidental	Incidental	Incidental
Puccinellia nuttalliana (Nuttall's salt-meadow grass) h.t.	13	Incidental	—	—	Incidental
Scirpus acutus (great bulrush) h.t.	17	Minor	Minor	Minor	Minor
Scirpus pungens (three-square bulrush) h.t.	23	Incidental	Incidental	Incidental	Incidental
Sparganium eurycarpum (giant bur-reed) c.t.	3	Incidental	—	—	Incidental
Typha latifolia (common cattail) h.t.	22	Minor	Minor	Minor	Minor

USE OF THE CLASSIFICATION

Sample Size and Distribution

At the beginning of the treatment of each type is given the sample size (number of plots) total, as well as within Alberta (some data was used from similar work done in Saskatchewan). A small map of Alberta is displayed showing the distribution of sample plots within the province. The small map shows major river courses as an aid to location.

Moisture/Nutrient Grid (Edatope) Position

The area on a moisture/nutrient grid that each type is estimated to typically occupy is shown on a small figure adapted from similar edatopes used in ecosite descriptions for Alberta (Beckingham and Archibald 1996). Some of these are quite rough estimations, especially the saline/alkaline types, such as the *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type and the disturbance community types, such as the *Betula papyrifera* (white birch) community type or the *Poa pratensis* (Kentucky bluegrass) community type.

Ecosites of Northern Alberta

Ecosites have been described for much of Alberta, especially on forested lands, including the Dry Mixedwood Natural Subregion (Beckingham and Archibald 1996). Within the framework of the ecosite system of classification, ecosite community types within the Dry Mixedwood Subregion have been classified for forage production and livestock carrying capacity (Willoughby 2000). Table 2 provides a crosswalk between Ecosites of Northern Alberta (Beckingham and Archibald 1996), Range Plant Community Types (Willoughby 2000) and each of the riparian and wetland habitat types and community types described in this document.

Table 2. Ecosites (Beckingham and Archibald 1996) and Range Plant Community Types (Willoughby 2000) that correspond to riparian and wetland habitat types (h.t.) and community types (c.t.)

Riparian/Wetland Habitat Types and Community Types	Ecosites of Northern Alberta (Beckingham and Archibald 1996)	Range Plant Community Types (Willoughby 2000)
	Coniferous Trees Types	
Picea glauca/Equisetum arvense (white spruce/common horsetail) h.t.	f2.1, f3.1	—
Picea glauca/Viburnum edule (white spruce/low-bush cranberry) h.t.	d2.3, d2.4, d2.6, d3.3, e2, e3	DMD5, DMD6, DMD7
	Deciduous Trees Types	
Betula papyrifera (white birch) c.t.	f3	DMA13
Populus balsamifera/Cornus stolonifera (balsam poplar/red-osier dogwood) c.t.	e1, f1	DMC8, DMC9
Populus balsamifera (balsam poplar) c.t.	e1, f1	—
Populus tremuloides/Cornus stolonifera (aspen/red-osier dogwood) h.t.	—	—
Populus tremuloides/Viburnum edule (aspen/low-bush cranberry) c.t.	d1.4, d1.5, d1.7	DMC6, DMC8a, DMC9, DMC11, DMC16
Populus tremuloides (aspen) c.t.	d1.4, d1.5, d1.7	—
	Willow Shrub Types	
Salix bebbiana/Carex atherodes (beaked willow/awned sedge) h.t.	f (lacking trees), k2.2, k2.3	DMA10
Salix bebbiana/Cornus stolonifera (beaked willow/red-osier dogwood) h.t.	e and f (lacking trees), k2	—
Salix bebbiana (beaked willow) c.t.	e and f (lacking trees), k2	DMA14
Salix exigua (sandbar willow) c.t.	e and f (lacking trees)	—
Salix lutea/Cornus stolonifera (yellow willow/red-osier dogwood) h.t.	e and f (lacking trees)	—
Salix pedicellaris/Potentilla palustris (bog willow/marsh cinquefoil) h.t.	k2	DMA10, DMA10a
Salix petiolaris/Carex atherodes (basket willow/awned sedge) h.t.	e and f (lacking trees), k2	DMA10
Salix petiolaris/Cornus stolonifera (basket willow/red-osier dogwood) h.t.	d, e, and f (lacking trees)	—

Table 2 (cont.)

Riparian/Wetland Habitat Types and Community Types	Ecosites of Northern Alberta (Beckingham and Archibald 1996)	Range Plant Community Types (Willoughby 2000)
Salix petiolaris (basket willow) c.t.	d, e, and f (lacking trees), k2	DMA14
Salix planifolia/Calamagrostis canadensis (flat-leaved willow/bluejoint) h.t.	k2	DMA10a
Salix planifolia/Carex aquatilis (flat-leaved willow/water sedge) h.t.	k2	DMA10
Salix planifolia/Cornus stolonifera (flat-leaved willow/red-osier dogwood) h.t.	e (lacking trees), k2	—
Salix planifolia (flat-leaved willow) c.t.	e (lacking trees), k2	DMA14
Salix scouleriana (Scouler's willow) c.t.	e and f (lacking trees)	—
	Non-Willow Shrub Types	
Alnus tenuifolia (river alder) c.t.	e (lacking trees)	—
Cornus stolonifera (red-osier dogwood) c.t.	e (lacking trees)	—
Elaeagnus commutata (silverberry) c.t.	—	—
Rosa acicularis (prickly rose) c.t.	d, e, and f (lacking trees)	—
	Sedge Types	
Carex aquatilis (water sedge) h.t.	k3	DMA1
Carex atherodes (awned sedge) h.t.	k3	DMA1
Carex diandra (two-stamened sedge) h.t.	k3	DMA1
Carex utriculata (beaked sedge) h.t.	k3	DMA1
	Non-Sedge Types	
Calamagrostis canadensis (bluejoint) h.t.	k3	DMA2
Calamagrostis inexpansa (narrow reed grass) c.t.	k3	—
Equisetum fluviatile (swamp horsetail) h.t.	—	—
Glyceria grandis (common tall manna grass) c.t.	—	—
Hordeum jubatum (foxtail barley) c.t.	—	—
Phalaris arundinacea (reed canary grass) h.t.	l	—
Phragmites australis (reed) h.t.	l	—
Poa pratensis (Kentucky bluegrass) c.t.	e (lacking trees), k3	DMA9
Puccinellia nuttalliana (Nuttall's salt-meadow grass) h.t.	—	—
Scirpus acutus (great bulrush) h.t.	l	DMA1a
Scirpus pungens (three-square bulrush) h.t.	—	—
Sparganium eurycarpum (giant bur-reed) c.t.	—	—
Typha latifolia (common cattail) h.t.	l	DMA1a

Vegetation Information

Community Composition Tables—Within each habitat type or community type description is a table of species composition of the community. Some types have two tables to separate late seral/climax (and undisturbed) stands from early to mid-seral, and/or disturbed, stands. These tables list the species composing the type. The list is separated into groups by lifeform (trees, shrubs, graminoids, forbs, and ferns and allies). Species are listed in alphabetical order within each lifeform group.

For each species recorded on any stand in the sample set is given this set of statistics in these tables:

- **Average canopy cover**—the mean percent canopy cover recorded for that species ***on those stands in the sample set having the species present***.
- **Range of canopy cover**—the minimum to maximum canopy cover recorded across all stands in the sample set.
- **Constancy**—the frequency of occurrence within the sample set, expressed as a percentage of stands in the sample set having the species present.
- **Prominence index**—an artificial index of species relative importance. Importance of a species is implied by strength of presence within the group of sampled stands, expressed as a single numerical value convenient for comparing a species

among its neighbours in the group. The method for calculating the prominence value follows Beckingham and others (1996a, 1996b, 1996c) and Archibald and others (1996). It is a simple mathematical normalization of the result from combining the average percent canopy cover of a species (in stands having it present) with the percent constancy (frequency of occurrence) in stands sampled. The formula expression is:

Prominence Index = square root of (percent canopy cover X percent constancy)

Mueller-Dombois and Ellenberg (1974) describe the utility of, and methods for calculating, various forms of importance value for ranking species in terms of their relative dominance, density, and frequency of occurrence.

Successional Information
For each type described, we provide a successional pathway diagram that shows the most common vegetation stages typically followed by seral progression on sites of the type, as well as a discussion of the effects of disturbance and the likely indicators of the different kinds of disturbance. Since stands were sampled in a wide range of seral stages of most types, we provide separate species composition tables for late seral/climax stage stands and for early seral/disturbed stands.

Successional Relationships—The process of change by which biotic communities replace each other and by which the physical environment becomes altered over time is called ***succession*** (Kimmins 1987). Vegetation community development is of two types: ***primary succession*** and ***secondary succession.*** Development on newly created soil surfaces, such as on a silted-in lake bottom, or a newly deposited alluvial bar, is ***primary succession.*** This slow process may require many centuries to stabilise into a climax community. ***Secondary succession*** occurs on a site after a disturbance (such as a fire) alters or destroys an established vegetation cover, but does not destroy the soil. Regeneration and regrowth usually happen quickly from roots or seeds remaining in the soil. In some severe disturbances (such as removal of all the soil by erosion or an extremely hot fire that consumes all organics in the substrate) the site may be set back to primary succession.

Secondary succession may occur toward or away from the climax (or potential) community. For example, the establishment of *Cornus stolonifera* (red-osier dogwood) and *Viburnum edule* (low-bush cranberry) under an overstory of *Picea glauca* (white spruce) and *Populus* (poplars) would represent successional progression toward the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type; whereas the failure of the tall shrubs to establish, and a resulting domination of the understory by *Poa pratensis* (Kentucky bluegrass) due to grazing influences, would represent successional regression away from the 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 disturbance-induced plant communities are named and described as ***community types*** in this document. Descriptions of seral stages and successional relationships are included in the descriptions of each habitat type.

On upland sites, ecologists and land managers have normally had only to deal with secondary succession. In contrast, on many riparian and wetland sites, primary succession is just as important as secondary succession in accounting for the mosaic of communities found. One of the most important characteristics of riparian and wetland areas is their dynamic nature. Not only does vegetation on a site change with time and disturbance, but potential of the site itself may also be altered by changes to the hydrology or soil. Thick alluvial depositions can change availability of water on a floodplain. Rapid accumulations of organic materials can change a fen, bog, or wet meadow, altering its water holding capacity and nutrient availability. Site potential may change when humans lower the water table by pumping or draining. Long-term flooding due to human or beaver activity will also change site potential on a time scale important to land management considerations. Any case where the site has changed significantly will in turn mean a different potential vegetation community (and habitat type). These changes could be referred to as site succession.

Successional status of *Picea glauca* (white spruce) and *Populus tremuloides* (aspen)—It is generally accepted that, while much of the Boreal Forest Natural Region is comprised of sites with climax potential for vegetation dominated by a *Picea glauca* (white spruce) canopy, relatively little of this area has historically been allowed to reach this potential due to a high frequency of wildfire. Fire suppression efforts over the last century have promoted the amount of *Picea* (spruce) cover, but stands remain relatively young, with few reaching 100 years of age (Dix and Swan, 1971). In this study, we have classified some sites as one of the *Picea glauca* (white spruce) habitat types even though it may presently be still dominated by a deciduous tree cover, with only a few young *Picea* (spruce) in the stand to confirm the site potential.

Sites dominated by *Populus tremuloides* (aspen) have been divided into two sets with different potential, depending on natural region. In the Parkland Natural Region, where there is generally no *Picea glauca* (white spruce) forest cover, we have identified *Populus tremuloides* (aspen) as the status of climax vegetation. Exceptions are along the riverine corridors to where the *Picea* (spruce) is limited. In the Dry Mixedwood Natural Subregion, the *Populus tremuloides* (aspen) is seral to the *Picea* (spruce).

Vegetation Species Response to Grazing Disturbance—Plant species responses to grazing disturbance (whether they may increase or decrease) are in the literature (Tannas 1997, Beckingham 1991, Thorpe 1996) Whereas these works generally apply to uplands as well as wetlands, many species respond differently in different settings. Furthermore, many wetland species have not been adequately studied. Analysis of the data collected in this study does reveal a few specific grazing responses within riparian/wetland areas. Information about species response to grazing disturbance related to each habitat type and community type is presented in the Successional Information section of each type discussion.

Soils Information

Detailed soil data was not collected for this study. A brief, generalized discussion of soils is provided for each type. While soil conditions are an important determinant of vegetation potential on a site, the availability of water is the defining factor within a given region of what will grow on a site riparian or wetland site. For example, the topographic position of a site can provide the necessary water for wetland vegetation, even in coarse textured substrates, that on another topographic position would drain too quickly.

Management Information

The habitat type is the basic unit of classifying land sites based on vegetation potential. This kind of classification assumes a theoretical end point community, which is capable of sustaining itself on the site indefinitely. This becomes problematic on riparian sites that experience morphologic change before the vegetation can pass through its natural sequence of successional stages. However, the habitat type system is useful for management purposes with the realization that the majority of sites at any given moment are in some earlier successional stage, and that we must also describe the more important of these earlier stages (described in this work as community types).

Some of the practical applications of habitat type classification are in predicting forage production for livestock and wildlife, wildlife habitat values, land inventory, land type mapping, species selection for vegetation restoration projects, development of best management practice guidelines, estimating potential for forage production after fire, planning soil management, predicting impacts of recreational uses, selecting natural areas for preservation, and predicting successional pathways after disturbance. In addition, habitat typing offers a basis of comparison and evaluation in design and implementation of field experiments in ecology or applied natural resource disciplines.

Other classification systems are being used in Alberta to categorize land sites for specific purposes in certain regions. For example: an ecological classification based on site moisture and nutrient regime is used for management and understanding of forested lands (i.e., Beckingham and Archibald 1996), and a range site - soils approach (adapted from the USDA Natural Resources Conservation Service Ecological Site Description [2002]) is under development for the prairie rangelands of southern Alberta. These different approaches reflect differences in management purpose as well as in ecological realities. As Kimmins (1987) points out, vegetation alone may not be adequate in all cases to distinguish differences among sites “where the biota is less diverse, where individual species tend to have broader ranges and be less specific in their environmental tolerances, ...” (e.g., the boreal forest). However, especially in complex riparian systems where river dynamics create a diverse mix of soil textures and moisture regimes within close proximity, differences in the vegetation community do reflect subsurface conditions. It is then up to us to decipher those differences.

There are typically three misconceptions about the use of the habitat type classification system: 1) an abundance of climax vegetation will be found on the landscape, 2) natural resource managers need to manage solely for climax vegetation, and 3) use of a habitat type classification system on a site requires climax or near-climax vegetation to be present.

For the first two misconceptions, the opposite is actually true. In the first case, a very high percentage of our landscape is responding to some degree of disturbance resulting in various seral stages of vegetation succession. In the second case, management strategies often favor seral species, regardless of the habitat type of a site. In the third misconception, comparing the relative reproductive success of the present plant species with known successional patterns generally allows accurate identification of the habitat type. In general, succession is more rapid for undergrowth species, thereby allowing insight into the habitat type identity on the site. Where stands are 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 similar sites can often help in correct habitat type identification.

Summary

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 of the information. Understanding the information available in this document will increase over time with usage. Some examples of the uses of this information are discussed here.

Land management plans sometimes call for attaining certain vegetation communities in riparian and wetland areas. 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 bebbiana* (beaked 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 bebbiana* (beaked willow) from 3 percent to 20 percent on the stream reach within 10 years. The canopy cover tables can be used to write species lists for site restoration projects. For example, on a gravel-mining site, there may be no vegetation remaining in the riparian or wetland area. 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 shading of a stream for fish habitat, the tables will provide a list of 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 community type described.

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

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

KEY TO RIPARIAN AND WETLAND SITES OF ALBERTA'S PARKLAND NATURAL REGION AND DRY MIXEDWOOD NATURAL SUBREGION

Some Areas Not Included in the Study
Within the study area, some wetland and riparian areas were not included, or have been altered to such an extent from their natural community that they can no longer appropriate to describe them in terms of their natural vegetation. These are:

Bog Wetlands—Within the Dry Mixedwood Subregion of the Boreal Natural Region are some areas of bog wetland with communities dominated by species such as *Picea mariana* (black spruce) and *Larix laricina* (tamarack). Sites with these communities were not sampled for this study.

Tame Pastures—Many areas within stream riparian zones, in close proximity of lakeshores, and in other lentic wetland areas have high potential for agricultural development. One such kind of development is the clearing of the natural wild vegetation and replacement of it with tame pasture species. Many such sites will key out to one of the habitat types or community types described in this document because the wild, natural vegetation will often re-establish presence by resprouting from remaining root stocks or invasion from adjoining sites. A site with more than 50 percent canopy cover of introduced forage species, such as *Bromus inermis* (awnless brome), *Festuca rubra* (creeping red fescue), *Agropyron repens* (quack grass), *Phleum pratense* (timothy), *Poa pratensis* (Kentucky bluegrass), *Medicago satvia* (alfalfa), and *Trifolium* species (clover). Tame Pasture sites may be assessed for functional health by using the Tame Pasture Health Assessment (Adams and Ehlert 2003).

Cropland—Some sites that would support riparian/wetland natural communities have been ploughed for crop production. These cannot be keyed to natural habitat type or community type unless the natural community has re-established to a degree that the key can be followed.

Some Recently Exposed Lakeshores and Recently Deposited River Bars—These sites were not omitted from the study, but in many cases they lack sufficiently developed vegetation to be keyed to any described habitat type or community type. They may be so newly exposed or deposited that they lack any plant growth; or they may simply be vegetated with very early pioneer species. Such sites may drop through the key into the "Unclassified Wetland Type."

Background
1. This key is written for Central and Northern Alberta east of the Rocky Mountains. Areas included in the study are the Parkland Natural Region and the Dry Mixedwood Natural Subregion (Figure 1). Within these areas certain bog-type wetlands with communities dominated by species such as *Picea mariana* (black spruce) and *Larix laricina* (tamarack) were excluded from the study.

2. The key identifies first the trees, then the shrubs, and last the herbaceous types. Within each of these major growth form categories, habitat types generally are identified before community types and wetter before drier types.

3. The key is designed to identify site potential; if that is not possible due to disturbance, either natural (e.g., recently deposited alluvial bars or fire) and/or human-caused (e.g., livestock overgrazing or the clearing of the bush), the key will then identify the community type occupying the site. ***Note: This document describes several seral plant communities (community types) that may occupy significant area and remain stable for time periods important for land management consideration.*** Possible potential(s) for such sites are listed in the Successional Information section of the community type description.

4. On severely degraded sites, the user should look at similar, less disturbed, positions on the landscape for indications of what could be there. Read the text of the type description before making a final determination.

5. Types were sampled in stands representing a range of vegetative development from early seral to climax stages, and across a broad range of disturbance. Type descriptions reflect these ranges.

Instructions
1. Accurately identify and record the canopy cover for all indicator species. The indicator species are those species used in the key.

2. Assure that the plot being classified is representative of the stand you are dealing with as a whole. If not, move the plot. Environmental or vegetation uniformity is a primary consideration in plot selection. The scale at which one is operating must also be considered when selecting stands to classify.

3. Identify potential lifeform using the ***Lifeform Group Key.*** Generally, a tree species is considered successfully reproducing if a density of 10 or more individuals per acre (25/ha) occupies or will occupy the site.

4. Within the correct lifeform group, determine the ***Habitat Type or Community Type*** by following the key literally. ***ALL*** conditions stipulated for each couplet must be satisfied for correct determination. The first set of conditions that yield a result from the key should supply the correct classification.

5. For sites where the vegetation is obviously depauperate (unusually sparse) because of high grazing or browsing pressure, dense shading, or duff accumulations, ***adjust the key criteria downward*** to reflect the reduced canopy cover. For example, when the key refers to a species with at least 5 percent canopy cover, the critical amount would be reduced to 1 percent. Comparison to the nearest non-depauperate, similar site may assist in the correct determination of type on such altered sites.

   In addition, when classifying a site, be aware of and avoid ***microsites. Microsites*** are small areas that are atypical of the stand as a whole. Examples include windthrow pockets filled with colluvium/alluvium, raised hummocks of *Salix* (willows) growing on old beaver dams, or small seep areas.

6. In sites that are heavily impacted by grazing or browsing pressures, look carefully for ***ANY*** shrub or tree growth or remnants (stumps). In extreme cases, the potential natural community (such as a willow) may be present only as dwarfed, widely scattered individuals. In this case, again adjust the key criteria downward to reflect the reduced canopy cover. Once again, comparison to the nearest non-grazed or non-browsed community occurring on a similar site may assist in correct determination of the type.

7. Habitat type or community type can generally be projected for a site in an early, or disturbed, seral stage by examining the closest location(s) having the same site conditions (soils, hydrologic characteristics, position on the landscape, etc.).

8. ***CAUTION!*** The potential of a site may change if the soil and/or water characteristics are changed. For example, a rather sudden change in site hydrology can occur with the drainage of a beaver pond, causing vegetation potential to change from open water to willows and sedges. Slower and subtler hydrologic change 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.

9. ***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 represent sampled sites and personal observations, but may not represent all sites on the landscape on which the type can occur.***

KEY TO LIFEFORM GROUPS

1. Coniferous trees present ***AND*** successfully reproducing (10 or more trees per acre) ***AND NOT*** restricted to microsites. (***NOTE:*** Sites dominated by *Picea mariana* [black spruce], *Larix laricina* [tamarack], or *Pinus banksiana* [jack pine] are not included in this key.)
   ..... **Key to Coniferous Tree Types (p. 23)**

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

   2. Deciduous trees present ***AND*** successfully reproducing (10 or more trees per acre) ***AND NOT*** restricted to microsites.....**Key to Deciduous Tree Types (p. 23)**

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

3. Shrubs with a combined canopy cover of at least 10 percent. .....**Key to Shrub Types (p. 24)**

3. Shrubs with a combined canopy cover of less than 10 percent; herbaceous species with a combined canopy cover of at least 15 percent, or emergent herbaceous species with at least 5 percent canopy cover.....
   .....**Key to Herbaceous Types (p. 27)**

KEY TO CONIFEROUS TREE TYPES

Coniferous trees present ***AND*** successfully reproducing (10 or more trees per acre) ***AND NOT*** restricted to microsites.

1. *Picea glauca* (white spruce) present and successfully reproducing. **2**

1. *Picea glauca* (white spruce) absent, or if present, not successfully reproducing. **4**

    2. *Equisetum arvense* (common horsetail) or *Equisetum sylvaticum* (woodland horsetail), individually or in combination, with at least 25 percent canopy cover. ..... ***Picea glauca/Equisetum arvense*** **(white spruce/common horsetail) Habitat Type (p. 30)**

    2. *Equisetum arvense* (common horsetail) or *Equisetum sylvaticum* (woodland horsetail), individually or in combination, with less than 25 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. ..... ***Picea glauca/Viburnum edule*** **(white spruce/low-bush cranberry) Habitat Type (p. 36)**

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

        In this case, where the site does not fit any other type in the 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, and wetland hydrology..... **Upland Site**

KEY TO DECIDUOUS TREE TYPES

Deciduous trees present and successfully reproducing (10 or more trees per acre) ***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. **7**

    2. The stand is located within the Parkland Natural Region (Figure 1) ***AND NOT*** located within the valleys of either the Battle River or the North Saskatchewan River. **3**

    2. The stand is located within the Boreal or Foothills Natural Regions (Figure 1) ***OR*** is located within the valleys of either the Battle River or the North Saskatchewan River. **5**

3. *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, ***OR*** *Populus balsamifera* (balsam poplar) with at least 15 percent canopy cover. ..... ***Populus tremuloides/Cornus stolonifera*** **(aspen/red-osier dogwood) Habitat Type (p. 73)**

3. *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, ***AND*** *Populus balsamifera* (balsam poplar) with less than 15 percent canopy cover. **4**

    4. Total shrub cover less than 25 percent. ..... ***Populus tremuloides*** **(aspen) Community Type (p. 94)**

    4. Total shrub species with 25 percent, or more, combined canopy cover. ..... **Upland Site**

5. *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. 82)**

5. *Viburnum edule* (low-bush cranberry), *Cornus stolonifera* (red-osier dogwood), or *Salix* species (willows), individually or in combination, with less than 1 percent canopy cover, ***AND*** *Populus balsamifera* (balsam poplar) with less than 15 percent canopy cover. **6**

6. Total shrub cover less than 25 percent. ..... ***Populus tremuloides*** **(aspen) Community Type (p. 94)**

6. Total shrub species with 25 percent, or more, combined canopy cover. ..... **Upland Site**

7. *Populus balsamifera* (balsam poplar) with a greater canopy cover than *Betula papyrifera* (white birch). **8**

7. *Betula papyrifera* (white birch) with greater canopy cover than *Populus balsamifera* (balsam poplar). .... **Betula papyrifera (white birch) Community Type (p. 47)**

8. Shrubs 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. 53)**

8. Shrubs 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. ..... ***Populus balsamifera*** **(balsam poplar) Community Type (p. 65)**

KEY TO SHRUB TYPES

Shrubs with a combined canopy cover of at least 10 percent.

1. *Salix* species (willows) with at least 5 percent canopy cover. ..... **Willow Shrub Key (p. 24)**

1. *Salix* species (willows) with less than 5 percent canopy cover. ..... **Non-Willow Shrub Key (p. 26)**

KEY TO WILLOW SHRUB TYPES

1. *Salix bebbiana* (beaked willow) with at least 5 percent canopy cover ***AND WITH*** greater canopy cover than *S. lutea* (yellow willow), *S. planifolia* (flat-leaved willow), or *S. petiolaris* (basket willow). **2**

1. *Salix bebbiana* (beaked willow) with less than 5 percent canopy cover ***OR WITHOUT*** greater canopy cover than *S. lutea* (yellow willow), *S. planifolia* (flat-leaved willow), or *S. petiolaris* (basket willow)..... **4**

2. *Carex atherodes* (awned sedge), *C. utriculata* (beaked sedge), or *C. aquatilis* (water sedge), individually or in combination, with at least 10 percent canopy cover. .... ***Salix bebbiana/Carex atherodes*** **(beaked willow/awned sedge) Habitat Type (p. 101)**

2. *Carex atherodes* (awned sedge), *C. utriculata* (beaked sedge), or *C. aquatilis* (water sedge), individually or in combination, with less than 10 percent canopy cover. **3**

3. *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover. .... ***Salix bebbiana/Cornus stolonifera*** **(beaked willow/red-osier dogwood) Habitat Type (p. 110)**

3. *Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover. .... ***Salix bebbiana*** **(beaked willow) Community Type (p. 119)**

4. *Salix lutea* (yellow willow) with at least 5 percent canopy cover ***AND WITH*** greater canopy cover than *S. bebbiana* (beaked willow), *S. planifolia* (flat-leaved willow), or *S. petiolaris* (basket willow). ..... ***Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) Habitat Type (p. 135)**

4. *Salix lutea* (yellow willow) with less than 5 percent canopy cover ***OR WITHOUT*** greater canopy cover than *S. scouleriana* (Scouler's willow), *S. bebbiana* (beaked willow), *S. planifolia* (flat-leaved willow), or *S. petiolaris* (basket willow). **5**

5. *Salix planifolia* (flat-leaved willow) with at least 5 percent canopy cover ***AND WITH*** greater canopy cover than *S. bebbiana* (beaked willow), *S. lutea* (yellow willow), or *S. petiolaris* (basket willow). **6**

5. *Salix planifolia* (flat-leaved willow) with less than 5 percent canopy cover ***OR WITHOUT*** greater canopy cover than *S. bebbiana* (beaked willow), *S. lutea* (yellow willow), or *S. petiolaris* (basket willow). **9**

6. *Carex aquatilis* (water sedge), *C. atherodes* (awned sedge), or *C. utriculata* (beaked sedge), individually or in combination, with at least 10 percent canopy cover. ..... ***Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) Habitat Type (p. 168)**

6. *Carex aquatilis* (water sedge), *C. atherodes* (awned sedge), or *C. utriculata* (beaked sedge), individually or in combination, with less than 10 percent canopy cover. **7**

7. *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover. ..... ***Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) Habitat Type (p. 176**

7. *Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover. **8**

8. *Calamagrostis canadensis* (bluejoint) with at least 10 percent canopy cover. ..... ***Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) Habitat Type (p. 163)**

8. *Calamagrostis canadensis* (bluejoint) with less than 10 percent canopy cover. ..... ***Salix planifolia* (flat-leaved willow) Community Type (p. 183)**

9. *Salix petiolaris* (basket willow) with at least 5 percent canopy cover ***AND WITH*** greater canopy cover than *S. bebbiana* (beaked willow), *S. lutea* (yellow willow), or *S. planifolia* (flat-leaved willow). **10**

9. *Salix petiolaris* (basket willow) with less than 5 percent canopy cover ***OR WITHOUT*** greater canopy cover than *S. bebbiana* (beaked willow), *S. lutea* (yellow willow), or *S. planifolia* (flat-leaved willow). **12**

10. *Carex atherodes* (awned sedge), *C. utriculata* (beaked sedge), or *C. aquatilis* (water sedge), individually or in combination, with at least 1 percent canopy cover. ..... ***Salix petiolaris/Carex atherodes* (basket willow/awned sedge) Habitat Type (p. 146)**

10. *Carex atherodes* (awned sedge), *C. utriculata* (beaked sedge), or *C. aquatilis* (water sedge), individually or in combination, with less than 1 percent canopy cover. **11**

11. *Cornus stolonifera* (red-osier dogwood) or *Salix* (willow) species other than *Salix petiolaris* (basket willow), individually or in combination, with at least 1 percent canopy cover. ..... ***Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) Habitat Type (p. 152)**

11. *Cornus stolonifera* (red-osier dogwood) and *Salix* (willow) species other than *Salix petiolaris* (basket willow), individually or in combination, with less than 1 percent canopy cover. ..... ***Salix petiolaris* (basket willow) Community Type (p. 158)**

12. *Salix pedicellaris* (bog willow) with greater canopy cover than any other individual willow species. ..... ***Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) Habitat Type (p. 142)**

12. Individual willow species, not mentioned earlier in the key, with greater canopy cover than *Salix pedicellaris* (bog willow). **13**

13. 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. 26)**

13. Individual ***WILLOW*** shrub species, not mentioned earlier in the key, with greater canopy cover than any individual ***NON-WILLOW*** shrub species. **14**

    14. *Salix scouleriana* (Scouler's willow) with greater canopy cover than any other individual willow species..... ..... ***Salix scouleriana*** **(Scouler's willow) Community Type (p. 190)**

    14. Individual willow species, not mentioned earlier in the key, with greater canopy cover than *Salix scouleriana* (Scouler's willow). **15**

15. *Salix exigua* (sandbar willow) with greater canopy cover than any individual willow species not mentioned earlier in the key. ..... ***Salix exigua*** **(sandbar willow) Community Type (p. 128)**

15. Other individual willow species, not mentioned earlier in the key, with greater canopy cover than *Salix exigua* (sandbar willow). **16**

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

        In this case, where the site does not fit any other type in the key, name the site in terms of a dominance type (cover type), which is the species with the greatest canopy cover over 25 percent in the overstory, or tallest vegetation layer.

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

KEY TO NON-WILLOW SHRUB TYPES

Shrubs with a combined canopy cover of at least 10 percent. *Salix* (willow) species with less than 5 percent combined canopy cover.

1. *Alnus tenuifolia* (river alder) with at least 15 percent canopy cover ***AND WITH*** the greatest cover in the tallest layer..... ..... ***Alnus tenuifolia*** **(river alder) Community Type (p. 196)**

1. *Alnus tenuifolia* (river alder) with less than 15 percent canopy cover ***OR WITHOUT*** the greatest cover in the tallest layer. **2**

    2. *Cornus stolonifera* (red-osier dogwood) with at least 15 percent canopy cover ***AND WITH*** the greatest cover in the tallest layer. ..... ***Cornus stolonifera*** **(red-osier dogwood) Community Type (p. 201)**

    2. *Cornus stolonifera* (red-osier dogwood) with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **3**

3. *Elaeagnus commutata* (silverberry) with at least 15 percent canopy cover ***AND WITH*** the greatest canopy cover in the tallest layer. ..... ***Elaeagnus commutata*** **(silverberry) Community Type (p. 206)**

3. *Elaeagnus commutata* (silverberry) with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **4**

    4. *Rosa acicularis* (prickly rose) or *R. woodsii* (common wild rose), individually or in combination, with at least 15 percent canopy cover ***AND WITH*** the greatest cover in the tallest layer..... ..... ***Rosa acicularis*** **(prickly rose) Community Type (p. 212)**

    4. *Rosa acicularis* (prickly rose) or *R. woodsii* (common wild rose), individually or in combination, with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer..... **5**

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

   In this case, where the site does not fit any other type in the key, name the site in terms of a dominance type (cover type), which is 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, and wetland hydrology. ..... **Upland Site**

KEY TO HERBACEOUS TYPES

Herbaceous species present with a combined canopy cover of at least 15 percent, or emergent herbaceous species with at least 5 percent canopy cover.

1. *Carex* species (sedges) with a combined canopy cover of at least 25 percent. ..... **Sedge Key (p. 27)**

1. *Carex* species (sedges) without a combined canopy cover of at least 25 percent..... **Non-Sedge Key (p. 27)**

KEY TO SEDGE TYPES

1. *Carex atherodes* (awned sedge) with greater canopy cover than all other sedge species. ..... ***Carex atherodes*** **(awned sedge) Habitat Type (p. 223)**

1. *Carex atherodes* (awned sedge) with less canopy cover than other sedge species..... **2**

   2. *Carex utriculata* (beaked sedge) with greater canopy cover than all other sedge species. ..... ***Carex utriculata*** **(beaked sedge) Habitat Type (p. 233)**

   2. *Carex utriculata* (beaked sedge) with less canopy cover than other sedge species. **3**

3. *Carex aquatilis* (water sedge) with greater canopy cover than all other sedge species. ..... ***Carex aquatilis*** **(water sedge) Habitat Type (p. 217)**

3. *Carex aquatilis* (water sedge) with less canopy cover than other sedge species. **4**

   4. *Carex diandra* (two-stamened sedge) with greater canopy cover than all other sedge species. ..... ***Carex diandra*** **(two-stamened sedge) Habitat Type (p. 229)**

   4. *Carex diandra* (two-stamened sedge) with less canopy cover than other sedge species..... **5**

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

   In this case, where the site does not fit any other type in the key, name the site in terms of a dominance type (cover type), which is the species with 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, and wetland hydrology. ..... **Upland Site**

KEY TO NON-SEDGE TYPES

1. *Typha latifolia* (common cattail) with at least 25 percent canopy cover. ..... ***Typha latifolia*** **(common cattail) Habitat Type (p. 289)**

1. *Typha latifolia* (common cattail) 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 15 percent canopy cover. ..... ***Scirpus acutus*** **(great bulrush) Habitat Type (p. 278)**

    2. *Scirpus acutus* (great bulrush) or *S. validus* (common great bulrush), individually or in combination, with less than 15 percent canopy cover. **3**

3. *Equisetum fluviatile* (swamp horsetail) with at least 25 percent canopy cover. ..... ***Equisetum fluviatile*** **(swamp horsetail) Habitat Type (p. 248)**

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

    4. *Calamagrostis canadensis* (bluejoint) with at least 25 percent canopy cover. ..... ***Calamagrostis canadensis*** **(bluejoint) Habitat Type (p. 239)**

    4. *Calamagrostis canadensis* (bluejoint) with less than 25 percent canopy cover. **5**

5. *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) with at least 15 percent canopy cover. ..... ***Puccinellia nuttalliana*** **(Nuttall's salt-meadow grass) Habitat Type (p. 274)**

5. *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) with less than 15 percent canopy cover. **6**

    6. *Phalaris arundinacea* (reed canary grass) with at least 25 percent canopy cover. ..... ***Phalaris arundinacea*** **(reed canary grass) Habitat Type (p. 260)**

    6. *Phalaris arundinacea* (reed canary grass) with less than 25 percent canopy cover. **7**

7. *Phragmites australis* (reed) with at least 25 percent canopy cover. ..... ***Phragmites australis*** **(reed) Habitat Type (p. 265)**

7. *Phragmites australis* (reed) with less than 25 percent canopy cover. **8**

    8. *Scirpus pungens* (three square bulrush) with at least 15 percent canopy cover. ..... ***Scirpus pungens*** **(three square bulrush) Habitat Type (p. 282)**

    8. *Scirpus pungens* (three square bulrush) with less than 15 percent canopy cover. ..... **READ THE FOLLOWING PARAGRAPH**

The following herbaceous communities represent seral or human-caused disturbance communities. Before you use this portion of the key, do the following:

A. Carefully examine the stand and determine if ***ANY*** tree or shrub species are present. If so, go back through the tree or shrub key and reduce all canopy coverages to "present."
B. If ***NO*** tree or shrub species are present, then go back through the herbaceous key and reduce all canopy coverages to 5 percent; ignore the presence of the biennial forbs *Melilotus alba* (white sweet-clover) and *Melilotus officinalis* (yellow sweet-clover).
C. If the stand still does not key out, then use the following key to ***EITHER*** major seral or disturbance herbaceous community types ***OR*** unclassified riparian or wetland sites.

1. *Sparganium eurycarpum* (giant bur-reed) or *S. angustifolium* (narrow-leaved bur-reed), individually or in combination, with a greater canopy cover than any other individual herbaceous species. ..... ***Sparganium eurycarpum* (giant bur-reed) Community Type (p. 286)**

1. Other individual herbaceous species with a greater canopy cover than the combination of *Sparganium eurycarpum* (giant bur-reed) and *S. angustifolium* (narrow-leaved bur-reed). **2**

    2. *Glyceria grandis* (common tall manna grass) with a greater canopy cover than any other individual herbaceous species. ..... ***Glyceria grandis* (common tall manna grass) Community Type (p. 252)**

    2. Other individual herbaceous species with a greater canopy cover than *Glyceria grandis* (common tall manna grass). **3**

3. *Calamagrostis inexpansa* (northern reed grass) or *C. stricta* (narrow reed grass), individually or in combination, with a greater canopy cover than any other individual herbaceous species. ..... ***Calamagrostis inexpansa* (northern reed grass) Community Type (p. 244)**

3. Other individual herbaceous species with a greater canopy cover than the combination of *Calamagrostis inexpansa* (northern reed grass) and *C. stricta* (narrow reed grass). **4**

    4. *Hordeum jubatum* (foxtail barley) with a greater canopy cover than any other individual herbaceous species..... ***Hordeum jubatum* (foxtail barley) Community Type (p. 256)**

    4. Other individual herbaceous species with a greater canopy cover than *Hordeum jubatum* (foxtail barley). **5**

5. *Poa pratensis* (Kentucky bluegrass) with a greater canopy cover than any other individual herbaceous species. ..... ***Poa pratensis* (Kentucky bluegrass) Community Type (p. 269)**

5. Other individual herbaceous species with a greater canopy cover than *Poa pratensis* (Kentucky bluegrass). **6**

    6. Site with at least one of the following wetland attributes present: hydric soils, hydrophytic vegetation, and wetland hydrology..... **Unclassified Riparian or Wetland Site**

    In this case, where the site does not fit any other type in the key, name the site in terms of a dominance type (cover type), which is the species with the greatest canopy cover over 25 percent in the overstory, or tallest vegetation layer.

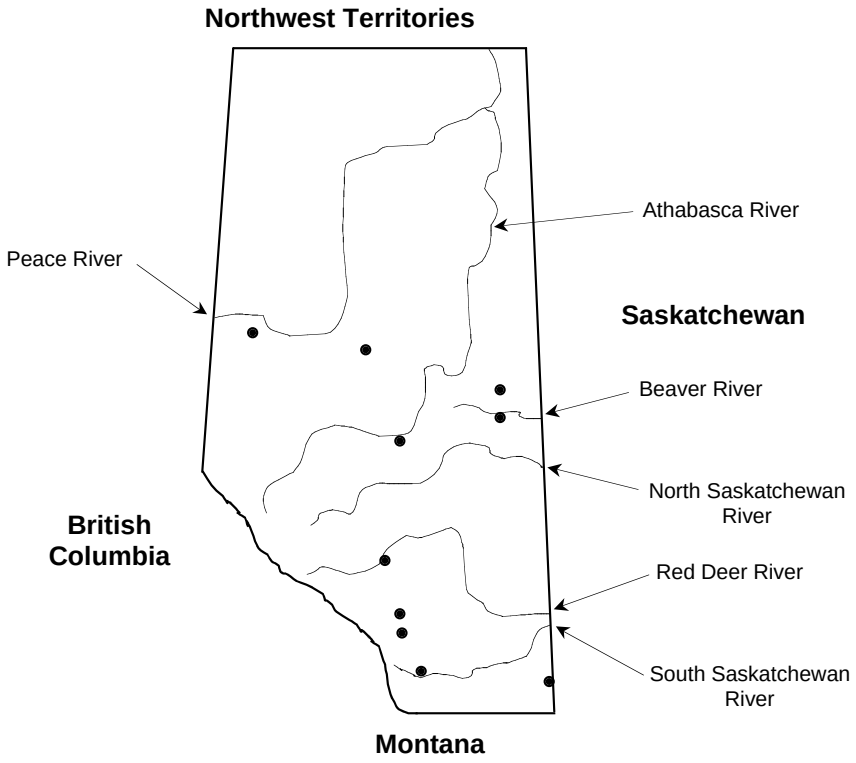
    6. Site without at least one of the following wetland attributes present: hydric soils, hydrophytic vegetation, and wetland hydrology. ..... **Upland Site**

CONIFEROUS TREE TYPES

Picea glauca/Equisetum arvense Habitat Type (White Spruce/Common Horsetail Habitat Type)

PICEGLA/EQUIARV
Number of Stands Sampled = 13
Number of Stands Sampled in Alberta = 13

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type is a minor type at mid to lower elevations in the Dry Mixedwood Subregion. This 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). 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.

Among the dataset are typical stands sampled on the Little Red Deer River near Bowden, the Beaver River north of St. Paul, Winagami Lake near High Prairie, Moonshine Lake near Spirit River, and the Peace River near Ft. Vermilion.

VEGETATION

In later seral stage communities *Picea glauca* (white spruce) typically forms a closed canopy, but also present in most stands are some deciduous trees, especially decadent individuals of *Populus balsamifera* (balsam poplar) remaining from an earlier seral stage. Shrub species coverage is typically low. The understory canopy is dominated by *Equisetum arvense* (common horsetail). Micro-relief caused by windthrow root crown pits and mounds can sometimes be extreme, and helps to account for the great number of forb species with low canopy cover amounts and the mixture of upland and wetland species (Table 3).

Table 3. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 13 stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Abies balsamea (balsam fir)	1	0-1	8	3
Betula papyrifera (white birch)	12	0-40	31	19
Picea glauca (white spruce)	62	20-90	100	79
Populus balsamifera (balsam poplar)	3	0-10	54	13
Populus tremuloides (aspen)	4	0-10	31	11
Shrubs				
Alnus tenuifolia (river alder)	7	0-10	31	15
Amelanchier alnifolia (Saskatoon)	2	0-3	31	6
Betula glandulosa (bog birch)	1	0-1	8	3
Cornus canadensis (bunchberry)	4	0-10	69	14
Cornus stolonifera (red-osier dogwood)	3	0-10	54	13
Ledum groenlandicum (common Labrador tea)	1	0-1	15	4
Linnaea borealis (twinflower)	1	0-3	38	6
Lonicera dioica (twining honeysuckle)	2	0-3	31	6
Lonicera involucrata (bracted honeysuckle)	2	0-3	46	10
Menziesia ferruginea (false azalea)	3	0-3	8	5
Ribes americanum (wild black currant)	10	0-10	8	9
Ribes glandulosum (skunk currant)	3	0-3	8	5
Ribes hudsonianum (northern black currant)	2	0-3	15	6
Ribes oxyacanthoides (northern gooseberry)	1	0-3	38	6
Ribes triste (wild red currant)	2	0-3	15	6
Rosa spp. (rose)	3	1-10	100	17
Rubus arcticus (dwarf raspberry)	2	0-3	15	6
Rubus idaeus (wild red raspberry)	1	0-1	23	5
Rubus pubescens (dewberry)	1	0-3	69	8
Salix bebbiana (beaked willow)	2	0-3	46	7
Salix myrtillifolia (myrtle-leaved willow)	1	0-1	8	3
Salix pseudomonticola (false mountain willow)	3	0-3	8	5
Salix scouleriana (Scouler's willow)	7	0-10	15	10
Shepherdia canadensis (Canada buffaloberry)	1	0-1	46	7
Symphoricarpos spp. (buckbrush)	1	0-1	31	6
Symphoricarpos occidentalis (buckbrush)	2	0-3	15	6
Vaccinium myrtilloides (common blueberry)	1	0-1	15	4
Viburnum edule (low-bush cranberry)	2	0-3	23	7
Viburnum opulus (high-bush cranberry)	1	0-1	8	3
Graminoids				
Agropyron repens (quack grass)	1	0-1	8	3
Agrostis scabra (rough hair grass)	1	0-1	8	3
Agropyron trachycaulum (slender wheat grass)	1	0-1	15	4
Alopecurus occidentalis (alpine foxtail)	1	0-1	8	3
Bromus ciliatus (fringed brome)	1	0-1	8	3
Bromus inermis (awnless brome)	1	0-1	8	3
Calamagrostis canadensis (bluejoint)	4	0-10	46	14
Carex concinna (beautiful sedge)	1	0-1	8	3
Carex deweyana (Dewey's sedge)	1	0-1	8	3
Carex disperma (two-seeded sedge)	9	0-20	31	16

Table 3 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Carex microglochin (short-awned sedge)	1	0-1	8	3
Carex norvegica (Norway sedge)	3	0-3	8	5
Carex praegracilis (graceful sedge)	1	0-1	8	3
Carex praticola (meadow sedge)	1	0-1	8	3
Carex sprengelii (Sprengel's sedge)	1	0-1	8	3
Carex vaginata (sheathed sedge)	2	0-3	15	6
Cinna latifolia (drooping wood-reed)	2	0-3	15	6
Elymus innovatus (hairy wild rye)	3	0-3	8	5
Elymus virginicus (Virginia wild rye)	1	0-1	8	3
Phleum pratense (timothy)	1	0-1	8	3
Poa palustris (fowl bluegrass)	1	0-1	23	5
Poa pratensis (Kentucky bluegrass)	2	0-3	31	8
Schizachne purpurascens (purple oat grass)	6	0-10	15	9
Stipa columbiana (Columbia needle grass)	3	0-3	8	5
Trisetum cernuum (nodding trisetum)	1	0-1	8	3
Forbs				
Achillea millefolium (common yarrow)	1	0-1	15	4
Achillea sibirica (many-flowered yarrow)	1	0-1	8	3
Actaea rubra (red and white baneberry)	1	0-3	38	6
Aralia nudicaulis (wild sarsaparilla)	2	0-3	15	6
Arnica chamissonis (leafy arnica)	1	0-1	8	3
Aster ciliolatus (Lindley's aster)	1	0-1	8	3
Aster conspicuus (showy aster)	2	0-3	31	8
Aster laevis (smooth aster)	2	0-3	23	7
Astragalus spp. (milk vetch)	1	0-1	15	4
Caltha palustris (marsh-marigold)	1	0-1	15	4
Campanula rotundifolia (harebell)	1	0-1	8	3
Corallorhiza trifida (pale coralroot)	1	0-1	8	3
Cypripedium spp. (lady's-slipper)	1	0-1	8	3
Disporum trachycarpum (fairybells)	1	0-1	15	4
Epilobium angustifolium (common fireweed)	1	0-3	69	8
Fragaria virginiana (wild strawberry)	2	0-3	69	8
Galium boreale (northern bedstraw)	1	0-1	38	6
Galium triflorum (sweet-scented bedstraw)	1	0-1	46	7
Geranium richardsonii (wild white geranium)	3	0-10	62	11
Geum aleppicum (yellow avens)	2	0-3	31	8
Geum macrophyllum (large-leaved yellow avens)	3	0-3	8	5
Habenaria obtusata (blunt-leaved bog orchid)	1	0-1	8	3
Heracleum lanatum (cow parsnip)	1	0-3	38	6
Impatiens noli-tangere (western jewelweed)	1	0-1	8	3
Lathyrus ochroleucus (cream-colored vetchling)	2	0-3	46	10
Maianthemum canadense (wild lily-of-the-valle)	1	0-1	15	4
Mertensia paniculata (tall lungwort)	2	0-3	46	7
Mitella nuda (bishop's-cap)	3	0-10	54	13
Moneses uniflora (one-flowered wintergreen)	1	0-1	15	4
Osmorhiza chilensis (blunt-fruited sweet cicely)	1	0-1	8	3
Osmorhiza depauperata (spreading sweet cicely)	2	0-3	31	6
Pedicularis bracteosa (western lousewort)	3	0-3	8	5
Petasites palmatus (palmate-leaved coltsfoot)	3	0-10	54	13
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	8	3
Petasites vitifolius (vine-leaved coltsfoot)	3	0-3	8	5
Potentilla gracilis (graceful cinquefoil)	1	0-1	8	3
Pyrola asarifolia (common pink wintergreen)	1	0-1	15	4
Ranunculus abortivus (small-flowered buttercup)	1	0-1	8	3
Ranunculus acris (tall buttercup)	1	0-1	8	3

Table 3 (cont.)

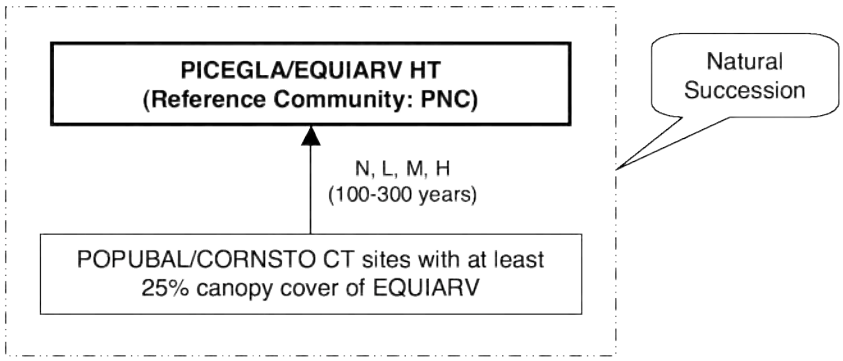
Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Sanicula marilandica (snakeroot)	1	0-1	8	3
Senecio pauperculus (balsam groundsel)	2	0-3	15	6
Smilacina racemosa (false Solomon's-seal)	1	0-1	8	3
Smilacina stellata (star-flowered Solomon's-seal)	2	0-3	38	9
Smilacina trifolia (three-leaved Solomon's-seal)	6	0-10	15	9
Solidago canadensis (Canada goldenrod)	1	0-1	8	3
Stachys palustris (marsh hedge-nettle)	1	0-1	8	3
Taraxacum officinale (common dandelion)	2	0-3	54	10
Thalictrum occidentale (western meadow rue)	3	0-3	8	5
Thalictrum venulosum (veiny meadow rue)	2	0-3	31	8
Trifolium repens (white clover)	3	0-3	8	5
Urtica dioica (common nettle)	1	0-1	15	4
Valeriana dioica (northern valerian)	1	0-1	8	3
Vicia americana (wild vetch)	1	0-3	46	7
Viola canadensis (western Canada violet)	7	0-30	38	16
Viola renifolia (kidney-leaved violet)	1	0-1	8	3
Zizia aptera (heart-leaved Alexanders)	1	0-1	8	3
Ferns and Allies				
Equisetum arvense (common horsetail)	38	0-90	92	59
Equisetum scirpoides (dwarf scouring-rush)	10	0-10	8	9
Equisetum sylvaticum (woodland horsetail)	40	0-40	8	18

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Primary Succession

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 in many cases to continue undisturbed for more than 200 years (Timoney and others 1997). New fluvial deposits become populated with pioneer species of *Alnus tenuifolia* (river alder), *Salix* (willows), *Populus balsamifera* (balsam poplar), and herbaceous hydrophytes, which rapidly recruit 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. Figure 3 is a schematic diagram of the most common community successional pathway.



Successional Pathway of *Picea glauca/Equisetum arvense* (white spruce/common horsetail)
Sites in North Central Alberta
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)
PICEGLA/EQUIARV HT—*Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type

Figure 3. 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 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.

Secondary Succession
In the boreal forests, fire return period in major river riparian floodplain forests is in the range of 186-213 years, whereas on upland sites fire returns on a period ranging from about 86-112 years (Timoney and others 1997). Following major stand-replacing disturbance such as fire, *Populus balsamifera* (balsam poplar) and *Populus tremuloides* (aspen) may be abundant in earlier seral stands along with seedling and sapling *Picea glauca* (white spruce). As the spruce canopy overtops the shade intolerant *Populus balsamifera* (balsam poplar) trees and associated shrub understory, shade tolerant, moist site herbs slowly replace them.

Following chronic, lower level disturbance, (e.g., prolonged high levels of grazing and browsing) the understories of later seral stands shift to greater presence of such low forbs as *Geranium richardsonii* (wild white geranium), *Fragaria virginiana* (wild strawberry), *Taraxacum officinale* (common dandelion), and *Smilacina stellata* (star-flowered Solomon's-seal).

EDATOPE

Figure 4 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).

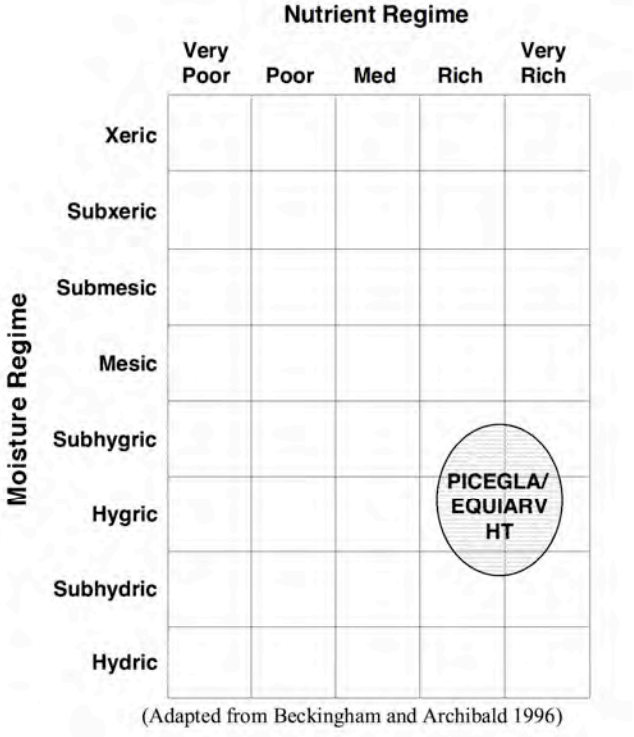


Figure 4. Edatope grid position for the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type (PICEGLA/EQUIARV HT)

SOILS

Parent material 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 greater than 6 cm, imperfectly to poorly drained mineral soils with texture in sampled stands ranging from sandy silt loam to sandy clay, and moisture regimes from subhygric to hygric (Beckingham and Archibald 1996).

ADJACENT COMMUNITIES

The *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type is the wettest of the low elevation *Picea* (spruce) wetland types. Adjacent wetter types may be dominated by one of the several *Salix* (willow) types. Adjacent drier types may be dominated by the *Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) habitat type, the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type, or *Picea glauca* (white spruce) with an upland understory.

MANAGEMENT INFORMATION

Livestock

Herbage production is moderate to low, decreasing as seral succession progresses and the overstory canopy closes. These sites have little value as livestock range other than shading. Lane and others (2000) recommend non-use for the *Picea glauca/Equisetum arvense/moss* (white spruce/common horsetail/moss) community type 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 limit tree seedling establishment.

Timber

Productivity is high on these moist, rich sites (Beckingham and others 1996) but offers limited potential due to the extremely fragile sites, 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.

Fire

Fire susceptibility is relatively low due to moist site conditions. However, *Picea glauca* (white spruce) is easily killed by fire (Fischer and Bradley 1987). The dead, dry, flammable lower limbs, low growing canopy, thin bark, and lichen growth in the branches contribute to susceptibility of the species to fire. The shallow root system is readily subject to injury from burning through the duff. Large older trees may survive one or more light fires, but deep accumulations of resinous needle litter around their bases usually render them very susceptible to fire damage.

Soil Management and Rehabilitation Opportunities

Road construction and development severely degrade sites along streamsides and sites with high water tables, poor drainage, or organic soils. Roads and trails should be located on adjacent uplands. Care should be taken to protect sites of this type from prolonged loitering by livestock, especially during the hot season when they may seek the shade in these sites.

Recreational Uses and Considerations

Because of high water tables and the problems with road construction, campgrounds should not be located in this type.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

The *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type is included within the *Populus balsamifera* (balsam poplar)-*Picea glauca* (white spruce) (Pb-Sw) phase and the *Picea glauca* (white spruce) (Sw) phase of the *Equisetum* (horsetail) ecosite in the Boreal Mixedwood ecological area representing the hygric/rich moisture/nutrient regime (Beckingham and Archibald 1996).

OTHER STUDIES

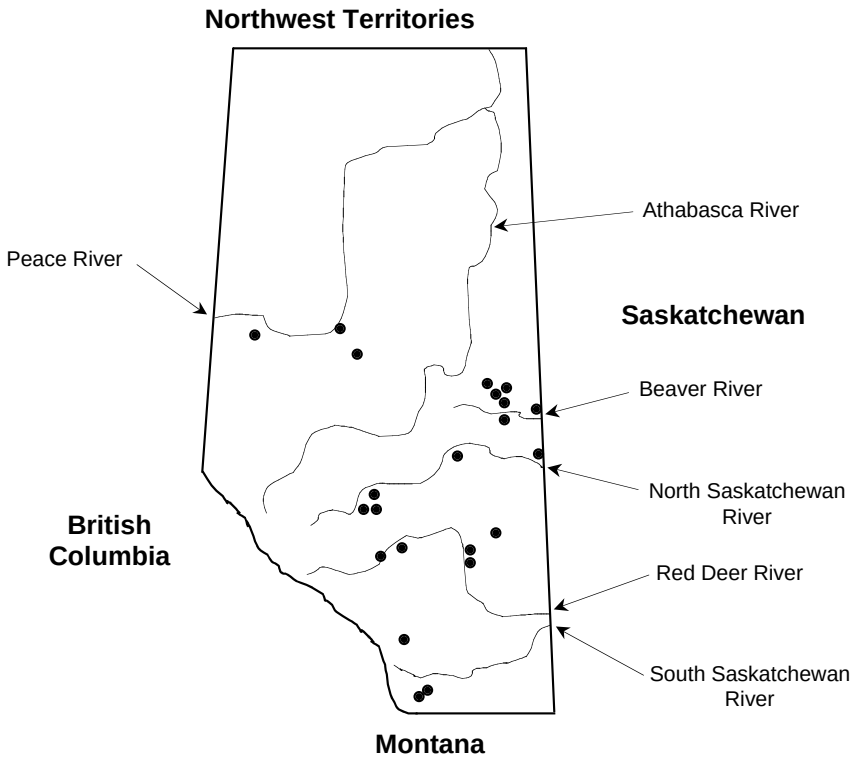
Thompson and Hansen (2002) describe a *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type in the Grassland Natural Region of southern Alberta. Beckingham and Archibald (1996) describe *Populus balsamifera-Picea glauca/Equisetum* (balsam poplar-white spruce/horsetail) and *Picea glauca/Equisetum* (white spruce/horsetail) community types of the *Equisetum* (horsetail) ecosite in the Boreal Mixedwood Subregions, the Boreal Highlands, and Subarctic Natural Subregions of Northern Alberta. Beckingham, Corns, and Archibald (1996) describe similar community types in the Lower Foothills, Upper Foothills, and the Montane Natural Subregions of West-Central Alberta. Archibald, Klappstein, and Corns (1996) also describe similar community types for the Lower Foothills, Upper Foothills, and Montane Natural Subregions of Southwestern Alberta, and Beckingham, Nielsen, and Futoransky (1996) do the same for the Mid-Boreal ecoregions of Saskatchewan.

Lane and others (2000) describe a *Picea glauca/Equisetum/*moss (white spruce/horsetail/moss) community type in the Lower Foothills Subregion. Corns (1983) described a *Picea glauca/Equisetum arvense/Hylocomium splendens* (white spruce/horsetail/feather moss) community type in west central Alberta. A *Picea/Equisetum arvense* (spruce/common horsetail) habitat type is described by Hansen and others (1995) for the mountains and foothills of Montana.

Picea glauca/Viburnum edule Habitat Type
(White Spruce/Low-Bush Cranberry Habitat Type)

PICEGLA/VIBUEDU
Number of Stands Sampled = 37
Number of Stands Sampled in Alberta = 37

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type is a major type at low to mid elevations in the Dry Mixedwood Subregion of the Boreal Forest Natural Region. It also occurs as an incidental type along major riverine corridors through the Parkland Natural Region. This type 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. Late seral mature and old growth stands of this type are rare because stands usually burn before they reach advanced maturity.

Among the dataset are typical stands sampled on the Battle River near Alliance, the Beaver River north of St. Paul, the Red Deer River near Big Valley, Cold Lake, Winagami Lake near High Prairie, Moonshine Lake near Spirit River, and the Peace River near Ft. Vermilion.

VEGETATION

The relatively closed overstory of late seral stands contains mature *Picea glauca* (white spruce). Some sites in earlier seral stage may have large amounts of *Populus balsamifera* (balsam poplar) or *Populus tremuloides* (aspen) present. Nine shrub

species occur on relatively late seral, undisturbed, stands with either constancy greater than 70 percent or prominence index greater than 20 (Table 4). On relatively early seral or disturbed stands, there is a similar abundance of shrub species (Tables 5 and 6). The most abundant, *Viburnum edule* (low-bush cranberry) and *Cornus stolonifera* (red-osier dogwood), indicate moist site conditions (Raup 1946).

Stand species richness may be high, but constancy and cover for most species is low due to ranges represented of seral stage and degree of site disturbance, as well as differences in the site itself. Shrub cover is typically abundant, especially in stands of earlier seral stage (before the *Picea glauca* [white spruce] canopy closes) (Table 5). Herbaceous species cover ranges from sparse to high, depending greatly on degree of disturbance. The list of graminoid species on early seral and disturbed stands is quite long, but *Calamagrostis canadensis* (bluejoint) is the only one with high constancy or prominence. *Aralia nudicaulis* (wild sarsaparilla) is the only forb species with prominence greater than 20 (Tables 4, 5, and 6).

Table 4. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 10 relatively undisturbed late seral to climax stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	4	0-10	50	14
Picea glauca (white spruce)	41	20-70	100	64
Populus balsamifera (balsam poplar)	14	0-20	60	28
Populus tremuloides (aspen)	17	0-30	60	32
Shrubs				
Alnus tenuifolia (river alder)	3	0-3	40	9
Amelanchier alnifolia (Saskatoon)	4	0-10	60	13
Cornus canadensis (bunchberry)	8	0-20	80	25
Cornus stolonifera (red-osier dogwood)	8	0-30	90	27
Corylus cornuta (beaked hazelnut)	3	0-3	20	8
Elaeagnus commutata (silverberry)	2	0-3	20	6
Linnaea borealis (twinflower)	3	0-10	80	15
Lonicera dioica (twining honeysuckle)	1	0-1	20	4
Lonicera involucrata (bracted honeysuckle)	5	0-10	80	18
Prunus virginiana (choke cherry)	2	0-3	20	6
Ribes lacustre (bristly black currant)	1	0-1	10	3
Ribes oxyacanthoides (northern gooseberry)	2	0-3	40	6
Ribes triste (wild red currant)	3	0-3	30	9
Rosa acicularis (prickly rose)	6	0-10	20	10
Rosa spp. (rose)	8	0-20	80	25
Rubus idaeus (wild red raspberry)	8	0-20	60	22
Rubus pubescens (dewberry)	6	0-20	80	22
Salix bebbiana (beaked willow)	1	0-1	20	4
Salix myrtillifolia (myrtle-leaved willow)	1	0-1	10	3
Salix scouleriana (Scouler's willow)	1	0-1	30	5
Shepherdia canadensis (Canada buffaloberry)	1	0-3	50	7
Symphoricarpos spp. (buckbrush)	3	0-10	90	16
Viburnum edule (low-bush cranberry)	18	1-60	100	42
Graminoids				
Agrostis stolonifera (redtop)	3	0-3	20	8
Bromus altissimus (Canada brome)	1	0-1	10	3
Bromus ciliatus (fringed brome)	1	0-1	10	3
Calamagrostis canadensis (bluejoint)	3	0-10	70	14
Carex atherodes (awned sedge)	3	0-3	10	5
Carex aurea (golden sedge)	1	0-1	10	3
Carex disperma (two-seeded sedge)	1	0-1	10	3
Carex leptalea (bristle-stalked sedge)	2	0-3	20	6
Carex spp. (sedge)	1	0-1	10	3
Elymus glaucus (smooth wild rye)	3	0-3	10	5
Elymus innovatus (hairy wild rye)	3	0-3	20	8

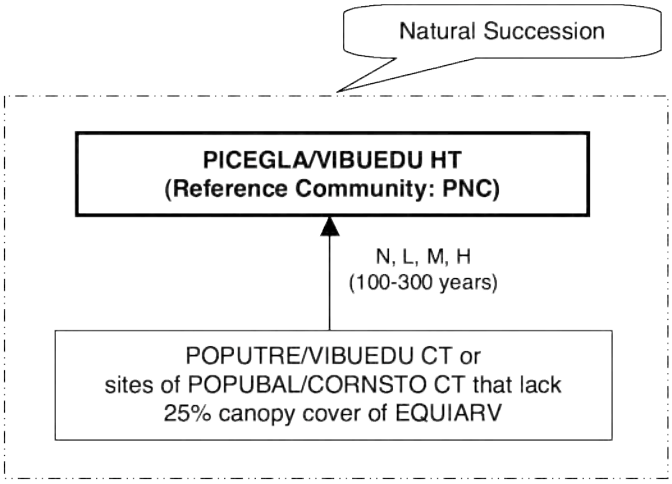
Table 4 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Phalaris arundinacea (reed canary grass)	1	0-1	10	3
Phleum pratense (timothy)	3	0-3	10	5
Poa palustris (fowl bluegrass)	20	0-20	10	14
Poa pratensis (Kentucky bluegrass)	1	0-1	20	4
Schizachne purpurascens (purple oat grass)	1	0-1	10	3
Trisetum cernuum (nodding trisetum)	3	0-3	10	5
Forbs				
Actaea rubra (red and white baneberry)	1	0-1	10	3
Apocynum cannabinum (Indian hemp)	3	0-3	10	5
Aralia nudicaulis (wild sarsaparilla)	13	0-30	50	25
Aster conspicuus (showy aster)	2	0-3	50	10
Aster hesperius (western willow aster)	3	0-3	10	5
Aster laevis (smooth aster)	3	0-3	20	8
Campanula rotundifolia (harebell)	1	0-1	10	3
Chrysanthemum leucanthemum (ox-eye daisy)	1	0-1	10	3
Cicuta maculata (water-hemlock)	1	0-1	10	3
Cirsium arvense (Canada thistle)	1	0-1	10	3
Disporum trachycarpum (fairybells)	1	0-1	20	4
Epilobium angustifolium (common fireweed)	2	0-3	50	10
Fragaria virginiana (wild strawberry)	2	0-3	40	6
Galium boreale (northern bedstraw)	1	0-3	60	8
Galium triflorum (sweet-scented bedstraw)	3	0-10	80	15
Geranium richardsonii (wild white geranium)	1	0-1	20	4
Habenaria spp. (bog orchid)	1	0-1	10	3
Lathyrus ochroleucus (cream-colored vetchling)	1	0-3	60	8
Maianthemum canadense (wild lily-of-the-valle)	1	0-1	40	6
Mertensia paniculata (tall lungwort)	4	0-10	80	15
Mitella nuda (bishop's-cap)	3	0-3	60	13
Orthilia secunda (one-sided wintergreen)	2	0-3	30	5
Osmorhiza depauperata (spreading sweet cicely)	1	0-1	10	3
Petasites palmatus (palmate-leaved coltsfoot)	2	0-3	50	10
Plantago major (common plantain)	1	0-1	10	3
Pyrola asarifolia (common pink wintergreen)	1	0-3	60	8
Senecio pauperculus (balsam groundsel)	1	0-1	10	3
Smilacina stellata (star-flowered Solomon's-seal)	2	0-3	40	9
Solidago canadensis (Canada goldenrod)	3	0-3	10	5
Stellaria longipes (long-stalked chickweed)	1	0-1	10	3
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0-1	20	4
Taraxacum officinale (common dandelion)	3	0-3	30	9
Thalictrum occidentale (western meadow rue)	3	0-3	10	5
Thalictrum venulosum (veiny meadow rue)	2	0-3	20	6
Tiarella trifoliata (laceflower)	1	0-1	10	3
Trientalis borealis (northern starflower)	1	0-1	10	3
Trifolium repens (white clover)	1	0-1	10	3
Urtica dioica (common nettle)	1	0-1	10	3
Vicia americana (wild vetch)	2	0-3	40	6
Viola orbiculata (evergreen violet)	1	0-1	10	3
Viola renifolia (kidney-leaved violet)	1	0-1	20	4
Ferns and Allies				
Equisetum arvense (common horsetail)	4	0-10	60	15
Equisetum scirpoides (dwarf scouring-rush)	3	0-3	20	8
Equisetum sylvaticum (woodland horsetail)	1	0-1	10	3

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Wildfire is often cited as a major agent of disturbance in forested lands of central Canada. Dix and Swan (1970) working in the southern edge of the Boreal Forest of Saskatchewan found few trees older than 100 years. These authors said that *Picea glauca* (white spruce) acts much like a pioneer species in establishing quickly on disturbed sites and having limited ability to reproduce within established forests. On sites where *Populus* (poplar) trees gain early domination, young *Picea* (spruce species) establish and grow slowly under the closed canopy. This means the *Populus* (poplar) stage of seral succession can be very long, usually much longer than the return period for fire to the site. Therefore, many such sites are continually reset by fire to early seral stage before ever reaching their vegetation potential (Moss 1955). For this reason, the majority of stands observed of this type were not in late seral stage. Figure 5 is a schematic diagram of the most common successional community progression pathway.



Successional Pathway of *Picea glauca/Viburnum edule* (white spruce/low bush cranberry)
Sites in North Central Alberta
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

EQUIARV—*Equisetum arvense* (common horsetail)
PICEGLA/VIBUEDU HT—*Picea glauca/Viburnum edule* (white spruce/low bush cranberry) habitat type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
POPUTRE/VIBUEDU CT—*Populus tremuloides/Viburnum edule* (aspen/low bush cranberry) community type

Figure 5. 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 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.

In relatively undisturbed early seral stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, *Populus tremuloides* (aspen) and *Populus balsamifera* (balsam poplar) are major tree species along with understory shrubs such as *Rosa* species (rose) and *Cornus stolonifera* (red-osier dogwood). The herbaceous understory is comprised of *Calamagrostis canadensis* (bluejoint), *Galium boreale* (northern bedstraw), and *Fragaria virginiana* (wild strawberry) (Table 5).

Table 5. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 16 relatively undisturbed early seral stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	6	0-20	38	15
Picea glauca (white spruce)	14	3-50	100	37
Populus balsamifera (balsam poplar)	28	0-70	75	46
Populus tremuloides (aspen)	31	0-70	88	52
Shrubs				
Alnus tenuifolia (river alder)	7	0-20	31	15
Amelanchier alnifolia (Saskatoon)	4	0-10	94	19
Arctostaphylos uva-ursi (common bearberry)	2	0-3	13	5
Betula occidentalis (water birch)	16	0-30	13	14
Clematis ligusticifolia (western clematis)	1	0-1	6	3
Cornus canadensis (bunchberry)	3	0-10	63	14
Cornus stolonifera (red-osier dogwood)	8	0-20	81	25
Elaeagnus commutata (silverberry)	1	0-1	13	4
Juniperus communis (ground juniper)	1	0-1	6	3
Linnaea borealis (twinflower)	3	0-10	63	14
Lonicera dioica (twining honeysuckle)	2	0-3	69	12
Lonicera involucrata (bracted honeysuckle)	6	0-10	63	19
Prunus virginiana (choke cherry)	4	0-10	38	12
Ribes americanum (wild black currant)	3	0-3	6	4
Ribes lacustre (bristly black currant)	2	0-3	19	4
Ribes oxyacanthoides (northern gooseberry)	5	0-30	50	16
Ribes triste (wild red currant)	2	0-3	13	5
Rosa spp. (rose)	13	1-30	100	36
Rubus idaeus (wild red raspberry)	5	0-20	69	19
Rubus pubescens (dewberry)	3	0-10	75	15
Salix bebbiana (beaked willow)	6	0-30	50	17
Salix exigua (sandbar willow)	3	0-3	6	4
Salix lucida (shining willow)	1	0-1	6	3
Salix lutea (yellow willow)	2	0-3	25	5
Salix pseudomonticola (false mountain willow)	1	0-1	6	3
Salix scouleriana (Scouler's willow)	2	0-3	19	6
Shepherdia canadensis (Canada buffaloberry)	3	0-10	38	11
Symphoricarpos spp. (buckbrush)	1	0-1	19	4
Symphoricarpos occidentalis (buckbrush)	6	0-10	63	19
Viburnum edule (low-bush cranberry)	7	0-20	63	21
Graminoids				
Agropyron repens (quack grass)	1	0-3	31	6
Agropyron trachycaulum (slender wheat grass)	1	0-1	13	4
Bromus ciliatus (fringed brome)	1	0-1	13	4
Bromus inermis (awnless brome)	6	0-10	13	8
Calamagrostis canadensis (bluejoint)	7	0-20	81	24
Carex atherodes (awned sedge)	1	0-1	6	3
Carex spp. (sedge)	3	0-3	6	4
Elymus innovatus (hairy wild rye)	3	0-3	13	6
Oryzopsis asperifolia (white-grained mountain rice grass)	3	0-3	13	6
Phleum pratense (timothy)	1	0-1	6	3
Poa palustris (fowl bluegrass)	2	0-3	19	4
Poa pratensis (Kentucky bluegrass)	2	0-3	13	5
Schizachne purpurascens (purple oat grass)	3	0-10	25	9
Forbs				
Achillea millefolium (common yarrow)	1	0-1	6	3
Achillea sibirica (many-flowered yarrow)	1	0-1	13	4

Table 5 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Actaea rubra (red and white baneberry)	1	0-1	38	6
Agrimonia striata (agrimony)	1	0-1	13	4
Anemone cylindrica (long-fruited anemone)	1	0-1	6	3
Apocynum androsaemifolium (spreading dogbane)	10	0-10	6	8
Aralia nudicaulis (wild sarsaparilla)	7	0-20	63	21
Artemisia biennis (biennial sagewort)	1	0-1	6	3
Aster ciliolatus (Lindley's aster)	10	0-10	6	8
Aster conspicuus (showy aster)	2	0-3	75	12
Aster laevis (smooth aster)	2	0-3	25	5
Campanula rotundifolia (harebell)	1	0-1	6	3
Circaea alpina (small enchanter's nightshade)	1	0-1	6	3
Cirsium arvense (Canada thistle)	1	0-1	6	3
Delphinium glaucum (tall larkspur)	1	0-1	19	4
Disporum trachycarpum (fairybells)	1	0-1	25	5
Epilobium angustifolium (common fireweed)	3	0-10	69	14
Fragaria virginiana (wild strawberry)	2	0-3	81	9
Galium boreale (northern bedstraw)	1	0-3	88	9
Galium triflorum (sweet-scented bedstraw)	1	0-1	25	5
Geum aleppicum (yellow avens)	1	0-1	13	4
Heracleum lanatum (cow parsnip)	3	0-10	38	11
Hieracium umbellatum (narrow-leaved hawkweed)	1	0-1	6	3
Lathyrus ochroleucus (cream-colored vetchling)	2	0-3	63	11
Lysimachia ciliata (fringed loosestrife)	1	0-1	6	3
Maianthemum canadense (wild lily-of-the-valle)	2	0-3	44	7
Melilotus officinalis (yellow sweet-clover)	1	0-1	6	3
Mertensia paniculata (tall lungwort)	3	0-10	50	12
Mitella nuda (bishop's-cap)	1	0-1	25	5
Monarda fistulosa (wild bergamot)	1	0-1	6	3
Orthilia secunda (one-sided wintergreen)	1	0-1	6	3
Osmorhiza depauperata (spreading sweet cicely)	1	0-1	6	3
Petasites palmatus (palmate-leaved coltsfoot)	3	0-3	56	11
Pyrola asarifolia (common pink wintergreen)	3	0-10	31	10
Ranunculus cymbalaria (seaside buttercup)	1	0-1	6	3
Scutellaria galericulata (marsh skullcap)	1	0-1	6	3
Senecio pauciflorus (few-flowered ragwort)	1	0-1	13	4
Smilacina stellata (star-flowered Solomon's-seal)	2	0-3	44	7
Solidago canadensis (Canada goldenrod)	1	0-3	38	6
Taraxacum officinale (common dandelion)	1	0-3	31	6
Thalictrum venulosum (veiny meadow rue)	2	0-3	50	7
Trientalis borealis (northern starflower)	1	0-1	13	4
Vicia americana (wild vetch)	1	0-3	94	10
Viola canadensis (western Canada violet)	2	0-3	25	7
Viola orbiculata (evergreen violet)	2	0-3	13	5
Viola renifolia (kidney-leaved violet)	1	0-1	6	3
Ferns and Allies				
Equisetum arvense (common horsetail)	4	0-10	44	13

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

Calamagrostis canadensis (bluejoint) is more abundant on early seral stands, diminishing in importance at the stands age. Forbs that show reduced presence as stands mature are *Fragaria virginiana* (wild strawberry), *Galium boreale* (northern bedstraw), and *Vicia americana* (wild vetch). Stands disturbed by high levels of grazing typically begin to show considerable presence of exotic disturbance increaser species, such as *Poa pratense* (Kentucky bluegrass), *Taraxacum officinale* (dandelion), and *Trifolium* species (clover). With disturbance, there is also elevated presence of certain native forbs, such as

Achillea millefolium (common yarrow), *Aster laevis* (smooth aster), *Fragaria virginiana* (wild strawberry), and *Viola canadensis* (western Canada violet) (Table 6.)

Table 6. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 11 disturbed stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	13	0-20	27	19
Picea glauca (white spruce)	32	10-60	100	57
Populus balsamifera (balsam poplar)	27	0-60	73	44
Populus tremuloides (aspen)	21	0-40	45	31
Shrubs				
Alnus tenuifolia (river alder)	10	0-30	64	25
Amelanchier alnifolia (Saskatoon)	2	0-3	45	10
Arctostaphylos uva-ursi (common bearberry)	1	0-1	9	3
Cornus canadensis (bunchberry)	8	0-30	73	24
Cornus stolonifera (red-osier dogwood)	9	0-20	73	26
Corylus cornuta (beaked hazelnut)	17	0-30	18	18
Elaeagnus commutata (silverberry)	10	0-20	27	17
Ledum groenlandicum (common Labrador tea)	1	0-1	9	3
Linnaea borealis (twinflower)	5	0-10	73	17
Lonicera dioica (twining honeysuckle)	1	0-1	45	7
Lonicera involucrata (bracted honeysuckle)	2	0-3	64	11
Prunus pensylvanica (pin cherry)	1	0-1	9	3
Prunus virginiana (choke cherry)	2	0-3	18	6
Ribes hirtellum (wild gooseberry)	1	0-1	9	3
Ribes oxyacanthoides (northern gooseberry)	2	0-3	27	5
Rosa spp. (rose)	7	1-20	100	26
Rubus chamaemorus (cloudberry)	3	0-3	9	5
Rubus idaeus (wild red raspberry)	10	0-10	18	13
Rubus pubescens (dewberry)	2	0-3	55	7
Salix bebbiana (beaked willow)	7	0-10	27	14
Salix drummondiana (Drummond's willow)	1	0-1	9	3
Salix exigua (sandbar willow)	1	0-1	9	3
Salix lucida (shining willow)	1	0-1	9	3
Salix lutea (yellow willow)	10	0-10	9	10
Salix planifolia (flat-leaved willow)	1	0-1	9	3
Salix scouleriana (Scouler's willow)	3	0-3	9	5
Salix spp. (willow)	20	0-20	9	13
Shepherdia canadensis (Canada buffaloberry)	1	0-1	45	7
Symphoricarpos spp. (buckbrush)	3	0-10	45	12
Symphoricarpos occidentalis (buckbrush)	3	0-3	27	9
Vaccinium myrtilloides (common blueberry)	2	0-3	18	6
Viburnum edule (low-bush cranberry)	2	0-10	64	11
Graminoids				
Agropyron repens (quack grass)	7	0-10	18	11
Agrostis stolonifera (redtop)	7	0-10	18	11
Agropyron trachycaulum (slender wheat grass)	2	0-3	27	5
Bromus ciliatus (fringed brome)	1	0-1	45	7
Bromus inermis (awnless brome)	7	0-10	18	11
Calamagrostis canadensis (bluejoint)	3	0-3	36	9
Carex disperma (two-seeded sedge)	3	0-3	18	7
Carex leptalea (bristle-stalked sedge)	2	0-3	36	9
Carex microglochin (short-awned sedge)	1	0-1	9	3
Carex rossii (Ross' sedge)	1	0-1	9	3
Carex sprengelii (Sprengel's sedge)	1	0-1	9	3
Carex spp. (sedge)	2	0-3	18	6

Table 6 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Elymus glaucus (smooth wild rye)	2	0-3	36	9
Elymus innovatus (hairy wild rye)	3	0-3	9	5
Festuca spp. (fescue)	1	0-1	18	4
Glyceria striata (fowl manna grass)	3	0-3	9	5
Oryzopsis asperifolia (white-grained mountain rice grass)	1	0-1	27	5
Phleum pratense (timothy)	1	0-1	9	3
Poa palustris (fowl bluegrass)	1	0-1	18	4
Poa pratensis (Kentucky bluegrass)	4	0-10	73	17
Schizachne purpurascens (purple oat grass)	2	0-3	36	9
Forbs				
Achillea millefolium (common yarrow)	1	0-1	55	7
Actaea rubra (red and white baneberry)	1	0-1	9	3
Aquilegia spp. (columbine)	1	0-1	9	3
Aralia nudicaulis (wild sarsaparilla)	7	0-20	45	17
Aster ciliolatus (Lindley's aster)	3	0-3	9	5
Aster conspicuus (showy aster)	2	0-3	73	12
Aster laevis (smooth aster)	3	0-3	45	12
Aster modestus (large northern aster)	3	0-3	9	5
Aster spp. (aster)	2	0-3	18	6
Astragalus spp. (milk vetch)	1	0-1	9	3
Athyrium filix-femina (lady fern)	3	0-3	9	5
Campanula rotundifolia (harebell)	1	0-1	36	6
Castilleja miniata (common red paintbrush)	1	0-1	9	3
Cerastium vulgatum (common mouse-ear chickweed)	1	0-1	18	4
Cicuta maculata (water-hemlock)	3	0-3	9	5
Disporum trachycarpum (fairybells)	1	0-1	36	6
Epilobium angustifolium (common fireweed)	2	0-3	36	9
Epilobium ciliatum (northern willowherb)	1	0-1	9	3
Fragaria virginiana (wild strawberry)	4	0-10	82	18
Galeopsis tetrahit (hemp-nettle)	20	0-20	9	13
Galium boreale (northern bedstraw)	1	0-1	73	9
Galium triflorum (sweet-scented bedstraw)	1	0-3	55	7
Geranium richardsonii (wild white geranium)	2	0-3	27	5
Geum macrophyllum (large-leaved yellow avens)	2	0-3	18	6
Habenaria spp. (bog orchid)	1	0-1	9	3
Heracleum lanatum (cow parsnip)	1	0-1	9	3
Hieracium umbellatum (narrow-leaved hawkweed)	1	0-1	36	6
Lappula squarrosa (bluebur)	1	0-1	9	3
Lathyrus ochroleucus (cream-colored vetchling)	1	0-1	82	9
Maianthemum canadense (wild lily-of-the-valle)	1	0-1	64	8
Mentha arvensis (wild mint)	3	0-3	9	5
Mertensia paniculata (tall lungwort)	1	0-3	55	7
Mitella nuda (bishop's-cap)	3	0-10	45	10
Orthilia secunda (one-sided wintergreen)	1	0-1	9	3
Osmorhiza depauperata (spreading sweet cicely)	1	0-1	9	3
Petasites palmatus (palmate-leaved coltsfoot)	2	0-3	73	12
Plantago major (common plantain)	1	0-1	18	4
Pyrola asarifolia (common pink wintergreen)	1	0-1	64	8
Ranunculus abortivus (small-flowered buttercup)	1	0-1	9	3
Ranunculus pedatifidus (northern buttercup)	1	0-1	9	3
Sanicula marilandica (snakeroot)	3	0-3	9	5
Smilacina stellata (star-flowered Solomon's-seal)	1	0-3	55	7
Solidago canadensis (Canada goldenrod)	2	0-3	18	6
Solidago spp. (goldenrod)	1	0-1	9	3
Stellaria calycantha (northern stitchwort)	1	0-1	9	3

Table 6 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Taraxacum officinale (common dandelion)	2	0-3	82	13
Thalictrum spp. (meadow rue)	1	0-1	9	3
Thalictrum venulosum (veiny meadow rue)	6	0-10	18	10
Trifolium hybridum (alsike clover)	1	0-1	45	7
Trifolium repens (white clover)	6	0-10	36	13
Urtica dioica (common nettle)	3	0-3	9	5
Veronica americana (American brooklime)	1	0-1	9	3
Vicia americana (wild vetch)	1	0-1	64	8
Viola adunca (early blue violet)	1	0-1	9	3
Viola canadensis (western Canada violet)	3	0-10	55	13
Ferns and Allies				
Equisetum arvense (common horsetail)	2	0-3	82	13

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

EDATOPE

Figure 6 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).

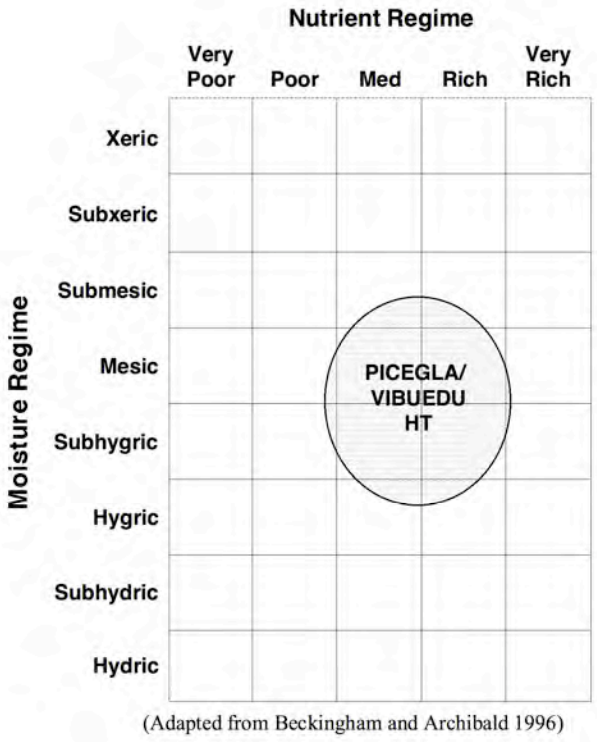


Figure 6. Edatope grid position for the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type (PICEGLA/VIBUEDU HT)

SOILS

Parent material may be alluvium or glacial deposits, and soils are generally Brunisols, Luvisols, or Regosols. Sites of this habitat type typically have organic (mor) layer thickness greater than 6 cm of humus in incompletely decomposed form,

moderately well to well drained mineral soils with texture in sampled stands ranging from sand to silt, and with moisture regime ranging from mesic to subhygric (Beckingham and Archibald 1996).

ADJACENT COMMUNITIES

The *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type is the drier of the two low elevation *Picea glauca* (white spruce) moist site types. Adjacent wetter types may include the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type or any of the several *Populus balsamifera* (balsam poplar) or *Salix* species (willow) types. Adjacent upland types may be dominated by *Picea glauca* (white spruce) with upland understory species, *Populus tremuloides* (aspen), or *Pinus* species (pine).

MANAGEMENT INFORMATION

Livestock

Herbage production on sites of this type is low to moderate. The dense overstory of later seral stands tends to limit forage production, thereby limiting utility for livestock other than as thermal cover. Several shrub species associated with this type are considered to have good to excellent forage value for livestock (e.g., *Cornus stolonifera* [red-osier dogwood], *Amelanchier alnifolia* [Saskatoon], and *Viburnum edule* [low-bush cranberry]) (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991). The most prevalent grass on sites of this type, *Calamagrostis canadensis* (bluejoint), is rated as fair forage value and is an important forage species in the wooded regions of northern and central Alberta (Tannas 1997).

High levels of livestock use of this type will cause a reduction of overall shrub cover and a shift to less palatable genera like *Rosa* (rose), *Lonicera* (honeysuckle), and *Symphoricarpos* (buckbrush); as well the introduction and increase of exotic herbaceous species (e.g., *Agropyron repens* [quack grass], *Bromus inermis* [awnless brome], *Poa pratensis* [Kentucky bluegrass], and *Taraxacum officinale* [common dandelion].

Timber

Timber productivity is moderate to high (Beckingham, Nielsen, and Futoransky 1996). Streamside locations and high water tables may restrict feasibility of timber harvest, or limit it to winter season.

Fisheries

Those stands of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type adjacent to streams provide hiding, thermal cover, debris recruitment, and streambank stability for fish. *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

Fire susceptibility is high during dry years. *Picea glauca* (white spruce) is easily killed by fire (Fischer and Bradley 1987). The dead, dry, flammable lower limbs, low growing canopy, thin bark, and lichen growth in the branches contribute to susceptibility of the species to fire. The shallow root system is readily subject to injury from fire burning through the duff. Large older trees may occasionally survive one or more light fires, but deep accumulations of resinous needle litter around their bases usually make them very susceptible to fire damage. Frequent fires can eliminate white spruce from an area because it does not produce seed in quantity until it is 30 years old or older (USDA Intermountain Fire Sciences Lab 1995).

Fire top-kills *Viburnum edule* (low-bush cranberry), but it sprouts from stump, roots, or underground stems following fire (USDA Intermountain Fire Sciences Lab 1995). *Cornus stolonifera* (red-osier dogwood) and the associated shrub species can survive all but the most severe fires that remove duff and cause extended heating of the upper layer of soil. After a fire, the shrubs sprout from the surviving rhizomes or stolons (runners) (Fischer and Bradley 1987). Red-osier dogwood is considered a semi-fire-tolerant, seed-banking species. Light fires, which partially remove the duff, stimulate germination of buried seed (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities

Machinery and livestock easily compact or otherwise damage the soil during periods with high water tables. Poorly drained sites, streamside locations, or sites with organic soils should also warrant special concern. Roads and trails should be located on adjacent uplands.

Recreational Uses and Considerations

Because of high water tables and the problems with road construction, campgrounds should not be located in this type.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

The *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type is included within two phases of two ecosites that represent the mesic/medium and subhygric/rich moisture/nutrient regimes. These are the *Populus tremuloides* (aspen)-*Picea glauca* (white spruce) (Aw-Sw) phase and the *Picea glauca* (white spruce) (Sw) phase of the *Viburnum edule* (low-bush cranberry) and the *Cornus stolonifera* (red-osier dogwood) ecosites in the Boreal Mixedwood ecological area (Beckingham and Archibald 1996).

OTHER STUDIES

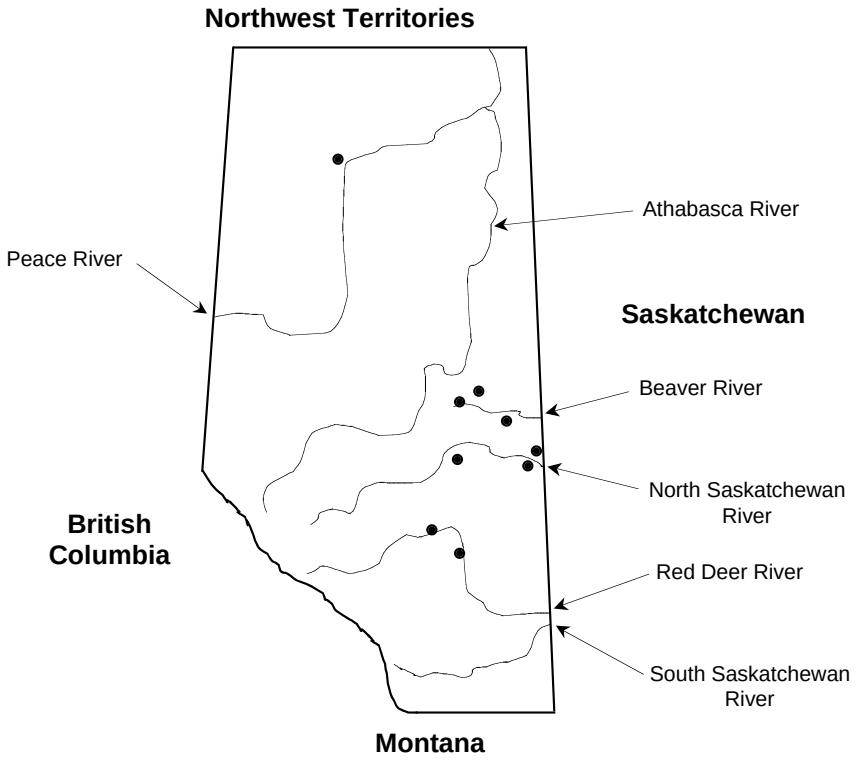
Thompson and Hansen (2002) describe a *Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) habitat type in the Grassland Natural Region of southern Alberta. Beckingham and Archibald (1996) describe several community types in the Boreal Mixedwood ecological area of Northern Alberta dominated by *Picea glauca* (white spruce) and having *Cornus stolonifera* (red-osier dogwood) as a key understory indicator. Beckingham, Corns, and Archibald (1996) describe a similar community type in the montane ecological area of west central Alberta.

Lane and others (2000) describe a white spruce/alder community type with *Viburnum edule* (low-bush cranberry) and *Cornus stolonifera* (red-osier dogwood) as understory components. Corns (1983) described a *Picea glauca/Rubus pubescens-Maianthemum canadense* (white spruce/dewberry/wild lily-of-the-valley) community type with a similar shrub understory in west central Alberta. A *Picea/Cornus stolonifera* (spruce/red-osier dogwood) habitat type is described by Hansen and others (1995) for the mountains and foothills of Montana.

Betula papyrifera Community Type (White Birch Community Type)

BETUPAP
Number of Stands Sampled = 14
Number of Stands Sampled in Alberta = 12

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Betula papyrifera* (white birch) community type is an incidental type at low to mid elevations in the Dry Mixedwood Subregion of the Boreal Forest Natural Region of Alberta. It occurs on alluvial terraces of streams and rivers and around lakes and sloughs, often resulting from selective cutting by beaver of other tree species from the site. Stands were sampled on the Vermilion River near Vermilion, Moose Lake near Bonnyville, near Caslan, Tulliby Lake, and Melito Creek near High Level.

VEGETATION

The tree *Betula papyrifera* (white birch) often occurs in mixed stands with *Populus tremuloides* (aspen) and *Populus balsamifera* (balsam poplar). Stands of this community type typically have the stumps of *Populus* (poplars) still evident. A wide variety of mesic and moist-site shrubs and herbaceous species can occupy the understory (Table 7). The great degree of species diversity reflects the pioneering and opportunistic nature of *Betula papyrifera* (white birch), as well as the disturbance that led to dominance by this tree species.

Table 7. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 14 stands of the *Betula papyrifera* (white birch) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	51	10-90	100	71
Larix laricina (tamarack)	3	0-3	7	5
Picea glauca (white spruce)	2	0-3	21	5
Populus balsamifera (balsam poplar)	16	0-30	14	15
Populus tremuloides (aspen)	2	0-3	50	10
Shrubs				
Alnus crispa (green alder)	40	0-40	7	17
Alnus tenuifolia (river alder)	20	0-20	7	12
Amelanchier alnifolia (Saskatoon)	16	0-60	43	26
Cornus canadensis (bunchberry)	5	0-10	43	15
Cornus stolonifera (red-osier dogwood)	13	0-30	64	29
Corylus cornuta (beaked hazelnut)	23	0-98	43	31
Elaeagnus commutata (silverberry)	1	0-1	14	4
Juniperus communis (ground juniper)	1	0-1	7	3
Ledum groenlandicum (common Labrador tea)	21	0-40	14	17
Linnaea borealis (twinflower)	3	0-10	43	11
Lonicera dioica (twining honeysuckle)	4	0-10	29	11
Lonicera involucrata (bracted honeysuckle)	10	0-10	7	8
Prunus pensylvanica (pin cherry)	15	0-20	14	15
Prunus virginiana (choke cherry)	9	0-20	29	16
Rhamnus alnifolia (alder-leaved buckthorn)	3	0-3	7	5
Rhus radicans (poison ivy)	1	0-1	7	3
Ribes lacustre (bristly black currant)	3	0-3	7	5
Ribes oxyacanthoides (northern gooseberry)	2	0-3	36	8
Ribes triste (wild red currant)	16	0-30	14	15
Rosa spp. (rose)	4	0-10	64	16
Rubus chamaemorus (cloudberry)	1	0-1	7	3
Rubus idaeus (wild red raspberry)	5	0-10	57	17
Rubus pubescens (dewberry)	3	0-10	64	11
Salix bebbiana (beaked willow)	14	0-40	29	20
Salix lutea (yellow willow)	2	0-3	14	5
Salix planifolia (flat-leaved willow)	1	0-1	7	3
Salix pseudomonticola (false mountain willow)	1	0-1	7	3
Salix scouleriana (Scouler's willow)	7	0-10	14	10
Salix spp. (willow)	3	0-3	7	5
Shepherdia canadensis (Canada buffaloberry)	3	0-10	29	9
Symphoricarpos spp. (buckbrush)	4	0-10	43	13
Symphoricarpos occidentalis (buckbrush)	3	0-3	7	5
Vaccinium myrtilloides (common blueberry)	20	0-20	7	12
Viburnum edule (low-bush cranberry)	3	0-10	43	11
Graminoids				
Agrostis scabra (rough hair grass)	1	0-1	7	3
Agropyron trachycaulum (slender wheat grass)	2	0-3	21	7
Bromus ciliatus (fringed brome)	3	0-3	7	5
Bromus inermis (awnless brome)	12	0-20	14	13
Calamagrostis canadensis (bluejoint)	9	0-30	57	21
Carex curta (short sedge)	3	0-3	7	5
Carex deweyana (Dewey's sedge)	1	0-1	7	3
Carex praegracilis (graceful sedge)	1	0-1	7	3
Carex siccata (hay sedge)	3	0-3	14	7
Carex sprengelii (Sprengel's sedge)	11	0-20	21	15
Carex spp. (sedge)	3	0-3	7	5
Glyceria striata (fowl manna grass)	1	0-1	14	4

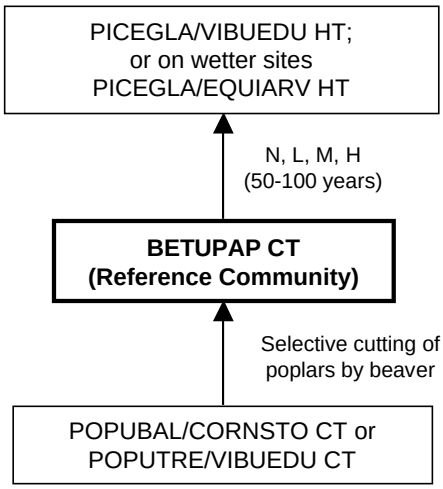
Table 7 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Oryzopsis asperifolia (white-grained mountain rice grass)	1	0-1	7	3
Poa palustris (fowl bluegrass)	3	0-3	7	5
Poa pratensis (Kentucky bluegrass)	14	0-30	36	22
Schizachne purpurascens (purple oat grass)	3	0-10	29	9
Forbs				
Achillea millefolium (common yarrow)	1	0-1	21	5
Achillea sibirica (many-flowered yarrow)	1	0-1	14	4
Actaea rubra (red and white baneberry)	1	0-1	43	7
Anemone canadensis (Canada anemone)	1	0-1	7	3
Anemone spp. (anemone)	1	0-1	7	3
Apocynum androsaemifolium (spreading dogbane)	3	0-3	7	5
Aralia nudicaulis (wild sarsaparilla)	14	0-30	50	26
Arnica spp. (arnicas)	1	0-1	7	3
Aster ciliolatus (Lindley's aster)	1	0-1	7	3
Aster conspicuus (showy aster)	2	0-3	29	5
Aster hesperius (western willow aster)	10	0-10	7	8
Aster laevis (smooth aster)	2	0-3	14	5
Aster puniceus (purple-stemmed aster)	1	0-1	7	3
Campanula rotundifolia (harebell)	1	0-1	14	4
Cirsium undulatum (wavy-leaved thistle)	6	0-10	14	8
Disporum trachycarpum (fairybells)	2	0-3	14	5
Epilobium angustifolium (common fireweed)	1	0-3	57	8
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	7	3
Fragaria virginiana (wild strawberry)	3	0-10	50	12
Galium boreale (northern bedstraw)	5	0-20	50	16
Galium triflorum (sweet-scented bedstraw)	1	0-1	36	6
Glycyrrhiza lepidota (wild licorice)	20	0-20	7	12
Lathyrus ochroleucus (cream-colored vetchling)	1	0-1	36	6
Maianthemum canadense (wild lily-of-the-valle)	1	0-3	43	7
Melilotus officinalis (yellow sweet-clover)	3	0-3	7	5
Mertensia paniculata (tall lungwort)	1	0-1	29	5
Mitella nuda (bishop's-cap)	3	0-3	7	5
Orthilia secunda (one-sided wintergreen)	1	0-1	14	4
Petasites palmatus (palmate-leaved coltsfoot)	2	0-3	14	5
Pyrola asarifolia (common pink wintergreen)	1	0-1	14	4
Sanicula marilandica (snakeroot)	3	0-3	14	7
Scutellaria galericulata (marsh skullcap)	1	0-1	7	3
Smilacina stellata (star-flowered Solomon's-seal)	1	0-1	14	4
Solidago canadensis (Canada goldenrod)	10	0-10	7	8
Solidago spp. (goldenrod)	1	0-1	7	3
Solidago gigantea (late goldenrod)	1	0-1	7	3
Sonchus arvensis (perennial sow-thistle)	3	0-3	7	5
Sonchus spp. (sow-thistle)	1	0-1	7	3
Stachys palustris (marsh hedge-nettle)	1	0-1	7	3
Taraxacum officinale (common dandelion)	3	0-3	29	8
Thalictrum dasycarpum (tall meadow rue)	3	0-3	7	5
Thalictrum occidentale (western meadow rue)	3	0-3	7	5
Trientalis borealis (northern starflower)	1	0-1	7	3
Urtica dioica (common nettle)	1	0-1	7	3
Vicia americana (wild vetch)	1	0-1	29	5
Viola canadensis (western Canada violet)	3	0-3	7	5
Ferns and Allies				
Equisetum arvense (common horsetail)	13	0-30	29	19

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

As presently understood in the Boreal Mixedwood Subregion, the *Betula papyrifera* (white birch) community type is an early seral successional, or disturbance, stage resulting from the removal, usually by beaver, of other tree species from a site seral to the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type. *Betula papyrifera* (white birch) is a short-lived, shade-intolerant, pioneer that rapidly colonizes disturbed sites opened by wildfire, windthrow, or beaver; but lasts only one generation before being replaced by shade-tolerant conifers or other hardwoods (USDA Intermountain Fire Sciences Lab 1995). In Boreal mixed woods, when free from further disturbance, *Betula papyrifera* (white birch) generally begin dying by 75 years of age. At this time *Pinus banksiana* (jack pine), *Picea mariana* (black spruce), and *Picea glauca* (white spruce) begin to take dominance. After 125 years most white birch on the site are dead (USDA Intermountain Fire Sciences Lab 1995). Figure 7 shows a schematic diagram of the common pathway for successional community progression to and from *Betula papyrifera* (white birch) stand dominance.



Successional Pathway of *Betula papyrifera* (white birch) Sites in North Central Alberta
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
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
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
POPUTRE/VIBUEDU CT—*Populus tremuloides* (aspen) community type

Figure 7. 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 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.

Stands on treed bog sites were observed with significant presence of *Betula papyrifera* (white birch) in association with *Picea mariana* (black spruce) and *Larix laricina* (tamarack), but these stands were not sampled for this study. The *Betula papyrifera* (white birch) on these treed bog sites are generally small statured and often decadent.

EDATOPE

Figure 8 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).

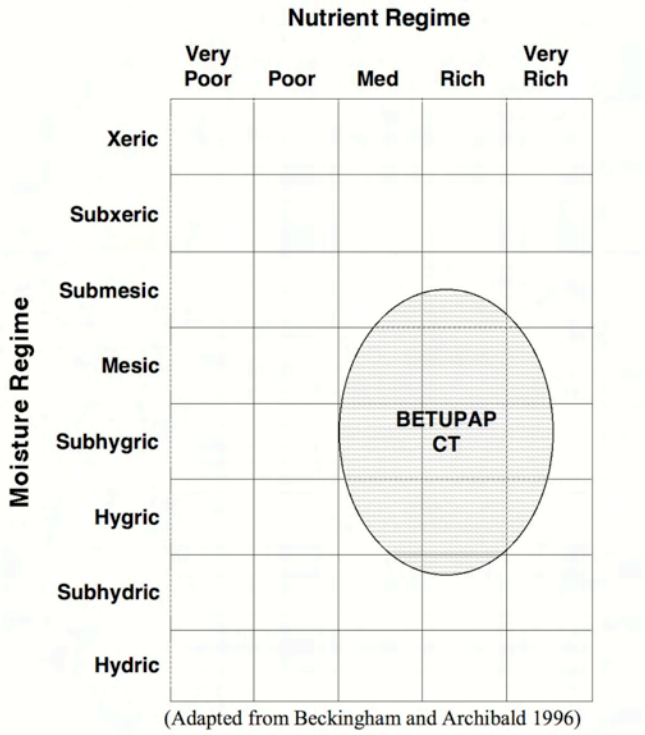


Figure 8. Edatope grid position for the *Betula papyrifera* (white birch) community type (BETUPAP CT). (*Betula papyrifera* (white birch) is normally found as a subdominant tree on some mixedwood forest sites. It may dominate sites near water bodies when beaver remove other deciduous trees.)

SOILS

Parent material may be alluvium or glacial deposits, and soils are generally Brunisols, Luvisols, or Regosols. Sites of this community type typically have organic layer thickness less than 6 centimetres, moderately well to well drained mineral soils with texture in sampled stands ranging from sand to silty clay loam, and with moisture regime ranging from mesic to hygric (Beckingham and Archibald 1996).

ADJACENT COMMUNITIES

Adjacent wetter communities are often dominated by *Salix* species (willow), *Carex atherodes* (awned sedge), *Calamagrostis canadensis* (bluejoint), *Phragmites australis* (reed), or *Alnus* species (alder). *Populus tremuloides* (aspen) or *Picea glauca* (white spruce) upland communities may be adjacent on slightly higher elevations.

MANAGEMENT INFORMATION

Livestock

Forage production is low to moderate in this type. Stands in healthy condition often support a dense understory of palatable shrubs of high forage value, including *Amelanchier alnifolia* (Saskatoon) and *Cornus stolonifera* (red-osier dogwood) (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991). *Calamagrostis canadensis* (bluejoint) and *Poa pratensis* (Kentucky bluegrass), the two most prominent grasses, are rated as fair to excellent forage species (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991).

Timber

Betula papyrifera (white birch) wood is used commercially for veneer, plywood, and pulpwood. It is easily worked and takes finishes and stains readily. Furniture, cabinets, and numerous specialty items are made from *Betula papyrifera* (white birch) lumber. Tree chips are used for pulp and paper manufacture, reconstituted uses, and fuel. It is commonly used as fireplace and wood stove fuel (USDA Intermountain Fire Sciences Lab 1995).

Wildlife
The *Betula papyrifera* (white birch) community type provides 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. Numerous cavity nesting birds nest in *Betula papyrifera* (white birch), including woodpeckers, chickadees, nuthatches, and swallows (USDA Intermountain Fire Sciences Lab 1995). Snowshoe hares browse *Betula papyrifera* (white birch) seedlings and saplings, and porcupines utilize the inner bark. Numerous birds and small mammals eat *Betula papyrifera* (white birch) 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 (USDA Intermountain Fire Sciences Lab 1995).

Fisheries
The streamside location of the *Betula papyrifera* (white birch) community type has fisheries value by providing shade and streambank stability.

Fire
Betula papyrifera (white birch) is well adapted to fire, recovering quickly by means of seedling establishment and vegetative regeneration Seedling establishment is the most significant method of post fire recovery. The species is a prolific producer of lightweight seeds that are easily dispersed by wind and that readily germinate on fire-prepared seedbeds. Young trees may sprout from the root collar following top-kill, but sprouting ability decreases after about 40 to 60 years of age (USDA Intermountain Fire Sciences Lab 1995). 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. During dry periods, *Betula papyrifera* (white birch) stands will burn readily (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities
Betula papyrifera (white birch) is useful for long-term revegetation and soil stabilization of severely disturbed sites. It is used to reclaim mine spoil sites. Best results are obtained by planting 2-year-old or older bare-root or containerized stock (USDA Intermountain Fire Sciences Lab 1995).

Recreational Uses and Considerations
Recreational opportunities in and around sites of this type are excellent for fishing, big game, and waterfowl hunting, and observing a variety of bird species. However, the dense nature of many of these stands may preclude various types of recreational activities such as fly-fishing.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

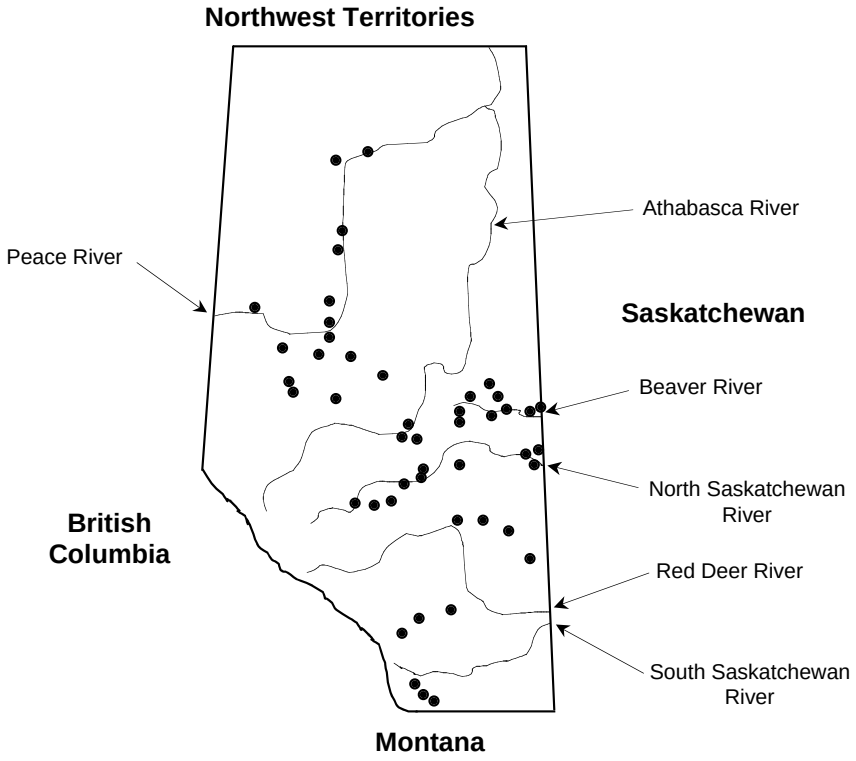
No ecosite described in Alberta contains a community type dominated only by *Betula papyrifera* (white birch). The species is subdominant to other tree species in some ecosite phases. *Betula papyrifera* (white birch) is subdominant to *Picea glauca* (white spruce) in the *Populus balsamifera-Picea glauca* (balsam poplar-white spruce) (Pb-Sw) phase of the *Equisetum* (horsetail) ecosite (f3) on sites with a hygric/rich moisture/nutrient regime in the Boreal Mixedwood (Beckingham and Archibald 1996). These authors also show *Betula papyrifera* (white birch) as subdominant to *Populus tremuloides* (aspen) in the *Betula papyrifera* (white birch) (Bw) phase of the *Vaccinium* (blueberry) ecosite on sites with a submesic/medium moisture/nutrient regime.

