Cows and Fish Report

Classification and Management of

Riparian and Wetland Sites

of Alberta's Grassland Natural Region

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Cows and Fish Report No. 018, March 2020 version, First Edition

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March 2002

by

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ACKNOWLEDGEMENTS

The authors would like to thank the following individuals for providing assistance in the development of the draft: Barry Adams (Alberta Agriculture, Food and Rural Development, Public Lands Service), Lorne Fitch (Alberta Environmental Protection, Natural Resources Service, Fisheries Management Division), and Greg Hale (Cows and Fish Program, Alberta Riparian Habitat Management Program). They have provided invaluable assistance in the development of the draft document. The patience extended to the authors by these good people is greatly appreciated.

Finally, the authors would like to thank the Alberta Riparian Habitat Management Partnership (ARHMP) represented by the Alberta Cattle Commission, Trout Unlimited Canada, the Canadian Cattleman's Association, Alberta Environment, Alberta Agriculture, Food and Rural Development, and the Department of Fisheries and Oceans for providing funding for the project.

Citation:

Thompson, William H. and Paul L. Hansen. 2002. Classification and Management of Riparian and Wetland Sites of Alberta's Prairie Biome. Bitterroot Restoration Inc. Prepared for Alberta Riparian Habitat Management Society (Cows and Fish), Lethbridge, Alberta. Reprinted with minor edits 2020. 416 pages.

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INTRODUCTION

The importance of riparian and wetland areas[1] far exceeds what might be expected from their relatively small area. They are the green zones bordering lakes, reservoirs, estuaries, potholes, springs and seeps, peatlands, wet meadows, vernal pools, and ephemeral, intermittent, or perennial streams. The riparian zone is the interface between the upland and the aquatic zone. These ecosystems are important islands and corridors of diversity and higher productivity contained within extensive uplands. They usually contain or are adjacent to bodies of water. They are important to water quality, water quantity, stream stability, and habitat for fish and other wildlife. They are valued for livestock grazing, so often contain concentrations of commercially important minerals, and are often developed into high quality farmland. Their abundant water, forage, and recreational value attract a far greater degree of use and conflict than is found on adjacent uplands.

Riparian and wetland areas in western North America tend to have the following characteristics (Thomas and others 1979): 1) they create well-defined habitat zones within the much drier surrounding areas, 2) they make up a minor proportion of the overall area (between 1-5 percent), 3) they are generally more productive of total biomass than other areas, and 4) they support great biological diversity. Both density and diversity of species tend to be higher at the land/water ecotones than in adjacent uplands.

The structure, function, and management requirements of riparian and wetland plant communities are less well understood than those of most other types of land area. They have often been overlooked, ignored, or considered only as minor inclusions of larger terrestrial or aquatic systems.

[1] "Riparian" and "wetland" are not synonyms, and usage varies greatly. We often use the terms in combination when speaking of general situations that include both.

Grazing, timber harvest, transportation corridors, mining, farming, and residential development can drastically alter these communities. Consequently, management of riparian and wetland areas has become—and will continue as—a major issue. Multi-resource opportunities, multi-disciplinary concerns, and multi-ownership patterns within riparian and wetland areas make necessary a high degree 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 uplands could be brought into production. Watercourses provided a primary means of transporting supplies and goods. Waterpower was harnessed to mill grain, saw wood, and perform other tasks. Fertile alluvial soils became excellent farmlands after drainage and clearing. Water from the streams, rivers, lakes, or ponds was diverted to irrigate cropland. Riparian trees became fence posts, building materials, and fuel for everything from the home and the forge to steamboats bringing more the settlers.

Increased environmental awareness since the 1960's has raised major concerns about the loss of wetlands to development and change in riparian areas. Agricultural expansion has been the major cause of wetland conversion in 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).
As an indication of the importance of this part of the prairie landscape, and the reason that conflicts of interest can arise, 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). Since that time more prairie wetlands have been converted to the economically important production of small grains. Within Alberta's Mixed Grass Ecoregion (4.5 percent of province area) and Dry Mixed Grass Ecoregion (7.2 percent on the province), the majority of the area is "significantly altered by agriculture" (Strong 1992).

In addition to draining of wetlands, many other human activities have greatly changed the structure and function of riparian and wetland areas. Improper timber harvesting and mining have caused severe impacts on the riparian zone in many regions. Livestock have often been grazed in riparian zones almost year-round. 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. Many bottomlands of ephemeral depressions and riparian areas have been cultivated. Hay has been mowed in some 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 caused mobilization of topsoil into riparian areas, further changing their vegetation potential and species composition and abundance (Kantrud 1986). Dissolved salts and residues from agricultural chemicals have migrated into many wetland and riparian areas, and irrigation has altered the hydrology and vegetation of wetlands.

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. One such asset is *Caring for the green zone* (Adams and Fitch 1995), a guidebook for ranchers and livestock producers on how to most effectively manage the riparian areas within their rangelands.

Benefits of a Healthy and Productive Riparian Area

Background—In a broad sense, the "health" of a riparian or wetland area may be defined as its ability to perform its normal functions. These functions include sediment filtering, streambank building, storing water, aquifer recharge, providing fish and wildlife habitat, and dissipating stream energy. Evaluating a stream's health requires consideration of upstream and adjacent management. For example, although noxious weeds such as *Cirsium arvense* (Canada thistle) or *Euphorbia esula* (leafy spurge) along a streambank may to some extent help trap sediment and bind the soil, their presence indicates compromised biotic health and should be a management concern.

Vegetation—Condition of vegetation along streams is a major factor in the health of riparian ecosystems. Healthy riparian vegetation makes the bank less likely to erode during high flow; it protects the bank from damage due to ice and animal trampling (Karr and Schlosser 1978, Platts 1979, Marlow and Pogacnik 1985). The roots of riparian plants support bank overhangs, which provide cover for aquatic animals. Much of a stream's sediment load, particularly during high flows, results from bank erosion. Schlosser and Karr (1981) found the amount of suspended solids increased quickly during storms at locations where the streambanks lacked vegetation.Vegetation along streams provides roughness, which reduces flow velocity, and therefore the erosive energy, of overbank floods (Schumm and Meyer 1979). Riparian vegetation also provides shade, reducing harm to native aquatic life by lowering water temperatures, (Meehan and others 1977).

Water Quality and Quantity—Riparian areas can improve water quality by filtering nutrients. In agricultural watersheds, such nutrient filtering by riparian areas can reduce agricultural nonpoint-source pollution (Lowrance

and others 1985). Materials eroded from nearby uplands are deposited in riparian areas during flooding. This deposition can alter surface soils, the hydrology, and the vegetation community in these low-lying sites (Lowrance and others 1985). Riparian vegetation reduces sediment and nutrient transport in a number of other ways. Roots, especially those of woody vegetation, help stabilize streambanks by holding soil intact. In addition to lowering flow velocities and causing sediment deposition, wetland vegetation also takes up and stores 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 moisture on these sites create soils with higher organic content than soils on uplands.

Riparian and wetland ecosystems generally serve to dissipate the energy of water and wind that can damage the land. Riparian and wetland areas dissipate the energy of runoff from agricultural land, slowing the surface water as it flows across the riparian zone, causing deposition of the sediments, and diminishing the water's further erosive potential. Riparian forests also provide important natural windbreaks in prairie lands.

Loss of wetlands has contributed to the change from perennial to intermittent flow in some streams. Many 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. Water storage in such aquifers once helped to maintain perennial flow in some rivers that are now dry beds much of most years.

Fisheries and Aquatics—Riparian vegetation produces the detritus that provides as much as 90 percent of the organic matter supporting stream (aquatic) communities (Campbell and Franklin 1979). In forested ecosystems, up to 99 percent of the stream biotic energy input may come from bordering riparian vegetation, with only 1 percent coming from instream photosynthesis by algae and mosses (Cummins 1974).

Wildlife Uses—Riparian and wetland ecosystems are the most productive wildlife habitats, benefiting the greatest number of species (Ames 1977, Hubbard 1977, Patton 1977). Examples of the wildlife values of riparian and wetland habitats are numerous. In western Montana 59 percent of the land bird species were found to use riparian and wetland habitats for breeding, and 36 percent of those breed exclusively in riparian or wetland areas (Mosconi and Hutto 1982). Thomas and others (1979) reported that of the 363 terrestrial species known to occur in the Great Basin of southeastern Oregon, 299 either directly depend on riparian or wetland areas, or utilize them more than any other habitats. Riparian and wetland areas are important not only to animals that are restricted to those areas. Population densities of birds in upland habitat adjacent to the riparian or wetland zones are influenced by the health and proximity of riparian or wetland areas (Carothers 1977). When a riparian or wetland area is destroyed or changed by humans, not only the riparian and wetland species are harmed, but wildlife on the adjacent uplands also suffers.

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 than that of adjacent uplands (Kauffman and Krueger 1984). Although riparian and wetland areas cover only about 1-2 percent of the summer range area of the U. S. Pacific Northwest, these areas can produce 20 percent of the summer range forage (Reid and Pickford 1946, Roath and Krueger 1982).

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 was like in the mid nineteenth century, particularly its riparian segments (Ehrhart and Hansen 1997). Cattle prefer riparian and wetland areas for the same reasons other animals do: availability of water, shade, and the higher quality and variety of forage (Ames 1977, Severson and Boldt 1978). Many of the sedges retain their crude protein levels until the first killing frost. Several sedges found in riparian and wetland zones exceed key upland forage species in sustained protein and energy content (Kauffman and Krueger 1984).