OTHER STUDIES

Willoughby (2000) describes a *Betula papyrifera/Salix* (white birch/willow) community type in the Central Mixedwood Subregion. Beckingham and Archibald (1996) and Beckingham, Nielsen, and Futoransky (1996) describe community types with *Picea glauca* (white spruce) and *Populus tremuloides* (aspen) codominant with *Betula papyrifera* (white birch) in northern Alberta and the Mid-Boreal ecoregions of Saskatchewan on the *Populus tremuloides* (aspen) *Betula papyrifera* (white birch) phase of the *Vaccinium* (blueberry) ecosite. Pfister and others (1977) mention a *Populus trichocarpa-Betula papyrifera* (black cottonwood-white birch) community occurring at low elevations in northwestern Montana.

POPUBAL/CORNSTO
Number of Stands Sampled = 79
Number of Stands Sampled in Alberta = 75

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type is a major type at low elevations in the Dry Mixedwood Subregion of the Boreal Forest Natural Region of Alberta. It occurs also as a minor type in the Parkland Natural Region. This type is found on alluvial terraces of streams and rivers, and around lakes, sloughs, and moist areas of the Boreal Forest and Parkland Ecoregions. Among the dataset are typical stands sampled on the Vermilion River near Vermilion, Buffalo Lake near Stettler, the Beaver River near Cold Lake, the Smoky River near Watino, Lake Winagami near High Prairie, the Whitemud River near Dixonville, and the Peace River near Ft. Vermilion.

VEGETATION

The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type is typically characterized by an overstory of *Populus balsamifera* (balsam poplar) dominating a dense and diverse understory of shrubs and herbaceous plants. *Cornus stolonifera* (red-osier dogwood) is the diagnostic understory species for this type, having a canopy cover of at least one percent. In addition, present with high constancy (greater than 50 percent) on relatively undisturbed stands are *Amelanchier alnifolia* (Saskatoon), *Rosa* species (rose), *Rubus* species (raspberry), *Salix bebbiana* (beaked willow), *Symphoricarpos* species (buckbrush), and *Viburnum edule* (low-bush cranberry) (Table 8). A wide variety of herbaceous species are usually present on relatively undisturbed sites. *Calamagrostis canadensis* (bluejoint) is the most prominent graminoid, occurring on more than three fourths of all undisturbed stands. The list of forb species is long, but only five species occurred on at least half the stands. Only *Aralia nudicaulis* (wild sarsaparilla) and *Equisetum arvense* (common horsetail) have prominence indices as high as 20 on relatively undisturbed sites (Table 8).

Table 8. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 36 relatively undisturbed stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	3	0-10	39	11
Picea glauca (white spruce)	2	0-3	22	5
Populus balsamifera (balsam poplar)	61	3-90	100	78
Populus tremuloides (aspen)	2	0-3	50	7
Shrubs				
Alnus crispa (green alder)	60	0-60	3	13
Alnus tenuifolia (river alder)	7	0-20	39	16
Amelanchier alnifolia (Saskatoon)	5	0-30	61	16
Arctostaphylos uva-ursi (common bearberry)	3	0-3	3	3
Betula occidentalis (water birch)	3	0-3	3	3
Cornus canadensis (bunchberry)	2	0-3	22	5
Cornus stolonifera (red-osier dogwood)	25	0-70	97	49
Corylus cornuta (beaked hazelnut)	7	0-30	22	12
Elaeagnus commutata (silverberry)	3	0-3	3	3
Ledum groenlandicum (common Labrador tea)	3	0-3	3	3
Linnaea borealis (twinflower)	2	0-3	8	3
Lonicera spp. (honeysuckle)	3	0-3	3	3
Lonicera dioica (twining honeysuckle)	3	0-10	31	10
Lonicera involucrata (bracted honeysuckle)	6	0-20	47	15
Prunus pensylvanica (pin cherry)	3	0-3	3	3
Prunus virginiana (choke cherry)	10	0-40	36	18
Ribes americanum (wild black currant)	1	0-1	6	2
Ribes glandulosum (skunk currant)	5	0-10	11	7
Ribes hudsonianum (northern black currant)	1	0-1	3	2
Ribes lacustre (bristly black currant)	4	0-10	11	7
Ribes oxyacanthoides (northern gooseberry)	2	0-3	44	9
Ribes triste (wild red currant)	1	0-3	22	5
Rosa spp. (rose)	9	0-30	94	29
Rubus arcticus (dwarf raspberry)	1	0-1	3	2
Rubus idaeus (wild red raspberry)	9	0-40	61	22
Rubus pubescens (dewberry)	3	0-10	58	13
Salix bebbiana (beaked willow)	6	0-30	50	17
Salix lucida (shining willow)	2	0-3	6	3
Salix lutea (yellow willow)	2	0-3	8	4
Salix planifolia (flat-leaved willow)	2	0-3	8	3
Salix pyrifolia (balsam willow)	1	0-1	3	2
Salix scouleriana (Scouler's willow)	4	0-10	28	11
Shepherdia canadensis (Canada buffaloberry)	4	0-10	8	6
Symphoricarpos spp. (buckbrush)	4	0-40	50	14
Symphoricarpos occidentalis (buckbrush)	2	0-3	22	7
Vaccinium caespitosum (dwarf bilberry)	1	0-1	3	2
Viburnum edule (low-bush cranberry)	6	0-20	64	20
Viburnum opulus (high-bush cranberry)	4	0-10	8	6
Graminoids				
Agropyron dasystachyum (northern wheat grass)	1	0-1	8	3
Agropyron repens (quack grass)	2	0-3	6	3
Agropyron trachycaulum (slender wheat grass)	1	0-1	11	3
Bromus ciliatus (fringed brome)	6	0-10	6	5
Bromus inermis (awnless brome)	1	0-3	17	4
Calamagrostis canadensis (bluejoint)	5	0-30	78	20
Carex deflexa (bent sedge)	1	0-1	3	2
Carex deweyana (Dewey's sedge)	1	0-1	3	2

Table 8 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Carex disperma (two-seeded sedge)	3	0-3	3	3
Carex praegracilis (graceful sedge)	1	0-1	3	2
Carex sprengelii (Sprengel's sedge)	3	0-3	3	3
Carex spp. (sedge)	1	0-1	6	2
Cinna latifolia (drooping wood-reed)	1	0-1	3	2
Elymus innovatus (hairy wild rye)	2	0-3	11	3
Oryzopsis asperifolia (white-grained mountain rice grass)	3	0-3	3	3
Phalaris arundinacea (reed canary grass)	10	0-10	3	5
Poa palustris (fowl bluegrass)	3	0-3	3	3
Poa pratensis (Kentucky bluegrass)	1	0-1	8	3
Schizachne purpurascens (purple oat grass)	3	0-10	11	6
Forbs				
Achillea millefolium (common yarrow)	2	0-3	8	3
Achillea sibirica (many-flowered yarrow)	1	0-1	8	3
Actaea rubra (red and white baneberry)	1	0-3	28	5
Allium spp. (onion)	1	0-1	3	2
Anemone canadensis (Canada anemone)	3	0-3	3	3
Antennaria parvifolia (small-leaved everlasting)	1	0-1	3	2
Aralia nudicaulis (wild sarsaparilla)	9	0-50	58	23
Aster ciliolatus (Lindley's aster)	5	0-10	8	6
Aster conspicuus (showy aster)	3	0-10	56	11
Aster hesperius (western willow aster)	1	0-1	11	3
Aster laevis (smooth aster)	1	0-1	3	2
Aster modestus (large northern aster)	1	0-1	6	2
Athyrium filix-femina (lady fern)	1	0-1	3	2
Caltha palustris (marsh-marigold)	1	0-1	3	2
Circaea alpina (small enchanter's nightshade)	7	0-10	6	6
Cirsium drummondii (Drummond's thistle)	1	0-1	3	2
Delphinium glaucum (tall larkspur)	1	0-1	3	2
Disporum trachycarpum (fairybells)	1	0-1	11	3
Epilobium angustifolium (common fireweed)	4	0-20	44	12
Fragaria virginiana (wild strawberry)	2	0-10	44	9
Galeopsis tetrahit (hemp-nettle)	2	0-3	11	3
Galium boreale (northern bedstraw)	2	0-10	42	9
Galium trifidum (small bedstraw)	1	0-1	3	2
Galium triflorum (sweet-scented bedstraw)	4	0-20	33	10
Geocaulon lividum (northern bastard toadflax)	3	0-3	3	3
Geranium richardsonii (wild white geranium)	2	0-3	6	3
Geum aleppicum (yellow avens)	1	0-1	8	3
Gymnocarpium dryopteris (oak fern)	1	0-1	6	2
Heracleum lanatum (cow parsnip)	1	0-3	28	5
Lathyrus ochroleucus (cream-colored vetchling)	2	0-10	50	10
Lilium philadelphicum (western wood lily)	1	0-1	3	2
Lysimachia ciliata (fringed loosestrife)	1	0-1	3	2
Maianthemum canadense (wild lily-of-the-valle)	1	0-1	14	4
Mentha arvensis (wild mint)	1	0-1	3	2
Mertensia paniculata (tall lungwort)	4	0-20	47	14
Mitella nuda (bishop's-cap)	2	0-3	22	5
Moehringia lateriflora (blunt-leaved sandwort)	1	0-1	8	3
Orthilia secunda (one-sided wintergreen)	1	0-1	3	2
Osmorhiza depauperata (spreading sweet cicely)	1	0-1	3	2
Petasites palmatus (palmate-leaved coltsfoot)	2	0-10	56	11
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	3	2
Pyrola asarifolia (common pink wintergreen)	1	0-3	19	4
Ranunculus spp. (ranunculus)	3	0-3	3	3

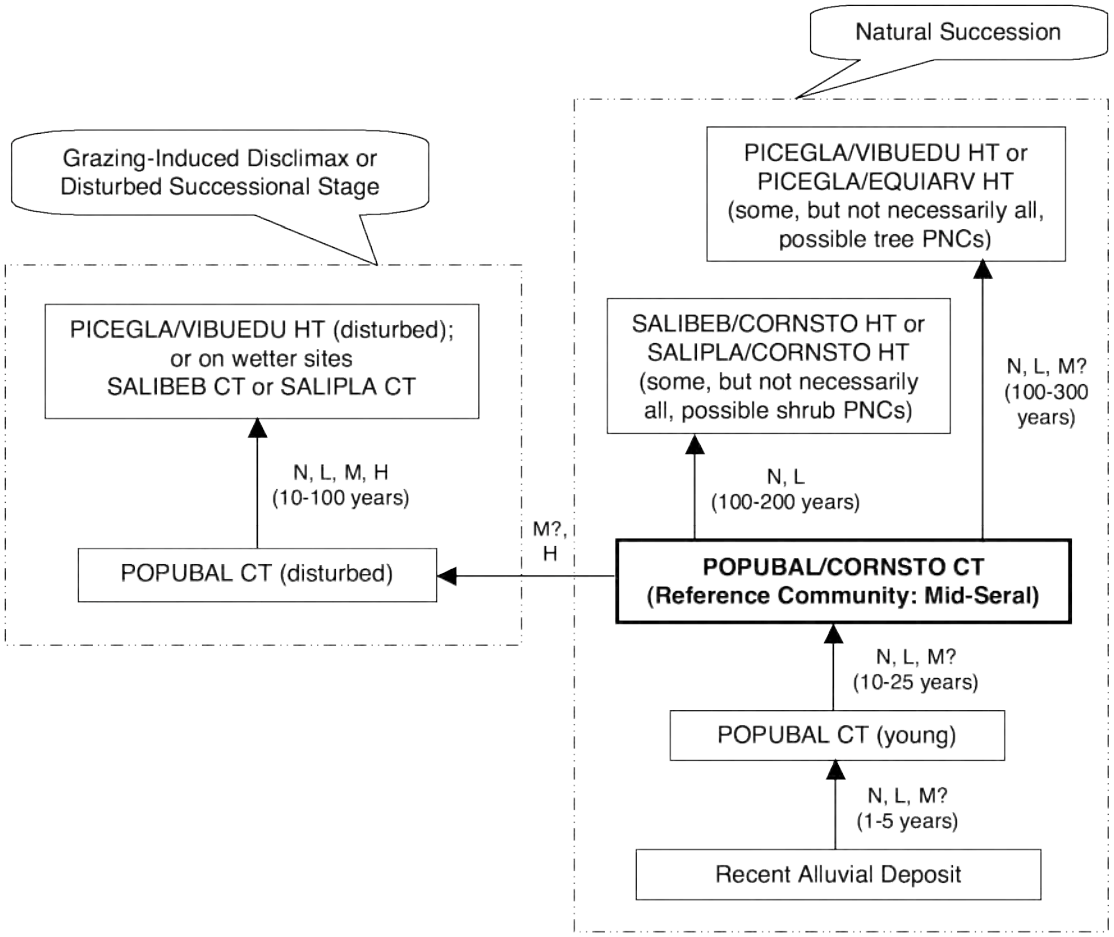
Table 8 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Sanicula marilandica (snakeroot)	5	0-10	8	6
Scutellaria galericulata (marsh skullcap)	2	0-3	6	3
Senecio pauciflorus (few-flowered ragwort)	1	0-1	3	2
Smilacina stellata (star-flowered Solomon's-seal)	3	0-10	39	9
Smilacina trifolia (three-leaved Solomon's-seal)	1	0-1	3	2
Solidago canadensis (Canada goldenrod)	2	0-3	28	5
Solidago spp. (goldenrod)	1	0-1	3	2
Solidago gigantea (late goldenrod)	1	0-1	3	2
Stachys palustris (marsh hedge-nettle)	3	0-3	14	6
Stellaria longifolia (long-leaved chickweed)	3	0-3	3	3
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0-1	3	2
Taraxacum officinale (common dandelion)	1	0-1	31	6
Thalictrum spp. (meadow rue)	3	0-3	3	3
Thalictrum venulosum (veiny meadow rue)	3	0-10	25	9
Thermopsis rhombifolia (golden bean)	10	0-10	3	5
Trientalis borealis (northern starflower)	1	0-1	3	2
Urtica dioica (common nettle)	1	0-3	14	4
Vicia americana (wild vetch)	2	0-3	53	7
Viola canadensis (western Canada violet)	3	0-10	14	6
Viola renifolia (kidney-leaved violet)	1	0-1	6	2
Ferns and Allies				
Equisetum arvense (common horsetail)	9	0-50	78	26

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

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 widely common example of secondary successional stands of this species occurs on burned areas where re-establishment may be by seed or vegetative propagation. Figure 9 shows a schematic diagram of expected successional pathways.



Successional Pathway of *Populus balsamifera* (balsam poplar) Sites in North Central Alberta
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/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
POPUBAL CT—*Populus balsamifera* (balsam poplar) community type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
SALIBEB CT—*Salix bebbiana* (beaked willow) community type
SALIBEB/CORNSTO HT—*Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type
SALIPLA CT—*Salix planifolia* (flat-leaved willow) community type
SALIPLA/CORNSTO HT—*Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type

Figure 9. 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 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.

Populus balsamifera (balsam poplar) reproduces both sexually and vegetatively. Seeds are wind dispersed, remaining viable for 2 to 4 weeks, but germinating immediately upon arrival on a suitable seedbed of exposed, moist mineral soil. The species is also capable of regenerating from root suckers, stump sprouts, stem sprouts, and buried branches. Root suckering is thought to be primarily a means of clonal expansion rather than a means of stand recovery following clearcutting or fire (USDA Intermountain Fire Sciences Lab 1995). Once established on more moist sites, *Populus balsamifera* (balsam poplar) will expand onto drier, sandier sites through vegetative expansion. Suckering is most common when the organic layer has been removed, exposing mineral soil, and is thought to increase when the overstory is removed, allowing warmer soil temperatures. Stands of *Populus balsamifera* (balsam poplar) are often polyclonal, with several genotypes and their sprouts making up a stand (USDA Intermountain Fire Sciences Lab 1995).

Early Seral Stage—On river floodplain sites erosion and deposition help maintain plant community diversity. Distribution of the various plant communities depends on the river dynamics. Channel migration rate determines the proportion of floodplain communities in early seral, mid-seral, late seral, and climax successional stages. If the channel migration rate is high, few stands progress to late successional stage before being swept away. Near the outer edges of the floodplain, effect of the river is reduced, allowing later stages to develop. Lateral movement of the river initiates a dynamic series of vegetation events. The stream erodes its banks on outside curves, typically covered with riparian vegetation in later successional stages. The stream then deposits fresh alluvium on point bars along inside curves. Each new alluvial deposit adds to or forms a distinct bar or terrace as a new site for young pioneer vegetation. Typically, the bands are progressively older with distance away from the channel and onto higher terraces. Parts of the floodplain may remain undisturbed long enough for there elevation to be raised enough above the channel by flood deposition that they become rarely, if ever, flooded. These are considered old, mature alluvial terraces, and may continue vegetative development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Mid-Seral Stage—On riverine sites, if disturbance (human-caused or natural) does not eliminate the stand, the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type will eventually become dominated by other species climax to the site, such as *Picea glauca* (white spruce) or *Populus tremuloides* (aspen), depending upon the ecoregion location of the site. If no climax tree species are present, the stand may progress to a tall shrub type dominated by a willow, such as *Salix lutea* (yellow willow). As the *Populus balsamifera* (balsam poplar) overstory matures, becomes open, and finally, decadent, these species are ready to replace them.

Late Seral to Climax (PNC) Stage—As the *Populus balsamifera* (balsam poplar) stand dies, primary succession toward a climax community progresses (in the absence of disturbance: fire on non riverine sites or flooding deposits of new sediment on riverine sites). In the absence of such disturbance, succession continues from the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type to a habitat type dominated by a species such as *Picea glauca* (white spruce), *Populus tremuloides* (aspen), or *Salix lutea* (yellow willow).

Secondary Successional Stages
Natural disturbances (e.g., fire) or human caused disturbances (e.g., intense livestock grazing) may alter or remove existing vegetation from a site. Following fire a site may have mineral soil exposed that becomes wetted to provide suitable sites for seeded establishment, but it is more likely for *Populus balsamifera* (balsam poplar) to repopulate the stand through vegetative regeneration from stumps and roots. In this scenario the full natural *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type can reoccupy the site, if left undisturbed further. However, at any point during early development a stand of this type may have its community composition altered to the extent that the course of seral progression is diverted. For example, browsing ungulates can eliminate the naturally dense understory of moist site shrubs. This can allow the substitution of lower, dry-site shrubs (e.g., *Symphoricarpos* species [buckbrush] and *Rosa* species [rose]) and herbaceous increaser species (e.g., *Bromus inermis* [awnless brome] and *Poa pratensis* [Kentucky bluegrass]), effectively drying out the site and even changing its vegetative potential.

With persistently high grazing or browsing levels, *Symphoricarpos* species (buckbrush) and *Elaeagnus commutata* (silverberry) are found to increase with a corresponding decrease in abundance and canopy cover of such desirable tall shrubs as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Lonicera involucrata* (bracted honeysuckle), *Prunus virginiana* (choke cherry), and *Viburnum edule* (low-bush cranberry) (Table 9). If high levels of grazing or browsing pressures continue, the more desirable shrubs will be drastically reduced or eliminated, leaving *Symphoricarpos occidentalis* (buckbrush), *Elaeagnus commutata* (silverberry), and *Rosa* species (rose) as the principle shrubs. With disturbance severe and long enough, this reduced community may become the *Populus balsamifera* (balsam poplar) community type. There are sites where ***ALL*** shrubs are eliminated and the understory is entirely converted to herbs such as *Bromus inermis* (awnless brome), *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (timothy), and a variety of weedy forbs.

During the process of converting from a naturally diverse, dense shrub understory to a disturbed herbaceous understory, the stand will open underneath, causing it to become drier. Finally, the trees become decadent with widely spaced, dying *Populus*

(poplars). The site can become open and dry enough to change the potential to an upland type, as indicated by the presence of upland species. Once the stand has been converted from a shrub-dominated understory to an open herbaceous one, the potential for return to its former moist shrub dominance is very low, even if the site hydrology remains intact. It may be possible, but will require a drastic change in management and may be very costly. Therefore, if a manager wants to maintain the moist shrub dominated understory, the most cost effective way is to manage accordingly ***BEFORE*** the site is too degraded.

Table 9. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 43 disturbed stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Trees				
Acer negundo (Manitoba maple)	1	0-1	5	2
Betula papyrifera (white birch)	1	0-3	16	4
Picea glauca (white spruce)	1	0-3	30	5
Populus balsamifera (balsam poplar)	53	3-80	100	73
Populus tremuloides (aspen)	2	0-3	37	9
Shrubs				
Alnus crispa (green alder)	3	0-3	2	3
Alnus tenuifolia (river alder)	13	0-60	33	21
Amelanchier alnifolia (Saskatoon)	3	0-10	51	12
Arctostaphylos uva-ursi (common bearberry)	1	0-1	2	2
Betula occidentalis (water birch)	6	0-20	12	8
Clematis occidentalis (purple clematis)	3	0-3	2	3
Cornus canadensis (bunchberry)	7	0-20	12	9
Cornus stolonifera (red-osier dogwood)	9	0-40	91	29
Corylus cornuta (beaked hazelnut)	3	0-3	2	3
Elaeagnus commutata (silverberry)	10	0-30	30	17
Juniperus communis (ground juniper)	1	0-1	2	2
Lonicera dioica (twining honeysuckle)	1	0-1	2	2
Lonicera involucrata (bracted honeysuckle)	3	0-10	19	7
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	2	2
Prunus virginiana (choke cherry)	4	0-20	35	12
Ribes americanum (wild black currant)	6	0-10	5	5
Ribes glandulosum (skunk currant)	6	0-10	5	5
Ribes hudsonianum (northern black currant)	1	0-1	2	2
Ribes oxyacanthoides (northern gooseberry)	2	0-3	30	8
Ribes triste (wild red currant)	1	0-1	2	2
Rosa spp. (rose)	9	0-30	79	27
Rubus idaeus (wild red raspberry)	5	0-20	47	15
Rubus pubescens (dewberry)	3	0-20	30	8
Salix bebbiana (beaked willow)	3	0-30	53	13
Salix candida (hoary willow)	3	0-3	2	3
Salix discolor (pussy willow)	21	0-40	5	10
Salix drummondiana (Drummond's willow)	1	0-1	2	2
Salix exigua (sandbar willow)	8	0-20	16	11
Salix lucida (shining willow)	15	0-20	5	8
Salix lutea (yellow willow)	6	0-20	30	12
Salix melanopsis (willow)	1	0-1	2	2
Salix myrtillifolia (myrtle-leaved willow)	7	0-10	5	6
Salix petiolaris (basket willow)	3	0-3	5	4
Salix planifolia (flat-leaved willow)	3	0-10	19	6
Salix pseudomonticola (false mountain willow)	1	0-1	7	3
Salix pyrifolia (balsam willow)	1	0-1	2	2
Salix scouleriana (Scouler's willow)	11	0-20	5	7
Shepherdia argentea (thorny buffaloberry)	1	0-1	2	2
Shepherdia canadensis (Canada buffaloberry)	3	0-10	19	6
Spiraea betulifolia (white meadowsweet)	1	0-1	2	2

Table 9 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Symphoricarpos spp. (buckbrush)	10	0-30	53	23
Symphoricarpos occidentalis (buckbrush)	11	0-30	23	15
Viburnum edule (low-bush cranberry)	4	0-10	16	7
Viburnum opulus (high-bush cranberry)	1	0-1	2	2
Graminoids				
Agropyron dasystachyum (northern wheat grass)	1	0-1	5	2
Agropyron repens (quack grass)	3	0-10	33	8
Agrostis scabra (rough hair grass)	20	0-20	2	7
Agrostis stolonifera (redtop)	16	0-20	12	14
Agropyron trachycaulum (slender wheat grass)	2	0-3	21	6
Alopecurus occidentalis (alpine foxtail)	3	0-3	2	3
Alopecurus pratensis (meadow foxtail)	1	0-1	2	2
Beckmannia syzigachne (slough grass)	1	0-1	2	2
Bromus ciliatus (fringed brome)	1	0-1	9	3
Bromus inermis (awnless brome)	8	0-30	42	18
Calamagrostis canadensis (bluejoint)	6	0-20	42	16
Calamagrostis inexpansa (northern reed grass)	24	0-40	7	13
Calamagrostis stricta (narrow reed grass)	11	0-20	5	7
Carex aenea (silvery-flowered sedge)	1	0-1	2	2
Carex atherodes (awned sedge)	10	0-10	2	5
Carex deweyana (Dewey's sedge)	2	0-3	12	5
Carex disperma (two-seeded sedge)	4	0-10	7	5
Carex lanuginosa (woolly sedge)	2	0-3	9	3
Carex microglochin (short-awned sedge)	1	0-1	2	2
Carex praegracilis (graceful sedge)	1	0-1	2	2
Carex sprengelii (Sprengel's sedge)	1	0-1	2	2
Cinna latifolia (drooping wood-reed)	3	0-3	5	4
Dactylis glomerata (orchard grass)	7	0-10	5	6
Elymus canadensis (Canada wild rye)	1	0-1	7	3
Elymus glaucus (smooth wild rye)	3	0-3	2	3
Elymus innovatus (hairy wild rye)	1	0-1	5	2
Elymus virginicus (Virginia wild rye)	1	0-1	5	2
Festuca idahoensis (bluebunch fescue)	1	0-1	2	2
Festuca pratensis (meadow fescue)	1	0-1	2	2
Festuca rubra (red fescue)	3	0-3	2	3
Festuca saximontana (Rocky Mountain fescue)	1	0-1	2	2
Festuca spp. (fescue)	10	0-10	2	5
Hordeum jubatum (foxtail barley)	1	0-1	7	3
Juncus balticus (wire rush)	7	0-10	12	9
Melica subulata (Alaska onion grass)	2	0-3	5	3
Oryzopsis asperifolia (white-grained mountain rice grass)	3	0-3	2	3
Phalaris arundinacea (reed canary grass)	5	0-10	7	6
Phleum pratense (timothy)	3	0-10	30	10
Poa palustris (fowl bluegrass)	4	0-30	30	11
Poa pratensis (Kentucky bluegrass)	13	0-40	63	29
Schizachne purpurascens (purple oat grass)	2	0-3	5	3
Scirpus pungens (three-square rush)	20	0-20	2	7
Forbs				
Achillea millefolium (common yarrow)	1	0-3	30	5
Achillea sibirica (many-flowered yarrow)	1	0-1	7	3
Actaea rubra (red and white baneberry)	2	0-10	35	6
Allium cernuum (nodding onion)	1	0-1	2	2
Anemone canadensis (Canada anemone)	1	0-1	2	2
Anemone cylindrica (long-fruited anemone)	1	0-1	5	2
Angelica arguta (white angelica)	2	0-3	9	3

Table 9 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Aralia nudicaulis (wild sarsaparilla)	5	0-20	16	9
Artemisia campestris (plains wormwood)	1	0-1	2	2
Artemisia dracunculus (dragonwort)	1	0-1	2	2
Artemisia ludoviciana (prairie sagewort)	1	0-1	2	2
Aster borealis (marsh aster)	1	0-1	2	2
Aster ciliolatus (Lindley's aster)	1	0-1	5	2
Aster conspicuus (showy aster)	4	0-20	40	13
Aster hesperius (western willow aster)	2	0-3	19	4
Aster laevis (smooth aster)	3	0-10	33	10
Aster puniceus (purple-stemmed aster)	1	0-1	5	2
Aster spp. (aster)	3	0-3	2	3
Astragalus spp. (milk vetch)	1	0-1	2	2
Athyrium filix-femina (lady fern)	1	0-1	2	2
Botrychium virginianum (Virginia grape fern)	1	0-1	5	2
Caltha palustris (marsh-marigold)	1	0-1	2	2
Campanula rotundifolia (harebell)	1	0-1	5	2
Castilleja spp. (paintbrush)	1	0-1	2	2
Chenopodium album (lamb's-quarters)	1	0-1	2	2
Chrysanthemum leucanthemum (ox-eye daisy)	1	0-1	2	2
Cicuta maculata (water-hemlock)	1	0-1	5	2
Circaea alpina (small enchanter's nightshade)	1	0-1	5	2
Cirsium arvense (Canada thistle)	2	0-10	35	8
Delphinium glaucum (tall larkspur)	2	0-3	12	5
Disporum trachycarpum (fairybells)	1	0-1	12	3
Epilobium angustifolium (common fireweed)	1	0-1	21	5
Epilobium ciliatum (northern willowherb)	1	0-1	2	2
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	2	2
Erysimum cheiranthoides (wormseed mustard)	1	0-1	2	2
Fragaria virginiana (wild strawberry)	2	0-10	58	11
Galeopsis tetrahit (hemp-nettle)	6	0-10	5	5
Galium boreale (northern bedstraw)	1	0-3	58	8
Galium triflorum (sweet-scented bedstraw)	1	0-3	21	5
Geranium richardsonii (wild white geranium)	3	0-20	33	10
Geum aleppicum (yellow avens)	2	0-3	7	3
Geum macrophyllum (large-leaved yellow avens)	2	0-3	16	6
Glycyrrhiza lepidota (wild licorice)	1	0-1	5	2
Habenaria dilatata (tall white bog orchid)	1	0-1	2	2
Halenia deflexa (spurred gentian)	1	0-1	2	2
Heracleum lanatum (cow parsnip)	3	0-10	19	7
Hieracium umbellatum (narrow-leaved hawkweed)	1	0-1	14	4
Lactuca pulchella (common blue lettuce)	1	0-1	2	2
Lathyrus ochroleucus (cream-colored vetchling)	2	0-3	35	6
Lomatium dissectum (mountain wild parsnip)	1	0-1	5	2
Lycopus asper (western water-horehound)	1	0-1	2	2
Lysimachia ciliata (fringed loosestrife)	1	0-1	5	2
Maianthemum canadense (wild lily-of-the-valle)	1	0-3	21	5
Matricaria perforata (scentless chamomile)	1	0-1	2	2
Medicago lupulina (black medick)	1	0-1	5	2
Melilotus alba (white sweet-clover)	1	0-1	7	3
Melilotus officinalis (yellow sweet-clover)	4	0-10	12	6
Mentha arvensis (wild mint)	2	0-3	5	3
Mertensia paniculata (tall lungwort)	3	0-10	23	8
Mitella nuda (bishop's-cap)	2	0-3	9	4
Monarda fistulosa (wild bergamot)	1	0-1	2	2
Moneses uniflora (one-flowered wintergreen)	1	0-1	2	2

Table 9 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Orthilia secunda (one-sided wintergreen)	1	0-1	2	2
Osmorhiza chilensis (blunt-fruited sweet cicely)	1	0-1	2	2
Osmorhiza depauperata (spreading sweet cicely)	2	0-3	9	4
Pedicularis bracteosa (western lousewort)	1	0-1	2	2
Pedicularis spp. (lousewort)	1	0-1	2	2
Petasites palmatus (palmate-leaved coltsfoot)	2	0-3	23	5
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	5	2
Physostegia parviflora (false dragonhead)	3	0-3	2	3
Plantago major (common plantain)	1	0-1	9	3
Potentilla anserina (silverweed)	2	0-3	7	3
Potentilla gracilis (graceful cinquefoil)	1	0-1	2	2
Potentilla norvegica (rough cinquefoil)	1	0-1	5	2
Prunella vulgaris (heal-all)	1	0-1	5	2
Pyrola asarifolia (common pink wintergreen)	1	0-3	26	5
Ranunculus acris (tall buttercup)	1	0-1	5	2
Scutellaria galericulata (marsh skullcap)	1	0-1	7	3
Senecio foetidus (marsh butterweed)	1	0-1	2	2
Senecio pauperculus (balsam groundsel)	2	0-3	5	3
Senecio triangularis (brook ragwort)	1	0-1	2	2
Smilacina racemosa (false Solomon's-seal)	1	0-1	2	2
Smilacina stellata (star-flowered Solomon's-seal)	2	0-10	56	11
Solidago canadensis (Canada goldenrod)	4	0-10	33	10
Solidago spp. (goldenrod)	3	0-3	2	3
Solidago gigantea (late goldenrod)	4	0-10	7	5
Solidago missouriensis (low goldenrod)	2	0-3	5	3
Sonchus arvensis (perennial sow-thistle)	10	0-10	2	5
Sonchus asper (prickly annual sow-thistle)	1	0-1	2	2
Sonchus spp. (sow-thistle)	5	0-10	21	10
Spiranthes romanzoffiana (hooded ladies'-tresses)	1	0-1	2	2
Stachys palustris (marsh hedge-nettle)	2	0-3	9	4
Stellaria longipes (long-stalked chickweed)	1	0-1	5	2
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0-1	7	3
Tanacetum vulgare (common tansy)	2	0-3	5	3
Taraxacum officinale (common dandelion)	3	0-10	79	15
Thalictrum dasycarpum (tall meadow rue)	3	0-3	2	3
Thalictrum spp. (meadow rue)	1	0-1	2	2
Thalictrum occidentale (western meadow rue)	1	0-1	2	2
Thalictrum venulosum (veiny meadow rue)	3	0-10	37	9
Trifolium spp. (clover)	3	0-10	40	11
Urtica dioica (common nettle)	3	0-10	16	7
Vicia americana (wild vetch)	2	0-10	67	12
Viola adunca (early blue violet)	2	0-3	5	3
Viola canadensis (western Canada violet)	2	0-10	28	7
Viola palustris (marsh violet)	1	0-1	2	2
Ferns and Allies				
Equisetum arvense (common horsetail)	7	0-30	79	24

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

EDATOPE

Figure 10 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).

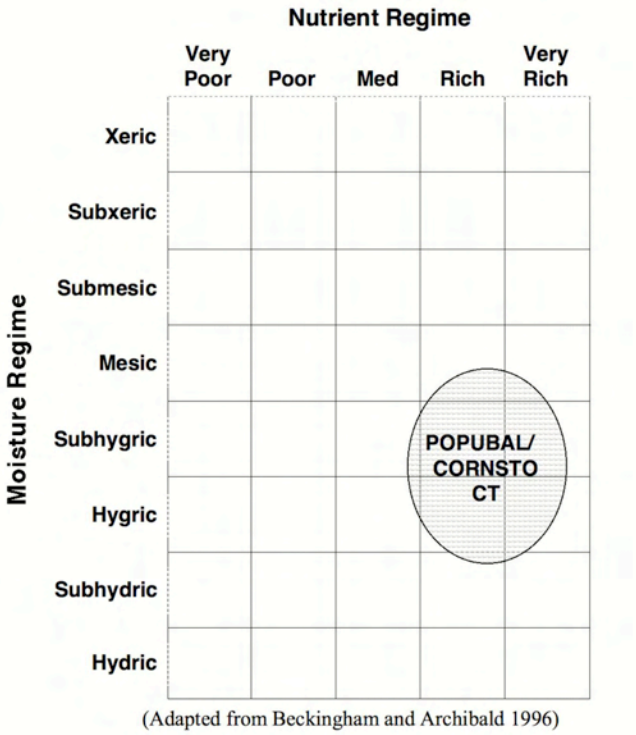


Figure 10. Edatope grid position for the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type (POPUBAL/CORNSTO CT)

SOILS

On fluvial sites, soils are typically Regosols with up to 1 m of mineral soil overlying river gravel and/or cobbles. Brunisols and Luvisols are typically found on non-fluvial forested sites. Mineral soil texture in sampled stands ranged from sand and gravel to clay. Typical organic layer thickness is at least six centimetres of incompletely decomposed litter (mor). Soil drainage regimes typically range from poor to moderately well drained, and nutrient regimes are typically rich (Beckingham and Archibald 1996). Water tables usually drop below 1 m of the soil surface in summer, but soils can remain moist due to capillary action. Redox concentrations (mottles) are common in these soils as evidence of a fluctuating, but high water table.

ADJACENT COMMUNITIES

Adjacent wetter communities are typically dominated by *Salix bebbiana* (beaked willow), *Salix lutea* (yellow willow), *Salix scouleriana* (Scouler's willow), *Alnus* species (alder), *Carex atherodes* (awned sedge), or *Calamagrostis canadensis* (bluejoint). Upland types usually occupy adjacent drier sites.

MANAGEMENT INFORMATION

Livestock

Forage production ranges from low to moderate due to the dense nature of the stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type. Stands in good to excellent health (condition) often support dense thickets of shrubs, limiting the available herbaceous forage. Some of the major shrub species found in this type (e.g., *Cornus stolonifera* [red-osier dogwood], *Amelanchier alnifolia* [saskatoon], *Prunus virginiana* [choke cherry], and *Viburnum edule* [low-bush cranberry]) are rated good as browse forage for livestock and wildlife (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991).

Sites 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 things as *Symphoricarpos* species (buckbrush), *Rosa* species (rose), and *Lonicera* species (honeysuckle) in the understory. With sufficient long-term intense usage, a site can be converted to the *Populus balsamifera* (balsam poplar) community type by reduction of total shrub cover to less than 25 percent.

Timber
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 1997). Mechanical logging places the species at a competitive advantage over *Picea glauca* (white spruce) by creating microsites for seedling establishment. Cutting mature *Populus balsamifera* (balsam poplar) results in sprouting from callus tissue and dormant buds (USDA Intermountain Fire Sciences Lab 1995). Stump sprouting is most pronounced on winter-logged areas. Improper harvesting can cause suppression of *Populus balsamifera* (balsam poplar) and dominance by shrubs in the clearings. Trees cut in summer have few surviving sprouts after four years (USDA Intermountain Fire Sciences Lab 1995).

Wildlife
The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type provides valuable cover, shade, and food for a variety of species. *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (Saskatoon), and *Viburnum edule* (low-bush cranberry) are important forage species for wild ungulates (Tannas 1997). Moose sparingly browse young *Populus balsamifera* (balsam poplar), and will strip bark from the trees in times of winter food shortage (USDA Intermountain Fire Sciences Lab 1995). 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
When located near a stream the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, provides thermal cover, debris, and streambank stability. The importance of this function cannot be over emphasized (see discussion in the Soil Management and Rehabilitation Opportunities section). *Cornus stolonifera* (red-osier dogwood) and associated shrub species are excellent in controlling erosion along streams (Hansen and others 1995). This is particularly important on the higher gradient streams where scouring by seasonal flooding may occur.

Fire
Populus balsamifera (balsam poplar) is considered one of the tree species most well adapted to fire in the boreal forest. Its ability to produce sprouts from roots and stumps enables it to quickly recover after fire. Severe fires kill *Populus balsamifera* (balsam poplar); however, underground parts survive in moist soils. Moderate fires 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 the site by preventing regeneration (USDA Intermountain Fire Sciences Lab 1995).

The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type is most susceptible to fire during late summer and fall. *Populus balsamifera* (balsam poplar) and shrubs associated with this community type are adapted to fire of light to moderate intensity (Hansen and others 1995). Many of these species can produce new sprouts after a burn. Therefore, 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 young sprouts (Hansen and others 1995).

Soil Management and Rehabilitation Opportunities
Riverine or floodplain sites supporting this community type are subject to recurring scouring by floods and alluvium deposition. However, with healthy natural vegetation communities these stands are relatively stable because of the strong root systems of the associated species. Management should emphasize the importance of the understory shrub layer in streambank stabilization. This is most important on higher gradient streams. Managers should strive to maintain a buffer of this community types adjacent to all rivers and streams where possible. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize streambanks, and dissipate flood energy.

If sites degraded by overgrazing still have a fairly high water table, the elimination of grazing and close monitoring of wildlife impacts ***MAY*** allow remnant shrubs to sprout and repopulate the stand. However, if the water table has dropped much, or if the shrubs are entirely gone, the opportunity to re-establish an understory of desirable shrubs may have been lost (Hansen and others 1995).

Recreational Uses and Considerations
Because of proximity to streams and lakes, recreational developments and transportation corridors are common in this type. Opportunities are excellent in and near this type for fishing, big game, and waterfowl hunting, and observing a variety of wildlife species. Care must be taken when locating structures in this type due to potential for flooding.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

No ecosite described in Alberta contains a community type dominated only by *Populus balsamifera* (balsam poplar). The species is codominant or subdominant to other tree species in some ecosite phases. It is codominant with *Populus tremuloides*

(aspen) in the *Populus balsamifera-Populus tremuloides* (balsam poplar-aspen) phase of two ecosites: the *Equisetum* (horsetail) ecosite (f1) on sites with a hygric/rich moisture/nutrient regime and the *Cornus stolonifera* (dogwood) ecosite (e1) on sites with a subhygric/rich moisture/nutrient regime in the Boreal Mixedwood (Beckingham and Archibald 1996). These authors also show *Populus balsamifera* (balsam poplar) as codominant and subdominant to *Picea glauca* (white spruce) and *Populus tremuloides* (aspen) in the *Populus balsamifera-Picea glauca* (balsam poplar-white spruce) phase of the *Cornus stolonifera* (dogwood) ecosite.

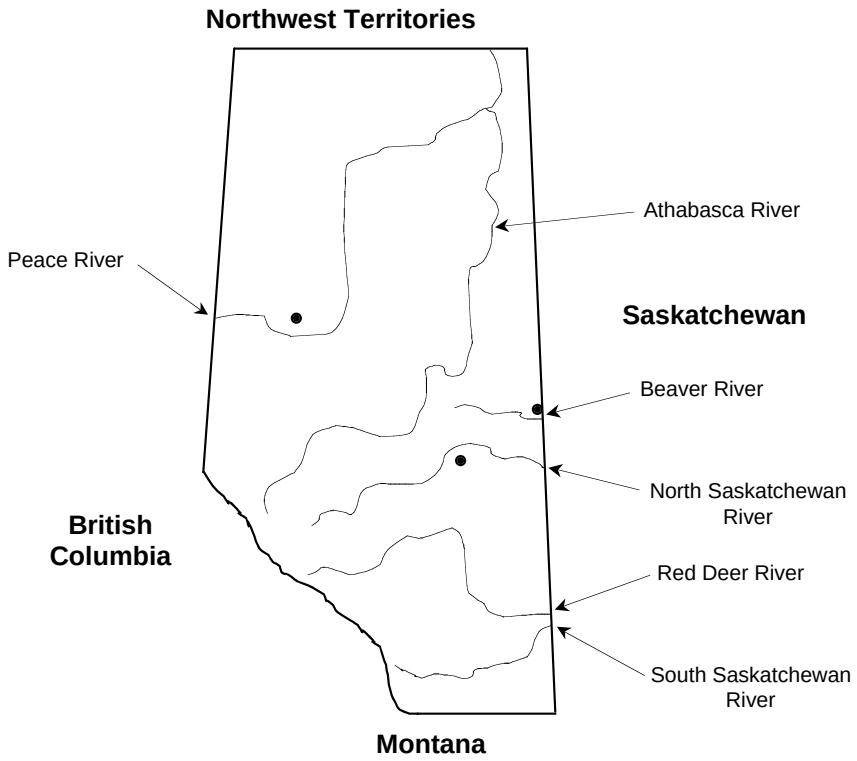
OTHER STUDIES

Thompson and Hansen (2002) describe a *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type in the Grassland Natural Region of southern Alberta. Thompson and Hansen (2001) describe a similar type for the Prairie Ecozone of southern Saskatchewan. Willoughby (2000) describes a *Populus balsamifera/Cornus stolonifera/-Rosa acicularis* (balsam poplar/dogwood/rose) community type in the Dry Mixedwood Ecoregion. Lane and others (2000) describe a *Populus balsamifera/Salix* spp./*Equisetum arvense* (balsam poplar/willow/horsetail) community type in the Lower Foothills Subregion. Beckingham and Archibald (1996) in northern Alberta and Beckingham, Nielsen, and Futoransky (1996) in the Mid-Boreal ecoregions of Saskatchewan describe community types codominated by *Populus tremuloides* (aspen) and *Populus balsamifera* (balsam poplar) with *Cornus stolonifera* (red-osier dogwood) as the key understory indicator. A *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type is described for the mountains, foothills, and intermountain valleys of Montana by Hansen and others (1995).

Populus balsamifera Community Type (Balsam Poplar Community Type)

POPUBAL
Number of Stands Sampled = 22
Number of Stands Sampled in Alberta = 19

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Populus balsamifera* (balsam poplar) community type is a minor type at low elevations in Dry Mixedwood Subregion of the Boreal Forest Natural Region, and a minor type in the Parkland Natural Region, of Alberta. This type is found on disturbed alluvial terraces of streams and rivers, and around lakes, sloughs, and moist areas of the Boreal Forest and Parkland Ecoregions. Presently in the study area, this type occurs only a minor presence, but its presence will increase with increased development and utilization of sites of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type. Among the dataset are typical stands sampled on Kneehills Creek near Three Hills, near Tulliby Lake, the Peace River near Dunvegan, and on the Notikewin River near Manning.

VEGETATION

In the northern Alberta forests, the *Populus balsamifera* (balsam poplar) community type represents stands of either early seral stage where the shrub understory has not yet developed, or (more commonly) severely disturbed stands dominated by balsam poplar, but having greatly altered understories. Typically, the more palatable moist-site shrubs (e.g., *Cornus stolonifera* [red-osier dogwood] and *Viburnum edule* [low-bush cranberry]) have been eliminated or replaced by *Elaeagnus commutata* (silverberry), *Symphoricarpos* species (buckbrush), *Ribes* species (currants), and *Rosa* species (rose) (Table 10). The herbaceous layer also has been altered from greater presence of *Calamagrostis canadensis* (bluejoint), *Aralia nudicaulis* (wild sarsaparilla), *Aster conspicuus* (showy aster), and *Petasites palmatus* (palmate-leaved coltsfoot) to a predominance of the exotic invaders *Bromus inermis* (awnless brome), *Poa pratensis* (Kentucky bluegrass), and *Taraxacum officinale* (common dandelion).

Table 10. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 22 stands of the *Populus balsamifera* (balsam poplar) community type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Trees				
Picea glauca (white spruce)	1	0-1	18	4
Populus balsamifera (balsam poplar)	53	3-98	100	73
Populus tremuloides (aspen)	2	0-3	32	6
Shrubs				
Alnus tenuifolia (river alder)	4	0-10	18	9
Amelanchier alnifolia (Saskatoon)	2	0-3	50	10
Arctostaphylos uva-ursi (common bearberry)	1	0-1	5	2
Cornus canadensis (bunchberry)	5	0-10	14	8
Cornus stolonifera (red-osier dogwood)	1	0-1	9	3
Corylus cornuta (beaked hazelnut)	20	0-30	9	13
Dryas drummondii (yellow mountain avens)	10	0-10	5	7
Elaeagnus commutata (silverberry)	14	0-30	23	18
Linnaea borealis (twinflower)	1	0-1	5	2
Lonicera dioica (twining honeysuckle)	1	0-1	9	3
Lonicera involucrata (bracted honeysuckle)	7	0-10	14	10
Potentilla fruticosa (shrubby cinquefoil)	2	0-3	9	4
Prunus virginiana (choke cherry)	4	0-10	14	7
Ribes americanum (wild black currant)	1	0-1	5	2
Ribes inerme (mountain gooseberry)	3	0-3	5	4
Ribes oxyacanthoides (northern gooseberry)	3	0-10	41	9
Ribes triste (wild red currant)	3	0-3	5	4
Rosa spp. (rose)	10	0-30	68	26
Rubus arcticus (dwarf raspberry)	1	0-1	5	2
Rubus idaeus (wild red raspberry)	6	0-20	23	11
Rubus pubescens (dewberry)	1	0-1	14	4
Salix bebbiana (beaked willow)	1	0-3	23	5
Salix drummondiana (Drummond's willow)	1	0-1	5	2
Salix exigua (sandbar willow)	20	0-30	9	13
Salix lucida (shining willow)	10	0-10	5	7
Salix lutea (yellow willow)	8	0-20	18	12
Salix myrtillifolia (myrtle-leaved willow)	1	0-1	9	3
Salix spp. (willow)	1	0-1	5	2
Shepherdia canadensis (Canada buffaloberry)	3	0-10	41	11

Table 10 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Symphoricarpos spp. (buckbrush)	5	0-20	64	18
Symphoricarpos occidentalis (buckbrush)	1	0-1	9	3
Viburnum edule (low-bush cranberry)	3	0-3	5	4
Graminoids				
Agropyron pectiniforme (crested wheat grass)	3	0-3	5	4
Agropyron repens (quack grass)	1	0-1	5	2
Agrostis scabra (rough hair grass)	10	0-10	5	7
Agrostis spp. (Agrostis)	3	0-3	5	4
Agrostis stolonifera (redtop)	1	0-1	5	2
Agropyron trachycaulum (slender wheat grass)	3	0-3	5	4
Alopecurus aequalis (short-awned foxtail)	1	0-1	5	2
Beckmannia syzigachne (slough grass)	1	0-1	5	2
Bromus carinatus (keeled brome)	3	0-3	9	5
Bromus inermis (awnless brome)	34	0-90	55	43
Calamagrostis canadensis (bluejoint)	3	0-10	32	10
Carex atherodes (awned sedge)	36	0-70	9	18
Carex crawfordii (Crawford's sedge)	3	0-3	5	4
Carex lanuginosa (woolly sedge)	1	0-1	5	2
Carex microglochin (short-awned sedge)	6	0-10	9	7
Carex praegracilis (graceful sedge)	3	0-3	9	5
Carex utriculata (beaked sedge)	1	0-1	5	2
Carex sprengelii (Sprengel's sedge)	3	0-3	14	6
Carex spp. (sedge)	3	0-3	5	4
Deschampsia cespitosa (tufted hair grass)	1	0-1	5	2
Eleocharis palustris (creeping spike-rush)	3	0-3	5	4
Elymus innovatus (hairy wild rye)	1	0-1	9	3
Elymus virginicus (Virginia wild rye)	1	0-1	5	2
Festuca rubra (red fescue)	3	0-3	5	4
Hordeum jubatum (foxtail barley)	1	0-1	9	3
Juncus alpinoarticulatus (alpine rush)	1	0-1	5	2
Juncus balticus (wire rush)	1	0-1	9	3
Phleum pratense (timothy)	11	0-40	23	16
Poa compressa (Canada bluegrass)	3	0-3	5	4
Poa interior (inland bluegrass)	1	0-1	5	2
Poa nervosa (Wheeler's bluegrass)	3	0-3	5	4
Poa palustris (fowl bluegrass)	2	0-3	14	5
Poa pratensis (Kentucky bluegrass)	21	0-50	50	32
Schizachne purpurascens (purple oat grass)	1	0-1	9	3
Scirpus microcarpus (small-fruited bulrush)	10	0-10	5	7
Stipa comata (needle-and-thread)	1	0-1	5	2
Stipa viridula (green needle grass)	3	0-3	5	4
Forbs				
Achillea millefolium (common yarrow)	2	0-3	32	8
Actaea rubra (red and white baneberry)	1	0-1	9	3
Allium cernuum (nodding onion)	1	0-1	5	2
Allium spp. (onion)	1	0-1	5	2
Anemone cylindrica (long-fruited anemone)	1	0-1	9	3
Apocynum cannabinum (Indian hemp)	1	0-1	5	2
Aralia nudicaulis (wild sarsaparilla)	3	0-3	9	5
Artemisia campestris (plains wormwood)	1	0-1	9	3
Artemisia ludoviciana (prairie sagewort)	1	0-1	9	3
Aster ciliolatus (Lindley's aster)	7	0-10	9	8
Aster conspicuus (showy aster)	3	0-10	23	8
Aster hesperius (western willow aster)	5	0-10	14	8
Aster laevis (smooth aster)	2	0-3	18	6

Table 10 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Aster puniceus (purple-stemmed aster)	1	0-1	5	2
Astragalus americanus (American milk vetch)	1	0-1	5	2
Campanula rotundifolia (harebell)	1	0-1	5	2
Capsella bursa-pastoris (shepherd's-purse)	1	0-1	5	2
Castilleja coccinea (scarlet paintbrush)	1	0-1	5	2
Cerastium arvense (field mouse-ear chickweed)	1	0-1	5	2
Chrysanthemum leucanthemum (ox-eye daisy)	1	0-1	9	3
Cicuta maculata (water-hemlock)	1	0-1	5	2
Cirsium arvense (Canada thistle)	7	0-10	14	10
Cirsium undulatum (wavy-leaved thistle)	10	0-10	5	7
Descurainia richardsonii (grey tansy mustard)	1	0-1	5	2
Disporum trachycarpum (fairybells)	3	0-3	5	4
Epilobium angustifolium (common fireweed)	1	0-1	14	4
Fragaria virginiana (wild strawberry)	2	0-3	50	10
Galium boreale (northern bedstraw)	3	0-10	32	10
Galium triflorum (sweet-scented bedstraw)	1	0-1	5	2
Geranium richardsonii (wild white geranium)	8	0-10	18	12
Glycyrrhiza lepidota (wild licorice)	3	0-3	9	5
Hackelia jessicae (Jessica's stickseed)	1	0-1	5	2
Heracleum lanatum (cow parsnip)	6	0-10	9	7
Heterotheca villosa (golden aster)	1	0-1	5	2
Hieracium umbellatum (narrow-leaved hawkweed)	1	0-1	9	3
Lathyrus ochroleucus (cream-colored vetchling)	7	0-30	36	16
Linaria dalmatica (broad-leaved toad-flax)	1	0-1	5	2
Linaria vulgaris (butter-and-eggs)	6	0-10	9	7
Linum lewisii (wild blue flax)	1	0-1	5	2
Maianthemum canadense (wild lily-of-the-valle)	2	0-3	9	4
Melilotus alba (white sweet-clover)	1	0-1	9	3
Melilotus officinalis (yellow sweet-clover)	1	0-1	5	2
Mertensia paniculata (tall lungwort)	2	0-3	18	6
Monarda fistulosa (wild bergamot)	1	0-1	9	3
Osmorhiza depauperata (spreading sweet cicely)	2	0-3	14	4
Pedicularis bracteosa (western lousewort)	1	0-1	5	2
Petasites palmatus (palmate-leaved coltsfoot)	2	0-3	14	5
Plantago major (common plantain)	6	0-10	9	7
Potentilla anserina (silverweed)	10	0-10	5	7
Potentilla gracilis (graceful cinquefoil)	1	0-1	5	2
Potentilla paradoxa (bushy cinquefoil)	1	0-1	5	2
Potentilla pensylvanica (prairie cinquefoil)	1	0-1	5	2
Pyrola asarifolia (common pink wintergreen)	1	0-3	23	5
Sanicula marilandica (snakeroot)	1	0-1	5	2
Senecio pauperculus (balsam groundsel)	2	0-3	18	6
Smilacina stellata (star-flowered Solomon's-seal)	3	0-10	45	12
Solidago canadensis (Canada goldenrod)	3	0-10	27	9
Solidago graminifolia (flat-topped goldenrod)	1	0-1	5	2
Solidago missouriensis (low goldenrod)	1	0-1	14	4
Sonchus arvensis (perennial sow-thistle)	2	0-3	18	6
Sonchus spp. (sow-thistle)	1	0-1	5	2
Spiranthes romanzoffiana (hooded ladies'-tresses)	1	0-1	5	2
Stachys palustris (marsh hedge-nettle)	1	0-1	5	2
Taraxacum officinale (common dandelion)	4	0-20	59	15
Thalictrum spp. (meadow rue)	10	0-10	5	7
Thalictrum venulosum (veiny meadow rue)	1	0-1	23	5
Thermopsis rhombifolia (golden bean)	2	0-3	14	5
Trifolium hybridum (alsike clover)	1	0-1	5	2

Table 10 (cont.)

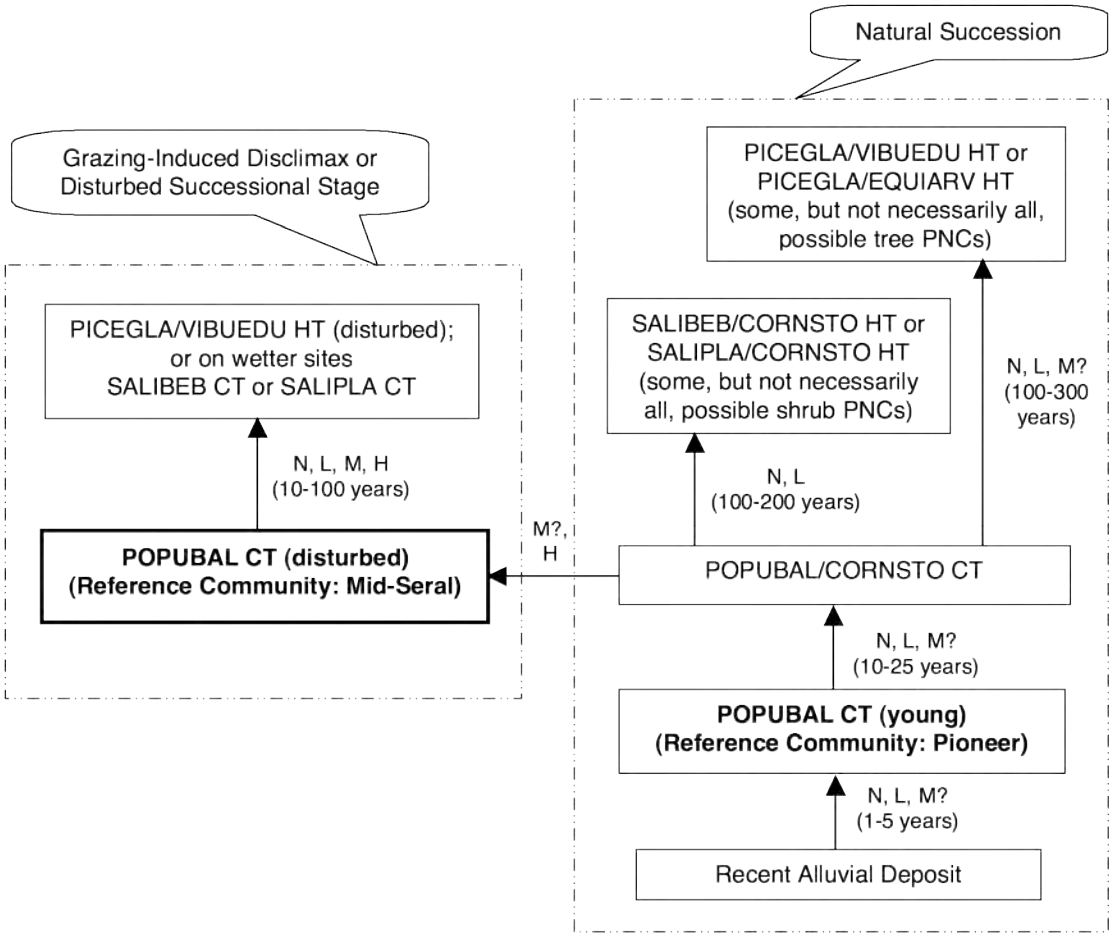
Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Trifolium repens (white clover)	11	0-20	9	10
Urtica dioica (common nettle)	7	0-20	14	10
Vicia americana (wild vetch)	2	0-3	45	10
Viola adunca (early blue violet)	1	0-1	5	2
Viola canadensis (western Canada violet)	2	0-3	14	4
Ferns and Allies				
Equisetum arvense (common horsetail)	2	0-3	55	10

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

While the *Populus balsamifera* (balsam poplar) community type does include the few sites that (for such reasons as having been recently burned or as occurring on a recent alluvial deposit) are too undeveloped vegetatively (immature) for keying to the more definitive *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, the great majority of stands represented in Table 10 are mature stands of *Populus balsamifera* (balsam poplar) trees with severely altered understories.

Populus balsamifera (balsam poplar) is a pioneering seral species that does not represent climax vegetation or potential for the site. Severely disturbed communities, as are often represented by this type, may have lost the vegetative capacity for regenerating the late seral communities naturally expected on sites of similar topographic and edaphic position. Management change may remove the disturbing influence and allow remnant late seral native species to repopulate the stand, or dramatic natural event may reset succession by removing the existing altered community and allowing natural propagation to repopulate the site with a new pioneer community. Figure 11 shows a schematic diagram of expected successional pathways.



Successional Pathway of *Populus balsamifera* (balsam poplar) Sites in North Central Alberta
Reference Community = *Populus balsamifera* (balsam poplar) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
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
POPUBAL CT—*Populus balsamifera* (balsam poplar) community type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
SALIBEB CT—*Salix bebbiana* (beaked willow) community type
SALIBEB/CORNSTO HT—*Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type
SALIPLA CT—*Salix planifolia* (flat-leaved willow) community type
SALIPLA/CORNSTO HT—*Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type

Figure 11. 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 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.

SOILS

On fluvial sites, soils are typically Regosols with up to 1 m of mineral soil overlying river gravel and/or cobbles. Brunisols and Luvisols are typically found on non-fluvial forested sites. Mineral soil textures on sampled stands ranged from sand and gravel to clay. Typical organic layer thickness is at least six centimetres of mor (incompletely decomposed litter). Soil drainage regimes typically range from poor to moderately well drained, and nutrient regimes are typically rich (Beckingham and Archibald 1996). Water tables usually drop below 1 m of the soil surface in summer, but soils can remain moist due to capillary action. Redox concentrations (mottles) are common in these soils as evidence of a fluctuating, but high water table.

ADJACENT COMMUNITIES

Adjacent wetter communities are typically dominated by *Salix bebbiana* (beaked willow), *Salix lutea* (yellow willow), *Salix scouleriana* (Scouler's willow), *Alnus* species (alder), *Carex atherodes* (awned sedge), or *Calamagrostis canadensis* (bluejoint). Upland types usually occupy adjacent drier sites.

MANAGEMENT INFORMATION

Livestock

Forage production ranges from low to moderate in stands of the *Populus balsamifera* (balsam poplar) community type that still have considerable cover of the less palatable shrubs, such as *Symphoricarpos* species (buckbrush), *Rosa* species (rose), and *Lonicera* species (honeysuckle). Forage production may actually rise somewhat with further reduction of those shrubs and corresponding increase in the herbaceous layer based on relative forage values (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991).

Timber

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 1997). Mechanical logging places the species at a competitive advantage over *Picea glauca* (white spruce) by creating microsites for seedling establishment. Cutting mature *Populus balsamifera* (balsam poplar) results in sprouting from callus tissue and dormant buds (USDA Intermountain Fire Sciences Lab 1995). Stump sprouting is most pronounced on winter-logged areas. Improper harvesting can cause suppression of *Populus balsamifera* (balsam poplar) and dominance by shrubs in the clearings. Trees cut in summer have few surviving sprouts after four years (USDA Intermountain Fire Sciences Lab 1995).

Wildlife

Wildlife habitat values of the *Populus balsamifera* (balsam poplar) community type are much reduced from those of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type due to the loss of such species as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (Saskatoon), and *Viburnum edule* (low-bush cranberry). Moose sparingly browse young *Populus balsamifera* (balsam poplar), and will strip bark from the trees in times of winter food shortage (USDA Intermountain Fire Sciences Lab 1995). 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

When located near a stream the *Populus balsamifera* (balsam poplar) trees provide thermal cover, debris, and bank structural stability for the stream. The importance of this function cannot be over emphasized (see discussion in the Soil Management and Rehabilitation Opportunities section).

Fire

Populus balsamifera (balsam poplar) is considered one of the tree species most well adapted to fire in the boreal forest. Its ability to produce sprouts from roots and stumps enables it to quickly recover after fire. Severe fires kill *Populus balsamifera* (balsam poplar); however, underground parts survive in moist soils. Moderate fires 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 the site by preventing regeneration (USDA Intermountain Fire Sciences Lab 1995).

Populus balsamifera (balsam poplar) is most susceptible to fire during late summer and fall. It and the shrubs associated with this community type are adapted to fire of light to moderate intensity (Hansen and others 1995). Many of these species can produce new sprouts after a burn. Therefore, 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 young sprouts (Hansen and others 1995).

Soil Management and Rehabilitation Opportunities
Riverine or floodplain sites supporting this community type are subject to recurring scouring by floods and alluvium deposition. However, with the natural shrub understory reduced, these stands are less able to withstand the erosive power of flood flows. Management should emphasize the importance of the understory shrub layer in streambank stabilization. This is most important on higher gradient streams. Managers should strive to maintain a healthy buffer of native tall shrubs adjacent to all rivers and streams where possible. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize streambanks, and dissipate flood energy.

If sites degraded by overgrazing still have a fairly high water table, the elimination of grazing and close monitoring of wildlife impacts ***MAY*** allow remnant shrubs to sprout and repopulate the stand. However, if the water table has dropped much, or if the shrubs are entirely gone, the opportunity to re-establish an understory of desirable shrubs may have been lost (Hansen and others 1995).

Recreational Uses and Considerations
Because of proximity to streams and lakes, recreational developments and transportation corridors are common in this type. Opportunities are excellent in and near this type for fishing, big game, and waterfowl hunting, and observing a variety of wildlife species. Care must be taken when locating structures in this type due to potential for flooding.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

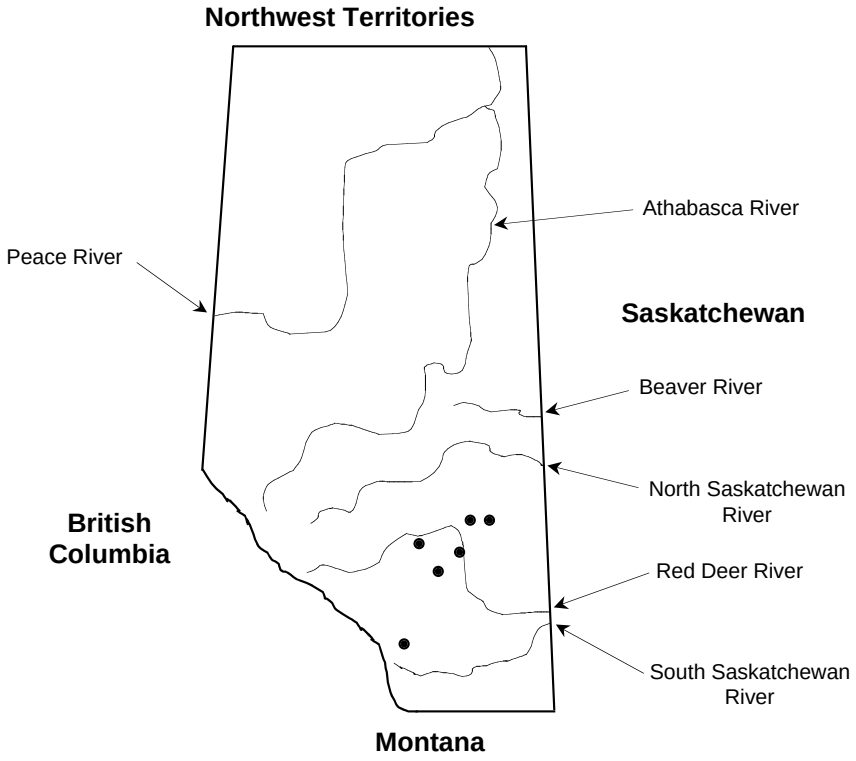
No ecosite described in Alberta contains a community type dominated only by *Populus balsamifera* (balsam poplar). The species is codominant or subdominant to other tree species in some ecosite phases. It is codominant with *Populus tremuloides* (aspen) in the *Populus balsamifera-Populus tremuloides* (balsam poplar-aspen) phase of two ecosites: the *Equisetum* (horsetail) ecosite on sites with a hygric/rich moisture/nutrient regime and the *Cornus stolonifera* (dogwood) ecosite on sites with a subhygric/rich moisture/nutrient regime in the Boreal Mixedwood (Beckingham and Archibald 1996). These authors also show *Populus balsamifera* (balsam poplar) as codominant and subdominant to *Picea glauca* (white spruce) and *Populus tremuloides* (aspen) in the *Populus balsamifera-Picea glauca* (balsam poplar-white spruce) phase of the *Cornus stolonifera* (dogwood) ecosite.

OTHER STUDIES

Thompson and Hansen (2002) describe *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) and *Populus balsamifera*/Herbaceous (balsam poplar/herbaceous) community types in the Grassland Natural Region of southern Alberta. Thompson and Hansen (2001) describe similar types for the Prairie Ecozone of southern Saskatchewan. Lane and others (2000) describe a *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/snowberry) community type in the Lower Foothills Subregion. Beckingham and Archibald (1996) in northern Alberta and Beckingham, Nielsen, and Futoransky (1996) in the Mid-Boreal ecoregions of Saskatchewan describe community types codominated by *Populus tremuloides* (aspen) and *Populus balsamifera* (balsam poplar) with *Cornus stolonifera* (red-osier dogwood) as the key understory indicator. A *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type is described for the mountains, foothills, and intermountain valleys of Montana by Hansen and others (1995).

POPUTRE/CORNSTO
Number of Stands Sampled = 9
Number of Stands Sampled in Alberta = 8

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

Populus tremuloides (aspen) is found at the drier end of the moisture regime scale for tree species that dominate riparian and wetland sites in Alberta. The *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type is a major late seral type limited in this study area to the Parkland Natural Region where *Picea glauca* (white spruce) is not generally found. The abundance of this type is far reduced from its pre-European settlement levels due to the value of its soil for agricultural production. Remaining stands occur most frequently as groves around lakes, sloughs, and pothole depressions, but also near streams and rivers on alluvial terraces and steep valley walls, and near springs and seeps. Farther north, as one nears the Dry Mixedwood forests in the Boreal Ecoregion and to the west as one enters the Upper Foothills Subregion, the *Populus tremuloides* (aspen) is seral to communities dominated by *Picea glauca* (white spruce). Typical stands were sampled near Alliance, on Buffalo Lake near Stettler, Dodd's Lake near Innisfail, and near Three Hills.

VEGETATION

The type is characterized by an overstory of *Populus tremuloides* (aspen) dominating an understory of dense *Amelanchier alnifolia* (Saskatoon), *Cornus stolonifera* (red-osier dogwood), *Viburnum edule* (low-bush cranberry) and a variety of other shrubs (Table 11). While *Populus tremuloides* (aspen) occurs on sites ranging from upland to quite moist riparian situations, we use the occurrence of *Cornus stolonifera* (red-osier dogwood) and/or *Viburnum edule* (low-bush cranberry) in the understory to indicate wetland status of the site (Raup 1946). The associated herbaceous layer in undisturbed stands is relatively sparse, with *Equisetum arvense* (common horsetail) being the most prominent.

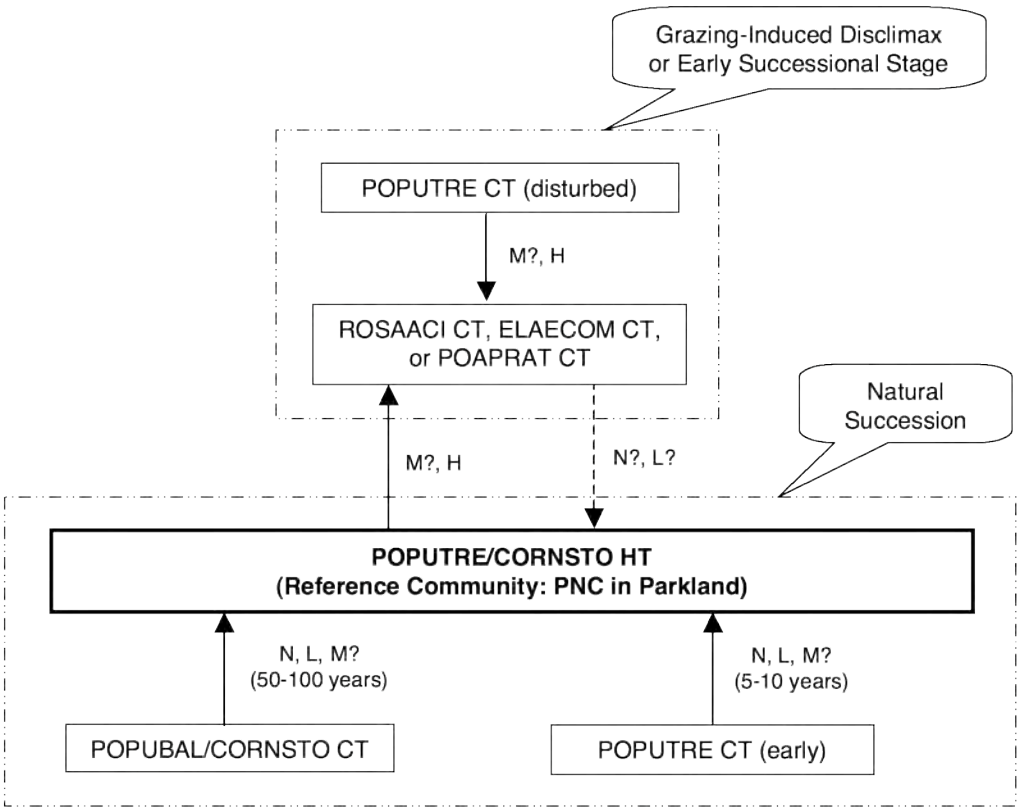
Table 11. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 3 relatively undisturbed late seral to climax stands of the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Trees				
Populus balsamifera (balsam poplar)	17	0-30	67	34
Populus tremuloides (aspen)	40	20-60	100	63
Shrubs				
Amelanchier alnifolia (Saskatoon)	11	3-20	100	33
Cornus stolonifera (red-osier dogwood)	14	3-30	100	37
Lonicera dioica (twining honeysuckle)	2	1-3	100	14
Prunus pensylvanica (pin cherry)	2	1-3	100	14
Prunus virginiana (choke cherry)	2	1-3	100	14
Ribes oxyacanthoides (northern gooseberry)	1	0-1	33	6
Ribes triste (wild red currant)	2	1-3	100	14
Rosa spp. (rose)	10	10-10	100	32
Rubus idaeus (wild red raspberry)	1	0-1	33	6
Rubus pubescens (dewberry)	2	1-3	100	14
Salix bebbiana (beaked willow)	2	0-3	67	12
Salix scouleriana (Scouler's willow)	2	0-3	67	12
Sorbus scopulina (western mountain-ash)	1	0-1	67	8
Symphoricarpos occidentalis (buckbrush)	3	3-3	100	17
Viburnum edule (low-bush cranberry)	11	3-20	100	33
Graminoids				
Agropyron trachycaulum (slender wheat grass)	1	0-1	33	6
Calamagrostis canadensis (bluejoint)	2	0-3	67	12
Poa palustris (fowl bluegrass)	1	0-1	67	8
Forbs				
Actaea rubra (red and white baneberry)	1	1-1	100	10
Agrimonia striata (agrimony)	1	0-1	33	6
Apocynum androsaemifolium (spreading dogbane)	1	0-1	33	6
Apocynum cannabinum (Indian hemp)	2	0-3	67	12
Aralia nudicaulis (wild sarsaparilla)	2	1-3	100	14
Aster conspicuus (showy aster)	1	0-1	67	8
Cirsium arvense (Canada thistle)	1	0-1	33	6
Disporum trachycarpum (fairybells)	2	1-3	100	14
Epilobium angustifolium (common fireweed)	2	1-3	100	14
Galium boreale (northern bedstraw)	1	0-1	33	6
Galium triflorum (sweet-scented bedstraw)	1	0-1	33	6
Geranium richardsonii (wild white geranium)	2	0-3	67	12
Geum aleppicum (yellow avens)	2	0-3	67	12
Heracleum lanatum (cow parsnip)	1	0-1	33	6
Lathyrus ochroleucus (cream-colored vetchling)	1	1-1	100	10
Lysimachia ciliata (fringed loosestrife)	1	0-1	33	6
Maianthemum canadense (wild lily-of-the-valle)	1	0-1	67	8
Mertensia paniculata (tall lungwort)	1	0-1	33	6
Pyrola asarifolia (common pink wintergreen)	1	1-1	100	10
Ranunculus acris (tall buttercup)	1	0-1	33	6
Sanicula marilandica (snakeroot)	1	0-1	67	8
Smilacina stellata (star-flowered Solomon's-seal)	1	0-1	67	8
Taraxacum officinale (common dandelion)	1	0-1	67	8
Thalictrum venulosum (veiny meadow rue)	1	0-1	67	8
Vicia americana (wild vetch)	1	1-1	100	10
Ferns and Allies				
Equisetum arvense (common horsetail)	13	10-20	100	36

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

This type is the late seral/climax stage of vegetation on sites dominated by *Populus tremuloides* (aspen) in the Parkland Ecoregion of Alberta in areas where *Picea glauca* (white spruce) does not occur. In the Boreal Forest to the north or the Foothills to the west, a community much the same as this one is seral to the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type. In those Natural Regions, *Populus tremuloides* (aspen) is seral to *Picea glauca* (white spruce) (Moss 1932, 1955, Beckingham and others 1996, Beckingham and Archibald 1996). Dix and Swan (1971) say that *Populus tremuloides* (aspen) is unable to reproduce in an established forest, and therefore is a seral species. However, while the Parkland groves may have once been periodically rejuvenated by recurrent fire, there is in the Parkland Natural Region an absence of a later seral tree species to assume dominance of aging *Populus tremuloides* (aspen) groves. In this absence, the *Populus tremuloides* (aspen) is the latest successional species on these sites (Fig. 12).



Successional Pathway of *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood)
Sites in North Central Alberta
Reference Community = *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES

ELAECOM CT—*Elaeagnus commutata* (silverberry) community type
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
POPUTRE CT—*Populus tremuloides* (aspen) community type
POPUTRE/CORNSTO HT—*Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type
ROSAACI CT—*Rosa acicularis* (prickly rose) community type

Figure 12. Successional pathway for sites of the *Populus tremuloides/Cornus stolonifera* (aspen/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 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* [awnless brome], *Poa pratensis* [Kentucky bluegrass], etc.).

High levels of use by livestock and wildlife will reduce the cover and reproductive success of *Populus tremuloides* (aspen) and of the palatable shrubs associated with this type (e.g., *Amelanchier alnifolia* [Saskatoon], *Cornus stolonifera* [red-osier dogwood], *Prunus virginiana* [choke cherry], and *Viburnum edule* [low-bush cranberry]), while increasing the coverages of less preferred species (e.g., *Symphoricarpos* species [buckbrush], and the forb *Galium boreale* [northern bedstraw]) (Table 12). (***Note:*** *Cornus stolonifera* (red-osier dogwood) is shown in Table 12 to increase with disturbance. This can be explained by the small sample set for this type and a single disturbed stand with large amount of the species. *Cornus stolonifera* (red-osier dogwood) has the ability to quickly repopulate a disturbed site if remnants remain after the disturbance is removed and conditions are favourable.)

A long-term high level of disturbance generally also is accompanied with introduction of exotic invader species, such as *Bromus inermis* (awnless brome), *Poa pratensis* (Kentucky bluegrass), and *Taraxacum officinale* (common dandelion) (Table 12). In extreme cases, a loss of all, or almost all, the woody understory may occur, and the stand will regress to the *Populus tremuloides* (aspen) community type.

Table 12. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 disturbed or early seral stands of the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Populus balsamifera (balsam poplar)	38	0-70	50	44
Populus tremuloides (aspen)	37	10-50	100	61
Shrubs				
Alnus tenuifolia (river alder)	3	0-3	17	7
Amelanchier alnifolia (Saskatoon)	7	0-10	83	24
Clematis occidentalis (purple clematis)	3	0-3	17	7
Cornus stolonifera (red-osier dogwood)	24	3-70	100	49
Corylus cornuta (beaked hazelnut)	3	0-3	17	7
Elaeagnus commutata (silverberry)	20	0-20	17	18
Lonicera spp. (honeysuckle)	3	0-3	17	7
Lonicera dioica (twining honeysuckle)	3	0-3	17	7
Prunus pensylvanica (pin cherry)	1	0-1	33	6
Prunus virginiana (choke cherry)	3	0-10	83	13
Ribes oxyacanthoides (northern gooseberry)	2	0-3	67	8
Rosa spp. (rose)	11	1-40	100	33
Rubus idaeus (wild red raspberry)	8	0-20	67	23
Rubus pubescens (dewberry)	1	0-1	17	4
Salix bebbiana (beaked willow)	1	0-1	17	4
Salix lutea (yellow willow)	3	0-3	17	7
Shepherdia canadensis (Canada buffaloberry)	1	0-1	33	6
Spiraea alba (narrow-leaved meadowsweet)	1	0-1	17	4
Symphoricarpos spp. (buckbrush)	7	0-10	67	22
Symphoricarpos occidentalis (buckbrush)	6	0-10	33	13
Viburnum edule (low-bush cranberry)	2	0-3	33	8
Viburnum opulus (high-bush cranberry)	10	0-10	17	13
Graminoids				
Agropyron dasystachyum (northern wheat grass)	10	0-10	17	13
Bromus ciliatus (fringed brome)	1	0-1	17	4
Bromus inermis (awnless brome)	9	0-20	67	23
Calamagrostis canadensis (bluejoint)	3	0-3	33	10
Calamagrostis inexpansa (northern reed grass)	3	0-3	17	7
Carex praegracilis (graceful sedge)	1	0-1	17	4

Table 12 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Carex sprengelii (Sprengel's sedge)	3	0-3	33	10
Elymus virginicus (Virginia wild rye)	1	0-1	17	4
Juncus balticus (wire rush)	10	0-10	17	13
Phleum pratense (timothy)	3	0-3	17	7
Poa pratensis (Kentucky bluegrass)	13	0-20	50	25
Schizachne purpurascens (purple oat grass)	1	0-1	17	4
Forbs				
Achillea millefolium (common yarrow)	1	0-1	33	6
Actaea rubra (red and white baneberry)	1	0-1	33	6
Aralia nudicaulis (wild sarsaparilla)	5	0-10	50	16
Aster ciliolatus (Lindley's aster)	3	0-3	17	7
Aster conspicuus (showy aster)	3	0-3	17	7
Aster laevis (smooth aster)	1	0-1	17	4
Chenopodium gigantospermum (maple-leaved goosefoot)	1	0-1	17	4
Chenopodium pratericola (goosefoot)	1	0-1	17	4
Disporum trachycarpum (fairybells)	1	0-1	33	6
Epilobium angustifolium (common fireweed)	20	0-20	17	18
Fragaria virginiana (wild strawberry)	2	0-3	50	10
Galium boreale (northern bedstraw)	4	0-10	67	16
Galium triflorum (sweet-scented bedstraw)	2	0-3	50	10
Geranium richardsonii (wild white geranium)	3	0-3	17	7
Heracleum lanatum (cow parsnip)	1	0-1	17	4
Hieracium umbellatum (narrow-leaved hawkweed)	1	0-1	17	4
Lathyrus ochroleucus (cream-colored vetchling)	1	0-1	17	4
Lysimachia ciliata (fringed loosestrife)	1	0-1	17	4
Maianthemum canadense (wild lily-of-the-valle)	1	0-1	17	4
Mertensia paniculata (tall lungwort)	3	0-3	17	7
Orthilia secunda (one-sided wintergreen)	1	0-1	17	4
Osmorhiza depauperata (spreading sweet cicely)	1	0-1	17	4
Pyrola asarifolia (common pink wintergreen)	2	0-3	50	10
Senecio pauperculus (balsam groundsel)	1	0-1	17	4
Silene menziesii (Menzies' catchfly)	1	0-1	17	4
Smilacina stellata (star-flowered Solomon's-seal)	1	0-1	83	9
Solidago canadensis (Canada goldenrod)	3	0-3	33	10
Solidago spp. (goldenrod)	1	0-1	17	4
Solidago spathulata (mountain goldenrod)	1	0-1	17	4
Sonchus arvensis (perennial sow-thistle)	3	0-3	17	7
Taraxacum officinale (common dandelion)	2	0-3	33	8
Thalictrum spp. (meadow rue)	1	0-1	17	4
Thalictrum venulosum (veiny meadow rue)	2	0-3	50	10
Urtica dioica (common nettle)	1	0-1	33	6
Vicia americana (wild vetch)	1	0-1	83	9
Viola canadensis (western Canada violet)	1	0-1	17	4
Ferns and Allies				
Equisetum arvense (common horsetail)	5	0-10	50	16

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

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 *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

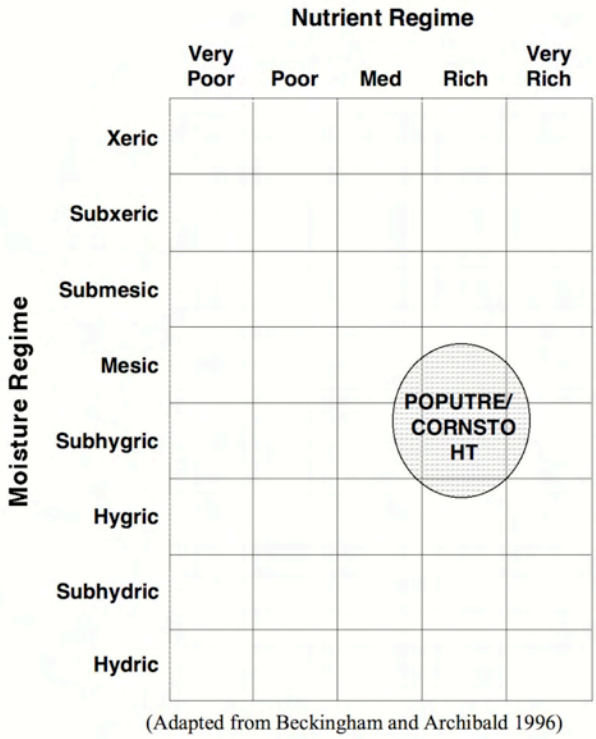


Figure 13. Edatope grid position for the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type (POPUTRE/CORNSTO HT)

SOILS

Parent material may be alluvium or glacial deposits, and soils are generally Brunisols, Luvisols, or Regosols. Sites of this community type typically have organic layer thickness from 6 to 15 cm of poorly decomposed mor material, moderately well to poorly drained mineral soils, and with moisture regime ranging from mesic to hygric (Beckingham and Archibald 1996, Beckingham, Nielsen, and Futoransky 1996). Mineral textures on sampled stands ranged from sand to clay.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by any of a variety of species, including *Carex atherodes* (awned sedge), *Carex aquatilis* (water sedge), *Salix bebbiana* (beaked willow), *Salix petiolaris* (basket willow), or occasionally *Populus balsamifera* (balsam poplar). Drier sites are usually uplands dominated by *Populus tremuloides* (aspen) with dry site understory or have been converted to agricultural use as farmed fields or tame pasture.

MANAGEMENT INFORMATION

Livestock

Forage production varies from low to moderate, depending on the density of the tree and shrub layer. Palatability of the various herbaceous species associated with this type are often high, and cattle use may be high as upland vegetation cures and animals spend much of their time in the shade provided by these communities. Livestock will use this type for forage, shade, and as bedding ground. They also browse young suckers and, combined with trampling and soil compaction, can alter both the age structure and understory composition of this type.

Cornus stolonifera (red-osier dogwood) is highly preferred by livestock and wildlife. Its abundance and growth form is a direct indication of past and current use levels. Overuse by livestock will result in a reduced vigour by the *Salix* (willows) present, as illustrated by highlining, clubbing, or dead clumps. With continued overuse, *Salix* (willows) show a sharp decline in vigour and may be eventually eliminated from the site. Stands in good to excellent health (condition) often support dense thickets of shrubs, limiting the available herbaceous forage. Some of the major shrub species found in this type (e.g., *Cornus stolonifera* [red-osier dogwood], *Amelanchier alnifolia* [saskatoon], *Prunus virginiana* [choke cherry], and *Viburnum edule* [low-bush cranberry]) are rated as good browse forage for livestock and wildlife (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991).

Sites 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 things as *Symphoricarpos* species (buckbrush), *Rosa* species (rose), and *Lonicera* species (honeysuckle) in the understory. With sufficient long-term intense usage, a site can be converted to the *Populus tremuloides* (aspen) community type by reduction of total shrub cover to less than 25 percent.

Timber
Populus tremuloides (aspen) wood is used primarily for particleboard, especially wafer board and oriented strand board, and for pulp. *Populus tremuloides* (aspen) fibres are well suited for making fine paper. *Populus tremuloides* (aspen) lumber is used for making boxes, crates, pallets, and furniture. Specialty products from *Populus tremuloides* (aspen) wood include excelsior, matchsticks, and tongue depressors (USDA Intermountain Fire Sciences Lab 1995). *Populus tremuloides* (aspen) wood is light, soft, and straight grained. It has good dimensional stability and it turns, sands, and holds glue and paint well. It has relatively low strength, however, and is moderately low in shock resistance. Both sapwood and heartwood have low decay resistance and are difficult for preservatives to penetrate (USDA Intermountain Fire Sciences Lab 1995).

Overstory removal for timber harvest will stimulate sprouting of young trees from roots and stumps. These will repopulate the site, but are susceptible to browsing damage by livestock or wildlife (Hansen and others 1995).

Wildlife
Populus tremuloides (aspen) groves provide important breeding, foraging, and resting habitat for a variety of birds and mammals. Wildlife utilization of *Populus tremuloides* (aspen) communities varies with species composition of the understory and relative age of the *Populus tremuloides* (aspen) stand. Young stands generally provide the most 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 (USDA Intermountain Fire Sciences Lab 1995).

Large Ungulates—Elk browse *Populus tremuloides* (aspen) year-round, feeding on bark, branch apices, and sprouts. In some areas, elk use it mainly in winter. *Populus tremuloides* (aspen) is important forage for mule and white-tailed deer. Deer consume the leaves, buds, twigs, bark, and sprouts. New growth on burns 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. Moose utilize it on summer and winter ranges. Young stands generally provide the best quality moose browse (USDA Intermountain Fire Sciences Lab 1995).

Lagomorphs—Rabbits and hares feed on *Populus tremuloides* (aspen) in summer and winter. In winter, snowshoe hare and cottontail rabbits eat *Populus tremuloides* (aspen) buds, twigs, and bark. *Populus tremuloides* (aspen) is one of the most important and nutritious summer browse species for rabbits in Alberta, and is a preferred winter food of snowshoe hare in Manitoba (USDA Intermountain Fire Sciences Lab 1995). Lagomorphs may girdle suckers or even mature trees. In some parts of Canada, fairly high *Populus tremuloides* (aspen) mortality has been attributed to rabbits and hares (USDA Intermountain Fire Sciences Lab 1995).

Small Rodents—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. Small mammal populations in *Populus tremuloides* (aspen) generally fluctuate widely with stand age and annual variation in animal population size. Highest densities typically occur in mature stands. Field mice (*Peromyscus* species), for example, are most abundant in mature communities. The red-backed vole, however, is most abundant in sapling stands, somewhat less abundant in mature stands, and least common in clearcuts (USDA Intermountain Fire Sciences Lab 1995).

Beaver—Beaver consume the leaves, bark, twigs, and all diameters of *Populus tremuloides* (aspen) branches. They use *Populus tremuloides* (aspen) stems for constructing dams and lodges. At least temporarily, beaver can eliminate *Populus tremuloides* (aspen) from as far as 122 m from waterways. An individual beaver consumes 1-2 kg of *Populus tremuloides* (aspen) bark daily, and it is estimated that as many as 200 *Populus tremuloides* (aspen) stems are required to support one beaver for a 1-year period (USDA Intermountain Fire Sciences Lab 1995).

Birds—*Populus tremuloides* (aspen) communities provide important feeding and nesting sites for a diverse array of birds. Bird species using *Populus tremuloides* (aspen) habitat include sandhill crane, western wood pewee, six species of ducks, blue, ruffed, and sharp-tailed grouse, band-tailed pigeon, mourning dove, wild turkey, red-breasted nuthatch, and pine siskin. *Populus tremuloides* (aspen) is host to a variety of insects that are food for woodpeckers and sapsuckers. Generally, moist to

mesic *Populus tremuloides* (aspen) sites have greater avian species diversity than *Populus tremuloides* (aspen) stands on dry sites (USDA Intermountain Fire Sciences Lab 1995).

Many bird species utilize *Populus tremuloides* (aspen) communities of only a particular seral stage. Research in northern Utah suggests that blue grouse, yellow-rumped warbler, warbling vireo, dark-eyed junco, house wren, and hermit thrush prefer mature *Populus tremuloides* (aspen) stands. The MacGillivray's warbler, chipping and song sparrows, and lazuli bunting prefer younger stands. Bluebirds, tree swallow, pine siskin, yellow-bellied sapsucker, and black-headed grosbeak favor *Populus tremuloides* (aspen) community edges (USDA Intermountain Fire Sciences Lab 1995).

Fisheries
Where adjacent to streams, stands of this type enhance fisheries by stabilizing banks and providing overhanging cover. *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 (Hansen and others 1995).

Fire
Response to Burning—Wet conditions in the spring and summer tend to limit successful burning to the drier fall period. Fire, sometimes in combination with cutting, is becoming an increasingly important tool in regenerating decadent stands of *Populus tremuloides* (aspen) (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 reproduction.

Populus tremuloides (aspen) sprouts from the roots and establishes from off-site, wind-blown seed after fire. It is the classic soboliferous species: a plant that sprouts from carbohydrate-storing lateral roots (sobols). *Populus tremuloides* (aspen) generally sprouts vigorously after fire. Long-term growth and survival of *Populus tremuloides* (aspen) sprouts depend on a variety of factors including prefire carbohydrate levels in roots, sprouting ability of the clone(s), fire severity, and season of fire. Moderate-severity fire generally results in dense sprouting. Fewer sprouts may be produced after severe fire. Since *Populus tremuloides* (aspen) is self-thinning, however, sprouting densities are generally similar several years after moderate and 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 sprouts later in the growing season and again the following year. Fires in mid-growing season generally result in late-season sprouting. *Populus tremuloides* (aspen) burned in late summer or fall usually sprouts the next spring (USDA Intermountain Fire Sciences Lab 1995).

Cornus stolonifera (red-osier dogwood) and the associated shrub species can survive all but the most severe fires that remove duff and cause extended heating of the upper layer of soil. After a fire, the shrubs sprout from the surviving rhizomes or stolons (runners) (Fischer and Bradley 1987).

Applying Fire—Prescribed fire is recommended for *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 *Populus tremuloides* (aspen) stands now live longer than they did prior to fire exclusion, and many stands are in a state of decline due to advanced age (USDA Intermountain Fire Sciences Lab 1995).

Prescribed fire is often difficult to apply in *Populus tremuloides* (aspen) stands because of the prominence of live fuels and often-sparse distribution of fine dead fuels. Even if fuels are plentiful, they are usually too moist to burn easily. Prescribed fire may be possible, however, when live vegetation cures enough to contribute to fire spread rather than hinder it. The optimum combination of dry weather and cured fuels occurs most often in early spring, late summer, and fall (USDA Intermountain Fire Sciences Lab 1995). In Alberta, these moderately severe, early season burning conditions can persist from snowmelt until the first week in June (Quintilo and others 1991).

In most years, leaf fall and autumn precipitation coincide, making fall burning difficult. If September and October are dry, however, burning may be possible. Brown and Simmerman (1986) provide a method for appraising fuels and flammability in *Populus tremuloides* (aspen) to assist managers in choosing when to apply prescribed fire and helps determine proper conditions for burning.

Burning Prescriptions—In the Aspen Parkland and northern forest Bailey (1978) found that in Alberta, prescribed burning in *Populus tremuloides* (aspen) forests and parklands in spring was usually not successful above relative humidity of 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.

Soil Management and Rehabilitation Opportunities
Soils compaction is likely when repeated animal use occurs on moist soils. Grazing should be deferred to periods when soils and streambanks are drier (Marlow 1984).

Populus tremuloides (aspen) may 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 roots of *Populus tremuloides* (aspen) effectively stabilize soils.

Where revegetation with woody shrub species is desired, *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants) may be well adapted to planting on disturbed sites. 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.

Populus tremuloides (aspen) are unique in their ability to stabilize soil and watersheds. Root sprouts promptly revegetate fire-killed stands. The trees produce abundant litter that contains more nitrogen, phosphorus, potash, and calcium than leaf litter of most other hardwoods. The litter decays rapidly, forming a nutrient-rich humus that may amount to 25 tons per acre (oven-dry basis). The humus reduces runoff and aids in percolation and recharge of ground water. Litter and humus layers reduce evaporation from the soil surface. Compared to conifers, more snow accumulates under *Populus tremuloides* (aspen) and snowmelt begins earlier in the spring. Soil under *Populus tremuloides* (aspen) thaws faster and infiltrates moisture more rapidly than soil under conifers (USDA Intermountain Fire Sciences Lab 1995).

Populus tremuloides (aspen) is well suited for restoration and rehabilitation on a wide range of sites. 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 *Populus tremuloides* (aspen) 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 most successful (USDA Intermountain Fire Sciences Lab 1995).

Recreational Uses and Considerations
Fishing, hunting, and bird watching opportunities are often good in and around stands of this type. *Populus tremuloides* (aspen) is valued for its aesthetic qualities at all times of the year. The yellow, orange, and red foliage of autumn particularly enhances recreational value of *Populus tremuloides* (aspen) sites.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

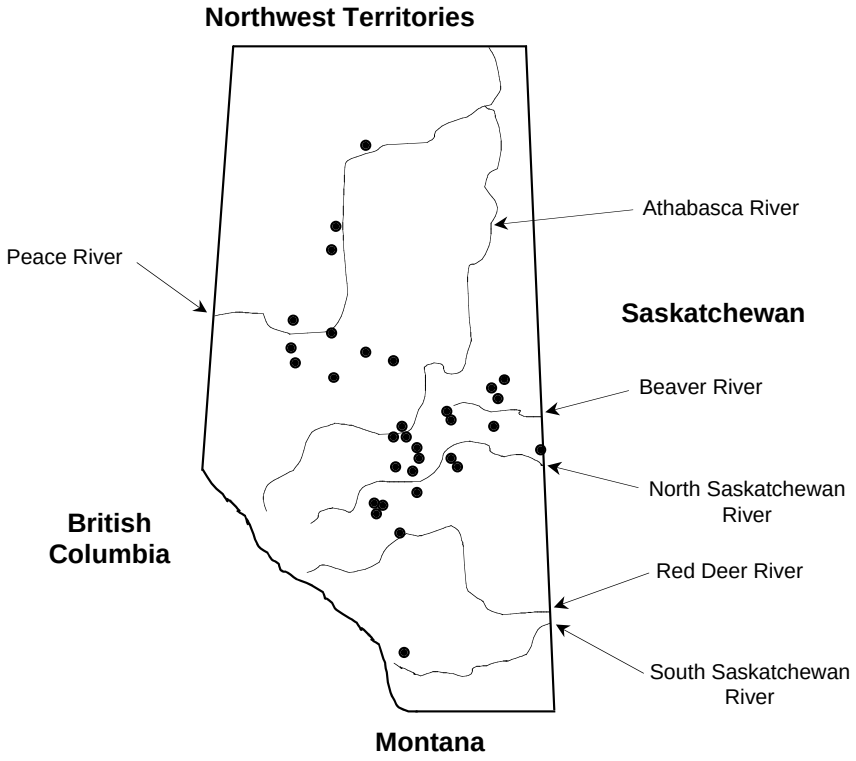
Forested ecosites have not yet been described for the Parkland Natural Region of Alberta, perhaps because so little forest cover in the Parkland remains intact. In the neighbouring Dry Mixedwood, Beckingham and Archibald (1996) describe ecosites having phases dominated by *Populus tremuloides* (aspen) and others codominated by *Populus tremuloides* (aspen) and *Populus balsamifera* (balsam poplar). However, these ecosites are always considered to have potential for a *Picea glauca* (white spruce) climax community, and may differ vegetatively in other ways as well (i.e., have more prominence of *Viburnum edule* [low-bush cranberry]).

OTHER STUDIES

Thompson and Hansen (2002) describe a *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type in the Grassland Natural Region of southern Alberta. Thompson and Hansen (2001) describe a similar type for the Prairie Ecozone of southern Saskatchewan. A *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type is described by Hansen and others (1995). A *Populus tremuloides* (aspen) community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan. Most other community types described for central and northern Alberta have been for sites seral to a *Picea glauca* (white spruce) dominated community.

POPUTRE/VIBUEDU
Number of Stands Sampled = 83
Number of Stands Sampled in Alberta = 83

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

Populus tremuloides (aspen) is found at the drier end of the moisture scale of tree species that dominate riparian and wetland sites in Alberta. The *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type is a major mid-seral type in the Boreal Natural Region, and an incidental type along major river corridors through the Parkland Natural Region where *Picea glauca* (white spruce) is found. It occurs in extensive stands around lakes, sloughs, depressions, and low moist forests near streams and rivers on alluvial terraces and valley slopes.

Among the dataset are typical stands sampled near Bruderheim, on Sturgeon Lake near Valleyview, the Bad Heart River north of Grande Prairie, Lake Cummings near Fairview, Lake Winagami near High Prairie, the Notikewin River near Hotchkiss, and the Ponton River near Ft. Vermilion.

VEGETATION

This type is characterized by an overstory of *Populus tremuloides* (aspen) dominating multi story undergrowth of dense shrubs and herbs. Important tall shrubs include *Amelanchier alnifolia* (Saskatoon), *Cornus stolonifera* (red-osier dogwood), *Salix* (willows), and *Viburnum edule* (low-bush cranberry) (Table 13). While *Populus tremuloides* (aspen) occurs on sites ranging from upland to quite moist riparian situations, we use the presence of *Cornus stolonifera* (red-osier dogwood) and/or *Viburnum edule* (low-bush cranberry) in the understory to indicate riparian (wetland) status of the site (Raup 1946). This community includes a mix of mesic and moister species. Species adapted to drier sites that are commonly represented in this type include *Cornus canadensis* (bunchberry), *Rosa* species (rose), and *Shepherdia canadensis* (Canada buffaloberry). Graminoids are the least represented lifeform group, with *Calamagrostis canadensis* (bluejoint) and *Elymus innovatus* (hairy

wild rye) being the most prominent. A great variety of forb species were recorded on stands of this type, with several occurring on at least 80 percent of stands sampled. These most constant forb species include *Aster conspicuus* (showy aster), *Epilobium angustifolium* (common fireweed), *Galium boreale* (northern bedstraw), *Lathyrus ochroleucus* (cream-colored vetchling), and *Vicia americana* (wild vetch). *Aralia nudicaulis* (wild sarsaparilla) occurs less frequently, but has high prominence due to large cover on some stands.

Table 13. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 66 relatively undisturbed stands of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	4	0-10	17	8
Picea glauca (white spruce)	2	0-3	27	5
Pinus contorta (lodgepole pine)	10	0-10	2	4
Populus balsamifera (balsam poplar)	19	0-80	77	38
Populus tremuloides (aspen)	57	10-90	100	75
Shrubs				
Alnus crispa (green alder)	13	0-40	11	12
Alnus tenuifolia (river alder)	5	0-10	8	6
Amelanchier alnifolia (Saskatoon)	5	0-20	79	20
Arctostaphylos uva-ursi (common bearberry)	7	0-10	6	7
Cornus canadensis (bunchberry)	5	0-20	76	19
Cornus stolonifera (red-osier dogwood)	13	0-40	71	30
Corylus cornuta (beaked hazelnut)	7	0-30	29	13
Ledum groenlandicum (common Labrador tea)	3	0-3	5	4
Linnaea borealis (twinflower)	5	0-20	48	16
Lonicera dioica (twining honeysuckle)	2	0-3	38	9
Lonicera involucrata (bracted honeysuckle)	5	0-10	59	17
Lonicera utahensis (red twinberry)	1	0-1	2	1
Prunus americana (wild plum)	3	0-3	3	3
Prunus virginiana (choke cherry)	5	0-30	23	11
Ribes glandulosum (skunk currant)	3	0-3	3	3
Ribes lacustre (bristly black currant)	2	0-3	12	3
Ribes oxyacanthoides (northern gooseberry)	2	0-3	27	7
Ribes triste (wild red currant)	2	0-3	14	5
Rosa spp. (rose)	18	0-70	97	42
Rubus idaeus (wild red raspberry)	5	0-20	41	14
Rubus pubescens (dewberry)	4	0-40	79	18
Salix bebbiana (beaked willow)	8	0-30	61	22
Salix discolor (pussy willow)	3	0-3	2	2
Salix lutea (yellow willow)	3	0-3	2	2
Salix myrtillifolia (myrtle-leaved willow)	1	0-1	2	1
Salix pseudomonticola (false mountain willow)	1	0-1	5	2
Salix scouleriana (Scouler's willow)	2	0-3	14	4
Shepherdia canadensis (Canada buffaloberry)	7	0-30	47	17
Spiraea betulifolia (white meadowsweet)	6	0-20	8	7
Symphoricarpos spp. (buckbrush)	4	0-10	39	11
Symphoricarpos occidentalis (buckbrush)	3	0-10	20	8
Vaccinium caespitosum (dwarf bilberry)	7	0-30	15	10
Vaccinium spp. (huckleberry)	1	0-1	2	1
Vaccinium myrtilloides (common blueberry)	3	0-3	2	2
Vaccinium vitis-idaea (bog cranberry)	3	0-3	2	2
Viburnum edule (low-bush cranberry)	13	0-70	91	34
Viburnum opulus (high-bush cranberry)	10	0-10	2	4
Graminoids				
Agropyron repens (quack grass)	2	0-3	3	2
Agropyron trachycaulum (slender wheat grass)	2	0-3	11	3
Bromus ciliatus (fringed brome)	2	0-3	6	2

Table 13 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Bromus inermis (awnless brome)	1	0-1	2	1
Calamagrostis canadensis (bluejoint)	6	0-40	89	23
Calamagrostis stricta (narrow reed grass)	1	0-1	2	1
Carex atherodes (awned sedge)	1	0-1	2	1
Carex backii (Back's sedge)	1	0-1	2	1
Carex capillaris (hair-like sedge)	1	0-1	2	1
Carex deweyana (Dewey's sedge)	1	0-1	5	2
Carex disperma (two-seeded sedge)	1	0-1	2	1
Carex siccata (hay sedge)	1	0-1	2	1
Carex spp. (sedge)	1	0-1	2	1
Elymus innovatus (hairy wild rye)	6	0-40	29	13
Oryzopsis asperifolia (white-grained mountain rice grass)	2	0-3	3	2
Poa palustris (fowl bluegrass)	1	0-3	8	3
Poa pratensis (Kentucky bluegrass)	2	0-3	6	2
Schizachne purpurascens (purple oat grass)	2	0-3	5	2
Forbs				
Achillea millefolium (common yarrow)	1	0-3	17	4
Achillea sibirica (many-flowered yarrow)	1	0-1	5	2
Actaea rubra (red and white baneberry)	1	0-3	42	7
Apocynum androsaemifolium (spreading dogbane)	20	0-20	2	6
Aralia nudicaulis (wild sarsaparilla)	7	0-40	55	20
Arnica cordifolia (heart-leaved arnica)	1	0-1	5	2
Aster ciliolatus (Lindley's aster)	4	0-10	32	11
Aster conspicuus (showy aster)	4	0-20	88	19
Botrychium virginianum (Virginia grape fern)	1	0-1	2	1
Castilleja miniata (common red paintbrush)	2	0-3	12	5
Circaea alpina (small enchanter's nightshade)	1	0-1	2	1
Cirsium arvense (Canada thistle)	1	0-1	2	1
Corallorhiza maculata (spotted coralroot)	1	0-1	2	1
Delphinium glaucum (tall larkspur)	2	0-3	5	2
Disporum trachycarpum (fairybells)	1	0-1	23	5
Dryopteris carthusiana (narrow spinulose shield fern)	1	0-1	2	1
Epilobium angustifolium (common fireweed)	6	0-20	80	20
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	3	2
Fragaria virginiana (wild strawberry)	3	0-10	76	15
Galium boreale (northern bedstraw)	2	0-3	82	13
Galium triflorum (sweet-scented bedstraw)	1	0-3	44	7
Gentianella amarella (felwort)	1	0-1	5	2
Geocaulon lividum (northern bastard toadflax)	1	0-1	2	1
Geranium richardsonii (wild white geranium)	1	0-1	2	1
Habenaria orbiculata (round-leaved bog orchid)	1	0-1	8	3
Habenaria viridis (bracted bog orchid)	1	0-1	8	3
Halenia deflexa (spurred gentian)	1	0-1	2	1
Heracleum lanatum (cow parsnip)	2	0-10	18	6
Hieracium triste (slender hawkweed)	1	0-1	5	2
Hieracium umbellatum (narrow-leaved hawkweed)	1	0-1	11	3
Lathyrus ochroleucus (cream-colored vetchling)	3	0-10	86	16
Lycopodium annotinum (stiff club-moss)	1	0-1	3	2
Lycopodium complanatum (ground-cedar)	3	0-3	2	2
Maianthemum canadense (wild lily-of-the-valle)	2	0-3	42	7
Mertensia paniculata (tall lungwort)	3	0-10	70	12
Mitella nuda (bishop's-cap)	2	0-3	33	8
Moehringia lateriflora (blunt-leaved sandwort)	1	0-1	2	1
Orthilia secunda (one-sided wintergreen)	1	0-3	21	5
Osmorhiza chilensis (blunt-fruited sweet cicely)	1	0-1	2	1

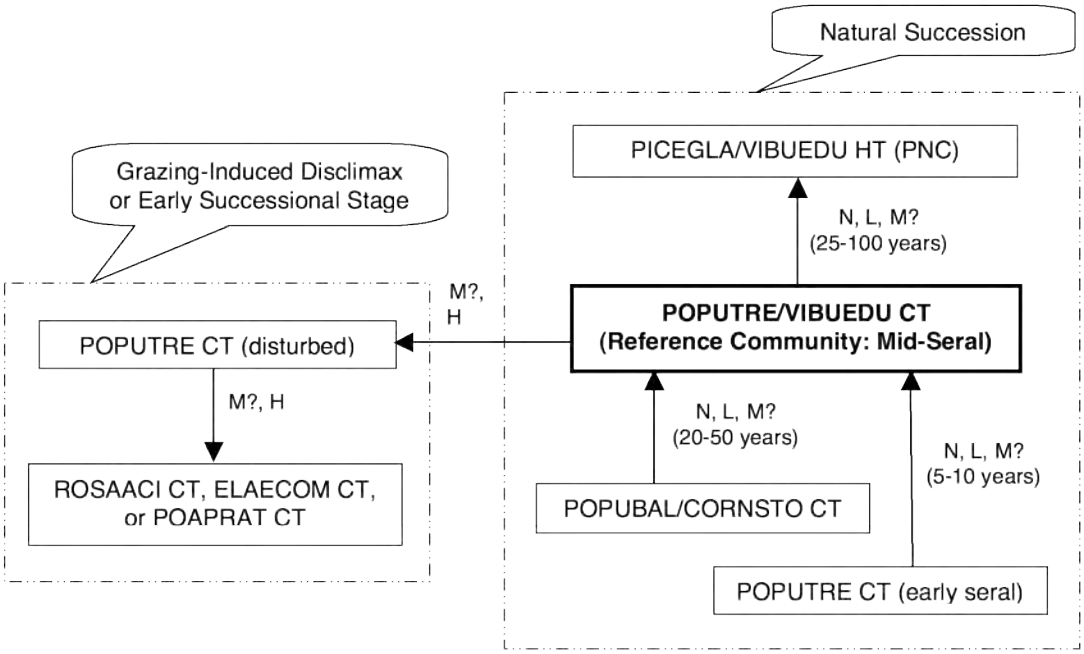
Table 13 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Osmorhiza depauperata (spreading sweet cicely)	2	0-3	6	2
Oxytropis deflexa (reflexed locoweed)	1	0-1	2	1
Petasites palmatus (palmate-leaved coltsfoot)	2	0-10	70	12
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	2	1
Pyrola asarifolia (common pink wintergreen)	3	0-10	56	11
Sanicula marilandica (snakeroot)	2	0-3	11	3
Senecio spp. (senecio)	1	0-1	2	1
Senecio eremophilus (cut-leaved ragwort)	1	0-1	2	1
Smilacina racemosa (false Solomon's-seal)	2	0-3	14	4
Smilacina stellata (star-flowered Solomon's-seal)	1	0-3	21	5
Solidago canadensis (Canada goldenrod)	2	0-3	17	6
Stachys palustris (marsh hedge-nettle)	1	0-1	2	1
Stellaria calycantha (northern stitchwort)	1	0-1	6	2
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0-1	3	2
Taraxacum officinale (common dandelion)	1	0-1	18	4
Thalictrum spp. (meadow rue)	1	0-1	2	1
Thalictrum occidentale (western meadow rue)	3	0-3	5	4
Thalictrum venulosum (veiny meadow rue)	1	0-3	20	4
Trientalis borealis (northern starflower)	1	0-1	3	2
Valeriana dioica (northern valerian)	3	0-3	2	2
Vicia americana (wild vetch)	2	0-10	85	13
Viola canadensis (western Canada violet)	2	0-3	12	3
Viola orbiculata (evergreen violet)	1	0-1	2	1
Viola renifolia (kidney-leaved violet)	2	0-3	12	3
Ferns and Allies				
Equisetum arvense (common horsetail)	3	0-20	41	11
Equisetum scirpoides (dwarf scouring-rush)	1	0-1	2	1
Equisetum sylvaticum (woodland horsetail)	1	0-1	2	1

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type is an early to mid-seral community on sites of the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type (Figure 14). In these areas near the transition to forest with more conifers, *Populus tremuloides* (aspen) is seral to *Picea glauca* (white spruce) (Moss 1932, 1955, Beckingham and others 1996, Beckingham and Archibald 1996). In much of the western Canadian forestlands the suppression of wildfire over the last half-century has allowed a shift toward more mature, later seral forest stands with more conifer trees present (USDA Intermountain Fire Sciences Lab 1995). Figure 14 shows a schematic diagram of the common pathways for succession 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 North Central Alberta
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
ELAECOM CT—*Elaeagnus commutata* (silverberry) community type
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
PICEGLA/VIBUEDU HT—*Picea glabrum/Viburnum edule* (white birch/low-bush cranberry) habitat type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) 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

Figure 14. 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* [awnless brome], *Poa pratensis* [Kentucky bluegrass], etc.).