Livestock grazing can decrease the vigor and biomass of the vegetation and alter the species diversity and composition (Ames 1977, Bryant and others 1972). Improper grazing of riparian areas can change, reduce, or eliminate the vegetation bordering a stream. The channel can be made wider and shallower; or it can be downcut or braided, depending on substrate composition (Marcuson 1977, Platts 1979). The water quality can be impaired by elevating water temperatures, nutrients, suspended sediments, bacterial counts, and by altering the timing and volume of peak and base flows (Platts 1979, Kauffman and Krueger 1984). Overgrazing can cause bank sloughing, accelerated sedimentation, and subsequent silting of spawning and food producing areas (Platts 1979, Platts 1981).

Excessive use of woody vegetation can negatively affect the health of riparian and wetland areas (Kauffman and Krueger 1984). Cattle grazing was also found to influence the spacing of plants and 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. Canopy cover was 82 percent greater in the ungrazed area. However, a change in management of the site can dramatically restore lost shrub canopy cover (Crouch 1979, Davis 1982, Kauffman and Krueger 1984, Hansen 1985).

Improper livestock grazing can significantly reduce bird species composition and foraging guilds, as well as small mammal density and diversity (Kauffman and Krueger 1984). Alderfer and Robinson (1949), Bryant and others (1972), Orr (1960), and Rauzi and Hanson (1966) all found soil compaction increased linearly with increases in grazing intensity.

Recent advancements in grazing management have allowed successful rehabilitation of many riparian and wetland areas. The damage caused by hot season use or season-long grazing is well documented (Marcuson 1977, Severson and Boldt 1978, Windell and others 1986, Platts and others 1987), but specialized grazing schemes hold promise for rehabilitating riparian and wetland areas without excluding cattle for long periods (Kauffman and Krueger 1984, Ehrhart and Hansen 1997). In a study in northeastern Oregon, Bryant (1985) found herbage production increased one- to four-fold through proper timing and intensity of grazing.

Summary—In the arid portions of western North America, riparian and wetland areas are important in the overall landscape mosaic, even though they represent a very small fraction of total area. Having greater soil moisture than surrounding uplands, they are more productive than those areas. They add great diversity to the landscape. They attract livestock and wildlife for the forage, thermal and other cover, nesting habitat, water, and browse they afford (Ames 1977, Severson and Boldt 1978). Because of all this, riparian and wetland areas must be focal points for management. Strategies must be found that recognize all these functions, and must be designed to maintain or restore the integrity of riparian and wetland communities.

Proper stewardship of riparian and wetland areas is “money-in-the-bank” for the landowner. Proper management of these areas means decreased streambank erosion and floodplain losses (Gunderson 1968, Marcuson 1977),

increased forage production (Pond 1961, Kauffman and Krueger 1984), increased wildlife and fisheries (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 see the change happening (Adams and Fitch 1995). Willows or cottonwoods may be eliminated from a stream reach, or it may cease to flow all summer for more years than it once did. These are changes that we can often prevent or processes that we can change.

In areas of rich, dark soil where groves of aspen and willow once surrounded every depressional wetland, these wooded lands have been greatly altered to agricultural usage. Across much of the Central Parkland Natural Subregion, land once occupied by aspen and willow carried a far greater 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 riparian and wetland functions reduced by land clearing. Such losses must be accounted in the benefit balance sheet when consideration is made of further clearing of groveland.

Defining Wetlands in Arid Lands

Defining the boundaries of wetlands became important when society began to recognize wetland values (Mitsch and Gosselink 1993). In the nineteenth and early twentieth century, when wetland draining was a common practice accepted by society, a precise wetland definition was not important. Wetland draining continued unabated into the late 1960's. When laws and regulations pertaining to wetland protection began to be written, the need for precision increased, and it became apparent that definitions affected land use options.

> "There is no single, correct, indisputable, ecologically sound definition for wetlands, primarily because of the diversity of wetlands and because the demarcation between dry and wet environments lies along a continuum. Because reasons or needs for defining wetlands also vary, a great proliferation of definitions has arisen including structural attributes, functional considerations, and jurisdictional criteria."—Cowardin and others (1979)

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."

That same year, the USDI Fish and Wildlife Service adopted a definition, which also recognized wetland hydrology, hydric soils, and hydrophytic vegetation as defining parameters (Cowardin and others 1979). The USDI Fish and Wildlife Service definition is different from the Canadian definition in that a wetland does not have to exhibit characteristics of all three parameters:

> "Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water . . . Wetlands must have one or more of the following three attributes: 1) at least periodically, the land supports predominantly hydrophytes, 2) the substrate is predominantly undrained hydric soil, and 3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year."

As a summary of literature, Windell and others (1986) provide a general definition:

> "The term wetland is a catch-all 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 (6.6 ft) 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 in response to waterfowl habitat concerns arising 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. 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.

Wetland Soils

Riparian and wetland areas are transitional between upland and aquatic ecosystems. Within an ecosystem, soils may have a strong influence on the vegetation. These influences are 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, 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 effect 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. Events may take place simultaneously or sequentially that enhance or negate each other. The factors of soil development are all interdependent. 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.

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 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. A gleyed soil indicates poor drainage. Mottles 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).

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.

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 the surface horizon or accumulating at the soil surface is greater in riparian and wetland soils than on adjacent uplands. Much of this organic matter is intimately mixed into the soil through biological activity and gives the soil a darker colour, greater fertility, and higher moisture holding capacity.

Human activities can also affect soil formation, usually negatively. Clearing trees, overgrazing, cultivating, irrigating, draining, and other development removes the natural vegetation and affects the depth of the water table. Irrigation increases the amount of water the 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. Soils on steep gradients are more susceptible to 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.

ALBERTA NATURAL REGIONS WITHIN THE STUDY AREA

The following descriptions Alberta Natural Regions and Subregions within the study area (see Figure 1) are taken `from the Alberta Government internet website (Government of Alberta 1999), except for the climate information for the Cypress Hills, which comes from Newsome and Dix (1968).

Topography and Landform

The Mixedgrass and Dry Mixedgrass Subregions—The topography of the Dry Mixedgrass Subregion is generally subdued with only a few minor uplands. The predominant landform is a low-relief ground moraine, but there are significant areas of hummocky moraine, glaciofluvial outwash, glaciolacustrine sand plains, fine-textured glaciolacustrine lake deposits, and eroded plains. Elevations range from 600 m (2,000 ft) near Empress to more than 1,300 m (4,300 ft) on slopes of the Cypress Hills and Sweetgrass Hills. Although permanent streams are relatively rare, the ones that do exist are well defined. The Subregion is drained by several major rivers that have carved deeply into the bedrock in some places. This has exposed Cretaceous shales and sandstones, creating extensive badlands in some areas. Drainage is to the Missouri River system via the Milk River and to the Saskatchewan River system via all of the other rivers in the subregion.

Northern Fescue Subregion—The Northern Fescue Subregion is characterized topographically by gently rolling terrain. The most common landforms are low-relief ground moraine and hummocky moraine. Areas of outwash and sand plains, dune fields, and fine-textured glaciolacustrine deposits occupy a smaller but significant amount of the landscape. Eroded plains are important in the Sullivan Lake area. The lowest elevations are in the eastern parts of the Subregion.

Stream drainage is part of the Saskatchewan River system except for a large area of internal drainage in the Sounding Creek Basin. Few stream valleys dissect the subregion but those with permanent flow are usually well incised.

Foothills Fescue Subregion—The Foothills Fescue Subregion occurs largely on morainal, glaciolacustrine and outwash deposits along the lower flanks of the Foothills Geologic Belt, the Porcupine Hills and onto the adjacent plains area. They occur primarily as a narrow band between the Mixedgrass Subregion and the Foothills Parkland Subregion, although in some areas Foothills Grassland merges directly into the Montane Subregion of the Rocky Mountain Region. There are disjunct areas on the lower slopes of the Sweetgrass Hills and on unglaciated loess deposits on the plateau of the Cypress Hills and immediately adjacent plains. The largest area of this latter type is on the Milk River Ridge.

Elevations in this subregion are much higher than in the other two grassland subregions. These range up to 1,400 m (4,600 ft) in parts of the Cypress Hills. A small portion of this subregion, in the Milk River Ridge and Cypress Hills areas, drains into the Milk River system. The rest is part of the Saskatchewan River system.

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 from 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. Elevations range from just over 500 m (1,650 ft) where the Battle River enters Saskatchewan to around 1,100 m (3,300 ft) 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.

Foothills Parkland Subregion—The Foothills Parkland Subregion occupies a narrow band along eastern edge of the geological foothills from Calgary south to the Porcupine Hills, and from Pincher Creek south to the U.S. border in the Waterton Lakes National Park area. The topography is rougher than that of the Central Parkland Subregion, and elevations are higher, ranging to over 1,300 m (4,300) near Paine Lake. Numerous permanent streams occur and drainage is into the Saskatchewan River system.

Surficial deposits include extensive areas of hummocky and ground moraine as well as more restricted areas of outwash and glaciolacustrine deposits along valleys. Extensive river terraces occur in some areas.

Cypress Hills portion of the Montane Subregion—The Cypress Hills are capped by Tertiary gravels and were unglaciated during the last glaciation. The landforms of the major valleys are primarily fluvial and glaciofluvial terraces and fans with smaller areas of glaciolacustrine, aeolian and morainal deposits.

Climate

Dry Mixedgrass Subregion—Climatically, the Dry Mixedgrass Subregion is the warmest and driest in Alberta. It has a typical continental climate with cold winters, warm summers and low precipitation. Because of the warm summer temperatures and a high average wind speed, the rate of evaporation is high throughout the summer months. There is high daily and seasonal temperature variation. It is characterized by a mean annual temperature of 4 degrees Celsius and a growing season (May - September) with mean of about 16 degrees Celsius. The mean winter temperature is typically –7 degrees Celsius and the mean summer temperature is about 16 degrees Celsius.

Total annual precipitation is typically around 260-280 mm and summer precipitation is lowest of any Subregion in Alberta. Compared to other Subregions, the Dry Mixedgrass

Subregion has high year-to-year precipitation variability. Spring is the wettest season with about two-thirds of the annual precipitation falling as rain, the peak occurring in June. The amount of snow cover is relatively low, as is the number of days of continuous snow cover. Chinooks are most common along the western border of the subregion where there are more than 30 chinook days per year.

Mixedgrass Subregion—The climate of the Mixedgrass Subregion is slightly moister and cooler than that of the Dry Mixedgrass Subregion. The mean annual temperature is about 5 degrees Celsius with a mean summer temperature about 15 degrees Celsius, which is 1-2 degrees Celsius cooler than the Dry Mixedgrass Subregion. Winter temperatures in the Mixedgrass Subregion are 1-2 degrees Celsius warmer than the Dry Mixedgrass Subregion, with a greater frequency of chinook days (20-30 days) but with greater snow cover due to greater winter precipitation. Annual precipitation in the Mixedgrass Subregion is about 20 percent greater than for the Dry Mixedgrass Subregion.

Northern Fescue Subregion—The climate of the Northern Fescue Subregion is transitional between the Mixedgrass and Central Parkland subregions. The mean May - September temperature is 14 degrees Celsius and the frost-free period is about 90 days. Mean annual precipitation is about 400 mm, with mean May - September precipitation about 280 mm.

Foothills Fescue Subregion—The climate of the Foothills Fescue Subregion differs from that of the Northern Fescue Subregion in having a greater frequency of chinooks and thus, a milder winter climate. There is also greater snowfall in late winter and early spring. The majority of precipitation falls during the growing season.

The mean annual precipitation ranges from 650 mm in the far south to about 500 mm in the north. The mean May - September precipitation is 290 mm. The mean May - September temperature is 11 to 13 degrees Celsius. The mean annual temperature is 3 degrees Celsius and the frost-free period averages 90 days.

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 - September precipitation averages 300 mm.

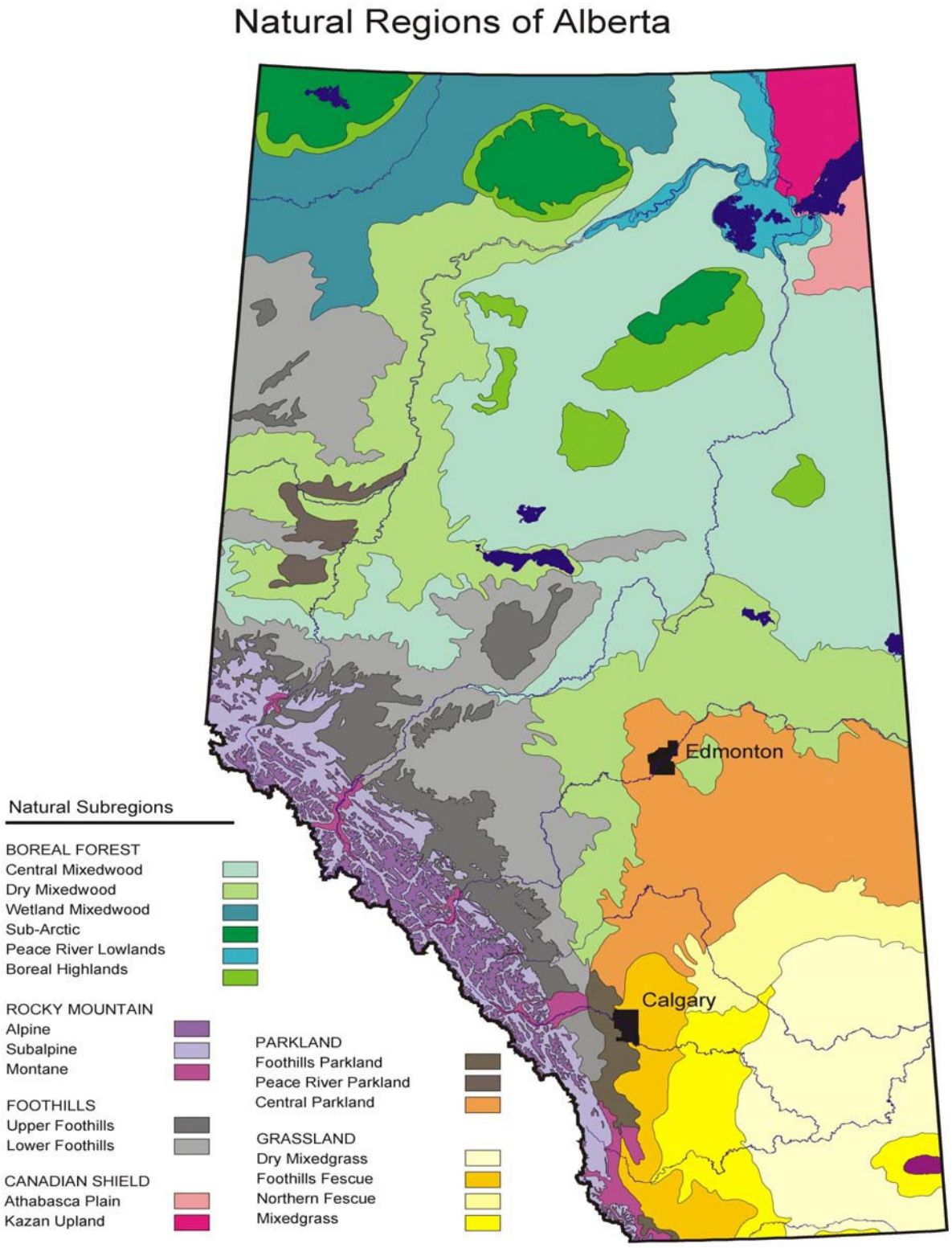


Figure 1. Natural regions of Alberta.

Foothills Parkland Subregion—Mean annual precipitation ranges from 650 mm in the far south to 500 mm in the northern part of the subregion. Mean May - September precipitation is 290 mm. The mean January temperature is –10 C and the mean July temperature is 14 degrees Celsius. The mean May - September temperature is 12-13 degrees Celsius and the frost-free period averages 90 days.

Cypress Hills portion of the Montane Subregion—The Cypress Hills comprise an elevated island surrounded by the Dry Mixed Grass Subregion. Climate data on top the Cypress Hills is scant. Newsome and Dix (1968) report a mean precipitation of 470 mm, a mean annual temperature of 3 degrees Celsius, and an average frost-free period of only 46 days over the period from 1919 to 1931.

Soils

Dry Mixedgrass Subregion—The characteristics soils of the Dry Mixedgrass Subregion are Brown and Dark Brown Chernozems. Brown Solonetz soils are common in the extreme southeast of the subregion and in a large area north of Dinosaur Provincial Park.

Mixedgrass Subregion—The characteristic soils of the Mixedgrass Subregion are Dark Brown Chernozems as contrasted with the Brown Chernozems of the Dry Grassland Subregion. A few Black Chernozems occur on moister sites along the northern and western boundaries of this Subregion.

Northern Fescue Subregion—The predominant soils are Dark Brown and Black Chernozems, with Brown Solonetz soils extending through the centre of the subregion in a broad band north of Hanna.

Foothills Fescue Subregion—The soils of this subregion are predominantly Dark Brown and Black Chernozems. Solonetzic soils are not important in the Foothills Fescue Subregion.

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.

Foothills Parkland Subregion—Predominant soils in the forested areas are Black Chernozems with Dark Brown and Black Chernozems in the grasslands. Regosolics occur on active stream floodplains while Gleysolics occur in wetland sites.

Cypress Hills portion of the Montane Subregion—Soils vary greatly with the complex topographic and climatic conditions in this Subregion and a wide range of soils is typical. Soils under grasslands are mostly Chernozemics, Brunisolics and Regosolics. Forest soils include Brunisolics and Luvisolics.

DEVELOPMENT OF THE ECOLOGICAL SITE CLASSIFICATION

Background

The Riparian and Wetland Research Program (RWRP) was contracted in 1998 to develop a riparian and wetland ecological site classification following the methods and format used for the *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995). To shorten the time necessary to obtain necessary body of stand data, we incorporated some of the data used for the Montana classification. The rationale for this is that the plant species and communities occurring in southern Alberta also are found in Montana. We recognize that we are working along ecologic gradients, such as latitude and elevation that are reflected floristically as one goes very far

in any direction. For this reason, we are collecting as much stand data as possible within the Alberta study area over the time span of this project.