High levels of use by livestock and/or wildlife will reduce the coverages and successful reproduction of *Populus tremuloides* (aspen) and many of the shrubs associated with this type (e.g., *Amelanchier alnifolia* [Saskatoon], *Cornus stolonifera* [red-osier dogwood], *Lonicera involucrata* [bracted honeysuckle], and *Viburnum edule* [low-bush cranberry]), while increasing the coverages of less preferred species. In extreme cases of long-term disturbance, a nearly complete loss of the woody understory may occur, leaving the stand with an open, park-like understory of disturbance increaser species and exotic invaders, such as *Cornus canadensis* (bunchberry), *Fragaria virginiana* (wild strawberry), *Geranium richardsonii* (wild

white geranium), *Taraxacum officinale* (common dandelion), *Trifolium* species (clover), and *Equisetum arvense* (common horsetail) (Table 14), This condition is described by the *Populus tremuloides* (aspen) community type.

Table 14. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 17 disturbed or early seral stands of the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	9	0-30	41	19
Picea glauca (white spruce)	2	0-3	47	7
Populus balsamifera (balsam poplar)	27	0-60	94	50
Populus tremuloides (aspen)	28	10-50	100	53
Shrubs				
Alnus crispa (green alder)	3	0-3	6	4
Alnus tenuifolia (river alder)	5	0-10	29	12
Amelanchier alnifolia (Saskatoon)	4	0-20	59	13
Arctostaphylos uva-ursi (common bearberry)	3	0-3	6	4
Betula glandulosa (bog birch)	1	0-1	6	2
Betula occidentalis (water birch)	1	0-1	6	2
Clematis occidentalis (purple clematis)	3	0-3	12	6
Cornus canadensis (bunchberry)	7	0-30	59	20
Cornus stolonifera (red-osier dogwood)	2	0-3	59	11
Corylus cornuta (beaked hazelnut)	4	0-10	24	10
Elaeagnus commutata (silverberry)	20	0-20	6	11
Ledum groenlandicum (common Labrador tea)	1	0-1	12	3
Linnaea borealis (twinflower)	5	0-10	35	13
Lonicera dioica (twining honeysuckle)	1	0-3	35	6
Lonicera involucrata (bracted honeysuckle)	3	0-10	53	10
Prunus virginiana (choke cherry)	4	0-10	24	10
Ribes hirtellum (wild gooseberry)	2	0-3	24	7
Ribes lacustre (bristly black currant)	3	0-3	6	4
Ribes oxyacanthoides (northern gooseberry)	2	0-3	59	11
Ribes triste (wild red currant)	3	0-3	6	4
Rosa spp. (rose)	11	1-30	100	33
Rubus arcticus (dwarf raspberry)	3	0-3	6	4
Rubus idaeus (wild red raspberry)	3	0-10	88	16
Rubus pubescens (dewberry)	2	0-3	71	12
Salix bebbiana (beaked willow)	4	0-30	76	17
Salix lutea (yellow willow)	1	0-1	6	2
Salix pseudomonticola (false mountain willow)	3	0-3	12	6
Salix pyrifolia (balsam willow)	3	0-3	12	6
Salix scouleriana (Scouler's willow)	7	0-20	35	16
Salix spp. (willow)	1	0-1	6	2
Shepherdia canadensis (Canada buffaloberry)	3	0-10	29	8
Spiraea betulifolia (white meadowsweet)	1	0-1	6	2
Symphoricarpos spp. (buckbrush)	4	0-20	71	17
Symphoricarpos occidentalis (buckbrush)	10	0-10	12	11
Vaccinium caespitosum (dwarf bilberry)	10	0-10	6	8
Vaccinium myrtilloides (common blueberry)	2	0-3	12	5
Viburnum edule (low-bush cranberry)	2	0-3	47	10
Graminoids				
Agropyron dasystachyum (northern wheat grass)	2	0-3	12	5
Agropyron spp. (wheat grass)	1	0-1	6	2
Agropyron repens (quack grass)	2	0-3	35	6
Agrostis scabra (rough hair grass)	1	0-1	12	3
Agropyron trachycaulum (slender wheat grass)	1	0-3	35	6
Alopecurus aequalis (short-awned foxtail)	1	0-1	6	2
Alopecurus pratensis (meadow foxtail)	2	0-3	12	5

Table 14 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Beckmannia syzigachne (slough grass)	1	0-1	6	2
Bromus ciliatus (fringed brome)	1	0-1	24	5
Bromus inermis (awnless brome)	2	0-3	12	5
Calamagrostis canadensis (bluejoint)	4	0-20	71	17
Calamagrostis spp. (reed grass)	10	0-10	6	8
Carex atherodes (awned sedge)	1	0-1	6	2
Carex disperma (two-seeded sedge)	4	0-10	35	10
Carex microglochin (short-awned sedge)	1	0-1	6	2
Carex sprengelii (Sprengel's sedge)	1	0-1	6	2
Carex vaginata (sheathed sedge)	1	0-1	6	2
Carex spp. (sedge)	1	0-1	6	2
Cinna latifolia (drooping wood-reed)	1	0-1	12	3
Elymus innovatus (hairy wild rye)	3	0-10	41	9
Festuca idahoensis (bluebunch fescue)	1	0-1	6	2
Festuca spp. (fescue)	1	0-1	6	2
Glyceria spp. (manna grass)	1	0-1	6	2
Koeleria macrantha (June grass)	1	0-1	6	2
Oryzopsis asperifolia (white-grained mountain rice grass)	1	0-1	18	4
Phleum pratense (timothy)	2	0-3	41	9
Poa palustris (fowl bluegrass)	1	0-1	24	5
Poa pratensis (Kentucky bluegrass)	5	0-10	88	19
Schizachne purpurascens (purple oat grass)	2	0-10	41	9
Forbs				
Achillea millefolium (common yarrow)	2	0-3	76	9
Actaea rubra (red and white baneberry)	1	0-1	53	7
Antennaria spp. (everlastings)	1	0-1	6	2
Arabis glabra (tower mustard)	1	0-1	6	2
Aralia nudicaulis (wild sarsaparilla)	5	0-30	41	14
Aster ciliolatus (Lindley's aster)	2	0-3	18	4
Aster conspicuus (showy aster)	3	0-10	88	16
Aster laevis (smooth aster)	10	0-10	6	8
Aster spp. (aster)	1	0-1	6	2
Athyrium filix-femina (lady fern)	1	0-1	12	3
Caltha palustris (marsh-marigold)	1	0-1	12	3
Campanula rotundifolia (harebell)	1	0-1	6	2
Cerastium vulgatum (common mouse-ear chickweed)	1	0-1	24	5
Circaea alpina (small enchanter's nightshade)	1	0-1	12	3
Cirsium arvense (Canada thistle)	1	0-1	18	4
Delphinium glaucum (tall larkspur)	1	0-3	29	5
Disporum trachycarpum (fairybells)	1	0-1	12	3
Epilobium angustifolium (common fireweed)	4	0-40	71	17
Epilobium ciliatum (northern willowherb)	2	0-3	12	5
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	6	2
Fragaria virginiana (wild strawberry)	3	0-10	94	17
Galeopsis tetrahit (hemp-nettle)	2	0-3	24	5
Galium boreale (northern bedstraw)	2	0-3	65	11
Galium trifidum (small bedstraw)	1	0-1	6	2
Galium triflorum (sweet-scented bedstraw)	1	0-1	35	6
Geranium richardsonii (wild white geranium)	3	0-10	29	9
Geum aleppicum (yellow avens)	1	0-1	6	2
Geum macrophyllum (large-leaved yellow avens)	1	0-3	59	8
Habenaria viridis (bracted bog orchid)	1	0-1	6	2
Halenia deflexa (spurred gentian)	1	0-1	6	2
Heracleum lanatum (cow parsnip)	2	0-3	35	8
Hieracium triste (slender hawkweed)	1	0-1	6	2

Table 14 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Hieracium umbellatum (narrow-leaved hawkweed)	1	0-1	12	3
Lathyrus ochroleucus (cream-colored vetchling)	1	0-3	94	10
Lilium philadelphicum (western wood lily)	1	0-1	6	2
Maianthemum canadense (wild lily-of-the-valle)	2	0-3	41	6
Mertensia paniculata (tall lungwort)	2	0-3	82	13
Mitella nuda (bishop's-cap)	2	0-10	59	11
Monarda fistulosa (wild bergamot)	1	0-1	6	2
Orthilia secunda (one-sided wintergreen)	1	0-1	18	4
Osmorhiza depauperata (spreading sweet cicely)	1	0-1	29	5
Oxytropis spp. (locoweed)	1	0-1	6	2
Petasites palmatus (palmate-leaved coltsfoot)	1	0-3	76	9
Plantago major (common plantain)	1	0-3	29	5
Potentilla norvegica (rough cinquefoil)	2	0-3	12	5
Pyrola asarifolia (common pink wintergreen)	2	0-3	53	7
Ranunculus abortivus (small-flowered buttercup)	3	0-3	6	4
Ranunculus spp. (ranunculus)	1	0-1	6	2
Ranunculus pedatifidus (northern buttercup)	1	0-1	6	2
Scutellaria galericulata (marsh skullcap)	1	0-1	6	2
Senecio pauperculus (balsam groundsel)	3	0-3	12	6
Senecio pseudaureus (thin-leaved ragwort)	1	0-1	6	2
Silene menziesii (Menzies' catchfly)	1	0-1	6	2
Smilacina stellata (star-flowered Solomon's-seal)	4	0-10	24	10
Solidago canadensis (Canada goldenrod)	1	0-1	12	3
Sonchus arvensis (perennial sow-thistle)	1	0-1	6	2
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0-1	24	5
Taraxacum officinale (common dandelion)	3	0-10	88	13
Thalictrum venulosum (veiny meadow rue)	2	0-3	29	8
Trifolium spp. (clover)	7	0-20	65	21
Urtica dioica (common nettle)	1	0-1	24	5
Veronica americana (American brooklime)	1	0-1	12	3
Vicia americana (wild vetch)	1	0-3	88	9
Viola canadensis (western Canada violet)	1	0-3	53	7
Ferns and Allies				
Equisetum arvense (common horsetail)	3	0-10	82	16

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

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 *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

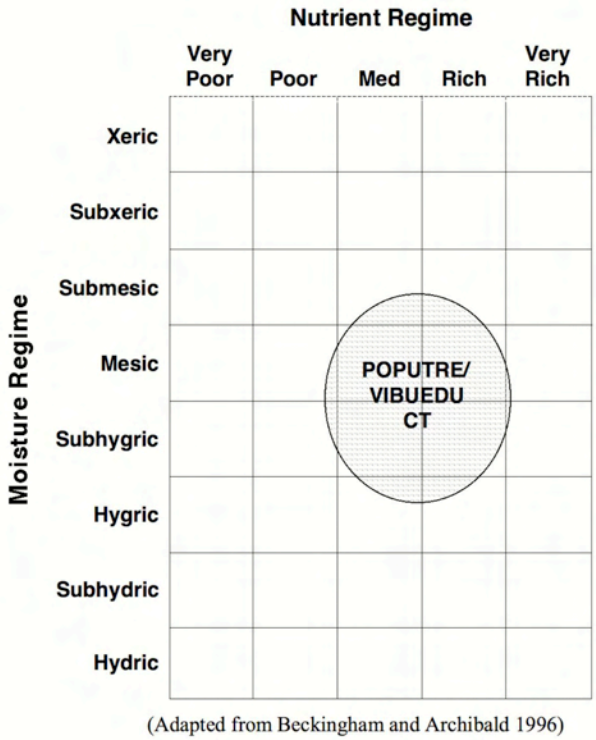


Figure 15. Edatope grid position for the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type (POPUTRE/VIRUEDU CT)

SOILS

Soils on sites adjacent to streams are often shallow Regosols overlying river cobbles. Brunisols and Luvisols are typically found on non-fluvial forested sites. Mineral soil textures on sampled stands ranged from sand and gravel to silty clay. Typical organic (mor) layer thickness is anything from 0 to 15 cm of incompletely decomposed litter. Soil drainage regimes typically range from poorly to well drained, and nutrient regimes are typically medium to rich (Beckingham and Archibald 1996, Beckingham, Nielsen, and Futoransky 1996).

ADJACENT COMMUNITIES

Adjacent wetter communities are dominated typically by *Carex atherodes* (awned sedge), *Salix bebbiana* (beaked willow), *Salix scouleriana* (Scouler's willow), and occasionally *Populus balsamifera* (balsam poplar), or *Betula papyrifera* (white birch). Drier sites are uplands usually dominated by *Picea glauca* (white spruce) and/or *Populus tremuloides* (aspen) with dry site understories.

MANAGEMENT INFORMATION

Livestock

Forage production varies from low to moderate, depending on the density of the tree and shrub layer. Palatability of the various herbaceous species associated with this type are often high, and cattle use may be high as upland vegetation cures and animals spend much of their time in the shade provided by these sites. Livestock will use this type for forage, shade, and bedding. They also browse young suckers and, combined with trampling and soil compaction, can alter both the age structure and understory composition of this type.

Cornus stolonifera (red-osier dogwood) and *Viburnum edule* (low-bush cranberry) are highly preferred by livestock and wildlife (Lawrence 2002). Their abundance and growth form is a direct indication of past and current use levels. Overuse by livestock will result in a reduced vigour by the *Salix* (willows) present, as illustrated by highlining, clubbing, or dead clumps. With continued overuse, *Salix* (willows) show a sharp decline in vigour and may be eventually eliminated from the site. Stands in good to excellent health (condition) often support dense thickets of shrubs, limiting the available herbaceous forage. Some of the major shrub species found in this type (e.g., *Cornus stolonifera* [red-osier dogwood], *Amelanchier*

alnifolia [saskatoon], *Prunus virginiana* [choke cherry], and *Viburnum edule* [low-bush cranberry]) are rated as good browse forage for livestock and wildlife (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991).

Sites are often subjected to high levels of grazing pressure because of their gentle topography and easy access. With moderate to high, prolonged grazing pressure, palatable shrubs will decrease relative to such things as *Symphoricarpos* species (buckbrush), *Rosa* species (rose), and *Lonicera* species (honeysuckle) in the understory. With sufficient long-term intense usage, a site can be converted to the *Populus tremuloides* (aspen) community type by reduction of total shrub cover to less than 25 percent.

Timber
Populus tremuloides (aspen) wood is used primarily for particleboard, especially wafer board and oriented strand board, and for pulp. *Populus tremuloides* (aspen) fibres are well suited for making fine paper. *Populus tremuloides* (aspen) lumber is used for making boxes, crates, pallets, and furniture. Specialty products from *Populus tremuloides* (aspen) wood include excelsior, matchsticks, and tongue depressors (USDA Intermountain Fire Sciences Lab 1995). *Populus tremuloides* (aspen) wood is light, soft, and straight grained. It has good dimensional stability and it turns, sands, and holds glue and paint well. It has relatively low strength, however, and is moderately low in shock resistance. Both sapwood and heartwood have low decay resistance and are difficult for preservatives to penetrate (USDA Intermountain Fire Sciences Lab 1995).

Overstory removal for timber harvest will stimulate sprouting of young trees from roots and stumps. These will repopulate the site, but are susceptible to browsing damage by livestock or wildlife (Hansen and others 1995).

Wildlife
Populus tremuloides (aspen) groves provide important breeding, foraging, and resting habitat for a variety of birds and mammals. Wildlife utilization of *Populus tremuloides* (aspen) communities varies with species composition of the understory and relative age of the *Populus tremuloides* (aspen) stand. Young stands generally provide the most 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 (USDA Intermountain Fire Sciences Lab 1995).

Large Ungulates—Elk browse *Populus tremuloides* (aspen) year-round, feeding on bark, branch apices, and sprouts. In some areas, elk use it mainly in winter. *Populus tremuloides* (aspen) is important forage for mule and white-tailed deer. Deer consume the leaves, buds, twigs, bark, and sprouts. New growth on burns 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. Moose utilize it on summer and winter ranges. Young stands generally provide the best quality moose browse (USDA Intermountain Fire Sciences Lab 1995).

Lagomorphs—Rabbits and hares feed on *Populus tremuloides* (aspen) in summer and winter. In winter, snowshoe hare and cottontail rabbits eat *Populus tremuloides* (aspen) buds, twigs, and bark. *Populus tremuloides* (aspen) is one of the most important and nutritious summer browse species for rabbits in Alberta, and is a preferred winter food of snowshoe hare in Manitoba (USDA Intermountain Fire Sciences Lab 1995). Lagomorphs may girdle suckers or even mature trees. In some parts of Canada, fairly high *Populus tremuloides* (aspen) mortality has been attributed to rabbits and hares (USDA Intermountain Fire Sciences Lab 1995).

Small Rodents—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. Small mammal populations in *Populus tremuloides* (aspen) generally fluctuate widely with stand age and annual variation in animal population size. Highest densities typically occur in mature stands. Field mice (*Peromyscus* species), for example, are most abundant in mature communities. The red-backed vole, however, is most abundant in sapling stands, somewhat less abundant in mature stands, and least common in clearcuts (USDA Intermountain Fire Sciences Lab 1995).

Beaver—Beaver consume the leaves, bark, twigs, and all diameters of *Populus tremuloides* (aspen) branches. They use *Populus tremuloides* (aspen) stems for constructing dams and lodges. At least temporarily, beaver can eliminate *Populus tremuloides* (aspen) from as far as 122 m from waterways. An individual beaver consumes 1-2 kg of *Populus tremuloides* (aspen) bark daily, and it is estimated that as many as 200 *Populus tremuloides* (aspen) stems are required to support one beaver for a 1-year period (USDA Intermountain Fire Sciences Lab 1995).

Birds—*Populus tremuloides* (aspen) communities provide important feeding and nesting sites for a diverse array of birds. Bird species using *Populus tremuloides* (aspen) habitat include sandhill crane, western wood pewee, six species of ducks, blue, ruffed, and sharp-tailed grouse, band-tailed pigeon, mourning dove, wild turkey, red-breasted nuthatch, and pine siskin.

Populus tremuloides (aspen) is host to a variety of insects that are food for woodpeckers and sapsuckers. Generally, moist to mesic *Populus tremuloides* (aspen) sites have greater avian species diversity than *Populus tremuloides* (aspen) stands on dry sites (USDA Intermountain Fire Sciences Lab 1995).

Many bird species utilize *Populus tremuloides* (aspen) communities of only a particular seral stage. Research at a northern Utah site suggests that blue grouse, yellow-rumped warbler, warbling vireo, dark-eyed junco, house wren, and hermit thrush prefer mature *Populus tremuloides* (aspen) stands. The MacGillivray's warbler, chipping and song sparrows, and lazuli bunting occur in younger stands. Bluebirds, tree swallow, pine siskin, yellow-bellied sapsucker, and black-headed grosbeak favor *Populus tremuloides* (aspen) community edges (USDA Intermountain Fire Sciences Lab 1995).

Fisheries
Where adjacent to streams, stands of this type enhance fisheries by stabilizing banks and providing overhanging cover. *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 (Hansen and others 1995).

Fire
Response to Burning—Wet conditions in the spring and summer tend to limit successful burning to the drier fall period. Fire, sometimes in combination with cutting, is becoming an increasingly important tool in regenerating decadent stands of *Populus tremuloides* (aspen) (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 reproduction.

Populus tremuloides (aspen) sprouts from the roots and establishes from off-site, wind-blown seed after fire. It is the classic soboliferous species: a plant that sprouts from carbohydrate-storing lateral roots (sobols). *Populus tremuloides* (aspen) generally sprouts vigorously after fire. Long-term growth and survival of *Populus tremuloides* (aspen) sprouts depend on a variety of factors including prefire carbohydrate levels in roots, sprouting ability of the clone(s), fire severity, and season of fire. Moderate-severity fire generally results in dense sprouting. Fewer sprouts may be produced after severe fire. Since *Populus tremuloides* (aspen) is self-thinning, however, sprouting densities are generally similar several years after moderate and 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 sprouts later in the growing season and again the following year. Fires in mid-growing season generally result in late-season sprouting. *Populus tremuloides* (aspen) burned in late summer or fall usually sprouts the next spring (USDA Intermountain Fire Sciences Lab 1995).

Cornus stolonifera (red-osier dogwood) and the associated shrub species can survive all but the most severe fires that remove duff and cause extended heating of the upper layer of soil. After a fire, the shrubs sprout from the surviving rhizomes or stolons (runners) (Fischer and Bradley 1987).

Applying Fire—Prescribed fire is recommended for *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, *Populus tremuloides* (aspen) stands now live longer than they did before fire exclusion, and many stands are in a state of decline due to advanced age (USDA Intermountain Fire Sciences Lab 1995).

Prescribed fire is often difficult to apply in *Populus tremuloides* (aspen) stands because of the prominence of live fuels and often-sparse distribution of fine dead fuels. Even if fuels are plentiful, they are usually too moist to burn easily. Prescribed fire may be possible, however, when live vegetation cures enough to contribute to fire spread rather than hinder it. The optimum combination of dry weather and cured fuels occurs most often in early spring, late summer, and fall (USDA Intermountain Fire Sciences Lab 1995). In Alberta, these moderately severe, early season burning conditions can persist from snowmelt until the first week in June (Quintilo and others 1991).

In most years, leaf fall and autumn precipitation coincide, making fall burning difficult. If September and October are dry, however, burning may be possible. Brown and Simmerman (1986) provide a method for appraising fuels and flammability in *Populus tremuloides* (aspen) to assist managers in choosing when to apply prescribed fire and helps determine proper conditions for burning.

Burning Prescriptions—In the Aspen Parkland and northern forest Bailey (1978) found that in Alberta, prescribed burning in *Populus tremuloides* (aspen) forests and parklands in spring was usually not successful above relative humidity of 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.

Soil Management and Rehabilitation Opportunities
Soils compaction is likely when repeated animal use occurs on moist soils. Grazing should be deferred to periods when soils and streambanks are drier (Marlow 1984). Livestock access to shallow lakeshores should be monitored carefully to avoid damage to fragile moist soils.

Populus tremuloides (aspen) may 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 *Populus tremuloides* (aspen) roots effectively stabilize soils.

Where revegetation with woody shrub species is desired, *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants) may be well adapted to planting on disturbed sites. 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.

Populus tremuloides (aspen) are unique in their ability to stabilize soil and watersheds. Root sprouts promptly revegetate fire-killed stands. The trees produce abundant litter that contains more nitrogen, phosphorus, potash, and calcium than leaf litter of most other hardwoods. The litter decays rapidly, forming a nutrient-rich humus that may amount to 25 tons per acre (oven-dry basis). The humus reduces runoff and aids in percolation and recharge of ground water. Litter and humus layers reduce evaporation from the soil surface. Compared to conifers, more snow accumulates under *Populus tremuloides* (aspen) and snowmelt begins earlier in the spring. Soil under *Populus tremuloides* (aspen) thaws faster and infiltrates moisture more rapidly than soil under conifers (USDA Intermountain Fire Sciences Lab 1995).

Populus tremuloides (aspen) is well suited for restoration and rehabilitation on a wide range of sites. 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 *Populus tremuloides* (aspen) 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 most successful (USDA Intermountain Fire Sciences Lab 1995).

Recreational Uses and Considerations
Fishing, hunting, and bird watching opportunities are often good in and around stands of this type. *Populus tremuloides* (aspen) is valued for its aesthetic qualities at all times of the year. The yellow, orange, and red foliage of autumn particularly enhances recreational value of *Populus tremuloides* (aspen) sites.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Beckingham and Archibald (1996) describe for the Dry Mixedwood Natural Region a *Populus tremuloides* (aspen) phase of the *Viburnum edule* (low-bush cranberry) ecosite (d1) on sites with a subhygric/rich moisture/nutrient regime, and a phase of the *Cornus stolonifera* (red-osier dogwood) ecosite codominated by *Populus balsamifera* (balsam poplar) and *Populus tremuloides* (aspen) (e1) on sites with a mesic/medium moisture/nutrient regime. These authors also describe a *Populus balsamifera-Populus tremuloides* (balsam poplar-aspen) phase of the *Equisetum* (horsetail) ecosite (f1) on hygric/rich sites, but this phase also has enough *Picea glauca* (white spruce) listed to key it into the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type described earlier in this document.

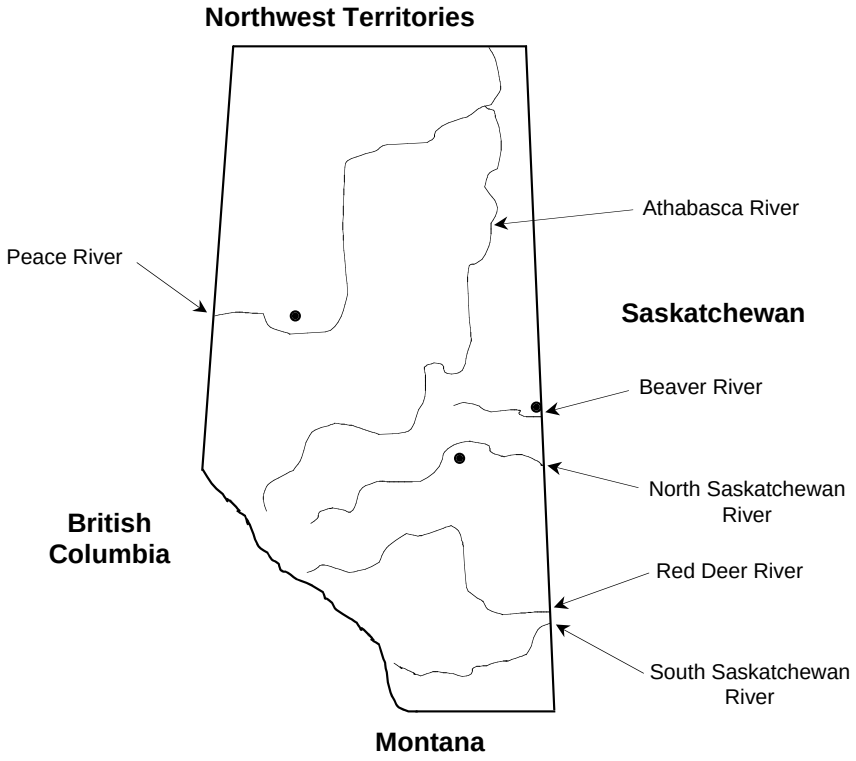
OTHER STUDIES

Thompson and Hansen (2002) describe a *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type in the Grassland Natural Region of southern Alberta. Thompson and Hansen (2001) describe a similar type for the Prairie Ecozone of southern Saskatchewan.

Willoughby (2000) and Lane and others (2000) describe several community types dominated by *Populus tremuloides* (aspen) having similar moist site shrub understories for the Dry and Central Mixedwood and the Lower Foothills Subregions. Beckingham and Archibald (1996) in northern Alberta and Beckingham, Nielsen, and Futoransky (1996) in the Mid-Boreal ecoregions of Saskatchewan describe community types codominated by *Populus tremuloides* (aspen) and *Populus balsamifera* (balsam poplar) with *Cornus stolonifera* (red-osier dogwood) as the key understory indicator. Downing and Karpuk (1992) describe a *Populus tremuloides/Rosa* species–*Viburnum edule* (aspen/rose-low-bush cranberry) vegetation type in the Low Boreal Mixedwood Ecoregion of east central Alberta. Corns (1983) describes a *Populus tremuloides/Viburnum edule/Rubus pubescens* (white spruce/low-bush cranberry/dewberry) community type in west central Alberta.

POPUTRE
Number of Stands Sampled = 4
Number of Stands Sampled in Alberta = 4

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Populus tremuloides* (aspen) community type is a minor type in the Parkland Natural Region and the Dry Mixedwood Subregion. It is a grazing induced disturbance community resulting from long-term high usage of *Populus tremuloides/ Cornus stolonifera* (aspen/red-osier dogwood) habitat type stands in the Parkland Natural Region or to *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type stands in the Boreal Natural Region. The *Populus tremuloides* (aspen) community type is found on moist sites around lakes, sloughs, and on alluvial terraces that have been subjected to long-term high levels of grazing pressure.

Although the type is not represented here by a large sample, it is likely that its occurrence in the Dry Mixedwood Subregion will increase as the Boreal Forest Region becomes more developed and the history of grazing usage of the forest lengthens. Typical stands of this disturbed community were sampled near Elk Island National Park, Cold Lake, and Cummings Lake near Fairview.

VEGETATION

The *Populus tremuloides* (aspen) community type is a grazing or browsing induced disturbance community. It is what remains on a site after grazing has eliminated most of the shrubs under an *Populus tremuloides* (aspen) overstory. Shrubs such as *Cornus stolonifera* (red-osier dogwood), *Viburnum edule* (low-bush cranberry), *Alnus tenuifolia* (river alder), *Amelanchier alnifolia* (saskatoon), and *Salix* species (willows) are essentially absent or present only in very small amounts (total shrub canopy cover is less than 25 percent). Herbaceous plants have replaced the missing shrubs. This disturbed community is heavily populated by disturbance-increasers (Tannas 1997), such as *Bromus inermis* (awnless brome), *Galium*

boreale (northern bedstraw), and *Equisetum arvense* (common horsetail) (Table 15). The small sample set may slightly misrepresent the truly expected constituency of this type, but more stands of this type are not needed on the landscape. We would also expect to find the usual disturbance induced exotic herbs *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (common dandelion), and *Trifolium* species (clovers) on sites of this type.

Table 15. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 4 stands of the *Populus tremuloides* (aspen) community type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Trees				
Betula papyrifera (white birch)	1	0-1	25	5
Picea glauca (white spruce)	1	0-1	25	5
Populus balsamifera (balsam poplar)	24	0-40	75	42
Populus tremuloides (aspen)	40	20-80	100	63
Shrubs				
Alnus tenuifolia (river alder)	1	0-1	25	5
Amelanchier alnifolia (Saskatoon)	2	0-3	75	9
Caragana arborescens (common caragana)	3	0-3	25	9
Cornus stolonifera (red-osier dogwood)	2	1-3	100	10
Lonicera dioica (twining honeysuckle)	1	0-1	25	5
Lonicera involucrata (bracted honeysuckle)	2	0-3	50	10
Ribes oxyacanthoides (northern gooseberry)	1	0-1	25	5
Rosa spp. (rose)	5	3-10	100	22
Rubus idaeus (wild red raspberry)	2	0-3	75	12
Rubus pubescens (dewberry)	2	1-3	100	10
Salix bebbiana (beaked willow)	1	0-1	25	5
Salix discolor (pussy willow)	1	0-1	25	5
Salix pseudomonticola (false mountain willow)	1	0-1	25	5
Symphoricarpos occidentalis (buckbrush)	3	0-3	25	9
Viburnum edule (low-bush cranberry)	2	0-3	75	9
Graminoids				
Bromus inermis (awnless brome)	50	0-50	25	35
Calamagrostis canadensis (bluejoint)	18	0-50	75	37
Forbs				
Actaea rubra (red and white baneberry)	1	0-1	50	7
Apocynum androsaemifolium (spreading dogbane)	1	0-1	25	5
Aralia nudicaulis (wild sarsaparilla)	40	0-40	25	32
Aster conspicuus (showy aster)	1	0-1	50	7
Aster laevis (smooth aster)	1	0-1	25	5
Cirsium arvense (Canada thistle)	3	0-3	25	9
Disporum trachycarpum (fairybells)	1	0-1	25	5
Epilobium angustifolium (common fireweed)	3	0-3	25	9
Fragaria virginiana (wild strawberry)	1	0-1	25	5
Galium boreale (northern bedstraw)	7	0-10	50	19
Galium triflorum (sweet-scented bedstraw)	1	0-1	50	7
Heracleum lanatum (cow parsnip)	1	0-1	25	5
Lathyrus ochroleucus (cream-colored vetchling)	2	0-3	75	9
Maianthemum canadense (wild lily-of-the-valle)	1	0-1	75	9
Mertensia paniculata (tall lungwort)	10	0-10	50	22
Petasites palmatus (palmate-leaved coltsfoot)	2	0-3	50	10
Sanicula marilandica (snakeroot)	3	0-3	25	9
Senecio spp. (senecio)	3	0-3	25	9
Senecio eremophilus (cut-leaved ragwort)	1	0-1	25	5
Solidago canadensis (Canada goldenrod)	10	0-10	25	16
Sonchus spp. (sow-thistle)	1	0-1	25	5
Stachys palustris (marsh hedge-nettle)	1	0-1	25	5
Thalictrum venulosum (veiny meadow rue)	3	0-3	25	9
Urtica dioica (common nettle)	1	0-1	25	5

Table 15 (cont.)

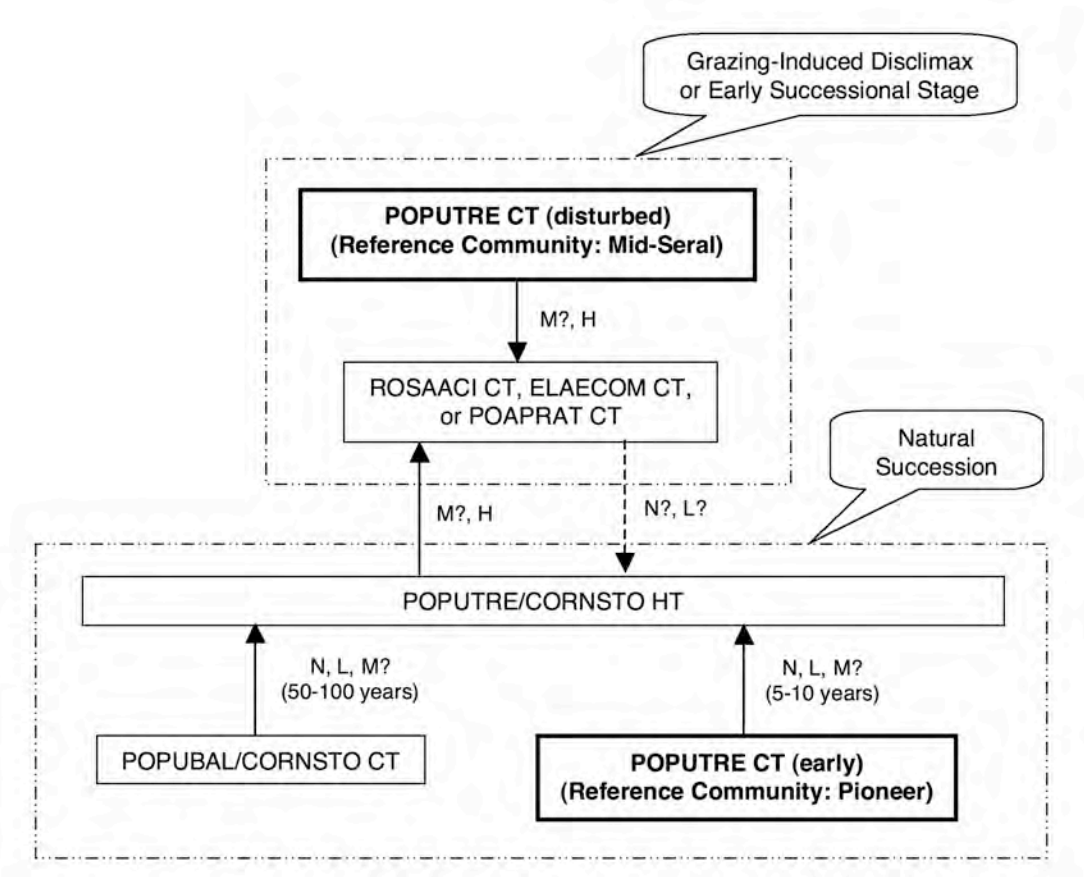
Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Vicia americana (wild vetch)	2	0-3	75	9
Ferns and Allies				
Equisetum arvense (common horsetail)	12	0-30	75	30

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The *Populus tremuloides* (aspen) community type reflects past periods of prolonged animal use. This community type is degraded by grazing or browsing disturbance from either the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type (on sites in the Parkland Natural Region) or the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type (on sites in the Boreal Natural Region). Loss of the original undergrowth dominants has occurred, and *Populus tremuloides* (aspen) reproduction has been severely limited. Careful observation of physical and vegetative characteristics may aid in determining the site's potential, because alteration to the plant community may have masked indications to wetland or upland status.

Figure 16 shows a schematic diagram of expected successional pathways of the *Populus tremuloides* (aspen) community type within the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type on sites in the Parkland Natural Region.



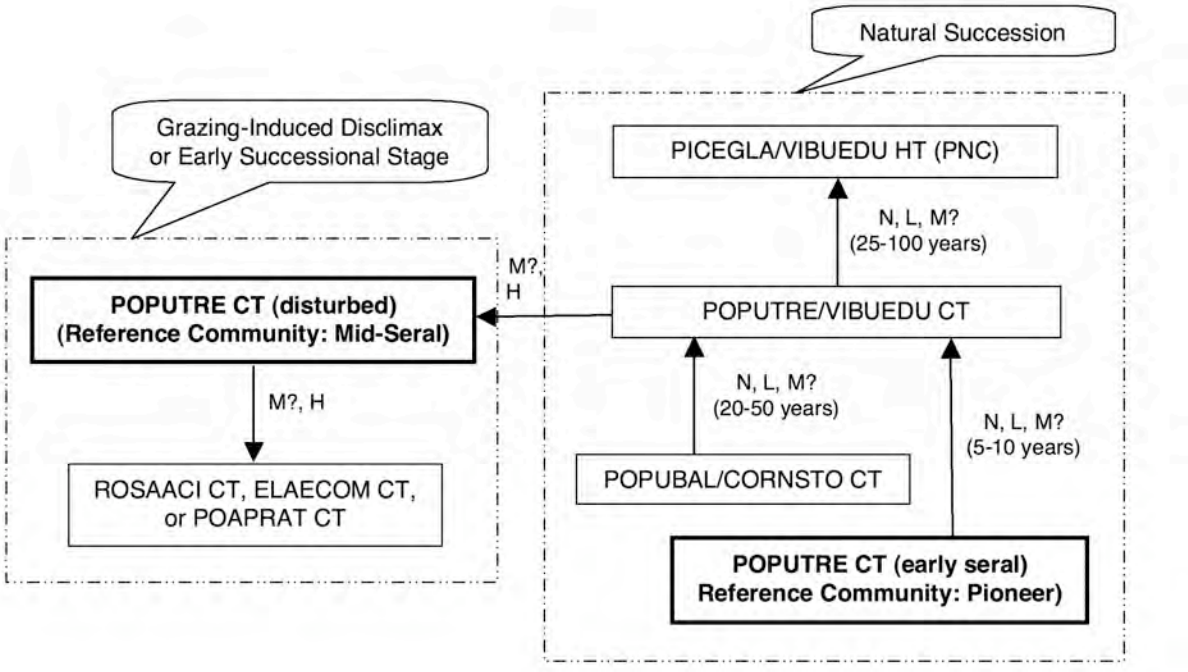
Successional Pathway of *Populus tremuloides* (aspen) Sites in the Parkland Natural Region of Alberta
Reference Community = *Populus tremuloides* (aspen) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
ELAECOM CT—*Elaeagnus commutata* (silverberry) community type
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
POPUTRE CT—*Populus tremuloides* (aspen) community type
POPUTRE/CORNSTO HT—*Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type
ROSAACI CT—*Rosa acicularis* (prickly rose) community type

Figure 16. Successional pathway for sites of the *Populus tremuloides* (aspen) community type in the Parkland Natural Region

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* [awnless brome], *Poa pratensis* [Kentucky bluegrass], etc.).

Figure 17 shows a schematic diagram of the common pathways for succession of the *Populus tremuloides* (aspen) community type within the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type on sites in the Boreal Natural Region.



Successional Pathway of *Populus tremuloides* (aspen) Sites in the Boreal Natural Region of Alberta
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
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
PICEGLA/VIBUEDU HT—*Picea glabrum/Viburnum edule* (white birch/low-bush cranberry) habitat type

POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) 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

Figure 17. Successional pathway for sites of the *Populus tremuloides* (aspen) community type in the Dry Mixedwood Natural Subregion

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* [awnless brome], *Poa pratensis* [Kentucky bluegrass], etc.).

SOILS

Parent material may be alluvium or glacial deposits, and soils are generally Brunisols, Luvisols, or Regosols. Sites of this community type typically have organic (mor) layer thickness from 6 to 15 cm of poorly decomposed material, moderately well to poorly drained mineral soils with textures that can range from sand and gravel to clay, and with moisture regime ranging from mesic to hygric (Beckingham and Archibald 1996, Beckingham, Nielsen, and Futoransky 1996). Due to the kind of disturbance that resulted in this community, the organic soil layer may have been trampled or eroded.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by any of a variety of species, including *Carex atherodes* (awned sedge), *Carex aquatilis* (water sedge), *Salix bebbiana* (beaked willow), *Salix petiolaris* (basket willow), or occasionally *Populus balsamifera* (balsam poplar). Drier sites are usually uplands dominated by *Populus tremuloides* (aspen) with dry site understory, or they may have been converted to agricultural use as farmed fields or tame pasture.

MANAGEMENT INFORMATION

Livestock

The *Populus tremuloides* (aspen) community type is a valuable source of browse and forage for livestock and wildlife. Livestock also use this type for shade and as bedding ground. However, persistent grazing and trampling have already caused compositional and structural changes, including the loss of native herbaceous species. Conversion back to the original vegetation is unlikely to occur simply by altering the grazing regime.

Bromus inermis (awnless brome) is a highly palatable and productive grass, especially early in the season when it is green (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991). *Bromus inermis* (awnless brome) is well adapted to grazing and is considered an invader. Streambanks with *Bromus inermis* (awnless brome) are susceptible to sloughing. Many stands of the *Populus tremuloides* (aspen) community type are dominated by, or have a large component of, *Poa pratensis* (Kentucky bluegrass). This grass responds to grazing similarly to *Bromus inermis* (awnless brome) by rapidly increasing.

Timber

Populus tremuloides (aspen) wood is used primarily for particleboard, especially wafer board and oriented strand board, and for pulp. *Populus tremuloides* (aspen) fibres are well suited for making fine paper. *Populus tremuloides* (aspen) lumber is used for making boxes, crates, pallets, and furniture. Specialty products from *Populus tremuloides* (aspen) wood include excelsior, matchsticks, and tongue depressors (USDA Intermountain Fire Sciences Lab 1995). *Populus tremuloides* (aspen) wood is light, soft, and straight grained. It has good dimensional stability and it turns, sands, and holds glue and paint well. It has relatively low strength, however, and is moderately low in shock resistance. Both sapwood and heartwood have low decay resistance and are difficult for preservatives to penetrate (USDA Intermountain Fire Sciences Lab 1995).

Overstory removal for timber harvest will stimulate sprouting of young trees from roots and stumps. These will repopulate the site, but are susceptible to browsing damage by livestock or wildlife (Hansen and others 1995).

Wildlife

Habitat values for wildlife species may be high, as described for the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type (on sites in the Parkland Natural Region) or the *Populus tremuloides/Viburnum edule* (aspen/low-bush

cranberry) community type (on sites in the Boreal Natural Region), but have been dramatically reduced due to loss of vegetative structure of the community and replacement of native species with invaders to which wildlife species have not yet become fully adapted.

Fire
While many responses, adaptations, and considerations relating to burning in stands of the *Populus tremuloides* (aspen) community type will remain the same as those for the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type (on sites in the Parkland Natural Region) or the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type (on sites in the Boreal Natural Region), many will have been altered by the reduction of understory density and structure. The sites will have been opened and dried, and fuel loading will have been reduced from conditions typical on undisturbed stands on similar landscape settings.

Soil Management and Rehabilitation Opportunities
Soils compaction is likely when repeated animal use occurs on moist soils. Grazing should be deferred to periods when soils and streambanks are drier (Marlow 1984). Livestock access to shallow lakeshores should be monitored carefully to avoid damage to fragile moist soils.

Populus tremuloides (aspen) may 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 *Populus tremuloides* (aspen) roots effectively stabilize soils.

Where revegetation with woody shrub species is desired, *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants) may be well adapted to planting on disturbed sites. 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.

Populus tremuloides (aspen) are unique in their ability to stabilize soil and watersheds. Root sprouts promptly revegetate fire-killed stands. The trees produce abundant litter that contains more nitrogen, phosphorus, potash, and calcium than leaf litter of most other hardwoods. The litter decays rapidly, forming a nutrient-rich humus that may amount to 25 tons per acre (oven-dry basis). The humus reduces runoff and aids in percolation and recharge of ground water. Litter and humus layers reduce evaporation from the soil surface. Compared to conifers, more snow accumulates under *Populus tremuloides* (aspen) and snowmelt begins earlier in the spring. Soil under *Populus tremuloides* (aspen) thaws faster and infiltrates moisture more rapidly than soil under conifers (USDA Intermountain Fire Sciences Lab 1995).

Populus tremuloides (aspen) is well suited for restoration and rehabilitation on a wide range of sites. 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 *Populus tremuloides* (aspen) 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 most successful (USDA Intermountain Fire Sciences Lab 1995).

Recreational Uses and Considerations
Fishing, hunting, and bird watching opportunities are often good in and around stands of this type. *Populus tremuloides* (aspen) is valued for its aesthetic qualities at all times of the year. The yellow, orange, and red foliage of autumn particularly enhances recreational value of *Populus tremuloides* (aspen) sites.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

The *Populus tremuloides* (aspen) community type may be found in either the Dry Mixedwood or the Parkland Natural Regions, however forested ecosites have not yet been described for the Parkland Natural Region of Alberta. Beckingham and Archibald (1996) describe for the Dry Mixedwood Natural Region a *Populus tremuloides* (aspen) phase of the *Viburnum edule* (low-bush cranberry) ecosite on sites with a subhygric/rich moisture/nutrient regime, and a phase of the *Cornus stolonifera* (red-osier dogwood) ecosite codominated by *Populus balsamifera* (balsam poplar) and *Populus tremuloides* (aspen) on sites with a mesic/medium moisture/nutrient regime. These authors also describe a *Populus balsamifera-Populus tremuloides* (balsam poplar-aspen) phase of the *Equisetum* (horsetail) ecosite on hygric/rich sites, but this phase also has enough *Picea glauca* (white spruce) listed to key it into the *Picea glauca/Equisetum arvense* (white birch/common horsetail) habitat type described earlier in this document.

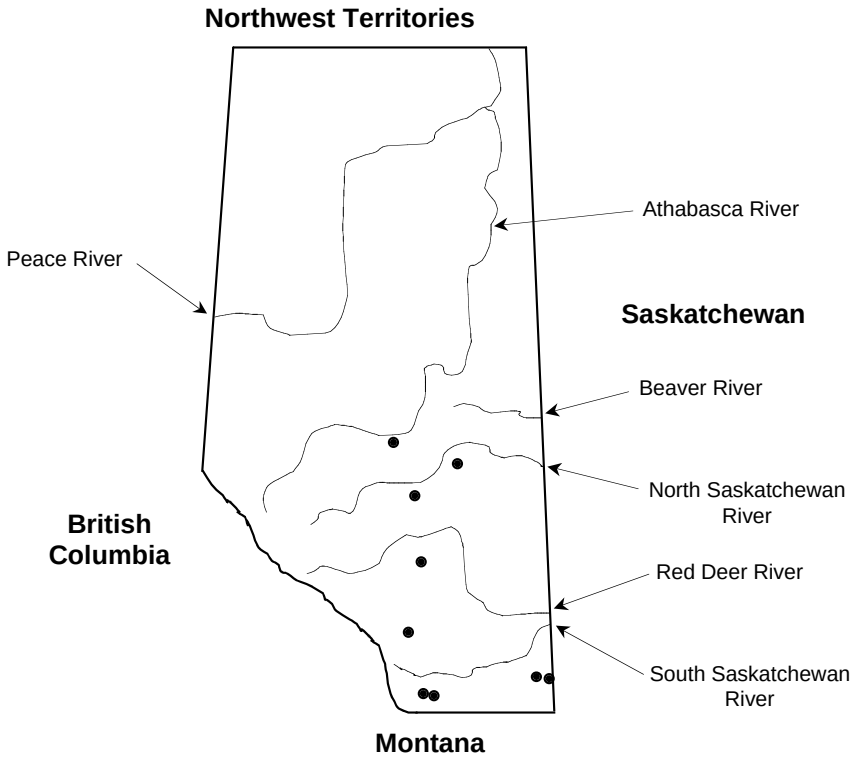
OTHER STUDIES

A *Populus tremuloides/*Herbaceous (aspen/herbaceous) community type was described in the southern Alberta Grassland Natural Region by Thompson and Hansen (2002). Thompson and Hansen (2001) describe a similar type for the Prairie Ecozone of southern Saskatchewan. Lane and others (2000) describe a grazing modified community type called *Populus tremuloides/Rosa acicularis/Trifolium repens* (aspen/rose/clover). Willoughby (2000) also describes a community with a modified understory called *Populus tremuloides/Fragaria virginiana/Elymus innovatus* (aspen/strawberry/hairy wildrye). A *Populus tremuloides/Poa pratensis* (aspen/Kentucky bluegrass) community type is described on severely disturbed *Populus tremuloides* (aspen) sites in Montana by Hansen and others (1995). A *Populus tremuloides* (aspen) community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan.

Salix bebbiana/Carex atherodes Habitat Type
(Beaked Willow/Awned Sedge Habitat Type)

SALIBEB/CAREATH
Number of Stands Sampled = 21
Number of Stands Sampled in Alberta = 16

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type is an incidental type in the Parkland Natural Region and a minor type in the Dry Mixedwood Natural Subregion of Alberta. It occupies moist to wet areas on alluvial terraces and near springs, seeps, and subirrigated meadows characterized by fine textured substrates and poor drainage. Typical stands were sampled near Carstairs, the Battle River near Ponoka, and near Elk Island National Park.

VEGETATION

The *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type is dominated by *Salix bebbiana* (beaked willow) in the tallest layer and *Carex atherodes* (awned sedge), *Carex aquatilis* (water sedge), or *Carex utriculata* (beaked sedge) in a very moist herbaceous understory (Table 16). Stands of this type may have large amounts of tall shrub cover, including other *Salix* species (willow), *Lonicera involucrata* (bracted honeysuckle), and *Corylus cornuta* (beaked hazelnut).

Table 16. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 5 relatively undisturbed late seral to climax stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Picea glauca (white spruce)	1	0-1	20	4
Picea mariana (black spruce)	3	0-3	20	8
Shrubs				
Betula glandulosa (bog birch)	3	0-3	20	8
Betula occidentalis (water birch)	1	0-1	20	4
Cornus canadensis (bunchberry)	3	0-3	20	8
Cornus stolonifera (red-osier dogwood)	1	0-1	20	4
Corylus cornuta (beaked hazelnut)	10	0-10	20	14
Ledum groenlandicum (common Labrador tea)	3	0-3	20	8
Linnaea borealis (twinflower)	1	0-1	20	4
Lonicera involucrata (bracted honeysuckle)	10	0-10	20	14
Ribes oxyacanthoides (northern gooseberry)	1	0-1	20	4
Rosa spp. (rose)	1	0-1	60	8
Rubus arcticus (dwarf raspberry)	2	0-3	40	9
Rubus pubescens (dewberry)	1	0-1	20	4
Salix bebbiana (beaked willow)	60	30-90	100	77
Salix drummondiana (Drummond's willow)	3	0-3	20	8
Salix lutea (yellow willow)	3	0-3	20	8
Salix maccalliana (velvet-fruited willow)	1	0-1	20	4
Salix myrtillifolia (myrtle-leaved willow)	3	0-3	20	8
Salix petiolaris (basket willow)	3	0-3	20	8
Salix planifolia (flat-leaved willow)	3	0-3	20	8
Salix pseudomonticola (false mountain willow)	1	0-1	20	4
Viburnum edule (low-bush cranberry)	1	0-1	20	4
Graminoids				
Agrostis scabra (rough hair grass)	10	0-10	20	14
Calamagrostis canadensis (bluejoint)	8	0-10	60	22
Calamagrostis inexpansa (northern reed grass)	1	0-1	20	4
Carex aquatilis (water sedge)	10	0-10	40	20
Carex atherodes (awned sedge)	50	0-80	40	45
Carex aurea (golden sedge)	3	0-3	20	8
Carex capillaris (hair-like sedge)	3	0-3	20	8
Carex curta (short sedge)	40	0-40	20	28
Carex disperma (two-seeded sedge)	10	0-10	20	14
Carex norvegica (Norway sedge)	10	0-10	20	14
Carex utriculata (beaked sedge)	32	0-60	40	36
Poa compressa (Canada bluegrass)	3	0-3	20	8
Poa palustris (fowl bluegrass)	1	0-1	20	4
Forbs				
Achillea millefolium (common yarrow)	3	0-3	20	8
Adenocaulon bicolor (pathfinder)	3	0-3	20	8
Aster borealis (marsh aster)	1	0-1	40	6
Aster ciliolatus (Lindley's aster)	3	0-3	20	8
Aster engelmannii (elegant aster)	1	0-1	20	4
Aster laevis (smooth aster)	10	0-10	20	14
Cicuta maculata (water-hemlock)	1	0-1	20	4
Epilobium angustifolium (common fireweed)	1	0-1	20	4
Fragaria vesca (woodland strawberry)	1	0-1	20	4
Fragaria virginiana (wild strawberry)	2	0-3	40	9
Galium boreale (northern bedstraw)	1	0-1	20	4
Galium trifidum (small bedstraw)	1	0-1	20	4
Galium triflorum (sweet-scented bedstraw)	3	0-3	20	8

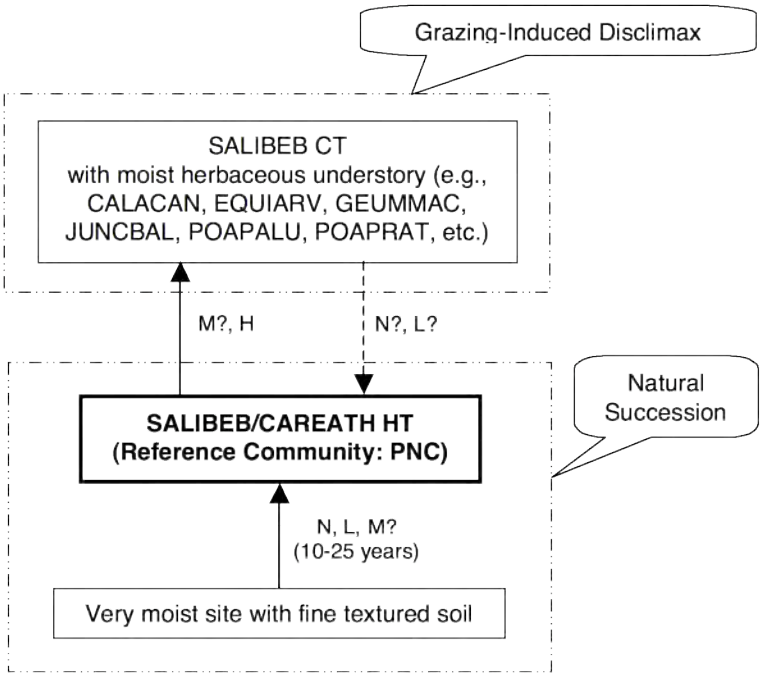
Table 16 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Gentianella amarella (felwort)	1	0-1	20	4
Geum macrophyllum (large-leaved yellow avens)	3	0-3	20	8
Geum triflorum (three-flowered avens)	3	0-3	20	8
Habenaria viridis (bracted bog orchid)	1	0-1	40	6
Halenia deflexa (spurred gentian)	1	0-1	20	4
Lathyrus ochroleucus (cream-colored vetchling)	1	0-1	20	4
Maianthemum canadense (wild lily-of-the-valle)	1	0-1	20	4
Mentha arvensis (wild mint)	2	0-3	40	9
Mertensia paniculata (tall lungwort)	3	0-3	20	8
Mitella nuda (bishop's-cap)	2	0-3	60	8
Parnassia fimbriata (fringed grass-of-parnassus)	1	0-1	20	4
Pedicularis bracteosa (western lousewort)	1	0-1	20	4
Pedicularis groenlandica (elephant's-head)	1	0-1	20	4
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	20	4
Potentilla gracilis (graceful cinquefoil)	1	0-1	20	4
Potentilla palustris (marsh cinquefoil)	1	0-1	40	6
Rumex occidentalis (western dock)	1	0-1	40	6
Senecio pauciflorus (few-flowered ragwort)	1	0-1	20	4
Smilacina trifolia (three-leaved Solomon's-seal)	3	0-3	20	8
Solidago canadensis (Canada goldenrod)	3	0-3	20	8
Stellaria longifolia (long-leaved chickweed)	3	0-3	20	8
Valeriana dioica (northern valerian)	3	0-3	20	8
Vicia americana (wild vetch)	1	0-1	20	4
Viola renifolia (kidney-leaved violet)	3	0-3	20	8
Ferns and Allies				
Equisetum arvense (common horsetail)	12	0-40	80	31
Equisetum scirpoides (dwarf scouring-rush)	1	0-1	20	4

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Salix bebbiana (beaked willow) is a pioneer species that, once established, can persist on sites that have moist conditions or frequent disturbance such as fire or flooding. On fluvially watered sites, channel changes that reduce the availability of water may prevent successful regeneration of *Salix bebbiana* (beaked willow) in established stands. *Salix bebbiana* (beaked willow) has low shade tolerance, and therefore loses dominance on sites with potential for tree species such as *Populus balsamifera* (balsam poplar), *Populus tremuloides* (aspen), or *Picea glauca* (white spruce). Sites of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type are generally too moist for trees. Figure 18 shows a schematic diagram of expected successional pathways for the vegetation communities on sites of this type.



Successional Pathway of Very Moist *Salix bebbiana* (beaked willow) Sites in North Central Alberta
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
CALACAN—Calamagrostis canadensis (bluejoint)
EQUIARV—*Equisetum arvensis* (common horsetail)
GEUMMAC—*Geum macrophyllum* (large-leaved yellow avens)
JUNCBAL—*Juncus balticus* (Baltic rush)
POAPALU—*Poa palustris* (fowl bluegrass)
POAPRAT—*Poa pratensis* (Kentucky bluegrass)
SALIBEB CT—*Salix bebbiana* (beaked willow) community type
SALIBEB/CAREATH HT—*Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type

Figure 18. 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 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.

With prolonged moderate to high levels of grazing pressure, the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type is likely to lose its *Carex* (sedge) understory, replaced by a more diverse set of generally drier, disturbance-increaser species such as *Bromus inermis* (awnless brome), *Juncus balticus* (wire rush), *Poa pratensis* (Kentucky bluegrass), *Mentha arvensis* (wild mint), and *Taraxacum officinale* (common dandelion) (Table 17). This disturbance has the effect of drying out the site and can result in the grazing induced *Salix bebbiana* (beaked willow) community type.

Table 17. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 16 disturbed or early seral stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	2	0-3	19	4
Larix laricina (tamarack)	1	0-1	13	4
Picea glauca (white spruce)	1	0-1	13	4
Picea mariana (black spruce)	1	0-1	6	3
Populus balsamifera (balsam poplar)	1	0-1	6	3
Populus tremuloides (aspen)	1	0-1	6	3
Shrubs				
Alnus tenuifolia (river alder)	3	0-3	13	6
Betula glandulosa (bog birch)	7	0-10	13	9
Betula occidentalis (water birch)	1	0-1	6	3
Cornus stolonifera (red-osier dogwood)	8	0-20	38	17
Elaeagnus commutata (silverberry)	2	0-3	13	5
Lonicera dioica (twining honeysuckle)	1	0-1	6	3
Potentilla fruticosa (shrubby cinquefoil)	3	0-3	6	4
Ribes americanum (wild black currant)	3	0-3	6	4
Ribes hirtellum (wild gooseberry)	1	0-1	6	3
Ribes inerme (mountain gooseberry)	1	0-1	6	3
Ribes lacustre (bristly black currant)	1	0-1	6	3
Ribes oxyacanthoides (northern gooseberry)	1	0-1	13	4
Rosa spp. (rose)	3	0-10	38	11
Rubus arcticus (dwarf raspberry)	2	0-3	19	4
Rubus idaeus (wild red raspberry)	5	0-10	19	10
Salix bebbiana (beaked willow)	47	10-90	100	69
Salix candida (hoary willow)	2	0-3	13	5
Salix exigua (sandbar willow)	3	0-3	6	4
Salix myrtillifolia (myrtle-leaved willow)	20	0-20	6	11
Salix petiolaris (basket willow)	16	0-30	38	24
Salix planifolia (flat-leaved willow)	3	0-3	25	7
Salix pseudomonticola (false mountain willow)	5	0-10	19	10
Salix serissima (autumn willow)	11	0-20	19	14
Symphoricarpos spp. (buckbrush)	1	0-3	31	6
Graminoids				
Agrostis scabra (rough hair grass)	1	0-1	6	3
Agropyron smithii (western wheat grass)	1	0-1	13	4
Agrostis stolonifera (redtop)	11	0-20	31	19
Agropyron trachycaulum (slender wheat grass)	5	0-10	19	10
Alopecurus occidentalis (alpine foxtail)	3	0-3	13	6
Alopecurus pratensis (meadow foxtail)	3	0-3	6	4
Beckmannia syzigachne (slough grass)	8	0-20	19	12
Bromus ciliatus (fringed brome)	1	0-1	6	3
Bromus inermis (awnless brome)	17	0-30	38	25
Calamagrostis canadensis (bluejoint)	28	0-60	25	26
Calamagrostis stricta (narrow reed grass)	10	0-10	13	11
Carex aquatilis (water sedge)	11	0-20	38	20
Carex atherodes (awned sedge)	17	0-50	56	31
Carex capillaris (hair-like sedge)	1	0-1	6	3
Carex curta (short sedge)	10	0-10	6	8
Carex lanuginosa (woolly sedge)	2	0-3	19	6
Carex petasata (pasture sedge)	3	0-3	6	4
Carex praegracilis (graceful sedge)	1	0-1	6	3
Carex utriculata (beaked sedge)	13	0-30	44	24
Carex spp. (sedge)	1	0-1	6	3
Deschampsia cespitosa (tufted hair grass)	1	0-1	6	3

Table 17 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Festuca saximontana (Rocky Mountain fescue)	1	0-1	13	4
Festuca spp. (fescue)	1	0-1	6	3
Glyceria borealis (northern manna grass)	20	0-20	6	11
Glyceria grandis (common tall manna grass)	20	0-20	6	11
Glyceria striata (fowl manna grass)	10	0-10	13	11
Hordeum jubatum (foxtail barley)	1	0-1	13	4
Juncus balticus (wire rush)	15	0-40	38	24
Phalaris arundinacea (reed canary grass)	20	0-30	13	16
Phleum pratense (timothy)	9	0-20	25	14
Poa interior (inland bluegrass)	1	0-1	13	4
Poa palustris (fowl bluegrass)	7	0-10	25	13
Poa pratensis (Kentucky bluegrass)	5	0-10	44	15
Scirpus microcarpus (small-fruited bulrush)	1	0-1	19	4
Forbs				
Achillea millefolium (common yarrow)	1	0-1	19	4
Achillea ptarmica (sneezewort yarrow)	3	0-3	6	4
Actaea rubra (red and white baneberry)	1	0-1	6	3
Anemone canadensis (Canada anemone)	3	0-3	6	4
Anemone cylindrica (long-fruited anemone)	1	0-1	6	3
Angelica arguta (white angelica)	3	0-3	13	6
Aralia nudicaulis (wild sarsaparilla)	1	0-1	6	3
Aster borealis (marsh aster)	1	0-1	6	3
Aster ciliolatus (Lindley's aster)	1	0-1	6	3
Aster conspicuus (showy aster)	2	0-3	13	5
Aster eatonii (Eaton's aster)	3	0-3	6	4
Aster laevis (smooth aster)	2	0-3	13	5
Aster puniceus (purple-stemmed aster)	2	0-3	13	5
Caltha palustris (marsh-marigold)	3	0-3	6	4
Campanula rotundifolia (harebell)	1	0-1	6	3
Chrysanthemum leucanthemum (ox-eye daisy)	1	0-1	6	3
Cicuta maculata (water-hemlock)	5	0-10	19	10
Cirsium arvense (Canada thistle)	3	0-10	44	9
Dodecatheon spp. (shooting star)	1	0-1	6	3
Epilobium angustifolium (common fireweed)	10	0-10	6	8
Epilobium ciliatum (northern willowherb)	2	0-3	19	4
Erigeron philadelphicus (Philadelphia fleabane)	3	0-3	6	4
Fragaria vesca (woodland strawberry)	1	0-1	6	3
Fragaria virginiana (wild strawberry)	5	0-20	31	11
Galium boreale (northern bedstraw)	1	0-1	25	5
Galium trifidum (small bedstraw)	1	0-1	13	4
Galium triflorum (sweet-scented bedstraw)	1	0-1	6	3
Geranium richardsonii (wild white geranium)	3	0-3	13	6
Geum aleppicum (yellow avens)	5	0-10	19	10
Geum macrophyllum (large-leaved yellow avens)	5	0-10	38	14
Habenaria spp. (bog orchid)	1	0-1	6	3
Heracleum lanatum (cow parsnip)	2	0-3	13	5
Lysimachia ciliata (fringed loosestrife)	3	0-3	6	4
Medicago lupulina (black medick)	1	0-1	6	3
Mentha arvensis (wild mint)	4	0-10	50	14
Mertensia paniculata (tall lungwort)	1	0-1	6	3
Parnassia palustris (northern grass-of-parnassus)	1	0-1	13	4
Pedicularis groenlandica (elephant's-head)	1	0-1	6	3
Petasites sagittatus (arrow-leaved coltsfoot)	4	0-10	38	12
Polygonum amphibium (water smartweed)	8	0-20	19	12
Polygonum coccineum (water smartweed)	3	0-3	6	4

Table 17 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Polygonum convolvulus (wild buckwheat)	1	0-1	6	3
Polygonum lapathifolium (pale persicaria)	1	0-1	6	3
Potentilla anserina (silverweed)	1	0-1	6	3
Potentilla norvegica (rough cinquefoil)	1	0-1	6	3
Potentilla palustris (marsh cinquefoil)	3	0-3	6	4
Pyrola asarifolia (common pink wintergreen)	1	0-1	6	3
Ranunculus acris (tall buttercup)	10	0-10	6	8
Rorippa palustris (marsh yellow cress)	1	0-1	6	3
Rumex crispus (curled dock)	1	0-1	6	3
Rumex occidentalis (western dock)	1	0-1	13	4
Sanicula marilandica (snakeroot)	1	0-1	6	3
Scutellaria galericulata (marsh skullcap)	2	0-3	13	5
Senecio pauperculus (balsam groundsel)	1	0-1	13	4
Smilacina stellata (star-flowered Solomon's-seal)	3	0-10	31	10
Solidago canadensis (Canada goldenrod)	5	0-10	19	10
Solidago missouriensis (low goldenrod)	11	0-20	13	11
Solidago rigida (stiff goldenrod)	1	0-1	6	3
Sonchus arvensis (perennial sow-thistle)	1	0-1	6	3
Sonchus spp. (sow-thistle)	3	0-3	6	4
Spiranthes romanzoffiana (hooded ladies'-tresses)	1	0-1	6	3
Stachys palustris (marsh hedge-nettle)	7	0-10	19	11
Stellaria calycantha (northern stitchwort)	1	0-1	6	3
Stellaria longifolia (long-leaved chickweed)	1	0-1	6	3
Taraxacum officinale (common dandelion)	6	0-20	44	15
Thalictrum occidentale (western meadow rue)	3	0-3	6	4
Thalictrum venulosum (veiny meadow rue)	4	0-10	19	9
Trifolium repens (white clover)	6	0-10	13	8
Urtica dioica (common nettle)	2	0-3	19	4
Vicia americana (wild vetch)	2	0-3	44	7
Viola spp. (violet)	3	0-3	13	6
Viola palustris (marsh violet)	1	0-1	6	3
Viola renifolia (kidney-leaved violet)	12	0-20	13	12
Ferns and Allies				
Equisetum arvense (common horsetail)	8	0-20	50	20
Equisetum fluviatile (swamp horsetail)	6	0-10	13	8

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

Salix bebbiana (beaked willow) is highly palatable to browsing animals. However, this does not seem to always negatively affect the presence of the species on a site. In fact, the species seems to have evolved a tolerance to browsing and can remain on a site under all but the most severe long-term browsing. This tolerance to browsing allows *Salix bebbiana* (beaked willow) to increase at the expense of less tolerant *Salix* (willow) species and other desirable shrubs, such as *Cornus stolonifera* (red-osier dogwood). On severely degraded sites with prolonged levels of browsing, *Salix bebbiana* (beaked willow) is typically the last *Salix* (willow) remaining. The degree to which introduced herbaceous species dominate the understory can indicate extent of disturbance.

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 *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

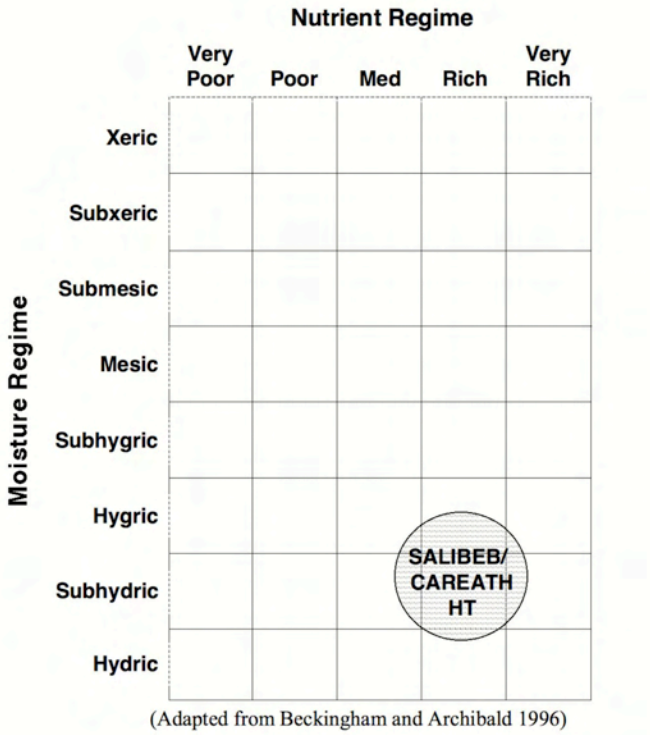


Figure 19. Edatope grid position for the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type (SALIBEB/CAREATH HT)

SOILS

Salix bebbiana (beaked willow) is usually found on moist sandy or gravelly soils but is adapted to a wide variety of soil textures (USDA Intermountain Fire Sciences Lab 1995). Soils commonly have a thick organic layer of peatymor humus form, but this type may also occur on fluvial sites with little organic accumulation. According to Beckingham and Archibald (1996), in northern Alberta the effective soil texture typically varies from sandy loam to clay loam with humic or fibric upper horizons frequently present. Mineral soil textures on sampled stands ranged from sandy loam to clay. Moisture regimes are typically hygric to hydric with water tables usually within 1 m of the soil surface throughout summer, and the nutrient regime typically is medium to rich (Beckingham and Archibald 1996, Beckingham, Nielsen, and Futoransky 1996). Redoximorphic features (mottles or gleyed soil) are also common within 1 m of the soil surface.

Salix bebbiana (beaked willow) will tolerate moderately alkaline soils but does poorly in extremely acidic or alkaline conditions. The general pH range for *Salix* (willows) is 5.5 to 7.5. *Salix bebbiana* (beaked willow) can survive short periods of standing water, but growth rates decline sharply if water persists above the root collar (USDA Intermountain Fire Sciences Lab 1995).

ADJACENT COMMUNITIES

Adjacent wetter types can include the *Carex atherodes* (awned sedge) habitat type and the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type, or the marsh types such as *Scirpus acutus* (great bulrush) and *Typha latifolia* (common cattail). Drier sites may support a variety of types, including the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type, the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type, the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type, the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, as well as upland communities.

MANAGEMENT INFORMATION

Livestock

Stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type are often populated by widely spaced shrubs within a matrix of dense sedges, allowing for easy livestock access. Forage production is moderate to high.

Salix bebbiana rates as good forage value (Tannas 1997); and the 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 1997). As a result, high use by livestock is common when 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 have highlined, clubbed, or decadent clumps. With continued overuse, *Salix* (willows) can show a sharp decline in vigour and may even be slowly eliminated from the site.

Frisina (1991) states that 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.

Wildlife
Where the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type occurs on winter game ranges, browsing of *Salix bebbiana* (beaked willow) by wild ungulates is often high enough to reduce plant vigour and regeneration. *Salix bebbiana* is a highly valuable browse for elk, with high levels of utilization common (USDA Intermountain Fire Sciences Lab 1995). 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. It also provides shade for fish in streams and ponds (USDA Intermountain Fire Sciences Lab 1995).

Fisheries
The importance of *Salix* (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) is highly adapted to fire in most habitats, sprouting rapidly from basal stems following fire (Haeussler and Coates 1986). Quick, hot 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 *Salix bebbiana* (beaked 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. The chance of *Salix bebbiana* (beaked willow) establishing after a fire lessens as faster growing herbaceous species and mosses occupy available mineral soil seedbeds. Prescribed burning is a common wildlife management tool used to rejuvenate decadent *Salix bebbiana* (beaked willow) communities (USDA Intermountain Fire Sciences Lab 1995).

Fire will kill above ground parts of *Salix bebbiana* (beaked willow), and severe fires can completely remove organic layers, leaving charred roots exposed, eliminating potential for basal sprouting, but the species produces an abundance of small, extremely light seeds capable of dispersing over long distances to repopulate suitable sites. The light seeds readily colonize exposed mineral soil after hot fires. *Salix bebbiana* (beaked willow) usually becomes the dominant species in *Salix* (willow) stands that follow forest fires in thickets adjacent to streams, swamps, and lakes. The degree to which it can re-establish after fire, however, depends on the time of year, weather, and presence of a mineral seedbed. A wet period after seed dispersal allows for germination, whereas a dry period can prevent germination. The chance for *Salix bebbiana* (beaked willow) establishing after a fire lessens as available mineral soil seedbeds become occupied by faster growing herbaceous species and mosses (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities
The *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type receives high use by wildlife and cattle. 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 30-50 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 10-20 days after planting. However, use of rooted cuttings and nursery grown stock will produce better results.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

The *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type lies within the *Salix* (willow) communities of the shrubby phase of the rich fen ecosite (k2.2 and k2.3) described by Beckingham and Archibald (1996) for the Dry Mixedwood Natural Region on sites with a subhydric/rich moisture/nutrient regime. It also occurs in the Parkland Natural Region where ecosites have not yet been described.

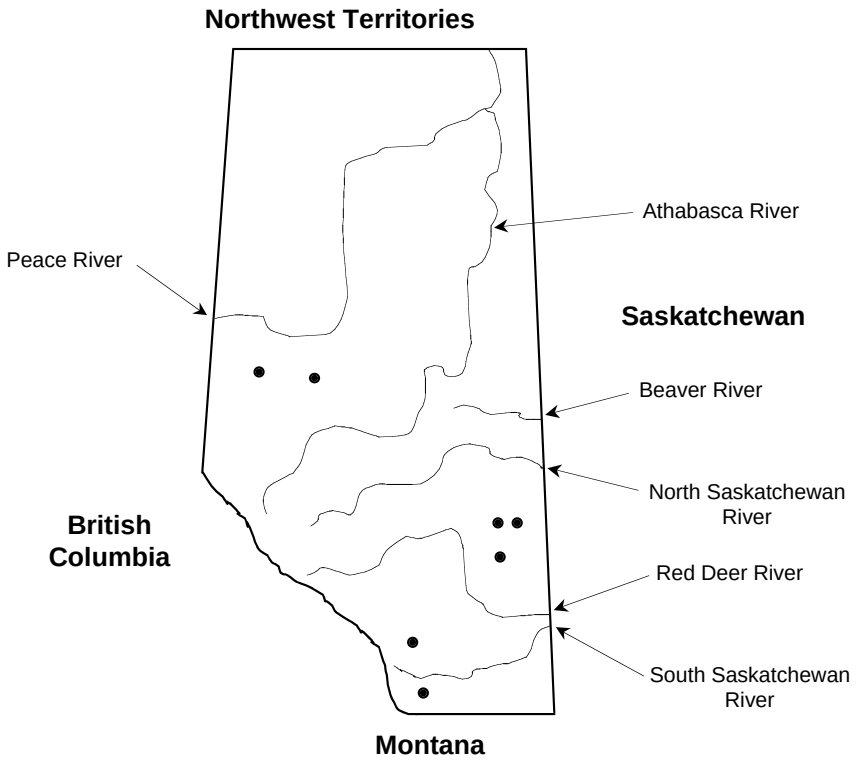
OTHER STUDIES

Thompson and Hansen (2002) described a *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type in the Grassland Natural Region of southern Alberta, and Thompson and Hansen (2001) describe a similar type for the Prairie Ecozone of southern Saskatchewan. Willoughby (2000) and Lane and others (2000) describe *Salix/Carex* (willow/sedge) community types for the Lower Foothills and the Mixedwood Subregions. Beckingham and Archibald (1996) in northern Alberta and Beckingham, Nielsen, and Futoransky (1996) in the Mid-Boreal ecoregions of Saskatchewan describe a *Salix/Carex/*moss (willow/sedge/moss) community type of the shrubby rich fen ecosites. A *Salix bebbiana* (beaked willow) community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan.

Salix bebbiana/Cornus stolonifera Habitat Type
(Beaked Willow/Red-Osier Dogwood Habitat Type)

SALIBEB/CORNSTO
Number of Stands Sampled = 17
Number of Stands Sampled in Alberta = 9

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type is a minor type in the Parkland Natural Region and an incidental type in the Dry Mixedwood Natural Subregion. It occupies moist areas on alluvial terraces, around lakes and sloughs, and near springs, seeps. These sites are somewhat drier than sites of the *Salix bebbiana/Carex*

atherodes (beaked willow/awned sedge) habitat type. Typical stands were sampled on the Battle River near Gallahad, at Sturgeon Lake near Valleyview, and Saskatoon Lake near Grande Prairie.

VEGETATION

The *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type is characterized by *Salix bebbiana* (beaked willow) in the tallest layer and *Cornus stolonifera* (red-osier dogwood) in a moist, tall shrub understory that lacks a prominent *Carex* (sedge) component (Table 18). Drier site graminoid species are much more prominent in this type than in the wetter *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type.

Table 18. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 5 relatively undisturbed late seral to climax stands of the *Salix bebbiana/Cornus stolonifera* (red-osier dogwood/beaked willow) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Acer negundo (Manitoba maple)	1	0-1	20	4
Populus tremuloides (aspen)	1	0-1	40	6
Shrubs				
Amelanchier alnifolia (Saskatoon)	2	0-3	60	8
Cornus stolonifera (red-osier dogwood)	43	3-70	100	66
Elaeagnus commutata (silverberry)	1	0-1	20	4
Lonicera involucrata (bracted honeysuckle)	1	0-1	20	4
Prunus virginiana (choke cherry)	3	0-3	40	11
Ribes americanum (wild black currant)	1	0-1	20	4
Ribes oxyacanthoides (northern gooseberry)	6	0-10	40	14
Rosa spp. (rose)	6	0-10	80	20
Rubus idaeus (wild red raspberry)	3	0-3	20	8
Rubus pubescens (dewberry)	1	0-1	20	4
Salix bebbiana (beaked willow)	82	70-90	100	91
Symphoricarpos spp. (buckbrush)	7	0-10	40	17
Viburnum edule (low-bush cranberry)	1	0-1	20	4
Graminoids				
Agropyron repens (quack grass)	1	0-1	20	4
Bromus inermis (awnless brome)	5	0-10	60	17
Calamagrostis canadensis (bluejoint)	30	0-30	20	24
Carex praegracilis (graceful sedge)	3	0-3	20	8
Carex praticola (meadow sedge)	3	0-3	20	8
Phalaris arundinacea (reed canary grass)	30	0-30	20	24
Poa pratensis (Kentucky bluegrass)	10	0-10	20	14
Forbs				
Achillea millefolium (common yarrow)	1	0-1	20	4
Achillea sibirica (many-flowered yarrow)	1	0-1	20	4
Artemisia absinthium (absinthe wormwood)	3	0-3	20	8
Aster conspicuus (showy aster)	1	0-1	20	4
Aster eatonii (Eaton's aster)	3	0-3	20	8
Aster ericoides (tufted white prairie aster)	3	0-3	20	8
Campanula rotundifolia (harebell)	1	0-1	20	4
Epilobium angustifolium (common fireweed)	1	0-1	20	4
Fragaria virginiana (wild strawberry)	1	0-1	40	6
Galium boreale (northern bedstraw)	2	0-3	40	9
Galium triflorum (sweet-scented bedstraw)	6	0-10	40	14
Geranium richardsonii (wild white geranium)	1	0-1	20	4
Geum aleppicum (yellow avens)	3	0-3	20	8
Geum macrophyllum (large-leaved yellow avens)	1	0-1	20	4
Heracleum lanatum (cow parsnip)	1	0-1	20	4
Lactuca pulchella (common blue lettuce)	1	0-1	20	4
Mertensia paniculata (tall lungwort)	1	0-1	20	4
Osmorhiza spp. (sweet cicely)	1	0-1	20	4

Table 18 (cont.)

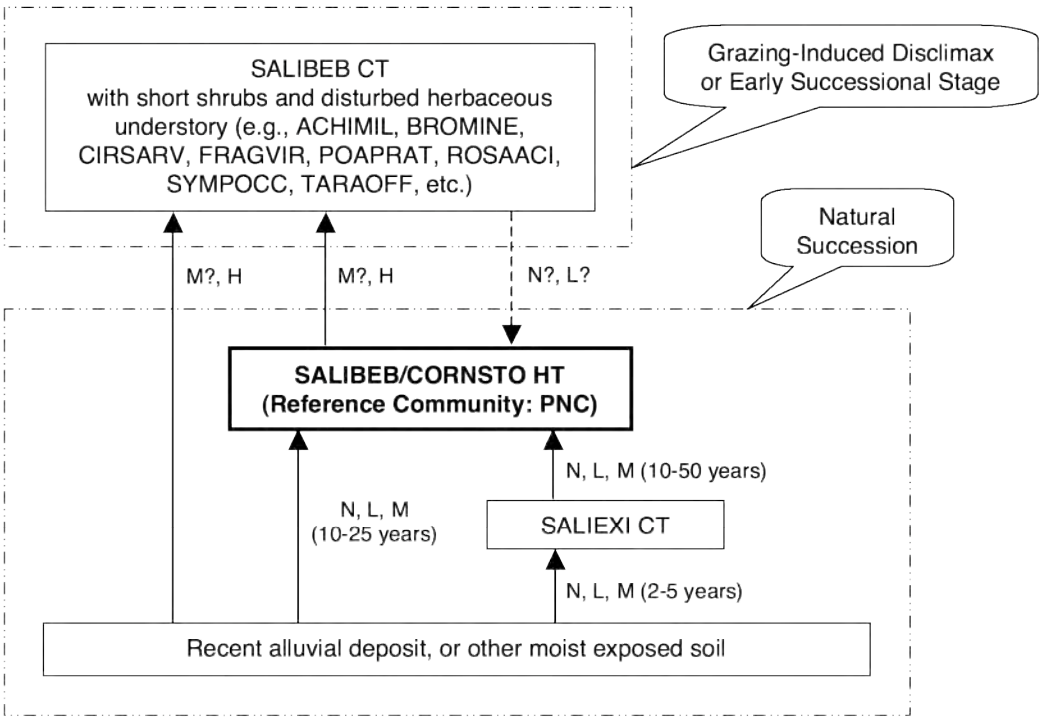
Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Pyrola asarifolia (common pink wintergreen)	3	0-3	20	8
Scutellaria galericulata (marsh skullcap)	1	0-1	20	4
Smilacina stellata (star-flowered Solomon's-seal)	4	0-10	60	15
Solidago canadensis (Canada goldenrod)	5	0-10	60	17
Solidago graminifolia (flat-topped goldenrod)	1	0-1	20	4
Stellaria longifolia (long-leaved chickweed)	3	0-3	20	8
Taraxacum officinale (common dandelion)	1	0-1	20	4
Thalictrum dasycarpum (tall meadow rue)	1	0-1	20	4
Thalictrum venulosum (veiny meadow rue)	10	0-10	20	14
Urtica dioica (common nettle)	3	0-3	40	11
Vicia americana (wild vetch)	2	0-3	40	9
Viola canadensis (western Canada violet)	11	0-20	40	20
Ferns and Allies				
Equisetum arvense (common horsetail)	5	0-10	60	17

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Sites of this type are assumed to lack potential for late seral trees species (*Populus tremuloides* [aspen] or *Picea glauca* [white spruce]), however we acknowledge some uncertainty regarding the possibility of invasion by spruce due to the long period required for establishment of spruce under a closed canopy.

With prolonged moderate to high levels of grazing pressure, the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type will lose much of its tall/moist shrub understory to a more diverse set of shorter, drier, less palatable shrub species and disturbance-increaser herbaceous species such as *Bromus inermis* (awnless brome), *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (common timothy), *Cirsium arvense* (Canada thistle), and *Sonchus arvensis* (perennial sow-thistle) (Table 19). This disturbance has the effect of drying out the site by opening it up and exposing the soil surface to sun and wind, and can eventually result in the grazing induced *Salix bebbiana* (beaked willow) community type (Fig. 20).



Successional Pathway of Mesic *Salix bebbiana* (beaked willow) Sites in North Central Alberta
Reference Community = *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
ACHIMIL—*Achillea millefolium* (common yarrow)
BROMINE—*Bromus inermis* (awnless brome)
CIRSARV—*Cirsium arvense* (Canada thistle)
FRAGVIR—*Fragaria virginiana* (wild strawberry)
POAPRAT—*Poa pratensis* (Kentucky bluegrass)
ROSAACI—*Rosa acicularis* (prickly rose)
SALIBEB CT—*Salix bebbiana* (beaked willow) community type
SALIBEB/CORNSTO HT—*Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type
SALIEXI CT—*Salix exigua* (sandbar willow) community type
SYMPOCC—*Symphoricarpos occidentalis* (buckbrush)
TARAOFF—*Taraxacum officinale* (common dandelion)

Figure 20. Successional pathway for sites of the *Salix bebbiana/Cornus stolonifera* (beaked 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 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.

Table 19. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 12 disturbed or early seral stands of the *Salix bebbiana/Cornus stolonifera* (red-osier dogwood/beaked willow) habitat type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Trees				
Populus balsamifera (balsam poplar)	1	0-1	8	3
Populus tremuloides (aspen)	1	0-1	17	4
Shrubs				
Amelanchier alnifolia (Saskatoon)	7	0-10	17	11
Betula occidentalis (water birch)	1	0-1	8	3
Cornus stolonifera (red-osier dogwood)	18	0-40	92	41
Elaeagnus commutata (silverberry)	1	0-1	8	3
Potentilla fruticosa (shrubby cinquefoil)	2	0-3	17	6
Prunus virginiana (choke cherry)	1	0-1	8	3
Ribes americanum (wild black currant)	3	0-3	17	7
Ribes oxyacanthoides (northern gooseberry)	2	0-3	42	9
Rosa spp. (rose)	7	0-20	67	22
Rubus idaeus (wild red raspberry)	4	0-10	42	13
Rubus pubescens (dewberry)	1	0-1	8	3
Salix bebbiana (beaked willow)	61	10-90	100	78
Salix discolor (pussy willow)	10	0-10	8	9
Salix exigua (sandbar willow)	7	0-10	17	11
Salix petiolaris (basket willow)	11	0-20	42	21
Salix planifolia (flat-leaved willow)	40	0-40	8	18
Shepherdia canadensis (Canada buffaloberry)	1	0-1	17	4
Spiraea alba (narrow-leaved meadowsweet)	1	0-1	8	3
Symphoricarpos spp. (buckbrush)	11	0-30	83	30
Graminoids				
Agropyron repens (quack grass)	3	0-3	8	5
Agropyron smithii (western wheat grass)	10	0-10	8	9
Agrostis stolonifera (redtop)	15	0-20	17	16
Agropyron trachycaulum (slender wheat grass)	1	0-1	8	3
Beckmannia syzigachne (slough grass)	1	0-1	8	3
Bromus inermis (awnless brome)	26	0-90	75	44
Calamagrostis canadensis (bluejoint)	12	0-20	17	14
Carex aquatilis (water sedge)	3	0-3	8	5
Carex atherodes (awned sedge)	3	0-3	33	10
Carex bebbii (Bebb's sedge)	10	0-10	8	9
Carex lanuginosa (woolly sedge)	1	0-1	8	3
Carex microglochin (short-awned sedge)	1	0-1	8	3
Carex praegracilis (graceful sedge)	3	0-3	8	5
Carex sartwellii (Sartwell's sedge)	3	0-3	8	5
Carex sprengelii (Sprengel's sedge)	1	0-1	8	3
Deschampsia cespitosa (tufted hair grass)	1	0-1	8	3
Festuca saximontana (Rocky Mountain fescue)	1	0-1	8	3
Juncus balticus (wire rush)	3	0-3	8	5
Phalaris arundinacea (reed canary grass)	1	0-1	8	3
Phleum pratense (timothy)	6	0-10	33	14
Poa palustris (fowl bluegrass)	14	0-50	33	22
Poa pratensis (Kentucky bluegrass)	10	0-30	67	26
Forbs				
Achillea millefolium (common yarrow)	2	0-3	25	5
Achillea sibirica (many-flowered yarrow)	1	0-1	17	4
Actaea rubra (red and white baneberry)	1	0-1	17	4
Anaphalis margaritacea (pearly everlasting)	3	0-3	8	5
Anemone cylindrica (long-fruited anemone)	5	0-10	25	11
Artemisia campestris (plains wormwood)	1	0-1	8	3
Aster borealis (marsh aster)	3	0-3	8	5

Table 19 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Aster ciliolatus (Lindley's aster)	10	0-10	8	9
Aster eatonii (Eaton's aster)	3	0-3	8	5
Aster ericoides (tufted white prairie aster)	5	0-10	25	11
Aster hesperius (western willow aster)	1	0-1	8	3
Aster laevis (smooth aster)	1	0-1	8	3
Aster subspicatus (leafy-bracted aster)	1	0-1	8	3
Castilleja spp. (paintbrush)	1	0-1	8	3
Castilleja miniata (common red paintbrush)	1	0-1	8	3
Chrysanthemum leucanthemum (ox-eye daisy)	1	0-1	8	3
Cicuta maculata (water-hemlock)	1	0-1	8	3
Cirsium arvense (Canada thistle)	3	0-10	50	12
Cynoglossum officinale (hound's-tongue)	3	0-3	8	5
Epilobium angustifolium (common fireweed)	2	0-3	25	7
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	17	4
Fragaria virginiana (wild strawberry)	2	0-3	50	10
Galium boreale (northern bedstraw)	2	0-3	42	9
Galium triflorum (sweet-scented bedstraw)	4	0-10	33	12
Geranium richardsonii (wild white geranium)	2	0-3	42	9
Geum aleppicum (yellow avens)	1	0-1	17	4
Geum macrophyllum (large-leaved yellow avens)	1	0-1	8	3
Glycyrrhiza lepidota (wild licorice)	3	0-3	8	5
Hedysarum alpinum (alpine hedysarum)	3	0-3	8	5
Heracleum lanatum (cow parsnip)	1	0-1	8	3
Hieracium umbellatum (narrow-leaved hawkweed)	1	0-1	8	3
Lathyrus ochroleucus (cream-colored vetchling)	2	0-3	33	6
Lysimachia ciliata (fringed loosestrife)	3	0-3	8	5
Mentha arvensis (wild mint)	2	0-3	25	5
Moehringia lateriflora (blunt-leaved sandwort)	1	0-1	8	3
Osmorhiza depauperata (spreading sweet cicely)	2	0-3	17	6
Plantago major (common plantain)	1	0-1	8	3
Potentilla gracilis (graceful cinquefoil)	1	0-1	17	4
Potentilla spp. (cinquefoil)	3	0-3	8	5
Pyrola asarifolia (common pink wintergreen)	6	0-10	17	9
Ranunculus acris (tall buttercup)	1	0-1	8	3
Ranunculus gmelinii (yellow water crowfoot)	1	0-1	8	3
Senecio pauperculus (balsam groundsel)	1	0-1	17	4
Sium suave (water parsnip)	1	0-1	8	3
Smilacina stellata (star-flowered Solomon's-seal)	3	0-10	58	11
Solidago canadensis (Canada goldenrod)	5	0-10	50	16
Solidago graminifolia (flat-topped goldenrod)	1	0-1	8	3
Sonchus arvensis (perennial sow-thistle)	18	0-50	50	30
Sonchus spp. (sow-thistle)	10	0-10	8	9
Stachys palustris (marsh hedge-nettle)	1	0-1	25	5
Stellaria longipes (long-stalked chickweed)	1	0-1	8	3
Stellaria longifolia (long-leaved chickweed)	1	0-1	8	3
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0-1	8	3
Taraxacum officinale (common dandelion)	3	0-10	67	14
Thalictrum occidentale (western meadow rue)	1	0-1	8	3
Thalictrum venulosum (veiny meadow rue)	4	0-10	33	12
Trifolium spp. (clover)	3	0-3	8	5
Trifolium repens (white clover)	3	0-3	8	5
Urtica dioica (common nettle)	5	0-10	25	11
Vicia americana (wild vetch)	2	0-3	42	9
Viola spp. (violet)	1	0-1	8	3
Viola canadensis (western Canada violet)	3	0-3	8	5

Table 19 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Ferns and Allies				
Equisetum arvense (common horsetail)	9	0-20	33	16

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

Salix bebbiana (beaked willow) is highly palatable to browsing animals. However, this does not always negatively affect the status of the species on a site. In fact, the species seems to have evolved a tolerance to browsing and can remain on a site under all but the most severe long-term utilization. This tolerance to browsing allows *Salix bebbiana* (beaked willow) to increase at the expense of less tolerant *Salix* (willow) species and other desirable shrubs, such as *Cornus stolonifera* (red-osier dogwood). On severely degraded sites with prolonged levels of browsing, *Salix bebbiana* (beaked willow) is typically the last *Salix* (willow) remaining. The degree to which introduced herbaceous species dominate the understory can indicate extent of disturbance.

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 *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

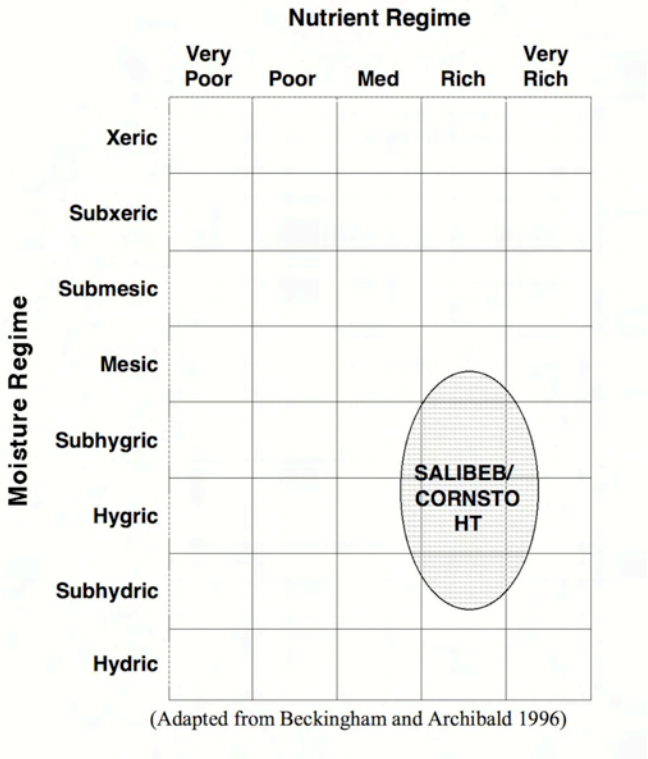


Figure 21. Edatope grid position for the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type (SALIBEB/CORNSTO HT)

SOILS

Salix bebbiana (beaked willow) is usually found on moist sandy or gravelly soils but is adapted to a wide variety of soil textures (USDA Intermountain Fire Sciences Lab 1995). Soils commonly have a thick organic layer of peatymor humus form, but this type may also occur on fluvial sites with little organic accumulation. According to Beckingham and Archibald (1996), in northern Alberta the effective soil texture typically varies from clay loam to sandy loam with humic or fibric upper

horizons frequently present. Mineral soil textures on sampled stands ranged from sandy loam to silty clay. Moisture regimes are typically hygric to hydric with water tables usually within 1 m of the soil surface throughout summer, and the nutrient regime typically is medium to rich (Beckingham and Archibald 1996, Beckingham, Nielsen, and Futoransky 1996). Redoximorphic features (mottles or gleyed soil) are also common within 1 m of the soil surface.

Salix bebbiana (beaked willow) will tolerate moderately alkaline soils but does poorly in extremely acidic or alkaline conditions. The general pH range for *Salix* (willows) is 5.5 to 7.5. This *Salix* (willow) can survive short periods of standing water, but growth rates decline sharply if water persists above the root collar (USDA Intermountain Fire Sciences Lab 1995).

ADJACENT COMMUNITIES

Adjacent wetter types can include the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type and the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. Drier sites may support a variety of types, including the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type, the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type, the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, as well as upland communities.

MANAGEMENT INFORMATION

Livestock

Stands of the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type provide moderate to high forage production, depending on the density of the shrubs. Palatability of the shrub species associated with this type is often high (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991), and cattle use may be high in the late, hot season as upland vegetation cures and animals seek the shade provided by these communities. Livestock will use this type for forage, shade, and as bedding ground. High levels of browsing of the young *Salix* (willow) shoots, combined with trampling and soil compaction, can alter both the age structure and vegetation composition of this type.

Cornus stolonifera (red-osier dogwood) is considered an ice cream plant by livestock and wildlife (Lawrence 2002, Hansen and others 1995). Its abundance, and growth form is a direct indication of past and current use levels. Overuse by livestock of the *Salix* (willows) will cause highlined or clubbed growth forms and dead clumps. With continued overuse, *Salix* (willows) will show a sharp decline in vigour and can be eventually eliminated from the site.

Frisina (1991) states that 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.

Wildlife

Where the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type occurs on winter game ranges, browsing of *Salix bebbiana* (beaked willow) by wild ungulates is often high enough to reduce plant vigour and regeneration. The species is a highly valuable browse for elk, with high utilization common (USDA Intermountain Fire Sciences Lab 1995). 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. It also provides shade for fish in streams and ponds (USDA Intermountain Fire Sciences Lab 1995).

Fisheries

The importance of *Salix* (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) is highly adapted to fire in most habitats, sprouting rapidly from basal stems following fire (Haeussler and Coates 1986). Quick, hot 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 species. 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. The chance of *Salix bebbiana* (beaked willow) establishing after a fire lessens as faster growing herbaceous species and mosses occupy available mineral soil seedbeds. Prescribed burning is a common wildlife management tool used to rejuvenate decadent *Salix bebbiana* (beaked willow) communities (USDA Intermountain Fire Sciences Lab 1995).

Fire will kill above ground parts of *Salix bebbiana* (beaked willow), and severe fires can completely remove organic layers, leaving charred roots exposed, eliminating potential for basal sprouting, but the species produces an abundance of small, extremely light seeds capable of dispersing over long distances to repopulate suitable sites. The light seeds readily colonize exposed mineral soil after hot fires. *Salix bebbiana* (beaked willow) usually becomes the dominant species in *Salix* (willow) stands that follow forest fires in thickets adjacent to streams, swamps, and lakes. The degree to which it can re-establish after fire, however, depends on the time of year, weather, and presence of a mineral seedbed. A wet period after seed dispersal allows for germination, whereas a dry period can prevent germination.

Soil Management and Rehabilitation Opportunities

The *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type receives high use by wildlife and cattle. 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 30-50 cm long and more than 1 cm in diameter produce the best results, as the cuttings root freely along the entire length of the stem. Shoots from cuttings can be expected to appear 10-20 days after planting. However, use of rooted cuttings and nursery grown stock will produce better results.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

The *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type lies within the *Salix* (willow) phase of the *Cornus stolonifera* (dogwood) (e), *Equisetum* (horsetail) (f, although lacking a tree canopy layer), and the shrubby phase of the rich fen (k2) ecosites described by Beckingham and Archibald (1996) for the Dry Mixedwood Natural Subregion on sites with subhygric/rich, hygric/rich, and subhydric/rich moisture/nutrient regimes. It also occurs in the Parkland Natural Region where ecosites have not yet been described.

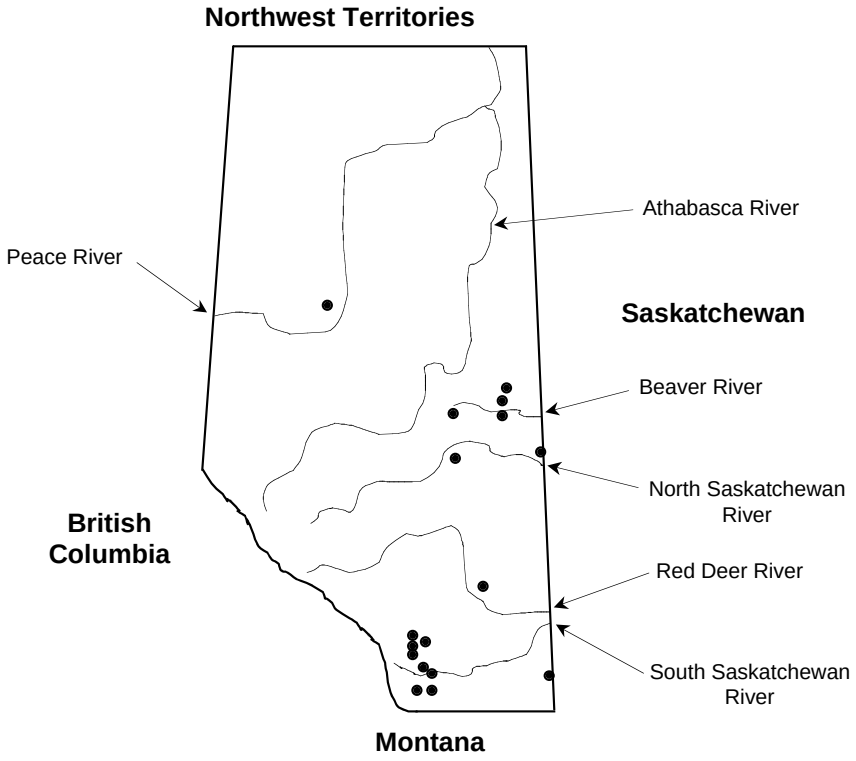
OTHER STUDIES

Thompson and Hansen (2002) described a *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type in the Grassland Natural Region of southern Alberta, and Thompson and Hansen (2001) describe a similar type for the Prairie Ecozone of southern Saskatchewan. Lawrence and Romo (1994) describe a *Salix bebbiana* (beaked willow) community on the Matador Research Station in southern Saskatchewan having *Cornus stolonifera* (red-osier dogwood) as a significant constituent. Beckingham and Archibald (1996) in northern Alberta describe a *Salix/Calamagrostis canadensis* (willow/marsh reed grass) community type of the shrubby rich fen ecosite that has more than 1 percent *Cornus stolonifera* (dogwood) present and less than 10 percent *Carex* (sedge).

Salix bebbiana Community Type
(Beaked Willow Community Type)

SALIBEB
Number of Stands Sampled = 23
Number of Stands Sampled in Alberta = 23

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Salix bebbiana* (beaked willow) community type is a minor type in the Parkland Natural Region and an incidental type in the Dry Mixedwood Natural Subregion. It occupies moist areas on alluvial terraces, around lakes and sloughs, and near springs, seeps. Occurrence of this type is likely to increase in the Dry Mixedwood as more sites of the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type and the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type becomes subjected to a longer history of livestock grazing. Typical stands of this disturbance community were sampled near Elk Island National Park, on the Beaver River north of St. Paul, the Whitemud River near Dixonville, and in the vicinity of Tulliby Lake.

VEGETATION

The *Salix bebbiana* (beaked willow) community type represents a browsing/grazing disturbance induced stage of either the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type or the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type. *Salix bebbiana* (beaked willow) dominates this community type over a diverse group of shorter and less palatable shrub species and disturbance-increaser herbaceous species, including many exotic invaders. Small amounts of the key sedge species or *Cornus stolonifera* (red-osier dogwood) are likely still present, but not in sufficient amounts to key to either habitat type. Prominent instead are such indicators of disturbance as *Bromus inermis* (awnless brome), *Juncus balticus* (wire rush), *Phleum pratense* (timothy), *Poa pratensis* (Kentucky bluegrass), *Cirsium arvense* (Canada thistle), and *Taraxacum officinale* (common dandelion) (Table 20).

Table 20. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 23 stands of the *Salix bebbiana* (beaked willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Abies balsamea (balsam fir)	1	0-1	4	2
Betula papyrifera (white birch)	2	0-3	17	6
Picea glauca (white spruce)	1	0-1	22	5
Populus balsamifera (balsam poplar)	3	0-10	26	7
Populus tremuloides (aspen)	2	0-3	9	4
Shrubs				
Alnus crispa (green alder)	1	0-1	4	2
Alnus tenuifolia (river alder)	1	0-1	4	2
Amelanchier alnifolia (Saskatoon)	2	0-3	30	6
Betula occidentalis (water birch)	3	0-3	4	4
Cornus canadensis (bunchberry)	1	0-1	4	2
Cornus stolonifera (red-osier dogwood)	1	0-1	26	5
Corylus cornuta (beaked hazelnut)	7	0-10	9	8
Elaeagnus commutata (silverberry)	3	0-3	4	4
Linnaea borealis (twinflower)	3	0-3	4	4
Lonicera involucrata (bracted honeysuckle)	2	0-3	35	6
Lonicera utahensis (red twinberry)	1	0-1	4	2
Potentilla fruticosa (shrubby cinquefoil)	1	0-3	26	5
Ribes americanum (wild black currant)	1	0-1	9	3
Ribes glandulosum (skunk currant)	1	0-1	4	2
Ribes hudsonianum (northern black currant)	3	0-3	4	4
Ribes lacustre (bristly black currant)	3	0-3	4	4
Ribes oxyacanthoides (northern gooseberry)	5	0-20	35	13
Ribes spp. (currant)	3	0-3	4	4
Ribes triste (wild red currant)	1	0-1	4	2
Rosa spp. (rose)	3	0-10	74	14
Rubus idaeus (wild red raspberry)	8	0-40	43	17
Rubus pubescens (dewberry)	2	0-3	26	7
Salix bebbiana (beaked willow)	47	10-90	100	69
Salix drummondiana (Drummond's willow)	3	0-3	4	4
Salix lutea (yellow willow)	1	0-1	4	2
Salix maccalliana (velvet-fruited willow)	3	0-3	4	4
Salix myrtillifolia (myrtle-leaved willow)	9	0-20	26	15
Salix petiolaris (basket willow)	8	0-20	13	10
Salix planifolia (flat-leaved willow)	8	0-20	39	18
Salix pseudomonticola (false mountain willow)	7	0-20	39	17
Salix scouleriana (Scouler's willow)	10	0-10	4	7
Shepherdia canadensis (Canada buffaloberry)	6	0-10	9	7
Symphoricarpos spp. (buckbrush)	16	0-50	22	19
Symphoricarpos occidentalis (buckbrush)	6	0-10	9	7
Viburnum edule (low-bush cranberry)	1	0-1	4	2
Graminoids				
Agrostis exarata (spike redtop)	3	0-3	4	4
Agropyron repens (quack grass)	2	0-3	17	4
Agrostis scabra (rough hair grass)	1	0-1	4	2
Agrostis stolonifera (redtop)	7	0-10	9	8
Agropyron trachycaulum (slender wheat grass)	2	0-3	30	8
Alopecurus aequalis (short-awned foxtail)	3	0-3	4	4
Alopecurus occidentalis (alpine foxtail)	3	0-3	13	6
Alopecurus pratensis (meadow foxtail)	3	0-3	4	4
Bromus ciliatus (fringed brome)	2	0-3	43	9
Bromus inermis (awnless brome)	28	0-80	13	19
Calamagrostis canadensis (bluejoint)	10	0-40	52	23

Table 20 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Calamagrostis stricta (narrow reed grass)	2	0-3	13	5
Carex aquatilis (water sedge)	3	0-3	4	4
Carex atherodes (awned sedge)	1	0-1	9	3
Carex curta (short sedge)	1	0-1	4	2
Carex lanuginosa (woolly sedge)	2	0-3	13	4
Carex microglochin (short-awned sedge)	2	0-3	13	5
Carex praegracilis (graceful sedge)	1	0-1	4	2
Carex utriculata (beaked sedge)	1	0-1	4	2
Carex sartwellii (Sartwell's sedge)	3	0-3	4	4
Carex scopulorum (Holm's Rocky Mountain sedge)	20	0-20	4	9
Carex sprengelii (Sprengel's sedge)	1	0-1	4	2
Carex vesicaria (blister sedge)	1	0-1	4	2
Cinna latifolia (drooping wood-reed)	3	0-3	4	4
Deschampsia cespitosa (tufted hair grass)	2	0-3	13	5
Elymus virginicus (Virginia wild rye)	1	0-1	4	2
Glyceria striata (fowl manna grass)	11	0-40	22	15
Hordeum jubatum (foxtail barley)	1	0-1	4	2
Juncus balticus (wire rush)	26	0-80	26	26
Oryzopsis asperifolia (white-grained mountain rice grass)	1	0-1	4	2
Phalaris arundinacea (reed canary grass)	10	0-10	4	7
Phleum pratense (timothy)	11	0-50	52	24
Poa palustris (fowl bluegrass)	6	0-20	48	17
Poa pratensis (Kentucky bluegrass)	12	0-30	78	31
Schizachne purpurascens (purple oat grass)	2	0-3	9	4
Scirpus microcarpus (small-fruited bulrush)	3	0-3	4	4
Forbs				
Achillea millefolium (common yarrow)	2	0-3	61	8
Achillea sibirica (many-flowered yarrow)	1	0-1	9	3
Actaea rubra (red and white baneberry)	1	0-1	9	3
Agrimonia striata (agrimony)	1	0-1	9	3
Allium schoenoprasum (wild chives)	1	0-1	9	3
Angelica arguta (white angelica)	1	0-1	9	3
Aralia nudicaulis (wild sarsaparilla)	5	0-10	13	8
Artemisia ludoviciana (prairie sagewort)	1	0-1	4	2
Aster borealis (marsh aster)	2	0-3	17	4
Aster ciliolatus (Lindley's aster)	3	0-3	17	6
Aster conspicuus (showy aster)	2	0-3	22	7
Aster eatonii (Eaton's aster)	10	0-10	4	7
Aster ericoides (tufted white prairie aster)	1	0-1	4	2
Aster hesperius (western willow aster)	1	0-1	13	4
Aster laevis (smooth aster)	3	0-10	30	10
Aster modestus (large northern aster)	3	0-3	13	6
Aster puniceus (purple-stemmed aster)	1	0-1	4	2
Aster subspicatus (leafy-bracted aster)	3	0-3	9	5
Caltha palustris (marsh-marigold)	3	0-3	4	4
Campanula rotundifolia (harebell)	1	0-1	4	2
Carum carvi (caraway)	3	0-3	4	4
Castilleja spp. (paintbrush)	3	0-3	4	4
Castilleja rhexifolia (alpine red paintbrush)	1	0-1	4	2
Cerastium nutans (long-stalked mouse-ear chickweed)	1	0-1	4	2
Cerastium vulgatum (common mouse-ear chickweed)	1	0-1	4	2
Chrysosplenium iowense (golden saxifrage)	1	0-1	4	2
Cicuta bulbifera (bulb-bearing water-hemlock)	1	0-1	4	2
Cicuta maculata (water-hemlock)	1	0-1	4	2
Circaea alpina (small enchanter's nightshade)	40	0-40	4	13

Table 20 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Cirsium arvense (Canada thistle)	2	0-10	61	11
Convolvulus arvensis (field bindweed)	1	0-1	4	2
Delphinium glaucum (tall larkspur)	1	0-3	22	5
Epilobium angustifolium (common fireweed)	2	0-3	43	7
Epilobium ciliatum (northern willowherb)	1	0-3	22	5
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	4	2
Erysimum cheiranthoides (wormseed mustard)	1	0-1	4	2
Fragaria virginiana (wild strawberry)	2	0-3	61	11
Galeopsis tetrahit (hemp-nettle)	1	0-1	9	3
Galium boreale (northern bedstraw)	1	0-1	48	7
Galium trifidum (small bedstraw)	11	0-20	9	9
Galium triflorum (sweet-scented bedstraw)	2	0-3	13	5
Geranium richardsonii (wild white geranium)	4	0-10	43	13
Geum aleppicum (yellow avens)	2	0-3	13	5
Geum macrophyllum (large-leaved yellow avens)	4	0-10	48	12
Glycyrrhiza lepidota (wild licorice)	1	0-1	4	2
Habenaria hyperborea (northern green bog orchid)	1	0-1	4	2
Hackelia americana (nodding stickseed)	1	0-1	9	3
Halenia deflexa (spurred gentian)	1	0-1	4	2
Helianthus nuttallii (common tall sunflower)	1	0-1	4	2
Heracleum lanatum (cow parsnip)	6	0-20	35	14
Lappula spp. (bluebur)	1	0-1	4	2
Lathyrus ochroleucus (cream-colored vetchling)	1	0-3	22	5
Lycopus uniflorus (northern water-horehound)	1	0-1	4	2
Medicago lupulina (black medick)	1	0-1	4	2
Mentha arvensis (wild mint)	4	0-10	22	8
Mertensia paniculata (tall lungwort)	3	0-10	26	9
Mitella nuda (bishop's-cap)	1	0-1	13	4
Moneses uniflora (one-flowered wintergreen)	1	0-1	4	2
Osmorhiza depauperata (spreading sweet cicely)	1	0-1	4	2
Pedicularis bracteosa (western lousewort)	3	0-3	4	4
Perideridia gairdneri (squawroot)	1	0-1	9	3
Petasites palmatus (palmate-leaved coltsfoot)	2	0-3	13	4
Petasites sagittatus (arrow-leaved coltsfoot)	4	0-10	13	7
Plantago major (common plantain)	1	0-1	26	5
Polygonum lapathifolium (pale persicaria)	1	0-1	4	2
Potentilla anserina (silverweed)	1	0-1	4	2
Potentilla gracilis (graceful cinquefoil)	2	0-3	17	4
Potentilla norvegica (rough cinquefoil)	2	0-3	9	4
Pyrola asarifolia (common pink wintergreen)	1	0-1	4	2
Ranunculus acris (tall buttercup)	20	0-20	4	9
Ranunculus sceleratus (celery-leaved buttercup)	3	0-3	4	4
Rumex occidentalis (western dock)	1	0-1	4	2
Sanicula marilandica (snakeroot)	2	0-3	13	4
Scutellaria galericulata (marsh skullcap)	1	0-1	9	3
Senecio eremophilus (cut-leaved ragwort)	1	0-1	4	2
Senecio foetidus (marsh butterweed)	3	0-3	4	4
Senecio pauperculus (balsam groundsel)	1	0-3	26	5
Sisymbrium loeselii (tall hedge mustard)	1	0-1	4	2
Sium suave (water parsnip)	3	0-3	4	4
Smilacina racemosa (false Solomon's-seal)	1	0-1	9	3
Smilacina stellata (star-flowered Solomon's-seal)	1	0-1	30	6
Solidago canadensis (Canada goldenrod)	4	0-20	35	12
Solidago gigantea (late goldenrod)	2	0-3	9	4
Solidago missouriensis (low goldenrod)	7	0-10	13	10

Table 20 (cont.)

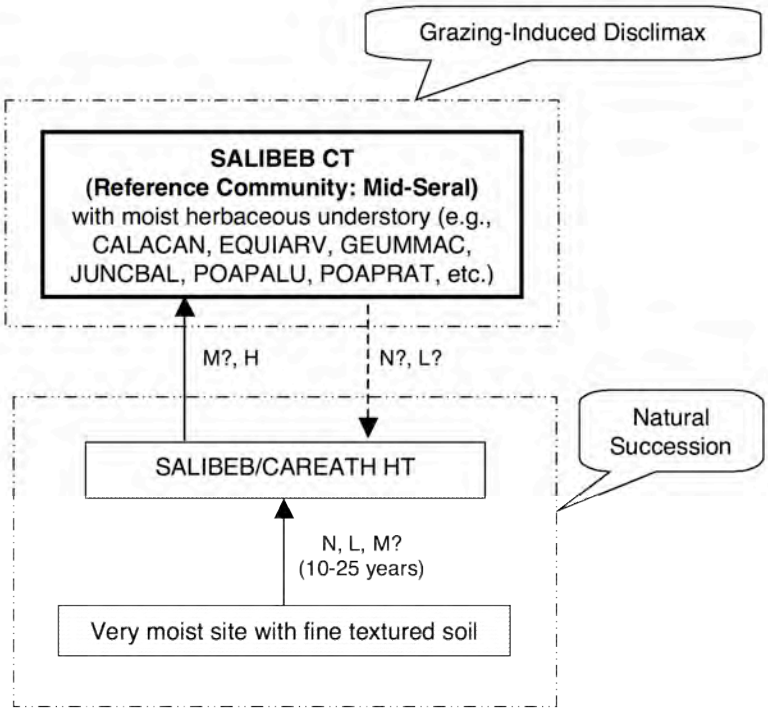
Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Sonchus arvensis (perennial sow-thistle)	1	0-1	4	2
Sonchus spp. (sow-thistle)	1	0-1	4	2
Sparganium spp. (sparganium)	1	0-1	4	2
Stachys palustris (marsh hedge-nettle)	2	0-10	52	10
Stellaria calycantha (northern stitchwort)	1	0-1	9	3
Stellaria longipes (long-stalked chickweed)	1	0-1	4	2
Streptopus amplexifolius (clasping-leaved twisted-stalk)	2	0-3	9	4
Taraxacum officinale (common dandelion)	4	0-20	83	18
Thalictrum spp. (meadow rue)	1	0-1	4	2
Thalictrum occidentale (western meadow rue)	1	0-1	4	2
Thalictrum venulosum (veiny meadow rue)	2	0-3	35	6
Thlaspi arvense (stinkweed)	1	0-1	4	2
Trifolium spp. (clover)	1	0-1	4	2
Trifolium repens (white clover)	4	0-10	22	8
Urtica dioica (common nettle)	3	0-10	39	9
Vicia americana (wild vetch)	2	0-3	78	9
Viola spp. (violet)	1	0-1	4	2
Viola canadensis (western Canada violet)	1	0-1	13	4
Viola palustris (marsh violet)	2	0-3	9	4
Zizia aptera (heart-leaved Alexanders)	1	0-1	4	2
Ferns and Allies				
Equisetum arvense (common horsetail)	5	0-30	65	18
Equisetum fluviatile (swamp horsetail)	1	0-1	4	2

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The *Salix bebbiana* (beaked willow) community type is a browsing/grazing disturbance induced stage of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type or of the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type. With managerial protection measures and sufficient time, it may be possible for remaining constituents of the damaged community to re-establish a semblance of the natural community composition, but in many cases too many of the natural community members have been entirely eliminated from the site and replaced by highly competitive invaders.

Figure 22 shows a schematic diagram of the common pathways for succession of the *Salix bebbiana* (beaked willow) community type on very moist sites of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type in North Central Alberta.



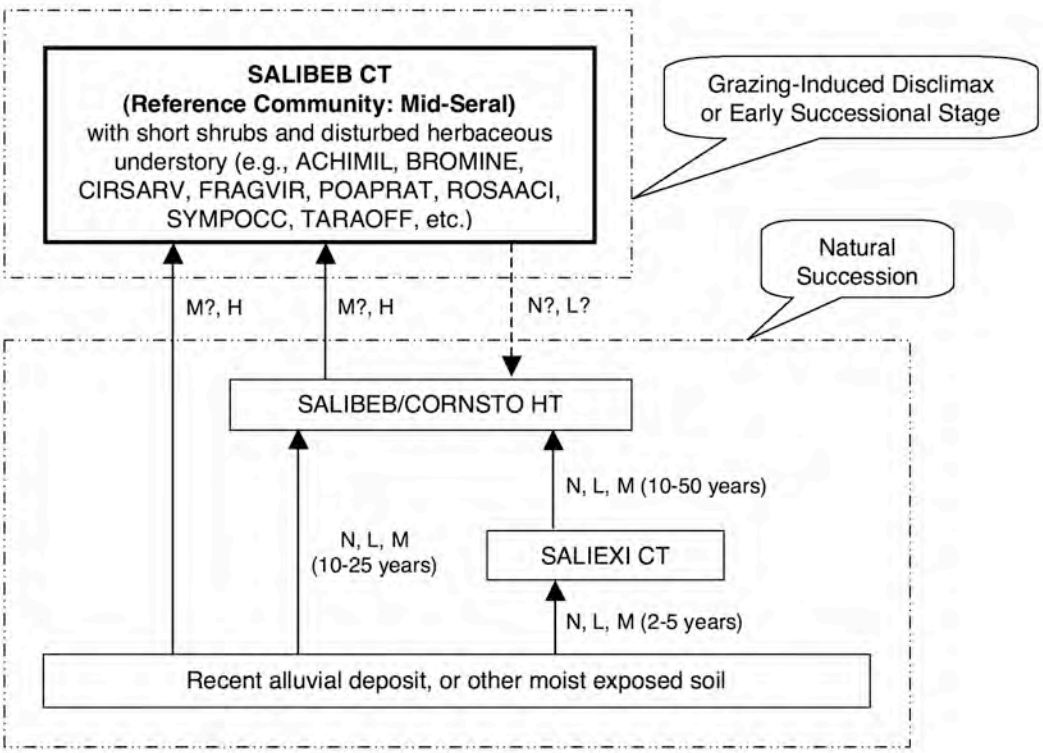
Successional Pathway of Very Moist *Salix bebbiana* (beaked willow) Sites in North Central Alberta
Reference Community = *Salix bebbiana* (beaked willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CALACAN—Calamagrostis canadensis (bluejoint)
EQUIARV—*Equisetum arvensis* (common horsetail)
GEUMMAC—*Geum macrophyllum* (large-leaved yellow avens)
JUNCBAL—*Juncus balticus* (Baltic rush)
POAPALU—*Poa palustris* (fowl bluegrass)
POAPRAT—*Poa pratensis* (Kentucky bluegrass)
SALIBEB CT—*Salix bebbiana* (beaked willow) community type
SALIBEB/CAREATH HT—*Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type

Figure 22. Successional pathway for sites of the *Salix bebbiana* (beaked willow) community type on very moist 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 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.

Figure 23 shows a schematic diagram of the common pathways for succession of the *Salix bebbiana* (beaked willow) community type on mesic sites of the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type in North Central Alberta.



Successional Pathway of Mesic *Salix bebbiana* (beaked willow) Sites in North Central Alberta
Reference Community = *Salix bebbiana* (beaked willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
ACHIMIL—*Achillea millefolium* (common yarrow)
BROMINE—*Bromus inermis* (awnless brome)
CIRSARV—*Cirsium arvense* (Canada thistle)
FRAGVIR—*Fragaria virginiana* (wild strawberry)
POAPRAT—*Poa pratensis* (Kentucky bluegrass)
ROSAACI—*Rosa acicularis* (prickly rose)
SALIBEB CT—*Salix bebbiana* (beaked willow) community type
SALIBEB/CORNSTO HT—*Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type
SALIEXI CT—*Salix exigua* (sandbar willow) community type
SYMPOCC—*Symphoricarpos occidentalis* (buckbrush)
TARAOFF—*Taraxacum officinale* (common dandelion)

Figure 23. Successional pathway for sites of the *Salix bebbiana* (beaked willow) community type on mesic sites of the *Salix bebbiana/Cornus stolonifera* (beaked 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 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.

Salix bebbiana (beaked willow) is highly palatable to browsing animals. However, this does not seem necessarily to negatively affect the status of the species on a site. In fact, the species seems to have evolved a tolerance to browsing and can remain on a site under all but the most severe long-term browsing. This tolerance to browsing allows *Salix bebbiana* (beaked willow) to increase at the expense of less tolerant *Salix* (willow) species and other desirable shrubs, such as *Cornus*

stolonifera (red-osier dogwood). On severely degraded sites with prolonged levels of browsing, *Salix bebbiana* (beaked willow) is typically the last *Salix* (willow) remaining on the site. The degree to which introduced herbaceous species dominate the understory can indicate extent of disturbance.

SOILS

Salix bebbiana (beaked willow) is usually found on moist sandy or gravelly soils but is adapted to a wide variety of soil textures (USDA Intermountain Fire Sciences Lab 1995). Soils commonly have a thick organic layer of peatymor humus form, but this type may also occur on fluvial sites with little organic accumulation. According to Beckingham and Archibald (1996), in northern Alberta the effective soil texture typically varies from clay loam to sandy loam with humic or fibric upper horizons frequently present. Mineral soil textures on all sampled stands dominated by *Salix bebbiana* (beaked willow) ranged from sandy loam to clay. Moisture regimes are typically hygric to hydric with water tables usually within 1 m of the soil surface throughout summer, and the nutrient regime typically is medium to rich (Beckingham and Archibald 1996, Beckingham, Nielsen, and Futoransky 1996). Redoximorphic features (mottles or gleyed soil) are also common within 1 m of the soil surface.

Salix bebbiana (beaked willow) will tolerate moderately alkaline soils but does poorly in extremely acidic or alkaline conditions. The general pH range for *Salix* (willows) is 5.5 to 7.5. *Salix bebbiana* (beaked willow) can survive short periods of standing water, but growth rates decline sharply if water persists above the root collar (USDA Intermountain Fire Sciences Lab 1995).

ADJACENT COMMUNITIES

Adjacent wetter types can include the *Carex atherodes* (awned sedge) habitat type and the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type, or the marsh types such as *Scirpus acutus* (great bulrush) and *Typha latifolia* (common cattail). Drier sites may support a variety of types, including the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type, the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type, the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, as well as upland communities.

MANAGEMENT INFORMATION

Livestock

Stands of the *Salix bebbiana* (beaked willow) community type provide moderate to high forage production, depending on the density of the shrubs. Forage value of the species associated with this type is often high (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991), and cattle use may be high in the late, hot season as upland vegetation cures and animals seek the shade provided by these communities. Livestock will use this type for forage, shade, and as bedding ground.

Wildlife

Where the *Salix bebbiana* (beaked willow) community type occurs on winter game ranges, browsing of *Salix bebbiana* (beaked willow) by wild ungulates is often high enough to reduce plant vigour and regeneration. *Salix bebbiana* (beaked willow) is a highly valuable browse for elk, with high levels of utilization common (USDA Intermountain Fire Sciences Lab 1995). 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. It also provides shade for fish in streams and ponds (USDA Intermountain Fire Sciences Lab 1995).

Fisheries

The importance of *Salix* (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) is highly adapted to fire in most habitats, sprouting rapidly from basal stems following fire (Haeussler and Coates 1986). Quick, hot 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 *Salix bebbiana* (beaked 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. The chance of *Salix bebbiana* (beaked willow) establishing after a fire lessens as faster growing herbaceous species and mosses occupy available mineral soil seedbeds. Prescribed burning is a common wildlife management tool used to rejuvenate decadent *Salix bebbiana* (beaked willow) communities (USDA Intermountain Fire Sciences Lab 1995).

Fire will kill above ground parts of *Salix bebbiana* (beaked willow), and severe fires can completely remove organic layers, leaving charred roots exposed, eliminating potential for basal sprouting, but the species produces an abundance of small, extremely light seeds capable of dispersing over long distances to repopulate suitable sites. The light seeds readily colonize exposed mineral soil after hot fires. *Salix bebbiana* (beaked willow) usually becomes the dominant species in *Salix* (willow) stands that follow forest fires in thickets adjacent to streams, swamps, and lakes. The degree to which it can re-establish after fire, however, depends on the time of year, weather, and presence of a mineral seedbed. A wet period after seed dispersal allows for germination, whereas a dry period can prevent germination. The chance for *Salix bebbiana* (beaked willow) establishing after a fire lessens as available mineral soil seedbeds become occupied by faster growing herbaceous species and mosses (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities

The *Salix bebbiana* (beaked willow) community type receives high use by wildlife and cattle. 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 30-50 cm long and more than 1 cm in diameter produce the best results, as cuttings root freely along the entire length of the stem. Shoots from cuttings can be expected to appear 10-20 days after planting. However, use of rooted cuttings and nursery grown stock will produce better results.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

The *Salix bebbiana* (beaked willow) community type lies within the *Salix* (willow) phase of the shrubby rich fen ecosite described by Beckingham and Archibald (1996) for the Dry Mixedwood Natural Subregion on sites with a subhydric/rich moisture/nutrient regime. It also occurs in the Parkland Natural Region where ecosites have not yet been described.

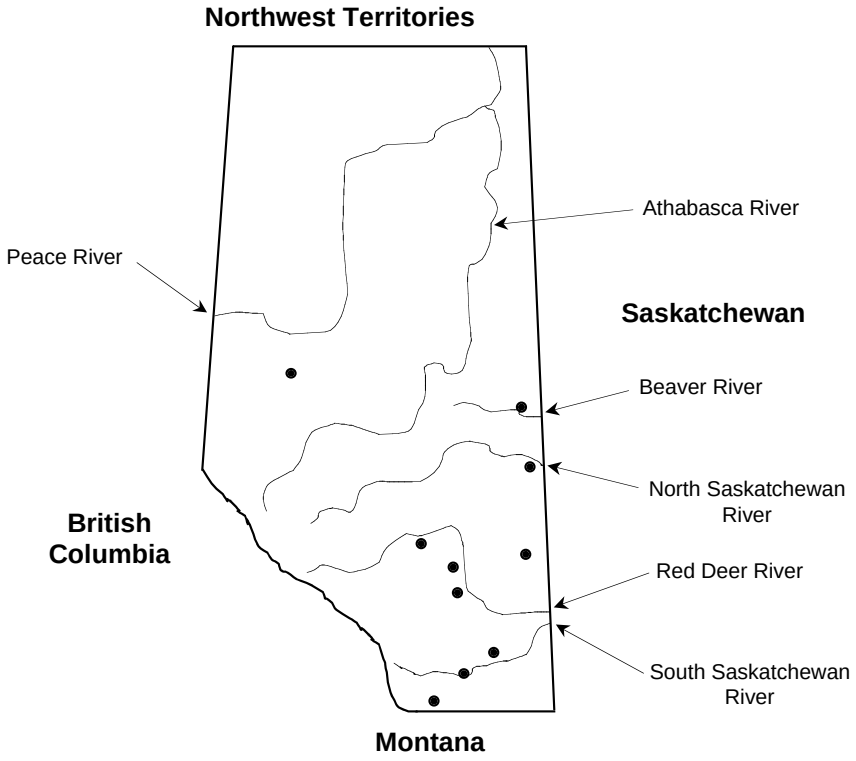
OTHER STUDIES

Thompson and Hansen (2002) describe a disturbance-induced *Salix bebbiana* (beaked willow) community type in the Grassland Natural Region of southern Alberta, and Thompson and Hansen (2001) describe a similar type for the Prairie Ecozone of southern Saskatchewan. A *Salix bebbiana* (beaked willow) community type is described by Hansen and others (1995) for Montana, where dominance by *Salix bebbiana* (beaked willow) was taken to always indicate an early seral stage or site disturbance. Lawrence and Romo (1994) describe a *Salix bebbiana* (beaked willow) community on the Matador Research Station in southern Saskatchewan. Willoughby (2000) describes a *Salix/Poa pratensis/Taraxacum* (willow/Kentucky bluegrass/dandelion) community in the Dry Mixedwood Subregion.

Salix exigua Community Type
(Sandbar Willow Community Type)

SALIEXI
Number of Stands Sampled = 20
Number of Stands Sampled in Alberta = 11

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Salix exigua* (sandbar willow) community type is a minor, type at low elevations in the Parkland Natural Region and the Dry Mixedwood Natural Subregion. Typical sites of this type are on moist alluvial deposits along rivers and streams. Occurrence of this type is frequent on suitable sites, but stands rarely cover large areas. Stands typically form narrow bands parallel to the stream channel on the youngest vegetated deposits. Typical stands were sampled on the Red Deer River near Innisfail, the Vermilion River near Marwayne, the Beaver River near Cold Lake, and the Smoky River near Grande Prairie.

VEGETATION

The pioneering *Salix exigua* (sandbar willow) is the major shrub species of this community type, although some stands may have large amounts of *Cornus stolonifera* (red-osier dogwood) and a variety of other shrubs present. *Salix lutea* (yellow willow) may be present, indicating a likely successional path. The herbaceous layer may include a wide variety of pioneering species (Table 21).

Table 21. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 4 relatively undisturbed stands of the *Salix exigua* (sandbar willow) community type

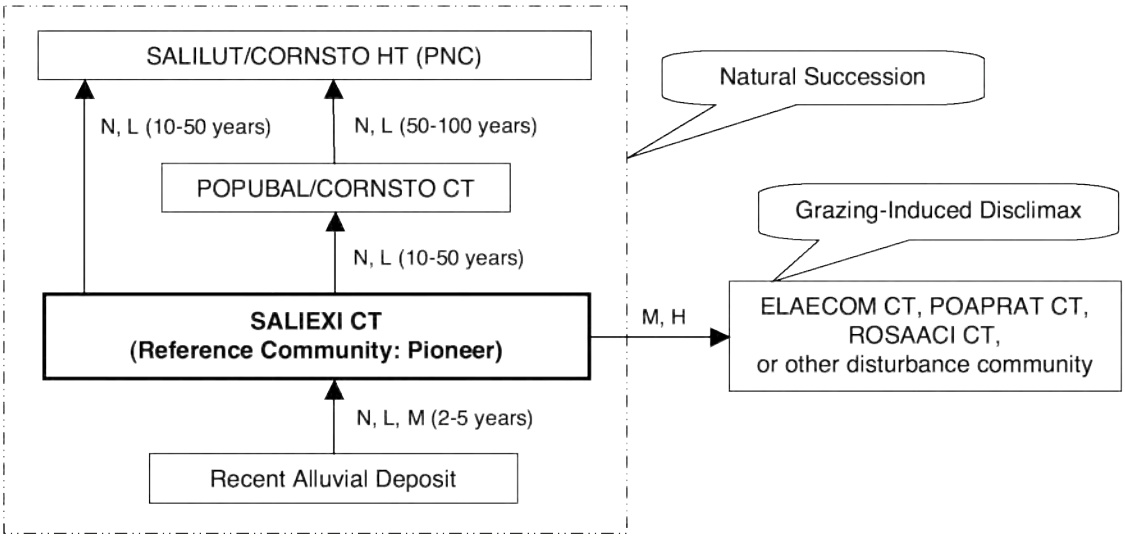
Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Populus balsamifera (balsam poplar)	1	0-1	50	7
Shrubs				
Cornus stolonifera (red-osier dogwood)	26	0-50	50	35
Ribes glandulosum (skunk currant)	1	0-1	25	5
Rosa spp. (rose)	1	0-1	25	5
Rubus idaeus (wild red raspberry)	1	0-1	25	5
Salix exigua (sandbar willow)	60	40-98	100	77
Salix lucida (shining willow)	1	0-1	25	5
Salix lutea (yellow willow)	2	0-3	50	10
Graminoids				
Agropyron repens (quack grass)	1	0-1	25	5
Agrostis scabra (rough hair grass)	1	0-1	25	5
Agropyron smithii (western wheat grass)	1	0-1	25	5
Agrostis stolonifera (redtop)	6	0-10	50	16
Bromus inermis (awnless brome)	3	0-3	25	9
Calamagrostis canadensis (bluejoint)	10	0-10	25	16
Calamagrostis inexpansa (northern reed grass)	3	0-3	25	9
Carex lanuginosa (woolly sedge)	10	0-10	25	16
Eleocharis palustris (creeping spike-rush)	3	0-3	25	9
Poa palustris (fowl bluegrass)	7	0-10	50	19
Poa pratensis (Kentucky bluegrass)	3	0-3	25	9
Scirpus microcarpus (small-fruited bulrush)	10	0-10	25	16
Forbs				
Apocynum cannabinum (Indian hemp)	3	0-3	25	9
Aster hesperius (western willow aster)	1	0-1	25	5
Bidens cernua (nodding beggarticks)	1	0-1	25	5
Fragaria virginiana (wild strawberry)	1	0-1	25	5
Gentianella amarella (felwort)	1	0-1	25	5
Geranium richardsonii (wild white geranium)	10	0-10	25	16
Hieracium umbellatum (narrow-leaved hawkweed)	1	0-1	25	5
Lycopus asper (western water-horehound)	1	0-1	25	5
Plantago major (common plantain)	1	0-1	25	5
Potentilla anserina (silverweed)	1	0-1	25	5
Salsola kali (Russian-thistle)	1	0-1	25	5
Solidago canadensis (Canada goldenrod)	1	0-1	75	9
Solidago spp. (goldenrod)	1	0-1	25	5
Sonchus arvensis (perennial sow-thistle)	1	0-1	25	5
Stachys palustris (marsh hedge-nettle)	1	0-1	25	5
Taraxacum officinale (common dandelion)	1	0-1	25	5
Thalictrum venulosum (veiny meadow rue)	10	0-10	25	16
Urtica dioica (common nettle)	1	0-1	25	5
Vicia americana (wild vetch)	3	0-3	25	9
Ferns and Allies				
Equisetum arvense (common horsetail)	10	0-20	75	27

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The *Salix exigua* (sandbar willow) community type is an early seral (pioneer) primary successional stage on newly deposited sediments. The type may persist on a site under a regime of repeated fluvial disturbance. It commonly occurs as a fringe around dense stands of *Populus balsamifera* (balsam poplar) or in dense, monospecific stands on suitable microsites. Stands of *Salix exigua* (sandbar willow) are generally seral to the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier

dogwood) community type or the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type along stream or river floodplains in central and northern Alberta. Figure 24 shows a schematic diagram of expected succession of vegetation communities on sites of this type.



Successional Pathway of *Salix exigua* (sandbar willow) Sites in North Central Alberta
Reference Community = *Salix exigua* (sandbar willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
ELAECOM CT—*Elaeagnus commutata* (silverberry) community type
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
SALIEXI CT—*Salix exigua* (sandbar willow) community type
SALILUT/CORNSTO HT—*Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type
ROSAACI CT—*Rosa acicularis* (prickly rose) community type

Figure 24. 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 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.

Seedlings of both *Salix exigua* (sandbar willow) and *Populus balsamifera* (balsam poplar) are commonly established simultaneously on alluvial mud flats. Initially, *Salix exigua* (sandbar willow) may grow faster than poplars; however, in a few years, the tree saplings will outgrow the *Salix* (willows) and begin to dominate. As the dense overstory of *Populus balsamifera* (balsam poplar) matures, the *Salix exigua* (sandbar willow) is shaded out, yielding to more shade-tolerant shrubs.

Disturbance Stages
Salix exigua (sandbar willow) is highly adapted to most forms of disturbance. It is a prolific sprouter and will re-establish itself on disturbed sites by successfully competing with aggressive herbs following release from high grazing pressure, provided it has not been totally killed. High levels of grazing may open up stands resulting in invasion by exotic species or less palatable native species, such as *Rosa* species (rose), *Bromus inermis* (awnless brome), *Phalaris arundinacea* (reed canary grass), *Poa pratensis* (Kentucky bluegrass), *Cirsium arvense* (Canada thistle), and *Taraxacum officinale* (common dandelion) (Table 22).

Table 22. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 16 relatively disturbed stands of the *Salix exigua* (sandbar willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Populus balsamifera (balsam poplar)	1	0-1	6	3
Shrubs				
Cornus stolonifera (red-osier dogwood)	16	0-50	38	24
Ribes hudsonianum (northern black currant)	20	0-20	6	11
Ribes oxyacanthoides (northern gooseberry)	1	0-1	6	3
Rosa spp. (rose)	5	0-10	38	14
Salix bebbiana (beaked willow)	1	0-1	6	3
Salix exigua (sandbar willow)	83	40-98	100	91
Salix lutea (yellow willow)	2	0-3	19	4
Salix petiolaris (basket willow)	3	0-3	6	4
Symphoricarpos spp. (buckbrush)	5	0-10	19	10
Graminoids				
Agropyron repens (quack grass)	2	0-3	19	4
Agropyron smithii (western wheat grass)	1	0-1	6	3
Agrostis stolonifera (redtop)	6	0-10	25	12
Agropyron trachycaulum (slender wheat grass)	10	0-20	19	14
Beckmannia syzigachne (slough grass)	3	0-3	6	4
Bromus inermis (awnless brome)	30	0-90	69	45
Calamagrostis canadensis (bluejoint)	1	0-1	6	3
Carex aquatilis (water sedge)	17	0-30	13	15
Carex atherodes (awned sedge)	2	0-3	13	5
Carex lanuginosa (woolly sedge)	3	0-3	6	4
Carex sprengelii (Sprengel's sedge)	3	0-3	6	4
Deschampsia cespitosa (tufted hair grass)	1	0-1	6	3
Elymus canadensis (Canada wild rye)	7	0-10	13	9
Glyceria grandis (common tall manna grass)	1	0-1	6	3
Hordeum jubatum (foxtail barley)	1	0-3	31	6
Phalaris arundinacea (reed canary grass)	25	0-98	44	33
Phleum pratense (timothy)	3	0-3	6	4
Poa compressa (Canada bluegrass)	1	0-1	6	3
Poa palustris (fowl bluegrass)	8	0-10	25	14
Poa pratensis (Kentucky bluegrass)	7	0-30	38	16
Scirpus microcarpus (small-fruited bulrush)	10	0-10	6	8
Forbs				
Apocynum cannabinum (Indian hemp)	1	0-1	6	3
Artemisia absinthium (absinthe wormwood)	10	0-10	6	8
Asclepias speciosa (showy milkweed)	1	0-1	6	3
Aster borealis (marsh aster)	1	0-1	6	3
Aster brachyactis (rayless aster)	2	0-3	13	5
Aster eatonii (Eaton's aster)	1	0-1	6	3
Aster hesperius (western willow aster)	1	0-1	13	4
Aster laevis (smooth aster)	1	0-1	6	3
Cicuta maculata (water-hemlock)	1	0-1	6	3
Cirsium arvense (Canada thistle)	5	0-20	38	14
Crepis tectorum (annual hawk's-beard)	1	0-1	6	3
Erysimum cheiranthoides (wormseed mustard)	3	0-3	6	4
Euphorbia esula (leafy spurge)	1	0-1	6	3
Geranium richardsonii (wild white geranium)	1	0-1	6	3
Glycyrrhiza lepidota (wild licorice)	11	0-30	31	19
Helianthus nuttallii (common tall sunflower)	1	0-1	6	3
Melilotus alba (white sweet-clover)	1	0-1	6	3
Melilotus officinalis (yellow sweet-clover)	2	0-3	13	5
Physostegia parviflora (false dragonhead)	1	0-1	6	3

Table 22 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Plantago major (common plantain)	1	0-1	6	3
Polygonum amphibium (water smartweed)	4	0-10	31	11
Polygonum coccineum (water smartweed)	3	0-3	6	4
Polygonum lapathifolium (pale persicaria)	1	0-1	6	3
Potentilla anserina (silverweed)	5	0-10	19	10
Potentilla rivalis (brook cinquefoil)	10	0-10	6	8
Pyrola asarifolia (common pink wintergreen)	1	0-1	6	3
Ranunculus cymbalaria (seaside buttercup)	3	0-3	6	4
Ranunculus macounii (Macoun's buttercup)	1	0-1	6	3
Rorippa sylvestris (creeping yellow cress)	20	0-20	6	11
Rumex crispus (curled dock)	3	0-3	6	4
Rumex occidentalis (western dock)	3	0-3	6	4
Rumex triangulivalvis (narrow-leaved dock)	3	0-3	6	4
Sium suave (water parsnip)	3	0-3	6	4
Smilacina stellata (star-flowered Solomon's-seal)	10	0-10	6	8
Solidago canadensis (Canada goldenrod)	4	0-10	19	9
Solidago spp. (goldenrod)	3	0-3	6	4
Solidago missouriensis (low goldenrod)	1	0-1	6	3
Solidago rigida (stiff goldenrod)	3	0-3	6	4
Sonchus asper (prickly annual sow-thistle)	2	0-3	13	5
Sonchus spp. (sow-thistle)	1	0-1	25	5
Stachys palustris (marsh hedge-nettle)	1	0-1	6	3
Taraxacum officinale (common dandelion)	2	0-3	44	7
Thlaspi arvense (stinkweed)	1	0-1	6	3
Trifolium spp. (clover)	1	0-1	6	3
Trifolium repens (white clover)	2	0-3	13	5
Urtica dioica (common nettle)	1	0-1	13	4
Vicia americana (wild vetch)	8	0-20	19	12
Xanthium strumarium (cocklebur)	1	0-1	13	4
Ferns and Allies				
Equisetum arvense (common horsetail)	18	0-40	25	21
Equisetum hyemale (common scouring-rush)	10	0-10	6	8

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

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 *Salix exigua* (sandbar willow) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

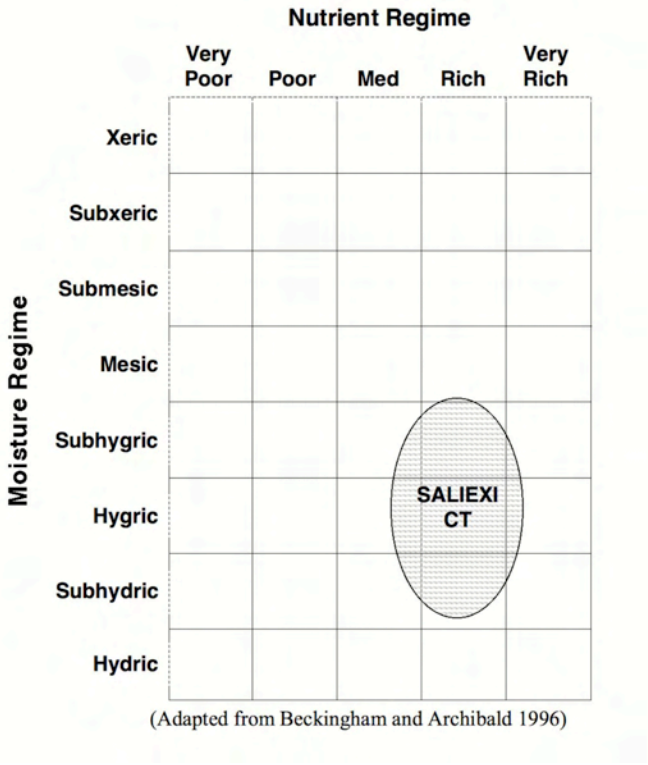


Figure 25. Edatope grid position for the *Salix exigua* (sandbar willow) community type (SALIEXI CT)

SOILS

Soils 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.

ADJACENT COMMUNITIES

Wetter communities are usually absent, but may include 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

Livestock

Forage production is low to occasionally moderate because of the high densities of *Salix exigua* (sandbar willow) stems. Dense stands inhibit livestock access. Overuse by livestock will result in a reduced vigour by the *Salix* (willows) present, as illustrated 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 1997), but palatability is lower than some associated shrub species, such as *Cornus stolonifera* (red-osier dogwood) or other *Salix* (willow) species.

Wildlife

Salix exigua (sandbar willow) can form stands or thickets several meters thick, with densely spaced stems that provide excellent thermal and hiding cover for many species of wildlife. *Salix exigua* (sandbar willow) 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 heavily by elk, but is of only slight importance as browse for mule deer (USDA Intermountain Fire Sciences Lab 1995).

Fisheries
The *Salix exigua* (sandbar willow) community type typically provides only limited overhanging shade due to its upright growth habit. The importance of *Salix* (willows) to streambank protection for fisheries 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.

Fire
Although the high soil and fuel moisture content characteristic of the *Salix exigua* (sandbar willow) community type minimize the chance of fire, *Salix exigua* (sandbar willow) 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 may serve as natural fire breaks (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities
Soil compaction is usually not a problem on coarse textured soils and substrates. Fine textured soils are subject to compaction when moist. 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 amount of streambank protection. Herbaceous species rarely afford sufficient stream bank protection. Management should emphasize *Salix* (willows) in protecting the streambank.

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 occur 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 best insure 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 30-50 cm long and greater than 1 cm in diameter produce best results. Shoots from cuttings can be expected to appear 10 days after planting (USDA Intermountain Fire Sciences Lab 1995).

Recreational Uses and Considerations
Recreational opportunities in *Salix exigua* (sandbar willow) stands are limited because of dense thickets and large mosquito populations. These areas are frequently flooded, making necessary additional consideration when planning roads, campsites, or any activities involving permanent or semipermanent investments.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

The *Salix exigua* (sandbar willow) community type occurs in the Dry Mixedwood Natural Subregion on sites included within the *Cornus stolonifera* (dogwood) (e) and *Equisetum* (horsetail) (f) ecosites (although lacking a tree canopy layer) on subhygric/rich and hygric/rich moisture/nutrient regimes, as described by Beckingham and Archibald (1996). This community type also occurs in the Parkland Natural Region where ecosites have not yet been described.

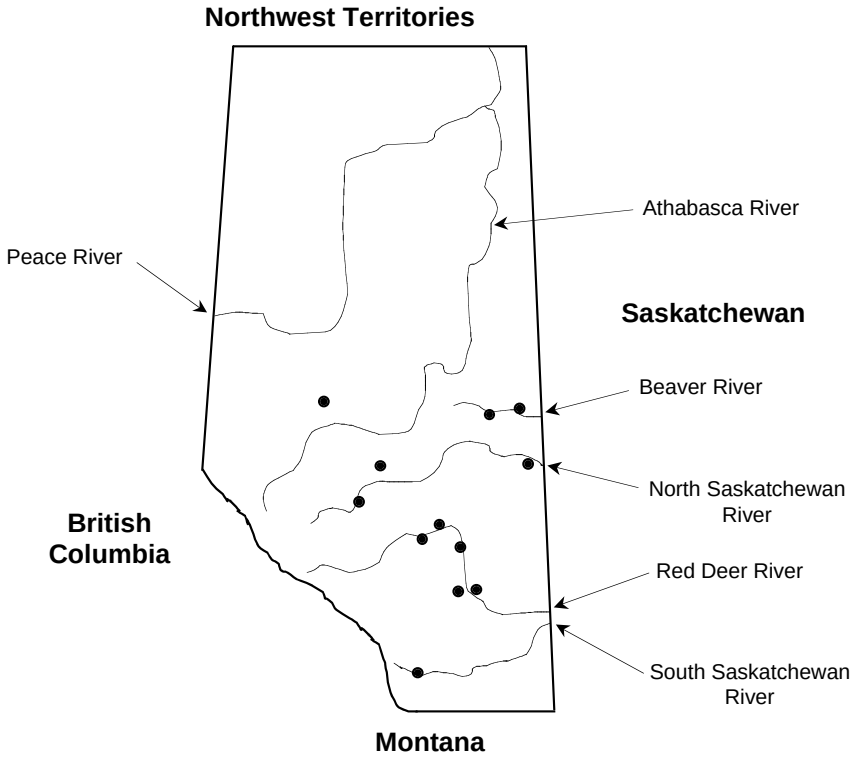
OTHER STUDIES

Thompson and Hansen (2002) describe a *Salix exigua* (sandbar willow) community type in the Grassland Natural Region of southern Alberta, and Thompson and Hansen (2001) describe a similar type for the Prairie Ecozone of southern Saskatchewan. The *Salix exigua* (sandbar willow) community type is described by Hansen and others (1995) for Montana.

Salix lutea/Cornus stolonifera Habitat Type
(Yellow Willow/Red-Osier Dogwood Habitat Type)

SALILUT/CORNSTO
Number of Stands Sampled = 20
Number of Stands Sampled in Alberta = 18

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type is a minor type in the Parkland Natural Region and an incidental type in the Dry Mixedwood Natural Subregion of Alberta on lotic (stream floodplain) sites. It is typically found in narrow, dense bands parallel to the channel on the lower floodplain terraces of major rivers. Typical stands were sampled on the Red Deer River east of Red Deer, the Vermilion River near Vermilion, the Beaver River near Cold Lake, the Waskahigan River near Little Smoky, and the Lobstick River near MacKay.

VEGETATION

The *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type is dominated by *Salix lutea* (yellow willow), a pioneer species with capability to persist on favourable sites. The tallest layer includes the *Salix lutea* (yellow willow) and *Cornus stolonifera* (red-osier dogwood) in a moist, tall shrub understory. Also prominently present may be *Alnus tenuifolia* (river alder), *Rosa* species (rose), *Symphoricarpos occidentalis* (buckbrush), and *Salix exigua* (sandbar willow) (Table 23).

Table 23. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 3 relatively undisturbed late seral to climax stands of the *Salix lutea/Cornus stolonifera* (red-osier dogwood/yellow willow) habitat type

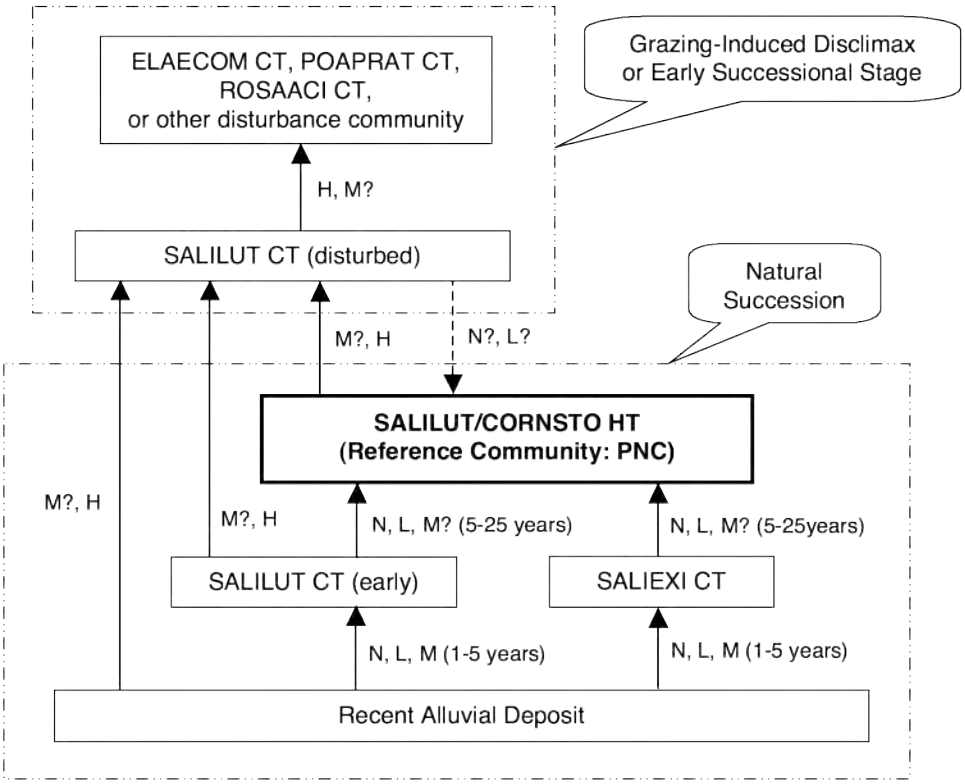
Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Alnus tenuifolia (river alder)	10	0-10	33	18
Cornus stolonifera (red-osier dogwood)	57	40-70	100	75
Prunus virginiana (choke cherry)	1	0-1	33	6
Ribes glandulosum (skunk currant)	3	0-3	33	10
Ribes hudsonianum (northern black currant)	3	0-3	33	10
Ribes oxyacanthoides (northern gooseberry)	1	0-1	33	6
Rosa spp. (rose)	1	0-1	67	8
Rubus idaeus (wild red raspberry)	3	0-3	33	10
Rubus pubescens (dewberry)	3	0-3	33	10
Salix exigua (sandbar willow)	7	0-10	67	22
Salix lutea (yellow willow)	50	30-80	100	71
Salix planifolia (flat-leaved willow)	3	0-3	33	10
Symphoricarpos occidentalis (buckbrush)	20	0-20	33	26
Graminoids				
Agropyron repens (quack grass)	1	0-1	33	6
Agropyron trachycaulum (slender wheat grass)	3	0-3	33	10
Bromus inermis (awnless brome)	3	0-3	33	10
Calamagrostis canadensis (bluejoint)	20	0-20	33	26
Carex sprengelii (Sprengel's sedge)	20	0-20	33	26
Poa palustris (fowl bluegrass)	3	0-3	33	10
Poa pratensis (Kentucky bluegrass)	2	0-3	67	12
Sphenopholis intermedia (slender wedge grass)	10	0-10	33	18
Forbs				
Actaea rubra (red and white baneberry)	1	0-1	33	6
Anemone cylindrica (long-fruited anemone)	3	0-3	33	10
Aralia nudicaulis (wild sarsaparilla)	10	0-10	33	18
Galium boreale (northern bedstraw)	20	0-20	33	26
Galium triflorum (sweet-scented bedstraw)	3	0-3	33	10
Geranium richardsonii (wild white geranium)	10	0-10	33	18
Lysimachia ciliata (fringed loosestrife)	1	0-1	33	6
Mentha arvensis (wild mint)	1	0-1	33	6
Scutellaria galericulata (marsh skullcap)	10	0-10	33	18
Smilacina stellata (star-flowered Solomon's-seal)	2	1-3	100	14
Solidago spp. (goldenrod)	3	0-3	33	10
Solidago gigantea (late goldenrod)	1	0-1	33	6
Stachys palustris (marsh hedge-nettle)	1	0-1	33	6
Stellaria crassifolia (fleshy stitchwort)	3	0-3	33	10
Taraxacum officinale (common dandelion)	1	0-1	33	6
Thalictrum venulosum (veiny meadow rue)	10	0-10	33	18
Urtica dioica (common nettle)	2	0-3	67	12
Vicia americana (wild vetch)	2	0-3	67	12
Viola canadensis (western Canada violet)	30	0-30	33	32
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0-1	33	6

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Salix lutea (yellow willow) is a pioneer species that disperses many light seeds via wind onto newly deposited alluvial sites alongside moist streambanks. It has the capability to persist indefinitely on floodplain terrace sites as long as the hydrologic conditions remain suitable. It forms dense stands that can successfully compete with other species, including trees. As with

many *Salix* (willow) species, *Salix lutea* (yellow willow) clumps regenerate by sprouting new stems from the old established root crowns. Figure 26 shows a schematic diagram of expected succession of vegetation communities on sites of this type.



Successional Pathway of *Salix lutea* (yellow willow) Sites in North Central Alberta
Reference Community = *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
ELAECOM CT—*Elaeagnus commutata* (silverberry) community type
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
ROSAACI CT—*Rosa acicularis* (prickly rose) community type
SALIEXI CT—*Salix exigua* (sandbar willow) community type
SALILUT CT—*Salix lutea* (yellow willow) community type
SALILUT/CORNSTO HT—*Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type

Figure 26. Successional pathway for sites of the *Salix lutea/Cornus stolonifera* (red-osier dogwood/yellow willow) 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 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.

With prolonged moderate to high levels of grazing pressure, the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type will lose much of its tall/moist shrub canopy, replaced with a more diverse set of shorter/drier shrub species and disturbance-increaser herbs, such as *Bromus inermis* (awnless brome), *Poa pratensis* (Kentucky bluegrass), and *Cirsium arvense* (Canada thistle) (Table 24).

Table 24. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 17 disturbed or early seral stands of the *Salix lutea/Cornus stolonifera* (red-osier dogwood/yellow willow) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Acer negundo (Manitoba maple)	3	0-3	6	4
Populus balsamifera (balsam poplar)	2	0-3	35	8
Shrubs				
Alnus tenuifolia (river alder)	7	0-30	53	19
Amelanchier alnifolia (Saskatoon)	6	0-20	24	11
Cornus stolonifera (red-osier dogwood)	17	0-30	76	36
Elaeagnus angustifolia (Russian olive)	1	0-1	6	2
Elaeagnus commutata (silverberry)	2	0-3	35	6
Lonicera dioica (twining honeysuckle)	1	0-1	12	3
Lonicera involucrata (bracted honeysuckle)	3	0-3	6	4
Ribes americanum (wild black currant)	1	0-1	6	2
Ribes glandulosum (skunk currant)	10	0-10	6	8
Ribes oxyacanthoides (northern gooseberry)	1	0-1	6	2
Rosa spp. (rose)	4	0-10	53	15
Rubus idaeus (wild red raspberry)	12	0-20	12	12
Rubus pubescens (dewberry)	3	0-3	6	4
Salix bebbiana (beaked willow)	2	0-3	12	5
Salix drummondiana (Drummond's willow)	3	0-3	6	4
Salix exigua (sandbar willow)	17	0-40	94	39
Salix lucida (shining willow)	5	0-10	29	12
Salix lutea (yellow willow)	27	10-90	100	52
Salix myrtillifolia (myrtle-leaved willow)	1	0-1	6	2
Salix petiolaris (basket willow)	1	0-1	6	2
Salix planifolia (flat-leaved willow)	3	0-3	24	7
Symphoricarpos spp. (buckbrush)	7	0-10	12	9
Symphoricarpos occidentalis (buckbrush)	2	0-3	18	6
Viburnum opulus (high-bush cranberry)	1	0-1	6	2
Graminoids				
Agropyron repens (quack grass)	4	0-10	35	10
Agrostis stolonifera (redtop)	11	0-20	24	16
Agropyron trachycaulum (slender wheat grass)	4	0-10	24	10
Beckmannia syzigachne (slough grass)	3	0-3	6	4
Bromus ciliatus (fringed brome)	1	0-1	6	2
Bromus inermis (awnless brome)	17	0-70	59	32
Calamagrostis canadensis (bluejoint)	9	0-20	41	19
Calamagrostis inexpansa (northern reed grass)	2	0-3	18	6
Carex aquatilis (water sedge)	10	0-10	12	11
Carex atherodes (awned sedge)	3	0-3	6	4
Carex aurea (golden sedge)	1	0-1	6	2
Carex bebbii (Bebb's sedge)	3	0-3	6	4
Carex deweyana (Dewey's sedge)	1	0-1	6	2
Carex lanuginosa (woolly sedge)	1	0-1	6	2
Carex retrorsa (turned sedge)	1	0-1	6	2
Carex utriculata (beaked sedge)	3	0-3	6	4
Carex utriculata (small bottle sedge)	10	0-10	6	8
Cinna latifolia (drooping wood-reed)	1	0-1	6	2
Deschampsia cespitosa (tufted hair grass)	1	0-1	6	2
Eleocharis palustris (creeping spike-rush)	10	0-10	6	8
Elymus canadensis (Canada wild rye)	1	0-1	6	2
Glyceria grandis (common tall manna grass)	4	0-10	18	8
Hordeum jubatum (foxtail barley)	1	0-1	6	2
Juncus alpinoarticulatus (alpine rush)	1	0-1	6	2
Juncus balticus (wire rush)	10	0-10	6	8

Table 24 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Koeleria macrantha (June grass)	1	0-1	6	2
Phalaris arundinacea (reed canary grass)	11	0-30	24	16
Phleum pratense (timothy)	1	0-1	6	2
Poa compressa (Canada bluegrass)	1	0-1	6	2
Poa palustris (fowl bluegrass)	7	0-20	65	21
Poa pratensis (Kentucky bluegrass)	8	0-20	59	22
Scirpus acutus (great bulrush)	1	0-1	12	3
Scirpus microcarpus (small-fruited bulrush)	4	0-10	24	10
Scirpus pungens (three-square rush)	1	0-1	6	2
Sphenopholis intermedia (slender wedge grass)	3	0-3	6	4
Forbs				
Achillea millefolium (common yarrow)	1	0-1	18	4
Achillea sibirica (many-flowered yarrow)	1	0-1	35	6
Aralia nudicaulis (wild sarsaparilla)	5	0-10	18	9
Aster borealis (marsh aster)	1	0-1	6	2
Aster conspicuus (showy aster)	3	0-3	6	4
Aster hesperius (western willow aster)	2	0-3	18	6
Aster laevis (smooth aster)	1	0-1	12	3
Aster modestus (large northern aster)	1	0-1	6	2
Aster spp. (aster)	1	0-1	6	2
Bidens cernua (nodding beggarticks)	1	0-1	6	2
Campanula rotundifolia (harebell)	1	0-1	6	2
Chrysanthemum leucanthemum (ox-eye daisy)	1	0-1	6	2
Cicuta bulbifera (bulb-bearing water-hemlock)	1	0-1	6	2
Cicuta maculata (water-hemlock)	6	0-20	24	12
Cirsium arvense (Canada thistle)	2	0-10	53	10
Cirsium spp. (thistle)	1	0-1	6	2
Epilobium angustifolium (common fireweed)	6	0-10	12	8
Erigeron acris (northern daisy fleabane)	1	0-1	6	2
Fragaria virginiana (wild strawberry)	1	0-1	18	4
Galium boreale (northern bedstraw)	1	0-1	18	4
Galium trifidum (small bedstraw)	1	0-1	6	2
Geranium richardsonii (wild white geranium)	2	0-3	24	5
Geum macrophyllum (large-leaved yellow avens)	1	0-1	6	2
Glycyrrhiza lepidota (wild licorice)	2	0-3	12	5
Helianthus nuttallii (common tall sunflower)	1	0-1	6	2
Heracleum lanatum (cow parsnip)	1	0-1	18	4
Hippuris vulgaris (common mare's-tail)	3	0-3	6	4
Lathyrus ochroleucus (cream-colored vetchling)	1	0-1	6	2
Lycopus asper (western water-horehound)	10	0-10	6	8
Lysimachia ciliata (fringed loosestrife)	6	0-10	12	8
Maianthemum canadense (wild lily-of-the-valle)	1	0-1	6	2
Melilotus officinalis (yellow sweet-clover)	1	0-1	6	2
Mentha arvensis (wild mint)	3	0-3	6	4
Mertensia paniculata (tall lungwort)	3	0-3	6	4
Mitella nuda (bishop's-cap)	1	0-1	6	2
Monarda fistulosa (wild bergamot)	1	0-1	6	2
Petasites palmatus (palmate-leaved coltsfoot)	3	0-3	6	4
Plantago major (common plantain)	1	0-1	12	3
Polygonum coccineum (water smartweed)	1	0-1	6	2
Potentilla anserina (silverweed)	3	0-3	18	7
Smilacina stellata (star-flowered Solomon's-seal)	4	0-10	24	10
Solidago canadensis (Canada goldenrod)	4	0-10	53	15
Solidago spp. (goldenrod)	2	0-3	12	5
Solidago gigantea (late goldenrod)	3	0-3	12	6

Table 24 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Sonchus arvensis (perennial sow-thistle)	1	0-1	6	2
Sonchus spp. (sow-thistle)	7	0-10	12	9
Sparganium eurycarpum (giant bur-reed)	10	0-10	6	8
Stachys palustris (marsh hedge-nettle)	1	0-1	24	5
Tanacetum vulgare (common tansy)	10	0-10	6	8
Taraxacum officinale (common dandelion)	1	0-1	24	5
Thalictrum venulosum (veiny meadow rue)	3	0-10	29	9
Trifolium hybridum (alsike clover)	1	0-1	6	2
Trifolium spp. (clover)	1	0-1	18	4
Trifolium repens (white clover)	3	0-3	6	4
Urtica dioica (common nettle)	1	0-1	12	3
Vicia americana (wild vetch)	5	0-20	59	17
Vicia cracca (tufted vetch)	3	0-3	6	4
Ferns and Allies				
Equisetum arvense (common horsetail)	4	0-20	41	13
Equisetum fluviatile (swamp horsetail)	10	0-10	6	8
Equisetum variegatum (variegated horsetail)	10	0-10	6	8

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

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 *Salix lutea/Cornus stolonifera* (red-osier dogwood/yellow willow) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

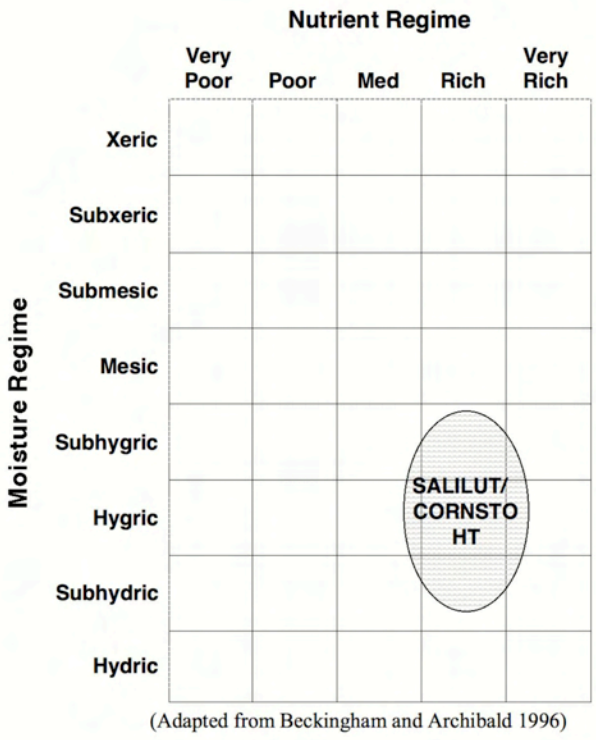


Figure 27. Edatope grid position for the *Salix lutea/Cornus stolonifera* (red-osier dogwood/yellow willow) habitat type (SALILUT/CORNSTO HT)

SOILS

Young, early seral stands of *Salix lutea* (yellow willow) usually initiate on medium to coarse textured alluvial deposits. As the stands age, so do the alluvial sites, becoming floodplain terraces progressively elevated from the stream channel by also progressively finer textured overbank flood deposits. Mature stands of the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type typically have textures from clay to fine sand and water tables within 1 m of the soil surface throughout the growing season. Mineral soil textures on sampled stands ranged from sand and gravel to clay. Redoximorphic features (mottles or gleyed soil) are common within 1 m of the soil surface, and thin surface accumulations of organic material are not uncommon under mature stands.

ADJACENT COMMUNITIES

Adjacent wetter sites may support such communities as the *Salix exigua* (sandbar willow) community type, *Carex* (sedge) species, the *Phalaris arundinacea* (reed canary grass) habitat type, or open water. Drier sites may include the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, the *Rosa acicularis* (prickly rose) community type, the *Elaeagnus commutata* (silverberry) community type, or an upland type.

MANAGEMENT INFORMATION

Livestock

Salix lutea (yellow willow) is rated as good forage value by Tannas (1997). Stands of the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type provide moderate to high forage production, depending on the density of the shrubs. Palatability of the various species associated with this type is often high. Livestock will browse the young *Salix* (willow) shoots; and, combined with trampling and soil compaction, they can shift the age structure toward the older stems and alter the vegetation composition of the stand.

Cornus stolonifera (red-osier dogwood) is considered an ice cream plant by livestock and wildlife (Lawrence 2002, Hansen and others 1995), and the species is rated as good forage value (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991). Its abundance, and growth form is a direct indication of past and current use levels. Overuse by livestock will reduce vigour of the willows, as indicated by highlined or clubbed growth forms and dead clumps. With continued overuse, *Salix* (willows) will decline in vigour and be eventually eliminated from the site.

Frisina (1991) states that 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.

Wildlife

The *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type provides important hiding and nesting sites for songbirds and waterfowl, as well as browse, cover, and thermal protection for many species of wildlife. Beaver heavily utilize *Salix lutea* (yellow willow), and moose and elk browse the species during both summer and winter.

Fisheries

The importance of *Salix* (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. *Salix lutea* (yellow willow), being closely associated with fluvial systems and streambank locations, is particularly important in this regard.

Fire

Salix lutea (yellow willow) generally has the ability to sprout from its roots or stem base following fire, although the high soil and fuel moisture content characteristic of this habitat reduces the chance of fire ignition and spread. Severe fires can completely remove organic soil layers leaving *Salix* (willow) roots exposed and charred, and thus eliminating basal sprouting. However, most fires kill only aboveground plant parts. Off-site plants are important in revegetating burned areas through the dispersal of numerous wind and water transported seeds (USDA Intermountain Fire Sciences Lab 1995).

Quick hot fires may be used to rejuvenate decadent willows, thus producing abundant browse for big game animals, however it may take five or more years for *Salix* (willows) to regain stem height and diameters resistant to browsing (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities

The *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type receives high use by wildlife and cattle. Streambank soils are susceptible to trampling damage, especially when fine textured or wet. Deferring grazing until sites are drier can reduce trampling and compaction problems (Marlow 1984).

Salix lutea (yellow willow) is valuable for revegetating streambanks. Cuttings are best taken in the spring from dormant two to four year old wood. Cuttings 30-50 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 10-20 days after planting. However, use of rooted cuttings and nursery grown stock will produce better results.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type in the Dry Mixedwood Natural Subregion are included within the *Cornus stolonifera* (dogwood) (e) and *Equisetum* (horsetail) (f) ecosites (although lacking a tree canopy layer), and rich fen (k) ecosite on subhygric/rich, hygric/rich, and subhydric/rich moisture/nutrient regimes, as described by Beckingham and Archibald (1996). This habitat type also occurs in the Parkland Natural Region where ecosites have not yet been described.

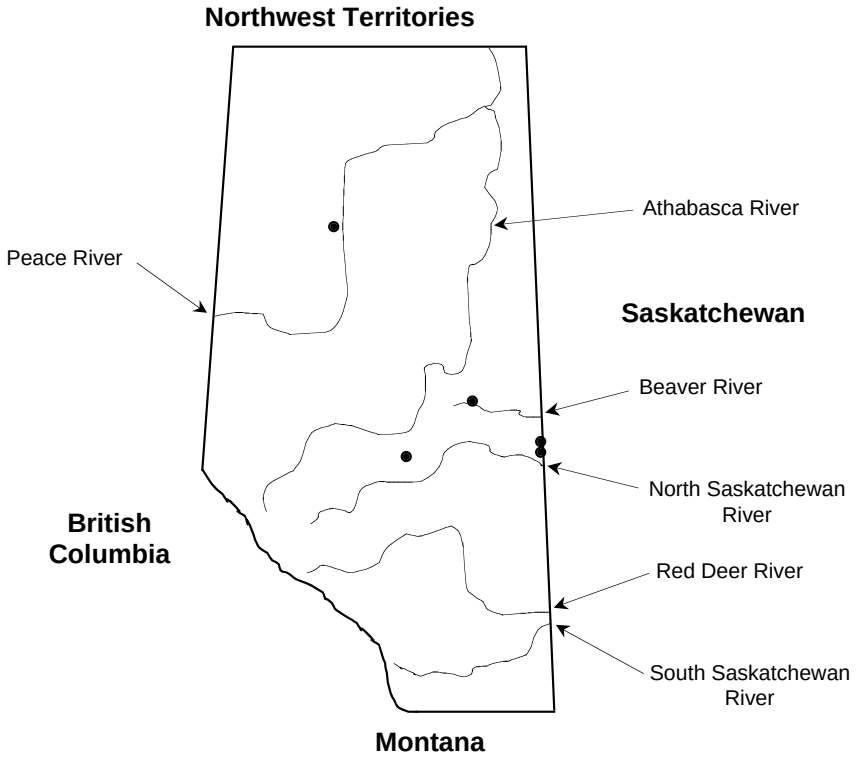
OTHER STUDIES

Thompson and Hansen (2002) described a *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type in the Grassland Natural Region of southern Alberta, and Thompson and Hansen (2001) describe a similar type for the Prairie Ecozone of southern Saskatchewan. Hansen and others (1995) describe a *Salix lutea/Carex rostrata* (yellow willow/beaked sedge) habitat type and a *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint) habitat type for similar landscape locations in eastern and central Montana.

Salix pedicellaris/Potentilla palustris Habitat Type
(Bog Willow/Marsh Cinquefoil Habitat Type)

SALIPED/POTEPAL
Number of Stands Sampled = 6
Number of Stands Sampled in Alberta = 6

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type is an incidental type in the Dry Mixedwood Natural Subregion. These sites are shrubby rich fen wetlands on geomorphically maturing glacial depressions that no longer have open water. The substrate is organic—a floating mat of plant material capable of supporting low shrubs, but not substantial enough to support trees or tall shrubs. This type is more common on the northern and eastern edges of the study area. Stands were sampled near Tulliby Lake, Caslan, Gunn, and High Level. This type is not expected to occur in the Parkland Natural Region. Little is presently known about the later seral progression of vegetation on this type.

VEGETATION

This type is characterized by the low growing *Salix pedicellaris* (bog willow), often on floating mats of rich fen vegetation. There is close affiliation in these *Salix pedicellaris* (bog willow) stands with *Carex diandra* (two-stamened sedge) and *Potentilla palustris* (marsh cinquefoil), although *Carex aquatilis* (water sedge) and *Calamagrostis* species (reed grass) are also quite prominent (Table 25).

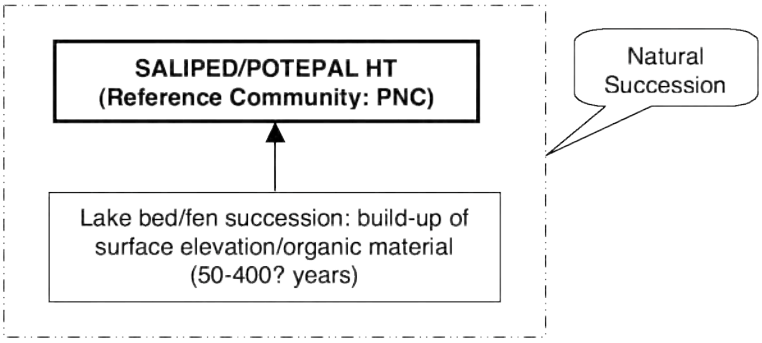
Table 25. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	2	0-3	67	8
Populus tremuloides (aspen)	1	0-1	17	4
Shrubs				
Andromeda polifolia (bog rosemary)	3	0-3	17	7
Betula glandulosa (bog birch)	3	0-3	33	10
Salix discolor (pussy willow)	3	0-3	33	10
Salix pedicellaris (bog willow)	40	10-60	100	63
Salix planifolia (flat-leaved willow)	1	0-1	17	4
Salix pseudomonticola (false mountain willow)	1	0-1	17	4
Graminoids				
Agrostis scabra (rough hair grass)	2	0-3	50	10
Calamagrostis canadensis (bluejoint)	70	0-70	17	34
Calamagrostis inexpansa (northern reed grass)	3	0-3	17	7
Calamagrostis stricta (narrow reed grass)	27	0-50	33	30
Carex aquatilis (water sedge)	25	0-70	50	35
Carex chordorrhiza (prostrate sedge)	10	0-10	17	13
Carex curta (short sedge)	1	0-1	17	4
Carex diandra (two-stamened sedge)	26	0-60	83	47
Carex lasiocarpa (hairy-fruited sedge)	20	0-20	17	18
Carex limosa (mud sedge)	11	0-20	33	18
Carex utriculata (beaked sedge)	10	0-10	17	13
Eriophorum gracile (slender cotton grass)	1	0-1	17	4
Forbs				
Aster borealis (marsh aster)	1	0-1	33	6
Caltha palustris (marsh-marigold)	3	0-3	17	7
Epilobium leptophyllum (narrow-leaved willowherb)	3	0-3	17	7
Galium trifidum (small bedstraw)	3	0-3	17	7
Mentha arvensis (wild mint)	1	0-1	17	4
Menyanthes trifoliata (buck-bean)	7	0-10	33	15
Petasites sagittatus (arrow-leaved coltsfoot)	10	0-10	17	13
Potentilla palustris (marsh cinquefoil)	11	3-20	100	33
Rumex occidentalis (western dock)	1	0-1	17	4
Scutellaria galericulata (marsh skullcap)	2	0-3	33	8
Triglochin maritima (seaside arrow-grass)	1	0-1	33	6
Ferns and Allies				
Equisetum fluviatile (swamp horsetail)	1	0-1	17	4

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type is a specialized community that grows on quite definite site conditions at the point along the scale of hydrarch succession where a floating mat of plant material (mostly roots and stems of decomposing *Carex* [sedges] and grasses) can now support low shrubs, but is not substantial enough for trees or taller shrubs. Figure 28 shows a schematic diagram of expected successional pathways for vegetation communities on sites of this type.



Successional Pathway of *Salix pedicellaris* (bog willow) Sites in North Central Alberta
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

SALIPED/POTEPAL HT—*Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type

Figure 28. 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 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.

Disturbance is generally none to light on these sites, compared to many of the other *Salix* (willow) types. These sites are seldom dry enough to support fire, to be accessible to livestock, or to offer much resource desired by humans.

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 *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

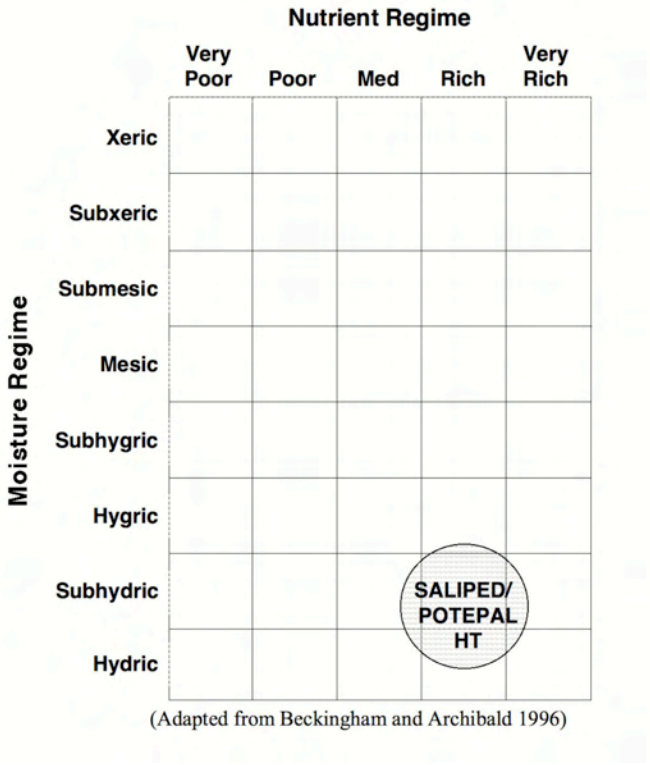


Figure 29. Edatope grid position for the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type (SALIPED/POTEPAL HT)

SOILS

Soils are saturated, organic and peaty, typically on a floating mat with no mineral substrate present, and water table at or very near the surface.

ADJACENT COMMUNITIES

Adjacent wetter sites may support the *Typha latifolia* (common cattail) habitat type, but the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type is usually the wettest type on the site. Adjacent drier sites may support such types as the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, 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 *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type.

MANAGEMENT INFORMATION

Livestock

Stands of this type have no potential for livestock utilization.

Wildlife

Wildlife values associated with the *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type are not well understood. It is likely that moose utilize this forage during certain seasons. Songbirds would likely also find nesting and feeding habitat among the shrubs and seed bearing graminoids present.

Fire

This type is usually too moist to support wildfire.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

The *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type occurs on sites of the shrubby phase of the rich fen ecosite (k2), a subhydric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996) for the Dry Mixedwood Natural Subregion.

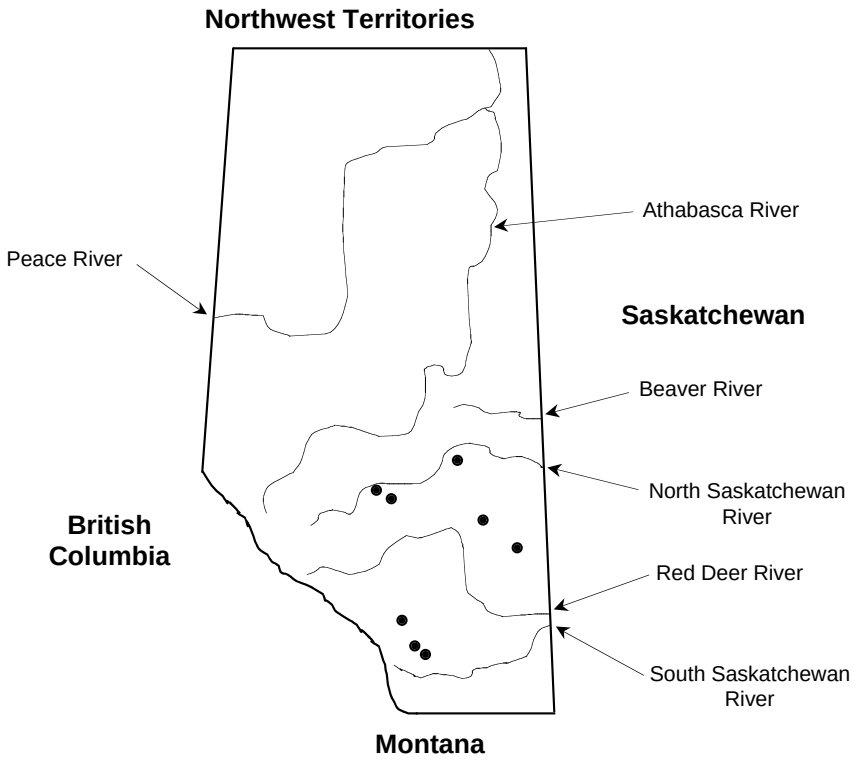
OTHER STUDIES

The *Salix pedicellaris/Potentilla palustris* (bog willow/marsh cinquefoil) habitat type has not previously been described in this region.

Salix petiolaris/Carex atherodes Habitat Type
(Basket Willow/Awned Sedge Habitat Type)

SALIPET/CAREATH
Number of Stands Sampled = 16
Number of Stands Sampled in Alberta = 9

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type is a minor type in the Parkland Natural Region and an incidental type in the lower Dry Mixedwood Natural Subregion, typically occurring in proximity to *Populus tremuloides* (aspen) groves around sloughs, depressional wetlands, wet meadows, and occasionally along streamsides. Typical stands were sampled near Alliance, Drayton Valley, Breton, and near Elk Island National Park.

VEGETATION

Undisturbed stands of this type are dominated by a dense, closed canopy of *Salix petiolaris* (basket willow) over a sparse understory that includes *Carex atherodes* (awned sedge) (Table 26). Stands may include small amounts of other species, including some shrubs, but undisturbed stands are heavily dominated by *Salix petiolaris* (basket willow) with little else beneath. Even the diagnostic sedge is more abundant closer to stand perimeters, and extensive stands may have interiors of almost monospecific *Salix petiolaris* (basket willow) with only leaf litter covering the soil surface.

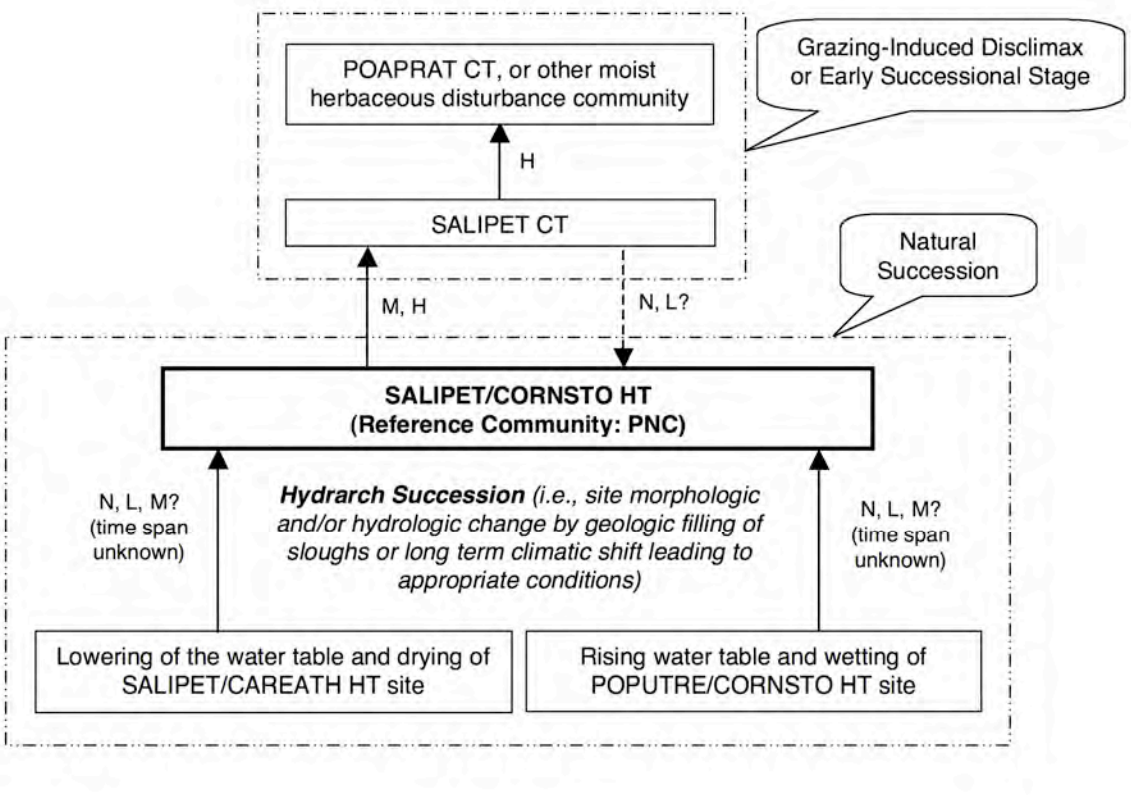
Table 26. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 relatively undisturbed late seral to climax stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Shrubs				
Cornus stolonifera (red-osier dogwood)	11	0-20	33	18
Rosa spp. (rose)	1	0-1	17	4
Salix bebbiana (beaked willow)	3	0-3	33	10
Salix petiolaris (basket willow)	95	90-98	100	97
Graminoids				
Bromus inermis (awnless brome)	3	0-3	17	7
Carex atherodes (awned sedge)	25	3-60	100	50
Carex petasata (pasture sedge)	3	0-3	17	7
Carex utriculata (beaked sedge)	1	0-1	17	4
Carex sychnocephala (long-beaked sedge)	3	0-3	17	7
Phalaris arundinacea (reed canary grass)	1	0-1	17	4
Poa palustris (fowl bluegrass)	2	0-3	33	8
Forbs				
Arnica chamissonis (leafy arnica)	3	0-3	17	7
Aster hesperius (western willow aster)	1	0-1	17	4
Cirsium arvense (Canada thistle)	1	0-1	17	4
Fragaria virginiana (wild strawberry)	1	0-1	17	4
Geum macrophyllum (large-leaved yellow avens)	1	0-1	17	4
Mentha arvensis (wild mint)	2	0-3	33	8
Rumex occidentalis (western dock)	1	0-1	17	4
Sonchus spp. (sow-thistle)	3	0-3	17	7

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

A late seral stand of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type has a very dense community of slender, fast growing, and short-lived *Salix* (willow) stems of all ages. Undisturbed older stands of *Salix petiolaris* (basket willow) have about equal components of dead and young replacement stems. Figure 30 shows a schematic diagram of the expected successional pathway for vegetation communities on sites of this type.



Successional Pathway of Very Moist *Salix petiolaris* (basket willow) Sites in North Central Alberta
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 HT—*Carex aquatilis* (water sedge) habitat type
CAREATH HT—*Carex atherodes* (awned sedge) habitat type
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
POPUTRE/CORNSTO HT—*Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type
SALIPET CT—*Salix petiolaris* (basket willow) 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 30. 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 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.

Livestock and wild ungulates readily browse these stands around the perimeter, but have difficulty penetrating their interior. Therefore, disturbance is often limited to the outside edge of the stand. This peripheral disturbance has the effect of opening up the edge to encroachment by disturbance-related species such as *Poa* species (bluegrass), *Cirsium arvense* (Canada thistle), *Geum macrophyllum* (large-leaved yellow avens), and *Sonchus arvensis* (perennial sow-thistle) (Table 27). Ultimately, continued severe browsing pressure can open the entire stand and replace the sedge with disturbance-related, drier, herbaceous species. When this happens, the community has been changed to the grazing induced *Salix petiolaris* (basket willow) community type.

Table 27. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 10 disturbed or early seral stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Betula glandulosa (bog birch)	2	0-3	20	6
Cornus stolonifera (red-osier dogwood)	11	0-20	30	18
Ribes oxyacanthoides (northern gooseberry)	2	0-3	30	5
Ribes spp. (currant)	1	0-1	10	3
Rosa spp. (rose)	4	0-10	30	11
Rubus arcticus (dwarf raspberry)	3	0-3	10	5
Rubus idaeus (wild red raspberry)	1	0-1	10	3
Rubus pubescens (dewberry)	1	0-1	10	3
Salix bebbiana (beaked willow)	3	0-3	10	5
Salix lutea (yellow willow)	1	0-1	10	3
Salix petiolaris (basket willow)	76	50-98	100	87
Salix planifolia (flat-leaved willow)	5	0-10	40	14
Symphoricarpos spp. (buckbrush)	3	0-3	10	5
Graminoids				
Agrostis scabra (rough hair grass)	3	0-3	10	5
Agropyron smithii (western wheat grass)	1	0-1	10	3
Agrostis stolonifera (redtop)	5	0-10	30	12
Alopecurus occidentalis (alpine foxtail)	10	0-10	20	14
Bromus inermis (awnless brome)	7	0-20	30	14
Calamagrostis canadensis (bluejoint)	10	0-10	10	10
Carex aquatilis (water sedge)	10	0-10	10	10
Carex atherodes (awned sedge)	28	0-70	80	47
Carex prairea (prairie sedge)	20	0-20	10	14
Carex utriculata (beaked sedge)	4	0-10	50	14
Festuca rubra (red fescue)	3	0-3	10	5
Festuca saximontana (Rocky Mountain fescue)	3	0-3	10	5
Poa palustris (fowl bluegrass)	7	0-20	50	19
Poa pratensis (Kentucky bluegrass)	20	0-20	10	14
Scirpus microcarpus (small-fruited bulrush)	1	0-1	10	3
Scirpus paludosus (prairie bulrush)	1	0-1	10	3
Scolochloa festucacea (spangletop)	3	0-3	10	5
Forbs				
Achillea millefolium (common yarrow)	1	0-1	20	4
Anemone cylindrica (long-fruited anemone)	20	0-20	10	14
Artemisia biennis (biennial sagewort)	1	0-1	10	3
Aster conspicuus (showy aster)	1	0-1	10	3
Aster laevis (smooth aster)	1	0-1	10	3
Aster modestus (large northern aster)	1	0-1	10	3
Aster spp. (aster)	10	0-10	10	10
Caltha palustris (marsh-marigold)	10	0-10	10	10
Cicuta maculata (water-hemlock)	10	0-10	10	10
Cirsium arvense (Canada thistle)	2	0-3	50	10
Cynoglossum officinale (hound's-tongue)	3	0-3	10	5
Epilobium angustifolium (common fireweed)	1	0-1	10	3
Epilobium ciliatum (northern willowherb)	1	0-1	10	3
Fragaria virginiana (wild strawberry)	1	0-1	10	3
Galium boreale (northern bedstraw)	2	0-3	20	6
Galium trifidum (small bedstraw)	1	0-1	10	3
Gentiana affinis (prairie gentian)	1	0-1	10	3
Geranium richardsonii (wild white geranium)	1	0-1	20	4
Geum aleppicum (yellow avens)	1	0-1	20	4
Geum macrophyllum (large-leaved yellow avens)	5	0-10	30	12
Heracleum lanatum (cow parsnip)	1	0-1	10	3

Table 27 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Lathyrus palustris (marsh vetchling)	1	0-1	10	3
Medicago lupulina (black medick)	1	0-1	10	3
Mentha arvensis (wild mint)	2	0-3	40	9
Mertensia paniculata (tall lungwort)	1	0-1	20	4
Polygonum amphibium (water smartweed)	2	0-3	30	5
Polygonum coccineum (water smartweed)	1	0-1	10	3
Polygonum lapathifolium (pale persicaria)	1	0-1	10	3
Potentilla anserina (silverweed)	5	0-10	30	12
Potentilla gracilis (graceful cinquefoil)	1	0-1	10	3
Potentilla norvegica (rough cinquefoil)	1	0-1	20	4
Rumex occidentalis (western dock)	3	0-3	10	5
Scutellaria galericulata (marsh skullcap)	1	0-1	20	4
Senecio conterminus (Arctic butterweed)	3	0-3	10	5
Sium suave (water parsnip)	1	0-1	10	3
Sonchus arvensis (perennial sow-thistle)	12	0-40	50	24
Sparganium eurycarpum (giant bur-reed)	1	0-1	10	3
Stachys palustris (marsh hedge-nettle)	1	0-1	10	3
Stellaria calycantha (northern stitchwort)	1	0-1	10	3
Stellaria longipes (long-stalked chickweed)	3	0-3	10	5
Taraxacum officinale (common dandelion)	2	0-3	30	5
Thalictrum venulosum (veiny meadow rue)	1	0-1	30	5
Typha latifolia (common cattail)	1	0-1	10	3
Valeriana dioica (northern valerian)	1	0-1	10	3
Vicia americana (wild vetch)	1	0-1	30	5
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0-1	10	3

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

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 *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

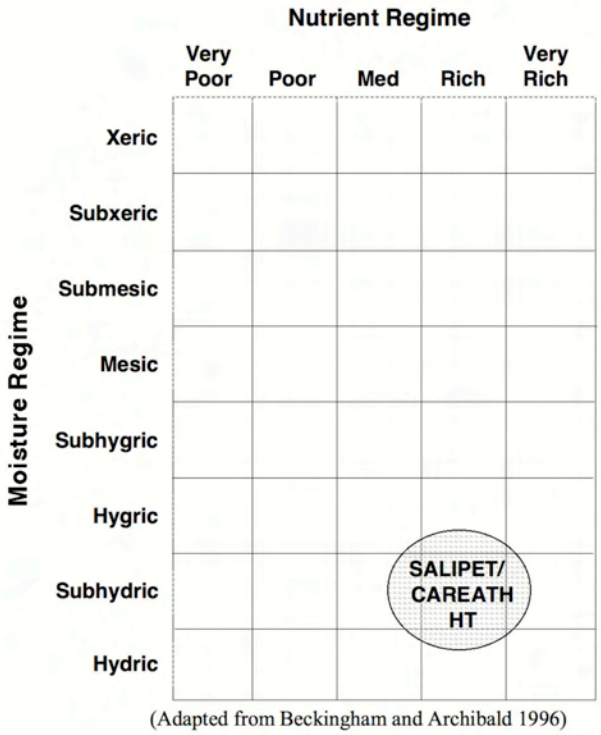


Figure 31. Edatope grid position for the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type (SALIPET/CAREATH HT)

SOILS

Mineral soil textures typically vary from sandy loam to clay, and on sampled stands ranged from sandy loam to sandy clay. Water tables are usually within 1 m of the soil surface through much of the growing season and redoximorphic features (mottles or gleyed soil) are common within 1 m of the soil surface on sites of this type.

ADJACENT COMMUNITIES

Adjacent wetter sites may include the *Carex atherodes* (awned sedge) habitat type or open water. Adjacent drier sites may include the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type, the *Salix petiolaris* (basket willow) community type, tame pasture, or developed agricultural land.

MANAGEMENT INFORMATION

Livestock

The *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type does not provide substantial herbaceous forage value for livestock due to the dense, closed nature of the stands. Livestock will browse the willows, but prolonged use will ultimately damage the community by reducing the *Salix* (willow) cover and altering the understory composition by introducing disturbance-related herbaceous invader species.

Wildlife

These dense *Salix* (willow) communities, 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, within a landscape often already greatly altered by agricultural development.

Fisheries

The *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type does not occur often in landscape positions that have much bearing on fisheries. When any *Salix* (willow) species occupies a streambank position, it should be protected and promoted. The importance of all *Salix* (willows) for streambank stabilization, cover, and thermal protection for fisheries cannot be over emphasized.

Fire
At this time, we know little about the response of *Salix petiolaris* (basket willow) to being burned, but suspect that, like most *Salix* (willow) species, it readily sprouts from the root crown after all but the most intense fire.

Soil Management and Rehabilitation Opportunities
Salix petiolaris (basket willow) is readily propagated through cuttings (Plants for a Future 2000), therefore is adaptable to rehabilitating suitable degraded sites where woody plants have been removed, but the water table remains high.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type in the Dry Mixedwood Natural Subregion occur within the *Cornus stolonifera* (dogwood) (e), *Equisetum* (horsetail) (f), and rich fen (k) ecosites on subhygric/rich, hygric/rich, and subhydric/rich moisture/nutrient regimes, as described by Beckingham and Archibald (1996). This habitat type also occurs in the Parkland Natural Region where ecosites have not yet been described.

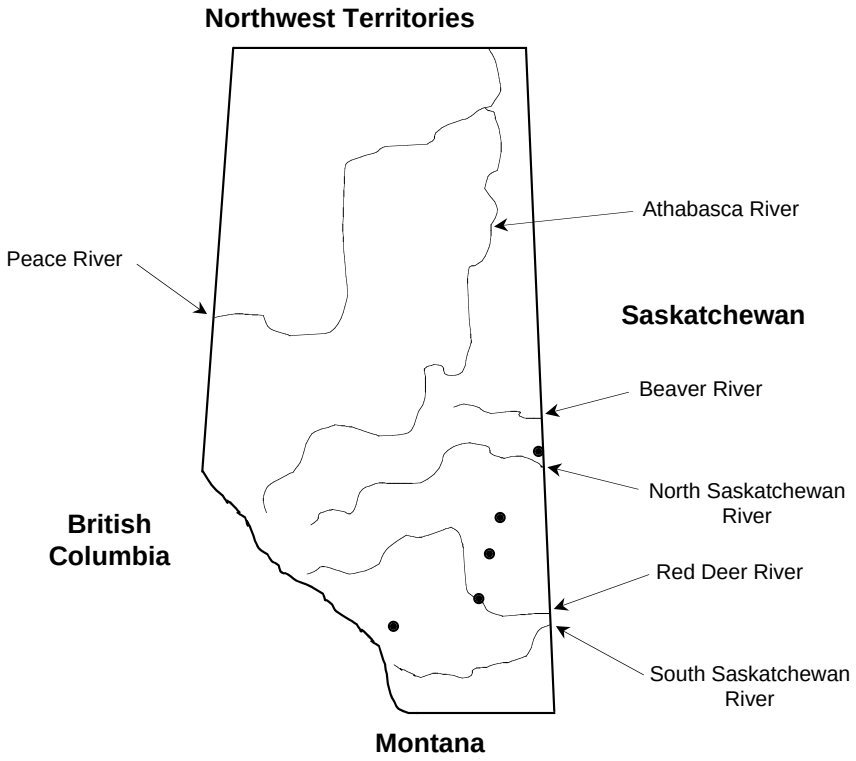
OTHER STUDIES

Thompson and Hansen (2002) described a *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type in the Grassland Natural Region of southern Alberta, and Thompson and Hansen (2001) describe a similar type for the Prairie Ecozone of southern Saskatchewan. Willoughby (2000) and Lane and others (2000) describe *Salix/Carex* (willow/sedge) community types for the Lower Foothills and the Mixedwood Subregions.

Salix petiolaris/Cornus stolonifera Habitat Type (Basket Willow/Red-Osier Dogwood Habitat Type)

SALIPET/CORNSTO
Number of Stands Sampled = 9
Number of Stands Sampled in Alberta = 4

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type is a minor type in the Parkland Natural Region. It was not observed, but may occur in the Dry Mixedwood Natural Subregion. The type is typically found on sites slightly up slope from the wetter *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type in proximity to *Populus tremuloides* (aspen) groves around sloughs, depressional wetlands, wet meadows, and occasionally along streamsides. Before European settlement this type occupied much more area in the Parkland, but due to its valuable soils, was cleared, and converted to agricultural production. Within the study area, stands were sampled near Galahad and Tulliby Lake.

VEGETATION

In undisturbed condition, this type is dominated by a dense, closed canopy of *Salix petiolaris* (basket willow) with other *Salix* (willow) species and *Cornus stolonifera* (red-osier dogwood). The understory is usually sparse. It may include a few short shrubs like *Ribes oxyacanthoides* (northern gooseberry) and *Symphoricarpos* species (buckbrush) (Table 28). The herbaceous layer is typically quite sparse.

Table 28. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 3 relatively undisturbed late seral to climax stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Amelanchier alnifolia (Saskatoon)	3	0-3	33	10
Clematis occidentalis (purple clematis)	3	0-3	33	10
Cornus stolonifera (red-osier dogwood)	45	0-50	67	55
Ribes oxyacanthoides (northern gooseberry)	2	0-3	67	12
Rosa spp. (rose)	10	0-10	33	18
Salix bebbiana (beaked willow)	3	0-3	33	10
Salix lutea (yellow willow)	3	0-3	33	10
Salix petiolaris (basket willow)	87	80-90	100	93
Symphoricarpos spp. (buckbrush)	12	0-20	67	28
Graminoids				
Agrostis stolonifera (redtop)	10	0-10	33	18
Bromus inermis (awnless brome)	7	0-10	67	22
Carex atherodes (awned sedge)	1	0-1	33	6
Forbs				
Epilobium angustifolium (common fireweed)	1	0-1	33	6
Epilobium ciliatum (northern willowherb)	1	0-1	33	6
Galium triflorum (sweet-scented bedstraw)	1	0-1	33	6
Mentha arvensis (wild mint)	1	0-1	33	6
Solidago canadensis (Canada goldenrod)	3	0-3	33	10
Sonchus spp. (sow-thistle)	1	0-1	33	6
Thalictrum venulosum (veiny meadow rue)	3	0-3	33	10
Thermopsis rhombifolia (golden bean)	1	0-1	33	6
Urtica dioica (common nettle)	1	0-1	33	6
Vicia americana (wild vetch)	1	0-1	33	6
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0-1	33	6

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type is a very densely growing community of slender, fast growing, and short-lived *Salix* (willow) stems of all ages. Undisturbed older stands of *Salix petiolaris* (basket willow) have about equal components of dead stems and young replacement stems. Unlike *Salix* species (willow) that pioneer on new fluvial deposits (lotic sites), *Salix petiolaris* (basket willow) is found mostly on lentic sites that do not normally provide the moist, exposed sites for *Salix* (willow) establishment from seed. Initial establishment of stands of this type is not well understood.

Livestock and wild ungulates readily browse the peripheries of these stands, but have difficulty penetrating them. Therefore, disturbance by these agents is generally limited to the outside edge. This peripheral disturbance has the effect of opening up the edge to encroachment by disturbance-related species such as *Bromus inermis* (awnless brome), *Poa* species (bluegrass), *Cirsium arvense* (Canada thistle), *Sonchus* species (sow-thistle), and *Solidago canadensis* (Canada goldenrod) (Table 29). Ultimately, continued severe browsing pressure will open the stand and replace the *Cornus stolonifera* (red-osier dogwood) with *Rosa* species (rose), *Symphoricarpos* species (buckbrush), and the disturbance-induced, drier, herbs. When this happens, the site has changed to the grazing induced *Salix petiolaris* (basket willow) community type. Figure 32 shows a schematic diagram of expected successional pathways for vegetation communities on sites of this type.

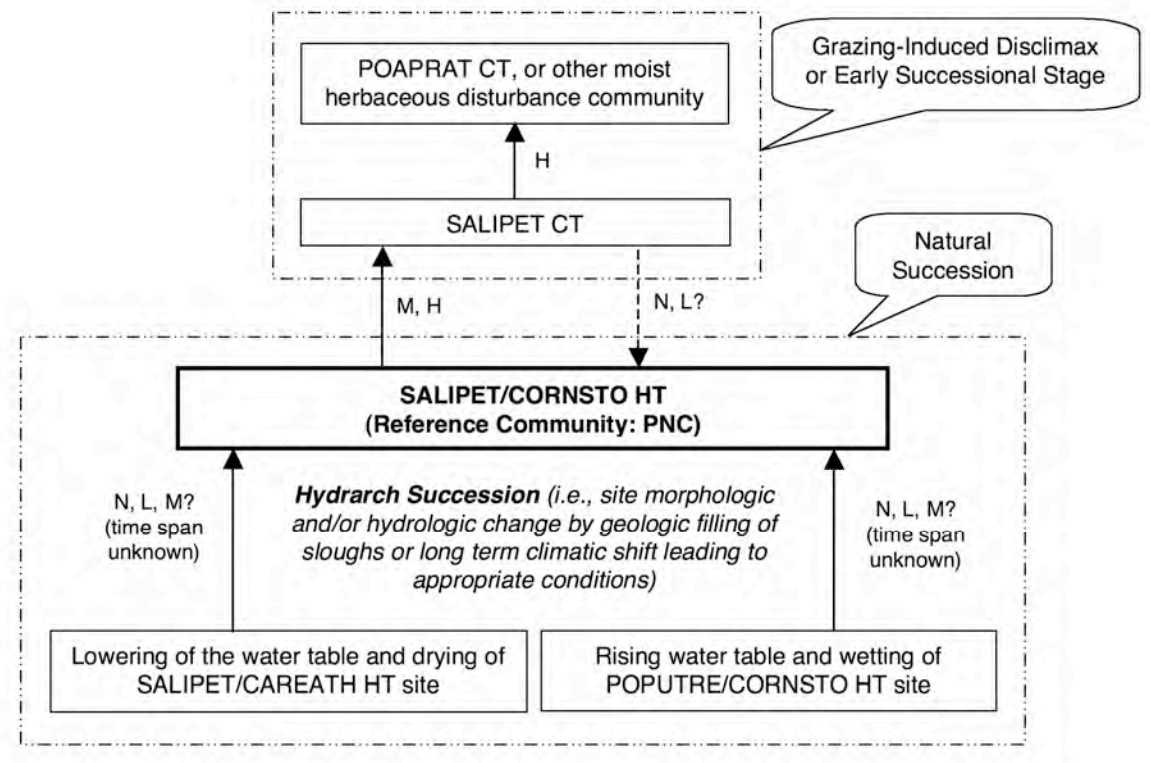
Table 29. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 disturbed or early seral stands of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	1	0-1	17	4
Picea glauca (white spruce)	1	0-1	17	4
Populus balsamifera (balsam poplar)	1	0-1	17	4
Shrubs				
Betula occidentalis (water birch)	1	0-1	17	4
Cornus stolonifera (red-osier dogwood)	17	0-30	33	24
Elaeagnus commutata (silverberry)	3	0-3	17	7
Prunus virginiana (choke cherry)	1	0-1	17	4
Ribes oxyacanthoides (northern gooseberry)	3	0-3	17	7
Rosa spp. (rose)	21	0-70	67	37
Rubus idaeus (wild red raspberry)	16	0-30	33	22
Salix bebbiana (beaked willow)	3	0-3	33	10
Salix exigua (sandbar willow)	35	0-60	33	34
Salix petiolaris (basket willow)	66	20-98	100	81
Salix planifolia (flat-leaved willow)	2	0-3	33	8
Symphoricarpos spp. (buckbrush)	11	0-30	50	22
Graminoids				
Agropyron smithii (western wheat grass)	1	0-1	17	4
Agrostis stolonifera (redtop)	10	0-10	17	13
Agropyron trachycaulum (slender wheat grass)	10	0-10	17	13
Bromus inermis (awnless brome)	40	0-90	83	58
Calamagrostis canadensis (bluejoint)	10	0-10	17	13
Carex bebbii (Bebb's sedge)	1	0-1	17	4
Carex praegracilis (graceful sedge)	1	0-1	17	4
Carex sprengelii (Sprengel's sedge)	1	0-1	17	4
Glyceria striata (fowl manna grass)	1	0-1	17	4
Hordeum jubatum (foxtail barley)	1	0-1	17	4
Phleum pratense (timothy)	10	0-10	17	13
Poa palustris (fowl bluegrass)	15	0-20	33	22
Poa pratensis (Kentucky bluegrass)	25	0-30	33	29
Forbs				
Achillea millefolium (common yarrow)	3	0-3	17	7
Anthemis cotula (mayweed)	3	0-3	17	7
Apocynum cannabinum (Indian hemp)	1	0-1	17	4
Aster ciliolatus (Lindley's aster)	3	0-3	17	7
Cirsium arvense (Canada thistle)	2	0-3	50	10
Delphinium glaucum (tall larkspur)	1	0-1	17	4
Epilobium angustifolium (common fireweed)	3	0-3	17	7
Fragaria virginiana (wild strawberry)	3	0-3	17	7
Galium boreale (northern bedstraw)	1	0-1	17	4
Geum aleppicum (yellow avens)	3	0-3	33	10
Glycyrrhiza lepidota (wild licorice)	12	0-20	33	20
Heracleum lanatum (cow parsnip)	3	0-3	17	7
Hieracium umbellatum (narrow-leaved hawkweed)	3	0-3	17	7

Table 29 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Melilotus alba (white sweet-clover)	3	0-3	17	7
Polygonum coccineum (water smartweed)	10	0-10	17	13
Polygonum lapathifolium (pale persicaria)	3	0-3	17	7
Potentilla gracilis (graceful cinquefoil)	3	0-3	17	7
Potentilla norvegica (rough cinquefoil)	1	0-1	17	4
Potentilla palustris (marsh cinquefoil)	1	0-1	17	4
Rumex occidentalis (western dock)	2	0-3	33	8
Smilacina stellata (star-flowered Solomon's-seal)	1	0-1	50	7
Solidago canadensis (Canada goldenrod)	6	0-10	67	20
Sonchus arvensis (perennial sow-thistle)	11	0-20	33	18
Sonchus spp. (sow-thistle)	10	0-10	17	13
Stellaria longifolia (long-leaved chickweed)	1	0-1	17	4
Taraxacum officinale (common dandelion)	2	0-3	33	8
Thalictrum venulosum (veiny meadow rue)	6	0-10	33	13
Urtica dioica (common nettle)	1	0-1	17	4
Vicia americana (wild vetch)	1	0-1	17	4
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0-1	17	4

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.



Successional Pathway of Mesic *Salix petiolaris* (basket willow) Sites in North Central Alberta
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
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
POPUTRE/CORNSTO HT—*Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type
SALIPET CT—*Salix petiolaris* (basket willow) 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 32. 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 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 *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

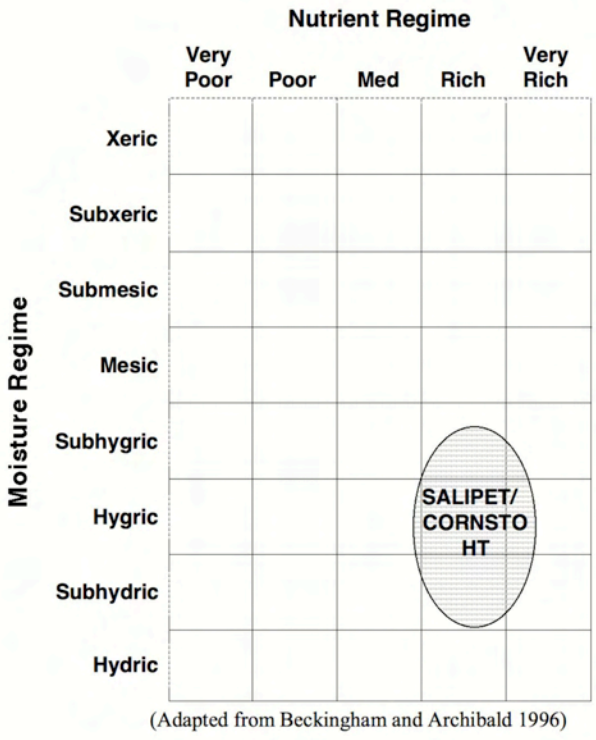


Figure 33. Edatope grid position for the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type (SALIPET/CORNSTO HT)

SOILS

Mineral soil textures on sampled stands ranged from sandy loam to clay. Water tables are usually within 1 m of the soil surface through much of the growing season and redoximorphic features (mottles or gleyed soil) are common within 1 m of the soil surface on sites of this type.

ADJACENT COMMUNITIES

Adjacent wetter sites may include the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type, the *Carex atherodes* (awned sedge) habitat type, or be open water. Adjacent drier sites may include the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type, tame pasture, or developed agricultural land.

MANAGEMENT INFORMATION

Livestock

The *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type does not provide substantial herbaceous forage value for livestock due to the dense, closed nature of the stands. Livestock will browse the willows, and prolonged use will ultimately damage the community by reducing *Salix* (willow) cover and introducing disturbance-related species. As stands become progressively opened by continued browsing pressure from the edges, the shrubs species, such as the *Salix* (willow) shoots and the *Cornus stolonifera* (red-osier dogwood) do provide good forage value (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991).

Wildlife

These dense *Salix* (willow) communities, associated with topographic depressions, provide browse and good thermal and hiding cover for many mammal and bird species, usually in a beneficial mosaic pattern within a landscape often already greatly altered by agricultural development.

Fisheries

The *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type does not occur often in landscape positions that have much bearing on fisheries. When any *Salix* species (willow) occupies a streambank position, it should be protected and promoted. The importance of *Salix* (willows) in streambank stabilization, cover, and thermal protection for fisheries cannot be over emphasized.

Fire

At this time, we know little about the response of *Salix petiolaris* (basket willow) to being burned, but suspect that, like most *Salix* species (willow), it readily sprouts from the root crown after all but the most intense fire.

Soil Management and Rehabilitation Opportunities

Salix petiolaris (basket willow) is readily propagated through cuttings (Plants for a Future 2000), therefore is adaptable to rehabilitating suitable degraded sites where woody plants have been removed, but the water table remains high.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type in the Dry Mixedwood Natural Subregion occur within the *Viburnum edule* (low-bush cranberry) (d), *Cornus stolonifera* (dogwood) (e), and *Equisetum* (horsetail) (f) ecosites (although a tree canopy is lacking) on mesic/medium, subhygric/rich, and hygric/rich moisture/nutrient regimes, as described by Beckingham and Archibald (1996). This habitat type also occurs in the Parkland Natural Region where ecosites have not yet been described.

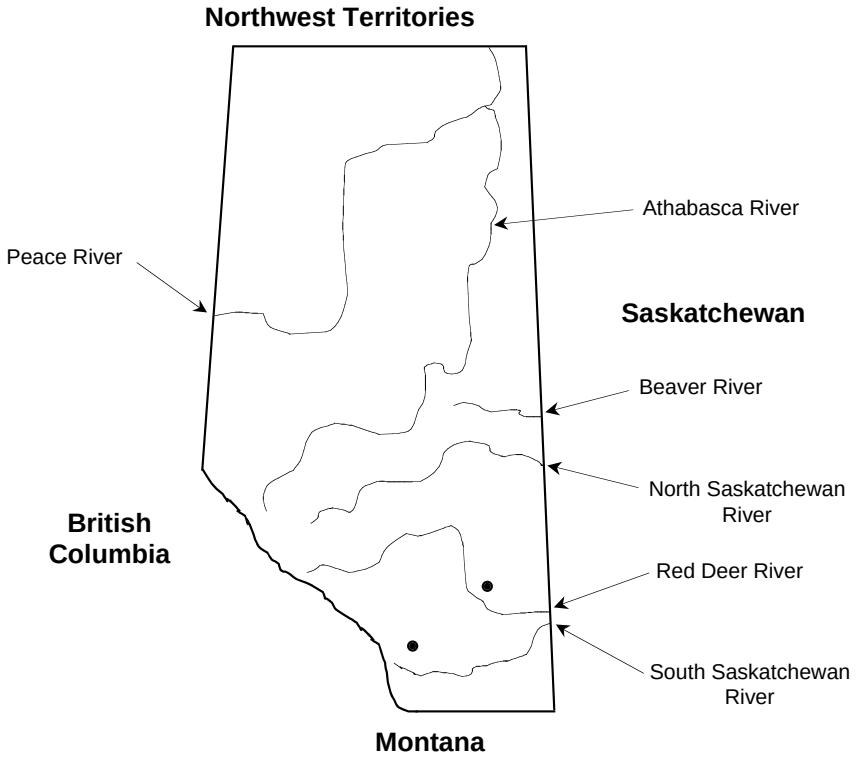
OTHER STUDIES

Thompson and Hansen (2002) described a *Salix petiolaris Cornus stolonifera* (basket willow/red-osier dogwood) habitat type in the Grassland Natural Region of southern Alberta, and Thompson and Hansen (2001) describe a similar type for the Prairie Ecozone of southern Saskatchewan.

Salix petiolaris Community Type
(Basket Willow Community Type)

SALIPET
Number of Stands Sampled = 5
Number of Stands Sampled in Alberta = 2

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Salix petiolaris* (basket willow) community type is an incidental type in the Parkland Natural Region and may occur in the Dry Mixedwood Natural Subregion. It is the result of long-term grazing disturbance to either of the *Salix petiolaris* (basket willow) habitat types, and is found around lentic wetlands (e.g., sloughs, depressions, and wet meadows). Before European settlement, *Salix petiolaris* (basket willow) occupied much more area in the Parkland, but due to their valuable soils, these sites were cleared and converted to agricultural production.

VEGETATION

This type is a disturbance-induced community, usually resulting from intense livestock grazing, on sites that would otherwise support the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type or the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. It is dominated by a canopy of *Salix petiolaris* (basket willow) that has been reduced and opened by browsing and trampling livestock. The result is an opened tall shrub canopy and an increase in disturbance related species such as *Bromus inermis* (awnless brome), *Juncus balticus* (wire rush), *Poa pratensis* (Kentucky bluegrass), *Cirsium arvense* (Canada thistle), and *Sonchus arvensis* (perennial sow-thistle) (Table 30).

Table 30. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 5 stands of the *Salix petiolaris* (basket willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Amelanchier alnifolia (Saskatoon)	1	0-1	20	4
Betula occidentalis (water birch)	10	0-10	20	14
Cornus stolonifera (red-osier dogwood)	1	0-1	20	4
Elaeagnus commutata (silverberry)	3	0-3	20	8
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	20	4
Ribes oxyacanthoides (northern gooseberry)	1	0-1	20	4
Rosa spp. (rose)	3	0-3	40	11
Salix bebbiana (beaked willow)	1	0-1	20	4
Salix petiolaris (basket willow)	73	30-98	100	85
Shepherdia argentea (thorny buffaloberry)	3	0-3	20	8
Symphoricarpos spp. (buckbrush)	30	0-30	20	24
Graminoids				
Agropyron dasystachyum (northern wheat grass)	1	0-1	20	4
Alopecurus aequalis (short-awned foxtail)	1	0-1	20	4
Bromus inermis (awnless brome)	31	0-70	60	43
Calamagrostis stricta (narrow reed grass)	1	0-1	20	4
Carex lanuginosa (woolly sedge)	20	0-30	40	28
Carex praegracilis (graceful sedge)	3	0-3	20	8
Carex scopulorum (Holm's Rocky Mountain sedge)	1	0-1	20	4
Carex sprengelii (Sprengel's sedge)	1	0-1	20	4
Deschampsia cespitosa (tufted hair grass)	3	0-3	20	8
Juncus balticus (wire rush)	30	0-30	40	35
Phleum pratense (timothy)	3	0-3	20	8
Phragmites australis (reed)	3	0-3	20	8
Poa palustris (fowl bluegrass)	3	0-3	20	8
Poa pratensis (Kentucky bluegrass)	15	0-20	40	24
Forbs				
Achillea millefolium (common yarrow)	1	0-1	20	4
Allium schoenoprasum (wild chives)	1	0-1	20	4
Arnica chamissonis (leafy arnica)	1	0-1	20	4
Aster borealis (marsh aster)	3	0-3	20	8
Aster hesperius (western willow aster)	1	0-1	20	4
Cirsium arvense (Canada thistle)	7	0-10	40	17
Epilobium spp. (willowherb)	1	0-1	20	4
Fragaria virginiana (wild strawberry)	1	0-1	20	4
Galium boreale (northern bedstraw)	1	0-1	20	4
Geum aleppicum (yellow avens)	1	0-1	20	4
Geum macrophyllum (large-leaved yellow avens)	1	0-1	20	4
Hieracium umbellatum (narrow-leaved hawkweed)	1	0-1	20	4
Lappula squarrosa (bluebur)	3	0-3	20	8
Melilotus alba (white sweet-clover)	10	0-10	20	14
Mentha arvensis (wild mint)	3	0-3	20	8
Penstemon procerus (slender blue beardtongue)	3	0-3	20	8
Potentilla anserina (silverweed)	10	0-10	20	14
Potentilla gracilis (graceful cinquefoil)	10	0-10	20	14
Pyrola asarifolia (common pink wintergreen)	10	0-10	20	14
Rumex occidentalis (western dock)	1	0-1	20	4
Smilacina stellata (star-flowered Solomon's-seal)	3	0-3	20	8
Solidago canadensis (Canada goldenrod)	1	0-1	20	4
Sonchus arvensis (perennial sow-thistle)	10	0-20	60	24
Stellaria longipes (long-stalked chickweed)	1	0-1	20	4
Thalictrum venulosum (veiny meadow rue)	10	0-10	20	14
Triglochin maritima (seaside arrow-grass)	3	0-3	20	8

Table 30 (cont.)