RWRP undertook concurrently in southern Saskatchewan a similar project to classify ecological sites, for which additional stands of many of the same site types were sampled. This additional data is used to further augment the working data set. During this process we identified a few types in Alberta that do not occur in Montana or Saskatchewan, and other types that differ to some degree from their Montana or Saskatchewan descriptions.

Field Methods

The database for development of the Alberta classification consists of 1,517 sample plots. The following data were analyzed:

1. Data collected in Alberta.
2. Data collected in Saskatchewan.
3. Data collected in Montana.

Selection of stands to sample 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 eventual placement of the stand within a classification system. In practice, field observers chose stands of vegetation to sample that they perceived as being dominated by particular species occurring repeatedly across the landscape of the study area.

For sampling herbaceous communities (graminoids and forbs) we used plots 5 m (16.4 ft) by 10 m (32.8 ft), total area of 50 m^2 (538 ft^2) (Mattson 1984, 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 (538 ft^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 (35.8 ft radius) 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: 1) soil morphology, 2) litter/duff accumulation, geomorphology, 3) human modifications, 4) elevation, and 5) natural and human-caused disturbances.

Office Methods

Development of the Alberta riparian and wetland site classification followed the general procedures and timetable outlined below.

1. Specimens of plants are identified in the field, the office, or The University of Montana herbarium.
2. We entered the stand data into a computer database capable of creating stand/species tables for analysis.
3. A stepwise procedure of successive approximations was used to develop the classification (Pfister and Arno 1980). Preliminary association tables are created using plot species and canopy cover values. Stands are then rearranged several times to group stands into sets with the greatest vegetation similarities. Plot-to-plot similarity relations, plot-to-set similarity relations, and set-to-set similarity relations were analyzed using a modified Sorensen's Index. The final placement of each sample plot in a set is based on both floristic and environmental relationships.

4. Average canopy cover, canopy cover range, and constancy tables are created for each group.
5. A dichotomous key to the preliminary types is developed based on the presence or abundance of diagnostic plant species that indicate the presence of certain environmental conditions (indicator species). The key was then applied to all plots, and necessary revisions are made to accommodate variations in the data.
6. A description is prepared for each habitat type and community type, with a general discussion of vegetation, physical site features, and management implications included.
7. Successive drafts of the classification for the Grassland Natural Region of Alberta were provided for interim use and field testing during the 1999 and 2000 field seasons.

A number of riparian habitat types and community types have been defined by various other authors in the general region of the Northern Great Plains and surrounding areas. Some of these are: Lawrence and Romo (1994) and Michalsky and others (1994) for localized areas within the southern Saskatchewan grasslands; Adams and others (1997) for the Suffield Canadian Forces Base, Alberta; Pfister and others (1977), Mueggler and Stewart (1980), and Hansen and Hoffman (1988) for Montana and adjacent states; Cooper and others (1991) for northern Idaho; Mueggler (1988) for Idaho and-Wyoming; Steele and others (1983) for eastern Idaho and western Wyoming; and Youngblood and others (1985b) for eastern Idaho-western Wyoming. We have attempted herein to adopt previously defined types whenever possible. However, many of the types described in these other classifications are not equivalent or did not match our descriptions. Therefore, we selected from those works the riparian habitat types and community types that best fit the ecological conditions observed in Alberta, or we defined new types based on the data of this study.

Taxonomic Considerations

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

Cottonwoods—Occasionally, some species present problems in positive identification. Taxonomic workers in North America dealing with the *Populus* genus have tended to be conservative in holding to broader species concepts in recognition of a broader range of variation within a species. Although cottonwood hybridization is common, the hybrid zones are generally geographically narrow (Stettler and others 1996). Natural F_1 hybrids between particular combinations of parental species may have consistent and recognizable morphologies and definite geographical ranges, but their coherence disappears with successive generations (Eckenwalder 1996). For these reasons we have not treated any of the suspected hybrids separately at this time, but have included them with the morphologically and spatially closest parent species.

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 *Polygonum coccineum* (water smartweed) community type includes all combinations of *Polygonum coccineum* (water smartweed) and *Polygonum amphibium* (water smartweed).
2. The *Eleocharis palustris* (creeping spike-rush) habitat type includes all combinations of *Eleocharis palustris* (creeping spike-rush) and *Eleocharis acicularis* (needle spike-rush).
3. The *Scirpus acutus* (great bulrush) habitat type includes all combinations of *Scirpus acutus* (great bulrush) and *Scirpus validus* (common great bulrush).

4. The *Typha latifolia* (common cattail) habitat type includes all combinations of *Typha latifolia* (common cattail) and *Typha angustifolia* (narrow-leaved cattail).
5. *Crataegus rotundifolia* (round-leaved hawthorn) community type includes all combinations of *Crataegus rotundifolia* (round-leaved hawthorn) and *Crataegus douglasii* (Douglas hawthorn).
6. *Rosa woodsii* (common wild rose) community type includes all combinations of *Rosa woodsii* (common wild rose) and *Rosa acicularis* (prickly rose).
7. The *Agrostis stolonifera* (redtop) community type includes all combinations of *Agrostis stolonifera* (redtop) and *Agrostis scabra* (rough hair grass).

Ecological Terms and Concepts

The following classification of climax vegetation was first proposed by Tansley (1935) and later modified by Daubenmire (1952). A ***climax community*** is a final or steady state plant community which is self-perpetuating and in dynamic equilibrium with its environment. ***Climatic climax*** vegetation develops on normal topography with deep loamy soil. Where topography or soil exerts sufficient influence to produce self-perpetuating, steady state vegetation distinct from the climatic climax, the terms ***topographic climax*** or ***edaphic climax*** respectively are used. Where special topographic conditions also favor the development of edaphic conditions distinct from the normal, and the climax vegetation is distinct from the climatic climax, the term ***topoedaphic climax*** is used. Where recurring disturbances, such as grazing or fire, exert the predominant influence in maintaining the structure and composition of the steady-state vegetation, the term ***disclimax*** is used. A ***zootic climax*** is stable vegetation, which is distinct because of heavy 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.

A ***habitat type*** is defined as the land area that supports, or has the potential of supporting, the same climax vegetation type (association) (Daubenmire 1952, 1968, 1978). A ***phase*** is a finer subdivision of a habitat type representing a minor variation in climax vegetation. Each habitat type represents a relatively narrow segment of environmental variation having a certain potential for vegetation development. Although any given habitat type may support a wide variety of disturbance-caused or seral vegetation, the ultimate product of vegetational succession anywhere within that habitat type will be a similar plant community. Therefore, the habitat type is a vegetation-based ecological site classification that uses the plant community as an indicator of integrated environmental factors as they affect species reproduction and plant community development. Changes in site conditions such as drying and filling of potholes or sufficient deposition of alluvium on floodplains to create a drier site over time can change the habitat type. Cyclical changes that do not change long-term site conditions will remain the same habitat type. Habitat types have been used extensively to classify grasslands, shrublands, woodlands, and forests throughout the western United States and to some areas in the central and eastern United States.

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

factors affecting vegetation. (The association, or climax plant community type is essentially equivalent to "potential natural community [type]" and climax vegetation is essentially equivalent to "potential natural vegetation" for purposes of developing a vegetation-based site classification system.)

Naming of the plant association follows the frequently used system of a binomial set with the dominant overstory species separated from the dominant or most diagnostic indicator of the undergrowth union by a slash. For example, numerous stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) association occur. The units of land on which these occur (currently or potentially) represent the *Salix bebbiana/Carex atherodes* (beaked 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, several major seral plant communities that are stable for time frames relevant to land management decisions have been described. These are referred to as ***community types.*** A ***community type*** is an aggregation of all plant communities distinguished by floristic and structural similarities in both overstory and undergrowth layers. Examples are the *Populus deltoides/Cornus stolonifera* (Plains cottonwood/red-osier dogwood) community type and the *Salix exigua* (sandbar willow) community type. ***In this classification, the term community type only represents seral or disclimax communities because climax community types are defined as riparian associations.***

Our goal is to explain plant community dynamics as they relate to factors of time, physical environment (site), and treatment; and to communicate that with a taxonomic classification. These concepts are illustrated in Figure 2.

The upper cell is the ***plant association*** (climax vegetation type or last successional stage attainable). After plant associations are identified, a taxonomic key is written to identify the column (physical environment or site) to represent the ***habitat type.*** This key enables identification of the habitat type in most stages of successional development. In some cases, the successional relationships are evident. For example, community types A-2, A-3, and A-4 represent specific and clearly identified successional stages within association A. However, community type B/C-2 is a grazing disclimax that extends over more than one habitat type and that may provide insufficient evidence to identify a single habitat type (column). In association D, our present knowledge only allows us to identify one seral stage, community type D-2. Finally, association E represents a site on which the time frame of succession is brief, and the last successional stage (riparian plant association) is reached after only a few years. Examples of association E include *Carex atherodes* (awned sedge) and *Typha latifolia* (common cattail) sites where the pioneering species is an aggressive native species that also represents the climax vegetation for the site.

The time frame for site-successional processes can vary greatly, depending upon the type, location, and origin of the riparian and wetland site. For example, a beaver pond may silt-in within a few years or hundreds of years. Analysis of a few mountain meadows in Colorado shows them to have been stable for 6,900 years (Windell and others 1986). In the Madison Range of Montana, Patten (1963) says that the vegetation is still adjusting to post-Pleistocene climate, but that vegetation patterns, including mountain meadows, are relatively stable.