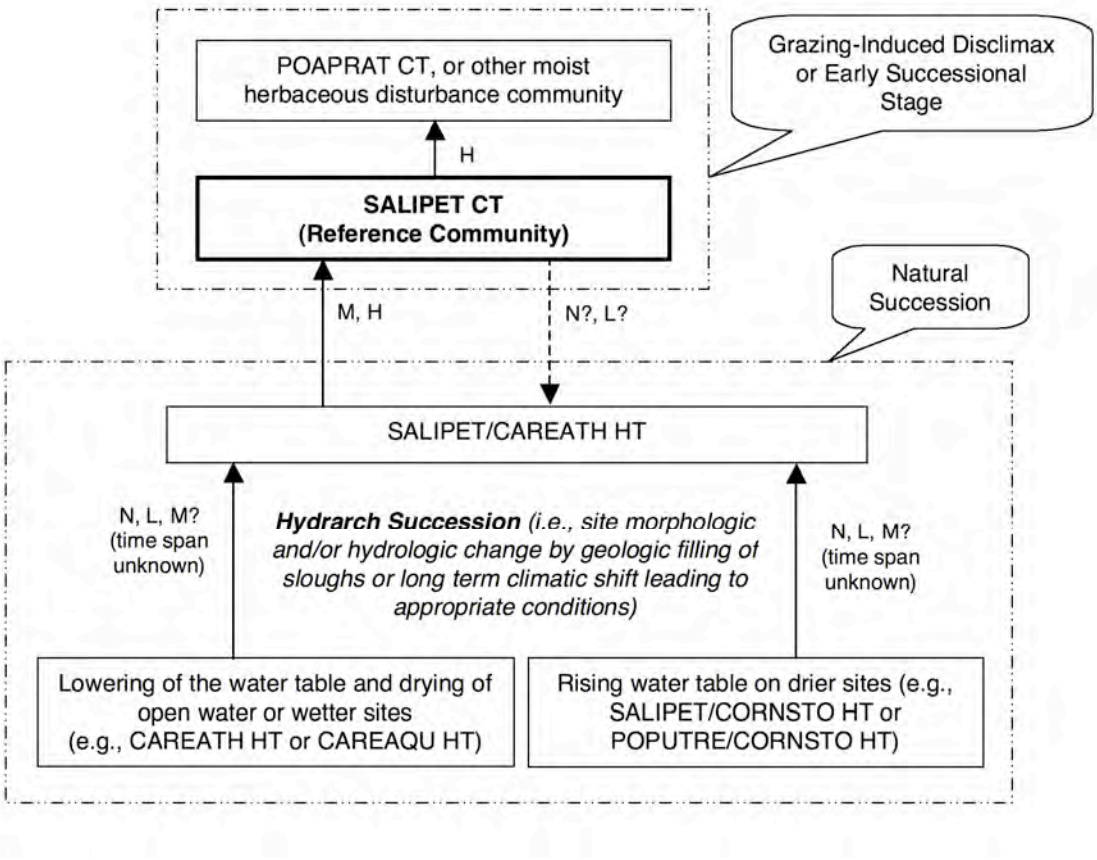
Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Urtica dioica (common nettle)	1	0-1	20	4
Vicia americana (wild vetch)	1	0-1	20	4
Viola adunca (early blue violet)	1	0-1	20	4

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The *Salix petiolaris* (basket willow) community type is a grazing induced disturbance stage 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. With rest from further disturbance, the stand may repopulate a semblance of its natural community, but this will depend on the degree to which the community composition and site hydrology has been altered. Remnant, viable propagules of later seral species are necessary, as well as freedom from excess competition by aggressive invader species.

Figure 34 shows a schematic diagram of the common pathways for succession of the *Salix petiolaris* (basket willow) community type on very moist sites of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type in North Central Alberta.



Successional Pathway of Very Moist *Salix petiolaris* (basket willow) Sites in North Central Alberta
Reference Community = *Salix petiolaris* (basket willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES

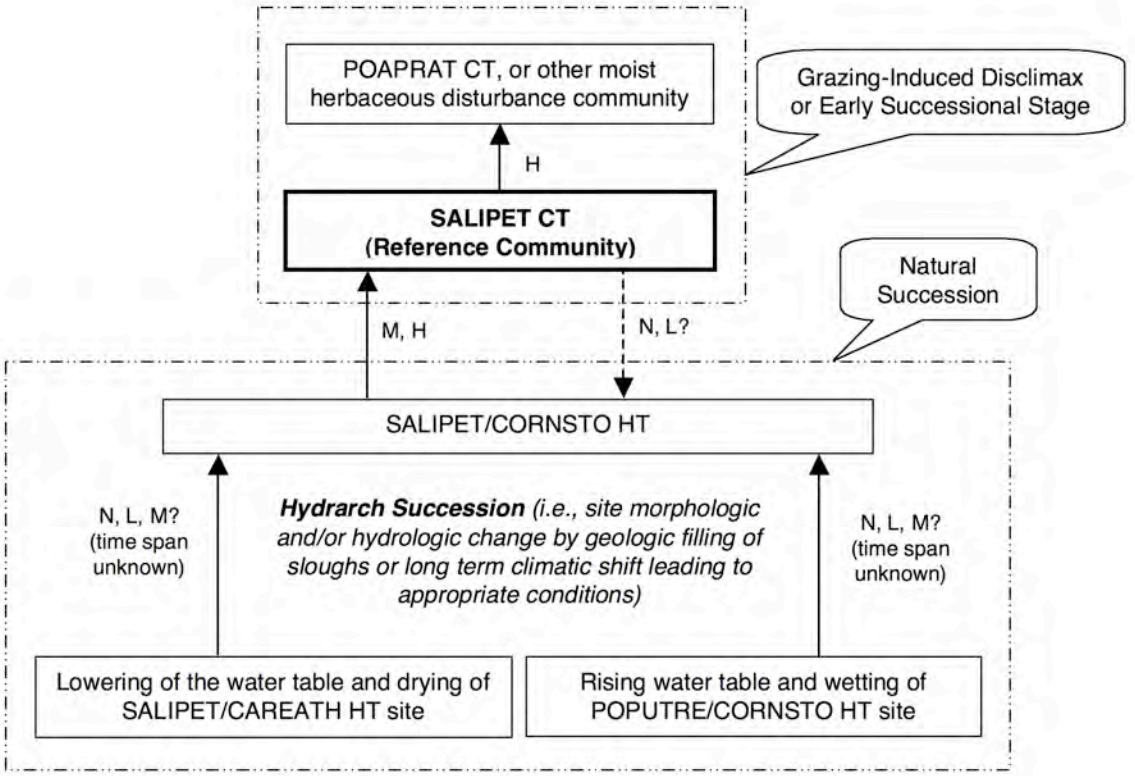
CAREAQU HT—*Carex aquatilis* (water sedge) habitat type
CAREATH HT—*Carex atherodes* (awned sedge) habitat type

POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
POPUTRE/CORNSTO HT—*Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type
SALIPET CT—*Salix petiolaris* (basket willow) 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 34. Successional pathway on very moist sites of the seral *Salix petiolaris* (basket willow) community type 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 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.

Figure 35 shows a schematic diagram of the common pathways for succession of the *Salix petiolaris* (basket willow) community type on mesic sites of the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type in North Central Alberta.



Successional Pathway of Mesic *Salix petiolaris* (basket willow) Sites in North Central Alberta
Reference Community = *Salix petiolaris* (basket willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
POPUTRE/CORNSTO HT—*Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type
SALIPET CT—*Salix petiolaris* (basket willow) 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 35. Successional pathway for more mesic sites of the seral *Salix petiolaris* (basket willow) community type 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 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.

SOILS

Mineral soil textures on all sampled stands dominated by *Salix petiolaris* (basket willow) ranged from sandy loam to clay. Water tables are usually within 1 m of the soil surface through much of the growing season and redoximorphic features (mottles or gleyed soil) are common within 1 m of the soil surface on sites of this type.

ADJACENT COMMUNITIES

Adjacent wetter sites may support the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type, the *Carex atherodes* (awned sedge) habitat type, any of several emergent herbaceous types, or be open water. Adjacent drier sites may support the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type, tame pasture, or be developed agricultural land.

MANAGEMENT INFORMATION

Livestock

Stands of this type have begun to be opened, allowing for easier livestock access. Forage productivity is also higher by virtue of the replacement of tall *Salix* (willows) with invading herbaceous species, such as *Bromus inermis* (awnless brome) and *Poa pratensis* (Kentucky bluegrass), resulting in potentially even heavier utilization, especially late in the season when upland vegetation dries. Continued overuse by livestock will further reduce the vigour of the *Salix* (willows) present to the point that they may be eliminated from the site.

To minimize undesired changes in community composition and structure, pasture or allotment management should be based on the forage available from stands of this and other riparian or wetland communities. This concept of the riparian or wetland pasture has had some success in maintaining or improving the health of riparian or wetland vegetation (Kinch 1987).

Wildlife

Dense *Salix* (willow) communities, 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, within a landscape often already greatly altered by agricultural development. The *Salix petiolaris/*(basket willow) community type is a community already reduced in wildlife values of cover, nesting and hiding opportunity, and forage production.

Fisheries

The *Salix petiolaris/*(basket willow) community type does not occur often in landscape positions that have much bearing on fisheries. When any *Salix* species (willow) occupies a streambank position, it should be protected and promoted. The importance of *Salix* (willows) in streambank stabilization, cover, and thermal protection for fisheries cannot be over emphasized.

Fire

At this time, we know little about the response of *Salix petiolaris* (basket willow) to being burned, but suspect that, like most *Salix* species (willow), it readily sprouts from the rootstocks after fire that is not extremely hot. Rhizomatous grasses that characterize the disturbed understory of this type, such as *Poa pratensis* (Kentucky bluegrass) and *Bromus inermis* (awnless brome), are usually promoted by fire that does not burn extremely hot (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities

Salix petiolaris is readily propagated through cuttings (Plants for a Future 2000), therefore is adaptable to rehabilitating suitable degraded sites where woody plants have been removed, but the water table remains high.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Salix petiolaris* (basket willow) community type in the Dry Mixedwood Natural Subregion occur within the *Viburnum edule* (low-bush cranberry), *Cornus stolonifera* (dogwood), and *Equisetum* (horsetail) ecosites on mesic/medium, subhygric/rich, and hygric/rich moisture/nutrient regimes, as described by Beckingham and Archibald (1996). It also occurs in the Parkland Natural Region where ecosites have not yet been described.

OTHER STUDIES

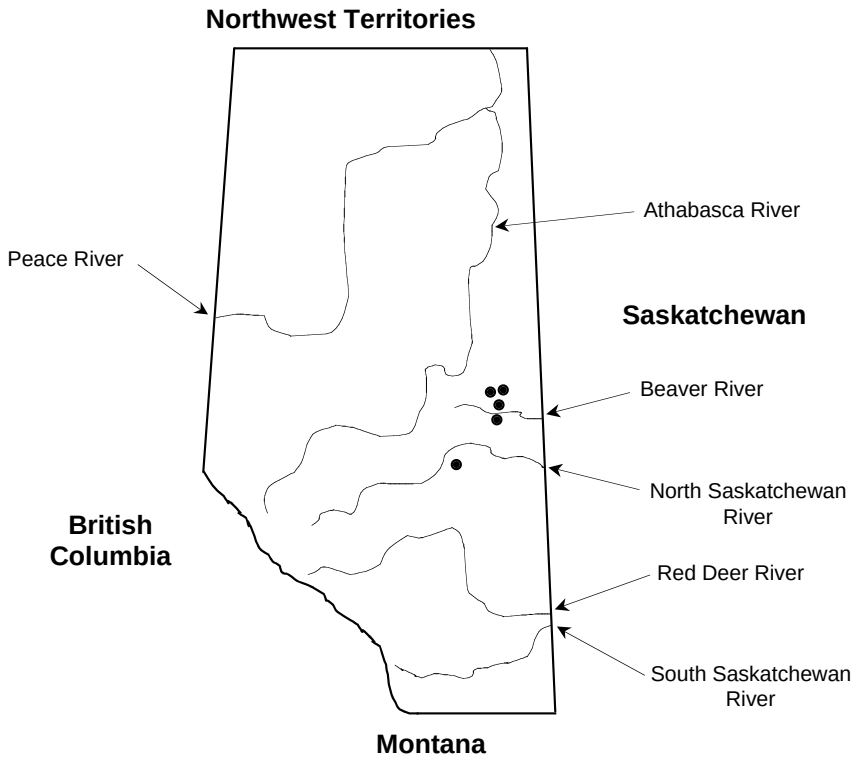
Thompson and Hansen (2002) described a *Salix petiolaris* (basket willow) community type in the Grassland Natural Region of southern Alberta, and Thompson and Hansen (2001) describe a similar type for the Prairie Ecozone of southern

Saskatchewan. Willoughby (2000) describes a *Salix/Poa pratensis/Taraxacum* (willow/Kentucky bluegrass/dandelion) community in the Dry Mixedwood Subregion.

Salix planifolia/Calamagrostis canadensis Habitat Type (Flat-Leaved Willow/Bluejoint Habitat Type)

SALIPLA/CALACAN
Number of Stands Sampled = 6
Number of Stands Sampled in Alberta = 6

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type is a minor type at low elevations in the Dry Mixedwood Natural Subregion of central and northern Alberta. It is found in wet areas adjacent to lakes, streams, and sloughs. Stands were sampled near Elk Island National Park and on the Beaver River north of St. Paul, but much of the sample set was taken near the transition to the Central Mixedwood Subregion in the vicinity of Lac La Biche and the Lakeland district; therefore this type may be more common in the Central Mixedwood. *Salix planifolia* (flat-leaved) is found more commonly on lentic sites that have less aerated water (e.g., fens, sloughs, and lakeshores) than on lotic sites by flowing water.

VEGETATION

This type is characterized by a moderate to extensive canopy of *Salix planifolia* (flat-leaved willow) over a heavy carpet of *Calamagrostis canadensis* (bluejoint), with a mix of other hydrophytic shrubs and graminoids, often including *Alnus tenuifolia* (river alder) and any of several other *Salix* (willow) species (Table 31).

Table 31. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	1	0-1	33	6
Picea glauca (white spruce)	1	0-1	17	4
Shrubs				
Alnus tenuifolia (river alder)	25	0-30	33	29
Betula pumila (dwarf birch)	3	0-3	17	7
Cornus stolonifera (red-osier dogwood)	1	0-1	17	4
Lonicera dioica (twining honeysuckle)	1	0-1	17	4
Ribes glandulosum (skunk currant)	3	0-3	17	7
Ribes hudsonianum (northern black currant)	10	0-10	17	13
Ribes oxyacanthoides (northern gooseberry)	1	0-1	33	6
Rosa spp. (rose)	1	0-1	33	6
Rubus pubescens (dewberry)	2	0-3	67	8
Salix bebbiana (beaked willow)	12	0-20	33	20
Salix discolor (pussy willow)	3	0-3	17	7
Salix lucida (shining willow)	1	0-1	17	4
Salix myrtillifolia (myrtle-leaved willow)	6	0-10	33	13
Salix petiolaris (basket willow)	6	0-10	33	13
Salix planifolia (flat-leaved willow)	53	30-70	100	73
Salix pseudomonticola (false mountain willow)	2	0-3	50	10
Graminoids				
Bromus ciliatus (fringed brome)	10	0-10	17	13
Calamagrostis canadensis (bluejoint)	38	10-80	100	62
Carex atherodes (awned sedge)	1	0-1	50	7
Carex bebbii (Bebb's sedge)	1	0-1	17	4
Carex curta (short sedge)	2	0-3	33	8
Carex disperma (two-seeded sedge)	3	0-3	17	7
Carex utriculata (beaked sedge)	1	0-1	17	4
Carex spp. (sedge)	1	0-1	17	4
Elymus innovatus (hairy wild rye)	1	0-1	17	4
Poa palustris (fowl bluegrass)	3	0-3	17	7
Poa pratensis (Kentucky bluegrass)	3	0-3	33	10
Forbs				
Achillea sibirica (many-flowered yarrow)	1	0-1	33	6
Aster laevis (smooth aster)	3	0-3	17	7
Aster modestus (large northern aster)	1	0-1	17	4
Aster puniceus (purple-stemmed aster)	1	0-1	17	4
Caltha palustris (marsh-marigold)	4	0-10	50	14
Cirsium arvense (Canada thistle)	1	0-1	33	6
Epilobium ciliatum (northern willowherb)	1	0-1	17	4
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	17	4
Fragaria virginiana (wild strawberry)	3	0-3	17	7
Galeopsis tetrahit (hemp-nettle)	3	0-3	17	7
Galium boreale (northern bedstraw)	1	0-1	17	4
Galium trifidum (small bedstraw)	2	0-3	67	8
Galium triflorum (sweet-scented bedstraw)	1	0-1	17	4
Geum aleppicum (yellow avens)	2	0-3	50	7
Impatiens noli-tangere (western jewelweed)	1	0-1	17	4
Mentha arvensis (wild mint)	1	0-1	33	6
Petasites sagittatus (arrow-leaved coltsfoot)	3	0-3	33	10
Plantago major (common plantain)	1	0-1	17	4
Potentilla norvegica (rough cinquefoil)	1	0-1	17	4
Pyrola asarifolia (common pink wintergreen)	3	0-3	17	7
Scutellaria galericulata (marsh skullcap)	1	0-1	33	6

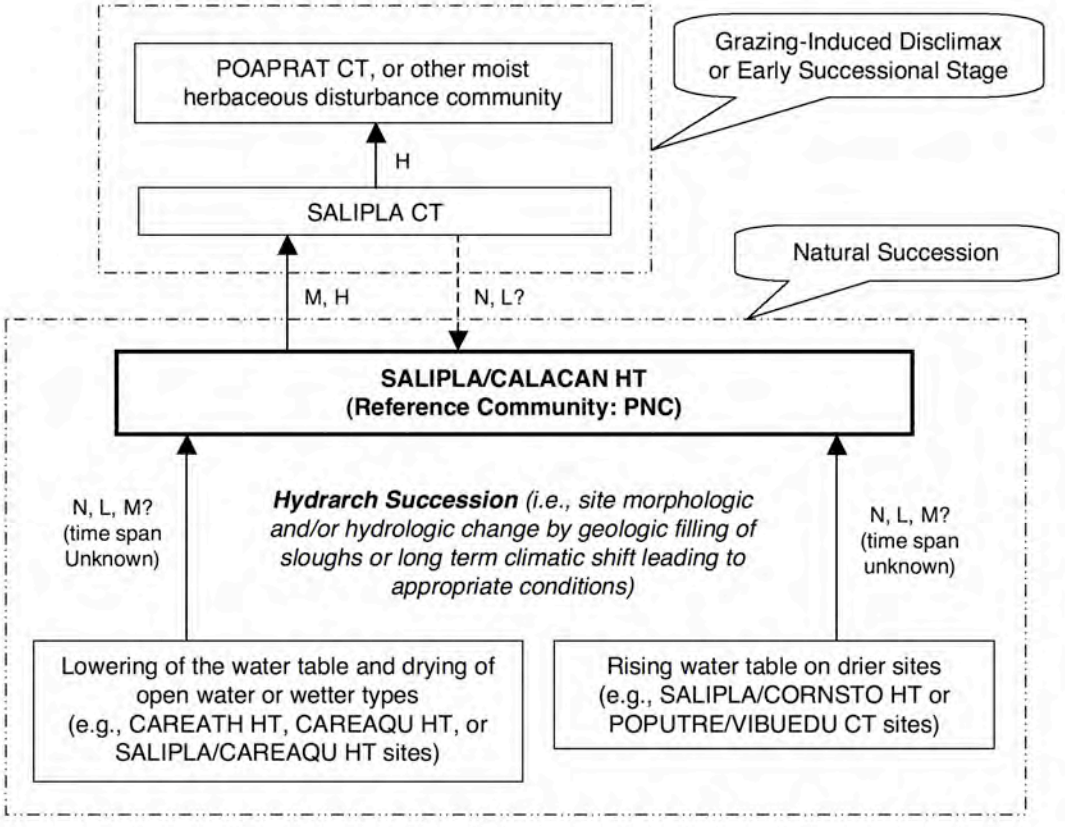
Table 31 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Sium suave (water parsnip)	1	0-1	17	4
Smilacina trifolia (three-leaved Solomon's-seal)	1	0-1	17	4
Solidago canadensis (Canada goldenrod)	1	0-1	17	4
Sonchus spp. (sow-thistle)	1	0-1	17	4
Stachys palustris (marsh hedge-nettle)	1	0-1	33	6
Stellaria longifolia (long-leaved chickweed)	1	0-1	17	4
Taraxacum officinale (common dandelion)	2	0-3	50	10
Thalictrum venulosum (veiny meadow rue)	1	0-1	17	4
Urtica dioica (common nettle)	2	0-3	33	8
Vicia americana (wild vetch)	1	0-1	17	4
Ferns and Allies				
Equisetum arvense (common horsetail)	2	0-3	50	7
Equisetum fluviatile (swamp horsetail)	6	0-10	33	13

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Although Raup (1946) states that *Salix planifolia* (flat-leaved willow) is seral to *Salix bebbiana* (beaked willow) on river floodplain (lotic) sites, these data do not indicate such a succession. *Salix planifolia* (flat-leaved willow) is found as a dominant more commonly on lentic sites, such as fens, sloughs, and lakeshores. *Salix planifolia* (flat-leaved willow) appears to have the capacity to pioneer on suitable sites and to sustain dominance where there is a lack of potential for shading by taller species (trees). Figure 36 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of Mesic *Salix planifolia* (flat-leaved willow) Sites in North Central Alberta
Reference Community = *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREATH HT—*Carex atherodes* (awned sedge) habitat type
CAREAQU HT—*Carex aquatilis* (water sedge) habitat type
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) Community Type
POPUTRE/VIBUEDU CT—*Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type
SALIPLA CT—*Salix planifolia* (flat-leaved willow) community type
SALIPLA/CALACAN HT—*Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type
SALIPLA/CAREAQU HT—*Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type
SALIPLA/CORNSTO HT—*Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type

Figure 36. Successional pathway for sites of the *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) 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 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.

Excessive grazing disturbance will result in a decrease of *Salix planifolia* (flat-leaved willow) vigour and cover, a decrease in *Calamagrostis canadensis* (bluejoint) cover, and an increase in invaders like *Poa pratensis* (Kentucky bluegrass) and *Taraxacum officinale* (common dandelion). With continued overuse by livestock, the site will dry out, allowing the increaser graminoids and forbs to take over the site.

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 *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

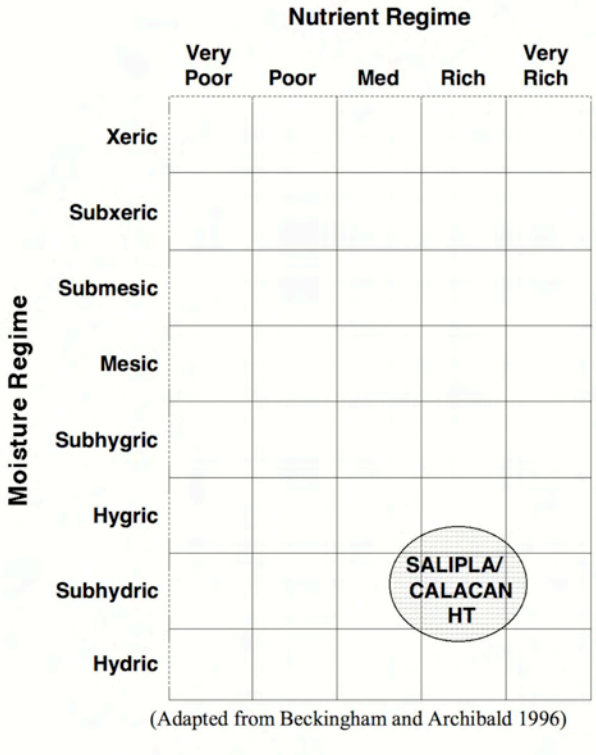


Figure 37. Edatope grid position for the *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type (SALIPLA/CALACAN HT)

SOILS

Mineral soils typically are gleyed and have textures from sandy loam to clay covered by an organic layer of varying thickness. Mineral soil textures on sampled stands ranged from silty sand to silt. This type has high water table in spring and early summer, but water may drop below one meter by fall (USDA Intermountain Fire Sciences Lab 1995). pH is typically slightly to moderately acidic (USDA Natural Resources Conservation Service. 2001).

ADJACENT COMMUNITIES

Adjacent wetter communities may include the *Carex aquatilis* (water sedge), *Carex atherodes* (awned sedge), or be open water. Adjacent drier communities may include the *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type or the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type, the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, or the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type.

MANAGEMENT INFORMATION

Livestock

Calamagrostis canadensis (bluejoint) is most palatable when young and succulent, since it grows in wet habitats, use by livestock is often limited until late in the season when the grass is tough (USDA Intermountain Fire Sciences Lab 1995). Estimated herbage production is moderate to high, but short growing season and continually wet soils limit livestock use until late summer and fall. *Salix planifolia* (flat-leaved willow) and *Calamagrostis canadensis* (bluejoint) have fair to good livestock forage value (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991).

Frisina (1991) states that 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.

Wildlife

Beaver and moose utilization of *Salix planifolia* (flat-leaved willow) is moderate to high. On some sites, high winter use by moose has almost eliminated stems near or above the snow surface. *Salix planifolia* (flat-leaved willow) provides excellent nesting and foraging habitat for a variety of birds, such as ducks, shorebirds, warblers, vireos, and sparrows (USDA Intermountain Fire Sciences Lab 1995)

Elk and deer use of *Calamagrostis canadensis* is moderate to high, while for waterfowl, nutritional value is fair and cover value is high (USDA Intermountain Fire Sciences Lab 1995).

Fisheries

The dense network of roots from the *Salix* (willows) and grass are effective in stabilizing streambanks. Immediately adjacent to the stream, the banks be undercut and sag into the water providing excellent cover for fish. The *Salix* (willows) provide valuable overhanging stream cover and shade. The importance of *Salix* (willows) in streambank protection, cover, and thermal protection for fisheries cannot be over emphasized.

Fire

The wet habitats *Salix planifolia* (flat-leaved willow) occupies rarely burn. In fact, these areas frequently act as firebreaks. However, under dry conditions, riparian habitats can burn severely. Most *Salix* (willows) sprout from the root crown following top-kill 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. *Salix planifolia* (flat-leaved willow) wind-dispersed seeds may be important in colonizing nearby burned areas. (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities

The *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type is only slightly resistant to trampling by livestock, big game, packstock, and campers. Rutting can be severe when packstock or hikers use occurs on wet soils. This can result in the development of wide, multi path trails. Off road vehicle use causes serious long-term damage on these sites. Care should be taken to maintain existing roads and to discourage off road travel. Any new trails or roads should be located on adjacent uplands.

Salix planifolia (flat-leaved willow) is valuable in revegetating disturbed streambanks. Cuttings should be first rooted then grown in a nursery to enhance survival rates. Cut stems of *Salix planifolia* (flat-leaved willow) produce low to moderate numbers of roots, located along the entire length of the stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm long and greater than 1 cm in diameter produces the best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting (Hansen and others 1995).

Recreational Uses and Considerations
These sites provide excellent opportunities for hunting and viewing wildlife such as moose, beaver, and waterfowl. Sites also provide access points for fishing. High levels of human use in the spring and summer can damage soils.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type in the Dry Mixedwood Natural Region occur within the shrubby phase of the rich fen ecosite (k2) with a subhydric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). This habitat type was not observed in the Parkland Natural Region.

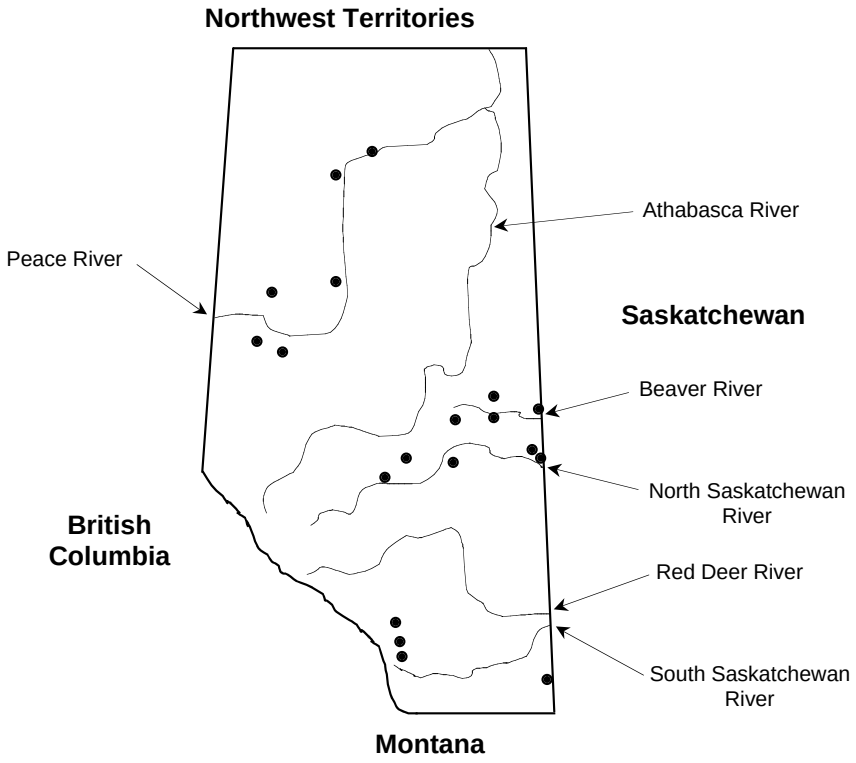
OTHER STUDIES

Thompson and Hansen (2002) describe a *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type, which has considerable overlap with the type described here, and a prominent presence of *Calamagrostis canadensis* (bluejoint) in the Alberta Grassland Natural Region. Beckingham and Archibald (1996) in northern Alberta and Beckingham, Nielsen, and Futoransky (1996) in the Mid-Boreal ecoregions of Saskatchewan describe a *Salix/Calamagrostis canadensis* (willow/marsh reed grass) community type of the shrubby rich fen ecosite. Willoughby (2000) and Lane and others (2000) describe *Salix/Calamagrostis canadensis* (willow/marsh reed grass) community types for the Lower Foothills and the Mixedwood Subregions.

Salix planifolia/Carex aquatilis Habitat Type
(Flat-leaved Willow/Water Sedge Habitat Type)

SALIPLA/CAREAQU
Number of Stands Sampled = 21
Number of Stands Sampled in Alberta = 21

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type is a frequently occurring minor type at low elevations in the Dry Mixedwood Natural Subregion of Alberta. The type is found in wet areas adjacent to lakes, streams, and sloughs. The sites are among the wettest terrestrial sites supporting willows, occurring often in extensive areas around larger lakes where land is low and flat. *Salix planifolia* (flat-leaved willow) is found more commonly on lentic sites that have less aerated water (e.g., fens, sloughs, and lakeshores) than on lotic sites by flowing water. When found on a riverine site, this type is often the result of long lasting beaver dam complexes. Typical stands were sampled in the lower Peace River Valley near Fort Vermilion and Dixonville, in the upper Peace River Valley near Wanham and Worsley, near Gunn, Bruderheim, St. Paul, Tulliby Lake, and places between.

VEGETATION

In a relatively undisturbed state, this type is characterized by a moderate to extensive cover of *Salix planifolia* (flat-leaved willow) over an extensive cover of sedges, with *Carex aquatilis* (water sedge) by far the most prominent, and a mix of other hydrophytic species, commonly including *Salix bebbiana* (beaked willow) or any of several other willows, and *Potentilla palustris* (marsh cinquefoil) (Table 32).

Table 32. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 relatively undisturbed late seral to climax stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	1	0-1	29	5
Picea glauca (white spruce)	1	0-1	14	4
Shrubs				
Betula glandulosa (bog birch)	10	0-10	14	12
Betula pumila (dwarf birch)	3	0-3	14	7
Cornus stolonifera (red-osier dogwood)	1	0-1	14	4
Salix bebbiana (beaked willow)	6	0-20	57	17
Salix candida (hoary willow)	1	0-1	14	4
Salix lucida (shining willow)	10	0-10	14	12
Salix pedicellaris (bog willow)	1	0-1	14	4
Salix petiolaris (basket willow)	6	0-10	29	12
Salix planifolia (flat-leaved willow)	49	20-90	100	70
Salix pseudomonticola (false mountain willow)	1	0-1	14	4
Salix serissima (autumn willow)	10	0-10	14	12
Graminoids				
Agrostis scabra (rough hair grass)	1	0-1	14	4
Calamagrostis canadensis (bluejoint)	30	0-50	29	29
Calamagrostis stricta (narrow reed grass)	2	0-3	43	7
Carex aquatilis (water sedge)	36	3-80	100	60
Carex atherodes (awned sedge)	9	0-20	43	20
Carex diandra (two-stamened sedge)	10	0-10	14	12
Carex utriculata (beaked sedge)	11	0-20	29	17
Poa palustris (fowl bluegrass)	1	0-1	14	4
Forbs				
Aster puniceus (purple-stemmed aster)	1	0-1	14	4
Cicuta maculata (water-hemlock)	10	0-10	14	12
Epilobium ciliatum (northern willowherb)	1	0-1	14	4
Epilobium palustre (marsh willowherb)	3	0-3	14	7
Fragaria virginiana (wild strawberry)	1	0-1	14	4
Galium trifidum (small bedstraw)	2	0-3	29	8
Geum aleppicum (yellow avens)	1	0-1	43	7
Hippuris vulgaris (common mare's-tail)	1	0-1	14	4
Lysimachia thyrsiflora (tufted loosestrife)	1	0-1	14	4
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	43	7
Polygonum lapathifolium (pale persicaria)	1	0-1	14	4
Potentilla norvegica (rough cinquefoil)	1	0-1	14	4

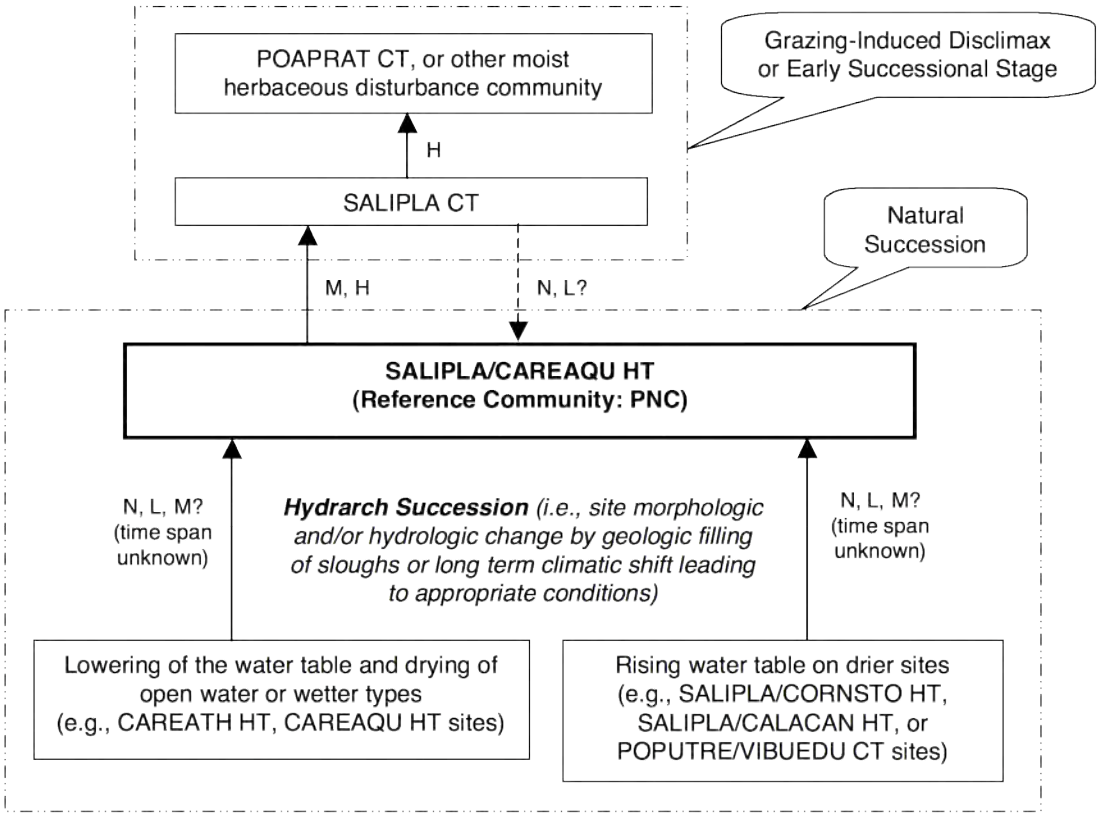
Table 32 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Potentilla palustris (marsh cinquefoil)	6	0-10	71	21
Pyrola asarifolia (common pink wintergreen)	3	0-3	14	7
Rumex occidentalis (western dock)	1	0-1	29	5
Scutellaria galericulata (marsh skullcap)	1	0-1	29	5
Stachys palustris (marsh hedge-nettle)	3	0-3	14	7
Trifolium repens (white clover)	1	0-1	14	4
Typha latifolia (common cattail)	3	0-3	14	7
Urtica dioica (common nettle)	1	0-1	14	4
Ferns and Allies				
Equisetum fluviatile (swamp horsetail)	2	0-3	29	8

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Although Raup (1946) states that *Salix planifolia* (flat-leaved willow) is seral to *Salix bebbiana* (beaked willow) on river floodplain (lotic) sites, these data do not indicate such a succession. *Salix planifolia* (flat-leaved willow) is found more commonly on lentic sites, such as fens, sloughs, and lakeshores. The species appears to have the capacity to pioneer on suitable sites and to sustain dominance on sites that lack potential for shading by taller species (trees). Figure 38 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of Very Moist *Salix planifolia* (flat-leaved willow) Sites in North Central Alberta
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 HT—*Carex aquatilis* (water sedge) habitat type
CAREATH HT—*Carex atherodes* (awned sedge) habitat type
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
POPUTRE/VIBUEDU CT—*Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type
SALIPLA CT—*Salix planifolia* (flat-leaved willow) community type
SALIPLA/CALACAN HT—*Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type
SALIPLA/CAREAQU HT—*Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type
SALIPLA/CORNSTO HT—*Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type

Figure 38. 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 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.

Prolonged moderate to heavy disturbance by grazing alters this community by reducing cover of both *Salix* (willows) and *Carex* (sedges) in favor of drier herbaceous genera such as *Calamagrostis* (reedgrass), *Poa* (bluegrass), *Aster* (aster), *Geum* (avens), and *Mentha arvensis* (wild mint) (Table 33). With continued overuse by livestock, the site will dry out, allowing these drier, more aggressive herbs to take over. On heavily disturbed sites adjacent to streams, streambed downcutting can lower the water table, causing a shift in site hydrology and vegetation potential (Hansen and others 1995).

Table 33. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 14 disturbed or early seral stands of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Trees				
Betula papyrifera (white birch)	1	0-1	7	3
Picea glauca (white spruce)	1	0-1	21	5
Populus balsamifera (balsam poplar)	2	0-3	29	7
Populus tremuloides (aspen)	1	0-1	21	5
Shrubs				
Betula glandulosa (bog birch)	11	0-20	14	12
Cornus stolonifera (red-osier dogwood)	1	0-1	7	3
Linnaea borealis (twinflower)	1	0-1	7	3
Lonicera involucrata (bracted honeysuckle)	3	0-3	14	7
Potentilla fruticosa (shrubby cinquefoil)	3	0-3	7	5
Ribes oxyacanthoides (northern gooseberry)	2	0-3	21	5
Ribes spp. (currant)	1	0-1	7	3
Ribes triste (wild red currant)	1	0-1	14	4
Rosa spp. (rose)	2	0-3	29	7
Rubus arcticus (dwarf raspberry)	3	0-3	29	8
Rubus idaeus (wild red raspberry)	1	0-1	14	4
Rubus pubescens (dewberry)	1	0-1	14	4
Salix bebbiana (beaked willow)	4	0-10	64	16
Salix candida (hoary willow)	1	0-1	7	3
Salix drummondiana (Drummond's willow)	1	0-1	7	3
Salix exigua (sandbar willow)	1	0-1	7	3
Salix lutea (yellow willow)	2	0-3	14	5
Salix maccalliana (velvet-fruited willow)	20	0-20	7	12
Salix myrtillifolia (myrtle-leaved willow)	7	0-10	21	12
Salix pedicellaris (bog willow)	1	0-1	14	4
Salix petiolaris (basket willow)	6	0-10	29	13
Salix planifolia (flat-leaved willow)	34	20-80	100	58
Salix pseudomonticola (false mountain willow)	4	0-10	29	11

Table 33 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Salix serissima (autumn willow)	1	0-1	7	3
Viburnum edule (low-bush cranberry)	1	0-1	7	3
Graminoids				
Agrostis exarata (spike redtop)	1	0-1	7	3
Agropyron repens (quack grass)	1	0-1	7	3
Agrostis scabra (rough hair grass)	2	0-3	21	7
Alopecurus occidentalis (alpine foxtail)	2	0-3	14	5
Alopecurus pratensis (meadow foxtail)	1	0-1	7	3
Beckmannia syzigachne (slough grass)	10	0-10	7	8
Bromus ciliatus (fringed brome)	1	0-1	21	5
Calamagrostis canadensis (bluejoint)	10	0-20	57	23
Calamagrostis inexpansa (northern reed grass)	23	0-50	21	22
Calamagrostis stricta (narrow reed grass)	1	0-1	14	4
Carex aquatilis (water sedge)	14	0-30	50	26
Carex atherodes (awned sedge)	26	0-70	43	33
Carex bebbii (Bebb's sedge)	1	0-1	7	3
Carex curta (short sedge)	1	0-1	7	3
Carex diandra (two-stamened sedge)	15	0-20	14	15
Carex disperma (two-seeded sedge)	3	0-3	7	5
Carex lanuginosa (woolly sedge)	30	0-30	7	15
Carex pseudo-cyperus (cyperus-like sedge)	20	0-20	7	12
Carex utriculata (beaked sedge)	11	0-30	71	27
Carex sartwellii (Sartwell's sedge)	10	0-10	7	8
Deschampsia cespitosa (tufted hair grass)	3	0-3	7	5
Eleocharis palustris (creeping spike-rush)	3	0-3	7	5
Festuca spp. (fescue)	20	0-20	7	12
Glyceria grandis (common tall manna grass)	16	0-30	14	15
Glyceria striata (fowl manna grass)	2	0-3	21	7
Hordeum jubatum (foxtail barley)	1	0-1	7	3
Juncus balticus (wire rush)	10	0-10	7	8
Phleum pratense (timothy)	3	0-3	14	7
Poa palustris (fowl bluegrass)	11	0-20	50	23
Poa pratensis (Kentucky bluegrass)	7	0-20	43	17
Scirpus microcarpus (small-fruited bulrush)	2	0-3	21	7
Forbs				
Achillea millefolium (common yarrow)	1	0-1	7	3
Achillea sibirica (many-flowered yarrow)	2	0-3	14	5
Angelica arguta (white angelica)	1	0-1	14	4
Aster ciliolatus (Lindley's aster)	1	0-1	7	3
Aster hesperius (western willow aster)	1	0-1	7	3
Aster laevis (smooth aster)	1	0-1	7	3
Aster modestus (large northern aster)	2	0-3	21	5
Aster puniceus (purple-stemmed aster)	1	0-1	7	3
Aster subspicatus (leafy-bracted aster)	3	0-3	7	5
Caltha palustris (marsh-marigold)	2	0-3	21	7
Cerastium vulgatum (common mouse-ear chickweed)	1	0-1	7	3
Cicuta maculata (water-hemlock)	3	0-3	7	5
Cirsium arvense (Canada thistle)	2	0-3	29	5
Epilobium angustifolium (common fireweed)	12	0-20	14	13
Epilobium ciliatum (northern willowherb)	1	0-1	14	4
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	7	3
Fragaria virginiana (wild strawberry)	1	0-1	21	5
Galium trifidum (small bedstraw)	3	0-10	36	8
Geranium richardsonii (wild white geranium)	1	0-1	7	3
Geum aleppicum (yellow avens)	4	0-10	29	11

Table 33 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Geum macrophyllum (large-leaved yellow avens)	3	0-3	36	10
Heracleum lanatum (cow parsnip)	1	0-1	7	3
Hieracium umbellatum (narrow-leaved hawkweed)	3	0-3	7	5
Hippuris vulgaris (common mare's-tail)	1	0-1	7	3
Lathyrus ochroleucus (cream-colored vetchling)	1	0-1	7	3
Lysimachia thyrsiflora (tufted loosestrife)	3	0-3	7	5
Mentha arvensis (wild mint)	4	0-10	36	12
Mertensia paniculata (tall lungwort)	1	0-1	14	4
Mitella nuda (bishop's-cap)	1	0-1	7	3
Moehringia lateriflora (blunt-leaved sandwort)	1	0-1	7	3
Pedicularis spp. (lousewort)	1	0-1	7	3
Petasites palmatus (palmate-leaved coltsfoot)	1	0-1	14	4
Petasites sagittatus (arrow-leaved coltsfoot)	2	0-3	36	8
Plantago major (common plantain)	1	0-1	14	4
Polygonum amphibium (water smartweed)	3	0-3	7	5
Polygonum lapathifolium (pale persicaria)	2	0-3	21	7
Potentilla norvegica (rough cinquefoil)	2	0-3	21	5
Potentilla palustris (marsh cinquefoil)	5	0-10	21	10
Ranunculus acris (tall buttercup)	1	0-1	7	3
Ranunculus spp. (ranunculus)	1	0-1	7	3
Ranunculus pedatifidus (northern buttercup)	3	0-3	7	5
Rorippa palustris (marsh yellow cress)	1	0-1	7	3
Rumex occidentalis (western dock)	1	0-3	36	6
Scutellaria galericulata (marsh skullcap)	1	0-3	36	6
Sisymbrium loeselii (tall hedge mustard)	1	0-1	7	3
Sium suave (water parsnip)	2	0-3	21	7
Smilacina stellata (star-flowered Solomon's-seal)	1	0-1	7	3
Solidago canadensis (Canada goldenrod)	6	0-10	14	8
Sonchus spp. (sow-thistle)	3	0-3	14	7
Stachys palustris (marsh hedge-nettle)	3	0-3	7	5
Stellaria longipes (long-stalked chickweed)	1	0-1	21	5
Stellaria longifolia (long-leaved chickweed)	6	0-10	14	8
Taraxacum officinale (common dandelion)	2	0-3	29	8
Trifolium hybridum (alsike clover)	1	0-1	7	3
Trifolium repens (white clover)	10	0-10	7	8
Typha latifolia (common cattail)	1	0-1	7	3
Urtica dioica (common nettle)	1	0-1	14	4
Vicia americana (wild vetch)	1	0-1	21	5
Viola palustris (marsh violet)	3	0-3	7	5
Ferns and Allies				
Equisetum arvense (common horsetail)	7	0-30	57	19
Equisetum fluviatile (swamp horsetail)	20	0-20	7	12

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

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 *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

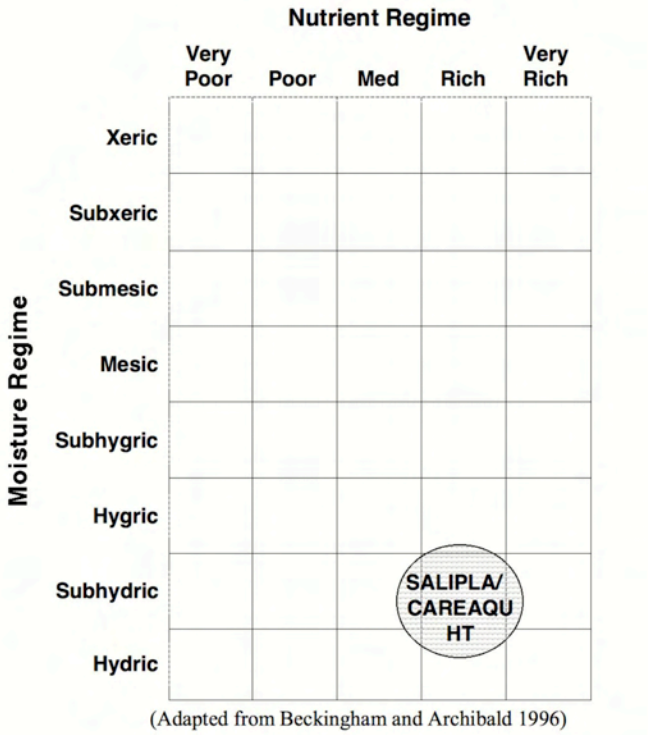


Figure 39. Edatope grid position for the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type (SALIPLA/CAREAQU HT)

SOILS

Mineral soils typically are gleyed and have textures from sandy loam to clay covered by an organic layer of varying thickness on sites of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type. Mineral soil textures on sampled stands ranged from silty sand to silty clay loam. This type has high water table in spring and early summer, but water may drop below one meter by fall (USDA Intermountain Fire Sciences Lab 1995). pH is typically slightly to moderately acidic (USDA Natural Resources Conservation Service. 2001).

ADJACENT COMMUNITIES

Adjacent wetter communities may include the *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), *Carex atherodes* (awned sedge), or open water. Adjacent drier communities may include the *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type, the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type, the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, or the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type.

MANAGEMENT INFORMATION

Livestock

Estimated herbage production is moderate on this type. Short growing seasons and continually wet soils limit livestock use until late summer and fall. These wet site *Carex* (sedges) and *Salix* (willows) offer fair forage value for livestock (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991). Palatability of the *Carex* (sedges) is greater in spring and early summer, but at this time, the sites are generally too wet for livestock access.

Myers (1989) found that deferred and rest rotation grazing systems generally favor *Carex* species (sedge) over *Salix* species (willow) because woody species are more vulnerable to late summer and fall use. Woody species are vulnerable to pruning damage, while *Carex* (sedges) are protected by a root reserve. Late summer and fall grazing of these sites should be carefully controlled.

Frisina (1991) states that 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.

Wildlife
Beaver and moose utilization of *Salix planifolia* (flat-leaved willow) is moderate to high. On some sites, high levels of winter use by moose has almost eliminated stems near or above the snow surface. *Salix planifolia* (flat-leaved willow) provides excellent nesting and foraging habitat for a variety of birds, such as ducks, shorebirds, warblers, vireos, and sparrows (USDA Intermountain Fire Sciences Lab 1995)

Fisheries
The dense network of roots from the *Salix* (willows) and *Carex* (sedges) are effective in stabilizing streambanks. Immediately adjacent to the stream, the banks be undercut and sag into the water providing excellent cover for fish. The *Salix* (willows) provide valuable overhanging stream cover and shade. The importance of *Salix* (willows) in streambank protection, cover, and thermal protection for fisheries cannot be over emphasized.

Fire
The wet habitats *Salix planifolia* (flat-leaved willow) occupies rarely burn. In fact, these areas frequently act as firebreaks. However, under dry conditions, riparian habitats can burn severely. Most *Salix* (willows) sprout from the root crown following top-kill 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. *Salix planifolia* (flat-leaved willow) wind-dispersed seeds may be important in colonizing nearby burned areas. (USDA Intermountain Fire Sciences Lab 1995)

Soil Management and Rehabilitation Opportunities
The *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type is only slightly resistant to trampling by livestock, big game, packstock, and campers. Rutting can be severe when packstock or hikers use occurs on wet soils. This can result in the development of wide, multi path trails. Off road vehicle use causes serious long-term damage on these sites. Care should be taken to maintain existing roads and to discourage off road travel. Any new trails or roads should be located on adjacent uplands.

Salix planifolia (flat-leaved willow) is valuable in revegetating disturbed streambanks. Cuttings should be first rooted then grown in a nursery to enhance survival rates. Cut stems of *Salix planifolia* (flat-leaved willow) produce low to moderate numbers of roots, located along the entire length of the stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm long and greater than 1 cm in diameter produces the best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting (Hansen and others 1995).

Recreational Uses and Considerations
These sites provide excellent opportunities for hunting and viewing wildlife such as moose, beaver, and waterfowl. Sites also provide access points for fishing. High levels of human use in the spring and summer can damage soils.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

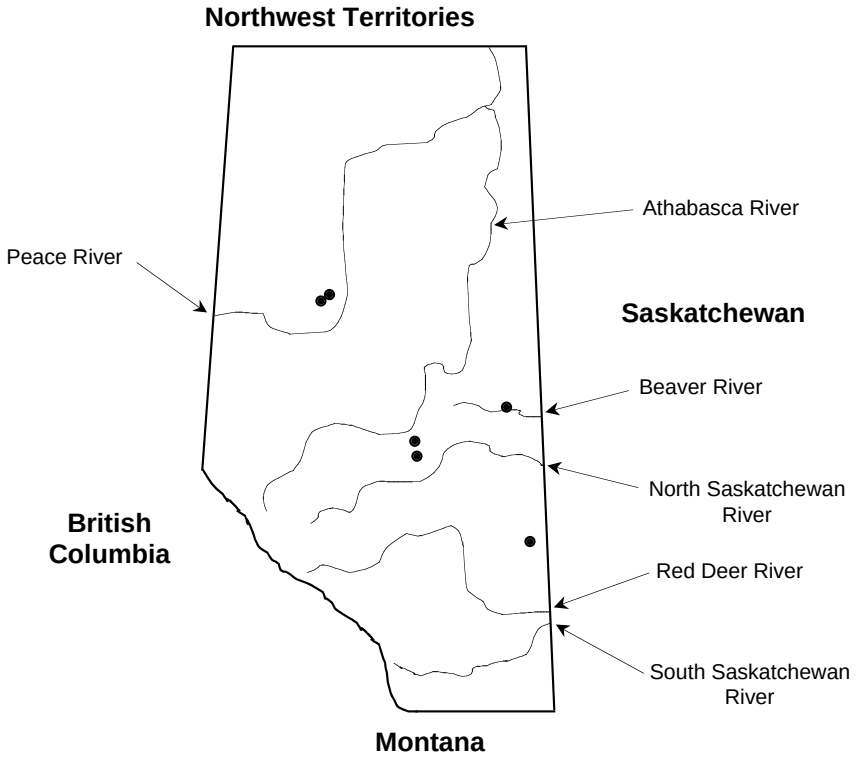
Sites of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type in the Dry Mixedwood Natural Region occur within the shrubby phase of the rich fen ecosite (k2) with a subhydric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). This habitat type was not observed in the Parkland Natural Region.

OTHER STUDIES

Thompson and Hansen (2002) describe a *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type in the Alberta Grassland Natural Region. Willoughby (2000) and Lane and others (2000) describe *Salix/Carex* (willow/sedge) community types for the Lower Foothills and the Mixedwood Subregions. Beckingham and Archibald (1996) in northern Alberta and Beckingham, Nielsen, and Futoransky (1996) in the Mid-Boreal ecoregions of Saskatchewan describe *Salix/Carex/*moss (willow/sedge/moss) community types of the shrubby rich fen ecosites.

SALIPLA/CORNSTO
Number of Stands Sampled = 8
Number of Stands Sampled in Alberta = 7

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type is an incidental type in the Dry Mixedwood Natural Subregion. It occupies moist areas on alluvial terraces, around lakes and sloughs, and low-lying forest sites. This type occupies locations with a more mesic moisture regime. On a scale of site hydrology, this type lies between sites supporting *Carex* species (sedge) or *Calamagrostis canadensis* (bluejoint) and sites with tree types. *Salix planifolia* (flat-leaved willow) is found more commonly on lentic sites that have less aerated water (e.g., fens, sloughs, and lakeshores) than on lotic sites by flowing water. Stands were sampled near Gooseberry Lake north of Consort, on the Beaver River north of St. Paul, in the lower Peace River Valley near Dixonville, near Gunn, and near Barrhead.

VEGETATION

This type is dominated by a dense stand of *Salix planifolia* (flat-leaved willow) in the tallest layer and *Cornus stolonifera* (red-osier dogwood) in a moist shrub understory (Table 34). The herbaceous layer is quite sparse in relatively undisturbed stands.

Table 34. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 3 relatively undisturbed late seral to climax stands of the *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	2	0-3	67	12
Shrubs				
Betula pumila (dwarf birch)	1	0-1	33	6
Cornus canadensis (bunchberry)	1	0-1	33	6
Cornus stolonifera (red-osier dogwood)	14	3-30	100	37
Lonicera involucrata (bracted honeysuckle)	2	0-3	67	12
Ribes hudsonianum (northern black currant)	3	0-3	33	10
Ribes lacustre (bristly black currant)	3	0-3	33	10
Rosa spp. (rose)	1	0-1	33	6
Rubus idaeus (wild red raspberry)	10	0-10	33	18
Rubus pubescens (dewberry)	1	0-1	67	8
Salix bebbiana (beaked willow)	3	0-3	33	10
Salix discolor (pussy willow)	3	0-3	33	10
Salix planifolia (flat-leaved willow)	77	70-90	100	88
Salix pseudomonticola (false mountain willow)	1	0-1	33	6
Graminoids				
Bromus ciliatus (fringed brome)	3	0-3	33	10
Calamagrostis canadensis (bluejoint)	6	0-10	67	18
Carex aquatilis (water sedge)	1	0-1	33	6
Poa palustris (fowl bluegrass)	3	0-3	33	10
Forbs				
Achillea sibirica (many-flowered yarrow)	1	0-1	67	8
Actaea rubra (red and white baneberry)	1	0-1	33	6
Aster conspicuus (showy aster)	1	0-1	33	6
Aster laevis (smooth aster)	1	0-1	33	6
Caltha palustris (marsh-marigold)	10	0-10	33	18
Epilobium angustifolium (common fireweed)	1	0-1	67	8
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	33	6
Fragaria virginiana (wild strawberry)	2	0-3	67	12
Galium trifidum (small bedstraw)	3	0-3	33	10
Galium triflorum (sweet-scented bedstraw)	1	0-1	33	6
Menyanthes trifoliata (buck-bean)	3	0-3	33	10
Petasites sagittatus (arrow-leaved coltsfoot)	3	0-3	33	10
Potentilla palustris (marsh cinquefoil)	1	0-1	33	6
Pyrola asarifolia (common pink wintergreen)	1	0-1	33	6
Scutellaria galericulata (marsh skullcap)	1	0-1	67	8
Senecio eremophilus (cut-leaved ragwort)	1	0-1	33	6
Sium suave (water parsnip)	1	0-1	33	6
Smilacina trifolia (three-leaved Solomon's-seal)	1	0-1	67	8
Stachys palustris (marsh hedge-nettle)	1	0-1	33	6
Taraxacum officinale (common dandelion)	1	0-1	33	6
Thalictrum spp. (meadow rue)	1	0-1	33	6
Urtica dioica (common nettle)	3	0-3	33	10
Ferns and Allies				
Equisetum arvense (common horsetail)	3	0-3	33	10
Equisetum fluviatile (swamp horsetail)	3	0-3	33	10

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

With prolonged moderate to high levels of grazing pressure, the stand will lose its tall/moist shrub understory to a more diverse set of shorter/drier, generally less palatable, shrubs such as *Ribes* (currants), *Rosa* species (rose), *Rubus* (raspberries), and *Symphoricarpos* species (buckbrush). Herbaceous disturbance-increasers such as *Bromus inermis* (awnless brome), *Juncus balticus* (wire rush), *Poa pratensis* (Kentucky bluegrass), *Sonchus* species (sow-thistle), and *Taraxacum officinale* (common dandelion) begin to dominate the understory (Table 35). This disturbance has the effect of drying out the site and can eventually result in the grazing induced *Salix planifolia* (flat-leaved willow) community type. Figure 40 shows a schematic diagram of expected successional vegetation pathways on sites of this type.

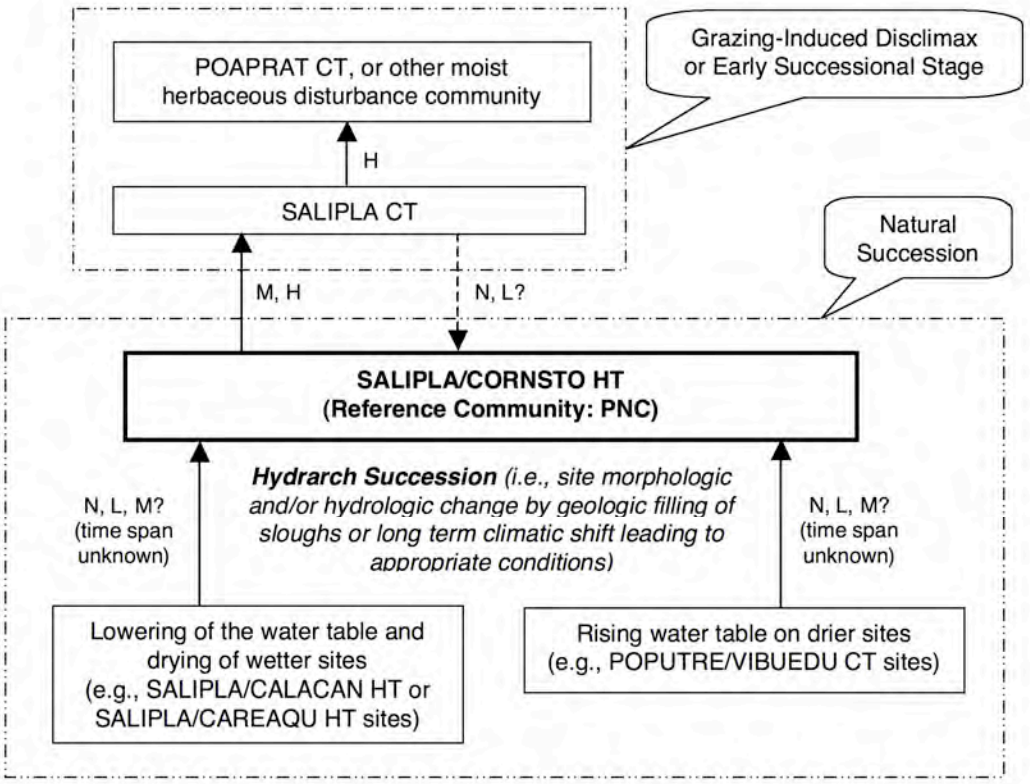
Table 35. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 5 disturbed or early seral stands of the *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Picea glauca (white spruce)	1	0-1	20	4
Populus balsamifera (balsam poplar)	2	0-3	60	8
Shrubs				
Amelanchier alnifolia (Saskatoon)	1	0-1	20	4
Betula occidentalis (water birch)	1	0-1	20	4
Cornus stolonifera (red-osier dogwood)	25	3-50	100	50
Lonicera dioica (twining honeysuckle)	1	0-1	20	4
Lonicera involucrata (bracted honeysuckle)	2	0-3	40	9
Ribes americanum (wild black currant)	10	0-10	20	14
Ribes oxyacanthoides (northern gooseberry)	3	0-3	20	8
Ribes triste (wild red currant)	3	0-3	20	8
Rosa spp. (rose)	2	0-3	60	11
Rubus idaeus (wild red raspberry)	17	0-30	40	26
Rubus pubescens (dewberry)	1	0-1	20	4
Salix bebbiana (beaked willow)	15	0-20	40	24
Salix candida (hoary willow)	3	0-3	20	8
Salix drummondiana (Drummond's willow)	20	0-20	20	20
Salix exigua (sandbar willow)	1	0-1	20	4
Salix lutea (yellow willow)	6	0-20	80	22
Salix myrtillifolia (myrtle-leaved willow)	20	0-20	20	20
Salix petiolaris (basket willow)	10	0-10	20	14
Salix planifolia (flat-leaved willow)	32	10-50	100	57
Salix pseudomonticola (false mountain willow)	7	0-10	40	17
Symphoricarpos spp. (buckbrush)	7	0-10	40	17
Viburnum edule (low-bush cranberry)	1	0-1	20	4
Graminoids				
Agropyron repens (quack grass)	1	0-1	20	4
Agrostis stolonifera (redtop)	3	0-3	20	8
Agropyron trachycaulum (slender wheat grass)	2	0-3	40	9
Bromus ciliatus (fringed brome)	1	0-1	40	6
Bromus inermis (awnless brome)	9	0-30	80	27
Calamagrostis canadensis (bluejoint)	10	0-10	40	20
Carex aquatilis (water sedge)	1	0-1	20	4
Carex deweyana (Dewey's sedge)	1	0-1	20	4
Carex praegracilis (graceful sedge)	1	0-1	20	4
Carex utriculata (beaked sedge)	3	0-3	20	8
Carex torreyi (Torrey's sedge)	1	0-1	20	4
Cinna latifolia (drooping wood-reed)	1	0-1	20	4
Glyceria striata (fowl manna grass)	10	0-10	20	14
Juncus balticus (wire rush)	20	0-20	20	20
Phalaris arundinacea (reed canary grass)	7	0-10	40	17
Phleum pratense (timothy)	10	0-10	20	14
Poa palustris (fowl bluegrass)	4	0-10	60	15

Table 35 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Poa pratensis (Kentucky bluegrass)	7	0-10	40	17
Scirpus microcarpus (small-fruited bulrush)	1	0-1	20	4
Sphenopholis obtusata (prairie wedge grass)	1	0-1	20	4
Forbs				
Achillea millefolium (common yarrow)	1	0-1	40	6
Achillea sibirica (many-flowered yarrow)	1	0-1	20	4
Actaea rubra (red and white baneberry)	3	0-3	20	8
Aster borealis (marsh aster)	1	0-1	20	4
Aster hesperius (western willow aster)	1	0-1	40	6
Aster subspicatus (leafy-bracted aster)	1	0-1	20	4
Cicuta maculata (water-hemlock)	10	0-10	20	14
Cirsium arvense (Canada thistle)	2	0-3	40	9
Delphinium glaucum (tall larkspur)	1	0-1	20	4
Fragaria virginiana (wild strawberry)	1	0-1	40	6
Galeopsis tetrahit (hemp-nettle)	1	0-1	20	4
Galium triflorum (sweet-scented bedstraw)	3	0-3	20	8
Geranium richardsonii (wild white geranium)	6	0-10	40	14
Geum aleppicum (yellow avens)	1	0-1	40	6
Habenaria spp. (bog orchid)	1	0-1	20	4
Heracleum lanatum (cow parsnip)	1	0-1	20	4
Lactuca serriola (prickly lettuce)	1	0-1	20	4
Lathyrus ochroleucus (cream-colored vetchling)	1	0-1	20	4
Medicago lupulina (black medick)	1	0-1	20	4
Melilotus officinalis (yellow sweet-clover)	3	0-3	20	8
Mentha arvensis (wild mint)	1	0-1	20	4
Mertensia paniculata (tall lungwort)	2	0-3	40	9
Mitella nuda (bishop's-cap)	1	0-1	20	4
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	20	4
Plantago major (common plantain)	1	0-1	40	6
Potentilla anserina (silverweed)	1	0-1	40	6
Pyrola asarifolia (common pink wintergreen)	3	0-3	20	8
Ranunculus acris (tall buttercup)	1	0-1	20	4
Scutellaria galericulata (marsh skullcap)	1	0-1	20	4
Senecio pauperculus (balsam groundsel)	1	0-1	20	4
Smilacina stellata (star-flowered Solomon's-seal)	1	0-1	40	6
Solidago canadensis (Canada goldenrod)	2	0-3	60	8
Solidago spp. (goldenrod)	1	0-1	20	4
Solidago gigantea (late goldenrod)	3	0-3	20	8
Sonchus arvensis (perennial sow-thistle)	10	0-10	20	14
Sonchus asper (prickly annual sow-thistle)	1	0-1	20	4
Sonchus spp. (sow-thistle)	2	0-3	40	9
Stachys palustris (marsh hedge-nettle)	1	0-1	40	6
Taraxacum officinale (common dandelion)	2	0-3	60	8
Thalictrum venulosum (veiny meadow rue)	3	0-3	40	11
Trifolium repens (white clover)	20	0-20	20	20
Urtica dioica (common nettle)	3	0-3	60	13
Vicia americana (wild vetch)	1	0-1	60	8
Viola canadensis (western Canada violet)	1	0-1	20	4
Ferns and Allies				
Equisetum arvense (common horsetail)	8	0-20	60	22

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.



Successional Pathway of Mesic *Salix planifolia* (flat-leaved willow) Sites in North Central Alberta
Reference Community = *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
POPUTRE/VIBUEDU CT—*Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type
SALIPLA CT—*Salix planifolia* (flat-leaved willow) community type
SALIPLA/CALACAN HT—*Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type e
SALIPLA/CAREAQU HT—*Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type
SALIPLA/CORNSTO HT—*Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type

Figure 40. Successional pathway for sites of the *Salix planifolia/Cornus stolonifera* (flat-leaved 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 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 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 *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

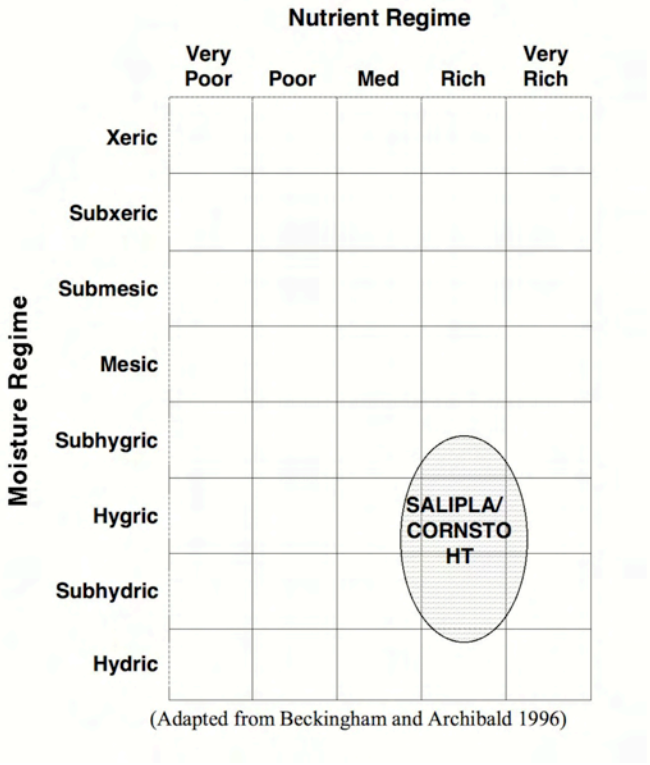


Figure 41. Edatope grid position for the *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type (SALIPLA/CORNSTO HT)

SOILS

Mineral soils typically show redoximorphic features, have textures from sandy loam to clay, and may be covered by an organic layer of varying thickness. Mineral soil textures on sampled stands ranged from sand to silty clay. This type has high water table in spring and early summer, but water may drop below one meter by fall (USDA Intermountain Fire Sciences Lab 1995). pH is typically slightly to moderately acidic (USDA Natural Resources Conservation Service. 2001).

ADJACENT COMMUNITIES

Adjacent wetter communities may include the *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type or the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type. Adjacent drier communities may include the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type, or an upland type.

MANAGEMENT INFORMATION

Livestock

Stands of the *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type provide moderate to high forage production, depending on the density of the shrubs. Palatability of the various species associated with undisturbed stands of this type is often high (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991), and cattle use may be high in the late, hot season as upland vegetation cures and animals seek the shade provided by these communities. Livestock will use this type for forage, shade, and as bedding ground. They will browse the young *Salix* (willow) shoots and, combined with trampling and soil compaction, can alter the age structure and vegetation composition of the stand (Hansen and others 1995).

Cornus stolonifera (red-osier dogwood) is considered an ice cream plant by livestock and wildlife (Lawrence 2002, Hansen and others 1995). Its abundance, and growth form is a direct indication of past and current use levels. Overuse by livestock will reduce vigour of the willows, as indicated by highlined or clubbed growth forms and dead clumps. With continued overuse, *Salix* (willows) will decline in vigour and be eventually eliminated from the site.

Frisina (1991) states that 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.

Wildlife
Beaver and moose utilization of *Salix planifolia* (flat-leaved willow) is moderate to high. On some sites, high levels of winter use by moose has almost eliminated stems near or above the snow surface. *Salix planifolia* (flat-leaved willow) provides excellent nesting and foraging habitat for a variety of birds, such as ducks, shorebirds, warblers, vireos, and sparrows (USDA Intermountain Fire Sciences Lab 1995). *Cornus stolonifera* (red-osier dogwood) is an important forage species for wild ungulates (Tannas 1997).

Fisheries
The dense network of *Salix* (willow) roots is most effective in stabilizing streambanks. Immediately adjacent to the stream, the banks be undercut and sag into the water providing excellent cover for fish. *Salix* (willows) provide valuable overhanging stream cover and shade. The importance of *Salix* (willows) in streambank protection, cover, and thermal protection for fisheries cannot be over emphasized.

Fire
The wet habitats *Salix planifolia* (flat-leaved willow) occupies rarely burn. In fact, these areas frequently act as firebreaks. However, under dry conditions, riparian habitats can burn severely. Most *Salix* (willows) sprout from the root crown following top-kill 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. *Salix planifolia* (flat-leaved willow) wind-dispersed seeds may be important in colonizing nearby burned areas. (USDA Intermountain Fire Sciences Lab 1995)

Soil Management and Rehabilitation Opportunities
Salix planifolia (flat-leaved willow) is valuable in revegetating disturbed streambanks. Cuttings should be first rooted then grown in a nursery to enhance survival rates. Cut stems of *Salix planifolia* (flat-leaved willow) produce low to moderate numbers of roots, located along the entire length of the stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm long and greater than 1 cm in diameter produces the best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting (Hansen and others 1995).

Recreational Uses and Considerations
These sites provide good opportunities for hunting and viewing wildlife such as moose, beaver, and waterfowl. Sites also provide access points for fishing. High levels of human use in the spring and summer can damage soils.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

The *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type in the Dry Mixedwood Natural Subregion occurs on sites lacking a tree cover within the *Cornus stolonifera* (dogwood) ecosite (e) on the wetter edge of the subhygric/rich moisture/nutrient regime, and on the shrubby phase of the rich fen ecosite (k2) with a subhydric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). This habitat type was also observed in the Parkland Natural Region where ecosites have not yet been described.

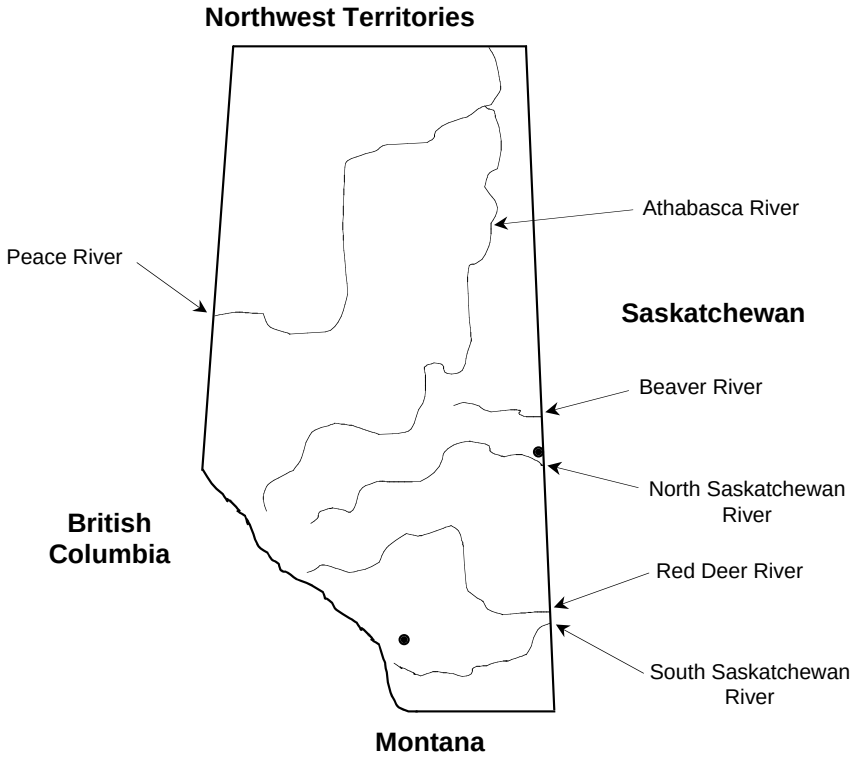
OTHER STUDIES

The *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type has not previously been described in this region.

Salix planifolia Community Type
(Flat-Leaved Willow Community Type)

SALIPLA
Number of Stands Sampled = 5
Number of Stands Sampled in Alberta = 5

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Salix planifolia* (flat-leaved willow) community type is an incidental type at low to mid elevations in the Dry Mixedwood Natural Subregion of central and northern Alberta. It is found in wet-to-moist areas adjacent to lakes, streams, and sloughs where a site of either the *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type, the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type, or the *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type has had its understory vegetation altered by severe grazing pressure. *Salix planifolia* (flat-leaved willow) is found more commonly on lentic sites that have less aerated water (e.g., fens, sloughs, and lakeshores) than on lotic sites by flowing water. Occurrence of this disturbed community type is likely to increase in the Dry Mixedwood as more sites of these habitat types become subjected to a longer history of livestock grazing.

VEGETATION

This type is characterized by a moderate to extensive cover of *Salix planifolia* (flat-leaved willow) with a mix of other *Salix* (willow) species and hydrophytic shrubs over a variety of disturbance related herbs. Other commonly prominent shrubs in this type are *Betula glandulosa* (bog birch), *Ribes oxyacanthoides* (northern gooseberry), *Salix bebbiana* (beaked willow), *Salix myrtillifolia* (myrtle-leaved willow), *Salix petiolaris* (basket willow), and *Salix pseudomonticola* (false mountain willow) (Table 36). Herbs with high frequency and prominence are the disturbance increasers *Poa pratensis* (Kentucky bluegrass) and *Fragaria virginiana* (wild strawberry).

Table 36. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 5 stands of the *Salix planifolia* (flat-leaved willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	1	0-1	40	6
Picea glauca (white spruce)	1	0-1	40	6
Populus balsamifera (balsam poplar)	2	0-3	40	9
Shrubs				
Betula glandulosa (bog birch)	11	0-20	60	26
Linnaea borealis (twinflower)	1	0-1	20	4
Lonicera involucrata (bracted honeysuckle)	2	0-3	40	9
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	20	4
Ribes oxyacanthoides (northern gooseberry)	5	0-10	60	17
Rosa spp. (rose)	1	0-1	60	8
Rubus arcticus (dwarf raspberry)	2	0-3	40	9
Rubus pubescens (dewberry)	1	0-1	20	4
Salix bebbiana (beaked willow)	12	0-20	80	31
Salix discolor (pussy willow)	12	0-20	40	22
Salix exigua (sandbar willow)	3	0-3	20	8
Salix lucida (shining willow)	3	0-3	20	8
Salix lutea (yellow willow)	10	0-10	20	14
Salix maccalliana (velvet-fruited willow)	40	0-40	20	28
Salix myrtillifolia (myrtle-leaved willow)	10	0-10	40	20
Salix petiolaris (basket willow)	15	0-20	40	24
Salix planifolia (flat-leaved willow)	28	10-40	100	53
Salix pseudomonticola (false mountain willow)	9	0-20	60	23
Graminoids				
Agropyron trachycaulum (slender wheat grass)	3	0-3	20	8
Alopecurus spp. (foxtail)	3	0-3	20	8
Bromus ciliatus (fringed brome)	1	0-1	20	4
Calamagrostis canadensis (bluejoint)	3	0-3	20	8
Calamagrostis spp. (reed grass)	3	0-3	20	8
Calamagrostis stricta (narrow reed grass)	1	0-1	20	4
Carex aquatilis (water sedge)	1	0-1	20	4
Carex atherodes (awned sedge)	1	0-1	40	6
Carex disperma (two-seeded sedge)	3	0-3	20	8
Carex utriculata (beaked sedge)	1	0-1	40	6
Carex spp. (sedge)	3	0-3	20	8
Festuca spp. (fescue)	1	0-1	20	4
Juncus balticus (wire rush)	3	0-3	20	8
Luzula parviflora (small-flowered wood-rush)	1	0-1	20	4
Poa palustris (fowl bluegrass)	7	0-10	40	17
Poa pratensis (Kentucky bluegrass)	15	0-40	60	30
Scirpus microcarpus (small-fruited bulrush)	50	0-50	20	32
Scirpus validus (common great bulrush)	3	0-3	20	8
Forbs				
Angelica arguta (white angelica)	2	0-3	40	9
Aster borealis (marsh aster)	1	0-1	20	4
Aster conspicuus (showy aster)	1	0-1	20	4
Aster hesperius (western willow aster)	1	0-1	20	4
Aster laevis (smooth aster)	1	0-1	20	4
Aster modestus (large northern aster)	1	0-1	20	4
Aster subspicatus (leafy-bracted aster)	3	0-3	20	8
Cirsium arvense (Canada thistle)	1	0-1	40	6
Delphinium glaucum (tall larkspur)	3	0-3	20	8
Epilobium angustifolium (common fireweed)	2	0-3	40	9
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	40	6

Table 36 (cont.)

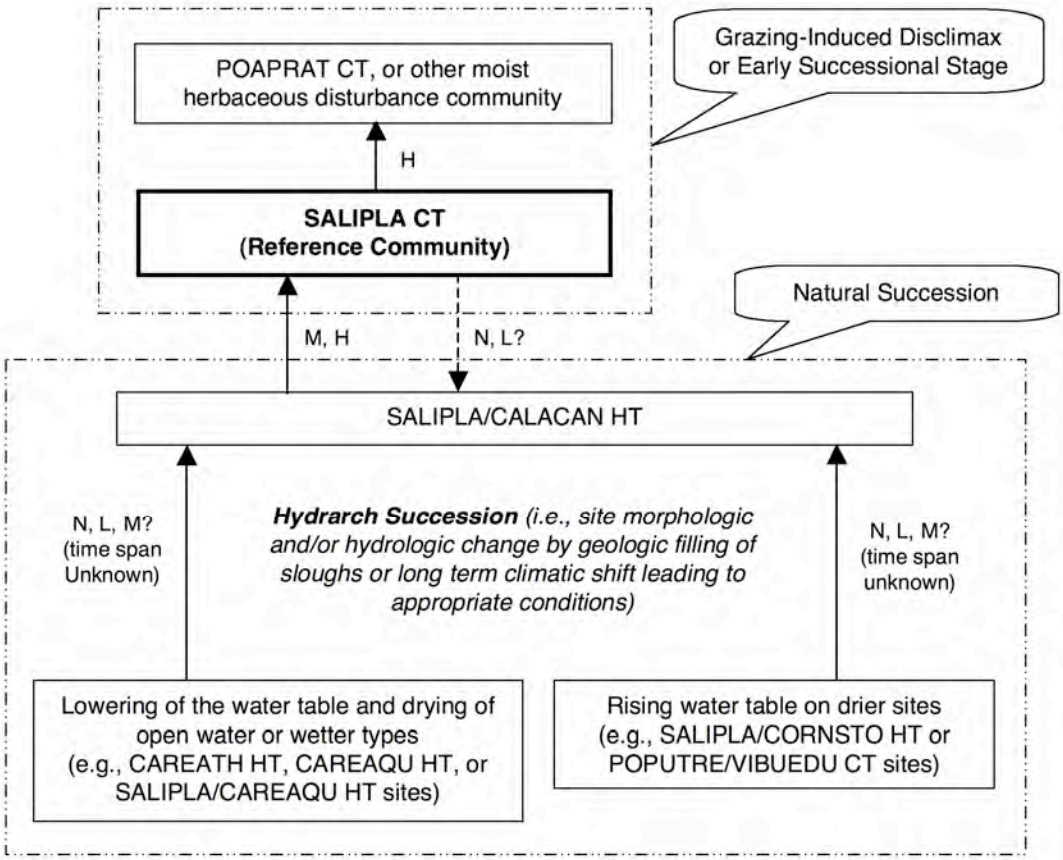
Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Fragaria virginiana (wild strawberry)	7	0-10	60	20
Galium boreale (northern bedstraw)	1	0-1	20	4
Geranium richardsonii (wild white geranium)	3	0-3	20	8
Geum aleppicum (yellow avens)	1	0-1	40	6
Geum macrophyllum (large-leaved yellow avens)	7	0-10	40	17
Habenaria spp. (bog orchid)	1	0-1	40	6
Mertensia paniculata (tall lungwort)	1	0-1	20	4
Mitella nuda (bishop's-cap)	1	0-1	20	4
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	20	4
Pyrola asarifolia (common pink wintergreen)	3	0-3	20	8
Scutellaria galericulata (marsh skullcap)	1	0-1	20	4
Smilacina stellata (star-flowered Solomon's-seal)	1	0-1	40	6
Sonchus spp. (sow-thistle)	10	0-10	20	14
Stachys palustris (marsh hedge-nettle)	1	0-1	20	4
Stellaria longipes (long-stalked chickweed)	1	0-1	20	4
Taraxacum officinale (common dandelion)	3	0-3	20	8
Typha latifolia (common cattail)	3	0-3	20	8
Urtica dioica (common nettle)	1	0-1	20	4
Vicia americana (wild vetch)	1	0-1	40	6
Viola palustris (marsh violet)	1	0-1	20	4
Ferns and Allies				
Equisetum arvense (common horsetail)	5	0-10	60	17

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The *Salix planifolia* (flat-leaved willow) community type is an early seral, or disturbed, stage of either the *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type, the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type, or the *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type. Whether a stand of this type still has the potential for regaining the community from which it was degraded will depend on whether viable remnants of the late seral understory community components are present, on how much the physical site parameters have been altered, and on how completely the site has been occupied by aggressive invader species.

Figure 42 shows a schematic diagram of the common pathways for succession for sites of the *Salix planifolia* (flat-leaved willow) community type on mesic sites of the *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type in North Central Alberta.



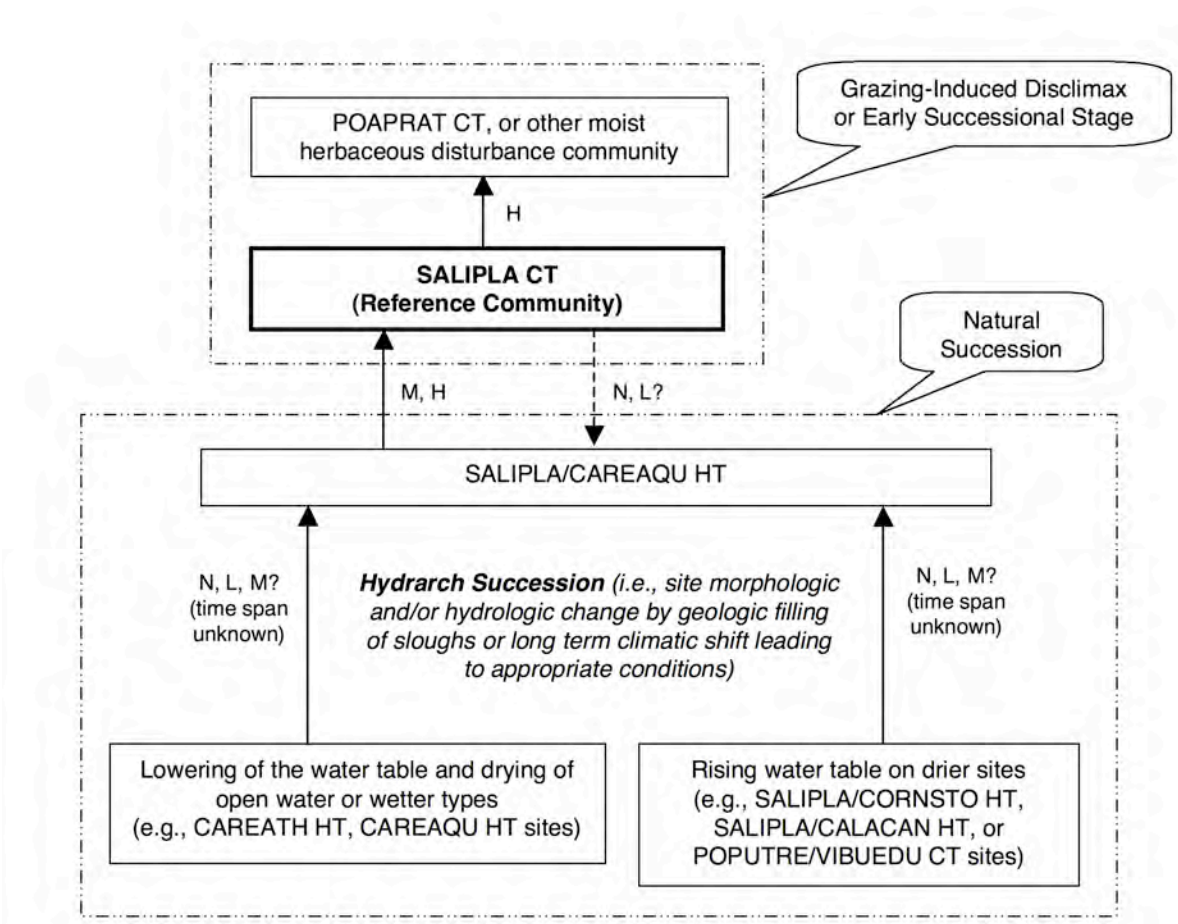
Successional Pathway of Mesic *Salix planifolia* (flat-leaved willow) Sites in North Central Alberta
Reference Community = *Salix planifolia* (flat-leaved willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREATH HT—*Carex atherodes* (awned sedge) habitat type
CAREAQU HT—*Carex aquatilis* (water sedge) habitat type
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) Community Type
POPUTRE/VIBUEDU CT—*Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type
SALIPLA CT—*Salix planifolia* (flat-leaved willow) community type
SALIPLA/CALACAN HT—*Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type
SALIPLA/CAREAQU HT—*Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type
SALIPLA/CORNSTO HT—*Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type

Figure 42. Successional pathway on mesic sites of the seral *Salix planifolia* (flat-leaved willow) community type of the *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) 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 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.

Figure 43 shows a schematic diagram of the common pathways for succession for sites of the *Salix planifolia* (flat-leaved willow) community type on very moist sites of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type in North Central Alberta.



Successional Pathway of Very Moist *Salix planifolia* (flat-leaved willow) Sites in North Central Alberta
Reference Community = *Salix planifolia* (flat-leaved willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

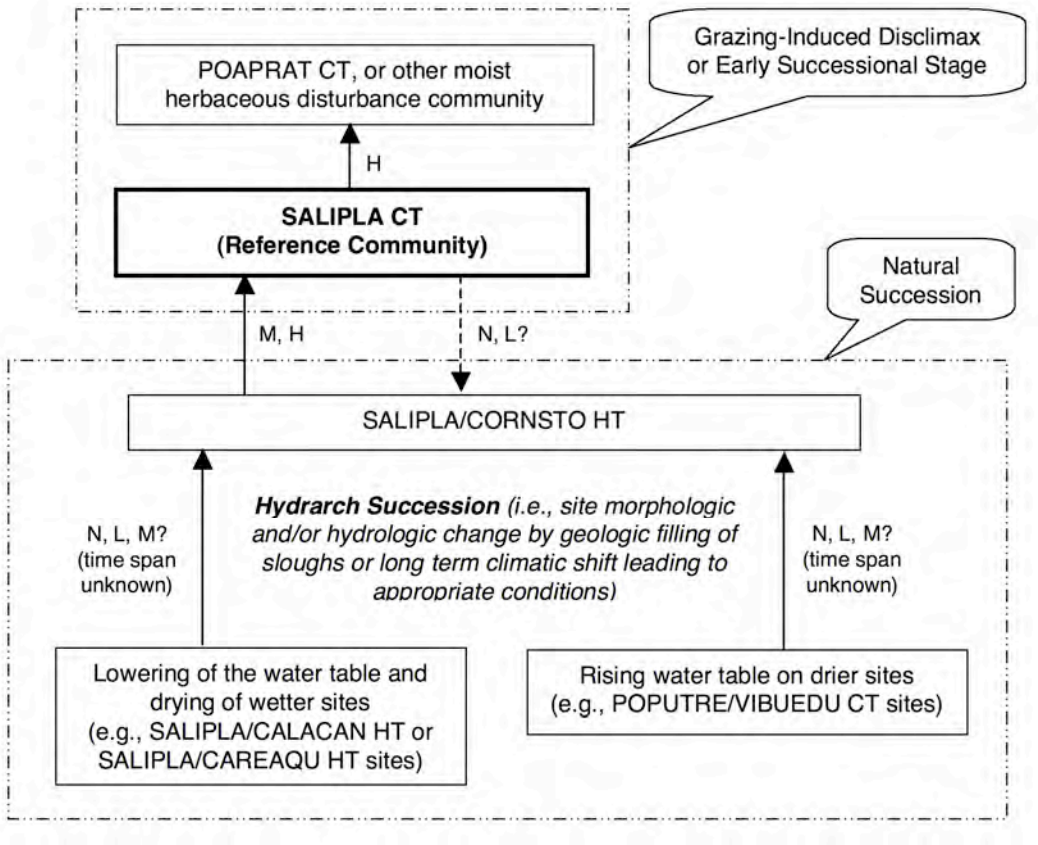
KEY TO 7-LETTER CODES
CAREAQU HT—*Carex aquatilis* (water sedge) habitat type
CAREATH HT—*Carex atherodes* (awned sedge) habitat type
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
POPUTRE/VIBUEDU CT—*Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type
SALIPLA CT—*Salix planifolia* (flat-leaved willow) community type
SALIPLA/CALACAN HT—*Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type
SALIPLA/CAREAQU HT—*Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type
SALIPLA/CORNSTO HT—*Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type

Figure 43. Successional pathway on very moist sites of the seral *Salix planifolia* (flat-leaved willow) community type 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 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.

Successional pathway for sites of the *Salix planifolia* (flat-leaved willow) community type on mesic sites of the *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type

Figure 44 shows a schematic diagram of the common pathways for succession on sites of the *Salix planifolia* (flat-leaved willow) community type on mesic sites of the *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type in North Central Alberta.



Successional Pathway of Mesic *Salix planifolia* (flat-leaved willow) Sites in North Central Alberta
Reference Community = *Salix planifolia* (flat-leaved willow) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
POPUTRE/VIBUEDU CT—*Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type
SALIPLA CT—*Salix planifolia* (flat-leaved willow) community type
SALIPLA/CALACAN HT—*Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type e
SALIPLA/CAREAQU HT—*Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type
SALIPLA/CORNSTO HT—*Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type

Figure 44. Successional pathway on mesic sites of the seral *Salix planifolia* (flat-leaved willow) community type of the *Salix planifolia/Cornus stolonifera* (flat-leaved 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 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.

SOILS

Mineral soils typically are gleyed and have textures from sandy loam to clay covered by an organic layer of varying thickness on sites of the *Salix planifolia* (flat-leaved willow) community type. Mineral soil textures on all sampled stands dominated by *Salix planifolia* (flat-leaved willow) ranged from silty sand to silty clay. This type has high water table in spring and early

summer, but water may drop below one meter by fall (USDA Intermountain Fire Sciences Lab 1995). pH is typically slightly to moderately acidic (USDA Natural Resources Conservation Service. 2001).

ADJACENT COMMUNITIES

Adjacent wetter sites may include the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type, the *Carex aquatilis* (water sedge) habitat type, the *Carex utriculata* (beaked sedge) habitat type, the *Carex atherodes* (awned sedge) habitat type, any of several emergent herbaceous types, or be open water. Adjacent drier communities may include the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type, or an upland type.

MANAGEMENT INFORMATION

Livestock

Livestock has usually opened stands of this type. Forage productivity may still be moderate to high with species like *Poa pratensis* (Kentucky bluegrass), resulting in potentially even heavier utilization, especially as nearby upland vegetation dries. *Poa pratensis* (Kentucky bluegrass) is a palatable and moderately productive grass (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991), especially when soil moisture levels are high. It tolerates a high degree of utilization. With continued overuse, *Salix* (willows) show a sharp decline in cover and may be eliminated from the site.

To minimize undesired changes in community composition and structure, pasture or allotment management should be based on the forage available from stands of this and other riparian or wetland communities. This concept of the riparian or wetland pasture has had some success in maintaining or improving the health of riparian or wetland vegetation (Kinch 1987).

Frisina (1991) states that 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.

Wildlife

Beaver and moose utilization of *Salix planifolia* (flat-leaved willow) is moderate to high. On some sites, high levels of winter use by moose has almost eliminated stems near or above the snow surface. *Salix planifolia* (flat-leaved willow) provides excellent nesting and foraging habitat for a variety of birds, such as ducks, shorebirds, warblers, vireos, and sparrows (USDA Intermountain Fire Sciences Lab 1995).

Fisheries

The dense network of *Salix* (willow) roots is most effective in stabilizing streambanks. Immediately adjacent to the stream, the banks be undercut and sag into the water providing excellent cover for fish. *Salix* (willows) provide valuable overhanging stream cover and shade. The importance of *Salix* (willows) in streambank protection, cover, and thermal protection for fisheries cannot be over emphasized.

Fire

The wet habitats *Salix planifolia* (flat-leaved willow) occupies rarely burn. In fact, these areas frequently act as firebreaks. However, under dry conditions, riparian habitats can burn severely. Most *Salix* (willows) sprout from the root crown following top-kill 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. *Salix planifolia* (flat-leaved willow) wind-dispersed seeds may be important in colonizing nearby burned areas. (USDA Intermountain Fire Sciences Lab 1995)

Soil Management and Rehabilitation Opportunities

Salix planifolia (flat-leaved willow) is valuable in revegetating disturbed streambanks. Cuttings should be first rooted then grown in a nursery to enhance survival rates. Cut stems of *Salix planifolia* (flat-leaved willow) produce low to moderate numbers of roots, located along the entire length of the stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm long and greater than 1 cm in diameter produces the best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting (Hansen and others 1995).

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Salix planifolia* (flat-leaved willow) community type in the Dry Mixedwood Natural Region occur within the shrubby phase of the rich fen ecosite with a subhydric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). This community type was not observed in the Parkland Natural Region.

OTHER STUDIES

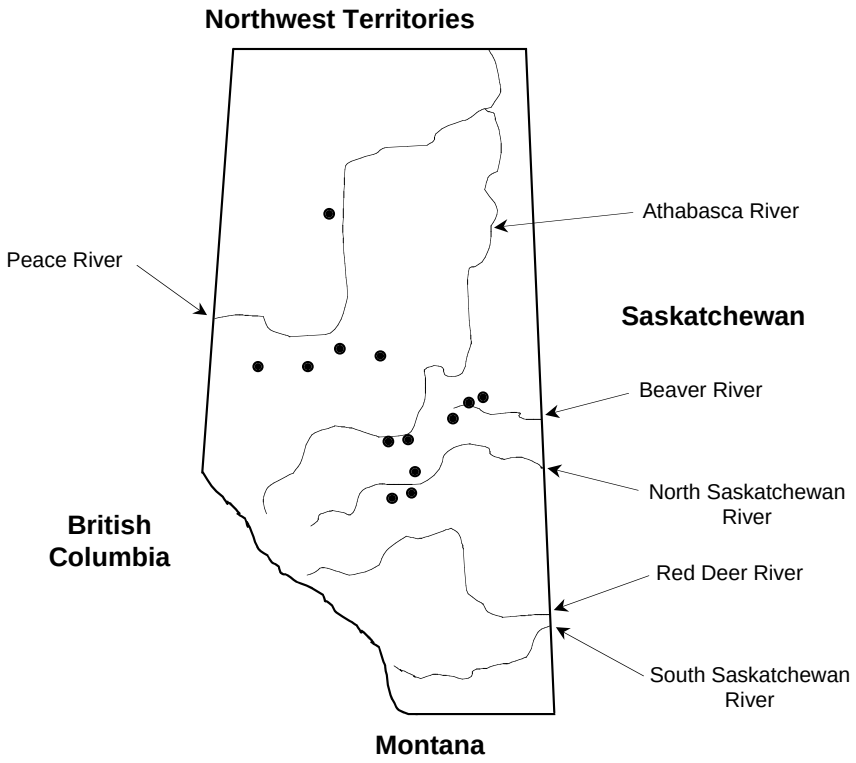
Thompson and Hansen (2002) described a *Salix planifolia* (flat-leaved willow) community type for early seral or disturbed sites in the Alberta Grassland Natural Region. Willoughby (2000) and Lane and others (2000) describe *Salix/Poa*

pratensis/Taraxacum (willow/Kentucky bluegrass/dandelion) community types for the Lower Foothills and the Mixedwood Subregions.

Salix scouleriana Community Type (Scouler's Willow Community Type)

SALISCO
Number of Stands Sampled = 20
Number of Stands Sampled in Alberta = 20

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Salix scouleriana* (Scouler's willow) community type is an incidental to minor type in the Dry Mixedwood Natural Subregion, occurring on low sites with continually high water tables adjacent to forested lakes. Sites are typically along the shallow edges of lakes, and rarely occupy large areas. *Salix scouleriana* (Scouler's willow) exhibits a broad range of adaptation to soil and moisture conditions in other regions of the northwestern North America, but this is the only case in which it is known to occur as an upper canopy dominant. Among typical stands sampled were sites on Pigeon Lake southwest of Edmonton, Thunder Lake near Barrhead, Long Lake near Boyle, Lesser Slave Lake, Saskatoon Lake near Grande Prairie, and Twin Lakes near Keg River in the Peace River Valley.

VEGETATION

This type is dominated by a dense canopy of tall *Salix scouleriana* (Scouler's willow) that reach small tree stature, and is likely to include small amounts of the tree species *Betula papyrifera* (white birch), *Picea glauca* (white spruce), *Populus balsamifera* (balsam poplar), and *Populus tremuloides* (aspen). Also commonly present are *Cornus stolonifera* (red-osier dogwood), *Lonicera involucrata* (bracted honeysuckle), *Rubus* species (raspberry), and other *Salix* (willows) in a mid height understory layer (Table 37). Prominent herbs of this type include *Calamagrostis canadensis* (bluejoint), *Carex atherodes* (awned sedge), *Urtica dioica* (common nettle), and *Equisetum arvense* (common horsetail).

Stands of *Salix scouleriana* (Scouler's willow) community type are some of the most likely sites to find such interesting flowering plants as *Caltha palustris* (marsh-marigold), *Circaea alpina* (small enchanter's nightshade), and *Impatiens* species (touch-me-not).

Table 37. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 20 stands of the *Salix scouleriana* (Scouler's willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	2	0-3	30	8
Picea glauca (white spruce)	2	0-3	15	4
Populus balsamifera (balsam poplar)	2	0-3	30	8
Populus tremuloides (aspen)	1	0-1	10	3
Shrubs				
Alnus tenuifolia (river alder)	9	0-20	25	15
Amelanchier alnifolia (Saskatoon)	2	0-3	10	4
Cornus canadensis (bunchberry)	2	0-3	15	4
Cornus stolonifera (red-osier dogwood)	8	0-30	80	24
Corylus cornuta (beaked hazelnut)	1	0-1	10	3
Ledum groenlandicum (common Labrador tea)	1	0-1	5	2
Lonicera spp. (honeysuckle)	3	0-3	5	4
Lonicera dioica (twining honeysuckle)	1	0-1	15	4
Lonicera involucrata (bracted honeysuckle)	4	0-10	60	13
Prunus virginiana (choke cherry)	1	0-1	5	2
Ribes americanum (wild black currant)	2	0-3	10	4
Ribes glandulosum (skunk currant)	7	0-20	20	12
Ribes hirtellum (wild gooseberry)	3	0-3	5	4
Ribes hudsonianum (northern black currant)	7	0-10	10	8
Ribes lacustre (bristly black currant)	6	0-10	10	7
Ribes oxyacanthoides (northern gooseberry)	2	0-3	15	4
Ribes triste (wild red currant)	2	0-3	20	6
Rosa spp. (rose)	3	0-10	25	9
Rubus idaeus (wild red raspberry)	4	0-10	65	16
Rubus pubescens (dewberry)	1	0-3	70	8
Salix bebbiana (beaked willow)	2	0-3	10	4
Salix myrtillifolia (myrtle-leaved willow)	1	0-1	5	2
Salix petiolaris (basket willow)	1	0-1	5	2
Salix planifolia (flat-leaved willow)	5	0-10	15	9
Salix pseudomonticola (false mountain willow)	8	0-20	15	11
Salix scouleriana (Scouler's willow)	59	10-90	100	77
Sorbus scopulina (western mountain-ash)	1	0-1	5	2
Spiraea betulifolia (white meadowsweet)	1	0-1	5	2
Symphoricarpos spp. (buckbrush)	2	0-3	10	4
Symphoricarpos occidentalis (buckbrush)	1	0-1	5	2
Viburnum edule (low-bush cranberry)	6	0-20	20	10
Graminoids				
Agropyron trachycaulum (slender wheat grass)	1	0-1	5	2
Bromus ciliatus (fringed brome)	1	0-1	20	4
Calamagrostis canadensis (bluejoint)	24	0-98	80	44
Carex aquatilis (water sedge)	1	0-1	5	2
Carex atherodes (awned sedge)	9	0-60	45	20
Carex curta (short sedge)	3	0-3	5	4
Carex deweyana (Dewey's sedge)	1	0-1	5	2
Carex diandra (two-stamened sedge)	10	0-10	5	7
Carex disperma (two-seeded sedge)	1	0-1	5	2
Carex utriculata (beaked sedge)	2	0-3	10	4
Carex spp. (sedge)	1	0-1	10	3

Table 37 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Cinna latifolia (drooping wood-reed)	5	0-20	25	11
Glyceria grandis (common tall manna grass)	3	0-3	5	4
Glyceria striata (fowl manna grass)	7	0-10	10	8
Poa palustris (fowl bluegrass)	3	0-3	25	9
Scirpus validus (common great bulrush)	1	0-1	5	2
Forbs				
Achillea millefolium (common yarrow)	1	0-1	5	2
Actaea rubra (red and white baneberry)	1	0-1	10	3
Adoxa moschatellina (moschatel)	1	0-1	5	2
Aralia nudicaulis (wild sarsaparilla)	3	0-10	30	8
Aster conspicuus (showy aster)	1	0-1	20	4
Aster hesperius (western willow aster)	1	0-1	5	2
Aster modestus (large northern aster)	1	0-1	5	2
Aster puniceus (purple-stemmed aster)	2	0-3	10	4
Athyrium filix-femina (lady fern)	3	0-3	5	4
Caltha palustris (marsh-marigold)	10	0-30	30	16
Cerastium vulgatum (common mouse-ear chickweed)	1	0-1	5	2
Cicuta maculata (water-hemlock)	2	0-3	15	5
Circaea alpina (small enchanter's nightshade)	3	0-10	35	8
Cirsium arvense (Canada thistle)	1	0-1	15	4
Clintonia uniflora (corn lily)	1	0-1	5	2
Delphinium glaucum (tall larkspur)	1	0-1	5	2
Disporum trachycarpum (fairybells)	1	0-1	5	2
Dryopteris carthusiana (narrow spinulose shield fern)	1	0-1	5	2
Epilobium angustifolium (common fireweed)	1	0-3	35	6
Epilobium ciliatum (northern willowherb)	3	0-3	20	6
Fragaria vesca (woodland strawberry)	1	0-1	5	2
Fragaria virginiana (wild strawberry)	2	0-3	10	4
Galeopsis tetrahit (hemp-nettle)	2	0-3	10	4
Galium boreale (northern bedstraw)	1	0-1	15	4
Galium trifidum (small bedstraw)	1	0-1	15	4
Galium triflorum (sweet-scented bedstraw)	1	0-3	65	8
Geum aleppicum (yellow avens)	1	0-3	45	7
Geum macrophyllum (large-leaved yellow avens)	1	0-1	5	2
Gymnocarpium dryopteris (oak fern)	1	0-1	5	2
Heracleum lanatum (cow parsnip)	2	0-3	15	4
Impatiens noli-tangere (western jewelweed)	2	0-3	10	4
Impatiens spp. (touch-me-not)	9	0-30	25	15
Lathyrus ochroleucus (cream-colored vetchling)	1	0-1	10	3
Maianthemum canadense (wild lily-of-the-valle)	1	0-1	5	2
Mentha arvensis (wild mint)	3	0-10	35	10
Mertensia paniculata (tall lungwort)	2	0-3	20	6
Mitella nuda (bishop's-cap)	1	0-3	35	6
Osmorhiza depauperata (spreading sweet cicely)	1	0-1	5	2
Petasites palmatus (palmate-leaved coltsfoot)	1	0-1	25	5
Petasites sagittatus (arrow-leaved coltsfoot)	2	0-3	10	4
Polygonum lapathifolium (pale persicaria)	10	0-10	5	7
Potentilla norvegica (rough cinquefoil)	1	0-1	5	2
Pyrola asarifolia (common pink wintergreen)	1	0-1	10	3
Rumex maritimus (golden dock)	3	0-3	5	4
Rumex occidentalis (western dock)	1	0-1	5	2
Scutellaria galericulata (marsh skullcap)	5	0-20	30	12
Sium suave (water parsnip)	1	0-1	5	2
Smilacina stellata (star-flowered Solomon's-seal)	1	0-1	15	4
Smilacina trifolia (three-leaved Solomon's-seal)	3	0-3	5	4

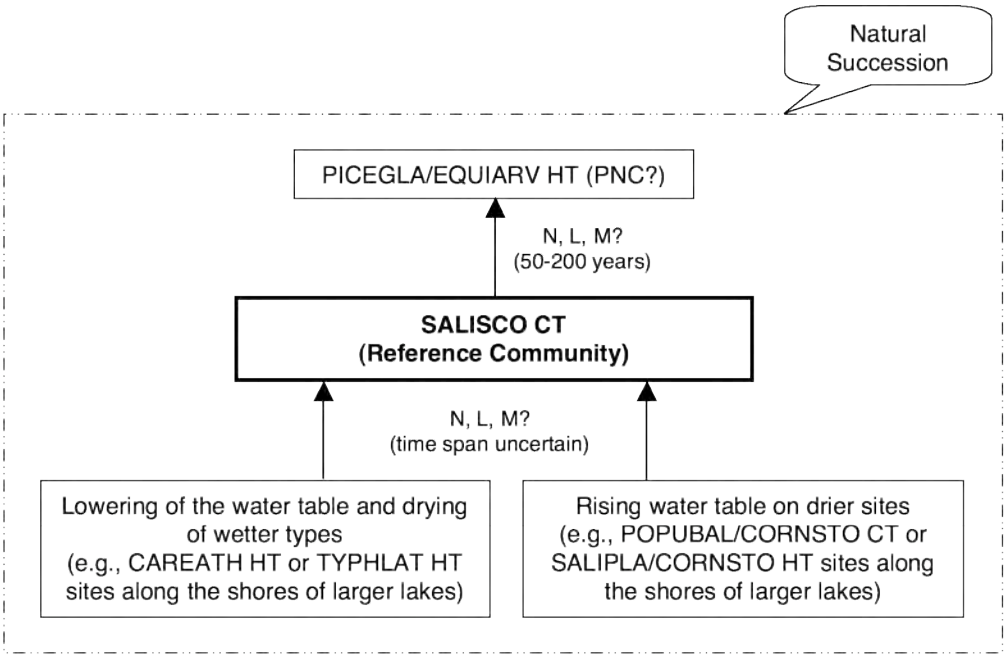
Table 37 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Sonchus spp. (sow-thistle)	1	0-1	10	3
Sparganium spp. (sparganium)	1	0-1	5	2
Stachys palustris (marsh hedge-nettle)	2	0-3	25	7
Stellaria calycantha (northern stitchwort)	1	0-1	5	2
Stellaria longifolia (long-leaved chickweed)	1	0-1	5	2
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0-1	5	2
Taraxacum officinale (common dandelion)	1	0-1	10	3
Thalictrum venulosum (veiny meadow rue)	1	0-1	10	3
Trientalis borealis (northern starflower)	1	0-1	5	2
Trifolium repens (white clover)	1	0-1	5	2
Typha latifolia (common cattail)	10	0-10	5	7
Urtica dioica (common nettle)	9	0-60	70	25
Vicia americana (wild vetch)	1	0-1	25	5
Viola canadensis (western Canada violet)	1	0-1	5	2
Viola renifolia (kidney-leaved violet)	1	0-1	5	2
Ferns and Allies				
Equisetum arvense (common horsetail)	11	0-60	80	30

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The successional status of the *Salix scouleriana* (Scouler's willow) community type is not well understood at this time. According to the US Forest Service, the species is a shade intolerant, persistent seral species that may be an understory component of climax conifer forest stands (USDA Intermountain Fire Sciences Lab 1995). Stands of this type may establish when a rare fire burns hotly enough on normally wet sites to expose mineral soil. This might explain the apparent old age of many stands of very large willows. This type may be a mid-seral stage of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type, as indicated by the presence of trees in more than half of sampled stands. Figure 45 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Salix scouleriana* (Scouler's willow) Sites in North Central Alberta
Reference Community = *Salix scouleriana* (Scouler's willow) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREATH HT—*Carex atherodes* (awned sedge) habitat type
PICEGLA/EQUIARV HT—*Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
SALIPLA/CORNSTO HT—*Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type
SALISCO CT—*Salix scouleriana* (Scouler's willow) community type
TYPHLAT HT—*Typha latifolia* (common cattail) habitat type

Figure 45. 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 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.