The long-term product of vegetative succession is the climax or steady-state community. Theoretically, this community, when free of major disturbance, is self-perpetuating and represents a meaningful integration of its total environment. It is with this assumption that climax

vegetation becomes useful in the identification of habitat types.

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

Some ecologists dispute the existence of successional end points in the form of climax communities. This argument has developed primarily from the study of global climate change, which indicates plant communities 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 more dramatic and may fluctuate significantly both seasonally and annually. These fluctuations and associated natural disturbances may result in an ever-changing environment, and make it difficult to predict the potential vegetation community. Nevertheless, current knowledge of successional pathways, and of the temporal persistence of major seral plant communities reflecting current site differences, is still relevant to resource management.

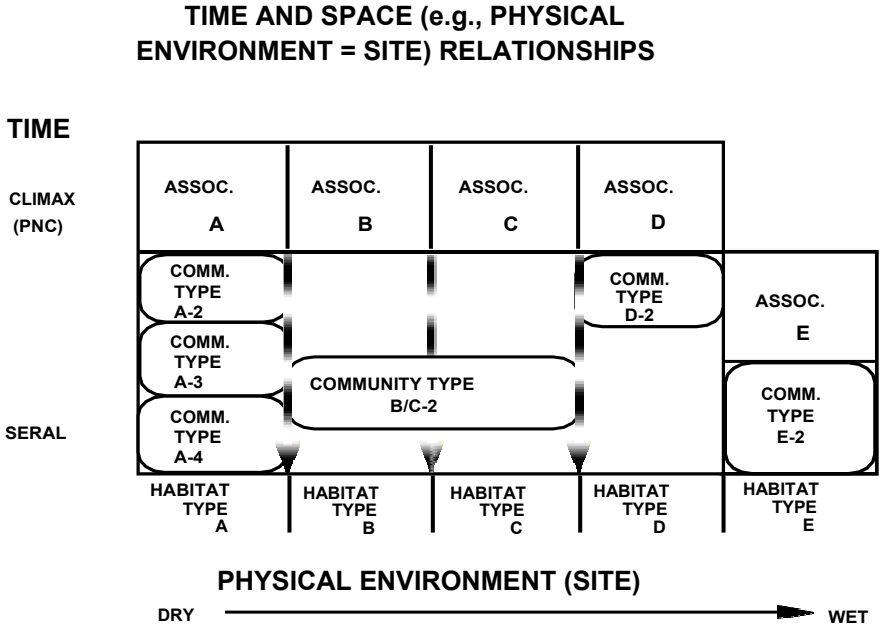


Figure 2. Illustration of the terminology as it relates to time and space (e.g. physical environment = site) for riparian and wetland sites.

LIST OF TYPES

A list of type names is provided in Table 1 along with the seven-letter name codes for use in the following tables of sampling distribution (Table 2) and distribution across the Natural Regions of the province (Table 3).

Table 1. List of riparian and wetland habitat types (HT) and community types (CT) described for the study area, with their Latin, common, and seven-letter code names

Type Latin and Common Name	Seven Letter Code Name
Coniferous Tree Types	
Picea glauca/Cornus stolonifera Habitat Type (White Spruce/Red-Osier Dogwood) Habitat Type	PICEGLA/CORNSTO HT
Picea glauca/Equisetum arvense Habitat Type (White Spruce/Common Horsetail) Habitat Type	PICEGLA/EQUIARV HT
Deciduous Tree Types	
Acer negundo/Prunus virginiana Habitat Type (Manitoba Maple/Choke Cherry) Habitat Type	ACERNEG/PRUNVIR HT
Populus angustifolia/Cornus stolonifera Community Type (Narrow-leaf Cottonwood/ Red-Osier Dogwood) Community Type	POPUANG/CORNSTO CT
*Populus angustifolia/*Herbaceous Community Type (Narrow-leaf Cottonwood/Herbaceous) Community Type	POPUANG/HERB CT
*Populus angustifolia/*Recent Alluvial Bar (Narrow-leaf Cottonwood/Recent Alluvial Bar) Community Type	POPUANG/R.A.B. CT
Populus angustifolia/Symphoricarpos occidentalis Community Type (Narrow-leaf Cottonwood/Buckbrush Community Type	POPUANG/SYMPOCC CT
Populus balsamifera/Cornus stolonifera Community Type (Balsam Poplar/Red-Osier Dogwood) Community Type	POPUBAL/CORNSTO CT
Populus balsamifera/Herbaceous Community Type (Balsam Poplar/Herbaceous) Community Type	POPUBAL/HERB CT
*Populus balsamifera/*Recent Alluvial Bar Community Type (Balsam Poplar/Recent Alluvial Bar) Community Type	POPUBAL/R.A.B. CT
Populus balsamifera/Symphoricarpos occidentalis Community Type (Balsam Poplar/Buckbrush) Community Type	POPUBAL/SYMPOCC CT
Populus deltoides/Cornus stolonifera Community Type (Plains Cottonwood/Red-Osier Dogwood) Community Type	POPUDEL/CORNSTO CT
*Populus deltoides/*Herbaceous Community Type (Plains Cottonwood/Herbaceous) Community Type	POPUDEL/HERB CT
*Populus deltoides/*Recent Alluvial Bar Community Type (Plains Cottonwood/Recent Alluvial Bar) Community Type	POPUDEL/R.A.B. CT
Populus deltoides/Symphoricarpos occidentalis Community Type (Plains Cottonwood/Buckbrush) Community Type	POPUDEL/SYMPOCC CT
Populus tremuloides/Cornus stolonifera Habitat Type (Aspen/Red-Osier Dogwood) Habitat Type	POPUTRE/CORNSTO HT
Populus tremuloides/Symphoricarpos occidentalis Community Type	POPUTRE/SYMPOCC CT

Table 1. List of riparian and wetland habitat types (HT) and community types (CT) described for the study area, with their Latin, common, and seven-letter code names

Type Latin and Common Name	Seven Letter Code Name
(Aspen/Buckbrush) Community Type	
Populus tremuloides/Herbaceous Community Type (Aspen/Herbaceous) Community Type	POPUTRE/HERB CT
Willow Shrub Types	
Salix amygdaloides Community Type (Peach-leaved Willow) Community Type	SALIAMY CT
Salix bebbiana/Cornus stolonifera Habitat Type (Beaked Willow/Red-Osier Dogwood) Habitat Type	SALIBEB/CORNSTO HT
Salix bebbiana/Carex atherodes Habitat Type (Beaked Willow/Awned Sedge) Habitat Type	SALIBEB/CAREATH HT
Salix bebbiana (Beaked Willow) Community Type	SALIBEB CT
Salix exigua (Sandbar Willow) Community Type	SALIEXI CT
Salix lutea/Cornus stolonifera Habitat Type (Yellow Willow/Red-Osier Dogwood) Habitat Type	SALILUT/CORNSTO HT
Salix lutea (Yellow Willow) Community Type	SALILUT CT
Salix petiolaris/Carex atherodes Habitat Type (Basket Willow/Awned Sedge) Habitat Type	SALIPET/CAREATH HT
Salix petiolaris/Cornus stolonifera Habitat Type (Basket Willow/Red-Osier Dogwood) Habitat Type	SALIPET/CORNSTO HT
Salix petiolaris (Basket Willow) Community Type	SALIPET CT
Salix planifolia/Carex utriculata Habitat Type (Flat-leaved willow/Beaked Sedge) Habitat Type	SALIPLA/CAREUTR HT
Non-Willow Shrub Types	
Artemisia cana/Agropyron smithii Habitat Type (Silver Sagebrush/Western Wheat Grass) Habitat Type	ARTECAN/AGROSMI HT
Betula occidentalis (Water Birch) Community Type	BETUOCC CT
Cornus stolonifera (Red-Osier Dogwood) Community Type	CORNSTO CT
Crataegus rotundifolia (Round-leaved Hawthorn) Community Type	CRATROT CT
Elaeagnus commutata (Silverberry) Community Type	ELAECOM CT
Prunus virginiana (Choke Cherry) Community Type	PRUNVIR CT
Rosa woodsii (Common Wild Rose) Community Type	ROSAWOO CT
Sarcobatus vermiculatus/Agropyron smithii Habitat Type (Greasewood/Western Wheat Grass) Habitat Type	SARCVER/AGROSMI HT
Shepherdia argentea (Thorny Buffaloberry) Community Type	SHEPARG CT
Symphoricarpos occidentalis (Buckbrush) Community Type	SYMPOCC CT
Sedge Types	
Carex aquatilis (Water Sedge) Habitat Type	CAREAQU HT
Carex atherodes (Awned Sedge) Habitat Type	CAREATH HT
Carex lanuginosa (Woolly Sedge) Habitat Type	CARELAN HT

Table 1. List of riparian and wetland habitat types (HT) and community types (CT) described for the study area, with their Latin, common, and seven-letter code names

Type Latin and Common Name	Seven Letter Code Name
Carex utriculata (Beaked Sedge) Habitat Type	CAREUTR HT
Non-Sedge Herbaceous Types	
Agropyron smithii (Western Wheat Grass) Habitat Type	AGROSMI HT
Bromus inermis (Smooth Brome) Community Type	BROMINE CT
Calamagrostis stricta (Narrow Reed Grass) Community Type	CALASTR CT
Deschampsia cespitosa (Tufted Hair Grass) Habitat Type	DESCCES HT
Distichlis stricta (Saltgrass) Habitat Type	DISTSTR HT
Eleocharis palustris (Creeping Spike-Rush) Habitat Type	ELEOPAL HT
Glycyrrhiza lepidota (Wild Licorice) Community Type	GLYCLEP CT
Hordeum jubatum (Foxtail Barley) Community Type	HORDJUB CT
Juncus balticus (Wire Rush) Community Type	JUNCBAL CT
Phalaris arundinacea (Reed Canary Grass) Habitat Type	PHALARU HT
Poa pratensis (Kentucky Bluegrass) Community Type	POAPRAT CT
Polygonum coccineum (Water Smartweed) Community Type	POLYCOC CT
Puccinellia nuttalliana (Nuttall's Salt-Meadow Grass) Habitat Type	PUCCNUT HT
Salicornia europaea (Samphire) Community Type	SALIEUR CT
Scirpus acutus (Great Bulrush) Habitat Type	SCIRACU HT
Scirpus paludosus (Prairie Bulrush) Habitat Type	SCIRPAU HT
Scirpus pungens (Three-square Rush) Habitat Type	SCIRPUN HT
Typha latifolia (Common Cattail) Habitat Type	TYPHLAT HT

Distribution of the Sample Among Study Areas

Concurrent with this project was a similar one to classify riparian and wetland sites in southern Saskatchewan. The data collected on stands dominated by species occurring in both provinces was merged along with compatible data from Montana to obtain as large a sample set as possible (Table 2). We assumed that the study areas in Alberta and Saskatchewan were ecologically similar enough to each other, and to the eastern and central portions of Montana, that the benefits from the increased dataset size would more than offset any slight vegetational differences due to geographical gradients across the distances involved. Montana stands were excluded from the analysis if they contained important species not known to occur in Alberta.

Table 2. Distribution of sample stands among Alberta, Saskatchewan, and Montana for each type described

Type (7-Letter Code)	Number of Stands			
	Total	Alberta	Sask.	Mont
Coniferous Tree Types				
PICEGLA/CORNSTO HT	11	11	0	0
PICEGLA/EQUIARV HT	13	11	0	2
Deciduous Tree Types				
ACERNEG/PRUNVIR HT	35	3	18	14
POPUANG/CORNSTO CT	17	4	0	13
POPUANG/HERB CT	6	4	0	2
POPUANG/R.A.B. CT	5	2	0	3
POPUANG/SYMPOCC CT	9	4	0	5
POPUBAL/CORNSTO CT	44	23	4	17
POPUBAL/HERB CT	19	7	2	10
POPUBAL/R.A.B. CT	15	3	1	11
POPUBAL/SYMPOCC CT	24	9	1	14
POPUDEL/CORNSTO CT	16	9	1	6
POPUDEL/HERB CT	12	5	2	5
POPUDEL/R.A.B. CT	34	8	1	25
POPUDEL/SYMPOCC CT	25	6	0	19
POPUTRE/CORNSTO HT	22	15	4	3
POPUTRE/SYMPOCC CT	9	4	3	2
POPUTRE/HERB CT	12	8	1	3
Willow Shrub Types				
SALIAMY CT	26	5	2	19
SALIBEB/CORNSTO HT	25	9	12	4
SALIBEB/CAREATH HT	14	10	2	2
SALIBEB CT	27	21	1	5
SALIEXI CT	70	13	15	42
SALILUT/CORNSTO HT	23	17	5	1
SALILUT CT	10	10	0	0
SALIPET/CAREATH HT	12	5	7	0
SALIPET/CORNSTO HT	10	5	5	0
SALIPET CT	5	2	3	0
SALIPLA/CAREUTR HT	17	13	0	4
SALIPLA CT	8	7	0	1

Type (7-Letter Code)	Total	Number of Stands		
		Alberta	Sask.	Mont
Non-Willow Shrub Types				
ARTECAN/AGROSMI HT	43	8	1	34
BETUOCC CT	22	10	5	7
CORNSTO CT	14	8	1	5
CRATROT CT	14	2	7	5
ELAECOM CT	20	12	8	0
PRUNVIR CT	25	9	10	6
ROSAWOO CT	15	6	1	8
SARCVER/AGROSMI HT	14	2	3	9
SHEPARG CT	28	9	7	12
SYMPOCC CT	29	9	8	12
Sedge Types				
CAREAQU HT	24	12	4	8
CAREATH HT	42	22	10	10
CARELAN HT	14	5	1	8
CAREUTR HT	50	24	2	24
Non-Sedge Types				
AGROSMI HT	34	9	9	16
BROMINE CT	7	2	5	0
CALASTR CT	8	5	1	2
DESCCES HT	14	7	6	1
DISTSTR HT	25	4	7	14
ELEOPAL HT	31	6	13	12
GLYCLEP CT	6	3	1	2
HORDJUB CT	17	5	7	5
JUNCBAL CT	14	7	1	6
PHALARU HT	31	5	13	13
POAPRAT CT	8	2	1	5
POLYCOC CT	11	2	4	5
PUCCNUT HT	22	8	6	8
SALIEUR CT	14	3	7	4
SCIRACU HT	41	16	12	13
SCIRPAU HT	23	7	11	5
SCIRPUN HT	33	11	10	12
TYPHLAT HT	53	12	10	31

Distribution of Types Among Ecological Subregions of Alberta

Table 3 lists the geographic distribution and relative abundance of riparian and wetland habitat types (HT) and community types (CT) among Natural Subregions in Alberta. Meaning of terms used for distribution and abundance are: ***major***—occupies extensive acreages in a least some portion of the riparian or wetland zone; ***minor***—seldom occupies large acreages but may be common on smaller areas within the riparian or wetland zone; ***incidental***—rarely occurs in the riparian or wetland zone. A "dash" indicates that the type is essentially absent from that particular subregion of the province.

Subregion delineations follow Government of Alberta (1999) *Natural Regions and Subregions of Alberta*. In Table 3 the Montane column represents the Cypress Hills portion of the Montane Subregion. The Central Parkland and Foothills Parkland Subregions are only partially represented by those portions that lie immediately adjacent to the Northern and Foothills Fescue Subregions.

Table 3. Distribution of riparian and wetland habitat types and community types among Natural Subregions

	Natural Subregions							
Type	**Dry Mixed Grass**	**Mixed Grass**	**Northern Fescue**	**Foothills Fescue**	**Lower Foothills**	**Central Parkland**	**Foothills Parkland**	**Montane**
Coniferous Tree Types								
PICEGLA/CORNSTO HT	—	—	—	—	—	Incidental	Incidental	Minor
PICEGLA/EQUIARV HT	—	—	—	—	—	Incidental	Incidental	Minor
Deciduous Tree Types								
ACERNEG/PRUNVIR HT	Incidental	—	—	—	—	—	—	—
POPUANG/CORNSTO CT	—	Minor	—	Incidental	Incidental	—	—	—
POPUANG/HERB CT	—	Minor	—	Incidental	Incidental	—	—	—
POPUANG/R.A.B. CT	—	Minor	—	Incidental	Incidental	—	—	—
POPUANG/SYMPOCC CT	—	Minor	—	Incidental	Incidental	—	—	—
POPUBAL/CORNSTO CT	—	Minor	Incidental	Minor	Major	Minor	Minor	Minor
POPUBAL/HERB CT	—	Minor	Incidental	Minor	Minor	Minor	Minor	—
POPUBAL/R.A.B. CT	—	Minor	Incidental	Minor	Minor	Incidental	Minor	—
POPUBAL/SYMPOCC CT	—	Minor	Incidental	Minor	Major	Minor	Minor	Minor
POPUDEL/CORNSTO CT	Minor	—	—	—	—	—	—	—
POPUDEL/HERB CT	Minor	—	—	—	—	—	—	—
POPUDEL/R.A.B. CT	Minor	—	—	—	—	—	—	—
POPUDEL/SYMPOCC CT	Minor	—	—	—	—	—	—	—
POPUTRE/CORNSTO HT	—	—	Incidental	Incidental	Minor	Major	Major	—
POPUTRE/SYMPOCC CT	—	—	Incidental	Incidental	Incidental	Minor	Minor	—
POPUTRE/HERB CT	—	—	Incidental	Incidental	Incidental	Incidental	Incidental	—
Willow Shrub Types								
SALIAMY CT	Incidental	—	—	—	—	—	—	—
SALIBEB/CORNSTO HT	Minor	Minor	Minor	Minor	Major	Incidental	Minor	Incidental
SALIBEB/CAREATH HT	—	Incidental	Incidental	Minor	Minor	Minor	Minor	Incidental
SALIBEB CT	Incidental	Minor	Minor	Minor	Major	Minor	Minor	Minor
SALIEXI CT	Minor	Minor	Incidental	Minor	Incidental	Incidental	Incidental	Incidental
SALILUT/CORNSTO HT	Minor	Minor	Incidental	—	—	—	—	—
SALILUT CT	Minor	Minor	Incidental	—	—	—	—	—
SALIPET/CAREATH HT	—	—	Incidental	Incidental	Incidental	Major	Minor	—

Table 3. Distribution of riparian and wetland habitat types and community types among Natural Subregions