Disturbance Stage
Relatively disturbed or early seral stands show a decreased cover and prominence of *Cornus stolonifera* (red-osier dogwood) and other *Salix* species (willows) in favor of *Lonicera* (honeysuckle) and *Ribes* species (currants). In the herbaceous layer, disturbance seems to increase the total number of forb species present. A significant decrease in cover of *Calamagrostis canadensis* (bluejoint) is noted along with a corresponding increase of *Urtica dioica* (common nettle).

EDATOPE

Figure 46 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).

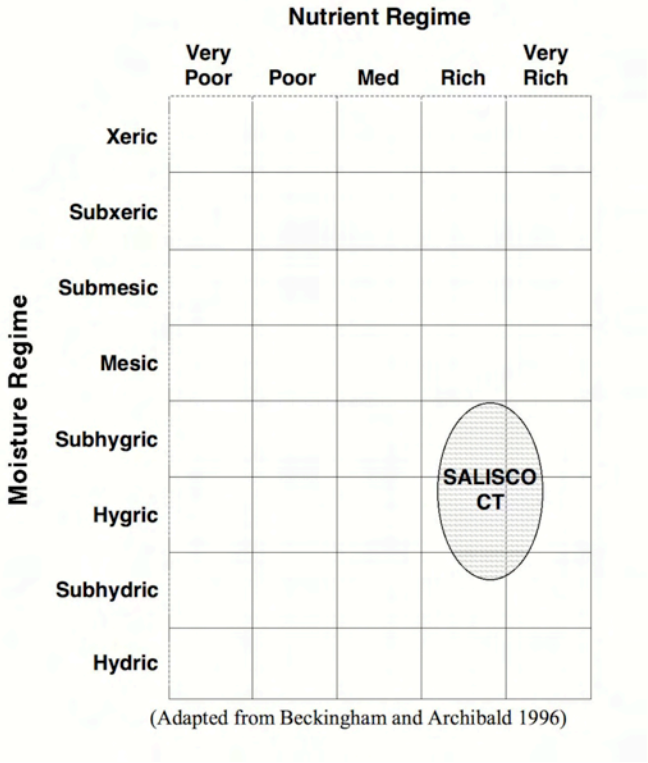


Figure 46. Edatope grid position for the *Salix scouleriana* (Scouler's willow) community type (SALISCO CT)

SOILS

Soils commonly have an organic layer from 5 to 30 cm thick overlaying mineral substrate with textures from sandy loam to sand. Mineral soil textures on sampled stands ranged from fine sand to clay. 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.

ADJACENT COMMUNITIES

Adjacent wetter sites may support the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type, the *Carex aquatilis* (water sedge) habitat type, any of several emergent herbaceous types, or be open water. Adjacent drier sites may support 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.

MANAGEMENT INFORMATION

Livestock

Stands of this type offer low to moderate forage opportunity, and are often too wet for livestock access. Some have begun to be opened allowing for easier livestock access, and in these cases, the forage productivity may increase due to the additional herbaceous cover induced, although a sharp reduction is noted with disturbance in cover of *Calamagrostis canadensis* (bluejoint). Overall, *Salix scouleriana* (Scouler's willow) is of intermediate nutritive quality, containing relatively high amounts of carotene and ascorbic acid, important for ungulate nutrition. It is moderately palatable for domestic livestock (USDA Intermountain Fire Sciences Lab 1995).

To minimize undesired changes in community composition and structure, pasture or allotment management should be based on the forage available from stands of this and other riparian or wetland communities. This concept of the riparian or wetland pasture has had some success in maintaining or improving the health of riparian or wetland vegetation (Kinch 1987).

Frisina (1991) states that 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.

Wildlife

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 (USDA Intermountain Fire Sciences Lab 1995).

Fisheries

The landscape position of the *Salix scouleriana* (Scouler's willow) community type near the edge of Boreal Forest lakes lends it certain importance to fisheries in those lakes. While the functional details of that importance are not available here, suffice it to note that any disruption of lakeside vegetation will be reflected in the lake's biota.

Fire

Salix scouleriana (Scouler's willow) resprouts vigorously from a subterranean root crown in response to disturbance, including fire, flooding, and mechanical damage (USDA Intermountain Fire Sciences Lab 1995). *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 may 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 from *Salix scouleriana* (Scouler's willow) seedlings can be expected on sites where fire exposes mineral soil (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities

Salix scouleriana (Scouler's willow) is readily propagated through cuttings (Plants for a Future 2000), therefore is adaptable to rehabilitating suitable degraded sites where woody plants have been removed. The species is effective in revegetation projects. It has been especially successful in establishing in riparian areas and at the base of dry slopes with sufficient moisture. *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. It may also be useful for rehabilitating recreation areas; 90 percent rooting success has been achieved for planted cuttings (USDA Intermountain Fire Sciences Lab 1995).

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Salix scouleriana* (Scouler's willow) community type in the Dry Mixedwood Natural Subregion occur within the *Cornus stolonifera* (dogwood) (e) and *Equisetum* (horsetail) (f) ecosites that have subhygric/rich and hygric/rich moisture/nutrient regimes, as described by Beckingham and Archibald (1996). This community type was not observed in the Parkland Natural Region.

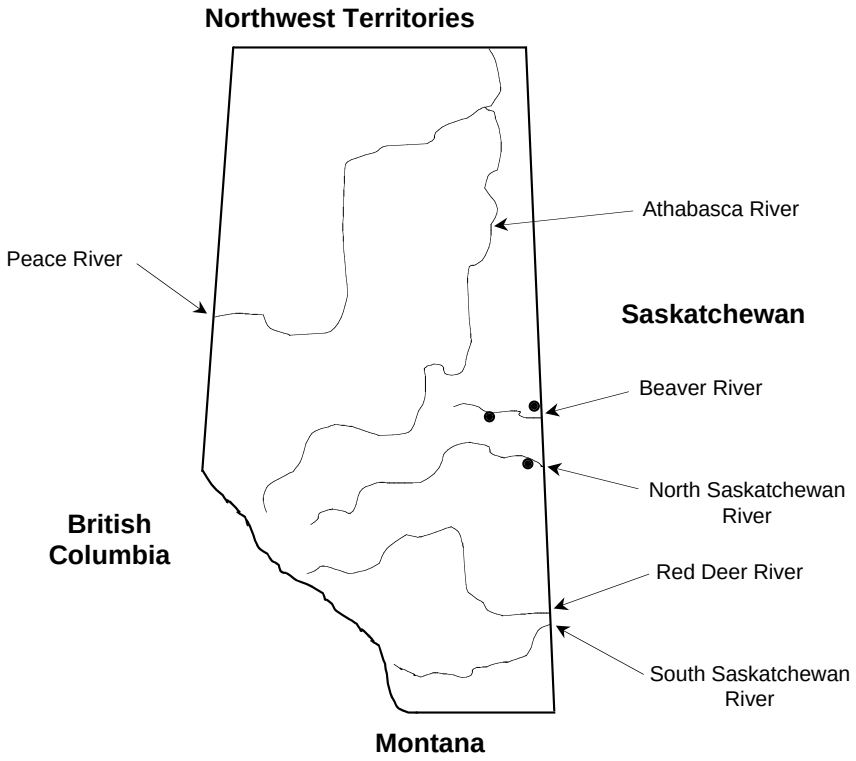
OTHER STUDIES

The *Salix scouleriana* (Scouler's willow) community type has not been described by others in this region.

Alnus tenuifolia Community Type
(River Alder Community Type)

ALNUTEN
Number of Stands Sampled = 4
Number of Stands Sampled in Alberta = 4

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Alnus tenuifolia* (river alder) community type is an incidental type at low elevations in the Parkland Natural Region and the Dry Mixedwood Natural Subregion. This community type occurs on moist fluvial sites as small dense thickets and narrow bands along streams, riverbanks, and lakeshores marking the transition zone from *Salix* (willows) to the *Populus balsamifera* (balsam poplar) forest (Raup 1946). Typical stands were sampled along the Vermilion River near Marwayne, the Beaver River north of St. Paul, and near Cold Lake.

VEGETATION

Undisturbed stands dominated by *Alnus tenuifolia* (river alder) form dense shrub communities. *Salix* species (willows) are usually present along with *Carex* species (sedges), *Calamagrostis canadensis* (bluejoint), and such moist site forbs as *Galeopsis tetrahit* (hemp-nettle) and *Urtica dioica* (common nettle) (Table 38). Indication of disturbance is evident in the appearance of invader species such as *Bromus inermis* (awnless brome), *Poa pratensis* (Kentucky bluegrass), and *Cirsium arvense* (Canada thistle).

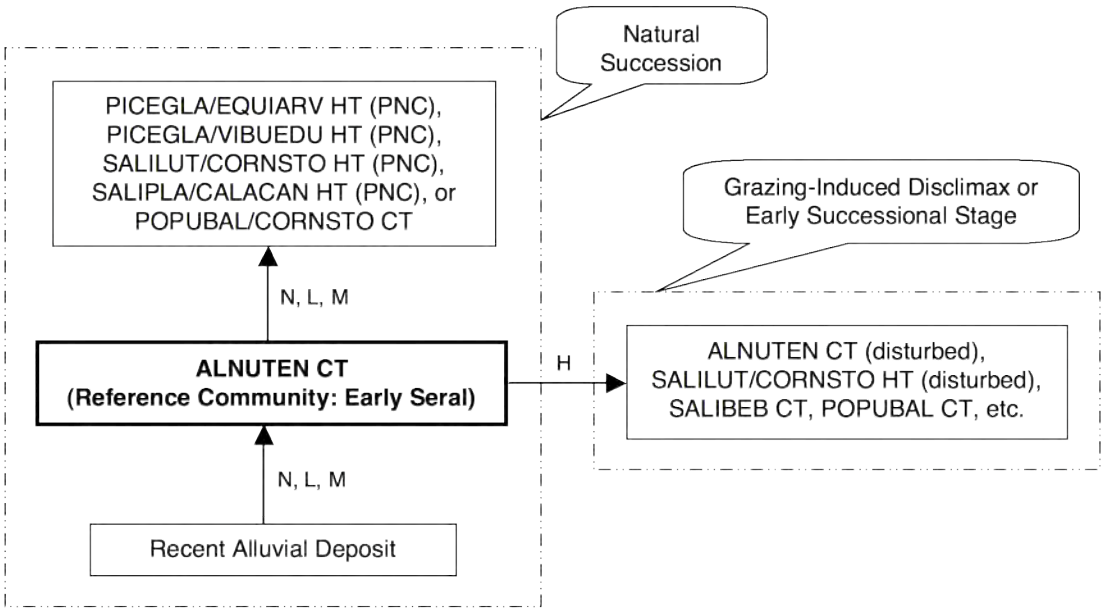
Table 38. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 4 stands of the *Alnus tenuifolia* (river alder) community type

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Shrubs				
Alnus tenuifolia (river alder)	75	30-98	100	86
Cornus stolonifera (red-osier dogwood)	7	0-10	50	19
Prunus virginiana (choke cherry)	1	0-1	25	5
Ribes glandulosum (skunk currant)	1	0-1	50	7
Rosa spp. (rose)	1	0-1	25	5
Rubus pubescens (dewberry)	2	0-3	50	10
Salix bebbiana (beaked willow)	1	0-1	25	5
Salix exigua (sandbar willow)	1	0-1	25	5
Salix lutea (yellow willow)	2	0-3	50	10
Salix planifolia (flat-leaved willow)	2	0-3	50	10
Graminoids				
Agropyron repens (quack grass)	3	0-3	25	9
Bromus ciliatus (fringed brome)	1	0-1	25	5
Bromus inermis (awnless brome)	50	0-50	25	35
Calamagrostis canadensis (bluejoint)	32	0-60	50	40
Carex diandra (two-stamened sedge)	3	0-3	25	9
Carex pseudo-cyperus (cyperus-like sedge)	3	0-3	25	9
Carex sprengelii (Sprengel's sedge)	30	0-30	25	27
Glyceria striata (fowl manna grass)	10	0-10	25	16
Poa palustris (fowl bluegrass)	3	0-3	25	9
Poa pratensis (Kentucky bluegrass)	10	0-10	25	16
Sphenopholis intermedia (slender wedge grass)	20	0-20	25	22
Forbs				
Achillea millefolium (common yarrow)	1	0-1	25	5
Achillea sibirica (many-flowered yarrow)	1	0-1	25	5
Aster hesperius (western willow aster)	1	0-1	25	5
Aster laevis (smooth aster)	1	0-1	25	5
Caltha palustris (marsh-marigold)	3	0-3	50	12
Cicuta maculata (water-hemlock)	1	0-1	25	5
Cirsium arvense (Canada thistle)	3	0-3	50	12
Epilobium angustifolium (common fireweed)	1	0-1	25	5
Epilobium ciliatum (northern willowherb)	3	0-3	25	9
Equisetum arvense (common horsetail)	1	0-1	25	5
Fragaria virginiana (wild strawberry)	1	0-1	25	5
Galeopsis tetrahit (hemp-nettle)	30	0-50	50	39
Galium triflorum (sweet-scented bedstraw)	11	0-20	50	22
Impatiens noli-tangere (western jewelweed)	10	0-10	25	16
Lactuca pulchella (common blue lettuce)	3	0-3	25	9
Lysimachia thyrsiflora (tufted loosestrife)	3	0-3	25	9
Mentha arvensis (wild mint)	2	0-3	50	10
Polygonum lapathifolium (pale persicaria)	1	0-1	25	5
Potentilla anserina (silverweed)	1	0-1	25	5
Potentilla palustris (marsh cinquefoil)	1	0-1	25	5
Ranunculus abortivus (small-flowered buttercup)	1	0-1	25	5
Solidago canadensis (Canada goldenrod)	1	0-1	50	7
Sonchus spp. (sow-thistle)	6	0-10	50	16
Stachys palustris (marsh hedge-nettle)	1	0-1	25	5
Taraxacum officinale (common dandelion)	1	0-1	25	5
Urtica dioica (common nettle)	2	0-3	75	12
Viola canadensis (western Canada violet)	30	0-30	25	27
Sphagnum spp. (sphagnum mosses)	70	0-70	25	42
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0-1	25	5

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The *Alnus tenuifolia* (river alder) community type is an early successional stage that colonizes stream channel bars and adjacent floodplains. It seems to be successional to such types as the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, and the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type. The genus *Alnus* (alder) is not much utilized by livestock (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991), and is tolerant of disturbance in general (Hansen 1995). Figure 47 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Alnus tenuifolia* (river alder) Sites in North Central Alberta
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
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
POPUBAL CT—*Populus balsamifera* (balsam poplar) community type
POPUBAL/CORNSTO CT—*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type
SALIBEB CT—*Salix bebbiana* (beaked willow) community type
SALIBEB/CORNSTO HT—*Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type
SALILUT CT—*Salix lutea* (yellow willow) community type
SALILUT/CORNSTO HT—*Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type
SALIPLA/CALACAN HT—*Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type

Figure 47. 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 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 48 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).

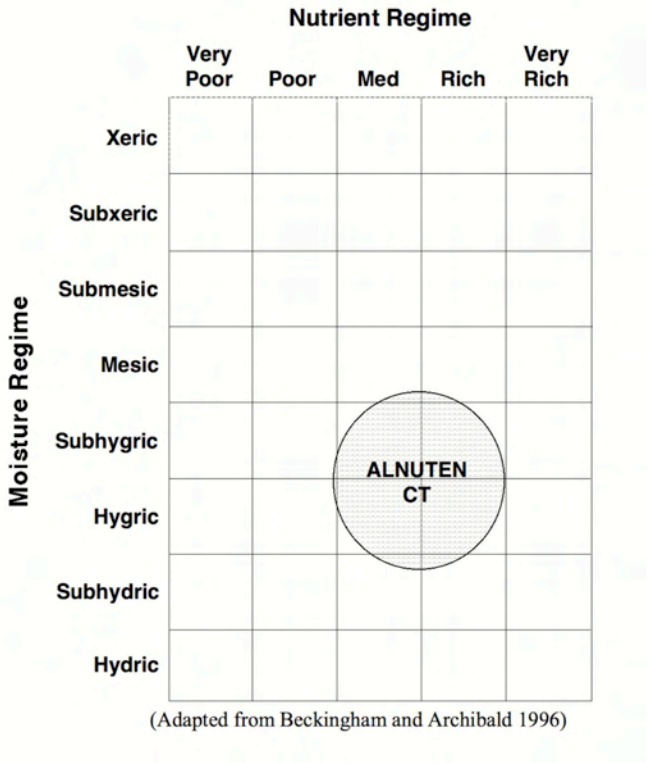


Figure 48. Edatope grid position for the *Alnus tenuifolia* (river alder) community type (ALNUTEN CT)

SOILS

Soils are commonly thin, coarse textured Regosols with little or no development. Mineral soil textures on sampled stands ranged from sand to loam. 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.

ADJACENT COMMUNITIES

Typically, there are no adjacent wetter communities between stands of this type and open water. Adjacent drier communities typically include the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type and the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type.

MANAGEMENT INFORMATION

Livestock

Forage production is low to moderate, depending on shrub density and amount of herbaceous cover present. Dense stands inhibit access by livestock. The genus *Alnus* (alder) is rated as poor forage value for livestock (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991), however, some of the associated species offer considerable value within more open stands. These species include *Cornus stolonifera* (red-osier dogwood) and *Calamagrostis canadensis* (bluejoint).

Wildlife

Alnus tenuifolia (river alder) is eaten by moose (Costain 1989) and by deer. The dense stands provide hiding and thermal cover for small mammals and birds. Deer eats the twigs and leaves of younger *Alnus tenuifolia* (river alder) plants. Elk, moose, muskrats, beavers, cottontails, and snowshoe hares all eat alder twigs and leaves. Beavers eat the bark and build dams and lodges with the stems. *Alnus tenuifolia* (river alder) seeds, buds, and catkins are eaten by redpolls, siskins, chickadees, and goldfinches (USDA Intermountain Fire Sciences Lab 1995).

Fisheries
Alnus tenuifolia (river alder) is an excellent shrub for controlling erosion along streams. This is particularly important on higher gradient streams where scoured by seasonal flooding. The dense, overhanging shrubs along the streambanks also provide protection and hiding cover for fish from predators (Hansen and others 1995).

Fire
Alnus tenuifolia (river alder) often sprouts from its root crown following fire. Several new sprouts may arise from each burned plant, thus increasing stand density. Off site alders are important in revegetating nearby areas following fire through the dispersal of numerous wind- and water-transported seeds. Since *Alnus tenuifolia* (river alder) disperses its seeds in the fall, favourable seedbeds created by late summer fires are immediately colonized. Riparian areas supporting *Alnus tenuifolia* (river alder) can serve as natural fire breaks due to its non-flammable bark and non-resinous leaves (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities
Coarse textured soils and high coarse fragment content minimizes most soil compaction problems. The *Alnus tenuifolia* (river alder) community type is often subject to scouring by floods and to alluvial deposition. Stands are relatively stable due to strong roots and stems. Management should emphasize the importance of *Alnus tenuifolia* (river alder) for streambank stabilization.

Alnus tenuifolia (river alder) is recommended for use in revegetating disturbed riparian areas. Since *Alnus tenuifolia* (river alder) is easy to establish on disturbed sites and has a rapid growth rate, it can quickly stabilize disturbed streambanks. The species can be established along streambanks from direct seeding, container-grown seedlings, or bare root stock, but propagation from stem cuttings is not recommended. Once established, plants spread well vegetatively and by natural seeding (USDA Intermountain Fire Sciences Lab 1995).

Recreational Uses and Considerations
Due to the frequency of flooding, trails, roads, campsites and buildings should be located elsewhere. However, this community type offers good opportunities for viewing wildlife.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Alnus tenuifolia* (river alder) community type in the Dry Mixedwood Natural Subregion occur on sites lacking a tree canopy within the *Cornus stolonifera* (dogwood) ecosite (e) with a subhygric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). This community type was also observed in the Parkland Natural Region.

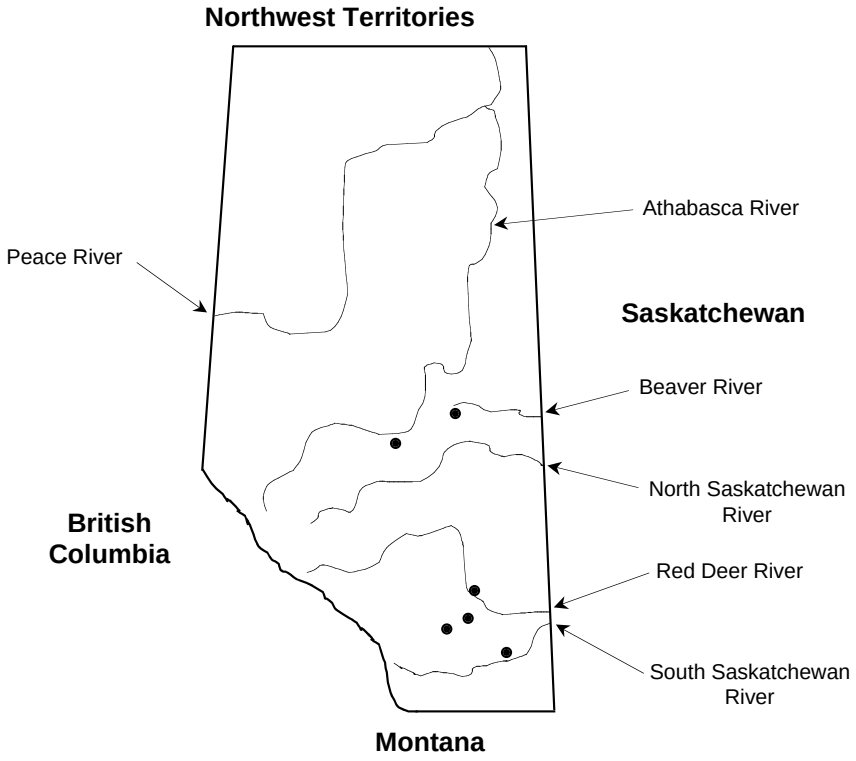
OTHER STUDIES

An *Alnus incana* (mountain alder) community type is described by Hansen and others (1995) for western Montana. Willoughby (2000) described a *Salix-Alnus tenuifolia/Calamagrostis canadensis* (willow-alder/marsh reedgrass) community type in the Central Mixedwood Natural Subregion of Alberta.

Cornus stolonifera Community Type
(Red-Osier Dogwood Community Type)

CORNSTO
Number of Stands Sampled = 8
Number of Stands Sampled in Alberta = 7

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Cornus stolonifera* (red-osier dogwood) community type is an incidental type on moist sites at low to mid elevations in the Parkland Natural Region and the Dry Mixedwood Natural Subregion. It occurs as small dense thickets, narrow bands, or irregular patches along lakeshores or streambanks. Stands were sampled along the Red Deer River near Drumheller, on Thunder Lake near Barrhead, and Long Lake near Boyle.

VEGETATION

Stands of the *Cornus stolonifera* (red-osier dogwood) community type that have not suffered severe browsing pressure typically form dense shrub communities covered by closed canopies of that species (Table 39). When disturbance occurs, stands become more open and populated with a variety of shorter, less palatable shrub species and increaser herbs. The most prominent of these are *Rosa* (rose) and *Symphoricarpos* species (buckbrush). The most noticeable increaser herbs in this sample are *Bromus inermis* (awnless brome) and *Cirsium arvense* (Canada thistle).

Table 39. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 stands of the *Cornus stolonifera* (red-osier dogwood) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Populus X acuminata (lance-leaf cottonwood)	1	0-1	13	4
Populus balsamifera (balsam poplar)	1	0-1	25	5
Populus tremuloides (aspen)	1	0-1	13	4
Shrubs				
Alnus tenuifolia (river alder)	1	0-1	13	4
Amelanchier alnifolia (Saskatoon)	6	0-10	25	11
Betula occidentalis (water birch)	1	0-1	13	4
Cornus stolonifera (red-osier dogwood)	71	30-90	100	84
Elaeagnus commutata (silverberry)	5	0-10	38	14
Lonicera involucrata (bracted honeysuckle)	3	0-3	13	6
Prunus pensylvanica (pin cherry)	3	0-3	13	6
Prunus virginiana (choke cherry)	17	0-50	38	25
Ribes lacustre (bristly black currant)	3	0-3	13	6
Ribes oxyacanthoides (northern gooseberry)	1	0-1	13	4
Rosa spp. (rose)	2	0-3	88	13
Rubus pubescens (dewberry)	1	0-1	13	4
Salix bebbiana (beaked willow)	2	0-3	25	7
Salix discolor (pussy willow)	1	0-1	13	4
Salix exigua (sandbar willow)	2	0-3	25	7
Symphoricarpos spp. (buckbrush)	8	0-10	63	22
Graminoids				
Agrostis stolonifera (redtop)	1	0-1	13	4
Bromus ciliatus (fringed brome)	1	0-1	13	4
Bromus inermis (awnless brome)	14	0-20	38	23
Calamagrostis canadensis (bluejoint)	2	0-3	38	9
Carex atherodes (awned sedge)	2	0-3	25	7
Carex lanuginosa (woolly sedge)	1	0-1	13	4
Carex utriculata (beaked sedge)	3	0-3	13	6
Carex sprengelii (Sprengel's sedge)	1	0-1	13	4
Phalaris arundinacea (reed canary grass)	40	0-40	13	22
Poa palustris (fowl bluegrass)	2	0-3	38	9
Poa pratensis (Kentucky bluegrass)	2	0-3	25	7
Forbs				
Actaea rubra (red and white baneberry)	1	0-1	13	4
Anemone cylindrica (long-fruited anemone)	1	0-1	13	4
Apocynum cannabinum (Indian hemp)	1	0-1	13	4
Aralia nudicaulis (wild sarsaparilla)	1	0-1	13	4
Arctium minus (common burdock)	3	0-3	13	6
Aster conspicuus (showy aster)	1	0-1	13	4
Aster hesperius (western willow aster)	1	0-1	13	4
Circaea alpina (small enchanter's nightshade)	1	0-1	13	4
Cirsium arvense (Canada thistle)	3	0-10	50	12
Epilobium angustifolium (common fireweed)	1	0-1	13	4
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	13	4
Fragaria virginiana (wild strawberry)	1	0-1	13	4
Galium boreale (northern bedstraw)	1	0-1	25	5
Galium triflorum (sweet-scented bedstraw)	1	0-1	25	5
Geranium richardsonii (wild white geranium)	1	0-1	25	5
Geum aleppicum (yellow avens)	1	0-1	13	4
Impatiens spp. (touch-me-not)	1	0-1	13	4
Maianthemum canadense (wild lily-of-the-valle)	1	0-1	13	4
Scutellaria galericulata (marsh skullcap)	1	0-1	25	5
Smilacina stellata (star-flowered Solomon's-seal)	1	0-1	63	8

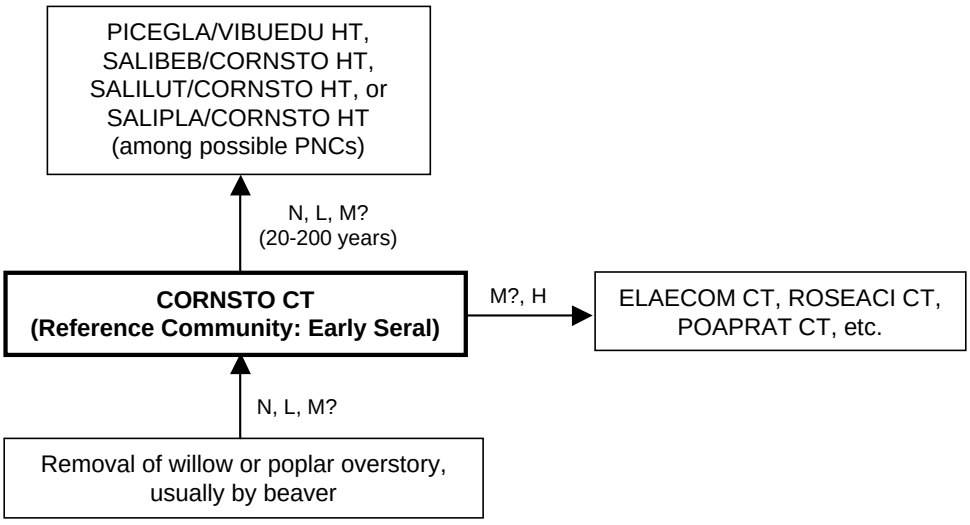
Table 39 (cont.)

Species	Percent Canopy Cover Average	Range	Constancy (Frequency)	Prominence Index[1]
Solidago canadensis (Canada goldenrod)	1	0-1	38	6
Taraxacum officinale (common dandelion)	1	0-1	13	4
Thalictrum occidentale (western meadow rue)	1	0-1	13	4
Thalictrum venulosum (veiny meadow rue)	1	0-1	25	5
Urtica dioica (common nettle)	6	0-10	25	11
Vicia americana (wild vetch)	1	0-1	13	4
Viola adunca (early blue violet)	1	0-1	13	4
Ferns and Allies				
Equisetum arvense (common horsetail)	2	0-3	25	7

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The *Cornus stolonifera* (red-osier dogwood) community type may represent an early primary successional stage that colonizes stream bars and adjacent floodplains, however the more likely way that stands become dominated by *Cornus stolonifera* (red-osier dogwood) is by the removal of a taller overstory of *Salix* (willows) or trees by either timber harvest or beaver. The type is successional to such habitat types as the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type, the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type, the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type, the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type, the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type, and the *Salix planifolia/Cornus stolonifera* (flat-leaved willow/red-osier dogwood) habitat type. Figure 49 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Cornus stolonifera* (red-osier dogwood) Sites in North Central Alberta
Reference Community = *Cornus stolonifera* (red-osier dogwood) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES

CORNSTO CT—*Cornus stolonifera* (red-osier dogwood) community type
ELAECOM CT—*Elaeagnus commutata* (silverberry) community type
PICEGLA/VIBUEDU HT—*Picea glauca/Viburnum edule* (white spruce/low bush cranberry) habitat type

POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
ROSAACI CT—*Rosa acicularis*(prickly rose) community type
SALIBEB/CORNSTO HT—*Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type
SALILUT/CORNSTO HT—*Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type
SALIPLA/CORNSTO HT—*Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/red-osier dogwood) habitat type

Figure 49. Successional pathway for sites of the *Cornus stolonifera* (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 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.

With severe grazing/browsing pressure, dense stands of *Cornus stolonifera* (red-osier dogwood) will be opened up so that disturbance-related species can invade. *Cornus stolonifera* (red-osier dogwood) is a highly preferred browse species for livestock and wild ungulates. Under high levels of utilization the *Cornus stolonifera* (red-osier dogwood) will decrease and *Rosa* species (rose) and *Symphoricarpos occidentalis* (buckbrush) will increase, along with herbaceous species such as *Poa pratensis* (Kentucky bluegrass) and *Bromus inermis* (awnless brome) taking advantage of the increased sunlight in the opened stand.

Although *Cornus stolonifera* (red-osier dogwood) is highly preferred for browse by wildlife and livestock, it seems able to repopulate sites where it was once severely reduced. For this reason we believe that large cover of *Cornus stolonifera* (red-osier dogwood) does not mean the community on a site is unaltered, but only that it has been free from severe browsing for several years.

EDATOPE

Figure 50 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 *Cornus stolonifera* (red-osier dogwood) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

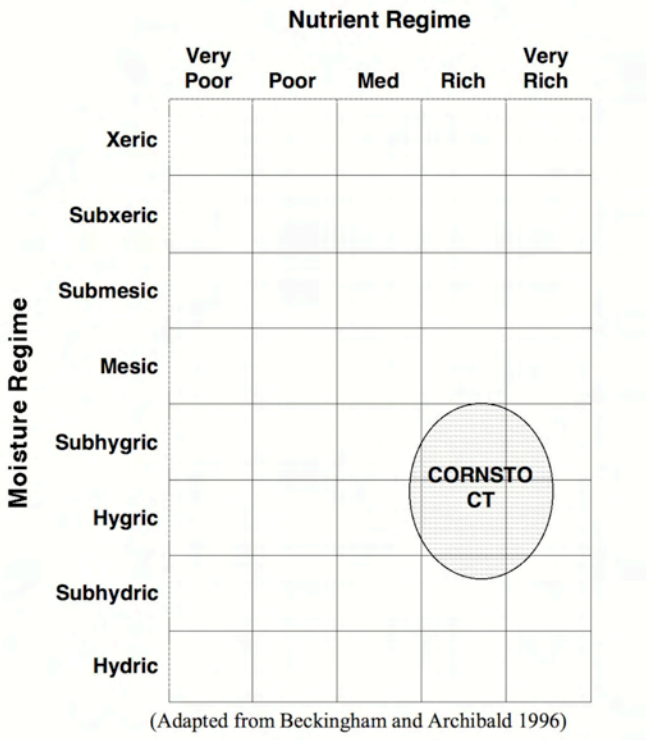


Figure 50. Edatope grid position for the *Cornus stolonifera* (red-osier dogwood) community type (CORNSTO CT)

SOILS

Although *Cornus stolonifera* (red-osier dogwood) grows on a variety of soils, it prefers rich, moist soils. Commonly young Brunisols or Regosols with little or no development. Mineral soil textures on sampled stands ranged from silt loam to silty clay. 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.

ADJACENT COMMUNITIES

Adjacent wetter communities may include younger *Populus* (poplar) community types, *Salix exigua* (sandbar willow), *Carex atherodes* (awned sedge), or open water. Adjacent drier communities may include the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type, the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type, the *Rosa acicularis* (prickly rose) community type, or a variety of upland communities.

MANAGEMENT INFORMATION

Livestock

Cornus stolonifera (red-osier dogwood) is highly preferred by livestock and wildlife (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991). Forage production is moderate to high, but dense stands may inhibit access by livestock.

Wildlife

The dense stands of *Cornus stolonifera* (red-osier dogwood) provide 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 (Costain 1989), cottontail rabbits, snowshoe hares, and numerous birds. Its 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 (USDA Intermountain Fire Sciences Lab 1995).

Fisheries

Cornus stolonifera (red-osier dogwood) is an excellent shrub for controlling erosion along streams. This is particularly important on higher gradient streams where scoured by seasonal flooding. The dense, overhanging shrubs along the streambanks also provide protection and hiding cover for fish from predators (Hansen and others 1995).

Fire

Cornus stolonifera (red-osier dogwood) generally increases following fire, and may invade recently burned areas from adjacent unburned areas. Aboveground material is usually killed by fire. However, the roots will survive all but the most severe fires, which remove the duff and heat the upper soil for extended periods. It is able to 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. The species is considered a semi-fire-tolerant, seed-banking species. 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 logging and burning (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities

Coarse textured soils and high coarse fragment content minimizes most soil compaction problems. The *Cornus stolonifera* (red-osier dogwood) community type is often subject to scouring by floods and to alluvial deposition. Stands are relatively stable due to strong roots and stems. Management should emphasize the maintenance of *Cornus stolonifera* (red-osier dogwood) for streambank stabilization.

For revegetation of degraded sites, *Cornus stolonifera* (red-osier dogwood) is valuable as it is readily established along stream edges by direct seeding, transplanting rooted cuttings, or planting nursery-grown seedlings. Its rapid growth quickly stabilizes deteriorated streambanks.

Recreational Uses and Considerations

Due to the frequency of flooding, campsites, buildings, and roads should be located elsewhere. However, sites with this community type generally offer good opportunities for viewing wildlife.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Cornus stolonifera* (red-osier dogwood) community type in the Dry Mixedwood Natural Subregion occur on sites lacking a tree canopy within the *Cornus stolonifera* (dogwood) ecosite (e) with a subhygric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). The type may also be found on similar sites throughout the Parkland Natural Region.

OTHER STUDIES

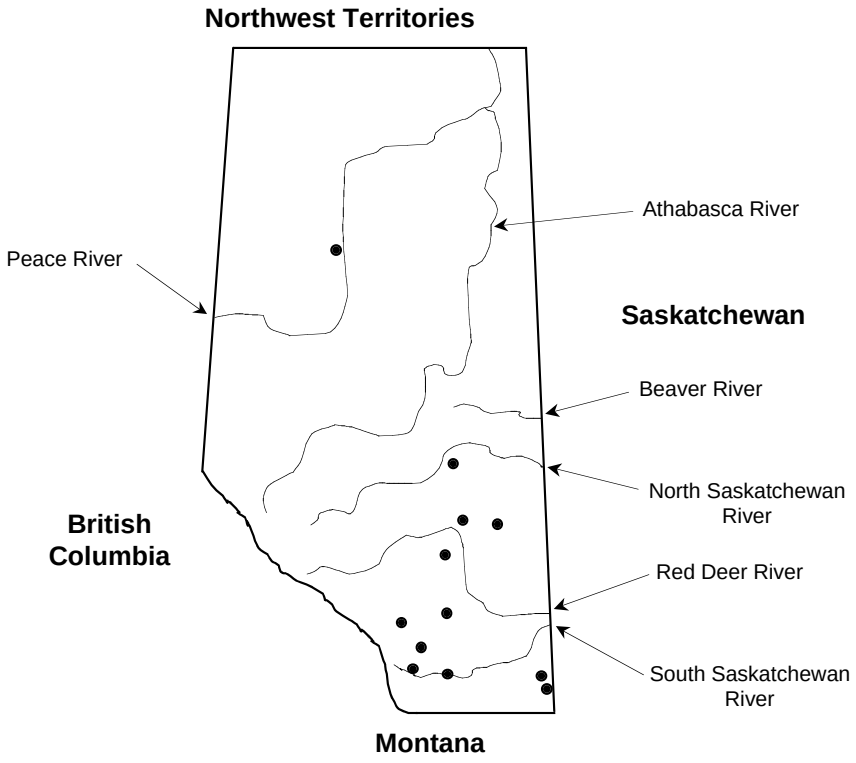
The *Cornus stolonifera* (red-osier dogwood) community type is described by Thompson and Hansen (2002) in the Grassland Natural Region of southern Alberta, by Thompson and Hansen (2001) in the Prairie Ecozone of southern Saskatchewan and by Hansen and others (1995) for Montana.

Elaeagnus commutata Community Type (Silverberry Community Type)

ELAECOM
Number of Stands Sampled = 16
Number of Stands Sampled in Alberta = 12

CAUTION—Not all sites currently dominated by *Elaeagnus commutata* (silverberry) are considered riparian or wetland sites. In some instances, they are considered upland sites. The topographic position of the site must match the description as presented in the Location and Associated Landform section.

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Elaeagnus commutata* (silverberry) community type is an incidental type in the Parkland Natural Region and the Dry Mixedwood Natural Subregion. It most commonly occurs on drier alluvial floodplain terraces that have been disturbed by human land usage, and in open, sunny areas where a forest cover has been removed. Most stands sampled were in the Parkland and prairies to the south, however stands were also sampled near Elk Island National Park and as far north as the lower Peace River Valley near Hotchkiss on the Notikewin River.

Elaeagnus commutata (silverberry) occurs in a variety of habitats including openings in forests of *Picea glauca* (white spruce), *Populus tremuloides* (aspen), and *Populus balsamifera* (balsam poplar). This species is a more important shrub in the

prairie region of southern Canada, occurring as a member of a diverse shrub layer under some taller community, or as a dominant in clonal patches on alluvial flats that are too dry or nutrient-poor to support trees or willows.

VEGETATION

The *Elaeagnus commutata* (silverberry) community type is typically found in small patches dominated by a clonal stand of *Elaeagnus commutata* (silverberry) in a dense thicket that enlarges itself by sending up new shoots from rhizomes at the stand periphery. For this reason stands of this type often show a somewhat mounded shape, with taller plants near the centre and younger plants around the edge—much like *Populus tremuloides* (aspen), but usually no more than about 2-3 m tall.

Although *Elaeagnus commutata* (silverberry) is a native species, this community type seems to be strongly associated with disturbance. Species with the greatest constancy of presence in silverberry stands are those considered disturbance-related. These include *Rosa* species (rose), *Symphoricarpos* species (buckbrush), *Bromus inermis* (awnless brome), *Poa pratensis* (Kentucky bluegrass), *Achillea millefolium* (common yarrow), *Cirsium arvense* (Canada thistle), and *Taraxacum officinale* (common dandelion) (Table 40).

Table 40. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 16 stands of the *Elaeagnus commutata* (silverberry) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Picea glauca (white spruce)	1	0-1	6	3
Populus balsamifera (balsam poplar)	2	0-3	19	4
Populus tremuloides (aspen)	1	0-1	13	4
Shrubs				
Amelanchier alnifolia (Saskatoon)	2	0-3	13	5
Clematis ligusticifolia (western clematis)	3	0-3	6	4
Cornus stolonifera (red-osier dogwood)	1	0-1	6	3
Elaeagnus commutata (silverberry)	62	30-98	100	79
Potentilla fruticosa (shrubby cinquefoil)	3	0-3	6	4
Prunus pensylvanica (pin cherry)	1	0-1	6	3
Prunus virginiana (choke cherry)	1	0-1	13	4
Rhus radicans (poison ivy)	3	0-3	6	4
Ribes lacustre (bristly black currant)	3	0-3	6	4
Ribes oxyacanthoides (northern gooseberry)	2	0-3	13	5
Rosa spp. (rose)	16	0-40	75	35
Rubus idaeus (wild red raspberry)	8	0-20	19	12
Rubus pubescens (dewberry)	10	0-10	6	8
Salix bebbiana (beaked willow)	3	0-3	6	4
Salix exigua (sandbar willow)	1	0-1	13	4
Spiraea alba (narrow-leaved meadowsweet)	1	0-1	6	3
Symphoricarpos spp. (buckbrush)	17	0-30	56	31
Symphoricarpos occidentalis (buckbrush)	10	0-10	6	8
Graminoids				
Agropyron repens (quack grass)	2	0-3	19	6
Agrostis scabra (rough hair grass)	1	0-1	6	3
Agropyron smithii (western wheat grass)	25	0-30	13	18
Agrostis stolonifera (redtop)	6	0-10	13	8
Agropyron trachycaulum (slender wheat grass)	9	0-40	31	17
Bromus inermis (awnless brome)	29	0-90	75	47
Calamagrostis canadensis (bluejoint)	3	0-3	6	4
Calamagrostis stricta (narrow reed grass)	70	0-70	6	21
Carex lanuginosa (woolly sedge)	3	0-3	6	4
Carex raymondii (Raymond's sedge)	1	0-1	6	3
Carex sprengelii (Sprengel's sedge)	1	0-1	6	3
Distichlis stricta (salt grass)	3	0-3	6	4
Elymus virginicus (Virginia wild rye)	3	0-3	6	4
Festuca rubra (red fescue)	7	0-10	13	9
Hordeum jubatum (foxtail barley)	10	0-10	6	8

Table 40 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Juncus balticus (wire rush)	11	0-20	25	17
Koeleria macrantha (June grass)	10	0-10	6	8
Phleum pratense (timothy)	9	0-20	19	13
Poa compressa (Canada bluegrass)	3	0-3	6	4
Poa palustris (fowl bluegrass)	1	0-1	13	4
Poa pratensis (Kentucky bluegrass)	24	0-40	63	39
Stipa spp. (needle grass)	1	0-1	6	3
Stipa columbiana (Columbia needle grass)	3	0-3	6	4
Stipa curtiseta (western porcupine grass)	3	0-3	6	4
Stipa richardsonii (Richardson needle grass)	1	0-1	6	3
Stipa viridula (green needle grass)	3	0-3	6	4
Forbs				
Achillea millefolium (common yarrow)	4	0-10	50	14
Antennaria aprica (low everlasting)	3	0-3	6	4
Antennaria parvifolia (small-leaved everlasting)	3	0-3	6	4
Arctium minus (common burdock)	3	0-3	6	4
Artemisia absinthium (absinthe wormwood)	1	0-1	6	3
Artemisia frigida (pasture sagewort)	3	0-3	6	4
Artemisia ludoviciana (prairie sagewort)	3	0-3	13	6
Aster ciliolatus (Lindley's aster)	6	0-10	13	8
Aster ericoides (tufted white prairie aster)	3	0-3	19	8
Aster laevis (smooth aster)	10	0-10	6	8
Campanula rotundifolia (harebell)	2	0-3	13	5
Carduus nutans (nodding thistle)	1	0-1	6	3
Cirsium arvense (Canada thistle)	4	0-10	56	15
Cirsium flodmanii (Flodman's thistle)	3	0-3	6	4
Cirsium undulatum (wavy-leaved thistle)	1	0-1	13	4
Epilobium angustifolium (common fireweed)	10	0-10	6	8
Erigeron caespitosus (tufted fleabane)	1	0-1	6	3
Erigeron glabellus (smooth fleabane)	1	0-1	6	3
Fragaria virginiana (wild strawberry)	4	0-10	38	12
Gaillardia aristata (gaillardia)	1	0-1	6	3
Galium boreale (northern bedstraw)	5	0-10	19	10
Geranium richardsonii (wild white geranium)	3	0-3	6	4
Geranium viscosissimum (sticky purple geranium)	1	0-1	6	3
Geum aleppicum (yellow avens)	1	0-1	6	3
Geum macrophyllum (large-leaved yellow avens)	1	0-1	13	4
Geum triflorum (three-flowered avens)	3	0-3	6	4
Glycyrrhiza lepidota (wild licorice)	1	0-1	6	3
Helianthus nuttallii (common tall sunflower)	1	0-1	6	3
Linum lewisii (wild blue flax)	1	0-1	6	3
Medicago lupulina (black medick)	4	0-10	25	10
Melilotus alba (white sweet-clover)	2	0-3	19	4
Melilotus officinalis (yellow sweet-clover)	1	0-1	6	3
Mentha arvensis (wild mint)	3	0-3	6	4
Monarda fistulosa (wild bergamot)	1	0-1	6	3
Oxytropis deflexa (reflexed locoweed)	3	0-3	6	4
Plantago major (common plantain)	3	0-3	6	4
Polygonum lapathifolium (pale persicaria)	1	0-1	6	3
Potentilla anserina (silverweed)	3	0-3	6	4
Potentilla gracilis (graceful cinquefoil)	2	0-3	25	7
Potentilla pensylvanica (prairie cinquefoil)	10	0-10	6	8
Ranunculus acris (tall buttercup)	2	0-3	13	5
Sisyrinchium montanum (common blue-eyed grass)	1	0-1	6	3
Smilacina stellata (star-flowered Solomon's-seal)	1	0-3	31	6

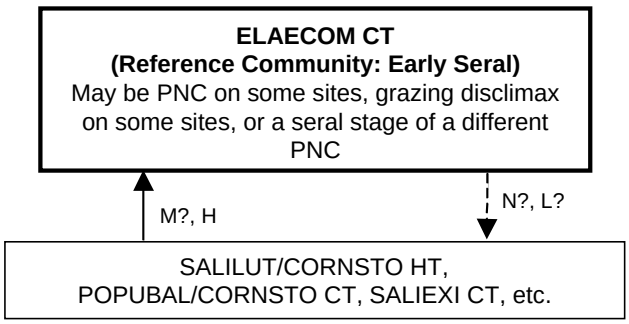
Table 40 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Solidago canadensis (Canada goldenrod)	8	0-20	38	16
Solidago gigantea (late goldenrod)	5	0-10	19	10
Solidago missouriensis (low goldenrod)	3	0-3	6	4
Sonchus arvensis (perennial sow-thistle)	10	0-10	13	11
Sonchus asper (prickly annual sow-thistle)	11	0-20	13	11
Sonchus spp. (sow-thistle)	6	0-10	13	8
Taraxacum officinale (common dandelion)	5	0-10	44	15
Thermopsis rhombifolia (golden bean)	13	0-20	25	18
Trifolium repens (white clover)	11	0-20	19	14
Urtica dioica (common nettle)	2	0-3	19	6
Vicia americana (wild vetch)	1	0-1	25	5
Ferns and Allies				
Equisetum arvense (common horsetail)	3	0-3	13	6
Equisetum laevigatum (smooth scouring-rush)	1	0-1	6	3

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The *Elaeagnus commutata* (silverberry) community type is an early seral community that may in some situations be induced and perpetuated by high levels of grazing. The species aggressively spreads by rhizomes onto adjoining areas. It may occupy sites with potential for the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, the *Populus tremuloides* types, or one of the *Salix* (willow) types. On other sites, the *Elaeagnus commutata* (silverberry) community type may represent a long-lived community not strongly influenced by grazing pressure, but sites dominated by *Elaeagnus commutata* (silverberry) and lacking abundant cover of species associated with long-term grazing disturbance appear to be quite rare. Figure 51 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Elaeagnus commutata* (silverberry) Sites in North Central Alberta
Reference Community = *Elaeagnus commutata* (silverberry) 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
SALIEXI CT—*Salix exigua* (sandbar willow) community type
SALILUT/CORNSTO HT—*Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type

Figure 51. 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 PNC.

Disturbance Stages

Disturbance-related species such as *Rosa* species (rose), *Symphoricarpos* species (buckbrush), *Bromus inermis* (awnless brome), and *Poa pratensis* (Kentucky bluegrass) are generally associated with the *Elaeagnus commutata* (silverberry) community type. *Elaeagnus commutata* (silverberry) is not usually preferred as a browse species, and normally only in extreme cases will livestock or wildlife utilize it. It follows that the abundance of *Elaeagnus commutata* (silverberry) are rarely impacted negatively by browsing pressure.

EDATOPE

Figure 52 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).

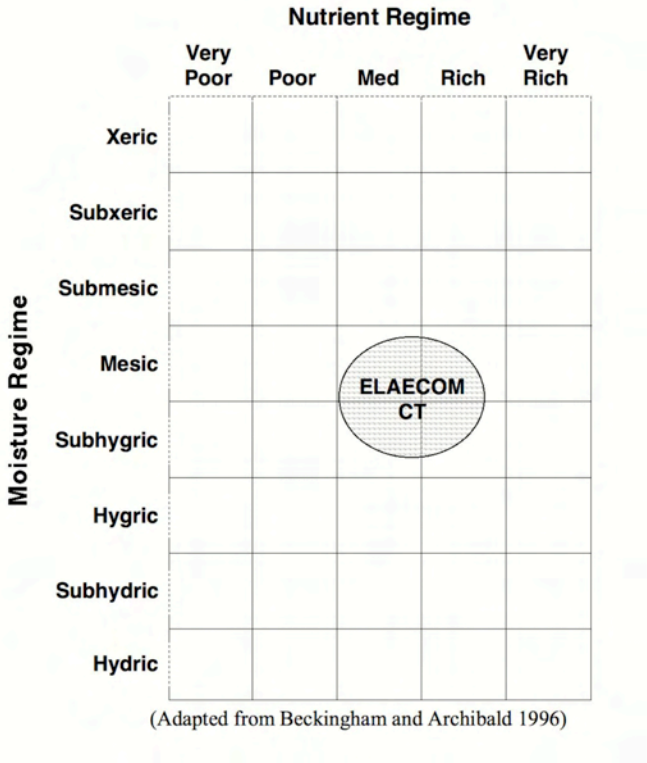


Figure 52. Edatope grid position for the *Elaeagnus commutata* (silverberry) community type (ELAECOM CT)

SOILS

Soils are quite variable and include Regosols and Chernozems. The *Elaeagnus commutata* (silverberry) community type occurs on virtually all soil textures. Mineral soil textures on sampled stands ranged 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 (USDA Intermountain Fire Sciences Lab 1995).

ADJACENT COMMUNITIES

Adjacent wetter communities may include the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, several of the *Salix* (willow) types such as the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type or the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type. Upland communities typically dominate adjacent drier communities.

MANAGEMENT INFORMATION

Livestock

Forage production for dense, monotypic stands of *Elaeagnus commutata* (silverberry) is low. As stands open, forage production increases accordingly due to the presence of *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).

Wildlife

The moderate structural diversity of the *Elaeagnus commutata* (silverberry) community type provides thermal and hiding cover for big game and upland bird species. The species is an important food for wildlife, particularly moose, mule deer, and snowshoe hares (USDA Intermountain Fire Sciences Lab 1995).

Fisheries

This community type offers streambank stabilization due to the rhizomatous nature of *Elaeagnus commutata* (silverberry), but otherwise relates little to fish habitat.

Fire

Elaeagnus commutata (silverberry) is probably killed by severe fires. *Elaeagnus commutata* (silverberry) sprouts from rhizomes after fire, and probably establishes from seed if dispersed onto burned sites. However, it does not recover quickly after fire. Numbers of *Elaeagnus commutata* (silverberry) may increase after fire, but cover usually decreases and recovers slowly. In the Canadian prairie *Elaeagnus commutata* (silverberry) is listed as a species seriously harmed by spring and fall burns (USDA Intermountain Fire Sciences Lab 1995). The suppression of fire for most of the past century may account for an increase in cover of this type.

Soil Management and Rehabilitation Opportunities

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 (USDA Intermountain Fire Sciences Lab 1995). At Fort McMurray, Alberta, *Elaeagnus commutata* (silverberry) spread rapidly on amended tailings sand. Survival remained high after 7 years, and rhizomatous reproduction was vigorous (Watson and others 1980).

Recreational Uses and Considerations

The recreational value of *Elaeagnus commutata* (silverberry) is minimal beyond the pleasant aroma of the blossoms in the spring.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites supporting the *Elaeagnus commutata* (silverberry) community type are not described for any ecosite within the Dry Mixedwood Natural Region by Beckingham and Archibald (1996).

OTHER STUDIES

An *Elaeagnus commutata* (silverberry) community type is described by Thompson and Hansen (2002) in the Grassland Natural Region of southern Alberta, by Thompson and Hansen (2001) in the Prairie Ecozone of southern Saskatchewan, as well as by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan. Communities dominated by *Elaeagnus commutata* (silverberry) were identified by Adams and others (1997) on the Suffield Canadian Forces Base near Medicine Hat, Alberta.

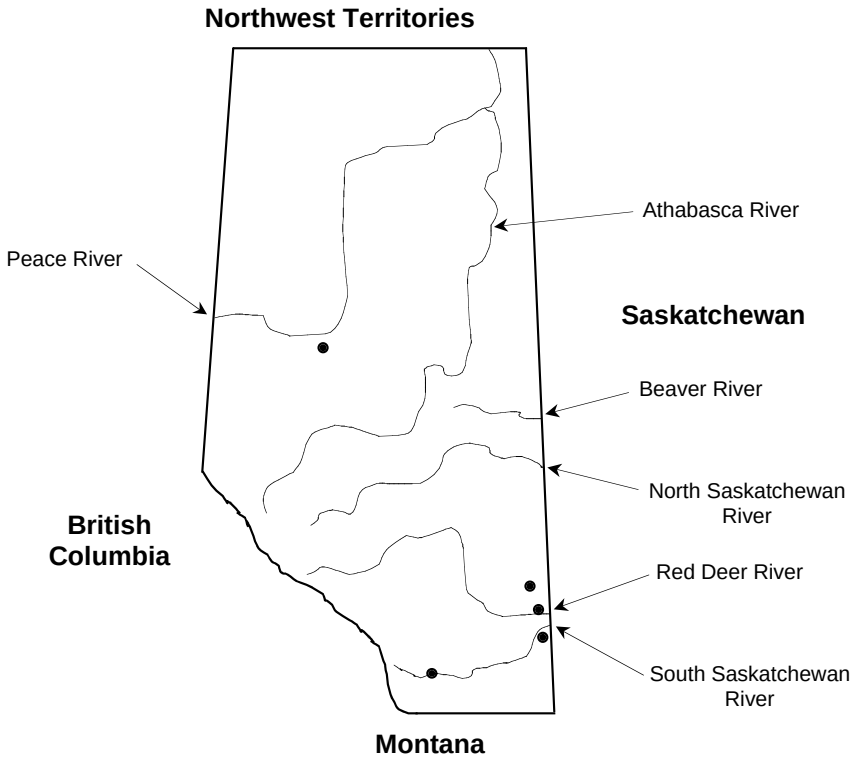
Rosa acicularis Community Type
(Prickly Rose Community Type)

ROSAACI
Number of Stands Sampled = 7
Number of Stands Sampled in Alberta = 6

CAUTION—Not all sites currently dominated by *Rosa* species (rose) are considered riparian or wetland sites. In some instances, they are upland sites. The topographic position of the site must match the description as presented in the Location and Associated Landform section.

***Note:* The *Rosa acicularis* (prickly rose) community type includes all combinations of *Rosa acicularis* (prickly rose) and *Rosa woodsii* due to similarities in environmental conditions and management concerns.**

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Rosa acicularis* (prickly rose) community type is an incidental type in the Parkland Natural Region and the Dry Mixedwood Subregion. It occurs on alluvial terraces along streams and rivers and in moist forest openings created by removal of the forest canopy and other, more palatable shrub species. Stands may also be located in V-shaped ravines and swale-like depressions where overland flows provide additional moisture, or they may be located on hillsides immediately below a spring or seep. Stands were sampled on Sounding Creek near Provost and the Smoky River near Watino.

VEGETATION

The *Rosa acicularis* (prickly rose) community type usually forms dense, often impenetrable stands. In some instances, the stands contain only *Rosa* species (rose), while in most cases; stands take on a two-layer appearance. The upper layer is comprised of *Rosa* species (rose). The second layer, which is only slightly shorter than the rose layer, is comprised of dense clones of *Symphoricarpos* species (buckbrush). The herbaceous layer is typically sparse, with the most prominent species being *Bromus inermis* (awnless brome) and *Poa pratensis* (Kentucky bluegrass) (Table 41).

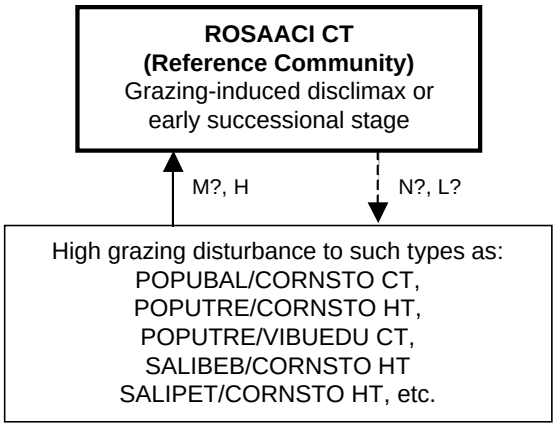
Table 41. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 stands of the *Rosa acicularis* (prickly rose) community type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Shrubs				
Amelanchier alnifolia (Saskatoon)	3	0-3	14	7
Cornus stolonifera (red-osier dogwood)	1	0-1	14	4
Elaeagnus commutata (silverberry)	2	0-3	29	8
Rosa spp. (rose)	69	10-90	100	83
Salix bebbiana (beaked willow)	3	0-3	14	7
Salix lutea (yellow willow)	1	0-1	14	4
Shepherdia argentea (thorny buffaloberry)	3	0-3	14	7
Symphoricarpos spp. (buckbrush)	35	0-70	86	55
Graminoids				
Agrostis scabra (rough hair grass)	3	0-3	14	7
Agropyron smithii (western wheat grass)	10	0-10	14	12
Agrostis stolonifera (redtop)	3	0-3	14	7
Agropyron trachycaulum (slender wheat grass)	12	0-20	29	19
Bromus inermis (awnless brome)	17	0-20	43	27
Carex lanuginosa (woolly sedge)	3	0-3	14	7
Koeleria macrantha (June grass)	3	0-3	14	7
Poa pratensis (Kentucky bluegrass)	25	0-40	29	27
Schizachne purpurascens (purple oat grass)	20	0-20	14	17
Forbs				
Achillea millefolium (common yarrow)	10	0-10	14	12
Artemisia dracunculus (dragonwort)	1	0-1	14	4
Artemisia ludoviciana (prairie sagewort)	1	0-1	14	4
Aster hesperius (western willow aster)	1	0-1	29	5
Aster laevis (smooth aster)	3	0-3	14	7
Botrychium simplex (dwarf grape fern)	1	0-1	14	4
Cirsium arvense (Canada thistle)	2	0-3	29	8
Fragaria virginiana (wild strawberry)	10	0-10	14	12
Geum macrophyllum (large-leaved yellow avens)	1	0-1	14	4
Glycyrrhiza lepidota (wild licorice)	1	0-1	14	4
Heuchera richardsonii (Richardson's alumroot)	3	0-3	14	7
Medicago lupulina (black medick)	10	0-10	14	12
Melilotus officinalis (yellow sweet-clover)	1	0-1	14	4
Plantago major (common plantain)	1	0-1	14	4
Smilacina stellata (star-flowered Solomon's-seal)	1	0-1	14	4
Solidago canadensis (Canada goldenrod)	2	0-3	57	11
Sonchus arvensis (perennial sow-thistle)	10	0-10	14	12
Sonchus asper (prickly annual sow-thistle)	1	0-1	14	4
Sonchus spp. (sow-thistle)	1	0-1	14	4
Taraxacum officinale (common dandelion)	6	0-10	29	12
Thalictrum venulosum (veiny meadow rue)	1	0-1	14	4
Thermopsis rhombifolia (golden bean)	1	0-1	14	4
Vicia americana (wild vetch)	6	0-10	57	17
Viola adunca (early blue violet)	1	0-1	14	4
Zizia aptera (heart-leaved Alexanders)	3	0-3	14	7
Ferns and Allies				
Equisetum arvense (common horsetail)	20	0-20	14	17

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Rosa acicularis (prickly rose) is a pioneer species on patches of mineral soil exposed by disturbance and on gravel bars along rivers or after fire. Along rivers in British Columbia and Alaska, it first establishes along with pioneering *Salix* (willows) and replaces them after they are overtopped by *Populus balsamifera* (balsam poplar) on exposed gravel and silt bars (USDA Intermountain Fire Sciences Lab 1995). The prickly rose community type may represent a mid-seral grazing disclimax on sites where intense grazing pressure has eliminated a *Salix* (willow) or other more palatable tall shrub canopy. In the Parkland and Dry Mixedwood Natural Regions this type may occupy sites with potential for the *Picea glauca/Viburnum edule* (white spruce/low-bush cranberry) habitat type, the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, the *Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type in the Boreal Dry Mixedwood, or the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type in the Parkland. Careful observation of site characteristics and remnant plant species will assist in determining site potential. Figure 53 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Rosa acicularis* (prickly rose) Sites in North Central Alberta
Reference Community = *Rosa acicularis* (prickly rose) 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/CORNSTO HT—*Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type
POPUTRE/VIBUEDU CT—*Populus tremuloides/Viburnum edule* (aspen/low-bush cranberry) community type
ROSAACI CT—*Rosa acicularis* (prickly rose) community type
SALIBEB/CORNSTO HT—*Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type
SALIPET/CORNSTO HT—*Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type

Figure 53. 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 mesic riparian tree and shrub types that normally have the palatable browse species, *Cornus stolonifera* (red-osier dogwood), as a major natural component of the understory.

The thorny nature of *Rosa* species (rose) precludes browsers from taking more than the youngest growth. The rose seems well adapted to this utilization and seems to increase relative to most other shrub species, except *Symphoricarpos occidentalis* (buckbrush). However, if the dense overstory is opened up, disturbance-related species such as *Bromus inermis* (awnless brome), *Poa pratensis* (Kentucky bluegrass), and *Achillea millefolium* (common yarrow) will invade.

EDATOPE

Figure 54 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).

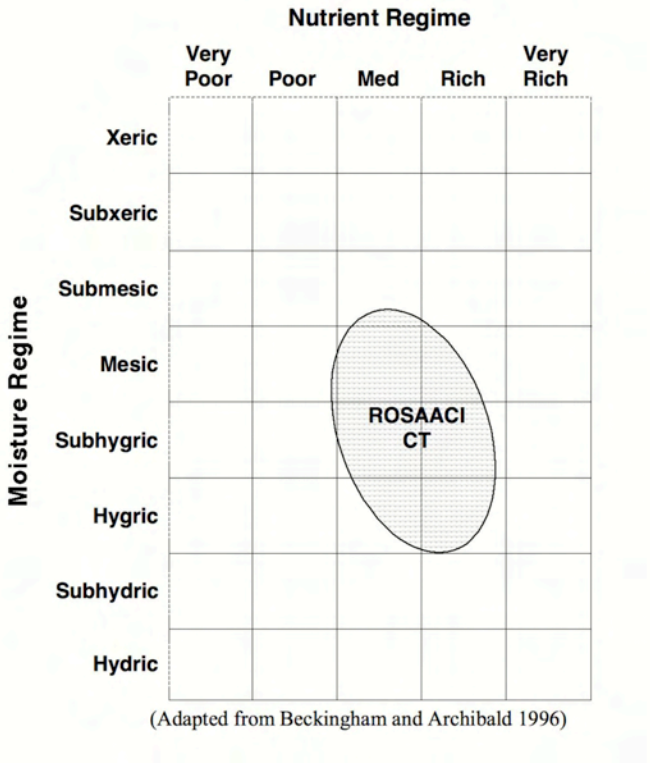


Figure 54. Edatope grid position for the *Rosa acicularis* (prickly rose) community type (ROSAACI CT)

SOILS

Rosa acicularis (prickly rose) does best on soils based on alluvium that may be seasonally flooded. Mineral soil textures on sampled stands ranged from silty sand to clay. However, it does not do well on peats or in basins with restricted drainage From British Columbia to Manitoba prickly rose does well on a variety of soil textures and soil moisture regimes and it has good drought tolerance (USDA Intermountain Fire Sciences Lab 1995).

ADJACENT COMMUNITIES

Adjacent wetter communities may include the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, several of the *Salix* (willow) types such as the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type or the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type. Upland communities typically dominate adjacent drier communities.

MANAGEMENT INFORMATION

Livestock

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).

Wildlife

Stands of *Rosa acicularis* (prickly rose) provide good structural diversity for thermal and hiding cover. Deer and elk may browse heavily on the species, and 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.

Fire

Rosa acicularis (prickly rose) is adapted to fire. It can sprout from the base of fire-killed aerial stems or from rhizomes. Although *Rosa acicularis* (prickly rose) recovery following fire is primarily vegetative, roses germinate from on-site and off-site seeds as well. *Rosa acicularis* (prickly rose) seeds are fire resistant, and germination may be stimulated by fire. This

sprouting capability makes it a good soil stabilizer. This is especially important given the severe disturbance common to areas colonized by this community type (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities

Rosa acicularis (prickly rose) is recommended for revegetation on moist to wet sites in Alberta (USDA Intermountain Fire Sciences Lab 1995). It is a good choice for erosion control, especially since the prickly stems may discourage over-browsing. It is tolerant of acidic situations, 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).

Recreational Uses and Considerations

The persistent rose hips are edible, and are one of the best natural sources of vitamin C. They can be dried for use in flavouring teas, jellies, fruitcakes, and puddings.

Nature trails should be routed around dense stands of this community type. However, *Rosa acicularis* (prickly rose) is useful for planting in recreation areas as a biological barrier to protect physical structures, young and delicate plants, or to direct traffic.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Rosa acicularis* (prickly rose) community type in the Dry Mixedwood Natural Region may occur on sites lacking a tree canopy as disturbed stands of the *Viburnum edule* (low-bush cranberry) ecosite (d) with a mesic/medium moisture/nutrient regime, the *Cornus stolonifera* (dogwood) ecosite (e), and the *Equisetum* (horsetail) ecosite (f) with a hygric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). The type may also be found on similar sites throughout the Parkland Natural Region.

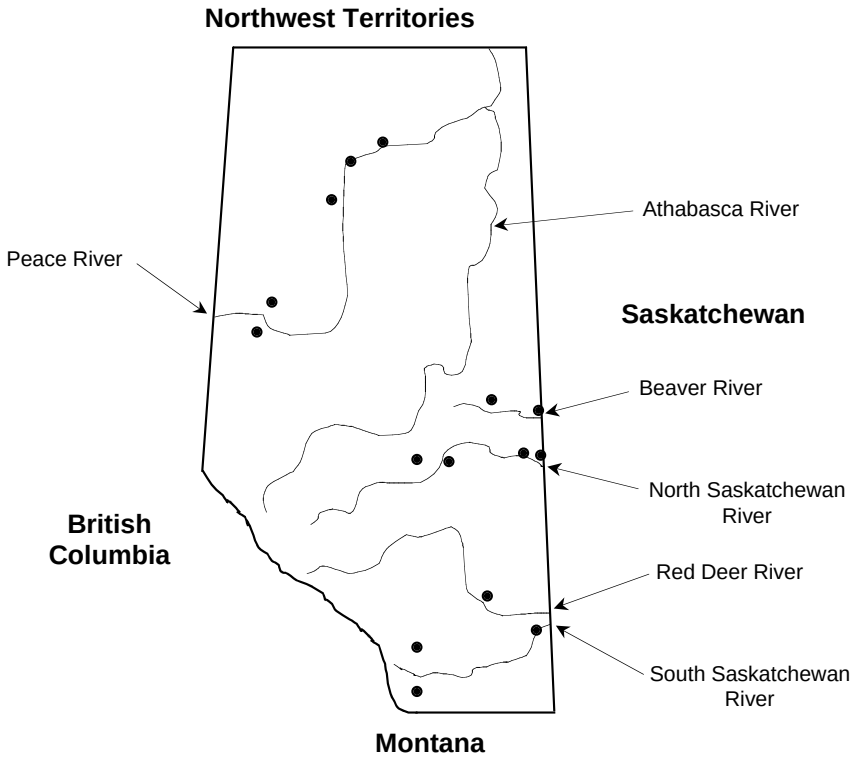
OTHER STUDIES

A *Rosa woodsii* (common wild rose) community type is described by is described by Thompson and Hansen (2002) in the Grassland Natural Region of southern Alberta, by Thompson and Hansen (2001) in the Prairie Ecozone of southern Saskatchewan Hansen and others (1995) for Montana, that includes *Rosa acicularis* (prickly rose) as well as *Rosa woodsii* (woods rose). The two types are ecologically similar, with the name change reflecting geographical distribution of the species. A *Rosa* species (rose) community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan.

Carex aquatilis Habitat Type
(Water Sedge Habitat Type)

CAREAQU
Number of Stands Sampled = 21
Number of Stands Sampled in Alberta = 17

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Carex aquatilis* (water sedge) habitat type is an incidental type in the Parkland Natural Region and a minor type in the Dry Mixedwood Subregion. It occurs on flat meadows, valley bottoms, or depressions, typically adjacent to open water. It may grade into the *Carex atherodes* (awned sedge) or the *Carex utriculata* (beaked sedge) habitat type with a slight increase in the water table depth or duration. Like the *Carex atherodes* (awned sedge) habitat type, sites are often silted-in beaver ponds, old oxbow sloughs, or narrow bands adjacent to small streams. Stands were sampled on Lac Ste. Anne near Gunn, near Bruderheim, Cold Lake, on Moonshine Lake near Spirit River, the Eureka River near Worsley, and the Peace River near Ft. Vermilion.

VEGETATION

Relatively undisturbed stands of the *Carex aquatilis* (water sedge) habitat type are dominated by almost monospecific stands of dense water sedge that spread by rhizomes but also form thick tufts (Table 42). However, it often has other wet site herbaceous species present. The prominence and diversity of other species increases with disturbance.

Table 42. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 relatively undisturbed late seral to climax stands of the *Carex aquatilis* (water sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Salix candida (hoary willow)	1	0-1	13	4
Salix pseudomonticola (false mountain willow)	1	0-1	13	4
Salix serissima (autumn willow)	3	0-3	13	6
Graminoids				
Calamagrostis stricta (narrow reed grass)	2	0-3	25	7
Carex aquatilis (water sedge)	90	80-98	100	95
Carex utriculata (beaked sedge)	10	0-10	13	11
Glyceria grandis (common tall manna grass)	1	0-1	13	4
Phalaris arundinacea (reed canary grass)	3	0-3	13	6
Poa palustris (fowl bluegrass)	1	0-1	13	4
Forbs				
Aster borealis (marsh aster)	1	0-1	13	4
Caltha palustris (marsh-marigold)	20	0-20	13	16
Epilobium palustre (marsh willowherb)	10	0-10	13	11
Galium trifidum (small bedstraw)	1		0-1	13 4
Hippuris vulgaris (common mare's-tail)	1	0-1	13	4
Mentha arvensis (wild mint)	1	0-1	13	4
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	13	4
Polygonum amphibium (water smartweed)	10	0-10	13	11
Potentilla palustris (marsh cinquefoil)	3	0-3	13	6
Rumex crispus (curled dock)	1	0-1	13	4
Rumex occidentalis (western dock)	3	0-3	13	6
Scutellaria galericulata (marsh skullcap)	3	0-3	13	6
Sium suave (water parsnip)	1	0-1	13	4
Stachys palustris (marsh hedge-nettle)	1	0-1	13	4
Stellaria crassifolia (fleshy stitchwort)	3	0-3	13	6
Typha latifolia (common cattail)	1	0-1	13	4

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Carex aquatilis (water sedge) functions as a pioneer colonizer of exposed mineral substrates, such as bare silt left when a beaver dam breaks; and also as a climax species by its ability to persist on a site for as long as the hydrology is favourable. High water table and a vigorous network of sedge rhizomes inhibit establishment of most other species. In general, a high water table throughout the growing season inhibits access by livestock. However, due to the high palatability of water sedge, severe grazing pressures can greatly decrease cover of the species and allow entry of such disturbance-related herbs as *Juncus balticus* (wire rush), *Galium trifidum* (small bedstraw), *Scutellaria galericulata* (marsh skullcap), and *Equisetum fluviatile* (swamp horsetail) (Table 43). Continued long-term high grazing levels can alter site hydrology and community composition to the *Poa pratensis* (Kentucky bluegrass) community type. Figure 55 shows a schematic diagram of expected successional vegetation pathways on sites of this type.

Table 43. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 13 disturbed or early seral stands of the *Carex aquatilis* (water sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	1	0-1	8	3
Shrubs				
Betula glandulosa (bog birch)	3	0-3	8	5
Salix bebbiana (beaked willow)	3	0-3	8	5

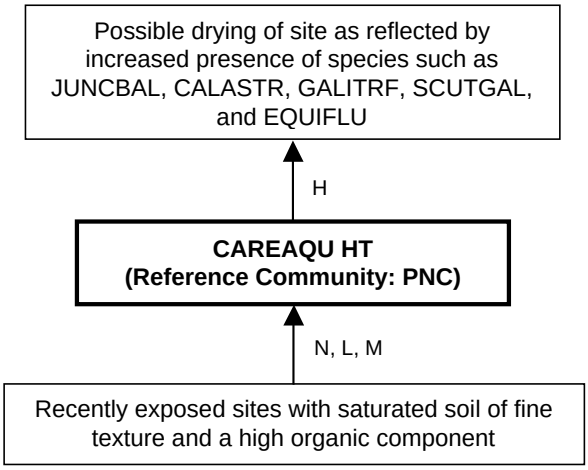
Table 43 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Salix petiolaris (basket willow)	1	0-1	8	3
Salix planifolia (flat-leaved willow)	1	0-1	46	7
Graminoids				
Agrostis scabra (rough hair grass)	2	0-3	23	7
Agropyron trachycaulum (slender wheat grass)	1	0-1	8	3
Beckmannia syzigachne (slough grass)	1	0-1	8	3
Calamagrostis canadensis (bluejoint)	3	0-3	15	7
Calamagrostis inexpansa (northern reed grass)	7	0-10	23	13
Calamagrostis stricta (narrow reed grass)	21	0-50	23	22
Carex aquatilis (water sedge)	57	20-90	100	75
Carex atherodes (awned sedge)	18	0-30	23	20
Carex curta (short sedge)	60	0-60	8	21
Carex diandra (two-stamened sedge)	10	0-10	8	9
Carex lacustris (lakeshore sedge)	3	0-3	8	5
Carex lanuginosa (woolly sedge)	3	0-3	8	5
Carex praegracilis (graceful sedge)	1	0-1	8	3
Carex utriculata (beaked sedge)	9	0-30	69	25
Eleocharis palustris (creeping spike-rush)	2	0-3	15	6
Glyceria borealis (northern manna grass)	1	0-1	8	3
Glyceria grandis (common tall manna grass)	1	0-1	8	3
Glyceria striata (fowl manna grass)	1	0-1	8	3
Hordeum jubatum (foxtail barley)	1	0-1	15	4
Juncus balticus (wire rush)	24	0-50	23	24
Phalaris arundinacea (reed canary grass)	2	0-3	15	6
Poa palustris (fowl bluegrass)	3	0-3	8	5
Scirpus acutus (great bulrush)	3	0-3	15	7
Scirpus paludosus (prairie bulrush)	1	0-1	8	3
Forbs				
Aster hesperius (western willow aster)	1	0-1	8	3
Cicuta bulbifera (bulb-bearing water-hemlock)	1	0-1	15	4
Cicuta maculata (water-hemlock)	6	0-10	15	9
Cirsium arvense (Canada thistle)	2	0-3	23	5
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	8	3
Galium trifidum (small bedstraw)	7	0-20	38	16
Geum aleppicum (yellow avens)	2	0-3	15	6
Hippuris vulgaris (common mare's-tail)	1	0-1	8	3
Lysimachia thyrsiflora (tufted loosestrife)	10	0-10	8	9
Mentha arvensis (wild mint)	1	0-1	23	5
Petasites sagittatus (arrow-leaved coltsfoot)	2	0-3	15	6
Potentilla anserina (silverweed)	1	0-1	8	3
Potentilla norvegica (rough cinquefoil)	1	0-1	8	3
Potentilla palustris (marsh cinquefoil)	4	0-10	31	11
Ranunculus cymbalaria (seaside buttercup)	1	0-1	8	3
Rumex occidentalis (western dock)	1	0-1	31	6
Scutellaria galericulata (marsh skullcap)	5	0-20	62	16
Senecio conterminus (Arctic butterweed)	1	0-1	8	3
Sium suave (water parsnip)	1	0-1	15	4
Sonchus asper (prickly annual sow-thistle)	1	0-1	8	3
Sonchus spp. (sow-thistle)	12	0-20	15	14
Sparganium eurycarpum (giant bur-reed)	1	0-1	8	3
Stellaria longipes (long-stalked chickweed)	3	0-3	15	7
Taraxacum officinale (common dandelion)	1	0-1	8	3
Triglochin maritima (seaside arrow-grass)	1	0-1	8	3
Typha latifolia (common cattail)	1	0-1	23	5

Table 43 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0-1	8	3
Equisetum fluviatile (swamp horsetail)	13	0-50	38	22

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.



Successional Pathway of *Carex aquatilis* (water sedge) Sites in North Central Alberta
Reference Community = *Carex aquatilis* (water sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CALASTR—*Calamagrostis stricta* (narrow reed grass)
CAREAQU HT—*Carex aquatilis* (water sedge) habitat type
EQUIFLU—*Equisetum fluviatile* (swamp horsetail)
GALITRF—*Galium trifidum* (small bedstraw)
JUNCBAL—*Juncus balticus* (Baltic rush)
SCUTGAL—*Scutellaria galericulata* (marsh skullcap)

Figure 55. 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 56 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).

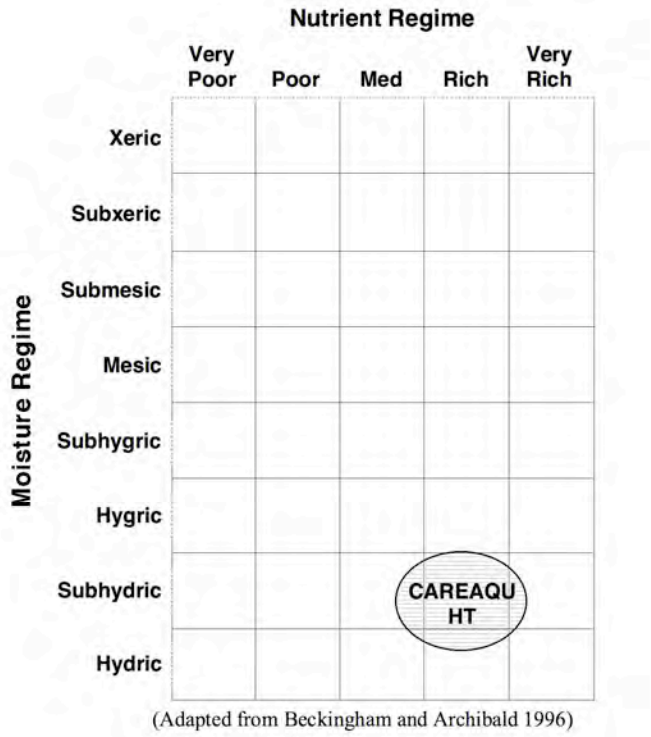


Figure 56. Edatope grid position for the *Carex aquatilis* (water sedge) habitat type (CAREAQU HT)

SOILS

Soils of the *Carex aquatilis* (water sedge) habitat type are typically Organic (Fibrisols, Mesisols, and Humisols). Mineral soil textures on sampled stands ranged from loam to clay. Water tables are at or near the surface throughout the year, although they can fall below 1 m by mid-summer. The soil reactions are acidic to neutral, with a pH range of 4.0 to 7.5 (USDA Natural Resources Conservation Service 2000). *Carex aquatilis* (water sedge) will grow on mineral soils, but the soil characteristically has a very high moisture-holding capacity with a shallow to deep peat layer.

ADJACENT COMMUNITIES

Adjacent wetter sites support the *Scirpus acutus* (great bulrush) or *Typha latifolia* (common cattail) habitat types. Drier sites support such communities as the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, the *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type, the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type, the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type, and the *Calamagrostis canadensis* (bluejoint) habitat type.

MANAGEMENT INFORMATION

Livestock

Livestock forage value of *Carex aquatilis* (water sedge) is rated as good (Tannas 1997), 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* (sedges) should respond satisfactorily to traditional grazing systems. However, on streamside sites ample 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 from these streamside sites for sedge regrowth at the end of the growing season should provide sufficient residual cover (Myers 1989).

Very wet soils may deter animal use until drying; however, if high levels 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). *Juncus balticus* (wire rush) is considered palatable early in the growing season when plants are young and tender. As stems mature and toughen, palatability declines (Tannas 1997).

Frisina (1991) states that 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.

Wildlife
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 swampy habitat of water sedge, grazing by most ungulates is limited. *Carex aquatilis* (water sedge) habitat provides nesting and hiding cover for some birds, waterfowl, and small mammals (USDA Intermountain Fire Sciences Lab 1995).

Fisheries
This habitat type is often located adjacent to waterways supporting trout fisheries. The combined tufted and rhizomatous growth habit of *Carex aquatilis* (water sedge) effectively stabilizes streambanks. Overhanging *Carex* (sedges) provide valuable cover and shade for fish.

Fire
Carex aquatilis (water sedge) recovers quickly from low-intensity fires. The rhizomes are approximately 2 inches (5 cm) below the ground surface, and well-protected form the heat of fire. The wet habitat also provides protection for roots and rhizomes, although the better-drained areas are more susceptible to fires during dry summers. The species colonizes burned areas by seeds and by rhizomes. The *Carex aquatilis* (water sedge) habitat type is suited to prescribed burning. Exclusion of livestock during the year prior to burning is essential. 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 should be taken in burning stands along streambanks to avoid impairing the excellent erosion protection this habitat type provides.

Soil Management and Rehabilitation Opportunities
These fine textured soils are highly susceptible to compaction when wet. Organic soils can be broken and churned by animal trampling. Site productivity may be lowered as soil is disturbed, and the site may become less favourable for *Carex aquatilis* (water sedge). Vehicle traffic causes serious long-term damage in these moist site types. Care should be taken to maintain existing roads in order to encourage travellers to stay on the road. New trails or roads near these sites should be located on adjacent uplands.

Generally, *Carex* (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 highly resistant to erosion. Along the stream, the sod may become undercut and may sag into the water, providing additional protection to streambanks.

Recreational Uses and Considerations
Recreational use is usually limited to the associated fishery. High levels of human use in the spring and summer can result in compacted soils, bank damage, and bare soils along stream edges. Moderate amounts of late season use have little impact.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Carex aquatilis* (water sedge) habitat type in the Dry Mixedwood Natural Subregion occur in the graminoid phase of the rich fen ecosite (k3) that has a subhydric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). The type may also be found on similar sites in the Parkland Natural Region.

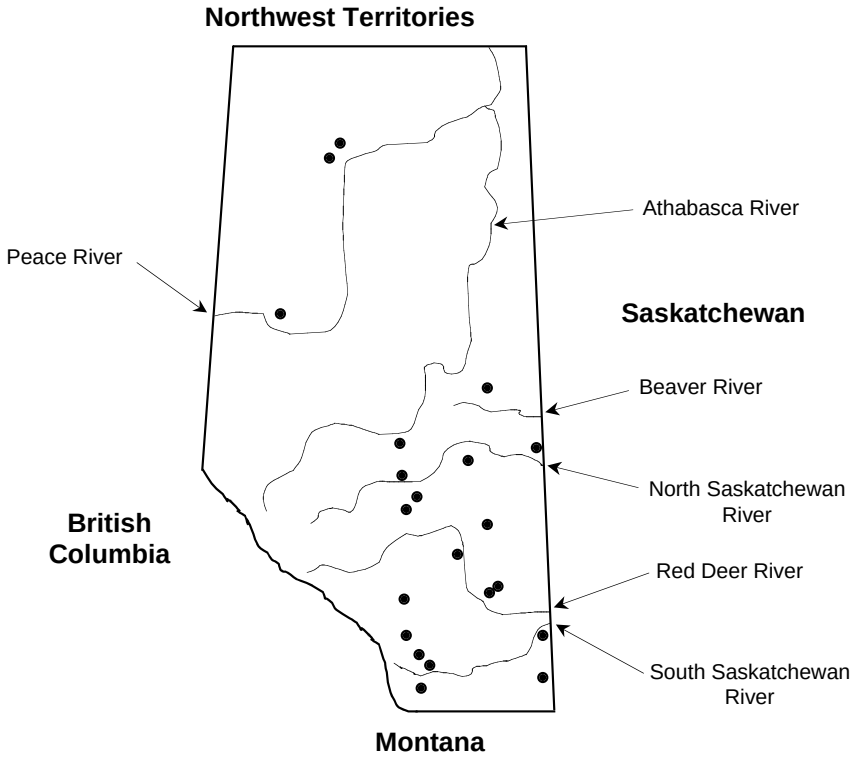
OTHER STUDIES

The *Carex aquatilis* (water sedge) habitat type is described is described by Thompson and Hansen (2002) in the Grassland Natural Region of southern Alberta, by Thompson and Hansen (2001) in the Prairie Ecozone of southern Saskatchewan, and by Hansen and others (1995) for Montana. Beckingham and Archibald (1996) in northern Alberta and Beckingham, Nielsen, and Futoransky (1996) in the Mid-Boreal ecoregions of Saskatchewan describe a sedge) fen community type of the graminoid rich fen ecosite. Willoughby (2000) describes a sedge meadow community type for the Dry Mixedwood Subregion of Alberta.

Carex atherodes Habitat Type
(Awned Sedge Habitat Type)

CAREATH
Number of Stands Sampled = 38
Number of Stands Sampled in Alberta = 28

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Carex atherodes* (awned sedge) habitat type is a minor type in the Parkland Natural Region and a major type in the Dry Mixedwood Natural Subregion. Sites are around depressional wetlands, sloughs, lakes, and low-lying steam floodplains. Stands may occur in standing water or on sites that become relatively dry during the later part of the growing season. They may be located where beaver ponds or shallow sloughs have filled with sediment. The *Carex atherodes* (awned sedge) habitat type represents one of the wetter major riparian and wetland communities. Stands were sampled on the Red Deer River near Trochu, near Elk Island National Park, Lac Ste. Anne near Gunn, and on Melito Creek near High Level.

VEGETATION

The *Carex atherodes* (awned sedge) habitat type in undisturbed condition usually supports a monospecific stand of *Carex atherodes* (awned sedge), however it may include lesser amounts of *Carex utriculata* (beaked sedge) and/or *Carex aquatilis* (water sedge) (Table 44). As stands are disturbed, herbaceous invaders come in, such as *Poa palustris* (fowl bluegrass), *Scolochloa festucacea* (spangletop), *Cicuta maculata* (water-hemlock), *Mentha arvensis* (wild mint), *Scutellaria galericulata* (marsh skullcap), and *Stachys palustris* (marsh hedge-nettle).

Table 44. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 25 relatively undisturbed late seral to climax stands of the *Carex atherodes* (awned sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Salix bebbiana (beaked willow)	1	0-1	4	2
Salix planifolia (flat-leaved willow)	1	0-1	4	2
Graminoids				
Carex aquatilis (water sedge)	16	0-30	8	11
Carex atherodes (awned sedge)	96	70-98	100	98
Carex utriculata (beaked sedge)	3	0-3	16	6
Carex spp. (sedge)	10	0-10	4	6
Glyceria grandis (common tall manna grass)	1	0-1	4	2
Hordeum jubatum (foxtail barley)	1	0-1	4	2
Scirpus microcarpus (small-fruited bulrush)	3	0-3	4	3
Scirpus pungens (three-square rush)	1	0-1	4	2
Scolochloa festucacea (spangletop)	3	0-3	4	3
Forbs				
Cicuta maculata (water-hemlock)	3	0-3	4	3
Circaea alpina (small enchanter's nightshade)	1	0-1	4	2
Galium trifidum (small bedstraw)	3	0-3	4	3
Geum aleppicum (yellow avens)	1	0-1	4	2
Lysimachia ciliata (fringed loosestrife)	3	0-3	4	3
Mentha arvensis (wild mint)	1	0-1	4	2
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	4	2
Polygonum amphibium (water smartweed)	2	0-3	16	6
Polygonum arenastrum (common knotweed)	1	0-1	4	2
Polygonum coccineum (water smartweed)	2	0-3	12	5
Polygonum lapathifolium (pale persicaria)	1	0-1	4	2
Rumex occidentalis (western dock)	1	0-1	8	3
Scutellaria galericulata (marsh skullcap)	2	0-3	8	4
Sium suave (water parsnip)	1	0-1	8	3
Sonchus arvensis (perennial sow-thistle)	1	0-1	4	2
Stachys palustris (marsh hedge-nettle)	3	0-3	4	3
Urtica dioica (common nettle)	1	0-1	8	3
Ferns and Allies				
Equisetum fluviatile (swamp horsetail)	1	0-1	4	2

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

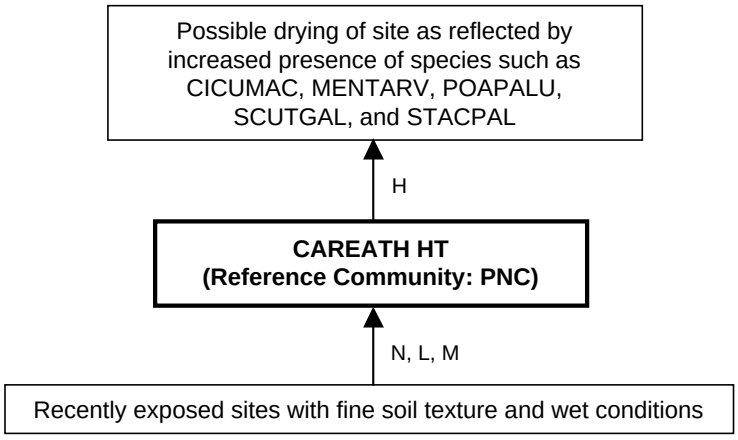
SUCCESSIONAL INFORMATION

Carex atherodes (awned sedge) can function as a pioneer colonizer of exposed mineral substrates, such as when a beaver dam breaks, or suitably wet sites otherwise become exposed; and it can also be a climax species by persisting on sites as long as hydrologic conditions remain favourable. High water tables and a vigorous rhizomatous root network limit establishment of most other species. In general, a high water table throughout the growing season inhibits access by livestock. However, livestock utilization can be high during drought years when upland forage is scarce and moist soils become dried. At these times severe grazing pressures can greatly decrease awned sedge cover, while increasing cover of disturbance-related herbs such as *Poa palustris* (fowl bluegrass), *Cicuta maculata* (water-hemlock), *Mentha arvensis* (wild mint), *Scutellaria galericulata* (marsh skullcap), and *Stachys palustris* (marsh hedge-nettle) (Table 45). Severe disturbance may lower the water table and shift potential of the site to a drier species such as *Calamagrostis inexpansa* (northern reed grass), *Scolochloa festucacea* (spangletop), or a *Poa* (bluegrass) species. In extreme cases, site hydrology and community composition could become altered to the *Poa pratensis* (Kentucky bluegrass) community type. Figure 57 shows a schematic diagram of expected successional vegetation pathways on sites of this type.

Table 45. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 13 disturbed or early seral stands of the *Carex atherodes* (awned sedge) habitat type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Trees				
Betula papyrifera (white birch)	3	0-3	8	5
Shrubs				
Rosa spp. (rose)	1	0-1	8	3
Salix spp. (willow)	3	0-3	15	7
Graminoids				
Alopecurus aequalis (short-awned foxtail)	1	0-1	8	3
Calamagrostis canadensis (bluejoint)	10	0-10	15	12
Calamagrostis inexpansa (northern reed grass)	2	0-3	15	6
Carex aquatilis (water sedge)	7	0-20	23	13
Carex atherodes (awned sedge)	72	20-98	100	85
Carex bebbii (Bebb's sedge)	3	0-3	8	5
Carex lanuginosa (woolly sedge)	1	0-1	8	3
Carex utriculata (beaked sedge)	13	0-40	38	22
Eleocharis palustris (creeping spike-rush)	10	0-10	8	9
Glyceria grandis (common tall manna grass)	1	0-1	15	4
Glyceria striata (fowl manna grass)	3	0-3	8	5
Juncus balticus (wire rush)	2	0-3	15	6
Phalaris arundinacea (reed canary grass)	1	0-1	23	5
Phragmites australis (reed)	3	0-3	8	5
Poa palustris (fowl bluegrass)	4	0-10	38	11
Poa pratensis (Kentucky bluegrass)	1	0-1	8	3
Scirpus acutus (great bulrush)	1	0-1	15	4
Scirpus microcarpus (small-fruited bulrush)	20	0-20	8	12
Scolochloa festucacea (spangletop)	24	0-40	23	24
Forbs				
Aster modestus (large northern aster)	1	0-1	8	3
Aster puniceus (purple-stemmed aster)	1	0-1	8	3
Caltha palustris (marsh-marigold)	3	0-3	8	5
Cicuta maculata (water-hemlock)	2	0-3	38	9
Cirsium arvense (Canada thistle)	1	0-1	15	4
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	8	3
Galium trifidum (small bedstraw)	1	0-1	8	3
Geum macrophyllum (large-leaved yellow avens)	3	0-3	8	5
Impatiens capensis (spotted touch-me-not)	1	0-1	8	3
Impatiens noli-tangere (western jewelweed)	3	0-3	8	5
Mentha arvensis (wild mint)	2	0-3	31	8
Petasites sagittatus (arrow-leaved coltsfoot)	6	0-10	15	9
Polygonum amphibium (water smartweed)	20	0-20	8	12
Polygonum coccineum (water smartweed)	3	0-3	8	5
Polygonum lapathifolium (pale persicaria)	1	0-1	8	3
Potentilla paradoxa (bushy cinquefoil)	1	0-1	8	3
Rumex occidentalis (western dock)	1	0-1	8	3
Sagittaria cuneata (arum-leaved arrowhead)	1	0-1	8	3
Scutellaria galericulata (marsh skullcap)	4	0-10	23	10
Senecio conterminus (Arctic butterweed)	1	0-1	8	3
Solidago canadensis (Canada goldenrod)	1	0-1	8	3
Sonchus spp. (sow-thistle)	1	0-1	15	4
Sparganium eurycarpum (giant bur-reed)	1	0-1	15	4
Stachys palustris (marsh hedge-nettle)	3	0-3	31	8
Taraxacum officinale (common dandelion)	3	0-3	8	5
Typha latifolia (common cattail)	2	0-3	15	6
Ferns and Allies				
Equisetum fluviatile (swamp horsetail)	1	0-1	8	3

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.



Successional Pathway of *Carex atherodes* (awned sedge) Sites in North Central Alberta
Reference Community = *Carex atherodes* (awned sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREATH HT—*Carex atherodes* (awned sedge) habitat type
CICUMAC—*Cicuta maculata* (water-hemlock)
MENTARV—*Mentha arvensis* (wild mint)
POAPALU—*Poa palustris* (fowl bluegrass)
SCUTGAL—*Scutellaria galericulata* (marsh skullcap)
STACPAL—*Stachys palustris* (marsh hedge-nettle)

Figure 57. 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 58 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).

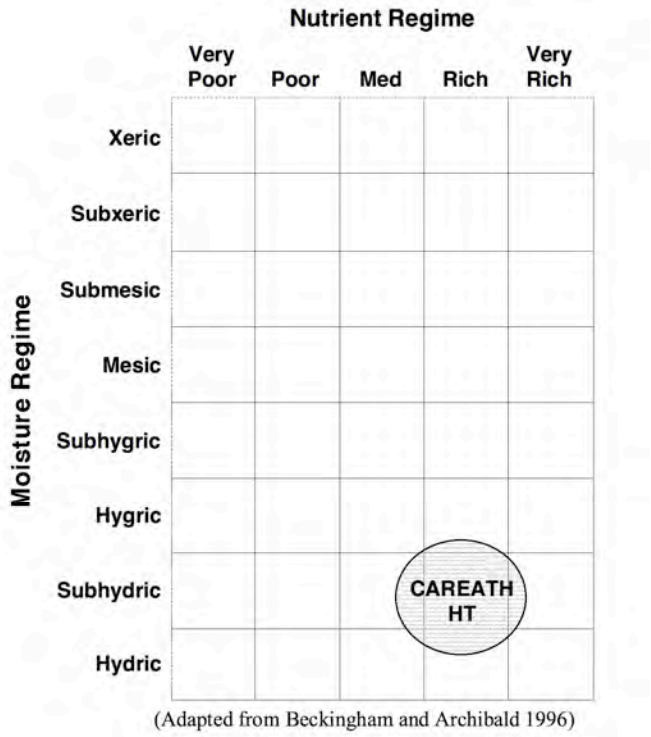


Figure 58. Edatope grid position for the *Carex atherodes* (awned sedge) habitat type (CAREATH HT)

SOILS

The *Carex atherodes* (awned sedge) habitat type is one of the wetter terrestrial plant communities. Stands may tolerate water as much as one meter deep for extended periods. A wide range of soils is associated with this type, but a thick organic layer at the surface is a common feature. Mineral soil textures on sampled stands ranged 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. Soil reaction ranges from moderately acidic to very slightly basic, with a pH range of 4.5 to 7.2 (USDA Natural Resources Conservation Service 2000).

ADJACENT COMMUNITIES

On many sites the *Carex atherodes* (awned sedge) habitat type is the wettest community present, such as in the centre of a shallow depression or slough. On other sites *Scirpus acutus* (great bulrush) or *Typha latifolia* (common cattail) or *Scirpus acutus* (great bulrush) stands may be present on adjacent areas with deeper water. Adjacent drier communities may include the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, the *Salix planifolia/ Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type, the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type, the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type, and the *Calamagrostis canadensis* (bluejoint) habitat type.

MANAGEMENT INFORMATION

Livestock

Livestock forage value of *Carex atherodes* (awned sedge) is high (Tannas 1997, 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 attractive (Tannas 1997, 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 drying, allowing the most palatable species to replenish their carbohydrate reserves and to persist within these communities. However, if high levels of grazing does occur, there will be a marked decrease in *Carex atherodes* (awned sedge) and an increase in less palatable species, including *Juncus balticus* (wire rush). *Juncus*

balticus (wire rush) is considered palatable early in the growing season when plants are young and tender. As stems mature and toughen, palatability declines (Tannas 1997, Hansen and others 1988).

Frisina (1991) states that 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.

Wildlife
Wetland sedge species, such as *Carex atherodes* (awned sedge) are an important component of valuable breeding 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 (USDA Intermountain Fire Sciences Lab 1995).

Fisheries
This type is found more frequently in lentic situations around depressional wetlands, sloughs, potholes, wet meadows, and fens where fish habitat is not an issue.

Fire
Carex atherodes (awned sedge) 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 type provides. Under drought conditions, there is danger of burning the soil peat layer and damaging the *Carex atherodes* (awned sedge) roots.

Soil Management and Rehabilitation Opportunities
Mineral soils are highly susceptible to compaction when wet. Organic soils can be broken and churned by animal trampling. Site productivity may be lowered as soil is disturbed to become less favourable for *Carex atherodes* (awned sedge). Vehicle traffic causes serious long-term damage in these moist site types on fine textured soils. Care should be taken to maintain existing roads to encourage travellers to stay on the road. New trails or roads should be located on adjacent uplands.

Generally, due to their stronger rhizomatous roots, *Carex* (sedges) offer better streambank protection than grasses. *Carex atherodes* (awned sedge) forms a dense, thick sod highly resistant to erosion. Along the stream, the sod may overhang the bank and sag into the water, providing additional protection to streambanks. However, in such cases, grazing or trailing impacts may cause the heavy sod to slough off into the channel.

Carex atherodes (awned sedge) is suited for long-term revegetation of disturbed sites and erosion control projects with a high water table. It can rapidly re-colonize disturbed sites by seeding and rhizome expansion. Its rhizomes form a dense network that is effective in stabilizing streambanks and preventing soil erosion.

Recreational Uses and Considerations
Recreational use is usually limited to the associated fishery. High levels of human use in the spring and summer can result in compacted soils, bank damage, and bare soils along stream edges. Moderate amounts of late season use have little impact.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Carex atherodes* (awned sedge) habitat type in the Dry Mixedwood Natural Subregion occur in the graminoid phase of the rich fen ecosite (k3) that has a subhydric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). The type may also be found on similar sites in the Parkland Natural Region.

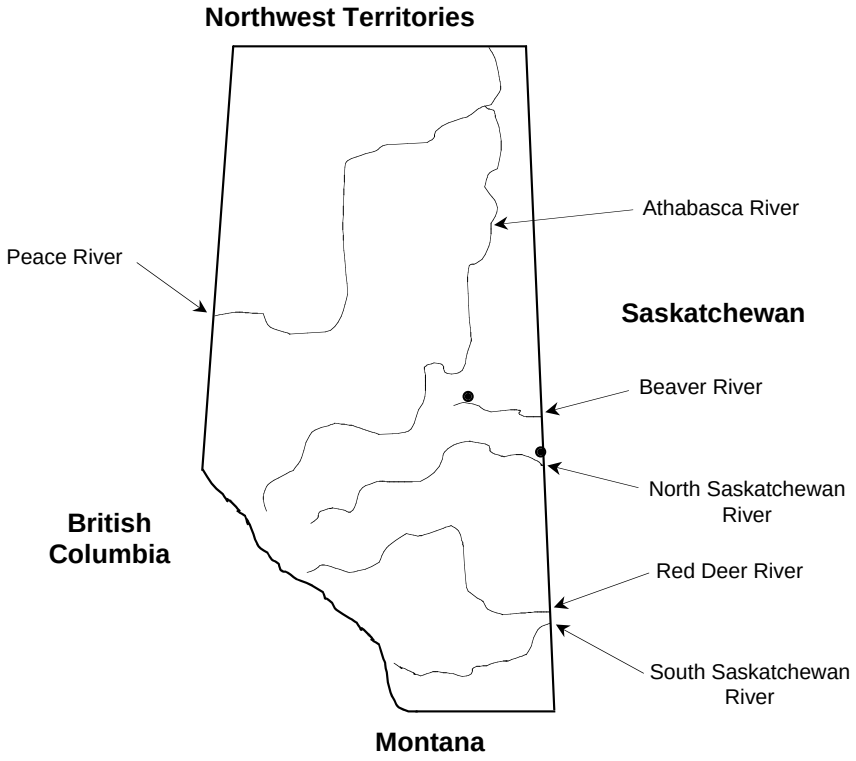
OTHER STUDIES

The *Carex atherodes* (awned sedge) habitat type is described by Thompson and Hansen (2002) in the Grassland Natural Region of southern Alberta, by Thompson and Hansen (2001) in the Prairie Ecozone of southern Saskatchewan. Beckingham and Archibald (1996) in northern Alberta and Beckingham, Nielsen, and Futoransky (1996) in the Mid-Boreal ecoregions of Saskatchewan describe a sedge fen community type of the graminoid rich fen ecosite. Willoughby (2000) describes a sedge meadow community type for the Dry Mixedwood Subregion of Alberta.

Carex diandra Habitat Type
(Two-stamened Sedge Habitat Type)

CAREDIA
Number of Stands Sampled = 6
Number of Stands Sampled in Alberta = 6

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Carex diandra* (two-stamened sedge) habitat type is an incidental type at low elevations in the Dry Mixedwood Natural Subregion of Alberta. This type occurs primarily on rich graminoid fens with saturated substrates of peat on a filled-in lake, or often on a floating mat of organic matter. Sites were sampled near Caslan and the Tulliby Lake vicinity.

VEGETATION

The *Carex diandra* (two-stamened sedge) habitat type often supports a nearly monospecific stand of dense *Carex diandra* (two-stamened sedge), but often it is mixed with a considerable amount of *Calamagrostis stricta* (narrow reed grass). Also often present are lesser amounts of *Carex atherodes* (awned sedge), *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), *Menyanthes trifoliata* (buck-bean), and *Potentilla palustris* (marsh cinquefoil) (Table 46).

Table 46. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Carex diandra* (two-stamened sedge) habitat type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Shrubs				
Betula papyrifera (white birch)	1	0-1	17	4
Salix arbusculoides (shrubby willow)	1	0-1	17	4

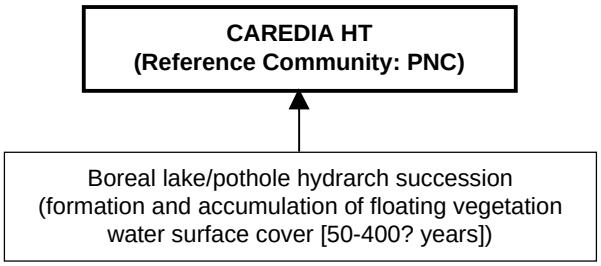
Table 46 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Salix candida (hoary willow)	1	0-1	17	4
Salix discolor (pussy willow)	1	0-1	33	6
Salix pedicellaris (bog willow)	1	0-1	33	6
Salix petiolaris (basket willow)	1	0-1	17	4
Graminoids				
Calamagrostis canadensis (bluejoint)	1	0-1	17	4
Calamagrostis stricta (narrow reed grass)	65	0-70	33	47
Carex aquatilis (water sedge)	2	0-3	67	12
Carex atherodes (awned sedge)	2	0-3	33	8
Carex curta (short sedge)	3	0-3	17	7
Carex diandra (two-stamened sedge)	66	20-98	100	81
Carex lacustris (lakeshore sedge)	1	0-1	17	4
Carex lasiocarpa (hairy-fruited sedge)	1	0-1	17	4
Carex utriculata (beaked sedge)	2	0-3	50	7
Eleocharis palustris (creeping spike-rush)	2	0-3	33	8
Eriophorum gracile (slender cotton grass)	1	0-1	17	4
Scirpus validus (common great bulrush)	1	0-1	17	4
Forbs				
Caltha palustris (marsh-marigold)	7	0-10	33	15
Cicuta maculata (water-hemlock)	1	0-1	17	4
Galium trifidum (small bedstraw)	1	0-1	17	4
Menyanthes trifoliata (buck-bean)	12	0-20	33	20
Polygonum amphibium (water smartweed)	1	0-1	17	4
Potentilla palustris (marsh cinquefoil)	5	0-10	50	16
Rumex occidentalis (western dock)	1	0-1	33	6
Scutellaria galericulata (marsh skullcap)	3	0-3	17	7
Stellaria longifolia (long-leaved chickweed)	1	0-1	17	4
Triglochin maritima (seaside arrow-grass)	1	0-1	17	4
Typha latifolia (common cattail)	1	0-1	17	4
Ferns and Allies				
Equisetum fluviatile (swamp horsetail)	2	0-3	33	8

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The *Carex diandra* (two-stamened sedge) habitat type typically occurs on floating mats of living and dead vegetation. Vegetation potential is difficult to define on such sites due to ever shifting conditions relating to drought cycles and hydrarch succession. We assume here that this community reflects the site potential under present hydrologic conditions. Figure 59 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Carex diandra* (two-stamened sedge) Sites in North Central Alberta
Reference Community = *Carex diandra* (two-stamened sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREDIA HT—*Carex diandra* (two-stamened sedge) habitat type

Figure 59. Successional pathway for sites of the *Carex diandra* (two-stamened sedge) habitat type

Note: The *Carex diandra* (two-stamened sedge) habitat type represents vegetation potential at a stable, long-term stage in the natural succession of shallow boreal lakes and potholes where the water surface has been covered with a floating mat of tightly bound herbaceous plant roots and debris, but there is still insufficient rooting medium for shrub species.

EDATOPE

Figure 60 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 diandra* (two-stamened sedge) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

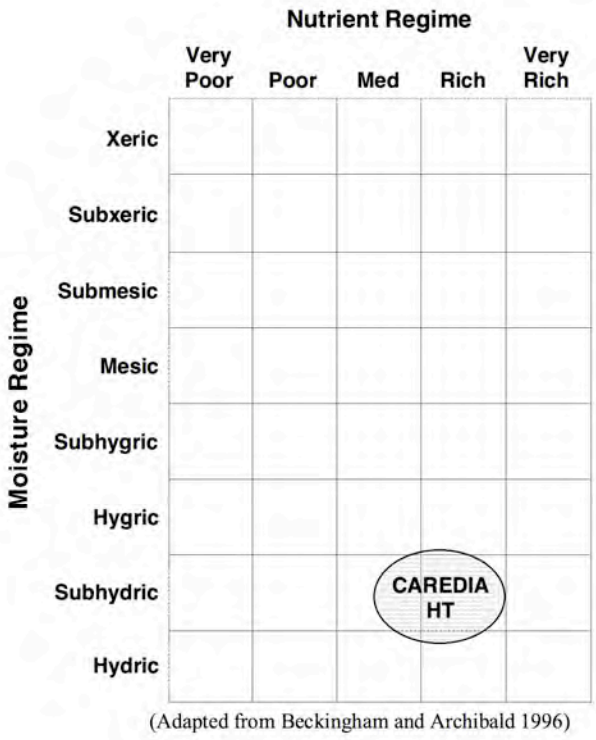


Figure 60. Edatope grid position for the *Carex diandra* (two-stamened sedge) habitat type (CAREIDA HT)

SOILS

The *Carex diandra* (two-stamened sedge) habitat type occurs on saturated peaty organic soil, typically lacking mineral substrate in the profile, and often in the form of a floating mat.

ADJACENT COMMUNITIES

On many sites the *Carex diandra* (two-stamened sedge) habitat type is the wettest community present. On other sites, wetter communities in deeper water may include *Scirpus acutus* (great bulrush), *Typha latifolia* (common cattail), or *Eleocharis palustris* (creeping spike-rush) stands. Adjacent drier communities may include *Salix* species (willow) communities or a grass type such as the *Calamagrostis inexpansa* (northern reedgrass) community type.

MANAGEMENT INFORMATION

Livestock
The *Carex diandra* (two-stamened sedge) habitat type offers no potential for livestock forage due to access limitations.

Wildlife
Moose and waterfowl may utilize stands of this type. Songbird activity was noted in stands of this type during sampling for this study.

Fisheries
Most stands of the *Carex diandra* (two-stamened sedge) habitat type are not in conjunction with fishery habitat.

Fire
Most stands of the *Carex diandra* (two-stamened sedge) habitat type are not in situations that are susceptible to fire.

Soil Management and Rehabilitation Opportunities
The *Carex diandra* (two-stamened sedge) habitat type neither requires much consideration of soil management, nor offers much opportunity for utilization in rehabilitation projects due to its narrow site condition requirements.

Recreational Uses and Considerations
Opportunity for recreational use is generally lacking beyond the interests of wetland botanists.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Carex diandra* (two-stamened sedge) habitat type in the Dry Mixedwood Natural Subregion occur in the graminoid phase of the rich fen ecosite (k3) that has a subhydric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). The type was not found in the Parkland Natural Region.

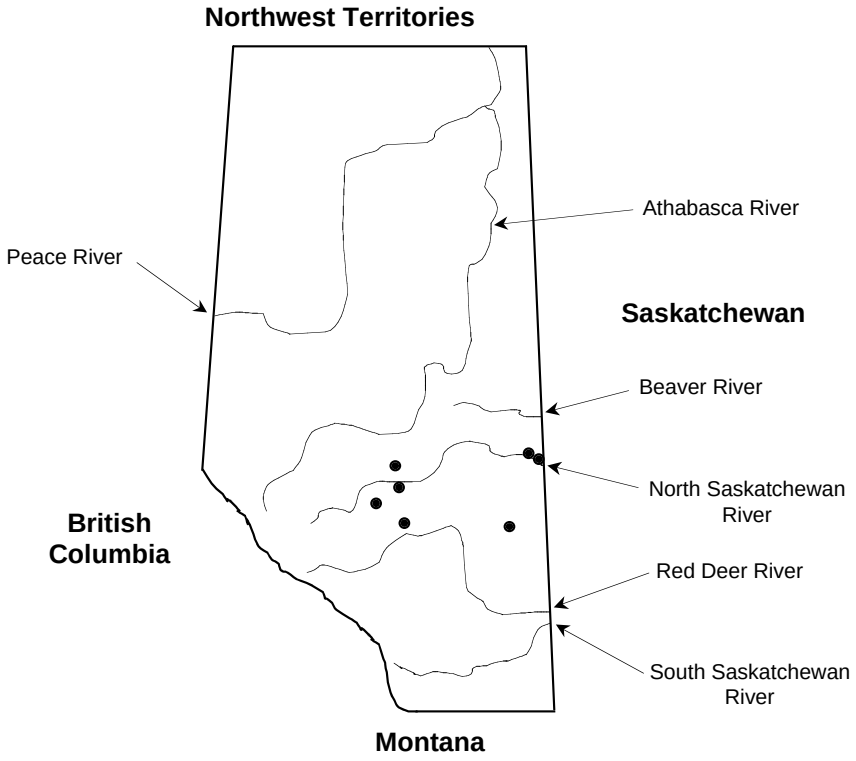
OTHER STUDIES

The *Carex diandra* (two-stamened sedge) habitat type has not been described for this region by others. Beckingham and Archibald (1996) in northern Alberta and Beckingham, Nielsen, and Futoransky (1996) in the Mid-Boreal ecoregions of Saskatchewan describe a sedge fen community type of the graminoid rich fen ecosite. Willoughby (2000) describes a sedge meadow community type for the Dry Mixedwood Subregion of Alberta.

Carex utriculata Habitat Type
(Beaked Sedge Habitat Type)

CAREUTR
Number of Stands Sampled = 14
Number of Stands Sampled in Alberta = 13

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Carex utriculata* (beaked sedge) habitat type is a minor type at low to mid elevations in the central Alberta part of the Dry Mixedwood Natural Subregion and an incidental type in the Parkland Natural Region Alberta. It was not observed in the Peace River part of the Dry Mixedwood, where the similar landscape position supports the *Carex atherodes* (awned sedge) habitat type. *Carex utriculata* (beaked sedge) appears to occur somewhat more frequently on coarser and younger soils, such as fluvial deposits, than does *Carex atherodes* (awned sedge). The hydrologic regime of the *Carex utriculata* (beaked sedge) habitat type appears to be slightly wetter than that of the *Carex atherodes* (awned sedge) habitat type or the *Carex aquatilis* (water sedge) habitat type, although these three *Carex* (sedges) occasionally codominate on disturbed sites or those with unstable hydrology.

VEGETATION

Relatively undisturbed stands of the *Carex utriculata* (beaked sedge) habitat type are a nearly monospecific stand of dense beaked sedge. Also present may be lesser amounts of *Carex atherodes* (awned sedge) or *Carex aquatilis* (water sedge) (Table 47). The high constancy of small amounts of *Typha latifolia* (common cattail) in undisturbed stands, and low occurrence in more disturbed stands is an anomaly that may be explained by the tendency of the stands in deeper water to receive less access from grazing animals.

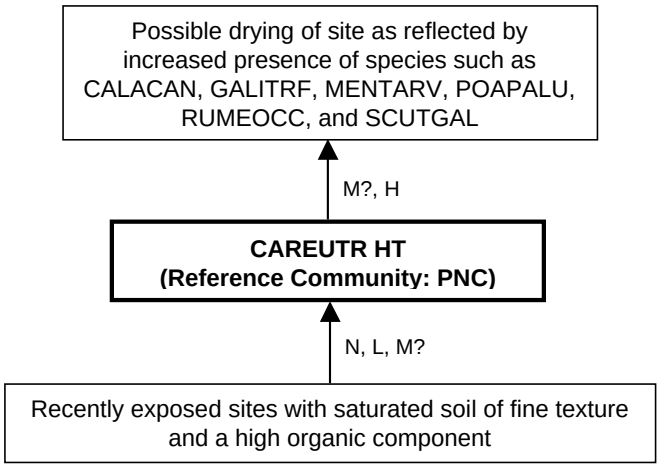
Table 47. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 relatively undisturbed late seral to climax stands of the *Carex utriculata* (beaked sedge) habitat type

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Graminoids				
Carex aquatilis (water sedge)	1	0-1	17	4
Carex atherodes (awned sedge)	7	0-10	33	15
Carex lanuginosa (woolly sedge)	10	0-10	17	13
Carex utriculata (beaked sedge)	94	90-98	100	97
Scirpus validus (common great bulrush)	1	0-1	17	4
Forbs				
Cirsium arvense (Canada thistle)	1	0-1	17	4
Galium trifidum (small bedstraw)	1	0-1	17	4
Lysimachia thyrsiflora (tufted loosestrife)	1	0-1	17	4
Polygonum lapathifolium (pale persicaria)	1	0-1	17	4
Potentilla palustris (marsh cinquefoil)	1	0-1	17	4
Scutellaria galericulata (marsh skullcap)	1	0-1	17	4
Sonchus spp. (sow-thistle)	1	0-1	17	4
Typha latifolia (common cattail)	1	0-3	83	9

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Carex utriculata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates, such as when a beaver dam breaks; and also as a climax species able to persist where established so long as site hydrology remains favourable. High water tables and a vigorous rhizome network limit establishment of most other species. In general, a high water table throughout the growing season inhibits access by livestock. However, severe grazing pressure during periods of drought can greatly decrease *Carex utriculata* (beaked sedge) cover, while increasing diversity of opportunistic species and the presence of disturbance-related herbs like *Poa* species (bluegrass), *Mentha arvensis* (wild mint), and *Scutellaria galericulata* (marsh skullcap) (Table 48). Long-term, severe disturbance may lower the water table and shift the site hydrology, causing change to drier species. Figure 61 shows a schematic diagram of the expected successional pathway on sites of this type.



Successional Pathway of *Carex utriculata* (beaked sedge) Sites in North Central Alberta
Reference Community = *Carex utriculata* (beaked sedge) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CALACAN—*Calamagrostis canadensis* (bluejoint)
CAREUTR HT—*Carex utriculata* (beaked sedge) habitat type
GALITRF—*Galium trifidum* (small bedstraw)
MENTARV—*Mentha arvensis* (wild mint)
POAPALU—*Poa palustris* (fowl bluegrass)
RUMEOCC—*Rumex occidentalis* (western dock)
SCUTGAL—*Scutellaria galericulata* (marsh skullcap)

Figure 61. 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) or the *Scirpus acutus* (great bulrush). A drier hydrologic regime would likely change the site potential to a shrub type.

Table 48. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 disturbed or early seral stands of the *Carex utriculata* (beaked sedge) habitat type

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Shrubs				
Salix lutea (yellow willow)	1	0-1	13	4
Salix spp. (willow)	3	0-3	38	11
Graminoids				
Alopecurus aequalis (short-awned foxtail)	1	0-1	13	4
Calamagrostis canadensis (bluejoint)	2	0-3	25	7
Calamagrostis inexpansa (northern reed grass)	2	0-3	25	7
Calamagrostis stricta (narrow reed grass)	1	0-1	13	4
Carex aquatilis (water sedge)	13	0-30	63	29
Carex atherodes (awned sedge)	10	0-10	50	22
Carex diandra (two-stamened sedge)	1	0-1	13	4
Carex microglochin (short-awned sedge)	10	0-10	13	11
Carex prairea (prairie sedge)	3	0-3	13	6
Carex utriculata (beaked sedge)	63	20-90	100	79
Eleocharis palustris (creeping spike-rush)	1	0-1	13	4
Hordeum jubatum (foxtail barley)	3	0-3	13	6
Phalaris arundinacea (reed canary grass)	1	0-1	13	4
Phragmites australis (reed)	1	0-1	13	4
Poa palustris (fowl bluegrass)	7	0-10	25	13
Scirpus validus (common great bulrush)	1	0-1	13	4
Forbs				
Cirsium arvense (Canada thistle)	1	0-1	13	4
Epilobium leptophyllum (narrow-leaved willowherb)	1	0-1	13	4
Epilobium palustre (marsh willowherb)	3	0-3	13	6
Galium trifidum (small bedstraw)	3	0-3	25	9
Geum aleppicum (yellow avens)	1	0-1	25	5
Lysimachia ciliata (fringed loosestrife)	3	0-3	13	6
Mentha arvensis (wild mint)	1	0-1	38	6
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	13	4
Polygonum amphibium (water smartweed)	1	0-1	13	4
Potentilla palustris (marsh cinquefoil)	1	0-1	13	4
Potentilla paradoxa (bushy cinquefoil)	1	0-1	13	4
Rorippa palustris (marsh yellow cress)	1	0-1	13	4
Rumex crispus (curled dock)	3	0-3	13	6
Rumex occidentalis (western dock)	1	0-1	38	6
Rumex triangulivalvis (narrow-leaved dock)	1	0-1	13	4
Scutellaria galericulata (marsh skullcap)	2	0-3	63	11
Sium suave (water parsnip)	1	0-1	13	4

Table 48 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Stellaria longifolia (long-leaved chickweed)	3	0-3	13	6
Typha latifolia (common cattail)	1	0-1	13	4
Ferns and Allies				
Equisetum arvense (common horsetail)	3	0-3	13	6
Equisetum fluviatile (swamp horsetail)	3	0-3	13	6

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

EDATOPE

Figure 62 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).

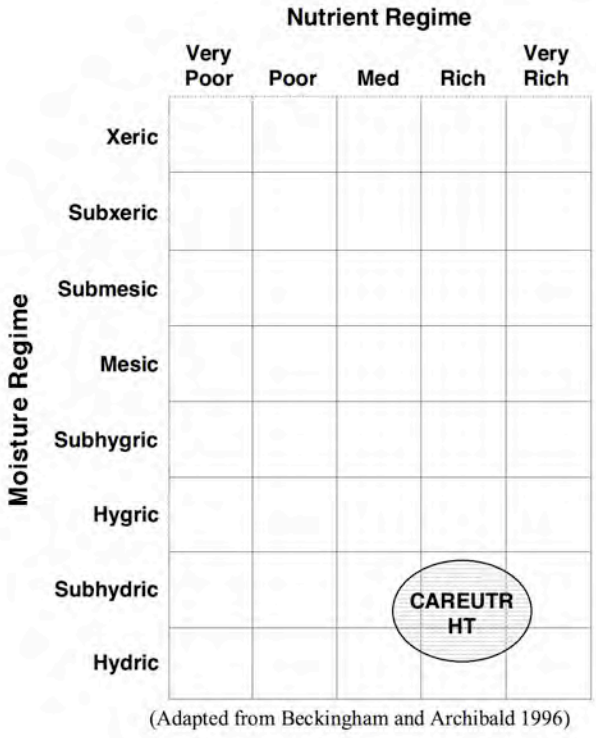


Figure 62. Edatope grid position for the *Carex utriculata* (beaked sedge) habitat type (CAREUTR HT)

SOILS

A wide range of soils is associated with the *Carex utriculata* (beaked sedge) habitat type. High water table is a more important site requirement than is the nature of the substrate (Hansen and others 1988). *Carex utriculata* (beaked sedge) colonizes the undeveloped soils of suitably wet, fresh alluvial deposits, but organic soils (Fibrisols, Mesisols, and Humisols) are most common. Mature stands often have organic accumulations greater than 1 m thick. Mineral soil textures in sampled stands range from clay to sandy loam. Redoximorphic features (mottling or gleying) are common in subsurface horizons. Water tables are typically at or above the soil surface throughout the growing season. Soil reaction ranges from slightly acidic to very slightly basic, with a pH range of 5.7 to 7.7 (USDA Natural Resources Conservation Service 2000).

ADJACENT COMMUNITIES

On many sites the *Carex utriculata* (beaked sedge) habitat type is the wettest community present. On other sites *Scirpus acutus* (great bulrush) or *Typha latifolia* (common cattail) stands may be present on adjacent areas with deeper water. Adjacent drier communities may include the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, *Salix bebbiana* (beaked willow), *Salix planifolia* (flat-leaved willow), or *Juncus balticus* (wire rush), or *Poa palustris* (fowl bluegrass). Drier adjacent communities likely encountered may include the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type, the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type, the *Carex aquatilis* (water sedge) habitat type, and the *Calamagrostis canadensis* (bluejoint) habitat type.

MANAGEMENT INFORMATION

Management of the *Carex utriculata* (beaked sedge) and *Carex atherodes* (awned sedge) habitat types are treated similarly.

Livestock

Livestock forage value of *Carex utriculata* (beaked sedge) is high (Tannas 1997, Beckingham 1991). The species is palatable in the spring, but palatability declines as the plants become coarse and tough in summer (Tannas 1997, Hansen and others 1988). Palatability may then increase again in fall as the *Carex utriculata* (beaked sedge) cures and upland forage is less attractive. In general, *Carex* (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).

Very wet soils may deter animal use until drying, allowing the most palatable species to replenish their carbohydrate reserves and to persist within these communities. *Carex utriculata* (beaked sedge) cover decreases in response to high levels of grazing pressure, and it will be replaced with an increase in less productive and less palatable species, such as *Juncus balticus* (wire rush), *Geum* species (avens), *Poa* species (bluegrass), *Rumex* species (dock), and *Scutellaria galericulata* (marsh skullcap). In general, *Carex* (sedges) should respond satisfactorily to traditional grazing systems designed for upland species. 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 time for sufficient residual cover (Myers 1989).

Frisina (1991) states that 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.

Wildlife

Carex utriculata (beaked sedge) is an important component of valuable breeding and feeding grounds for geese and other waterfowl. Birds that are commonly associated with 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 (USDA Intermountain Fire Sciences Lab 1995).

Fisheries

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.

Fire

The *Carex utriculata* (beaked sedge) habitat type is suited to prescribed burning, but is difficult to burn. Prescribed fires are most effective in late summer, early fall, or during dry years when the water is below the soil surface. Peat soils are flammable when dry. Hot fires may penetrate the soil and destroy sedge rhizomes (USDA Intermountain Fire Sciences Lab 1995). It is essential 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 succession in treed or shrubby fens to open sedge meadows that support little woody vegetation (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities

Mineral soils are highly susceptible to compaction when wet. Organic soils can be broken and churned by animal trampling. Site productivity may be lowered as soil is disturbed to become less favourable for *Carex utriculata* (beaked sedge). Vehicle

traffic causes serious long-term damage in these moist site types on fine textured soils. Care should be taken to maintain existing roads in order to encourage travellers to stay on the road. New trails or roads should be located on adjacent uplands.

Generally, *Carex* (sedges) offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex utriculata* (beaked sedge) tends to form a dense, thick sod highly resistant to erosion. Along the stream, the sod may become undercut and may sag into the water, providing additional protection to streambanks. However, if grazing or trailing impacts are severe, the heavy weight of the sod makes it susceptible to sloughing.

The low stream gradient and well-developed floodplains typically associated with this type allow high rates of streambank damage recovery through the bank building process. This requires residual vegetation cover remaining in the spring to filter sediments. Removing cattle for at least 30 days for fall regrowth should allow time for sufficient residual sedge cover (Myers 1989).

Recreational Uses and Considerations

Recreational use is usually limited to any associated fishery. High levels of human use, such as hiking, in the spring and summer can cause soil compaction, bank damage, and bare soils along stream edges. Moderate amounts of late season use have little impact.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Carex utriculata* (beaked sedge) habitat type in the Dry Mixedwood Natural Subregion occur in the graminoid phase of the rich fen ecosite (k3) which has a subhydric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). The type also occurs in the Parkland Natural Region.

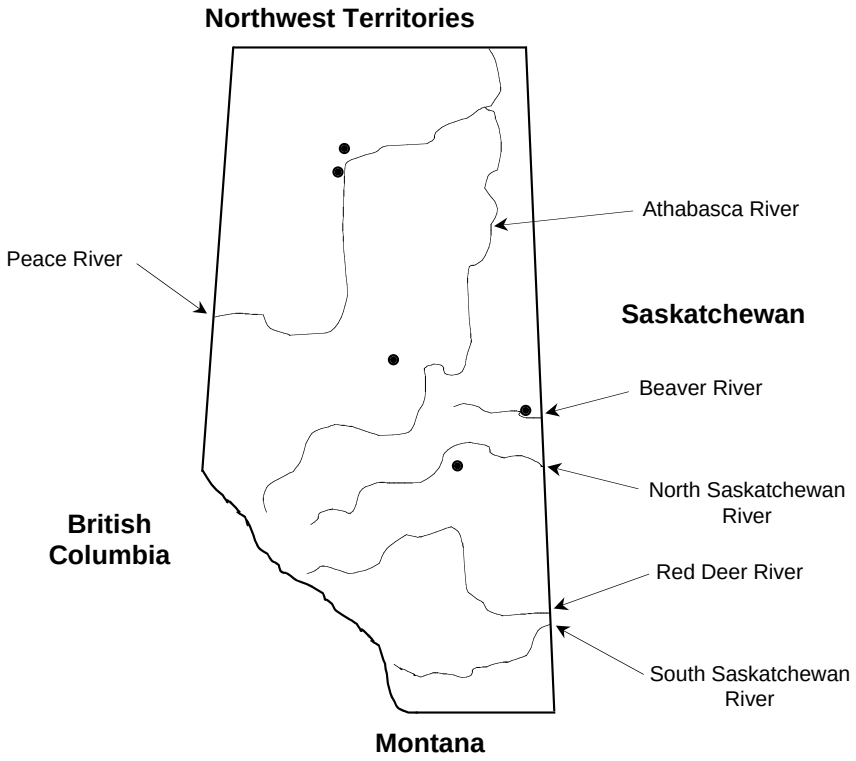
OTHER STUDIES

The *Carex utriculata* (beaked sedge) habitat type is described by Thompson and Hansen (2002) in the Grassland Natural Region of southern Alberta, by Thompson and Hansen (2001) in the Prairie Ecozone of southern Saskatchewan. A similar *Carex rostrata* (beaked sedge) habitat type is described by Hansen and others (1995) in Montana. Numerous other studies have identified similar communities, reflective of the widespread distribution of this type: Norton (1981), Ratliff (1982), Tuhy and Jensen (1982), Mutz and Queiroz (1983), Mattson (1984), Youngblood and others (1985b), Chadde and others (1988), and Padgett and others (1989). Beckingham and Archibald (1996) in northern Alberta and Beckingham, Nielsen, and Futoransky (1996) in the Mid-Boreal ecoregions of Saskatchewan describe a sedge fen community type of the graminoid rich fen ecosite. Willoughby (2000) describes a sedge meadow community type for the Dry Mixedwood Subregion of Alberta.

Calamagrostis canadensis Habitat Type (Bluejoint Habitat Type)

CALACAN
Number of Stands Sampled = 7
Number of Stands Sampled in Alberta = 7

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Calamagrostis canadensis* (bluejoint) habitat type is a minor type in the Dry Mixedwood Natural Subregion of Alberta. Although *Calamagrostis canadensis* (bluejoint) is a common understory component of many wooded types in the region, this habitat type occurs in open wet meadows, such as filled-in or drained beaver ponds, and on low alluvial terraces or benches along low gradient streams. Stands were sampled on the Beaver River near Cold Lake, near Kinuso, and on the Boyer River near High Level.

VEGETATION

The diagnostic species of this community type is *Calamagrostis canadensis* (bluejoint), but commonly associated are *Carex atherodes* (awned sedge), *Poa palustris* (fowl bluegrass), *Stachys palustris* (marsh hedge-nettle), and *Urtica dioica* (common nettle) (Table 49). *Calamagrostis canadensis* (bluejoint) tends to inhibit entry of other species by forming a dense sod, therefore, the increased presence of other species, especially herbs, is a general indication of disturbance.

Table 49. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 stands of the *Calamagrostis canadensis* (bluejoint) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Populus balsamifera (balsam poplar)	1	0-1	14	4
Populus tremuloides (aspen)	1	0-1	29	5
Shrubs				
Cornus stolonifera (red-osier dogwood)	1	0-1	14	4
Ribes glandulosum (skunk currant)	1	0-1	14	4
Rosa spp. (rose)	3	0-3	14	7
Rubus idaeus (wild red raspberry)	1	0-1	14	4
Salix bebbiana (beaked willow)	1	0-1	29	5
Salix discolor (pussy willow)	1	0-1	14	4
Salix exigua (sandbar willow)	1	0-1	14	4
Salix spp. (willow)	1	0-1	14	4
Symphoricarpos occidentalis (buckbrush)	1	0-1	14	4
Graminoids				
Agrostis scabra (rough hair grass)	3	0-3	14	7
Bromus inermis (awnless brome)	1	0-1	14	4
Calamagrostis canadensis (bluejoint)	74	30-98	100	86
Carex aquatilis (water sedge)	2	0-3	29	8
Carex atherodes (awned sedge)	9	0-20	71	25
Carex bebbii (Bebb's sedge)	2	0-3	29	8
Carex utriculata (beaked sedge)	1	0-1	14	4
Carex sychnocephala (long-beaked sedge)	1	0-1	14	4
Glyceria grandis (common tall manna grass)	1	0-1	14	4
Juncus balticus (wire rush)	10	0-10	14	12
Phragmites australis (reed)	10	0-10	14	12
Poa palustris (fowl bluegrass)	2	0-3	43	9
Poa pratensis (Kentucky bluegrass)	3	0-3	14	7
Forbs				
Aster hesperius (western willow aster)	1	0-1	14	4
Aster modestus (large northern aster)	3	0-3	14	7
Cicuta maculata (water-hemlock)	1	0-1	29	5
Cirsium arvense (Canada thistle)	3	0-3	14	7
Epilobium angustifolium (common fireweed)	1	0-1	14	4
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	14	4
Erysimum cheiranthoides (wormseed mustard)	1	0-1	14	4
Fragaria virginiana (wild strawberry)	1	0-1	14	4
Galium trifidum (small bedstraw)	2	0-3	29	8
Geranium richardsonii (wild white geranium)	1	0-1	14	4
Geum aleppicum (yellow avens)	1	0-1	14	4
Geum macrophyllum (large-leaved yellow avens)	3	0-3	14	7
Impatiens spp. (touch-me-not)	1	0-1	14	4
Mentha arvensis (wild mint)	1	0-1	29	5
Petasites sagittatus (arrow-leaved coltsfoot)	3	0-3	14	7
Polygonum lapathifolium (pale persicaria)	3	0-3	14	7
Potentilla anserina (silverweed)	1	0-1	14	4
Potentilla norvegica (rough cinquefoil)	1	0-1	14	4
Potentilla paradoxa (bushy cinquefoil)	1	0-1	14	4
Rumex crispus (curled dock)	1	0-1	14	4
Rumex occidentalis (western dock)	1	0-1	14	4
Scutellaria galericulata (marsh skullcap)	2	0-3	29	8
Solidago gigantea (late goldenrod)	1	0-1	14	4
Solidago missouriensis (low goldenrod)	1	0-1	14	4
Sonchus spp. (sow-thistle)	1	0-1	29	5
Stachys palustris (marsh hedge-nettle)	2	0-3	43	9

Table 49 (cont.)

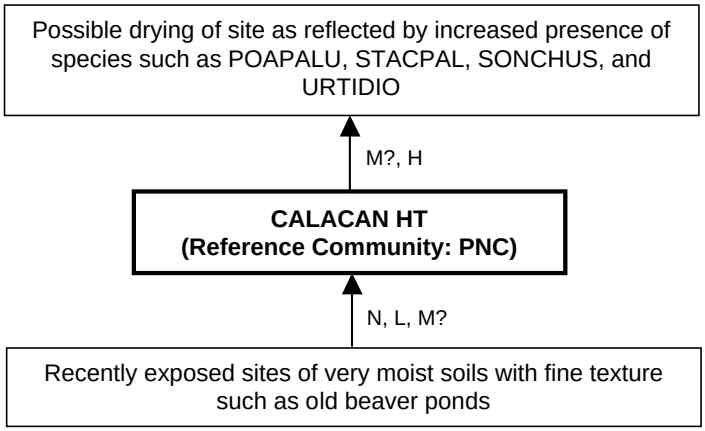
Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Taraxacum officinale (common dandelion)	1	0-1	14	4
Typha latifolia (common cattail)	1	0-1	14	4
Urtica dioica (common nettle)	4	0-10	43	13
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0-1	14	4

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

A vigorous combination of sexual and vegetative reproduction strategies *Calamagrostis canadensis* (bluejoint) allows this grass to persist throughout the successional continuum. It is an aggressive ground colonizer of available moist sites. Once established, a very dense stand of bluejoint may persist almost indefinitely, severely limiting the invasion of woody species.

Under high levels of grazing *Calamagrostis canadensis* (bluejoint) cover is reduced, and other graminoids and forbs are promoted on 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), *Fragaria virginiana* (wild strawberry), and *Galium trifidum* (small bedstraw). Severely disturbed wetter sites generally become dominated by *Juncus balticus* (Baltic rush), *Glyceria grandis* (common tall manna grass) and such wetter forbs as *Cicuta maculata* (water-hemlock), *Geum* species (avens), and *Sonchus* species (sow-thistle). With continued high levels of disturbance, these stands may be reduced to the *Poa pratensis* (Kentucky bluegrass) community type, which may even indicate a shift in site hydrology to the drier. Figure 63 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Calamagrostis canadensis* (bluejoint) Sites in North Central Alberta
Reference Community = *Calamagrostis canadensis* (bluejoint) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES

CALACAN HT—*Calamagrostis canadensis* (bluejoint) habitat type
POAPALU—*Poa palustris* (fowl bluegrass)
SONCHUS—*Sonchus* species (sow-thistle)
STACPAL—*Stachys palustris* (marsh hedge-nettle)
URTIDIO—*Urtica dioica* (common nettle)

Figure 63. Successional pathway for sites of the *Calamagrostis canadensis* (bluejoint) habitat type

Note: The above figure may not represent all possible successional pathways or potential communities for any given site.

EDATOPE

Figure 64 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* (bluejoint) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

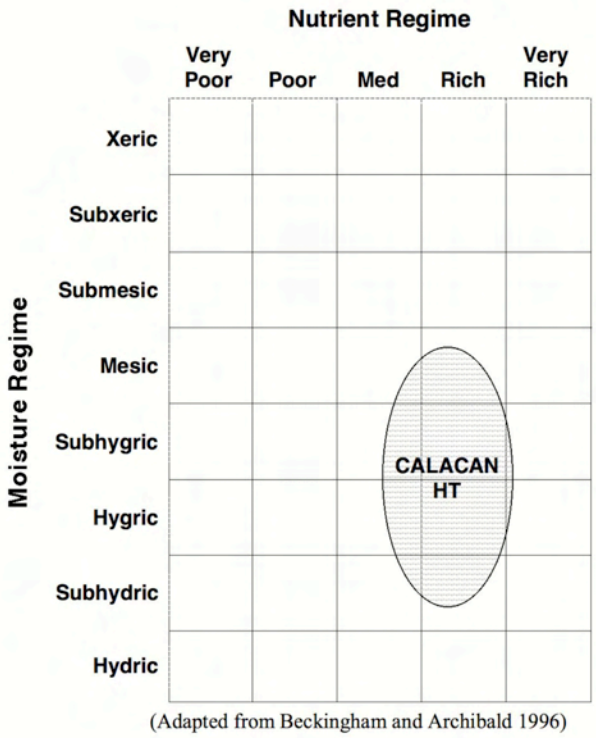


Figure 64. Edatope grid position for the *Calamagrostis canadensis* (bluejoint) habitat type (CALACAN HT)

SOILS

A wide range of soils may be associated with the *Calamagrostis canadensis* (bluejoint) 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. Soil reaction ranges from moderately acidic to very slightly basic, with a pH range of 4.5 to 8.0 (USDA Natural Resources Conservation Service 2000).

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type, the *Carex utriculata* (beaked sedge), *Carex atherodes* (awned sedge), or *Carex aquatilis* (water sedge) habitat types. 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

Livestock

Forage production and value from the *Calamagrostis canadensis* (bluejoint) habitat type is fair to good (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991). Palatability varies from fair to good, depending upon season and availability of other species (Tannas 1997, Hansen and others 1988)). Foliage is most palatable when young, but wet

conditions early in the grazing season limits use by livestock. Continued high levels of utilization reduces production on the site.

Frisina (1991) states that 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.

Wildlife
Calamagrostis canadensis (bluejoint) is grazed lightly by deer but makes up a major part of the diet of elk in the winter (USDA Intermountain Fire Sciences Lab 1995).

Fisheries
The rhizomatous nature of *Calamagrostis* species (reedgrass) will help provide bank stability for those sites adjacent to streams.

Fire
When grazing pressure is light, litter accumulates rapidly. Low-intensity fires can be used to remove this litter and improve forage quality (Kantrud and others 1989). Because of wet conditions in the spring and summer, successful burning of these communities is limited to the drier fall period. Fires reducing the abundance of other associated species tend to result in dramatic increases in *Calamagrostis canadensis* (bluejoint) and other rhizomatous species (Haeussler and Coates 1986).

Fire will kill aboveground vegetation of *Calamagrostis canadensis* (bluejoint). Severe fires will also kill belowground rhizomes, The species will re-establish on burned sites by sprouting from surviving rhizomes and from buried or wind-dispersed seeds. Light surface burning tends to increase the abundance of *Calamagrostis canadensis* (bluejoint) on site (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities
Sites with fine textured soils are susceptible to compaction, particular when moist. Roads and trails should be located on adjacent uplands to avoid sites of this type. *Calamagrostis canadensis* (bluejoint) propagates itself by both seeds and rhizomes, making it a valuable species for stabilizing or rehabilitating disturbed sites. The rhizomatous nature of the species helps provide streambank stability. It is a vigorous invader of oil spill sites in the Northwest Territories, and recovers rapidly after spills (Hardy BBT Limited 1989).

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

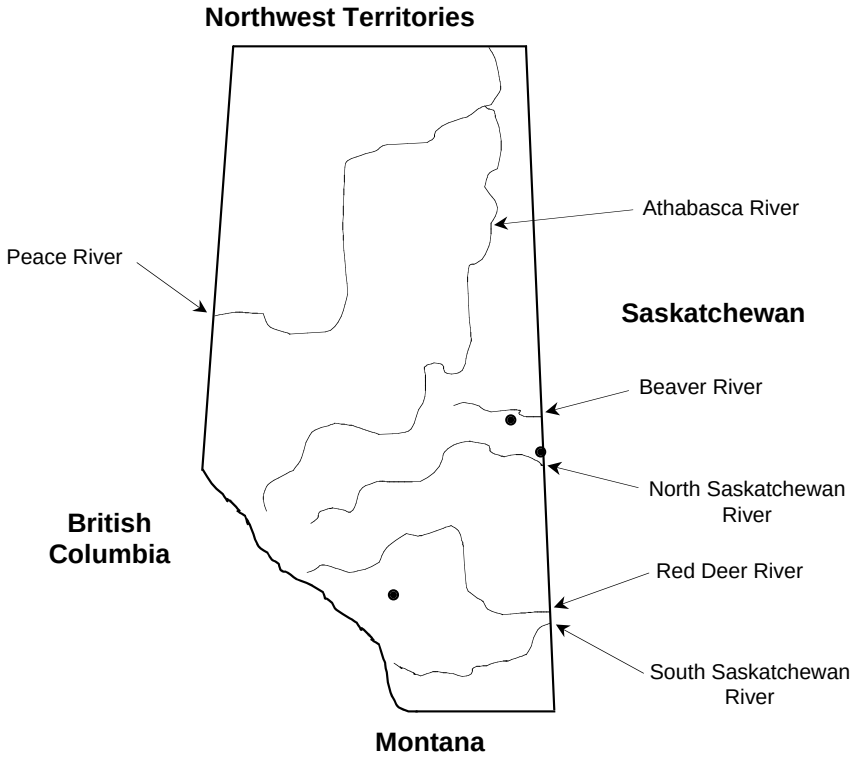
Sites of the *Calamagrostis canadensis* (bluejoint) habitat type in the Dry Mixedwood Natural Subregion occur in the graminoid phase of the rich fen ecosite (k3) which has a subhydric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). The type was not observed in the Parkland Natural Region.

OTHER STUDIES

Beckingham and Archibald (1996) and Beckingham, Nielsen, and Futoransky (1996) describe rich fen community types dominated by *Calamagrostis* species (reed grass) in the Boreal Mixedwood Ecoregion of Alberta and in the Mid-boreal Ecoregion of Saskatchewan. Willoughby (2000) describes a *Calamagrostis canadensis* (marsh reedgrass) community type for the Dry Mixedwood Subregion of Alberta. Hansen and others (1995) describe a *Calamagrostis canadensis* (bluejoint reedgrass) habitat type in the mountains and foothills of Montana.

CALAINE
Number of Stands Sampled = 5
Number of Stands Sampled in Alberta = 4

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Calamagrostis inexpansa* (northern reedgrass) community type is an incidental type at low elevations in the central Alberta part of the Dry Mixedwood Natural Subregion. The type occurs on sandy sites in wet meadows, basins, and slightly saline depressions. Stands were sampled near Tulliby Lake, in the vicinity of Moose Lake near Bonnyville, and as far south as Cochrane Lake near Calgary in the Foothills Subregion of the Parkland.

VEGETATION

Diagnostic of this community type are the narrow panicled *Calamagrostis* species (reedgrass) of *Calamagrostis inexpansa* (northern reed grass) and *Calamagrostis stricta* (narrow reed grass). Also prominent or commonly present are disturbance related, or somewhat saline tolerant, species *Hordeum jubatum* (foxtail barley), *Juncus balticus* (wire rush), *Poa palustris* (fowl bluegrass), *Mentha arvensis* (wild mint), and *Sonchus* species (sow-thistle) (Table 50).

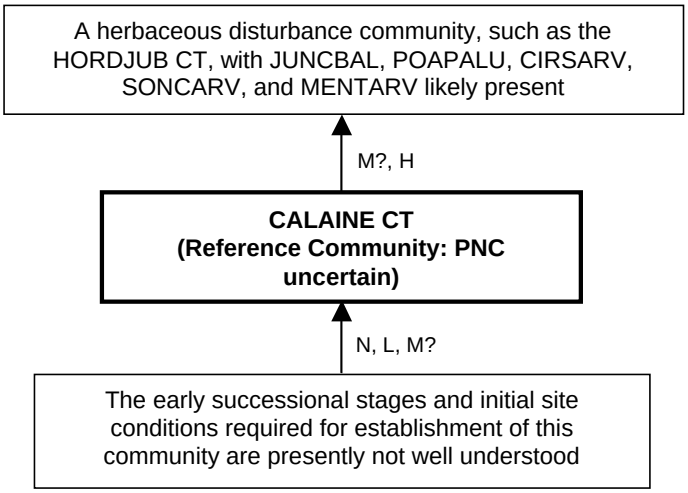
Table 50. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 5 stands of the *Calamagrostis inexpansa* (northern reed grass) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Graminoids				
Agropyron smithii (western wheat grass)	10	0-10	20	14
Calamagrostis inexpansa (northern reed grass)	60	0-90	60	60
Calamagrostis stricta (narrow reed grass)	60	0-70	40	49
Carex lanuginosa (woolly sedge)	20	0-20	20	20
Hordeum jubatum (foxtail barley)	4	0-10	80	18
Juncus balticus (wire rush)	9	0-30	80	27
Phalaris arundinacea (reed canary grass)	1	0-1	20	4
Phleum pratense (timothy)	3	0-3	20	8
Poa palustris (fowl bluegrass)	16	0-30	40	24
Poa pratensis (Kentucky bluegrass)	10	0-10	20	14
Puccinellia nuttalliana (Nuttall's salt-meadow grass)	1	0-1	20	4
Scirpus acutus (great bulrush)	1	0-1	20	4
Forbs				
Achillea millefolium (common yarrow)	1	0-1	20	4
Antennaria parvifolia (small-leaved everlasting)	1	0-1	20	4
Aster borealis (marsh aster)	1	0-1	20	4
Aster spp. (aster)	3	0-3	20	8
Cirsium arvense (Canada thistle)	2	0-3	40	9
Erigeron philadelphicus (Philadelphia fleabane)	3	0-3	20	8
Fragaria virginiana (wild strawberry)	1	0-1	20	4
Melilotus alba (white sweet-clover)	10	0-10	20	14
Mentha arvensis (wild mint)	12	0-20	40	22
Polygonum amphibium (water smartweed)	1	0-1	20	4
Potentilla anserina (silverweed)	10	0-10	20	14
Potentilla norvegica (rough cinquefoil)	1	0-1	20	4
Potentilla pensylvanica (prairie cinquefoil)	10	0-10	20	14
Scutellaria galericulata (marsh skullcap)	1	0-1	20	4
Sonchus arvensis (perennial sow-thistle)	3	0-3	20	8
Sonchus spp. (sow-thistle)	6	0-10	40	14
Taraxacum officinale (common dandelion)	1	0-1	20	4
Trifolium repens (white clover)	1	0-1	20	4
Urtica dioica (common nettle)	20	0-20	20	20

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Calamagrostis inexpansa (northern reedgrass) is, like *Calamagrostis canadensis* (bluejoint), a species able to propagate via both seed and rhizome. This allows it to colonize newly available sites and to persist on established sites. Light disturbance, such as grazing of more palatable competitors or light fire, may increase its presence on a site. Continued moderate to high grazing pressure will cause a decrease of *Calamagrostis inexpansa* (northern reedgrass) or *Calamagrostis stricta* (narrow reed grass), in favor of such graminoids as *Juncus balticus* (Baltic rush), *Hordeum jubatum* (foxtail barley), or *Poa palustris* (fowl bluegrass); and have an abundance of forbs such as *Mentha arvensis* (wild mint), *Potentilla* (cinquefoil), and *Sonchus* species (sow-thistle). Severely disturbed moist sites generally become dominated by *Juncus balticus* (Baltic rush) or *Poa pratensis* (Kentucky bluegrass), and by an assortment of weedy forbs, such as *Cirsium arvense* (Canada thistle) and *Sonchus* species (sow-thistle). Ultimately, the site can be reduced to the *Poa pratensis* (Kentucky bluegrass) community type, which may even indicate a drying of the site hydrology. Figure 65 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Calamagrostis inexpansa* (northern reed grass) Sites in North Central Alberta
Reference Community = *Calamagrostis inexpansa* (northern reed grass) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CALAINE CT—*Calamagrostis inexpansa* (northern reed grass) community type
CIRSARV—*Cirsium arvensis* (Canada thistle)
HORDJUB CT—*Hordeum jubatum* (foxtail barley) community type
JUNCBAL—*Juncus balticus* (Baltic rush)
MENTARV—*Mentha arvensis* (wild mint)
POAPALU—*Poa palustris* (fowl bluegrass)
SONCARV—*Sonchus arvensis* (perennial sow-thistle)

Figure 65. Successional pathway for sites of the *Calamagrostis inexpansa* (northern reed grass) community type

Note: Succession on sites presently supporting stands of this type is not yet well understood. This type may be the vegetative potential (PNC) on some sites.

EDATOPE

Figure 66 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 inexpansa* (northern reed grass) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

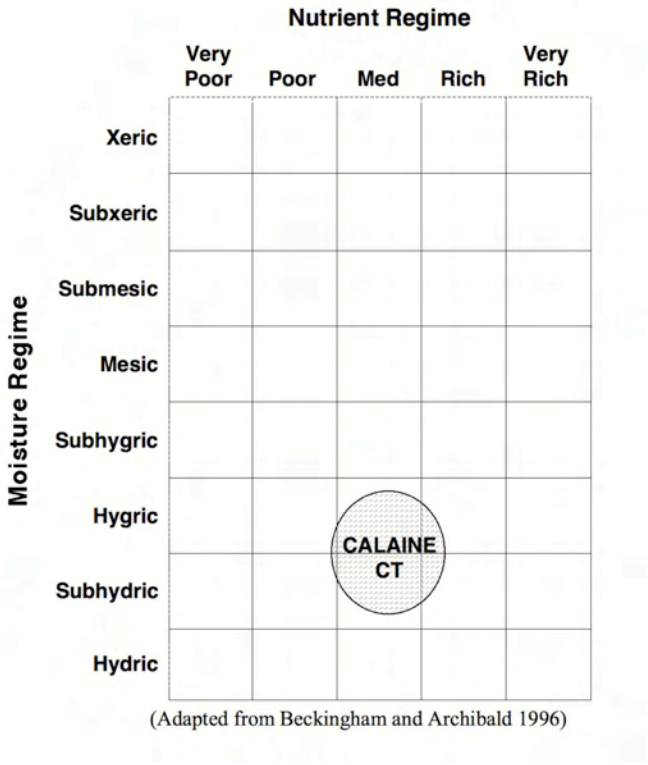


Figure 66. Edatope grid position for the *Calamagrostis inexpansa* (northern reed grass) community type (CALAINE CT)

SOILS

Parent materials are usually sorted glacial deposits with a large sand component. Soils are commonly slightly to moderately saline. According to the USDA Plants Database (USDA Natural Resources Conservation Service 2000), soil reactions are moderately acidic to slightly basic, with a pH range of pH 5.5 to 8.0. Mineral soil textures on sampled sites range from sand to sandy clay. Soils remain moist through much of the growing season.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by any of several herbaceous types, including the *Hordeum jubatum* (foxtail barley) community type, the *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type, and the *Scirpus acutus* (great bulrush) habitat type. Adjacent drier communities may be dominated by the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type, the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type, or the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type.

MANAGEMENT INFORMATION

Livestock

Forage production from the *Calamagrostis inexpansa* (northern reedgrass) community type is fair (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, Beckingham 1991). Palatability varies from moderate to high, depending upon season and availability of other species (Tannas 1997, Hansen and others 1988). Foliage is most palatable when young, but wet conditions early in the grazing season restrict use by livestock.

Wildlife

Elk may make moderate summer use of *Calamagrostis* species (reedgrass) and *Juncus balticus* (Baltic rush) (Kufeld 1973).

Fisheries

The rhizomatous nature of *Calamagrostis* species (reedgrass) will help provide bank stability for those sites adjacent to streams.

Fire
Fires reducing the abundance of other associated species tend to result in dramatic increases in *Calamagrostis stricta* (narrow reedgrass) and other rhizomatous species (Haeussler and Coates 1986).

Soil Management and Rehabilitation Opportunities
Roads and trails should be located on adjacent uplands. *Calamagrostis inexpansa* (northern reed grass) and *Calamagrostis stricta* (narrow reedgrass) propagate by both seeds and rhizomes, making them valuable species for stabilizing or rehabilitating suitable disturbed sites.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Calamagrostis inexpansa* (northern reed grass) community type in the Dry Mixedwood Natural Subregion occur in the graminoid phase of the rich fen ecosite (k3) which has a subhydric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). The type also occurs in the Parkland Natural Region.

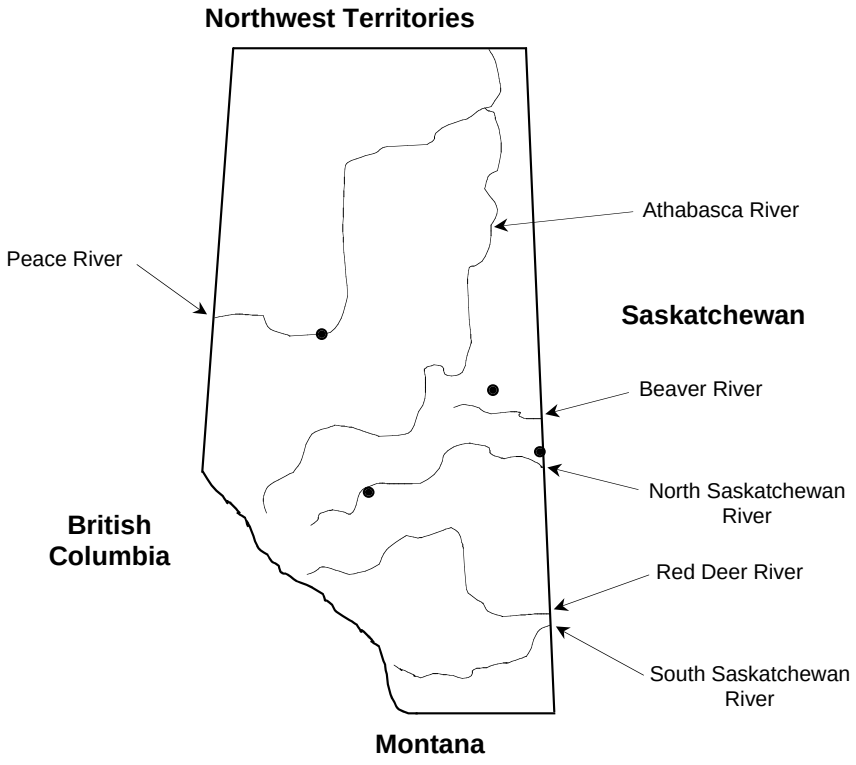
OTHER STUDIES

The *Calamagrostis inexpansa* (northern reedgrass) community type has not previously been described in this region. The *Calamagrostis* (reed grass) fens described by Beckingham and Archibald (1996) and Beckingham, Nielsen, and Futoransky (1996) in the Boreal Mixedwood Ecoregion of Alberta and in the Mid-Boreal Ecoregion of Saskatchewan are both dominated by *Calamagrostis canadensis* (bluejoint) in the boreal Dry Mixedwood Subregion. Willoughby (2000) also described the *Calamagrostis canadensis* (marsh reed grass) community type.

Equisetum fluviatile Habitat Type (Swamp Horsetail Habitat Type)

EQUIFLU
Number of Stands Sampled = 5
Number of Stands Sampled in Alberta = 5

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Equisetum fluviatile* (swamp horsetail) habitat type is an incidental type in the Dry Mixedwood Natural Subregion of Alberta. It typically occurs on somewhat alkaline sites prone to yearly flooding and season-long high water table, along streams, rivers, lake margins, and reservoirs. This habitat type 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. Its occurrence is not frequent in the study area, but typical stands were sampled on the Tulliby Lake Grazing Association lands and a large stand was sampled on the Peace River near the Shaftsbury Ferry.

VEGETATION

Typically, stands are almost pure *Equisetum fluviatile* (swamp horsetail). In this small sample set, no other species occurred on more than a single stand (Table 51).

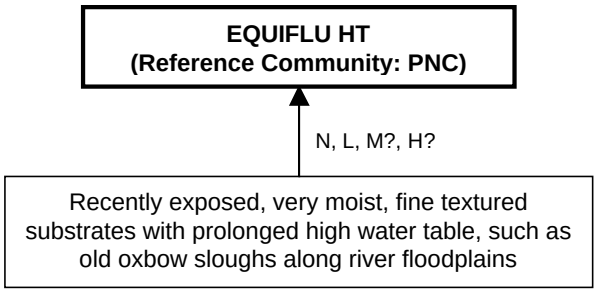
Table 51. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 5 stands of the *Equisetum fluviatile* (swamp horsetail) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Alnus tenuifolia (river alder)	1	0-1	20	4
Rubus pubescens (dewberry)	1	0-1	20	4
Salix exigua (sandbar willow)	1	0-1	20	4
Salix lutea (yellow willow)	1	0-1	20	4
Graminoids				
Beckmannia syzigachne (slough grass)	1	0-1	20	4
Calamagrostis canadensis (bluejoint)	3	0-3	20	8
Carex aquatilis (water sedge)	3	0-3	20	8
Carex atherodes (awned sedge)	3	0-3	20	8
Carex utriculata (beaked sedge)	3	0-3	20	8
Carex utriculata (small bottle sedge)	1	0-1	20	4
Glyceria grandis (common tall manna grass)	1	0-1	20	4
Juncus nodosus (knotted rush)	1	0-1	20	4
Scirpus validus (common great bulrush)	1	0-1	20	4
Forbs				
Cicuta maculata (water-hemlock)	1	0-1	20	4
Cirsium arvense (Canada thistle)	1	0-1	20	4
Epilobium leptophyllum (narrow-leaved willowherb)	40	0-40	20	28
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	20	4
Hippuris vulgaris (common mare's-tail)	1	0-1	20	4
Mentha arvensis (wild mint)	1	0-1	20	4
Plantago major (common plantain)	1	0-1	20	4
Rumex occidentalis (western dock)	1	0-1	20	4
Sagittaria cuneata (arum-leaved arrowhead)	1	0-1	20	4
Sium suave (water parsnip)	1	0-1	20	4
Sonchus spp. (sow-thistle)	3	0-3	20	8
Typha latifolia (common cattail)	2	0-3	40	9
Ferns and Allies				
Equisetum fluviatile (swamp horsetail)	91	80-98	100	95

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Equisetum fluviatile (swamp horsetail) is an early colonizer of shallowly submerged sediments. This rhizomatous species can persist on suitably wet sites if undisturbed; however, sites of this type are typically not hydrologically stable in a long-term geomorphic sense. Their usual position in old channel sloughs receive additional fluvial deposition during flood events, causing a progressive shift in relation to the water table. Most sites are so wet throughout the growing season that most kinds of disturbance are precluded. Figure 67 shows a schematic diagram of the expected successional pathway on sites of this type.



Successional Pathway of *Equisetum fluviatile* (swamp horsetail) Sites in North Central Alberta
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 67. 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 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 68 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).

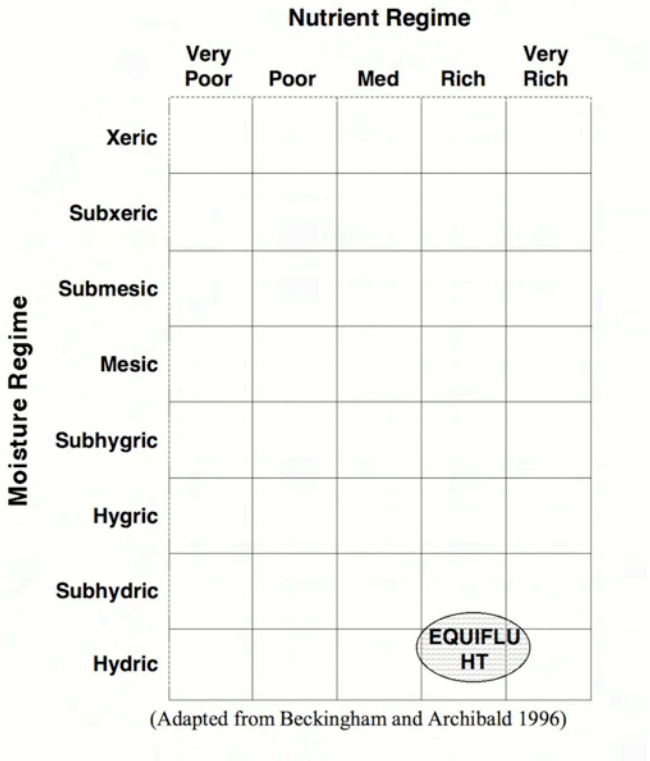


Figure 68. Edatope grid position for the *Equisetum fluviatile* (swamp horsetail) habitat type (EQUIFLU HT)

SOILS

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. Soils on sampled stands were either organic or silt mud.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by *Typha* species (cattails), *Scirpus* species (bulrush), or be open water. Adjacent drier communities 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

Livestock

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 (horsetail) is known to cause scours, paralysis, and occasionally death. Hay containing around 20 percent or more *Equisetum* species (horsetail) can produce poisoning symptoms in horses (Hansen and others 1995). 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.

Wildlife

Equisetum fluviatile (swamp horsetail) is seldom grazed by wildlife due to its low palatability. Waterfowl and muskrats use this habitat type for nesting and hiding cover.

Soil Management and Rehabilitation Opportunities

These sites are generally so wet as to preclude most development. Trampling damage and soil churning occurs readily with livestock use.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Equisetum fluviatile* (swamp horsetail) habitat type are not included in any ecosite of the Dry Mixedwood Natural Subregion, as described by Beckingham and Archibald (1996). The type was not observed in the Parkland Natural Region.

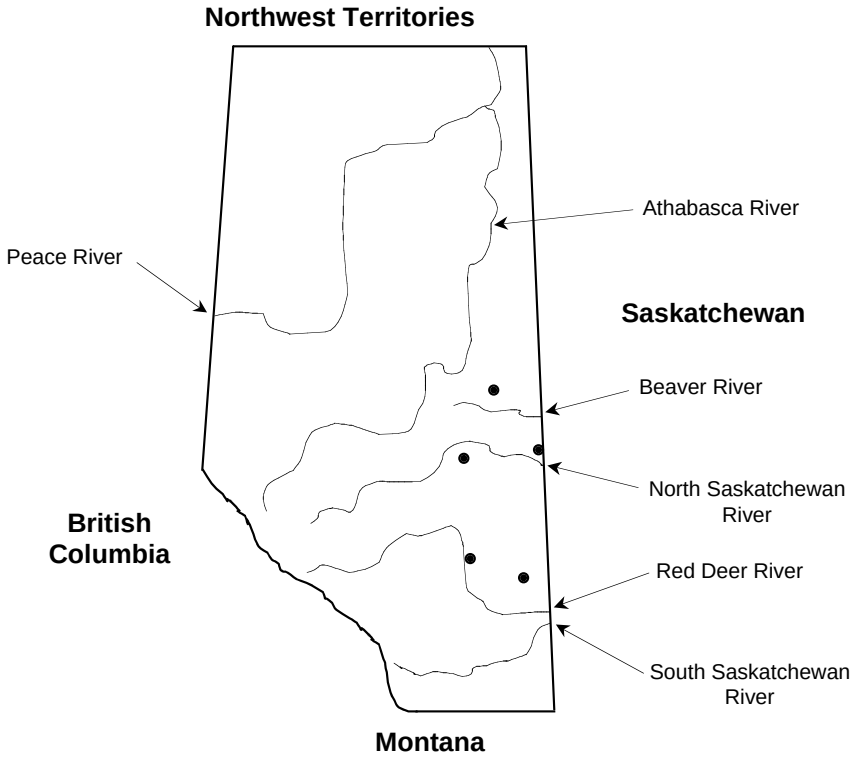
OTHER STUDIES

The *Equisetum fluviatile* (swamp horsetail) habitat type is described by Hansen and others (1995) in Montana. Dirschl and others (1974) describe a similar community in the Peace-Athabasca region of northern Alberta.

Glyceria grandis Community Type
(Common Tall Manna Grass Community Type)

GLYCGRA
Number of Stands Sampled = 6
Number of Stands Sampled in Alberta = 6

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Glyceria grandis* (common tall manna grass) community type is an incidental type at low elevations in the Parkland Natural Region and the Dry Mixedwood Natural Subregion. This community type occurs in the shallow water of slow moving streams, ponds, sloughs, and wet meadows that are seasonally flooded. *Glyceria grandis* (common tall manna grass) is frequently present as a component of several wet-site communities, but large, pure stands are not often found. The species seems to respond to rapidly fluctuating water level on nutrient-rich, fine textured soils. This situation was observed on the site of a drained beaver pond near Lac La Biche and as a narrow band surrounding the declining water level in small lakes on the Tulliby Lake Grazing Association lands.

VEGETATION

The *Glyceria grandis* (common tall manna grass) community type is characterized by a dense stand of the tall, wet-site grass. Stands of this type are often accompanied by other pioneering wet-site species such as *Beckmannia syzigachne* (slough grass), *Carex atherodes* (awned sedge), and *Eleocharis palustris* (creeping spike-rush) (Table 52).

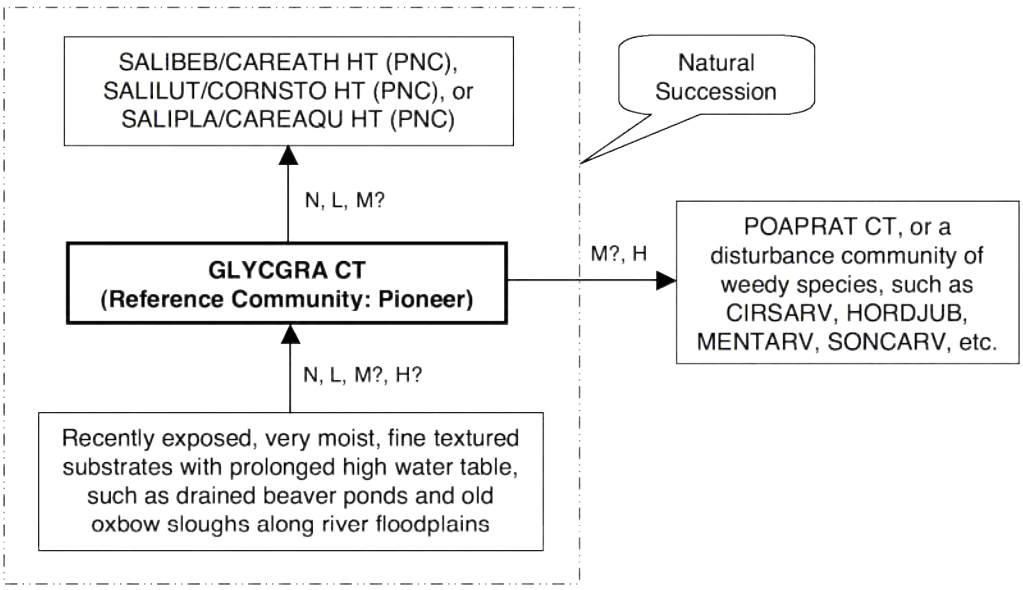
Table 52. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Glyceria grandis* (common tall manna grass) community type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Graminoids				
Alopecurus aequalis (short-awned foxtail)	7	0-10	33	15
Beckmannia syzigachne (slough grass)	11	0-30	67	27
Carex atherodes (awned sedge)	3	0-3	50	12
Carex bebbii (Bebb's sedge)	10	0-10	17	13
Eleocharis palustris (creeping spike-rush)	15	0-20	33	22
Glyceria grandis (common tall manna grass)	84	60-98	100	92
Hordeum jubatum (foxtail barley)	1	0-1	50	7
Phalaris arundinacea (reed canary grass)	1	0-1	33	6
Poa palustris (fowl bluegrass)	3	0-3	33	10
Scirpus microcarpus (small-fruited bulrush)	1	0-1	17	4
Forbs				
Chenopodium fremontii (Fremont's goosefoot)	1	0-1	17	4
Cicuta maculata (water-hemlock)	1	0-1	17	4
Cirsium arvense (Canada thistle)	1	0-1	17	4
Epilobium ciliatum (northern willowherb)	1	0-1	17	4
Epilobium leptophyllum (narrow-leaved willowherb)	3	0-3	17	7
Galium trifidum (small bedstraw)	3	0-3	17	7
Mentha arvensis (wild mint)	12	0-20	33	20
Polygonum amphibium (water smartweed)	2	0-3	33	8
Polygonum lapathifolium (pale persicaria)	2	0-3	33	8
Sium suave (water parsnip)	1	0-1	17	4
Sonchus spp. (sow-thistle)	1	0-1	33	6
Stachys palustris (marsh hedge-nettle)	1	0-1	17	4
Typha latifolia (common cattail)	1	0-1	50	7
Ferns and Allies				
Equisetum fluviatile (swamp horsetail)	10	0-10	17	13

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The *Glyceria grandis* (common tall manna grass) community type is an early seral (pioneer) stage. The species is a common colonizer of suitably wet sites made available by drainage of beaver ponds, or otherwise lowered water level that exposes a mud bottom. Its strongly rhizomatous root system provide advantage in surviving disturbance and maintaining presence on a site where later seral species are inhibited. Heavy grazing pressure may divert the normal successional progression from a *Salix* (willow) community to that of a host of invader exotics and disturbance related increasers like *Poa* species (bluegrass), *Sonchus* species (sow-thistle), *Cirsium arvense* (Canada thistle), and *Mentha arvensis* (wild mint). Figure 69 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Glyceria grandis* (common tall manna grass) Sites in North Central Alberta
Reference Community = *Glyceria grandis* (common tall manna grass) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CIRSARV—*Cirsium arvense* (Canada thistle)
HORDJUB—*Hordeum jubatum* (foxtail barley)
GLYCGRA CT—*Glyceria grandis* (common tall manna grass) community type
MENTARV—*Mentha arvensis* (wild mint)
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type
SALIBEB/CAREATH HT—*Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type
SALILUT/CORNSTO HT—*Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type
SALIPLA/CAREAQU HT—*Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type
SONCARV—*Sonchus arvensis* (perennial sow-thistle)

Figure 69. Successional pathway for sites of the *Glyceria grandis* (common tall manna 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 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 70 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 *Glyceria grandis* (common tall manna grass) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

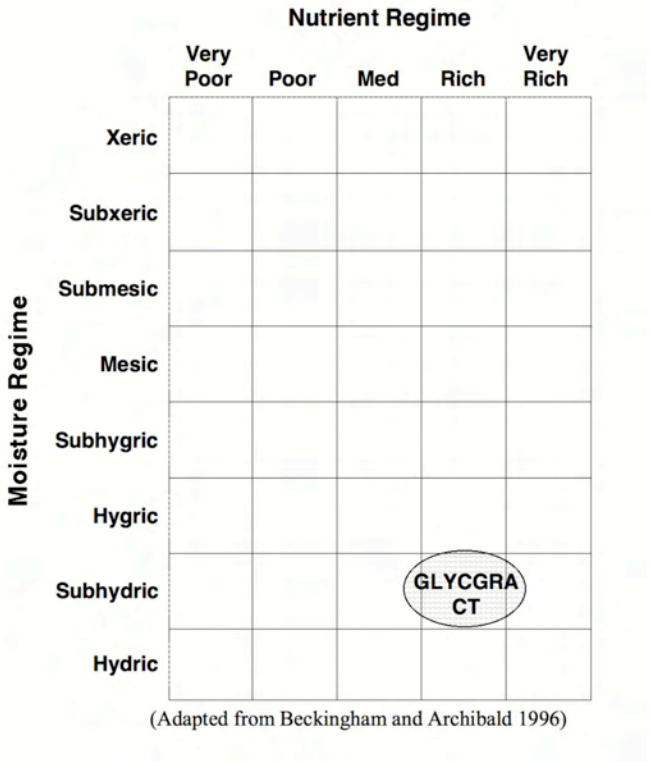


Figure 70. Edatope grid position for the *Glyceria grandis* (common tall manna grass) community type (GLYCGRA CT)

SOILS

Soils typically are organic, or have a thick organic layer over fine textured, poorly to very poorly drained, mineral soil. Mineral soil textures on sampled stands ranged from silt to clay. The water table remains above the soil surface most of the growing season on sites supporting this type.

ADJACENT COMMUNITIES

Typically, this type is the wettest community on the site, but the *Typha latifolia* (common cattail) habitat type or the *Equisetum fluviatile* (swamp horsetail) habitat type may be adjacent in deeper water. Adjacent drier communities may include such types as the *Eleocharis palustris* (creeping spike-rush) habitat type, the *Calamagrostis canadensis* (bluejoint) habitat type, the *Carex atherodes* (awned sedge) habitat type, or any of several *Salix* (willow) dominated communities.

MANAGEMENT INFORMATION

Livestock

Forage value of the *Glyceria grandis* (common tall manna grass) community type is good (Stone and Lawrence 2000, Tannas 1997, Beckingham 1991), but little use is made of it due to small area and inaccessibility on wet sites (Hansen and others 1988). *Glyceria grandis* (common tall manna grass) decreases with continued high livestock use (Tannas 1997, Beckingham 1991).

Wildlife

Glyceria grandis (common tall manna grass) provides good thermal and feeding cover and food value for small mammals, waterfowl, and small non-game birds (Dittberner and Olson 1983). It provides fair food value for elk and mule deer (Dittberner and Olson 1983).

Soil Management and Rehabilitation Opportunities

Glyceria grandis (common tall manna grass) has limited value for soil management and revegetation uses due to very specific site requirements of soil type and high water table, however in certain situations it may be the only or best fit. Its rhizomatous habit and large production of good forage give it soil stabilizing and habitat value when used.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Glyceria grandis* (common tall manna grass) community type are not included in any ecosite of the Dry Mixedwood Natural Region, as described by Beckingham and Archibald (1996).

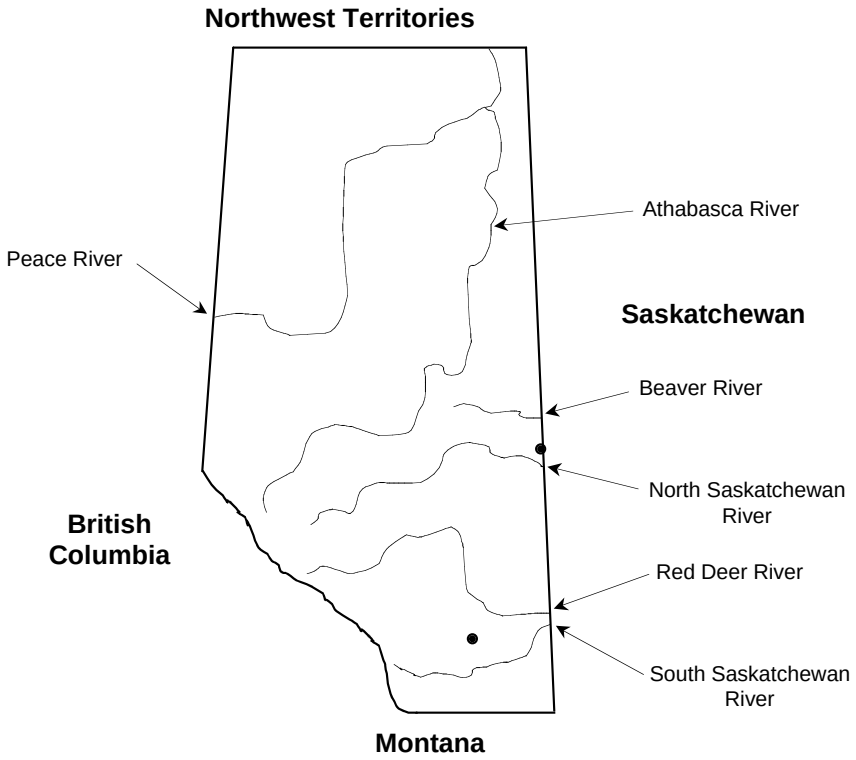
OTHER STUDIES

A *Glyceria grandis* (American manna grass) dominance type is described by Hansen and others (1988) for Montana for communities similar to those sampled in Alberta.

Hordeum jubatum Community Type
(Foxtail Barley Community Type)

HORDJUB
Number of Stands Sampled = 6
Number of Stands Sampled in Alberta = 4

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Hordeum jubatum* (foxtail barley) community type is an incidental type at low elevations in the Parkland Natural Region and the central Alberta part of the Dry Mixedwood Natural Subregion on sites where soils have slightly to moderately elevated salt levels. This community type occurs often in the drawdown zone of lakes and ponds or ephemeral depressions. These sites may be flooded during the early part of the growing season, but the water table falls below the soil surface by late spring or early summer. This community type often occurs in a narrow band near, and parallel to, the shoreline. Typical stands were sampled along small pothole lakes in the vicinity of Tulliby Lake.

VEGETATION

Vegetation diversity is low on stands of this type. *Hordeum jubatum* (foxtail barley) generally dominates the stand, with a few other alkali/saline tolerant species present in small amounts (Table 53).

Table 53. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Hordeum jubatum* (foxtail barley) community type

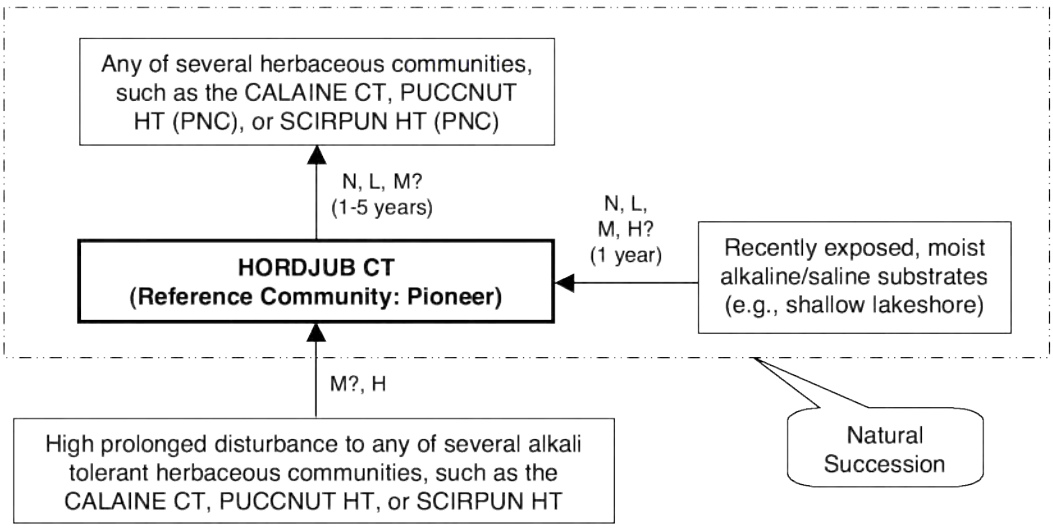
Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Graminoids				
Bromus inermis (awnless brome)	1	0-1	17	4
Eleocharis palustris (creeping spike-rush)	10	0-10	17	13
Hordeum jubatum (foxtail barley)	84	70-98	100	92
Juncus balticus (wire rush)	1	0-1	17	4
Phleum pratense (timothy)	20	0-20	17	18
Poa palustris (fowl bluegrass)	1	0-1	17	4
Puccinellia nuttalliana (Nuttall's salt-meadow grass)	1	0-1	33	6
Scirpus acutus (great bulrush)	1	0-1	17	4
Scirpus pungens (three-square rush)	3	0-3	17	7
Forbs				
Atriplex spp. (atriplex)	10	0-10	17	13
Atriplex prostrata (prostrate saltbush)	30	0-30	17	22
Cirsium arvense (Canada thistle)	3	0-3	17	7
Crepis tectorum (annual hawk's-beard)	1	0-1	17	4
Medicago falcata (yellow lucerne)	10	0-10	17	13
Melilotus officinalis (yellow sweet-clover)	3	0-3	17	7
Oxytropis deflexa (reflexed locoweed)	3	0-3	17	7
Plantago major (common plantain)	3	0-3	17	7
Potentilla argentea (silvery cinquefoil)	1	0-1	17	4
Ranunculus cymbalaria (seaside buttercup)	3	0-3	17	7
Rumex crispus (curled dock)	3	0-3	17	7
Taraxacum officinale (common dandelion)	1	0-1	33	6
Trifolium hybridum (alsike clover)	3	0-3	17	7
Triglochin maritima (seaside arrow-grass)	1	0-1	17	4
Triglochin palustris (slender arrow-grass)	1	0-1	17	4

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

In most cases, the *Hordeum jubatum* (foxtail barley) community type represents an early seral (pioneer) stage on recently exposed moist sites of slightly to moderately elevated alkalinity/salinity, and that will be eventually replaced by one of a variety of later seral species. The most common such sites are found on the exposed shallow beds of lakes receding during drought or other drawdown of water level. Close observation of communities on sites in similar landscape position may give insight to the climax community for the site if the hydrology of the site were to stabilize where it is. It appears that this community is always present around basin water bodies in the glaciated region during periods of declining water level during drought cycles. A band of foxtail barley can seem to march in step with the falling shoreline to remain within its narrow zone of suitable hydrologic condition. During periods of increasing water level, older stands are being drowned and no bare lakebed is being exposed for new establishment of this pioneer species.

In some other cases, the *Hordeum jubatum* (foxtail barley) community type represents an early seral grazing disturbance stage of the *Carex aquatilis* (water sedge) habitat type or the *Carex atherodes* (awned sedge) habitat type. Figure 71 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Hordeum jubatum* (foxtail barely) Sites in North Central Alberta
Reference Community = *Hordeum jubatum* (foxtail barely) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CALAINE CT—*Calamagrostis inexpansa* (northern reed grass) community type
HORDJUB CT—*Hordeum jubatum* (foxtail barely) community type
PUCCNUT HT—*Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type
SCIRPUN HT—*Scirpus pungens* (three-square bulrush) habitat type

Figure 71. Successional pathway for sites of the *Hordeum jubatum* (foxtail barley) community type

Note: This species will colonize and occupy a wide range of recently exposed or disturbed alkaline or saline sites. It serves as an early seral pioneer on such sites, and when free of high, prolonged disturbance, will be replaced by a later seral herbaceous community.

EDATOPE

Figure 72 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 *Hordeum jubatum* (foxtail barley) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

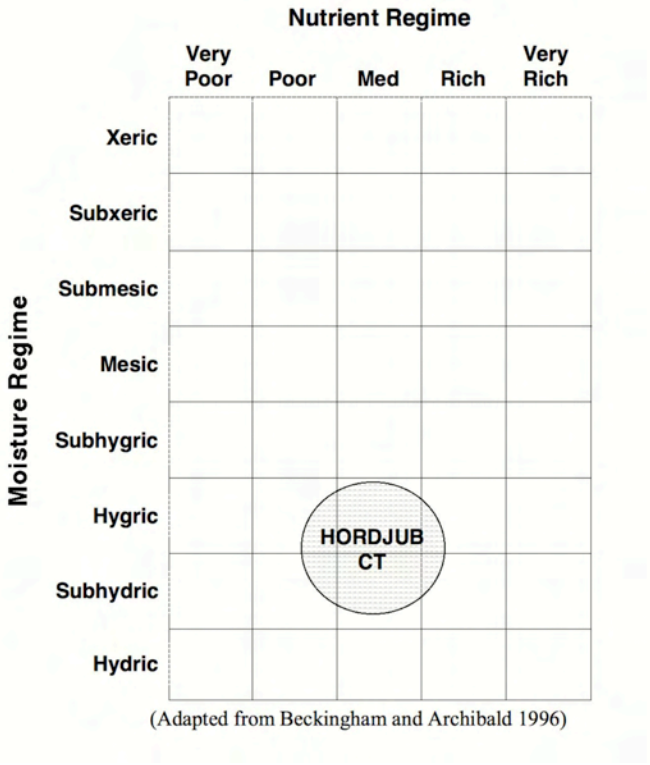


Figure 72. Edatope grid position for the *Hordeum jubatum* (foxtail barley) community type (HORDJUB CT)

SOILS

Sites are typically on fine textured and poorly to very poorly drained mineral soils with water tables remaining at or slightly below the soil surface, and slightly to moderately elevated alkalinity or salinity. Mineral soil textures on sampled stands ranged from fine sand to clay.

ADJACENT COMMUNITIES

Adjacent wetter communities are usually occupied by the *Typha latifolia* (common cattail) habitat type, the *Scirpus pungens* (three-square rush) habitat type, the *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type, or open water. Adjacent drier communities may be dominated by *Juncus balticus* (Baltic rush), the *Calamagrostis inexpansa* (northern reedgrass) community type, any of several *Salix* (willow) community types or habitat types, or an upland community.

MANAGEMENT INFORMATION

Livestock

Forage value of the *Hordeum jubatum* (foxtail barley) community type is poor (Stone and Lawrence 2000, Tannas 1997, Beckingham 1991). Palatability of *Hordeum jubatum* (foxtail barley) is fair for livestock before seed heads develop (Tannas 1997), but consumption of the awned seed heads can cause severe mouth sores or occasionally death. Injuries to wildlife such as elk, deer, and pronghorn have also been documented (USDA Forest Service 1937).

Hordeum jubatum (foxtail barley) is an increaser under excessive grazing pressure, and quickly invades suitable sites (Stone and Lawrence 2000, Tannas 1997, Beckingham 1991). Light to moderate grazing may allow desired species to regain dominance.

Wildlife

Low herbage production and palatability makes this community type of limited value for wildlife. Consuming the mature awned seed heads can cause severe mouth sores or occasionally death. Injuries to wildlife such as elk, deer, and pronghorn have also been documented (USDA Forest Service 1937).

Soil Management and Rehabilitation Opportunities
Occurrence of this type on sites where it has not been previously noted may indicate increased salinity. The presence or expansion of saline seep areas may indicate that small grain crops, fallow fields, or excessive irrigation is elevating the water table. Excess water migrating through the soil, gathers soluble salts, and evaporates in these depressional sites. The salts concentrate over time, thereby altering the plant community able to tolerate conditions on the site. It should be noted that saline areas also occur naturally in these parent materials and glaciated landscape.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Hordeum jubatum* (foxtail barley) community type are not included in any ecosite of the Dry Mixedwood Natural Region, as described by Beckingham and Archibald (1996).

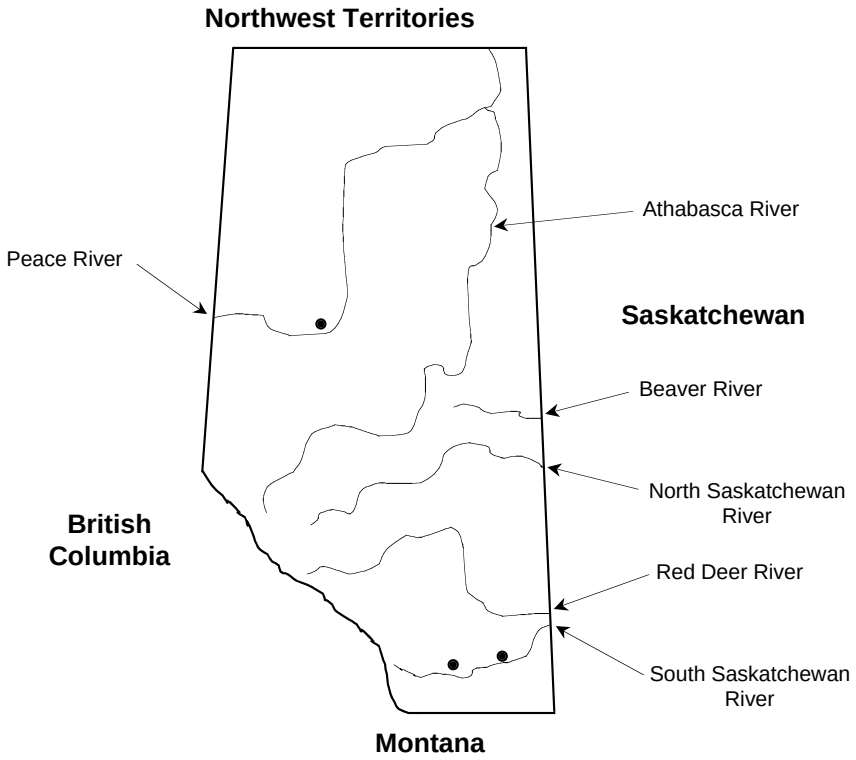
OTHER STUDIES

The *Hordeum jubatum* (foxtail barley) community type is described by Thompson and Hansen (2002) in the Grassland Natural Region of southern Alberta, by Thompson and Hansen (2001) in the Prairie Ecozone of southern Saskatchewan, and by Hansen and others (1995) for Montana.

Phalaris arundinacea Habitat Type
(Reed Canary Grass Habitat Type)

PHALARU
Number of Stands Sampled = 14
Number of Stands Sampled in Alberta = 5

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Phalaris arundinacea* (reed canary grass) habitat type is an incidental type in the Dry Mixedwood Natural Subregion and in the Parkland Natural Region of Alberta. It occurs along streams, rivers, oxbows, lake and pond margins, ditches, irrigation

channels, and in wet meadows. Although a native species, *Phalaris arundinacea* (reed canary grass) has been widely distributed as a seeded forage species, and readily escapes from pastures into riparian or wetland areas, displacing more desirable species. Typical sites were sampled on Lac Cardinal near Peace River and on the Little Red Deer River near Bowden.

VEGETATION

Stands are dominated by the tall *Phalaris arundinacea* (reed canary grass). This species is highly competitive with other riparian or wetland plants because of its heavy sod forming habit. It forms dense, highly productive monospecific stands that spread radially (Apfelbaum and Sams 1987). Due to its location near stream channels on alluvial deposits, other pioneer species may be present in varying amounts. With high levels of grazing pressure opening up the dense stands, disturbance induced invaders appear. These may include *Scirpus microcarpus* (small-fruited bulrush), *Cirsium arvense* (Canada thistle), *Polygonum amphibium* (water smartweed), and *Trifolium repens* (white clover) (Table 54).

Table 54. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 14 stands of the *Phalaris arundinacea* (reed canary grass) habitat type

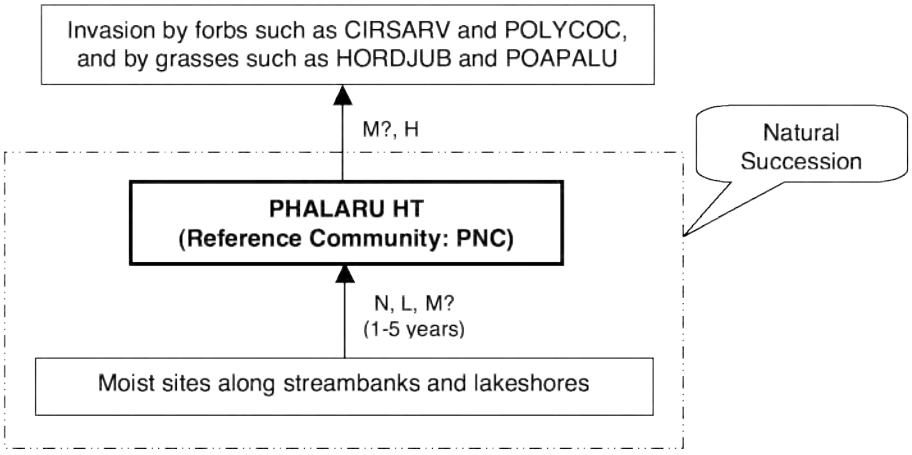
Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Salix exigua (sandbar willow)	1	0-1	7	3
Graminoids				
Agropyron repens (quack grass)	1	0-1	7	3
Agrostis stolonifera (redtop)	10	0-10	7	8
Agropyron trachycaulum (slender wheat grass)	1	0-1	7	3
Beckmannia syzigachne (slough grass)	3	0-3	7	5
Carex utriculata (beaked sedge)	1	0-1	7	3
Carex sychnocephala (long-beaked sedge)	1	0-1	7	3
Festuca rubra (red fescue)	10	0-10	7	8
Hordeum jubatum (foxtail barley)	1	0-1	14	4
Phalaris arundinacea (reed canary grass)	91	50-98	100	95
Phleum pratense (timothy)	10	0-10	7	8
Poa palustris (fowl bluegrass)	3	0-3	14	7
Scirpus acutus (great bulrush)	1	0-1	7	3
Scirpus microcarpus (small-fruited bulrush)	7	0-10	14	10
Forbs				
Astragalus cicer (cicer milk vetch)	30	0-30	7	15
Chenopodium album (lamb's-quarters)	1	0-1	7	3
Cirsium arvense (Canada thistle)	6	0-20	29	13
Lathyrus ochroleucus (cream-colored vetchling)	1	0-1	7	3
Mentha arvensis (wild mint)	1	0-1	7	3
Polygonum amphibium (water smartweed)	5	0-10	21	10
Potentilla anserina (silverweed)	1	0-1	7	3
Rumex crispus (curled dock)	1	0-1	7	3
Sonchus spp. (sow-thistle)	3	0-3	7	5
Stachys palustris (marsh hedge-nettle)	3	0-3	7	5
Taraxacum officinale (common dandelion)	2	0-3	14	5
Trifolium repens (white clover)	6	0-10	14	8
Triglochin maritima (seaside arrow-grass)	1	0-1	7	3
Urtica dioica (common nettle)	2	0-3	14	5
Vicia americana (wild vetch)	1	0-1	7	3
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0-1	14	4

[1] Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Phalaris arundinacea (reed canary grass) is another of the pioneering graminoids that can establish on new alluvial deposits and persist on the sites as long as hydrologic conditions remain favourable. The species has a strong tolerance to grazing

except in its early growth stages. However, if stands are severely impacted, species such as *Agrostis stolonifera* (red top), *Mentha arvensis* (wild mint), *Polygonum coccinium* (water smartweed), *Scirpus microcarpus* (small-fruited bulrush), *Cirsium arvense* (Canada thistle), and *Trifolium repens* (white clover) replace *Phalaris arundinacea* cover. Figure 73 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Phalaris arundinacea* (reed canary grass) Sites in North Central Alberta
Reference Community = *Phalaris arundinacea* (reed canary grass) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CIRSARV—*Cirsium arvense* (Canada thistle)
HORDJUB—*Hordeum jubatum* (foxtail barely)
PHALARU HT—*Phalaris arundinacea* (reed canary grass) habitat type
POAPALU—*Poa palustris* (fowl bluegrass)
POLYCOC—*Polygonum coccineum* (water smartweed)

Figure 73. 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 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 74 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).

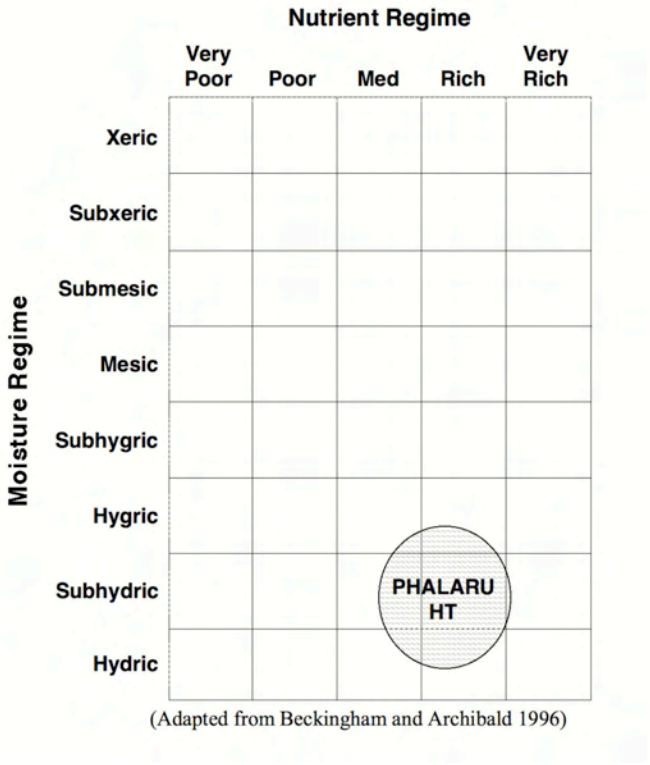


Figure 74. Edatope grid position for the *Phalaris arundinacea* (reed canary grass) habitat type (PHALARU HT)

SOILS

Soils typically have medium to fine texture and reactions ranging from moderately acid to slightly alkaline (pH 5.5 to 8.0) (USDA Natural Resources Conservation Service 2000). Soils are commonly poorly drained, often with anaerobic conditions. Mineral soil textures on sampled stands ranged 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.

ADJACENT COMMUNITIES

Adjacent wetter sites may include open water or the *Carex atherodes* (awned sedge), *Typha latifolia* (common cattail), and *Scirpus acutus* (great bulrush) habitat types. Adjacent drier sites support a variety of *Populus balsamifera* (balsam poplar) and *Salix* (willow) communities, including the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type, the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type, the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type, the *Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) habitat type, and the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type.

MANAGEMENT INFORMATION

Livestock

Herbage production from the *Phalaris arundinacea* (reed canary grass) habitat type is high. However, palatability of the coarse *Phalaris arundinacea* (reed canary grass) is only low to moderate. It is most palatable when actively growing, and becomes less palatable in fall and winter. *Phalaris arundinacea* (reed canary grass) is strongly tolerant of grazing, except in the early growth stages. Increased alkaloid and fibre content with maturity cause a gradual decline in palatability. Grazing should begin as soon as soils have dried enough to minimize trampling damage (Hansen and others 1995). This type should be grazed using intense stocking and a short rotation plan that leaves at least a 5-8 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 type 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 1997, Hansen and others 1988).

Wildlife
In many locations, the *Phalaris arundinacea* (reed canary grass) habitat type is inundated long enough to provide some nesting habitat for waterfowl and cover for muskrats. Stands of this habitat type are rated fair for white tail and mule deer forage and cover, and good for elk forage (Dittberner and Olson 1983). Small game and bird thermal and feeding cover is rated fair to good, and food value is rated fair.

Fisheries
This habitat type can provide valuable spawning areas and hiding cover for many fish species when high water extends into *Phalaris arundinacea* (reed canary grass) stands.

Fire
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 arundinacea* (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 23-30 cm thick to reduce plant density and improve wildlife feeding areas (USDA Intermountain Fire Sciences Lab 1995).

Soil Management and Rehabilitation Opportunities
These sites are generally so wet as to preclude most development activities. Even sites that dry out near the end of the growing season are highly susceptible to compaction due to fine textured soils.

Once established, *Phalaris arundinacea* (reed canary grass) spreads rapidly and is extremely difficult to eliminate (Apfelbaum and Sams 1987). The resilient nature of this rhizomatous grass makes it an effective stabilizer of streambanks and ditches. ***However, its future use in revegetating degraded sites should be severely restricted.*** *Phalaris arundinacea* (reed canary grass) is becoming a threat to wetland areas supporting other native species.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Phalaris arundinacea* (reed canary grass) habitat type are included in the marsh ecosite (l) of the Dry Mixedwood Natural Region with a hydric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). The type also occurs in the Parkland Natural Region.

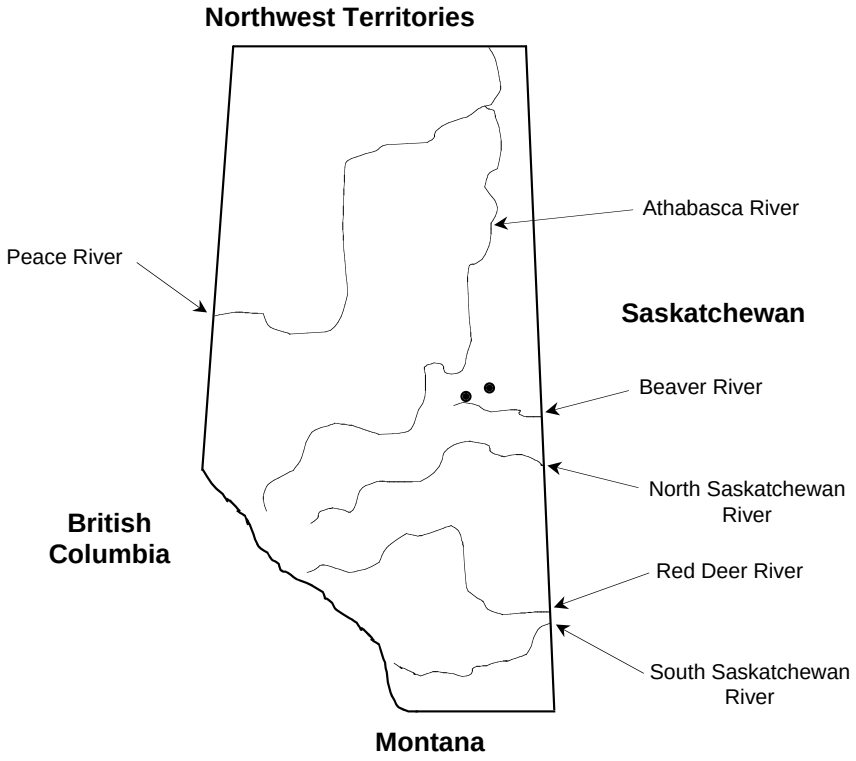
OTHER STUDIES

The *Phalaris arundinacea* (reed canary grass) habitat type is described by Thompson and Hansen (2002) in the Grassland Natural Region of southern Alberta, by Thompson and Hansen (2001) in the Prairie Ecozone of southern Saskatchewan, and by Hansen and others (1995) for Montana.

Phragmites australis Habitat Type
(Reed Habitat Type)

PHRAAUS
Number of Stands Sampled = 9
Number of Stands Sampled in Alberta = 3

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Phragmites australis* (reed) habitat type is an incidental type at low elevations in the Dry Mixedwood Natural Subregion. It occurs on pond and lake margins, river floodplain backwater areas, and on the banks of rivers and streams. More stands were sampled in Saskatchewan, but Alberta occurrences were sampled near Caslan and Lac La Biche.

VEGETATION

Phragmites australis (reed) is a strongly rhizomatous perennial that generally forms tall (2-3 m), dense, monospecific stands (Table 55).

Table 55. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 stands of the *Phragmites australis* (reed) habitat type

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Shrubs				
Salix spp. (willow)	3	0-3	11	6
Graminoids				
Beckmannia syzigachne (slough grass)	1	0-1	11	3
Bromus inermis (awnless brome)	1	0-1	11	3

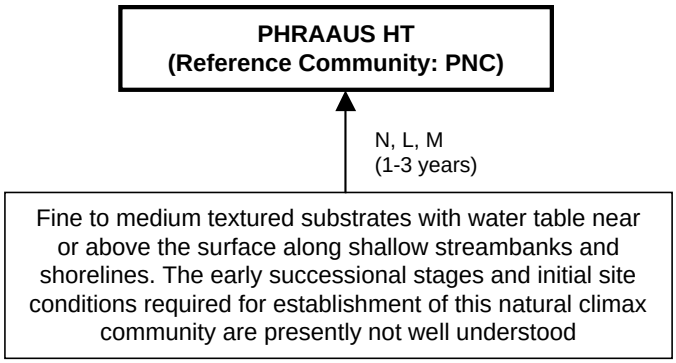
Table 55 (cont.)

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Calamagrostis canadensis (bluejoint)	3	0-3	11	6
Calamagrostis inexpansa (northern reed grass)	1	0-1	11	3
Calamagrostis stricta (narrow reed grass)	3	0-3	11	6
Carex aquatilis (water sedge)	1	0-1	11	3
Carex atherodes (awned sedge)	6	0-10	22	11
Carex microglochin (short-awned sedge)	1	0-1	11	3
Carex utriculata (beaked sedge)	3	0-3	11	6
Eleocharis palustris (creeping spike-rush)	10	0-10	11	11
Phalaris arundinacea (reed canary grass)	1	0-1	11	3
Phragmites australis (reed)	84	30-98	100	92
Scirpus acutus (great bulrush)	10	0-10	11	11
Scirpus validus (common great bulrush)	3	0-3	22	8
Forbs				
Cicuta maculata (water-hemlock)	1	0-1	11	3
Circaea alpina (small enchanter's nightshade)	1	0-1	11	3
Cirsium arvense (Canada thistle)	7	0-10	22	12
Cirsium undulatum (wavy-leaved thistle)	3	0-3	11	6
Hippuris vulgaris (common mare's-tail)	1	0-1	11	3
Lycopus asper (western water-horehound)	3	0-3	11	6
Mentha arvensis (wild mint)	1	0-1	22	5
Moehringia lateriflora (blunt-leaved sandwort)	3	0-3	11	6
Polygonum lapathifolium (pale persicaria)	1	0-1	11	3
Potentilla norvegica (rough cinquefoil)	1	0-1	11	3
Potentilla paradoxa (bushy cinquefoil)	1	0-1	11	3
Sagittaria cuneata (arum-leaved arrowhead)	1	0-1	11	3
Scutellaria galericulata (marsh skullcap)	1	0-1	33	6
Sium suave (water parsnip)	1	0-1	11	3
Sonchus arvensis (perennial sow-thistle)	6	0-10	22	11
Stachys palustris (marsh hedge-nettle)	1	0-1	11	3
Typha latifolia (common cattail)	10	0-10	11	11
Urtica dioica (common nettle)	3	0-3	11	6

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The sites are generally so wet as to preclude most forms of disturbance. *Phragmites australis* (reed) is a strongly rhizomatous perennial that tends to out compete all other plant species on suitable sites. However, with increased disturbance, weedy species such as *Bromus inermis* (awnless brome), *Cirsium arvense* (Canada thistle), and *Sonchus arvensis* (perennial sow-thistle) may invade. Figure 75 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Phragmites australis* (reed) Sites in North Central Alberta
Reference Community = *Phragmites australis* (reed) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
PHRAAUS HT—*Phragmites australis* (reed) habitat type

Figure 75. Successional pathway for sites of the *Phragmites australis* (reed) habitat type

Note: Due to the very wet sites occupied by this species, it is not often subjected to severe grazing disturbance.

EDATOPE

Figure 76 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 *Phragmites australis* (reed) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

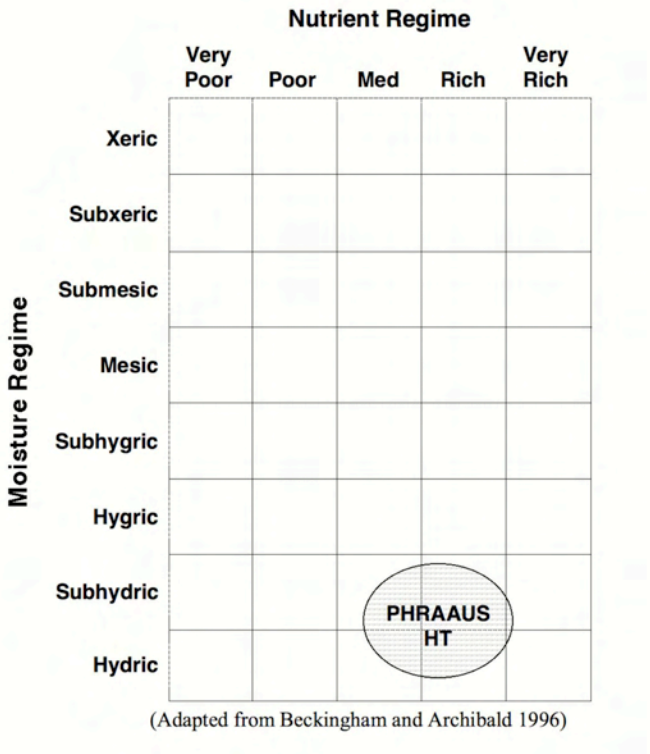


Figure 76. Edatope grid position for the *Phragmites australis* (reed) habitat type (PHRAAUS HT)

SOILS

Soil texture typically ranges from clay to sandy loam overlain by a thick organic layer. Mineral soil textures on sampled stands ranged from sandy loam to sandy clay. Sites frequently experience prolonged flooding, but water tables may fluctuate greatly from 50 cm above to 1 m below the soil surface over the span of the growing season.

ADJACENT COMMUNITIES

Adjacent wetter sites may be dominated by the *Typha latifolia* (common cattail) or the *Scirpus acutus* (great bulrush) habitat types, or may be open water. Adjacent drier sites may include a variety of communities, such as the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type, the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type, the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type, and the *Salix exigua* (sandbar willow) community type.

MANAGEMENT INFORMATION

Livestock

Herbage production in the *Phragmites australis* (reed) habitat type is high to very high, but the literature is conflicting on its value as livestock forage. Beckingham (1991) rates the species as poor, while Hansen and others (1995) say the species is highly palatable to both livestock and wildlife, especially when the plants are young and growing vigorously. *Phragmites australis* (reed) is moderately tolerant of grazing produces good quality hay or silage in other parts of North America (USDA Intermountain Fire Sciences Lab 1995).

Wildlife

Phragmites australis (reed) is highly palatable to both livestock and wildlife, especially when the plants are young and growing vigorously. Its high stature provides excellent thermal and hiding cover for wildlife. Waterfowl use this habitat type for nesting and hiding cover. Other birds such as red-winged blackbirds and yellow-headed blackbirds are also common inhabitants (Hansen and others 1995).

Fisheries

The *Phragmites australis* (reed) habitat type provides excellent streambank protection. The rhizomes hold and stabilize the bank while the above ground vegetation helps trap and filter sediments.

Soil Management and Rehabilitation Opportunities

Phragmites australis (reed) can provide excellent streambank protection. Rhizomes hold and stabilize the bank while the above ground vegetation helps trap and filter sediments. Once established, these characteristics help to stabilize the site.

Recreational Uses and Considerations

The *Phragmites australis* (reed) habitat type does not offer much opportunity for human recreation.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Phragmites australis* (reed) habitat type are included in the marsh ecosite (l) of the Dry Mixedwood Natural Subregion with a hydric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). The type was not observed in the Parkland Natural Region.

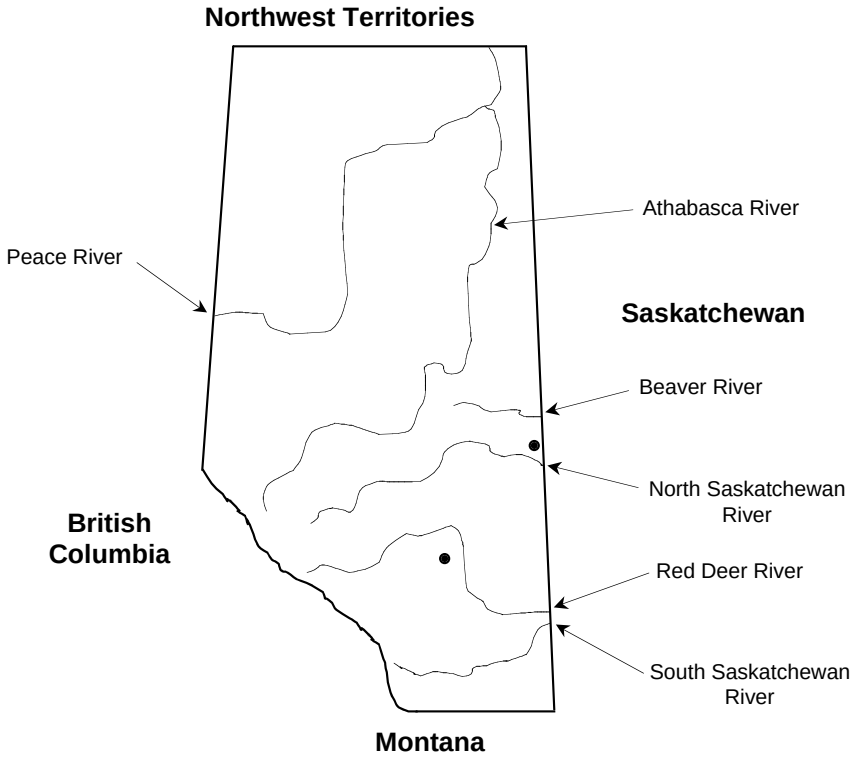
OTHER STUDIES

The *Phragmites australis* (reed) habitat type is described by Thompson and Hansen (2001) in the Prairie Ecozone of southern Saskatchewan and by Hansen and others (1995) for Montana.

Poa pratensis Community Type
(Kentucky Bluegrass Community Type)

POAPRAT
Number of Stands Sampled = 5
Number of Stands Sampled in Alberta = 4

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Poa pratensis* (Kentucky bluegrass) community type is an incidental type in the Parkland Natural Region and the Dry Mixedwood Natural Subregion of Alberta. The best examples may be found on mesic alluvial terraces having been subjected to past long-term overgrazing. Although the species is widespread across Alberta, and is certainly increasing as a member of disturbed, moist communities, sites presently dominated by *Poa pratensis* are not yet as common as they may become in northern Alberta.

VEGETATION

The *Poa pratensis* (Kentucky bluegrass) community type represents a grazing disturbance-induced community resulting from degradation of any one of several natural communities. *Poa pratensis* (Kentucky bluegrass) is a European meadow grass that is widely introduced and naturalized in North America, and that has a keen competitive advantage over most palatable native species. Stands may be almost pure *Poa pratensis* (Kentucky bluegrass), or they may be a mixture of this species and other weedy herbs, like *Cirsium arvense* (Canada thistle), *Sonchus* species (sow-thistle), *Taraxacum officinale* (common dandelion), and *Trifolium* species (clover) (Table 56). This type represents one of the drier herbaceous riparian or wetland community types, although the site hydrology, as well as vegetation, may have been altered by disturbance.

Table 56. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 5 stands of the *Poa pratensis* (Kentucky bluegrass) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Rosa spp. (rose)	1	0-1	20	4
Salix petiolaris (basket willow)	1	0-1	20	4
Graminoids				
Agropyron dasystachyum (northern wheat grass)	1	0-1	20	4
Agrostis scabra (rough hair grass)	7	0-10	40	17
Agropyron trachycaulum (slender wheat grass)	3	0-3	20	8
Bromus ciliatus (fringed brome)	3	0-3	20	8
Carex atherodes (awned sedge)	1	0-1	20	4
Carex prairea (prairie sedge)	3	0-3	20	8
Distichlis stricta (salt grass)	3	0-3	20	8
Festuca rubra (red fescue)	1	0-1	20	4
Festuca saximontana (Rocky Mountain fescue)	1	0-1	20	4
Hordeum jubatum (foxtail barley)	2	0-3	40	9
Juncus balticus (wire rush)	10	0-10	20	14
Poa palustris (fowl bluegrass)	30	0-30	20	24
Poa pratensis (Kentucky bluegrass)	69	20-98	100	83
Sphenopholis obtusata (prairie wedge grass)	1	0-1	20	4
Forbs				
Achillea millefolium (common yarrow)	10	0-10	20	14
Arnica chamissonis (leafy arnica)	1	0-1	20	4
Aster brachyactis (rayless aster)	3	0-3	20	8
Aster laevis (smooth aster)	3	0-3	20	8
Campanula rotundifolia (harebell)	1	0-1	20	4
Cerastium arvense (field mouse-ear chickweed)	3	0-3	20	8
Cirsium arvense (Canada thistle)	16	0-30	40	24
Crepis tectorum (annual hawk's-beard)	1	0-1	20	4
Delphinium glaucum (tall larkspur)	1	0-1	20	4
Descurainia sophia (flixweed)	1	0-1	20	4
Fragaria virginiana (wild strawberry)	10	0-10	20	14
Galium boreale (northern bedstraw)	1	0-1	20	4
Gentianella amarella (felwort)	1	0-1	20	4
Geum aleppicum (yellow avens)	3	0-3	20	8
Grindelia squarrosa (gumweed)	1	0-1	20	4
Lactuca pulchella (common blue lettuce)	3	0-3	20	8
Lathyrus ochroleucus (cream-colored vetchling)	10	0-10	20	14
Melilotus alba (white sweet-clover)	10	0-10	20	14
Potentilla norvegica (rough cinquefoil)	1	0-1	20	4
Sonchus arvensis (perennial sow-thistle)	3	0-3	20	8
Sonchus asper (prickly annual sow-thistle)	20	0-20	20	20
Taraxacum officinale (common dandelion)	20	0-20	40	28
Thalictrum venulosum (veiny meadow rue)	3	0-3	20	8
Trifolium hybridum (alsike clover)	1	0-1	20	4
Trifolium repens (white clover)	10	0-10	20	14
Vicia americana (wild vetch)	3	0-3	40	11
Ferns and Allies				
Equisetum arvense (common horsetail)	10	0-10	20	14

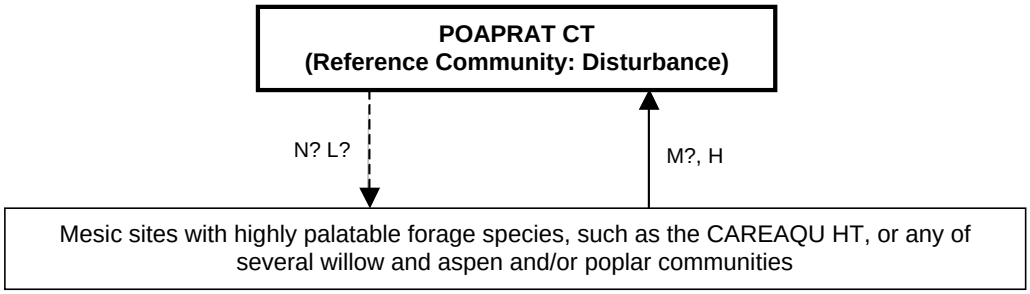
[1] Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The *Poa pratensis* (Kentucky bluegrass) community type is a grazing induced disturbance community representing an early/mid-seral secondary stage of succession. Overgrazing has brought drastic changes on a sites formerly occupied by

native graminoids (Volland 1978). Once a site is disturbed, the aggressive rhizomatous nature of *Poa pratensis* (Kentucky bluegrass) allows it to rapidly spread onto these areas. It withstands high levels of utilization, making replacement by former site occupants, such as native bunchgrasses or sedges, very unlikely.

This community type represents a disturbance seral stage reduced from any one of several types, including the *Calamagrostis canadensis* (bluejoint) habitat type, the *Carex aquatilis* (water sedge) habitat type, and the *Carex atherodes* (awned sedge) habitat type. Even *Salix* (willow) types may become so altered that the woody plants die, leaving domination by the *Poa pratensis* (Kentucky bluegrass) Close observation of similar sites may give insight to the potential climax community for the site. Figure 77 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Poa pratensis* (Kentucky bluegrass) Sites in North Central Alberta
Reference Community = *Poa pratensis* (Kentucky bluegrass) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
CAREAQU HT—*Carex aquatilis* (water sedge) habitat type
POAPRAT CT—*Poa pratensis* (Kentucky bluegrass) community type

Figure 77. Successional pathway for sites of the *Poa pratensis* (Kentucky bluegrass) community type

Note: This type is the result of grazing disturbance that occurs over several decades of high use.

EDATOPE

Figure 78 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 *Poa pratensis* (Kentucky bluegrass) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

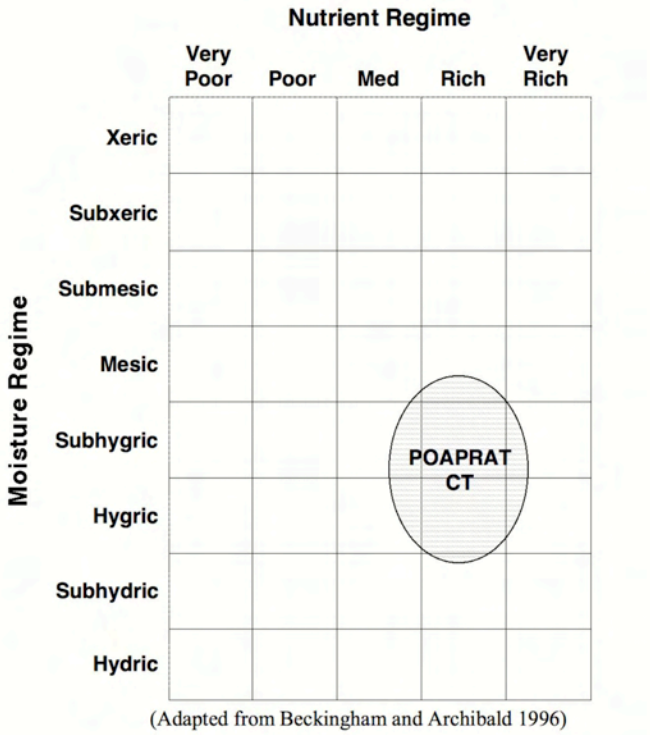


Figure 78. Edatope grid position for the *Poa pratensis* (Kentucky bluegrass) community type (POAPRAT CT)

SOILS

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. Mineral soil textures on sampled stands ranged from sand sandy loam. *Poa pratensis* (Kentucky bluegrass) is generally intolerant of prolonged flooding, seasonally high water tables, or poor drainage. It is tolerant of mildly alkaline (pH 8.0), and saline soils (Hansen and others 1995).

ADJACENT COMMUNITIES

Wetter sites support a wide range of communities including most of the many *Salix* (willow) and *Carex* (sedge) types described here. Adjacent drier sites are usually upland types.