Type	Natural Subregions							
	Dry Mixed Grass	Mixed Grass	Northern Fescue	Foothills Fescue	Lower Foothills	Central Parkland	Foothills Parkland	Montane
SALIPET/CORNSTO HT	—	—	Incidental	Incidental	Incidental	Minor	Minor	—
SALIPET CT	—	—	Incidental	Incidental	Incidental	Minor	Incidental	—
SALIPLA/CAREUTR HT	—	—	Incidental	Incidental	Minor	Incidental	Incidental	—
SALIPLA CT	—	—	Incidental	Incidental	Minor	Incidental	Incidental	—
Non-Willow Shrub Types								
ARTECAN/AGROSMI HT	Minor	—	—	—	—	—	—	—
BETUOCC CT	Minor	Incidental	—	Incidental	Incidental	—	Incidental	—
CORNSTO CT	Incidental	Incidental	Incidental	Incidental	Incidental	Incidental	Incidental	Incidental
CRATROT CT	—	Incidental	—	—	—	—	—	—
ELAECOM CT	Major	Major	Major	Major	Minor	Minor	Minor	Incidental
PRUNVIR CT	Minor	Incidental	Incidental	Incidental	Incidental	—	Incidental	—
ROSAWOO CT	Minor	Incidental	Incidental	Incidental	Incidental	Incidental	Incidental	—
SARCVER/AGROSMI HT	Minor	—	—	—	—	—	—	—
SHEPARG CT	Minor	Minor	—	—	—	—	—	—
SYMPOCC CT	Major	Minor	Minor	Minor	Minor	Minor	Minor	—
Sedge Types								
CAREAQU HT	Minor	Minor	—	Minor	Minor	—	Minor	Incidental
CAREATH HT	Incidental	Minor	Minor	Minor	Minor	Minor	Minor	—
CARELAN HT	Minor	Incidental	—	—	—	—	—	—
CAREUTR HT	Incidental	Incidental	—	Minor	Minor	—	Minor	—
Non-Sedge Herbaceous Types								
AGROSMI HT	Minor	—	—	—	—	—	—	—
BROMINE CT	Incidental	Incidental	Incidental	Incidental	Incidental	Incidental	Incidental	—
CALACAN HT	—	—	—	—	Incidental	Incidental	Minor	Incidental
DESCCES HT	Minor	Incidental	—	—	—	—	—	—
DISTSTR HT	Minor	Incidental	—	—	—	—	—	—
ELEOPAL HT	Major	Minor	Minor	Minor	Minor	Minor	Minor	Minor
GLYCLEP CT	Minor	—	—	—	—	—	—	—
HORDJUB CT	Minor	—	—	—	—	—	—	—
JUNCBAL CT	Incidental	Incidental	—	Minor	Minor	—	Minor	—
PHALARU HT	Incidental	—	—	Incidental	Incidental	—	—	—
POAPRAT CT	Incidental	Incidental	Incidental	Incidental	Incidental	Incidental	Incidental	—
POLYCOC CT	Incidental	—	—	—	—	—	—	—
PUCCNUT HT	Minor	—	—	—	—	—	—	—
SALIEUR CT	Minor	—	—	—	—	—	—	—
SCIRACU HT	Minor	Minor	Incidental	Incidental	Incidental	Incidental	Incidental	Incidental
SCIRPAU HT	Minor	—	—	—	—	—	—	—
SCIRPUN HT	Minor	—	—	—	—	—	—	—
TYPHLAT HT	Minor	Minor	Incidental	Incidental	Incidental	Incidental	Incidental	—

USE OF THE CLASSIFICATION

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-mid seral (and/or disturbed) stands. These tables list the species composing the type. The list is separated by lifeform group (trees, shrubs, graminoids, forbs, and ferns and allies. Species are listed in alpha order within each lifeform group.

For each species recorded on any stand in the sample set is given a set of statistics in these tables. These statistics are:

Average Canopy Cover—the mean percent canopy cover recorded for that species on stands 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 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 (PI) = square root of (percent canopy cover * 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.

Management Interpretations

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

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

For the first two misconceptions, the opposite is actually true. In the first case, a very high percentage of our landscape reflects some degree of disturbance resulting in

domination by various seral stages. 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 adjacent stands on similar physical sites can assist in correct habitat type identification.

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 predictability of the landscape, and
4) A basis for making predictions about various management decisions or expected trends resulting from natural disturbances on similar units of land.

Successional Relationships

The process of change by which biotic communities replace each other and by which the physical environment becomes altered over a period of time is referred to as ***succession*** (Kimmins 1987). Two types of succession characterize vegetation development: ***primary succession*** and ***secondary succession.*** Development of vegetation on newly created soil surfaces, such as on a silted-in lake, or a newly deposited alluvial bar, is ***primary succession.*** This slow process may require many centuries to reach a stable or climax community. ***Secondary succession*** occurs after a disturbance (such as a fire) alters or destroys the vegetation cover, but not the soil. Regeneration and regrowth usually happen quickly from roots or seeds already in the soil. In some severe disturbances (such as soil erosion or fire consumption of a peat substrate) the site may be changed drastically enough to initiate primary succession.

Secondary succession may occur in either of two directions: toward or away from the climax community or potential natural community (PNC). For example, the establishment of *Acer negundo* (Manitoba maple) seedlings under an overstory of cottonwoods would represent progressive succession toward the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type. The failure of *Acer negundo* to establish itself and the resulting domination of the understory by *Poa pratensis* (Kentucky bluegrass) due to grazing influences could represent regressive succession 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 disclimax plant communities are formally defined as ***community types*** in this publication. 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 only had to deal with secondary succession. However, in many riparian and wetland situations, primary succession is just as important as secondary succession in accounting for the overall landscape mosaics. One of the most important characteristics of riparian and wetland areas is their dynamic nature. Not only does vegetation in a habitat type change with time and disturbance, but the site itself may also be altered by changes in hydrological or soil conditions. Deep alluvial depositions on floodplains can alter availability of water. Rapid accumulations of organic materials can occur on fens, bogs, and wet meadows,

altering the water holding capacity and nutrient availability of the soil. Site potential may change when de-watering occurs (the lowering of the water table) by pumping, draining, or heavy other human land uses. Permanent flooding due to human or wildlife activity (beaver) will also change site potential. Any case where the site has changed significantly will in turn mean a different potential climax community (and habitat type). These changes could be referred to as "site succession."

Developing Reasonable and Attainable Management Goals and Objectives

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

Land management decisions sometimes require achieving certain vegetative communities in riparian and wetland areas. With the information provided in this document, a good understanding of what is feasible for a site can be determined. For example, on a degraded site with only a scattering of *Salix bebbiana* (beaked willow), the expected canopy cover can be determined from the canopy cover tables in the text and specific objectives can be formulated (i.e., to increase the canopy cover of *Salix bebbiana* from 2 percent to 55 percent on the stream reach within 12 years). The associated species in the average canopy cover tables can be used to determine species lists for site rehabilitation. For example, on a gravel-mining site, there may be no vegetation remaining in the riparian or wetland area. The tables and appendices provide a list of species that may occur on the site. The species that are most desirable, available for planting, or easiest to obtain or establish can be selected.

If the goal is to provide shading of a stream for trout habitat, the tables and appendices will provide a list of species that will grow on a type, so that informed decisions can be made to prevent planting species unsuited for the site. Long term planning, land use decisions, threatened and endangered species consultations, and environmental documents can also be guided by successional information presented in each habitat type or community type.

KEY TO RIPARIAN AND WETLAND SITES OF ALBERTA'S GRASSLAND NATURAL REGION

(Including the eastern portion of the Foothills Parkland Subregion, the southern portion of the Central Parkland Subregion, and the Cypress Hills portion of the Montane Subregion)

BACKGROUND

1. This key is written for the area of Southern Alberta east of the Rocky Mountains. This area includes all subregions of the Grassland Natural Region, the Cypress Hills portion of the Montane Subregion of the Rocky Mountain Natural Region, and an adjacent fringe of various widths within the Central Parkland and Foothills Parkland Subregions lying adjacent to the grasslands on the north and west. Geographic boundaries for this key are the provincial boundaries on the southern and eastern edges, the foothills of the Rocky Mountains on the western edge and an indistinct line on the north in vicinity of the Battle River near Stettler and Wainwright that represents the transition from grassland to aspen parkland. The Cypress Hills are included here, even though they are unique within the study area due to their montane setting.

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

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) and/or human-caused (e.g., livestock overgrazing or the clearing of groves), the key will then take the user to a community type. ***NOTE: This document*** describes ***several major seral plant communities (community types) that are stable for times important for land management consideration.*** The possible potential(s) for such a site can be projected by reading the Successional Information section of each community type.

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 a broad range of disturbance.

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.

3. Identify the 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 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.