MANAGEMENT INFORMATION

Livestock

Poa pratensis (Kentucky bluegrass) is rated as good forage value (Stone and Lawrence 2000, Tannas 1997, Thorpe 1996, and Beckingham 1991). The *Poa pratensis* (Kentucky bluegrass) community type 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 1997, Hansen and others 1995). Fall regrowth can occur if moisture is sufficient and temperatures remain above freezing. *Poa pratensis* (Kentucky bluegrass) is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). This species can produce new shoots from either existing tillers or rhizomes. Grazing practices influence the growth form present (Volland 1978). A high density of weak, low vigour tillers results under season-long grazing. Early season rest increases the vigour of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater. Streambanks with *Poa pratensis* (Kentucky bluegrass) stands are very susceptible to hoof shear damage.

Wildlife

Elk and deer make use of the grasses and forbs of this community type, especially in early spring when other forages have not yet greened. Waterfowl utilize *Poa pratensis* (Kentucky bluegrass) for food and cover. Upland game birds, small mammals, and small nongame birds use this type for cover (Dittberner and Olson 1983).

Fisheries
The *Poa pratensis* (Kentucky bluegrass) community type is not effective in stabilizing streambanks (Hansen and others 1995). Bank undercutting and sloughing will likely occur, especially when soils are wet.

Fire
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).

Soil Management and Rehabilitation Opportunities
The potential for soil compaction is greatest in spring when soils are moist. *Poa pratensis* (Kentucky bluegrass) has an extensive rhizome system, but its shallow rooting habit make it only marginally effective in stabilizing streambanks. The potential for erosion problems associated with this community type are quite high. Managers need to pay close attention to streambanks with the *Poa pratensis* (Kentucky bluegrass) community type 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 THE ECOSITE CLASSIFICATION SYSTEM

Stands of the *Poa pratensis* (Kentucky bluegrass) community type are typically found on very disturbed stands (where the tree and shrub cover has been removed by long-term livestock overgrazing) of the *Cornus stolonifera* (dogwood) ecosite (e) in the Dry Mixedwood Natural Subregion with a subhygric/rich moisture/nutrient regime, as described by Beckingham and Archibald (1996). The type also occurs in similar situations in the Parkland Natural Region.

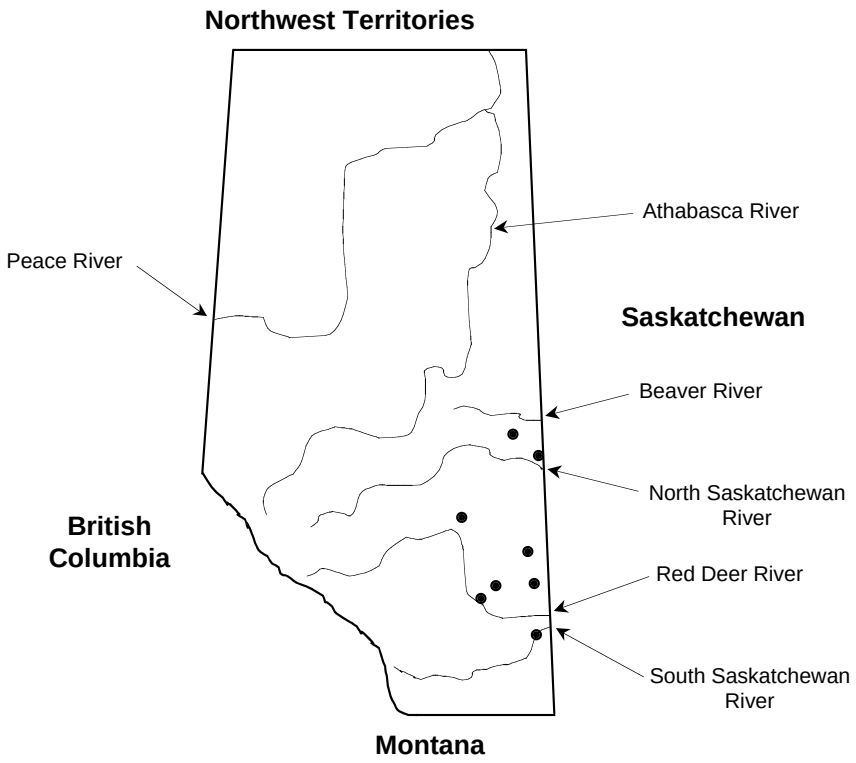
OTHER STUDIES

The *Poa pratensis* (Kentucky bluegrass) community type is described by Thompson and Hansen (2002) in the Grassland Natural Region of southern Alberta, by Thompson and Hansen (2001) in the Prairie Ecozone of southern Saskatchewan, and by Hansen and others (1995) for Montana. Willoughby (2000) describes a *Poa pratensis-Deschampsia* (Kentucky bluegrass-hairgrass) community type in Dry Mixedwood Subregion grasslands and several types containing the species in tame grasslands.

Puccinellia nuttalliana Habitat Type
(Nuttall's Salt-Meadow Grass)

PUCCNUT
Number of Stands Sampled = 13
Number of Stands Sampled in Alberta = 8

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type is an incidental type in the Parkland Natural Region and the Dry Mixedwood Natural Subregion of central Alberta. It is more common in the drier grasslands of southeastern Alberta and southern Saskatchewan where moist sites tend to accumulate salts. The type is found in basins, swales, sloughs, lake margins, and seep areas with elevated saline or alkali levels, and represents a fairly narrow set of hydrologic and soil chemistry conditions. Typical stands were sampled near Bonnyville, at Rochon Sands near Buffalo Lake, and near Tulliby Lake in east central Alberta. Stands of the type can be seen as distinct bands that occupy sites with this set of conditions around lakeshores and saline seep areas.

VEGETATION

The *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type is characterized by dense, often monospecific stands of the tufted *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) with frequent presence of a few other saline tolerant species, such as *Distichlis stricta* (saltgrass), *Hordeum jubatum* (foxtail barley), and *Triglochin maritima* (seaside arrow-grass) (Table 57).

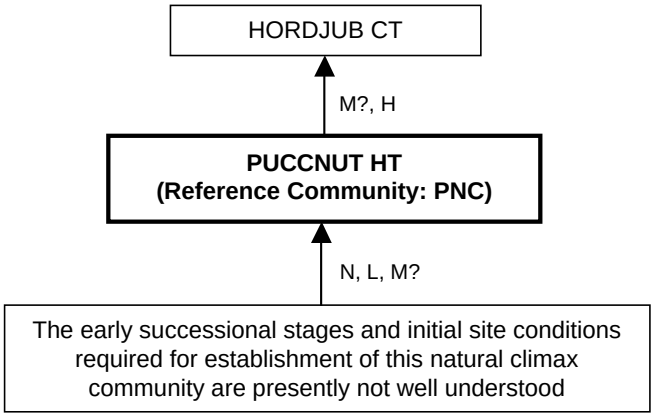
Table 57. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 13 stands of the *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Graminoids				
Agropyron trachycaulum (slender wheat grass)	3	0-3	8	5
Beckmannia syzigachne (slough grass)	20	0-20	8	12
Distichlis stricta (salt grass)	25	0-40	31	28
Hordeum jubatum (foxtail barley)	9	0-20	54	22
Juncus balticus (wire rush)	1	0-1	8	3
Juncus bufonius (toad rush)	80	0-80	8	25
Puccinellia nuttalliana (Nuttall's salt-meadow grass)	78	50-98	100	88
Scirpus paludosus (prairie bulrush)	2	0-3	23	5
Scirpus pungens (three-square rush)	11	0-20	15	12
Forbs				
Aster brachyactis (rayless aster)	10	0-10	8	9
Aster ericoides (tufted white prairie aster)	1	0-1	8	3
Atriplex spp. (atriplex)	10	0-10	8	9
Atriplex prostrata (prostrate saltbush)	3	0-3	8	5
Bassia hyssopifolia (five-hook bassia)	1	0-1	8	3
Chenopodium album (lamb's-quarters)	10	0-10	8	9
Haplopappus lanceolatus (lance-leaved ironplant)	3	0-3	8	5
Kochia scoparia (summer-cypress)	10	0-10	8	9
Ranunculus cymbalaria (seaside buttercup)	10	0-10	8	9
Rumex maritimus (golden dock)	1	0-1	8	3
Salicornia europaea (samphire)	8	0-10	23	14
Salsola kali (Russian-thistle)	10	0-10	8	9
Sonchus arvensis (perennial sow-thistle)	1	0-1	8	3
Sonchus spp. (sow-thistle)	1	0-1	8	3
Suaeda calceoliformis (western sea-blite)	1	0-1	8	3
Triglochin maritima (seaside arrow-grass)	9	0-20	31	16

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Puccinellia nuttalliana (Nuttall's salt-meadow grass) occupies a narrow range of hydrologic and soil chemistry conditions. High grazing use of this habitat type will weaken the *Puccinellia nuttalliana* (Nuttall's salt-meadow grass). With severe grazing disturbance the stands become opened, the sensitive balance of soil hydrology and chemistry is altered, and invaders enter. Among these are *Hordeum jubatum* (foxtail barley) and a variety of disturbance-related, alkali tolerant forbs, such as members of the Chenopodiacae family and *Sonchus* species (sow-thistle), increase. Figure 79 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) Sites in North Central Alberta
Reference Community = *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
HORDJUB CT—*Hordeum jubatum* (foxtail barley) community type
PUCCNUT HT—*Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type

Figure 79. Successional pathway for sites of the *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type

Note: The *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type will colonize and occupy moist, slightly to moderately alkaline sites, such as swales, depressions, and pond margins.

EDATOPE

Figure 80 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 *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

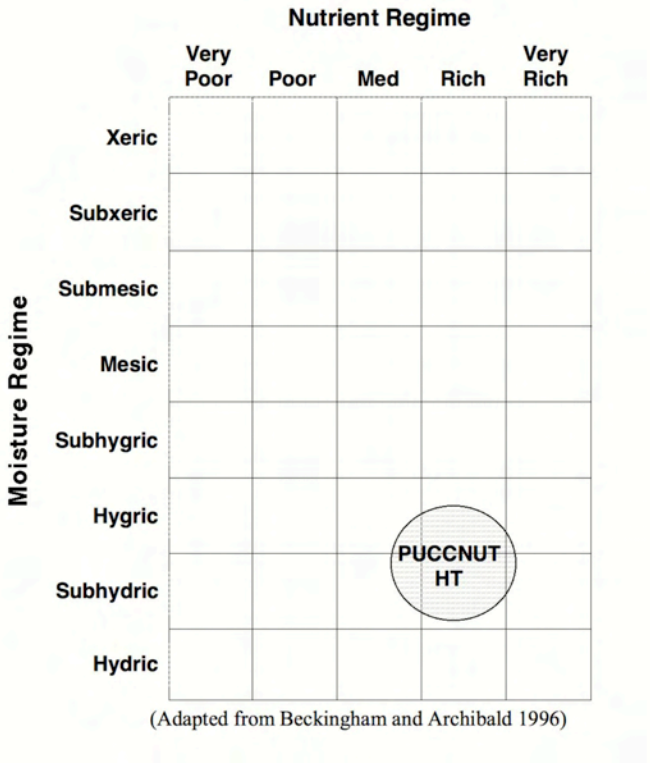


Figure 80. Edatope grid position for the *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type (PUCCNUT HT)

SOILS

Soils are mineral, with textures on sampled stands ranging from sand to clay. Water tables usually remain at or slightly below the soil surface. Soil reaction is commonly is moderately to highly basic (pH greater than 8.0). Soils of this type characteristically have high concentrations of soluble salts.

ADJACENT COMMUNITIES

The *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type is often at the lowest (wettest) topographic level of the local drainage. On other sites adjacent wetter communities may be dominated by the *Scirpus pungens* (three-square rush), may be unvegetated mud, or open water. Drier communities typically are somewhat less alkaline/saline, and may be dominated by species such as *Distichlis stricta* (saltgrass), *Hordeum jubatum* (foxtail barley), or *Calamagrostis inexpansa* (northern reed grass) or an upland community. Adjacent sites that are even more saline are likely to be unvegetated.

MANAGEMENT INFORMATION

Livestock

Tannas (1997) and Beckingham (1991) rate *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) forage value as high. Production is rated as moderate to low (Hansen and others 1988) and palatability for livestock is rated high (Tannas 1997, Hansen and others 1988). High levels of utilization of this type will reduce the cover of the *Puccinellia nuttalliana* (Nuttall's salt-meadow grass), and with prolonged high use, *Hordeum jubatum* (foxtail barley) may replace it.

Wildlife

The *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type is of limited value as wildlife habitat. It provides some cover, forage, and nesting habitat for waterfowl.

Fire

The response to, and utility of, fire in the *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type is not well known at this time.

Soil Management and Rehabilitation Opportunities
The high clay content and saline nature common to theses soils make them extremely susceptible to compaction. They present limitations to development. New trails or roads should be located outside this type on the adjacent uplands.

Recreational Uses and Considerations
Recreational use of this type is extremely limited. Campsites, roads, and trails should located elsewhere due to the high clay content of this type.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites of the *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type are not included in the description of any ecosite of the Dry Mixedwood Natural Subregion, as described by Beckingham and Archibald (1996). This type also occurs in the Parkland Natural Region, as well as in the grasslands of southern Alberta.

OTHER STUDIES

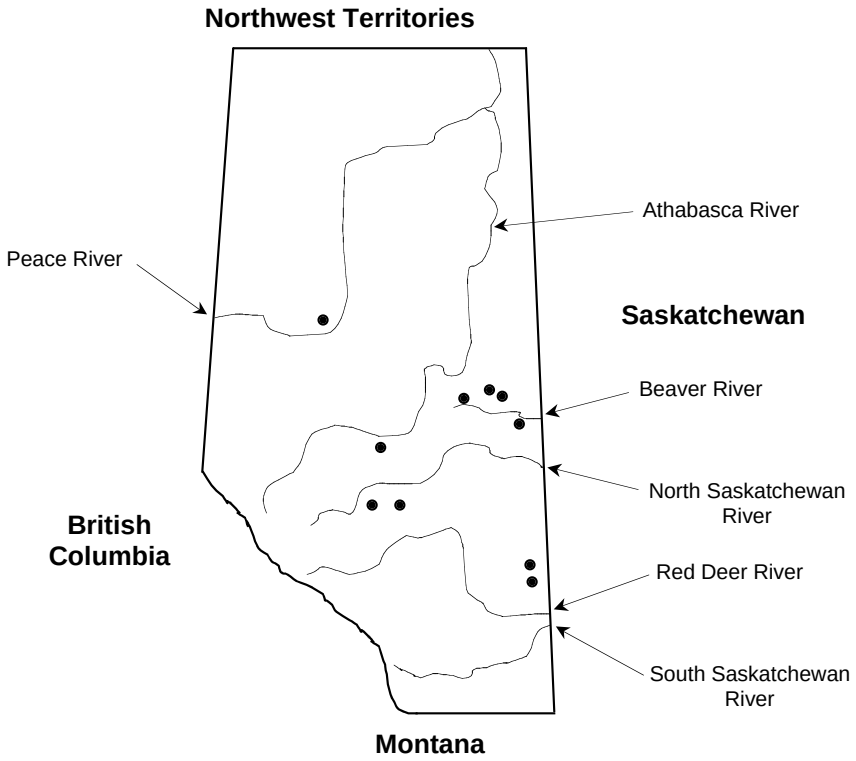
The *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type is described by Thompson and Hansen (2002) in the Grassland Natural Region of southern Alberta and by Thompson and Hansen (2001) in the Prairie Ecozone of southern Saskatchewan. A *Puccinellia nuttalliana* (Nuttall alkaligrass) dominance type is described by Hansen and others (1988) for Montana.

Scirpus acutus Habitat Type
(Great Bulrush Habitat Type)

SCIRACU
Number of Stands Sampled = 17
Number of Stands Sampled in Alberta = 11

***Note:* The *Scirpus acutus* (great bulrush) habitat type includes all combinations of *Scirpus acutus* (great bulrush) and *Scirpus validus* (common great bulrush) due to similarities in environmental conditions and management concerns.**

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Scirpus acutus* (great bulrush) habitat type is a minor type occurring in the Parkland Natural Region and the Dry Mixedwood Natural Subregion. Typical locations include pond and lake margins in water up to 2 m deep. Typical stands were sampled on Thunder Lake near Barrhead, Moose Lake near Bonnyville, near Lac La Biche, Caslan, and on Lac Cardinal near Peace River.

VEGETATION

The *Scirpus acutus* (great bulrush) habitat type typically occurs as a fringe along the margins of ponds and lakes. It also occupies basins where water tables remain relatively high but may drop below the soil surface later during the growing season. Other species are absent or present only in limited amounts in undisturbed stands (Table 58). Disturbance allows entry of such species as *Alopecurus aequalis* (short-awned foxtail), *Beckmannia syzigachne* (slough grass), *Eleocharis* species (spike-rush), *Mentha arvensis* (wild mint), and *Polygonum* (smartweed).

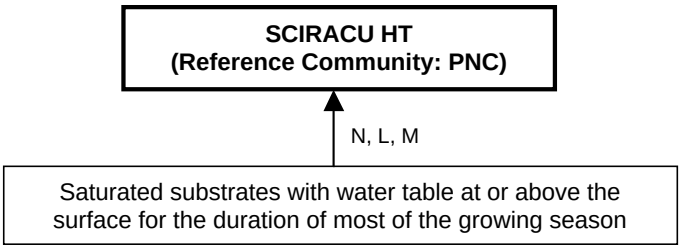
Table 58. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 17 stands of the *Scirpus acutus* (great bulrush) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Graminoids				
Agrostis scabra (rough hair grass)	1	0-1	6	2
Alopecurus aequalis (short-awned foxtail)	2	0-3	12	5
Beckmannia syzigachne (slough grass)	2	0-3	12	5
Calamagrostis canadensis (bluejoint)	3	0-3	6	4
Carex aquatilis (water sedge)	3	0-3	6	4
Carex atherodes (awned sedge)	10	0-10	6	8
Eleocharis spp. (spike-rush)	30	0-30	6	13
Eleocharis palustris (creeping spike-rush)	40	0-40	6	15
Hordeum jubatum (foxtail barley)	1	0-1	12	3
Poa palustris (fowl bluegrass)	1	0-1	6	2
Scirpus acutus (great bulrush)	84	0-98	88	86
Scirpus validus (common great bulrush)	55	0-60	12	25
Forbs				
Aster brachyactis (rayless aster)	3	0-3	6	4
Chenopodium rubrum (red goosefoot)	3	0-3	6	4
Epilobium ciliatum (northern willowherb)	10	0-10	6	8
Epilobium palustre (marsh willowherb)	1	0-1	6	2
Lemna minor (common duckweed)	3	0-3	6	4
Lycopus asper (western water-horehound)	10	0-10	6	8
Mentha arvensis (wild mint)	4	0-10	18	8
Polygonum lapathifolium (pale persicaria)	2	0-3	12	5
Polygonum ramosissimum (bushy knotweed)	3	0-3	6	4
Rumex maritimus (golden dock)	10	0-10	6	8
Sagittaria cuneata (arum-leaved arrowhead)	1	0-1	12	3
Senecio conterminus (Arctic butterweed)	1	0-1	6	2
Sparganium spp. (sparganium)	1	0-1	6	2
Typha latifolia (common cattail)	5	0-10	18	9
Urtica dioica (common nettle)	1	0-1	6	2

[1] Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Scirpus acutus (great bulrush) and *Scirpus validus* (common great bulrush) are early colonizers of suitable habitats, but are able to persist under continually wet conditions. Due to the continually saturated conditions and the aggressive characteristic of *Scirpus acutus* (great bulrush), most other species are precluded. Most disturbance to this type occurs during drought years when grazing animals can gain access to these sites. Disturbance promotes such species as *Hordeum jubatum* (foxtail barley) and members of the *Polygonum* (smartweed) genus. Figure 81 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Scirpus acutus* (great bulrush) Sites in North Central Alberta
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 81. 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 82 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).

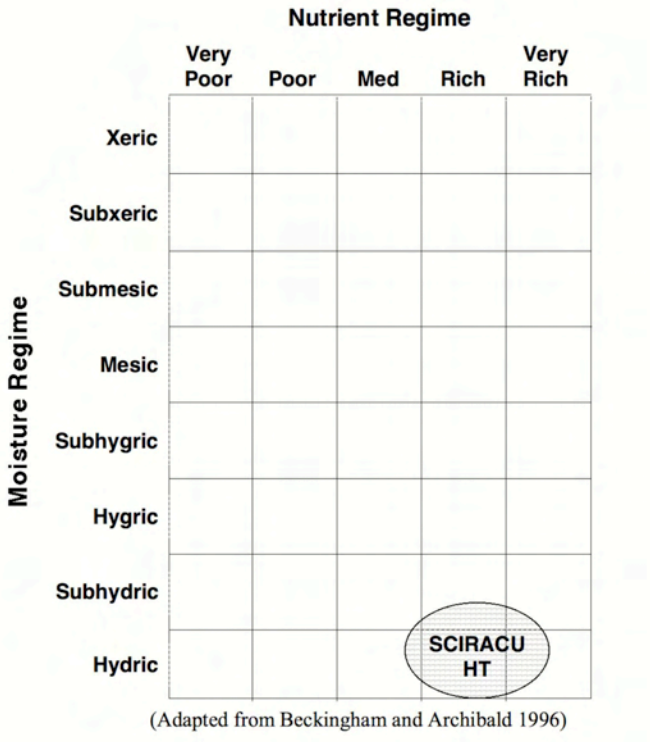


Figure 82. Edatope grid position for the *Scirpus acutus* (great bulrush) habitat type (SCIRACU HT)

SOILS

Soils are commonly fine textured Humic Gleysols or occasionally Organic. Mineral soil textures on sampled stands ranged from sand to silty clay. Water tables are generally at or above the soil surface throughout the growing season. Soil reaction varies from neutral to moderately alkaline (pH 7.0 to 8.0).

ADJACENT COMMUNITIES

The *Typha latifolia* (common cattail) habitat type is often adjacent to this type, especially where surface water persists year round, but more typically, this type is adjacent to deep, open water. Drier sites support the *Carex atherodes*, (awned sedge), *Carex utriculata* (beaked sedge), *Carex aquatilis* (water sedge), and many different *Salix* (willow) types. There are lakeshore sites with the *Scirpus acutus* (great bulrush) habitat type adjacent to the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type on a steep bank.

MANAGEMENT INFORMATION

Livestock

Deep water and the lack of palatable forage limit livestock use of this type. However, if upland forage becomes limited and soil conditions become dry, livestock may utilize the *Scirpus acutus* (great bulrush) (Tannas 1997, Hansen and others 1995).

Wildlife

Scirpus acutus (great bulrush) provides valuable nesting and roosting cover for a variety of songbirds and waterfowl, notably red winged and yellow-headed blackbirds. *Scirpus acutus* (great bulrush) is a staple food for muskrats and is used in construction of their huts. Seeds of *Scirpus acutus* (great bulrush) are eaten by a variety of birds. Waterfowl managers often attempt to increase the proportion of *Scirpus acutus* (great bulrush) relative to *Typha* species (cattails) as a means of improving habitat.

Fire

The *Scirpus acutus* (great bulrush) habitat type will burn in late fall or early spring if water levels have fallen.

Soil Management and Rehabilitation Opportunities

Soils are commonly wet throughout the growing season and easily damaged from trampling by livestock and wildlife.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

The *Scirpus acutus* (great bulrush) habitat type occurs on sites described as the bulrush community type within the marsh ecosite (l) of the Dry Mixedwood Natural Subregion, having a hydric/rich moisture/nutrient regime (Beckingham and Archibald 1996). This type also occurs in the Parkland, as well as in the grasslands of southern Alberta.

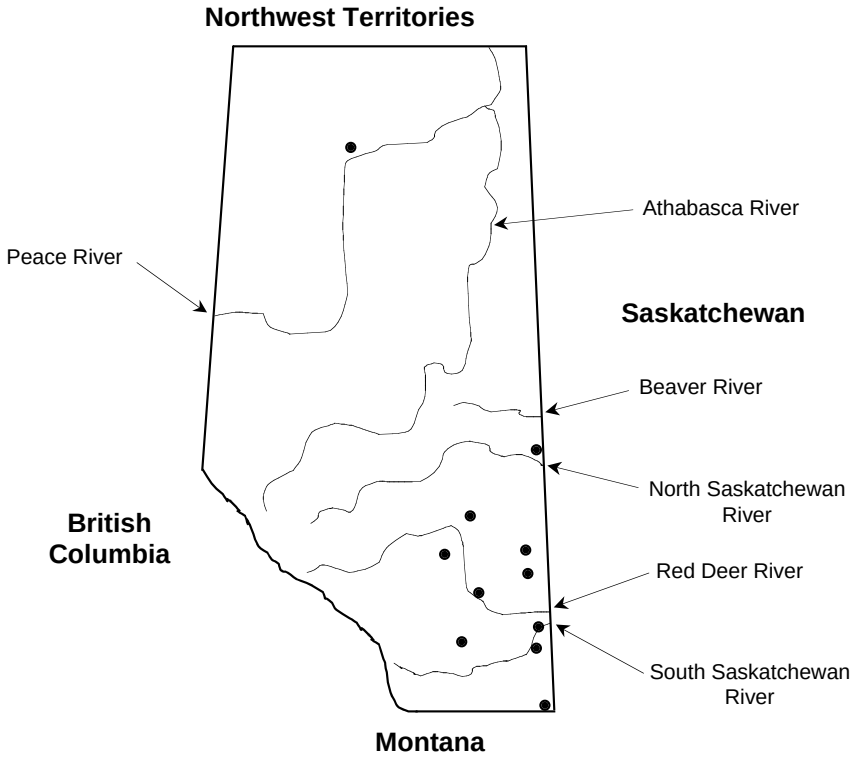
OTHER STUDIES

The *Scirpus acutus* (great bulrush) habitat type is described by Thompson and Hansen (2002) in the Grassland Natural Region of southern Alberta, by Thompson and Hansen (2001) in the Prairie Ecozone of southern Saskatchewan, and by Hansen and others (1995) for Montana. Beckingham and Archibald (1996) and Beckingham, Nielsen, and Futoransky (1996) describe a *Scirpus* (bulrush) community type of the marsh ecosite in northern Alberta and the Mid-Boreal ecoregions of Saskatchewan.

Scirpus pungens Habitat Type
(Three-Square Rush Habitat Type)

SCIRPUN
Number of Stands Sampled = 23
Number of Stands Sampled in Alberta = 13

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Scirpus pungens* (three-square rush) habitat type is an incidental type in the Parkland Natural Region and the Dry Mixedwood Natural Subregion of Alberta, occurring on moist sites of mineral soils with slightly to moderately elevated alkalinity/salinity. Sites are located in wet areas such as along smaller streams (usually perennial), and the edges of marshes, ponds, and lakes. Typical stands were sampled on Buffalo Lake near Stettler, Gooseberry Lake near Consort, near Tulliby Lake, and along the Ponton River near High Level.

VEGETATION

When undisturbed, the *Scirpus pungens* (three-square rush) habitat type usually forms nearly monospecific stands dominated by *Scirpus pungens* (three-square rush) in a variety of densities, depending on degree of salinity. With disturbance, the cover of three-square rush is reduced, and other saline/alkaline tolerant species invade. Among these invaders are *Hordeum jubatum* (foxtail barley), *Juncus* species (rush), *Potentilla anserina* (silverweed), *Sonchus* species (sow-thistle), and *Triglochin maritima* (seaside arrow-grass) (Table 59).

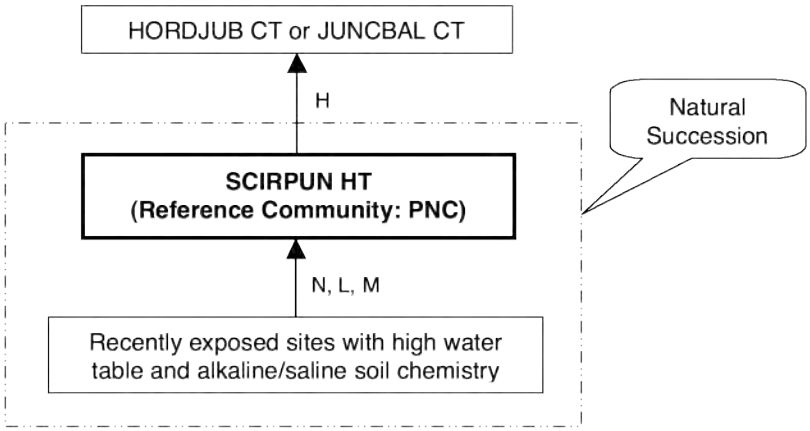
Table 59. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 23 stands of the *Scirpus pungens* (three-square rush) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Salix exigua (sandbar willow)	1	0-1	4	2
Graminoids				
Agrostis scabra (rough hair grass)	3	0-3	9	5
Agropyron trachycaulum (slender wheat grass)	3	0-3	4	4
Calamagrostis inexpansa (northern reed grass)	1	0-1	4	2
Calamagrostis stricta (narrow reed grass)	3	0-3	4	4
Carex aquatilis (water sedge)	1	0-1	4	2
Carex lanuginosa (woolly sedge)	3	0-3	4	4
Carex retrorsa (turned sedge)	3	0-3	4	4
Deschampsia cespitosa (tufted hair grass)	3	0-3	4	4
Eleocharis palustris (creeping spike-rush)	30	0-50	13	20
Elymus virginicus (Virginia wild rye)	3	0-3	4	4
Hordeum jubatum (foxtail barley)	3	0-10	61	14
Juncus alpinoarticulatus (alpine rush)	2	0-3	9	4
Juncus balticus (wire rush)	13	0-20	13	13
Juncus nodosus (knotted rush)	1	0-1	4	2
Phalaris arundinacea (reed canary grass)	10	0-10	4	7
Poa pratensis (Kentucky bluegrass)	1	0-1	4	2
Puccinellia nuttalliana (Nuttall's salt-meadow grass)	3	0-3	17	7
Scirpus acutus (great bulrush)	1	0-1	4	2
Scirpus microcarpus (small-fruited bulrush)	1	0-1	4	2
Scirpus paludosus (prairie bulrush)	10	0-10	4	7
Scirpus pungens (three-square rush)	77	30-98	100	88
Forbs				
Aster brachyactis (rayless aster)	2	0-3	9	4
Aster ericoides (tufted white prairie aster)	1	0-1	4	2
Aster spp. (aster)	20	0-20	4	9
Atriplex spp. (atriplex)	2	0-3	9	4
Atriplex prostrata (prostrate saltbush)	2	0-3	9	4
Chenopodium album (lamb's-quarters)	8	0-10	13	10
Cirsium arvense (Canada thistle)	3	0-3	9	5
Epilobium leptophyllum (narrow-leaved willowherb)	3	0-3	4	4
Kochia scoparia (summer-cypress)	1	0-1	9	3
Lycopus asper (western water-horehound)	1	0-1	4	2
Polygonum arenastrum (common knotweed)	1	0-1	4	2
Potentilla anserina (silverweed)	5	0-10	22	10
Ranunculus cymbalaria (seaside buttercup)	2	0-3	13	5
Rumex crispus (curled dock)	1	0-1	9	3
Rumex maritimus (golden dock)	1	0-1	4	2
Salicornia europaea (samphire)	40	0-40	4	13
Senecio pauperculus (balsam groundsel)	1	0-1	4	2
Sonchus arvensis (perennial sow-thistle)	20	0-30	9	13
Sonchus spp. (sow-thistle)	3	0-3	4	4
Sonchus uliginosus (smooth perennial sow-thistle)	1	0-1	4	2
Trifolium spp. (clover)	1	0-1	4	2
Triglochin maritima (seaside arrow-grass)	40	0-60	9	19
Triglochin palustris (slender arrow-grass)	7	0-10	9	8
Typha latifolia (common cattail)	1	0-1	4	2
Ferns and Allies				
Equisetum arvense (common horsetail)	10	0-10	4	7

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Scirpus pungens (three-square rush) is an early colonizer of suitable habitats and is able to persist under suitable conditions. Due to continual saturation and its aggressive habit, most other species are precluded. Wet conditions usually limit most disturbance other than occasional trampling by livestock. However, grazing disturbance can dramatically increase the disturbance-related species present. These include *Hordeum jubatum* (foxtail barley), *Juncus* species (rush), *Potentilla anserina* (silverweed), *Sonchus* species (sow-thistle), and *Triglochin maritima* (seaside arrow-grass). Figure 83 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Scirpus pungens* (three-square bulrush) Sites in North Central Alberta
Reference Community = *Scirpus pungens* (three-square bulrush) habitat type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
HORDJUB CT—*Hordeum jubatum* (foxtail barely) community type
JUNCBAL CT—*Juncus balticus* (Baltic rush) community type
SCIRPUN HT—*Scirpus pungens* (three-square bulrush) habitat type

Figure 83. Successional pathway for sites of the *Scirpus pungens* (three-square rush) habitat type

Note: The *Scirpus pungens* (three-square rush) habitat type will become established on suitably wet, exposed substrates along shores and low floodplain sites having alkaline/saline soil chemistry.

EDATOPE

Figure 84 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 pungens* (three-square rush) habitat type. The figure is adapted from the work of Beckingham and Archibald (1996).

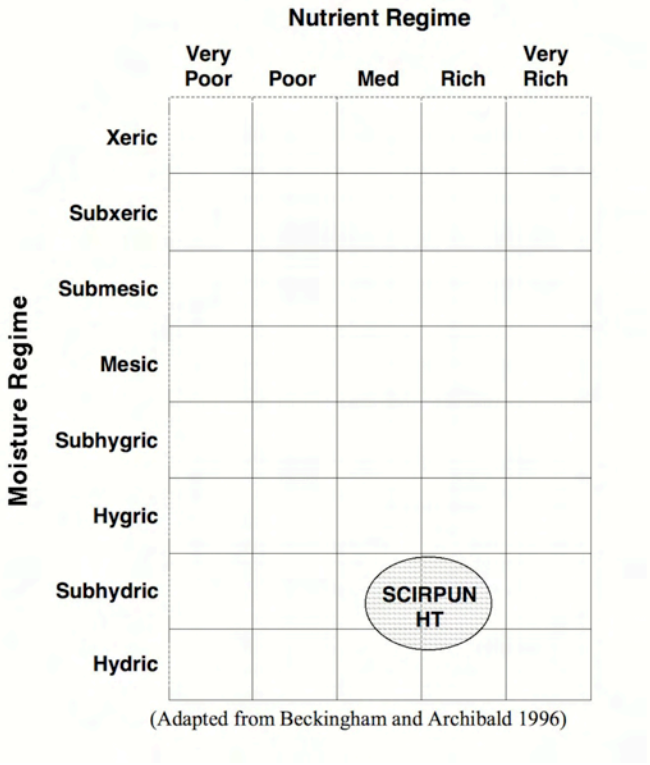


Figure 84. Edatope grid position for the *Scirpus pungens* (three-square rush) habitat type (SCIRPUN HT)

SOILS

Soils are typically Humic Gleysols. Mineral soil textures on sampled stands ranged from sand to clay. Water tables are high, remaining within 1 m of the soil surface throughout the year. Soils are rated as somewhat poorly drained to poorly drained. Soil reaction is typically alkaline, with pH greater than 8.0. Saline soils are also common.

ADJACENT COMMUNITIES

Dominant species on adjacent wetter sites may include *Scirpus acutus* (great bulrush), *Typha latifolia* (common cattail), or *Eleocharis palustris* (common spike sedge). Dominant species on adjacent drier sites may include *Calamagrostis inexpansa* (northern reed grass), the *Juncus balticus* (Baltic rush), *Salix exigua* (sandbar willow), or upland communities.

MANAGEMENT INFORMATION

Livestock

Forage value of *Scirpus pungens* (three-square rush) is rated poor and palatability is rated low (Stone and Lawrence 2000, Tannas 1997). Livestock or wildlife seldom grazes it; however, if other forage becomes unavailable and the site dries out, livestock may heavily utilize these communities (Hansen and others 1995). High levels of grazing and trampling disturbance can alter the community to the *Hordeum jubatum* (foxtail barley) community type.

Wildlife

The *Scirpus pungens* (three-square rush) habitat type can be an important source of hiding cover and food for wildlife. *Scirpus pungens* (three-square rush) is used by muskrats for construction of huts. Waterfowl use this site type for nesting and hiding cover. Other birds such as red-winged blackbirds and yellow-headed blackbirds are common inhabitants (Hansen and others 1995).

Fisheries

The *Scirpus pungens* (three-square rush) habitat type buffers wind and wave action on bodies of water. Fish may use this site type for spawning. Along streams, this site type helps to filter out sediments and build streambanks.

Soil Management and Rehabilitation Opportunities
In fluvial settings, the *Scirpus pungens* (three-square rush) habitat type helps filter sediments to build streambanks. This type is fairly drought tolerant being able to persist through several years of dry conditions. *Scirpus pungens* (three-square rush) is a prolific seed producer. Dissemination occurs by both wind and water. Seeds require moist, bare soil for germination. Rhizomes spread into exposed areas, rapidly colonizing mudflats and drawdown areas.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites with the *Scirpus pungens* (three-square bulrush) habitat type are not described within any ecosite of the Dry Mixedwood Natural Subregion by Beckingham and Archibald (1996). This type also occurs more frequently in the Parkland and in the grasslands of southern Alberta.

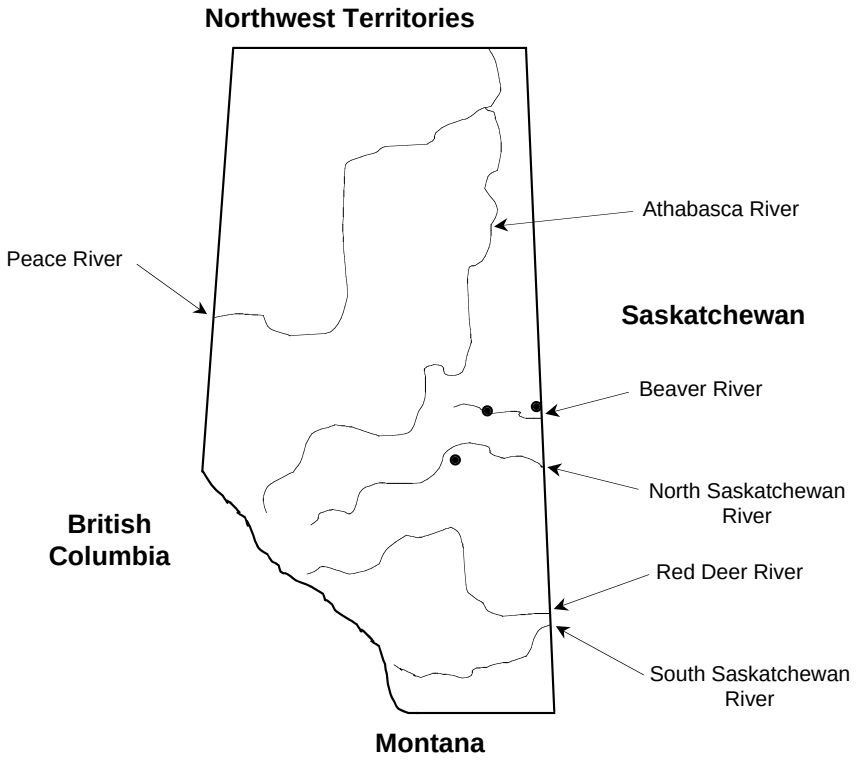
OTHER STUDIES

The *Scirpus pungens* (three-square rush) habitat type is described by Thompson and Hansen (2002) in the Grassland Natural Region of southern Alberta, by Thompson and Hansen (2001) in the Prairie Ecozone of southern Saskatchewan, and by Hansen and others (1995) for Montana.

Sparganium eurycarpum Community Type (Giant Bur-Reed Community Type)

SPAREUR
Number of Stands Sampled = 3
Number of Stands Sampled in Alberta = 3

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Sparganium eurycarpum* (giant bur-reed) community type is an incidental type at low elevations in the Central Parkland Natural Subregion and the Lower Dry Mixedwood Natural Subregion. This community type occurs in the shallow water

along the channel edges of slow moving streams and rivers. The species is native to North America (USDA Natural Resources Conservation Service 2000) and distributed through central Alberta (Moss 1983), but common occurrence of extensive stands seems localized in an area of east central Alberta between the Beaver River and the Battle River. Stands sampled were near Cold Lake, on the Beaver River north of St. Paul, and near Elk Island National Park.

VEGETATION

Vegetative diversity is low on stands of this type, consisting primarily of dense, monospecific, stands of *Sparganium eurycarpum* (giant bur-reed) with a few other hydrophytic species occasionally present (Table 60).

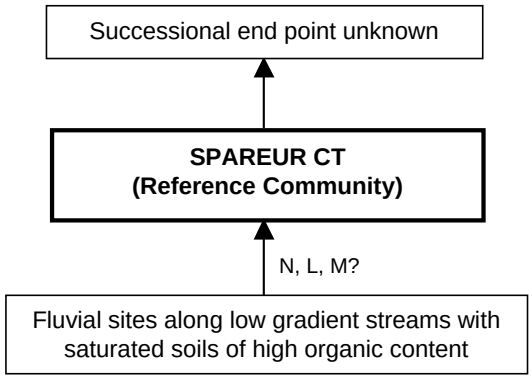
Table 60. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 3 stands of the *Sparganium eurycarpum* (giant bur-reed) community type

Species	Percent Canopy Cover Average	Percent Canopy Cover Range	Constancy (Frequency)	Prominence Index[1]
Graminoids				
Agrostis scabra (rough hair grass)	3	0-3	33	10
Alopecurus aequalis (short-awned foxtail)	1	0-1	33	6
Carex bebbii (Bebb's sedge)	3	0-3	33	10
Carex sychnocephala (long-beaked sedge)	10	0-10	33	18
Eleocharis palustris (creeping spike-rush)	3	0-3	33	10
Glyceria grandis (common tall manna grass)	1	0-1	33	6
Scirpus acutus (great bulrush)	2	0-3	67	12
Forbs				
Cicuta bulbifera (bulb-bearing water-hemlock)	10	0-10	33	18
Cicuta maculata (water-hemlock)	3	0-3	33	10
Epilobium ciliatum (northern willowherb)	10	0-10	33	18
Rumex maritimus (golden dock)	3	0-3	33	10
Sagittaria cuneata (arum-leaved arrowhead)	3	0-3	33	10
Senecio conterminus (Arctic butterweed)	1	0-1	33	6
Sparganium eurycarpum (giant bur-reed)	86	80-98	100	93
Typha latifolia (common cattail)	1	0-1	33	6
Ferns and Allies				
Equisetum fluviatile (swamp horsetail)	10	0-10	33	18

[1]Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

The successional status of the *Sparganium eurycarpum* (giant bur-reed) community type is not clearly understood at this point. Figure 85 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Sparganium eurycarpum* (giant bur-reed) Sites in North Central Alberta
Reference Community = *Sparganium eurycarpum* (giant bur-reed) community type
Grazing Level: N = None, L = Light, M = Moderate, H = High

KEY TO 7-LETTER CODES
SPAREUR CT—*Sparganium eurycarpum* (giant bur-reed) community type

Figure 85. Successional pathway for sites of the *Sparganium eurycarpum* (giant bur-reed) community type

Note: The ecological status of this community is presently not well understood.

EDATOPE

Figure 86 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 *Sparganium eurycarpum* (giant bur-reed) community type. The figure is adapted from the work of Beckingham and Archibald (1996).

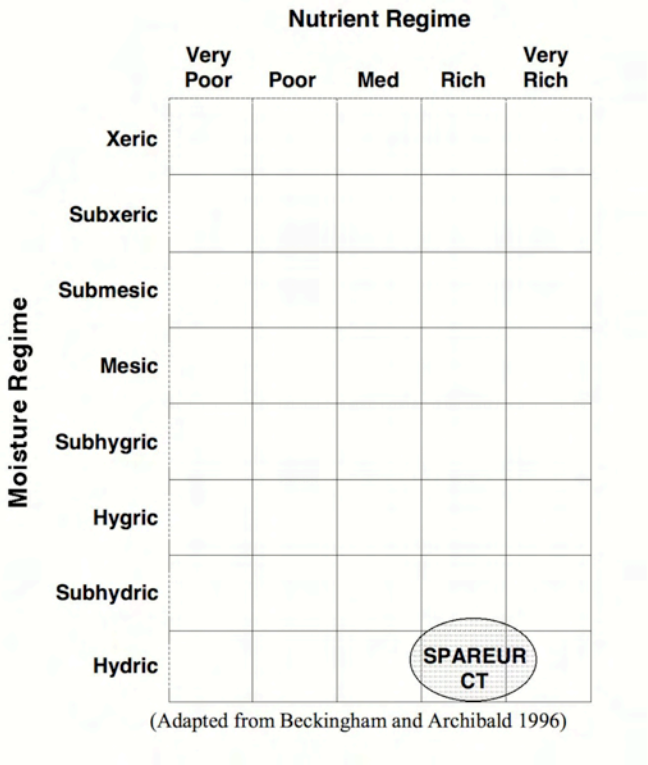


Figure 86. Edatope grid position for the *Sparganium eurycarpum* (giant bur-reed) community type (SPAREUR CT)

SOILS

Soils are typically fine textured organic muck and silt mud in 10 to 100 cm of slow moving to standing water. Textures on sampled stands ranged from Organic muck to silty sand.

ADJACENT COMMUNITIES

Occasional adjacent wetter communities may be small stands of the *Scirpus acutus* (great bulrush) habitat type and the *Typha latifolia* (common cattail) habitat type, or open water. Adjacent drier communities may be dominated by *Salix lutea* (yellow willow) or *Salix planifolia* (flat-leaved willow) communities, *Carex atherodes* (awned sedge), *Carex aquatilis* (water sedge), or *Carex utriculata* (beaked sedge).

MANAGEMENT INFORMATION

Livestock
The *Sparganium eurycarpum* (giant bur-reed) community type offers little value as livestock forage due to the extremely wet sites.

Wildlife
Information scarce on wildlife usage of this species, although the abundant herbage and large seed production would seem likely to be of value to waterfowl and aquatic mammals, such as muskrats and beaver.

Soil Management and Rehabilitation Opportunities
With growth habit, stature, and setting similar to that of *Typha latifolia* (common cattail), stands of *Sparganium eurycarpum* (giant bur-reed) serve to dissipate flood flow energies and prevent bank and channel erosion on stream situations, and wave erosion on lakeshore situations.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

Sites with the *Sparganium eurycarpum* (giant bur-reed) community type are not described within any ecosite of the Dry Mixedwood Natural Subregion by Beckingham and Archibald (1996). This type was not observed in the Parkland.

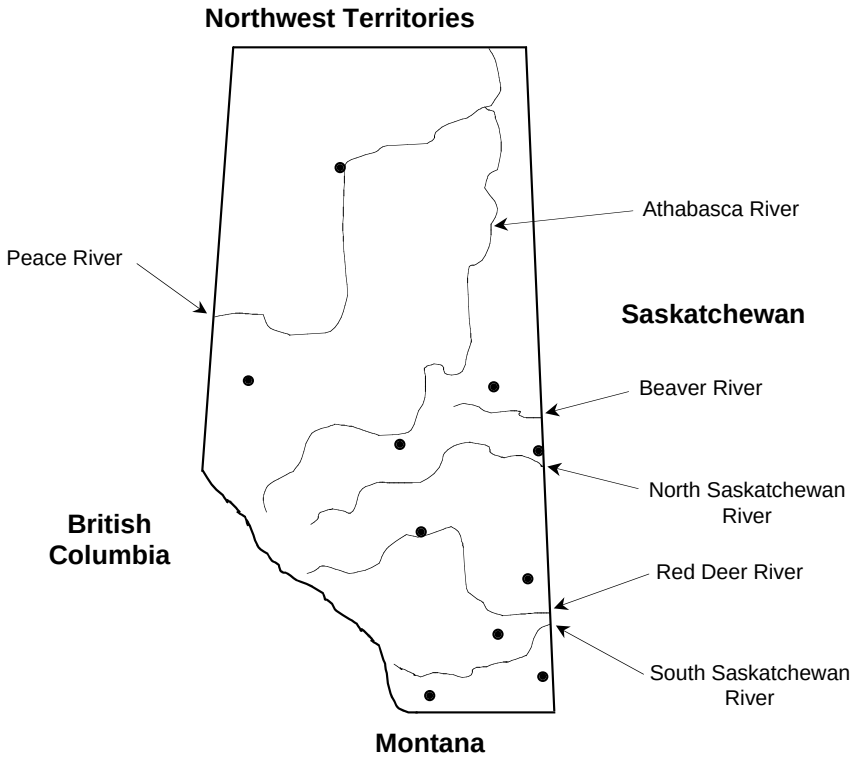
OTHER STUDIES

The *Sparganium eurycarpum* (giant bur-reed) community type has not previously been describe in this region.

Typha latifolia Habitat Type
(Common Cattail Habitat Type)

TYPHLAT
Number of Stands Sampled = 22
Number of Stands Sampled in Alberta = 12

(***Note:*** Some stand data used for this document came from other authors and did not contain plot location. Therefore, the following distribution map of sampled sites in Alberta may not contain the same number of stands as indicated above.)



LOCATION AND ASSOCIATED LANDFORMS

The *Typha latifolia* (common cattail) habitat type is a minor type in the Parkland Natural Region and the Dry Mixedwood Natural Subregion of Alberta. This type commonly occurs along lake and pond margins, ditches, sloughs, backwater areas, and marshes in water up to 2 m deep. Typical stands were sampled near Tulliby Lake, on Thunder Lake near Barrhead, on Saskatoon Lake near Grande Prairie, and near Paddle River in the Lower Peace River Valley.

VEGETATION

Continually saturated or inundated conditions tend to limit species diversity within this type. *Typha latifolia* (common cattail) is typically dominant in an essentially monospecific stand when undisturbed (Table 61). Disturbance allows invasion of such species as *Beckmannia syzigachne* (slough grass), *Eleocharis palustris* (creeping spike-rush), *Mentha arvensis* (wild mint), and *Polygonum* (smartweed).

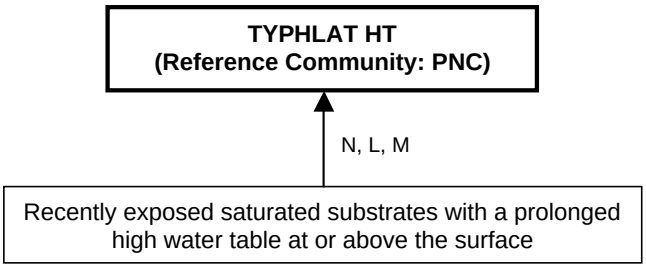
Table 61. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 22 stands of the *Typha latifolia* (common cattail) habitat type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Shrubs				
Salix scouleriana (Scouler's willow)	3	0-3	5	4
Graminoids				
Beckmannia syzigachne (slough grass)	3	0-3	5	4
Carex atherodes (awned sedge)	7	0-10	9	8
Carex utriculata (beaked sedge)	8	0-10	14	10
Eleocharis palustris (creeping spike-rush)	6	0-20	18	10
Scirpus acutus (great bulrush)	6	0-10	9	7
Forbs				
Chenopodium pratericola (goosefoot)	20	0-20	5	10
Cicuta maculata (water-hemlock)	1	0-1	5	2
Cirsium arvense (Canada thistle)	2	0-3	9	4
Epilobium ciliatum (northern willowherb)	10	0-10	5	7
Galium trifidum (small bedstraw)	1	0-1	5	2
Lycopus asper (western water-horehound)	1	0-1	5	2
Mentha arvensis (wild mint)	3	0-3	5	4
Polygonum lapathifolium (pale persicaria)	7	0-10	9	8
Rumex maritimus (golden dock)	3	0-3	5	4
Senecio conterminus (Arctic butterweed)	1	0-1	5	2
Sparganium spp. (sparganium)	3	0-3	5	4
Typha latifolia (common cattail)	95	70-98	100	97
Urtica dioica (common nettle)	1	0-1	5	2
Ferns and Allies				
Equisetum fluviatile (swamp horsetail)	3	0-3	5	4

[1] Prominence Index is the square root of the product of average canopy cover and constancy (frequency) values.

SUCCESSIONAL INFORMATION

Typha latifolia (common cattail) is an early colonizer of suitable habitats and can persist under suitably wet conditions. 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 not subject to most forms of disturbance. However, if the site does dry out, high livestock use can converts these stands to the *Hordeum jubatum* (foxtail barley) community type or some other slightly drier disturbance-related species. Disturbance can dramatically increase the number of forb species present. Figure 87 shows a schematic diagram of expected successional vegetation pathways on sites of this type.



Successional Pathway of *Typha latifolia* (common cattail) Sites in North Central Alberta
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 87. Successional pathway for sites of the *Typha latifolia* (common cattail) habitat type

Note: The *Typha latifolia* (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 88 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).

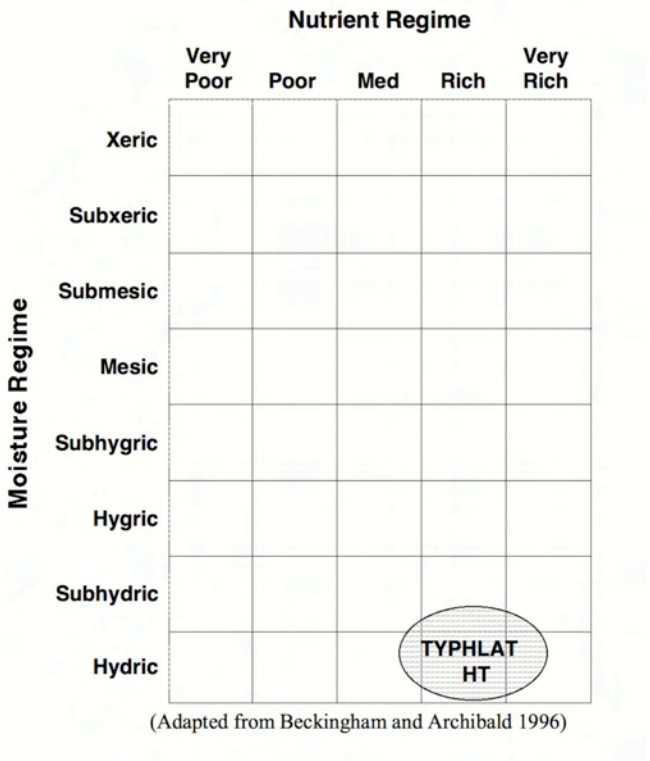


Figure 88. Edatope grid position for the *Typha latifolia* (common cattail) habitat type (TYPHLAT HT)

SOILS

Soils are commonly Gleysols, often characterized by accumulations of organic matter overlying deposits of fine silt and clay. Mineral soil textures on sampled stands ranged from sandy loam to clay. These types are commonly inundated with 30-100 cm of water throughout the year. Redoximorphic features (mottling or gleying) in mineral horizons are common. Soil reactions are within a narrow range of moderately acidic to very slightly basic (pH 5.5 to 7.5) (USDA Natural Resources Conservation Service 2000).

ADJACENT COMMUNITIES

Scirpus acutus (great bulrush) is a common dominant of sites with similar water regimes, although *Scirpus acutus* (great bulrush) appears to tolerate more brackish conditions than does *Typha latifolia* (common cattail). The *Carex atherodes* (awned sedge) habitat type frequently occupies adjacent drier sites, although there are lakeshore sites with the *Typha latifolia* (common cattail) habitat type adjacent to the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type on a steep bank.

MANAGEMENT INFORMATION

Livestock

Typha latifolia (common cattail) is normally little used by livestock. However, if the site dries sufficiently, or upland forage is limited, livestock may utilize this type. In such cases, a wide variety of disturbance induced herbaceous species can be induced. Generally, though, the *Typha latifolia* (common cattail) rootstocks remain to restore the original stand when water levels rise.

Wildlife

Typha latifolia (common cattail) is an important source of shade, hiding cover, and food for wildlife. This species is a highly preferred food of muskrats (Allen and Hoffman 1984). It is also used by muskrats for construction of huts. Waterfowl use this type for nesting and hiding cover if the stands are not too dense, although dense stands will hinder waterfowl uses. Deer also use this type for forage and hiding cover. The type is a critical source of nesting and roosting cover for yellow-headed and redwinged blackbirds (Hansen and others 1995).

Fire

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.

Soil Management and Rehabilitation Opportunities

Standing water and continually wet conditions restrict most development on these sites.

RELATIONSHIP TO THE ECOSITE CLASSIFICATION SYSTEM

The *Typha latifolia* (common cattail) habitat type occurs on sites described as the *Typha* (cattail) marsh community type within the marsh ecosite (l) of the Dry Mixedwood Natural Subregion, having a hydric/rich moisture/nutrient regime (Beckingham and Archibald 1996). This type occurs in similar habitats throughout Alberta.

OTHER STUDIES

The *Typha latifolia* (common cattail) habitat type is described by Thompson and Hansen (2002) in the Grassland Natural Region of southern Alberta, by Thompson and Hansen (2001) in the Prairie Ecozone of southern Saskatchewan, and by Hansen and others (1995) for Montana. Beckingham and Archibald (1996) and Beckingham, Nielsen, and Futoransky (1996) describe a *Typha* (cattail) community type of the marsh ecosite in northern Alberta and the Mid-Boreal ecoregions of Saskatchewan.

OTHER POTENTIAL TYPES

Occasionally we would find stands of vegetation that did not fit any of the types described in the text. Most of these represent occurrences of a type that is rare within the study area, but that may be more common in adjacent regions. Some of these "possible" types were not actually sampled in the study area, but that were observed. We feel that a minimum of three stands of a community must have been observed within the study area before being considered as a type for description and inclusion in the key. An example is the *Eleocharis palustris* (common spike sedge) habitat type, of which two stands were sampled, but no more were observed.

The following is a list of species that were observed in dominance on sites, or even sampled on rare occasion, in the Parkland Natural Region and the Dry Mixedwood Subregion of Alberta. However, sites dominated by these species were not observed in more than rare abundance.

Symphoricarpos occidentalis (buckbrush)—Described as the *Symphoricarpos occidentalis* (buckbrush) community type for Alberta's Prairie Biome (Thompson and Hansen 2002) and for the Prairie Ecozone of Saskatchewan (Thompson and Hansen 2001).

Bromus inermis (awnless brome)—Described as the *Bromus inermis* (awnless brome) community type for Alberta's Prairie Biome (Thompson and Hansen 2002) and for the Prairie Ecozone of Saskatchewan (Thompson and Hansen 2001).

Deschampsia cespitosa (tufted hair grass)—Described as the *Deschampsia cespitosa* (tufted hair grass) habitat type for Alberta's Prairie Biome (Thompson and Hansen 2002) and for the Prairie Ecozone of Saskatchewan (Thompson and Hansen 2001).

Eleocharis palustris (creeping spike-rush)—Described as the *Eleocharis palustris* (creeping spike-rush) habitat type for Alberta's Prairie Biome (Thompson and Hansen 2002) and for the Prairie Ecozone of Saskatchewan (Thompson and Hansen 2001).

Juncus balticus (wire rush)—Described as the *Juncus balticus* (wire rush) community type for Alberta's Prairie Biome (Thompson and Hansen 2002) and for the Prairie Ecozone of Saskatchewan (Thompson and Hansen 2001).

Prunus virginiana (choke cherry)—Described as the *Prunus virginiana* (choke cherry) community type for Alberta's Prairie Biome (Thompson and Hansen 2002) and for the Prairie Ecozone of Saskatchewan (Thompson and Hansen 2001).

Salix lucida (shining willow)—Mostly observed in the Peace River country and also in some other central and northern Alberta riverine locations.

Scirpus paludosus (prairie bulrush)—Mostly in central and southern Alberta shallow lentic saline areas.

Scolochloa festucacea (spangletop)—Described as the *Scolochloa festucacea* (spangletop) habitat type for the Prairie Ecozone of Saskatchewan (Thompson and Hansen 2001).

LITERATURE CITED

Adams, B. W., A. Robertson, M. Willoughby, G. Ehlert, M. Alexander, D. Downing, D. Lawrence, C. Lane, and C. Stone. 2000. Range/pasture health assessment short form. Alberta Range Health Task Group. Alberta, Canada. 17 p.

Adams, Barry and Lorne Fitch. 1998. Caring for the green zone, riparian areas and grazing management, Second Edition. Alberta Riparian Habitat Management Project. Lethbridge, Alberta, Canada. 41 p.

Adams, Barry W., and Gerry Ehlert. 2003. Range/pasture health assessment for Alberta rangelands. Rangeland Management Branch. Public Lands Division. Alberta Sustainable Resource Development. March, 2003 Version. Alberta, Canada. 10 p.

Adams, Glen D., Garry C. Trottier, Wayne L. Strong, Ian D. MacDonald, Samuel J. Barry, Paul G. Gregoire, Gregg W. Babish, and Garry Weiss. 1997. Canadian Forces Base Suffield National Wildlife Area, wildlife inventory, vegetation component report. Canadian Wildlife Service, Environment Canada, Prairie and Northern Region, Edmonton, Alberta, Canada. 96 p.

Alberta Agriculture. 1981. Alberta forage manual. Edmonton, Alberta, Canada. 87 p.

Alderfer, R. B., and R. R. Robinson. 1949. Runoff from pastures in relation to grazing intensity and soil compaction. Journal of American Society of Agronomy 39:948-958.

Allen, A. W. 1983. Habitat suitability index models: beaver. USDI Fish and Wildlife Service, FWS/OBS-82/10.30, Fort Collins, Colorado, USA. 20 p.

Allen, A. W., and R. D. Hoffman. 1984. Habitat suitability index models: muskrat. USDI Fish and Wildlife Service, Biological Report OBS-82/10.46, Fort Collins, Colorado, USA. 27 p.

Ames, C. R. 1977. Wildlife conflicts in riparian management: grazing. *In:* Importance, preservation, and management of riparian habitat. USDA Forest Service General Technical Report RM-43. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USA. pp. 39-51.

Anderson, F. W., R. D. Ohmart, and J. Disano. 1978. Revegetating the riparian floodplain for wildlife. *In:* Strategies for protection and management of floodplain wetlands and other riparian ecosystems (R. R. Johnson and J. F. McCormick, Technical Coordinators). USDA Forest Service General Technical Report WO-12. Washington, DC, USA. pp. 318-331.

Apfelbaum, S. I., and C. E. Sams. 1987. Ecology and control of reed canary grass (*Phalaris arundinacea* L.). Natural Areas Journal 7(2):69-74.

Archibald, J. H., G. D. Klappstein, and I. G. W. Corns. 1996. Field guide to ecosites of southwestern Alberta. Natural Resources Canada, Canadian Forest Service, Northwest Region, Northern Forestry Centre, Edmonton, Alberta, Canada. Special Report 8. 522 p.

Bailey, Arthur W. 1978. Prescribed burning as an important tool for Canadian rangelands. *In:* Proceedings of the fire and range seminar. 1978 April. Regina, Saskatchewan. Saskatchewan Department of Agriculture, Lands Branch, Regina, Saskatchewan, and Department Regional Economics Expansion-PFRA, Land Use Service, Regina, Saskatchewan, Canada: 15-27.

Barkley, T. M., editor. 1986. Flora of the Great Plains. Great Plains Flora Association. University Press of Kansas, Lawrence, Kansas, USA. 1,392 p.

Beckingham, John D., 1991. Grazing in the Boreal Mixedwood Ecoregion Alberta Literature Review. Alberta Forestry Lands and Wildlife, Public Lands Division, Peace River Region. Alberta, Canada. 295 p.

Beckingham, J. D., I. G. W. Corns, and J. H. Archibald. 1996. Field guide to ecosites of west-central Alberta. Natural Resources Canada, Canadian Forest Service, Northwest Region, Northern Forestry Centre, Edmonton, Alberta, Canada. Special Report 9. 630 p.

Beckingham, J. D. and J. H. Archibald. 1996. Field guide to ecosites of northern Alberta. Natural Resources Canada, Canadian Forest Service, Northwest Region, Northern Forestry Centre, Edmonton, Alberta, Canada. Special Report 5. 508 p.

Beckingham, J. D., D. G. Nielsen, and V. A. Futoransky. 1996. Field guide to ecosites of the mid-boreal ecoregions of Saskatchewan. Natural Resources Canada, Canadian Forest Service, Northwest Region, Northern Forestry Centre, Edmonton, Alberta, Canada. Special Report 6. 517 p.

Beidleman, R. G. 1978. The cottonwood-willow riparian ecosystem as a vertebrate habitat, with particular reference to birds. *In:* Strategies for protection and management of floodplain wetlands and other riparian ecosystems (R. R. Johnson and J. F. McCormick, Technical Coordinators). USDA Forest Service General Technical Report WO-12. Washington, DC, USA. pp. 192-195.

Bernard, J. M. 1975. The life history and population dynamics of shoots of *Carex rostrata*. Journal of Ecology 64:1040-1045.

Boul, S. W., F. D. Hole, and R. J. McCracken. 1980. Soil Genesis and Classification. 2nd. edition. Iowa State University Press, Ames, Iowa, USA. 406 p.

Bradley, C. E., and D. G. Smith. 1986. Plains cottonwood recruitment and survival on a prairie meandering river floodplain, Milk River, southern Alberta and northern Montana. Canadian Journal of Botany. 64: 1433-1442.

Brayshaw, T. C. 1978. Catkin bearing plants of British Columbia. Occasional Paper Series 18. British Columbia Province Museum, Victoria, British Columbia, Canada.

Brinson, M. M., H. S. Bradshaw, R. N. Holmes, and J. B. Elkins, Jr. 1980. Litterfall, stemflow, and throughfall in an alluvial swamp forest. Ecology 61:827-835.

Brown, James K. 1984. Fire effects and application of prescribed fire in aspen *In:* Rangeland fire effects symposium. Boise, Idaho, USA. p. 38-47.

Brown, James K., Dennis G. Simmerman. 1986. Appraising fuels and flammability in western aspen: a prescribed fire guide. General Technical Report INT-205. USDA Forest Service, Intermountain Research Station, Ogden, Utah, USA. 48 p.

Bryant, F. T., R. E. Blaser, and J. R. Peterson. 1972. Effect of trampling by cattle on bluegrass yield and soil compaction of a Meadowville Loam. Agronomy Journal 64:331-334.

Bryant, Larry D. 1985. Livestock management in the riparian ecosystem. *In:* R. Roy Johnson, Charles D. Ziebell, David R. Patton, Peter F. Ffolliott, and R. H. Hamre (technical coordinators), Riparian ecosystems, and their management: reconciling conflicting uses. First North American riparian conference, April 16-18, Tucson, AZ. USDA Forest Service General Technical Report RM-120. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USA. 523 p.

Campbell, A. G., and J. F. Franklin. 1979. Riparian vegetation in Oregon's western Cascade Mountains: composition, biomass, and autumn phenology. Coniferous Forest Biome, Ecosystem Analysis Studies, US International Biological Program, Progress Bulletin Number 14. University of Washington, Seattle, Washington, USA.

Canada Soil Survey Committee, Subcommittee on Soil Classification. 1978. The Canadian system of soil classification. Canada Department of Agriculture. Publication 1646. Supply and Services Canada, Ottawa, Ontario, Canada. 164 p.

Carothers, S. W. 1977. Importance, preservation and management of riparian habitat: an overview. *In:* Importance, Preservation and Management of Riparian Habitat. USDA Forest Service General Technical Report RM-43:2-4. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USA.

Collins, T. C. 1976. Population characteristics and habitat relationships of beavers in northwest Wyoming. Ph.D. Dissertation. University of Wyoming, Laramie, Wyoming, USA. 216 p.

Cooper, Stephen V. 1981. Forest habitat types of the Blackfeet Indian Reservation. Final Report. USDA Forest Service Intermountain Forest and Range Experiment Station, Ogden, Utah, USA. 87 p.

Cooperrider, Allen Y., Raymond J. Boyd, and Hanson R. Stuart. 1986. Inventory and monitoring of wildlife habitat. USDI Bureau of Land Management, Denver Service centre, Denver Colorado, USA. 858 p.

Corns, I. G. W. 1983. Forest community types of west-central Alberta in relation to selected environmental factors. Canadian Journal of Forest Resources. 13:995-1010.

Costain, Brent. 1989. Habitat use patterns and population trends among Shiras moose in a heavily logged region of northwest Montana. M.S. Thesis. University of Montana, Missoula, Montana, USA. 265 p.

Coupland, Robert T. 1950. Ecology of mixed prairie in Canada. Ecological Monographs 20: 271-315.

Coupland, Robert T. 1961. A reconsideration of grassland classification in the northern Great Plains of North America. Journal of Ecology 49: 135-167.

Cowardin, Lewis M., Virginia Carter, Francis C. Golet, and Edward T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. FWS/OBS-79/31. Office of Biological Services, Fish and Wildlife Service, USDI, Washington, DC, USA. 103 p.

Cummins, K. W. 1974. Structure and function of stream ecosystems. Bioscience 24:631-641.

Daubenmire, R. 1970. Steppe vegetation of Washington. Technical Bulletin 62. Washington Agricultural Experiment Station, Washington State University, Pullman, Washington, USA. 131 p.

Daubenmire, R. D. 1952. Forest vegetation of northern Idaho and adjacent Washington, and its bearing on concepts of vegetation classification. Ecological Monographs 22:301-330.

Daubenmire, R. D. 1959. A canopy-coverage method of vegetation analysis. Northwest Science 33:43-66.

Daubenmire, R. D. 1976. The use of vegetation in assessing the productivity of forest lands. Botanical Review 42(2): 115-143.

Daubenmire, R. D. 1978. Plant geography with special reference to North America. Academic Press, New York, New York, USA. 338 p.

Daubenmire, R. D. 1984. Viewpoint: ecological site/range site/habitat type. Rangelands 6:263-264.

Daubenmire, R., and J. B. Daubenmire. 1968. Forest vegetation of eastern Washington and northern Idaho. Technical Bulletin 60. Washington Agricultural Experiment Station, Washington State University, Pullman, Washington, USA. 104 p.

Davis, J. W. 1982. Livestock vs. riparian habitat management-there are solutions. p. 175-184. *In:* Wildlife-Livestock Relationships Symposium: Proceedings 10. University of Idaho Forest, Wildlife, and Range Experiment Station, Moscow, Idaho, USA.

DeBenedetti, S. H., and D. J. Parsons. 1984. Postfire succession in a Sierra subalpine meadow. American Midland Naturalist 111:118-125.

Dirschl, H. J., D. L. Dabbs, and G. C. Gentle. 1974. Landscape, class, and plant succession trends in the Peace-Athabasca Delta. Canadian Wildlife Service Report Series 30. 30 p.

Dittberner, Phillip L., and Michael R. Olson. 1983. The plant information network (PIN) data base: Colorado, Montana, North Dakota, Utah, and Wyoming. USDI Fish and Wildlife Service, FWS/OBS-83/36. 786 p.

Dix, R.L., and F.E. Smeins. 1967. The prairie meadow and marsh vegetation of Nelson County North Dakota. Canadian Journal of Botany 45:21-58.

Dix, R. L., and J. M. A. Swan. 1971. The roles of disturbance and succession in upland forest at Candle Lake, Saskatchewan. Canadian Journal of Botany 49:657-676.

Downing, D. and E. Karpuk. 1992. Aspen vegetation types of the low boreal Mixedwood Ecoregion, east central Alberta (first approximation). Alberta Forestry, Lands and Wildlife Resource Information Branch. Land Information Services. Edmonton, Alberta, Canada. 79 p.

Dorn, R. D. 1984. Vascular Plants of Montana. Mountain West Publishing, Cheyenne, Wyoming, USA. 276 p.

Duff, D. A. 1979. Riparian habitat recovery on Big Creek, Rich County, Utah. p. 91. *In:* Proceedings, Forum-Grazing and Riparian/Stream Ecosystems. Trout Unlimited, Inc., Vienna, Virginia, USA.

Echenwalder, J. E. 1996. Systematics and evolution of *Populus*. *In:* Biology of *Populus* and its implications for management and conservation. Part I, Chapter 1. Edited by R. F. Stettler, H. D. Bradshaw, Jr., P. E. Heilman, and T. M. Hinckley. NRC Research Press, National Research Council of Canada, Ottawa. pp. 7-32.

Ehrhart, Robert C. and Paul L. Hansen. 1997. Effective cattle management in riparian zones: a field survey and literature review. Montana BLM Riparian Technical Bulletin No. 3. USDI Bureau of Land Management, Montana State Office. Billings, Montana, USA. 92 p.

Environment Canada. 1986. Land use change in Canada: Wetlands in Canada, a valuable resource. Fact sheet 86-4. Secretariat. Canada committee on ecological land classification. Lands Directorate. Environment Canada. Ottawa, Canada. 8 p.

Fedkenheuer, A. W. Heacock, H. M. Lewis, D. L. 1980. Early performance of native shrubs and trees planted on amended Athabasca oil sand tailings. Reclamation Review. 3: 47-55.

Ferguson, Dennis E., Penelope Morgan, and Frederic D. Johnson (compilers). 1989. Proceedings—land classifications based on vegetation: applications for resource management. [November 17-19, 1987, Moscow, ID]. USDA Forest Service General Technical Report INT-257. Intermountain Forest and Range Experiment Station, Ogden, Utah, USA. 315 p.

Fern, Ken. 1999. Plants for a future species database: a resource and information centre for edible and other useful plants. The Field, Penpol, Lostwithiel, Cornwall, PL22 0NG, England. *Internet website:* http://www.metalab.unc.edu/pfaf/cgi-bin/arr_html?Salix+petiolaris.

Fischer, William C. and Anne F. Bradley. 1987. Fire ecology of western Montana forest habitat types. USDA Forest Service General Technical Report INT-223. Intermountain Research Station, Ogden, Utah, USA. 95 p.

Fitch, L. and N. Ambrose. 2003. Riparian Areas: A user's guide to health. Lethbridge, Alberta, Canada: Cows and Fish Program. ISBN No. 0-7785-2305-5. 46 p.

Fitch, L., B. W. Adams, and G. Hale, Eds. 2001. Riparian health assessment for streams and small rivers—Field Workbook. Lethbridge, Alberta, Canada: Cows and Fish Program. 86 p.

Foth, Henry D. and John W. Schafer. 1980. Soil geography and land use. John Wiley and Sons, Inc., New York, New York, USA. 484 p.

Frisina, Michael R. 1991. Cows?!! On riparian areas?!! *In:* Proceedings of the Riparian Workshop. Laramie, WY, August 20-22, 1991. Wyoming Cooperative Fish and Wildlife Research Unit, Laramie, Wyoming, USA. 151 p.

Gordon, Nancy. D., Thomas A. McMahon, and Brian L. Finlayson. 1992. Stream hydrology: an introduction for ecologists. John Wiley and Sons, Publisher, Chichester, England. 526 p.

Government of Alberta. 1999. Alberta Natural Region Land Classification System (an expansion and update of Strong [1992]: Ecoregions of Alberta) Government of Alberta. Internet website: http://www.gov.ab.ca/env/parks/anhic/anhic.html

Gunderson, D. R. 1968. Floodplain use related to stream morphology and fish populations. Journal of Wildlife Management 32:507-514.

Haeussler, S., and D. Coates. 1986. Autecological characteristics of selected species that compete with conifers in British Columbia: a literature review. Land Management Report, ISSN0702-9861, No. 33. Information Services Branch, Ministry of Forests, Victoria, British Columbia, Canada. 180 p.

Hansen, Paul L. 1988. Conflict in the riparian zone: The effects and challenges of agricultural use. Western Wildlands 14(2):12-16.

Hansen, Paul L., Steve W. Chadde, and Robert D. Pfister. 1988. Riparian dominance types of Montana. Miscellaneous Publication No. 49, June 1988. Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, Montana, USA. 411 p.

Hansen, Paul L., Robert D. Pfister, Keith Boggs, Bradley J. Cook, John Joy, and Dan K. Hinckley. 1995. Classification and management of Montana's riparian and wetland sites. Montana Riparian and Wetland Association, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, Montana, USA. 646 p.

Hansen, Paul L. and James B. Hall. 2002. Classification and management of USDI Bureau of Land Management's riparian and wetland sites in eastern and southern Idaho. Bitterroot Restoration, Inc., Corvallis, Montana, USA. 304 p.

Hardy BBT Limited. 1989. Manual of plant species suitability for reclamation in Alberta. 2d ed. Report No. RRTAC 89-4. Alberta Land Conservation and Reclamation Council. Edmonton, Alberta, Canada. 436 p.

Hitchcock, A. S. 1951. Manual of the grasses of the United States. 2nd edition, revised by A. Chase. USDA Miscellaneous Publications. Washington, DC, USA. 200 p.

Hitchcock, C. L., A. Cronquist, M. Ownbey, and J. W. Thompson. 1969. Vascular Plants of the Pacific Northwest. Volumes 1-5. University of Washington Press, Seattle, Washington, USA.

Hubbard, J. P. 1977. Importance of riparian ecosystems: biotic considerations. *In:* Importance, Preservation and Management of Riparian Habitat. USDA Forest Service General Technical Report RM-43:14-18. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USA.

Huel, Denis. 2000. Managing Saskatchewan wetlands—a landowner's guide. Saskatchewan Wetland Conservation Corporation. Regina, Saskatchewan, Canada. 68 p.

Jeglum, J. K., A. M. Boissonneau, and V. F. Haavisto. 1974. Toward a wetland classification for Ontario. Canadian Department of the Environment, Forest Service Information Report 0-X-215. Sault St. Marie, Ontario, Canada.

Johnson, R. R., and S. W. Carothers. 1980. Riparian habitats and recreation: interrelationships and impacts in the Rocky Mountain region. Produced under agreement 53-82 FT-0-125 of the Eisenhower Consortium for Western Environmental Forestry Research, Fort Collins, Colorado, USA. 109 p.

Kantrud, Harold A., John B. Millar, and A. G. van der Valk. 1989. Vegetation of wetlands of the prairie pothole region. In: van der Valk, Arnold, ed. Northern prairie wetlands. Ames, Iowa, USA: Iowa State University Press: 132-187.

Kantrud, Harold A. 1986. Effects of vegetation manipulation on breeding waterfowl in prairie wetlands—a literature review. USDI Fish and Wildlife Service, Fish and Wildlife Technical Report 3. Washington DC, USA. 15 p.

Karr, J. R., and I. J. Schlosser. 1978. Water resources and the land-water interface. Science 201:229-234.

Kauffman, J. Boone, and W. C. Krueger. 1984. Livestock impacts on riparian ecosystems and streamside management implications: a review. Journal of Range Management 37(5):430-438.

Kennedy, C. E. 1977. Wildlife conflicts in Riparian Management: Water. *In:* Importance, Preservation and Management of Riparian Habitat. USDA Forest Service General Technical Report RM-43. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USA. pp. 52-58.

Kent, Donald M. 1994. Applied wetlands science and technology. Donald M. Kent, editor. CRC Press, Inc., Lewis Publishers, Boca Raton, Florida, USA. 436 p.

Kimmins, J. P. 1987. Forest ecology. Macmillan Publishing Company. New York, New York, USA. 531 p.

Kinch, Gene. 1987. Draft technical reference on grazing management in riparian areas. USDI Bureau of Land Management, Denver, Colorado, USA. 47 p.

Knopf, F. L., and R. W. Cannon. 1982. Structural resilience of a willow riparian community to changes in grazing practices. *In:* Wildlife-Livestock Relationships Symposium: Proceedings 10. University of Idaho Forest, Wildlife, and Range Experiment Station, Moscow, Idaho, USA. pp. 198-209.

Knopf, Fritz L. 1991. Institutional challenges. *In:* Proceedings of the Riparian Workshop. Laramie, WY, August 20-22, 1991. Wyoming Cooperative Fish and Wildlife Research Unit, Laramie, Wyoming, USA. 151 p.

Kovalchik, Bernard L. 1987. Riparian zone associations: Deschutes, Ochoco, Fremont, and Winema National Forests. USDA Forest Service Region 6 Ecology Technical Paper 279-87. Pacific Northwest Region, Portland, Oregon, USA. 171 p.

Kufeld, R. C. 1973. Foods eaten by the Rocky Mountain elk. Journal of Range Management 26(2):106-113.

Lane, Cam T., Michael G. Willoughby, and Michael J. Alexander. 2000. Range plant community types and carrying capacity for the Lower Foothills Subregion of Alberta, 3rd approximation. Publication No. T532. Two Volumes. Alberta Environment Land and Forest Service and Alberta Agriculture, Food, and Rural Development Public Lands Division. Edmonton, Alberta, Canada. 300+ p.

Lawrence, Donna L., and J. T. Romo. 1994. Tree and shrub communities of wooded draws near the Matador Research Station in southern Saskatchewan. The Canadian Field-Naturalist, Vol. 108. pp 397-412.

Lawrence, Donna L. 2002. (Personal communication). Public Land Division. Alberta Agriculture, Food and Rural Development. Barrhead, Alberta, Canada.

Lodge, R. W. 1969. Agricultural use of wetlands. *In:* Saskatoon Wetlands Seminar. Canadian Wildlife Service Report Series—Number 6. Ottawa, Ontario, Canada. pp. 11-15.

Lowrance, Richard, Ralph Leonard, and Joseph Sheridan. 1985. Managing riparian ecosystems to control nonpoint pollution. Journal of Soil and Water Conservation 40:87-91.

Mackey, Dennis L., Shari K. Gregory and William C. Matthews, Jr. 1987. Impacts of water levels on breeding Canada geese and Methods for Mitigation and Management in the southern Flathead Valley, Montana. Bonneville Power Administration, Portland, Oregon, USA. 162 p.

Marchant, C. and J. Sherlock. 1984. A guide to selection and propagation of some native woody species for land rehabilitation in British Columbia. British Columbia Ministry of Forestry, Research Report RR84007-HQ, Victoria, British Columbia, Canada.

Marcuson, P. E. 1977. The effect of cattle grazing on brown trout in Rock Creek, Montana. Montana Department of Fish and Game, Special Report, Project Number F-20-R-21-11a., 23 p., Helena, Montana, USA.

Marlow, C. B. 1984. Controlling riparian zone damage with little forage loss. Montana AgResearch 2(3):1-7. Montana State University, Bozeman, Montana, USA.

Marlow, C. B., and T. M. Pogacnik. 1986. Cattle feeding and resting patterns in a foothill riparian zone. Journal of Range Management 39(3):212-217.

Marlow, Clayton, B., and Thomas M. Pogacnik. 1985. Time of grazing and cattle-induced damage to streambanks. *In:* Riparian ecosystems, and their management: reconciling conflicting uses. R. Roy Johnson, Charles D. Ziebell, David R. Patton, Peter F. Ffolliott, and R. H. Hamre (technical coordinators). [First North American riparian conference, April 16-18, Tucson, AZ.] USDA Forest Service General Technical Report RM-120. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USA. 523 p.

Marlow, Clayton B. 1995. (Personal communication). Bozeman, Montana, USA: Montana State University.

Martin, A. C., H. S. Zim, and A. L. Nelson. 1951. American wildlife and plants. McGraw-Hill, New York, New York, USA.

Meehan, W. R., F. J. Swanson, and J. R. Sedell. 1977. Influences of riparian on aquatic ecosystem with particular reference to salmonid fishes and their food supply. *In:* Importance, Preservation and Management of Riparian Habitat. USDA

Forest Service General Technical Report RM-43:137-143. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USA.

Millar, J. B. 1976. Wetland classification in western Canada: a guide to marshes and shallow open water wetlands in the grasslands and parklands of the Prairie Provinces. Canadian Wildlife Service Report Series Number 37, Ottawa, Ontario, Canada. 38 p.

Mitsch, William J., and James G. Gosselink. 1993. Wetlands. Second Edition. Van Nostrand Reinhold Publishers, New York, New York, USA. 722 p.

Mosconi, S. L., and R. L. Hutto. 1982. The effects of grazing on land birds of a western Montana riparian habitat. *In:* Wildlife-Livestock Relationships Symposium: Proceedings 10. University of Idaho Forest, Wildlife, and Range Experiment Station, Moscow, Idaho, USA. pp. 221-233.

Moss, E. H. 1932. The vegetation of Alberta, IV, The poplar association and related vegetation of central Alberta. Journal of Ecology 20: 380-415.

Moss, E. H. 1955. The vegetation of Alberta. The Botanical Review. 21:493-567.

Moss, E. H. 1983 (as revised by John G. Packer). Flora of Alberta. Second edition. University of Toronto Press. Toronto, Ontario, Canada. 687 p.

Mueggler, Walter F. 1985. Vegetation associations. *In:* Aspen: Ecology and Management in the Western United States (Norbert V. DeByle and Robert P. Winkor, editors). USDA Forest Service General Technical Report RM-119. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USA. 283 p.

Mueggler, Walter F. 1988. Aspen community types of the Intermountain region. USDA Forest Service General Technical Report INT-250. Intermountain Research Station, Ogden, Utah, USA. 135 p.

Mueggler, Walter F., and Robert B. Campbell, Jr. 1982. Aspen community types on the Caribou and Targhee National Forests in southeastern Idaho. USDA Forest Service Research Paper INT-294. Intermountain Forest and Range Experiment Station, Ogden, Utah, USA. 32 p.

Mueller-Dombois, D., and H. Ellenberg. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, New York, New York, USA. 547 p.

Myers, Lewis H. 1989. Grazing and riparian management in southwestern Montana. *In:* Practical Approaches To Riparian Resource Management: An Educational Workshop. Gresswell, Robert E., Bruce A. Barton, and Jeffery L. Kershner, editors. [Billings, Montana, May 8-11, 1989] p. 117-120. BLM-MT-PT-89-001-4351. Superintendent of Documents, US Government Printing Office, Washington, DC, USA. 193 p.

Newsome, R. D. and R. L. Dix. 1968. The forests of the Cypress Hills, Alberta and Saskatchewan, Canada. The American Midland Naturalist. Vol. 80(1):118-185.

Ogilvie, R. T. 1962. Ecology of spruce forests on the east slope of the Rocky Mountains in Alberta. Ph. D. Dissertation. Washington State University, Pullman, Washington, USA. 189 p.

O'Leary, Dennis. and David Downing. 1986. Integrated resource inventory of the Grande Prairie County west study area, Vol. II Vegetation Classification. Alberta Forestry, Lands and Wildlife. Edmonton, Alberta, Canada. 148 p.

Patton, D. R. 1977. Riparian research needs. *In:* Importance, Preservation and Management of Riparian Habitat. USDA Forest Service General Technical Report RM-43:80-82. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USA.

Pelton, John. 1953. Studies of the life-history of *Symphoricarpos occidentalis* Hook. in Minnesota. Ecological Monographs 23:17-39.

Pfister, Robert D. 1989. Ecological site classification in northern Rocky Mountain forests: putting theory to practice. *In:* Forestry on the Frontier. Proceedings, 1989 National Convention, Society of American Foresters, Washington, DC, USA. 444 p.

Pfister, Robert D., and Stephen F. Arno. 1980. Classifying forest habitat types based on potential climax vegetation. Forest Science 26(1):52-70.

Pfister, Robert D., Bernard L. Kovalchik, Stephen F. Arno, and Richard C. Presby. 1977. Forest habitat types of Montana. USDA Forest Service General Technical Report INT-34. Intermountain Forest and Range Experiment Station, Ogden, Utah, USA. 175 p.

Pickford, G. D., and E. H. Reid. 1943. Competition of elk and domestic livestock for summer range forage. Journal of Wildlife Management 7(3):328-332.

Plants for a Future. 2000. Internet website URL: http://www.scs.leeds.ac.uk/pfaf/index.html

Platts, W. S. 1979. Livestock grazing and riparian/stream ecosystems. p. 39-45. *In:* Proceedings, Forum-Grazing and Riparian/Stream Ecosystems. Trout Unlimited, Inc., Vienna, Virginia, USA.

Platts, W. S. 1981. Effects of sheep grazing on a riparian-stream environment. USDA Forest Service Research Note INT-307. Intermountain Forest and Range Experiment Station, Ogden, Utah, USA. 6 p.

Platts, W. S., C. Armour, G. D. Booth, M. Bryant, J. L. Bufford, P. Cuplin, S. Jensen, G. W. Lienkaemper, G. W. Minshall, S. B. Monsen, R. L. Nelson, J. R. Sedell, and J. S. Tuhy. 1987. Methods for evaluating riparian habitats with applications to management. USDA Forest Service General Technical Report INT-221. Intermountain Research Station, Ogden, Utah, USA. 187 p.

Pond, F. W. 1961. Effect of three intensities of clipping on the density and production of meadow vegetation. Journal of Range Management 14:34-38.

Quintilo, D., Alexander, M. E., Ponto, R. L. 1991. Spring fires in a semimature trembling aspen stand in central Alberta. Information Report NOR-X-323. Edmonton, Alberta, Canada: Forestry Canada, Northwest Region, Northern Forestry Centre. 30 p.

Raup, Hugh M. 1946. Phytogeographic studies in the Athabasca-Great Slave Lake region, II. Journal of the Arnold Arboretum 27:1-85.

Rauzi, F., and C. L. Hanson. 1966. Water intake and runoff as affected by intensity and grazing. Journal of Range Management 19:351-356.

Schlosser, I. J., and J. R. Karr. 1981. Riparian vegetation and channel morphology impact on spatial patterns of water quality in agricultural watersheds. Environmental Management 5:233-243.

Schumm, S. A., and David F. Meyer. 1979. Morphology of alluvial rivers of the Great Plains. *In:* Riparian and Wetland Habitats of the Great Plains. Proceedings of the 31st Annual Meeting, Great Plains Agricultural Council. Publication Number 91. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USA pp. 9-15.

Severson, K. E., and C. E. Boldt. 1978. Cattle, wildlife, and riparian habitats in the western Dakotas. *In:* Management and Use of Northern Plains Rangeland. Regional Rangelands Symposium, Dickinson, North Dakota, USA. pp. 94-103.

Shaw, S. P., and C. G. Fredine. 1956. Wetlands of the United States: Their extent and their value for waterfowl and other wildlife. USDI Fish and Wildlife Service, Circular 39. Washington, DC, USA. 67 p.

Shay, J. M., and C. T. Shay. 1986. Prairie marshes in western Canada, with specific reference to the ecology of five emergent macrophytes. Canadian Journal of Botany 64:443-454.

Sims, R. A., D. W. Cowell and G. M. Wickware. 1982. Classification of fens near southern James Bay, Ontario, using vegetation physiognomy. Canadian Journal of Botany 60:2608-2623.

Singer, F. J. 1975. Wildlife and ungulates in the Glacier National Park Area, northwestern Montana. M.S. thesis. University of Idaho, Moscow, Idaho, USA. 53 p.

Smith, L. M., and J. A. Kadlec. 1983. Seed banks and their role during drawdown of a North American marsh. Journal of Applied Ecology 20:673-684.

Snow, C. 1973. Habitat management series for endangered species: report number 5, bald eagle. USDI Bureau of Land Management, TN-171. 58 p.

Society for Range Management. 1989. A glossary of terms used in range management. Third edition. Glossary Revision Special Committee, Publications Committee, Peter W. Jocoby, Chairman. Society for Range Management, Denver, Colorado, USA. 20 p.

Soil Classification Working Group. 1998. The Canadian System of Soil Classification. Research Branch, Agriculture and Agri-Food Canada. Publication 1646, 3rd edition. NRC Research Press, Ottawa, Ontario, Canada. 187 p.

Stettler, R. F., L. Zsuffa, and R. Wu. 1996. The role of hybridization in the genetic manipulation of *Populus* and its implications for management and conservation. Part 1, Chapter 4. Edited by R. F. Stettler, H. D. Bradshaw, Jr., P. E. Heilman, and T. M. Hinckley. NRC Research Press, National Research Council of Canada, Ottawa, Ontario, Canada. pp. 87-112.

Stevens, D. R. 1966. Range relationships of elk and livestock, Crow Creek Drainage, Montana. Journal of Wildlife Management 30(2):349-363.

Stewart, R. E., and H. A. Kantrud. 1972. Classification of natural ponds and lakes in the glaciated prairie region. USDI Fish and Wildlife Service, Research Publication 92. Jamestown, North Dakota, USA. 57 p.

Stone, C., and D. Lawrence. 2000. Northern range plants. Alberta Agriculture, Food and Rural Development. 206 p.

Strong, W. L. 1992. Ecoregions and ecodistricts of Alberta. Volume I. Alberta Forestry, Lands and Wildlife. Edmonton, Alberta, Canada. 77 p.

Tannas, Kathy. 1997a. Common plants of western rangelands. Volume I: grasses, grass-like species, trees and shrubs. Lethbridge Community College. Lethbridge, Alberta, Canada. 312 p.

Tannas, Kathy. 1997b. Common plants of western rangelands. Volume II: forbs. Lethbridge Community College. Lethbridge, Alberta, Canada. 310 p.

Tansley, A. G. 1935. The use and abuse of vegetational concepts and terms. Ecology 16: 284-307.

Tarnocai, C. 1979. Canadian Wetland Registry. *In:* Proceedings of a Workshop on Canadian Wetlands Environment. D. D. A. Rubec and F. C. Pollett (eds.). Canada Land Directorate, Ecological Land Classification Series, No. 12. pp. 9-38.

Thomas, J. W., C. Maser, and J. E. Rodiek. 1979. Wildlife habitat in managed rangelands—the Great Basin of southeastern Oregon. Riparian zones. USDA Forest Service General Technical Report PNW-80. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon, USA. 18 p.

Thompson, William H. and Paul L. Hansen. 2002. Classification and management of riparian and wetland sites of the Alberta Grassland Natural Region and adjacent subregions. Bitterroot Restoration, Inc. Prepared for the Alberta Riparian Habitat Management Program-Cows and Fish, Lethbridge, Alberta, Canada. 416 p.

Thompson, William H. and Paul L. Hansen. 2001. Classification and management of riparian and wetland sites of the Saskatchewan prairie ecozone and parts of adjacent subregions. Saskatchewan Wetland Conservation Corporation. Regina, Saskatchewan, Canada. 298 p.

Thorpe, Jeff. 1996. Range assessment techniques for forested land in Saskatchewan, a report for the Agricultural Development Fund. Saskatchewan Research Council, Resources and Environment Group. Publication R-1540-3-E-96. 46 p.

Tiedeman, James A., Richard E. Francis, Charles Terwilliger, Jr., and Len H. Carpenter. 1987. Shrub-steppe habitat types of Middle Park, Colorado. USDA Forest Service Research Paper RM-273. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USA. 20 p.

Timoney, Kevin P., George Peterson, and Ross Wein. 1997. Vegetation development of boreal riparian plant communities after flooding, fire, and logging, Peace River, Canada. Forest Ecology and Management. Elsevier Science B.V. Amsterdam. 93:101-120.

Tuhy, Joel S., and Sherman Jensen. 1982. Riparian classification for the Upper Salmon/Middle Fork Salmon Rivers, Idaho. USDA Forest Service Final Report, Region IV Contract, White Horse Associates, Smithfield, Utah, USA. 200 p.

USDA Forest Service. 1937. Range plant handbook. United States Government Printing Office, Washington, DC, USA.

USDA Forest Service Intermountain Research Station's Fire Sciences Laboratory (IFSL). 1995, modified 1998. Fire Effects Information System (FEIS). Missoula, Montana. Internet website: http://www.fs.fed.us/database/feis/

USDA Natural Resources Conservation Service (NRCS). 2001. The PLANTS Database, Version 3.1 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, Louisiana, USA 70874-4490 USA.

USDA Natural Resources Conservation Service (NRCS). 2002. Ecological Site Description Internet database. Internet website: http://ironwood.itc.nrcs.usda.gov/scripts/ndISAPI.dll/ESD/pgWelcome

US Army Corps of Engineers. 1992. Wetlands of the West: An endangered resource. US Army Corps of Engineers—Omaha District, Omaha, Nebraska, USA. 4 p.

Utzig, G., D. Mcdonald, G. G. Still, M. Ketcheson, T. Braumand, and A. Warner. 1983. Ecological classification for the Nelson Forest Region (third approximation). Province of British Columbia, Ministry of Forests, Victoria, British Columbia, Canada. 79 p.

Valastin, Pat, R. 2000. Caring for shoreline properties—Changing the way we look at owning lakefront property in Alberta. Alberta Conservation Association. Edmonton, Alberta, Canada. 29 p.

Van der Valk, A. G., and C. B. Davis. 1978. The role of seed banks in the vegetation dynamics of prairie glacial marshes. Ecology 59:322-335.

Van Velson, R. 1979. Effects of livestock grazing upon rainbow trout in Otter Creek. *In:* Proceedings, Forum-Grazing and Riparian/Stream Ecosystems. Trout Unlimited, Inc., Vienna, Virginia, USA. pp. 53-56.

Volland, L. A. 1978. Trends in standing crop and species composition of a rested Kentucky bluegrass meadow over an 11-year period. *In:* Proceedings of the First International Rangeland Congress. D. N. Hyder editor. Denver, Colorado, USA. pp. 525-529.

Walker J. M., and E. R. Waygood. 1968. Ecology of *Phragmites communis.* I: Photosynthesis of a single shoot in-situ. Canadian Journal of Botany 46:549-555.

Walker, B. H., and R. T. Coupland. 1968. An analysis of vegetation-environment relationships in Saskatchewan sloughs. Canadian Journal of Botany 46:509-522.

Ward, E. 1942. Phragmites management. Trans. North American Wildlands Conference 7: 294-298.

Wasser, Clinton H. 1982. Ecology and culture of selected species useful in revegetating disturbed lands in the West. USDI Fish and Wildlife Service FWS/OBS-82/56. 347 p.

Watson, L. E., R. W. Parker, and D. F. Polster. 1980. Manual of plant species suitability for reclamation in Alberta. Volume 2. Forbs, shrubs and trees. Land Conservation and Reclamation Council. Edmonton, Alberta, Canada 537 p.

Weller, M. W., and C. S. Spatcher. 1965. Role of habitat in the distribution and abundance of marsh birds. Iowa State University Agriculture and Home Economics Experiment Station Special Report 43. Ames, Iowa, USA. 31 p.

White, R. S. and P. O. Currie. 1982. Prescribed burning in northern mixed grass plant communities. *In:* Society for Range Management abstracts, 35th annual meeting. Calgary, Alberta, Canada. p. 36.

Willoughby, Michael G, and Rangeland Health Assessment Project, and Forest Rangeland Action Plan. 2000. Guide to range plant community types and carrying capacity for the Dry and Central Mixedwood Subregions in Alberta. Two Volumes.

Publication No. T526. Alberta Environment Land and Forest Service and Alberta Agriculture, Food, and Rural Development Public Lands Division. Edmonton, Alberta, Canada. 300+ p.

Wilson, H. C. 1969. Ecology and successional patterns of wet meadows, Rocky Mountain National Park, Colorado. Ph.D. Dissertation. University of Utah, Salt Lake City, Utah, USA. 99 p.

Youngblood, Andrew P., Wayne G. Padgett, and Alma H. Winward. 1985a. Riparian community type classification of northern Utah and adjacent Idaho. Preliminary Draft, USDA Forest Service Intermountain Research Station, Ogden, Utah, USA. 104 p.

Youngblood, Andrew P., Wayne G. Padgett, and Alma H. Winward. 1985b. Riparian community type classification of eastern Idaho—western Wyoming. USDA Forest Service Region 4 Ecology 85-01. Intermountain Research Station, Ogden, Utah, USA. 78 p.

APPENDIX. PHOTOGRAPHS OF SELECTED HABITAT TYPES AND COMMUNITY TYPES

This stand of the ***Picea glauca/Equisetum arvense*** **(white spruce/common horsetail) habitat type**, near Barrhead is at late seral stage, with large spruce trees, a sparse shrub understory, and nearly closed canopy. This type occurs on poorly drained, low-lying sites throughout the Dry Mixedwood Subregion.

This is an outside view of a ***Picea glauca/Viburnum edule*** **(white spruce/low-bush cranberry) habitat type** stand in mid-to-late seral stage, showing large old poplars with younger spruce coming in. This stand is located near Rocky Mountain House.

A stand of the ***Picea glauca/Viburnum edule*** **(white spruce/low-bush cranberry) habitat type** near Boyle at mid-to-late seral stage with few poplar trees remaining in the stand.

A stand of the ***Picea glauca/Viburnum edule*** **(white spruce/low-bush cranberry) habitat type** near Barrhead showing the result of long term grazing disturbed. Note the open aspect, large amount of low forb ground cover, and lack of shrubs.

A stand of ***Betula papyrifera*** **(white birch) community type** on the bank of the Athabasca River near Fort Assiniboine that serves as a livestock loafing shed. Note the beaver-cut poplar stump is in the foreground.

A large stand of ***Betula papyrifera*** **(white birch) community type** near Fort Saskatchewan that was killed by fire, and now is showing vigorous resprouting from the root crowns.

A vigorous, young-mature stand of the ***Populus balsamifera/Cornus stolonifera*** **(balsam poplar/red-osier dogwood) community type** located on the Peace River floodplain near Dunvegan. Note the dense understory of *Cornus stolonifera* (red-osier dogwood).

An older-mature stand of the ***Populus balsamifera/Cornus stolonifera*** **(balsam poplar/red-osier dogwood) community type** near North Buck Lake west of Caslan showing a typical view of undisturbed understory with lots of tall shrubs and little herbaceous vegetation.

An example of the ***Populus balsamifera*** **(balsam poplar) community type** near the Athabasca River west of Barrhead that resulted from grazing disturbance. Note the general lack of understory vegetation and the "umbrelled" or "highlined" tall shrub growth form.

A relatively undisturbed, young-mature stand of the ***Populus tremuloides/Cornus stolonifera*** **(aspen/red-osier dogwood) habitat type** along the Red Deer River near Big Valley. Note the density of the understory shrub layer.

This is a relatively undisturbed, mid seral stand of the ***Populus tremuloides/Viburnum edule*** **(aspen/low-bush cranberry) community type** near Tulliby Lake. Note the effects of moose utilization of shrubs.

A mid seral stand of the ***Populus tremuloides/Viburnum edule*** **(aspen/low-bush cranberry) community type** near Rocky Mountain House that has been opened by livestock grazing. Note the lack of tall shrub cover and the abundance of short forbs in the understory.

A stand of the grazing disturbance-caused ***Populus tremuloides*** **(aspen) community type** near Cold Lake. Note the lack of shrubs in the understory and the predominance of the exotic invader grass *Bromus inermis* (awnless brome).

A stand of the ***Populus tremuloides*** **(aspen) community type** near Wabamun comprised of saplings re-sprouted from the root crowns of fire-killed trees. Growth form is altered by heavy wildlife browse use, causing a "clubbed" or "flat-topped" appearance.

Overview of an extensive stand of the ***Salix bebbiana/Carex atherodes*** **(beaked willow/awned sedge) habitat type** near Thunder Lake west of Barrhead showing the low lying landscape position and dense willow stand typical of this type.

Interior of a moderately disturbed ***Salix bebbiana/Cornus stolonifera*** **(beaked willow/red-osier dogwood) habitat type** stand near Grande Prairie. The understory includes several exotic herbs: *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (timothy), and *Taraxacum officinale* (dandelion).

A stand of the grazing disturbance-caused ***Salix bebbiana*** **(beaked willow) community type** that has had the understory altered to predominantly exotic herbs. Note the open aspect of the understory and the umbrella-shaped growth form of the willows.

A typical young stand of the early seral ***Salix exigua*** **(sandbar willow) community type** on a newly deposited bar along the Smoky River at Highway 43. These stands are often soon overtopped by trees, such as *Populus balsamifera* (balsam poplar), or taller shrubs, such as *Alnus tenuifolia* (river alder).

This young stand of ***Salix lutea/Cornus stolonifera*** **(yellow willow/red-osier dogwood) habitat type** is on the Little Red Deer River near Innisfail in a typical streamside setting. The sapling age shrubs in this stand are about a two-to-one mix of *Salix lutea* (yellow willow) and *Cornus stolonifera* (red-osier dogwood).

This stand of the ***Salix pedicellaris/Potentilla palustris*** **(bog willow/marsh cinquefoil) habitat type** is located near Gunn. It shows the low-statured *Salix pedicellaris* (bog willow) growing on a floating mat over a subsurface water body lying within a few decimetres of the surface.

This relatively undisturbed stand of the ***Salix petiolaris/Carex atherodes*** **(basket willow/awned sedge) habitat type** located near Brenton is a mosaic of willow clumps with sedges filling in between, but the type may be a very dense stand of willows with sparse herbaceous understory.

An understory view in a stand of the ***Salix petiolaris/Carex atherodes*** **(basket willow/awned sedge) habitat type** showing the many-stem habit of the *Salix petiolaris* (basket willow) clumps and the dense sedge cover supported on these very moist low-lying sites.

This stand of the ***Salix petiolaris/Cornus stolonifera*** **(basket willow/red-osier dogwood) habitat type** is located near Stettler. The type typically occurs in a band surrounding a lower depressional wetland, as shown in this view, where the central area can become a herbaceous meadow during periods of drought.

This stand of the ***Salix planifolia/Carex aquatilis*** **(flat-leaved willow/water sedge) habitat type** near Manning shows the mosaic pattern of mature willow clumps within a sedge matrix on a low-lying, very moist site.

This young stand of the ***Salix planifolia/Carex aquatilis*** **(flat-leaved willow/water sedge) habitat type,** located near Tomahawk, shows some browse utilization by moose.

This stand of the ***Salix planifolia/Calamagrostis canadensis*** **(flat-leaved willow/bluejoint) habitat type** is near the Beaver River northwest of Bonnyville. Sites of this type are slightly drier than those of the *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type.

This stand of the ***Salix planifolia/Cornus stolonifera*** **(flat-leaved willow/red-osier dogwood) habitat type** is near Lac Ste Anne. It shows the dense canopy of tall shrubs typical on these rich, moist sites.

This stand of the ***Salix scouleriana* (Scouler's willow) community type** is on Wabamun Lake west of Edmonton. *Salix scouleriana* (Scouler's willow) reaches small tree stature in the rich, moist sites along shallow boreal lakeshores. The understory is a diverse mix of wet-site, shade tolerant herbs.

This stand of the ***Alnus tenuifolia* (river alder) community type** is on the Vermilion River near Marwayne. This type (as indicated in its name) occurs typically along riverbanks, but is considered seral to tree types and some of the taller willow types. Note the series of beaver dams.

This stand of the ***Cornus stolonifera*** **(red-osier dogwood) community type** is on Thunder Lake near Barrhead. This community type is early seral, and usually results from some disturbance that removes a tree or willow shrub canopy—in this case by beaver.

This stand of the ***Elaeagnus commutata*** **(silverberry) community type** is on bank of the Hotchkiss River near Manning. Several indicators of severe site disturbance are shown: lack of preferred shrub species, exotic invader herb cover (of low productivity), and eroding bank.

This stand of the ***Rosa acicularis*** **(prickly rose) community type** is on the Smoky River floodplain near Watino. It resulted from a disturbance to the site, and shows the stand density that this aggressive species can reach in open sunlight. However, this stand has willow seedlings already beginning to show through.

This stand of the ***Carex aquatilis*** **(water sedge) habitat type** near Spirit River traces the band of suitable hydrologic conditions along a lakeshore lying between the cattails and the willows above.

This stand of the ***Carex aquatilis* (water sedge) habitat type** near Cold Lake shows the very wet site conditions represented by the type. It is an example of the nearly monospecific stands produced by the dense sod formed by *Carex aquatilis* (water sedge) that inhibits establishment of invading plants.

This stand of the ***Carex atherodes* (awned sedge) habitat type** near Boyle shows the very dense, monospecific growth habit of this species that effectively excludes nearly all other plants form its hydrologic zone between deep, open water and the zone of trees and shrubs.

This stand of the ***Carex diandra*** **(two-stamened sedge) habitat type** near Tulliby Lake occupies a linear zone of suitable hydrologic conditions along the shore of a slightly saline lake between the recently drought-exposed lake bottom and the higher zone of woody vegetation marking a historic shore elevation.

This stand of the ***Carex utriculata*** **(beaked sedge) habitat type** near Buck Lake shows the monospecific, dense stand of beaked sedge that can form in the middle of small lakes as they dry, and fill in. This species can tolerate drought conditions, as well as extended flooding to two or three decimetres depth.

A large, typically dense and monospecific, stand of the ***Calamagrostis canadensis*** **(bluejoint) habitat type** near Kinuso. This very productive site may have been used to produce hay crops some years.

A close view of a stand of the ***Calamagrostis canadensis*** **(bluejoint) habitat type** near High Level on the Boyer River. These stands occupy sunny openings in the wooded canopy. Such openings may be created by the drying of sloughs during drought or the drainage of beaver ponds.

This stand of the early successional ***Calamagrostis inexpansa*** **(northern reedgrass) community type** is near Tulliby Lake on lakeshore that was recently exposed by drought. The substrate is slightly saline and not very nutrient rich. There were a few poplar and willow seedlings beginning to appear in this stand.

This stand of the ***Equisetum fluviatile*** **(swamp horsetail) habitat type** occupies an old channel slough on the Peace River floodplain near Grimshaw. While this community can persist as long as site hydrologic conditions remain favourable, such conditions can change rapidly with additional sediment deposition.

This linear stand of the ***Equisetum fluviatile*** **(swamp horsetail) habitat type** occupies the very wet emergent zone between shallow surface water and the imperfectly drained zone supporting the tall grass above. Creeping rootstocks allow the stand to follow optimum conditions with the changing water levels.

This stand of the early seral ***Glyceria grandis*** **(common tall manna grass) community type** near a small lake near Tulliby Lake occupies the shore area recently exposed by drought drawdown. An older lakeshore edge can be traced at the line of shrubs in the background.

This stand of the ***Glyceria grandis*** **(common tall manna grass) community type** near Lac La Biche covers an area on the floodplain of a small creek where a large beaver pond was recently drained.

This stand of the early seral ***Hordeum jubatum*** **(foxtail barley) community type** occupies a nearly flat area of recently exposed, moderately saline, lakeshore in the Tulliby Lake vicinity. *Hordeum jubatum* (foxtail barley) is a common pioneer on exposed, or disturbed, moist sites in areas with saline soils.

This stand of the ***Phalaris arundinacea*** **(reed canary grass) habitat type** along the Little Red Deer River near Bowden illustrates the aggressive dominance displayed by this tall grass. While the species is a native, it is thought to have had more aggressive, perhaps agronomic, strains introduced.

This stand of the ***Phragmites australis*** **(reed) habitat type** on North Buck Lake near Caslan occupies a zone of shallow surface water and saturated soils that follow a band between the deeper water with the dark band of *Scirpus acutus* (great bulrush) and the wooded higher ground above.

A large stand of the ***Puccinellia nuttalliana*** **(Nuttall's salt-meadow grass) habitat type** near Tulliby Lake on a saline area of nearly flat lake bottom exposed by drought. This species requires moist-to- saturated soils and is one of our most salt tolerant grasses.

This stand of the ***Scirpus acutus*** **(great bulrush) habitat type** on Pigeon Lake shows the typical position of these stands in water ranging in depth from a few centimetres to about two meters. These stands provide great protection of the shoreline from waves caused by wind or boat wakes.

This stand of the ***Scirpus pungens* (three-square bulrush) habitat type** near Buffalo Lake occupies the narrow band of suitable conditions between the drier zone with the wooded canopy and the wetter zone of extreme salinity where evaporation has precipitated the white deposits.

This stand of the ***Sparganium eurycarpum* (giant bur-reed) community type** on the Beaver River north of St. Paul shows the shallow water/lower bank position of this type along slow moving rivers. The species and its stands somewhat resemble *Typha latifolia* (common cattail) in appearance and location.

This large stand of the ***Typha latifolia*** **(common cattail) habitat type** occupies almost the entire shallow zone of Lac Ste. Anne where drawdown due to drought has created extensive new shallow water habitat that is easily colonized by the fast growing rootstocks.

This stand of the ***Typha latifolia*** **(common cattail) habitat type** occupies the narrow zone of suitable habitat that continues to shrink as the pothole dries during drought conditions. The outer ring of dead cattail stalks from the previous year's stand indicates the ability of the species to follow changing water level.

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 that 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 the gross outline of an individual plant’s foliage; or collectively covered by all individuals of a species within a stand or a sample plot.

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 form 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.

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 in Montana: 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 unforested landscape.

Gleization. A process in saturated or nearly saturated soils that involves the reduction of iron. This process tends to give gray colours (low chroma) to those parts of the soil from which the iron has been reduced or removed, and to impart rust colours (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 colours through the soil mass or in mottles (spots or streaks) among other colours. 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 colour, 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 aluminium, 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 or occupies only a small area of a 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 an extensive area within a 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 areas but may be common within a 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 colour or shades of colour interspersed within the dominant colour in a soil layer, usually resulting from the presence of periodic reducing soil conditions. See also redox concentrations.

Nonhydric Soils. A soil that has developed under predominantly unsaturated soil conditions.

Nonpersistent 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.

Nonwetland. 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 nontidal 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 colour.

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.

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).