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. ..... **Key to Coniferous Tree Types (p. 30)**

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

2. *Acer negundo* (Manitoba maple) or *Populus tremuloides* (aspen) present ***AND*** successfully reproducing (10 or more trees per acre) ***AND*** not restricted to microsites. ..... **Key to Deciduous Tree Types (p. 31)**

2. *Acer negundo* (Manitoba maple) and *Populus tremuloides* (aspen) absent ***OR*** if present, not successfully reproducing, ***OR*** are restricted to microsites. **3**

3. Other deciduous tree species present with a combined canopy cover of at least 25 percent..... ..... **Key to Deciduous Tree Types (p. 31)**

3. Trees species with a combined canopy cover of less than 25 percent. **4**

4. Shrubs with a combined canopy cover of at least 10 percent..... **Key to Shrub Types (p. 33)**

4. 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. 38)**

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 reproducing successfully..... **2**

1. *Picea glauca* (white spruce) absent, or if present, not reproducing successfully. **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. 42)**

2. *Equisetum arvense* (common horsetail) or *Equisetum sylvaticum* (woodland horsetail), individually or in combination, with less than 25 percent canopy cover. **3**

3. *Cornus stolonifera* (red-osier dogwood) or willows (*Salix* spp.) present..... ..... ***Picea glauca/Cornus stolonifera*** **(white spruce/red-osier dogwood) Habitat Type (p. 46)**

3. *Cornus stolonifera* (red-osier dogwood) and willows (*Salix* spp.) absent. **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), which is 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

Acer negundo (Manitoba maple) or *Populus tremuloides* (aspen) present ***AND*** successfully reproducing (10 or more trees per acre) ***AND NOT*** restricted to microsites ***OR*** deciduous tree species other than *Acer negundo* (Manitoba maple) or *Populus tremuloides* (aspen) with a combined canopy cover of at least 25 percent.

1. *Acer negundo* (Manitoba maple) or *Populus tremuloides* (aspen) with at least 5 percent canopy cover..... **2**

1. *Acer negundo* (Manitoba maple) and *Populus tremuloides* (aspen) with less than 5 percent canopy cover, deciduous tree species other than *Acer negundo* (Manitoba maple) or *Populus tremuloides* (aspen) have a combined canopy cover of at least 25 percent **5**

2. *Acer negundo* (Manitoba maple) with at least 5 percent canopy cover..... ..... ***Acer negundo/Prunus virginiana*** **(Manitoba maple/choke cherry) Habitat Type (p. 53)**

2. *Acer negundo* (Manitoba maple) with less than 5 percent canopy cover **3**

3. *Cornus stolonifera* (red-osier dogwood) or Willows (*Salix* spp.), individually or in combination, with at least 5 percent canopy cover; *Picea glauca* (white spruce) absent..... .....***Populus tremuloides/Cornus stolonifera*** **(aspen/red-osier dogwood) Habitat Type (p. 167)**

3. *Cornus stolonifera* (red-osier dogwood) or Willows (*Salix* spp.), individually or in combination, with less than 5 percent canopy cover **4**

4. Shrubs with at least 25 percent total canopy cover .... ***Populus tremuloides/Symphoricarpos occidentalis*** **(aspen/buckbrush) Community Type (p. 175)**

4. Shrubs with less than 25 percent total canopy cover..... ..... ***Populus tremuloides/*****Herbaceous (aspen/herbaceous) Community Type (p. 180)**

5. *Populus balsamifera* (balsam poplar), *P. angustifolia* (narrow-leaf cottonwood), or *P. deltoides* (plains cottonwood) with a greater canopy cover than other individual tree species. **6**

5. Other individual tree species with greater canopy cover than *Populus balsamifera* (balsam poplar), *P. angustifolia* (narrow-leaf cottonwood), or *P. deltoides* (plains cottonwood). **17**

6. *Populus balsamifera* (balsam poplar) with greater canopy cover than either *P. angustifolia* (narrow-leaf cottonwood) or *P. deltoides* (plains cottonwood). **7**

6. *Populus angustifolia* (narrow-leaf cottonwood) or *P. deltoides* (plains cottonwood) with greater canopy cover than *P. balsamifera* (balsam poplar). **10**

7. Seedling or sapling age classes (dbh < 13 cm [5 in]) of *Populus balsamifera* (balsam poplar) dominate the site; the site is a recently deposited alluvial bar.....
..... ***Populus balsamifera*/Recent Alluvial Bar (balsam poplar/recent alluvial bar) Community Type (p. 109)**

7. Pole or mature age classes (dbh > 13 cm [5 in]) of *Populus balsamifera* (balsam poplar) dominate. **8**

8. Shrubs with at least 25 percent canopy cover. **9**

8. Shrubs with less than 25 percent canopy cover.....
..... ***Populus balsamifera*/Herbaceous (balsam poplar/herbaceous) Community Type (p. 129)**

9. *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover.....
..... ***Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) Community Type (p. 97)**

9. *Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover .....
..... ***Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) Community Type (p. 115)**

10. *Populus angustifolia* (narrow-leaf cottonwood) with greater canopy cover than *P. deltoides* (plains cottonwood).……. **11**

10. *Populus deltoides* (plains cottonwood) with greater canopy cover than *P. angustifolia* (narrow-leaf cottonwood).……. **14**

11. Seedling or sapling age classes (dbh < 13 cm [5 in]) of *Populus angustifolia* (narrow-leaf cottonwood) dominate the site; the site is a recently deposited alluvial bar. .....
... ***Populus angustifolia/*Recent Alluvial Bar (narrow-leaf cottonwood/recent alluvial bar) Community Type (p. 75)**

11. Pole or mature age classes (dbh > 13 cm [5 in]) of *Populus angustifolia* (narrow-leaf cottonwood) dominate the site..... **12**

12. Shrubs with at least 25 percent canopy cover. **13**

12. Shrubs with less than 25 percent canopy cover.....
.....***Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/herbaceous) Community Type (p. 90)**

13. *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover. .....
.....***Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) Community Type (p. 66)**

13. *Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover. .....
.***Populus angustifolia/Symphoricarpos occidentalis*** **(narrow-leaf cottonwood/buckbrush) Community Type (p. 81)**

14. Seedling or sapling age classes (dbh < 13 cm [5 in]) of *Populus deltoides* (plains cottonwood) dominate the site; the site is a recently deposited alluvial bar.....
.....***Populus deltoides*****/Recent Alluvial Bar (plains cottonwood/recent alluvial bar) Community Type (p. 145)**

14. Pole or mature age classes (dbh > 13 cm [5 in]) of *Populus deltoides* (plains cottonwood) dominate the site. **15**

15. Shrubs with at least 25 percent canopy cover. **16**

15. Shrubs with less than 25 percent canopy cover .....
.....***Populus deltoides*****/Herbaceous (plains cottonwood/herbaceous) Community Type (p. 160)**

16. *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover.....
.....***Populus deltoides/Cornus stolonifera*** **(plains cottonwood/red-osier dogwood) Community Type (p. 136)**

16. *Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover. .....
.....***Populus deltoides/Symphoricarpos occidentalis*** **(plains cottonwood/buckbrush) Community Type (p. 151)**

17. 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.

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

KEY TO SHRUB TYPES

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

1. Willows (*Salix* spp.) with at least 10 percent combined canopy cover. ..... **Willow Shrub Key (p. 34)**

1. Willows (*Salix* spp.) with less than 10 percent combined canopy cover..... **Non-Willow Shrub Key (p. 36)**

KEY TO WILLOW SHRUB TYPES

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

1. *Salix lutea* (yellow willow) with less than 5 percent canopy cover ***OR*** less canopy cover than either *Salix bebbiana* (beaked willow), *Salix petiolaris* (basket willow), or *Salix planifolia* (flat-leaved willow) **3**

2. *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover.....
……..***Salix lutea/Cornus stolonifera*** **(yellow willow/red-osier dogwood) Habitat Type (p. 228)**

2. *Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover .....
..... ***Salix lutea*** **(yellow willow) Community Type (p. 235)**

3. *Salix bebbiana* (beaked willow) with at least 5 percent canopy cover ***AND*** greater canopy cover than each *Salix petiolaris* (basket willow) or *Salix planifolia* (flat-leaved willow) **4**

3. *Salix bebbiana* (beaked willow) with less than 5 percent canopy cover ***OR*** less canopy cover than either *Salix petiolaris* (basket willow) or *Salix planifolia* (flat-leaved willow) **6**

4. *Carex atherodes* (awned sedge), *C. utriculata* (beaked sedge), or *C. aquatilis* (water sedge), individually or in combination, with at least 10 percent canopy cover ***AND*** *Cornus stolonifera* (red-osier dogwood) with less than 5 percent canopy cover.....***Salix bebbiana/Carex atherodes*** **(beaked willow/awned sedge) Habitat Type (p. 191)**

4. *Carex atherodes* (awned sedge), *C. utriculata* (beaked sedge), or *C. aquatilis* (water sedge), in combination, with less than 10 percent canopy cover ***OR*** *Cornus stolonifera* (red-osier dogwood) with at least 5 percent canopy cover……. ….**5**

5. *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover.....
..... ***Salix bebbiana/Cornus stolonifera*** **(beaked willow/red-osier dogwood) Habitat Type (p. 200)**

5. *Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover .....
.....***Salix bebbiana*** **(beaked willow) Community Type (p. 210)**

6. *Salix planifolia* (flat-leaved willow) with at least 5 percent canopy cover ***AND*** greater canopy cover than *Salix petiolaris* (basket willow) **7**

6. *Salix planifolia* (flat-leaved willow) with less than 5 percent canopy cover ***OR*** less canopy cover than *Salix petiolaris* (basket willow) **8**

7. *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 planifolia/Carex utriculata*** **(flat-leaved willow/beaked sedge) Habitat Type (p. 256)**

7. *Carex atherodes* (awned sedge), *C. utriculata* (beaked sedge), or *C. aquatilis* (water sedge), in combination, with less than 10 percent canopy cover .....***Salix planifolia*** **(flat-leaved willow) Community Type (p. 263)**

8. *Salix petiolaris* (basket willow) with greater canopy cover than other willow species.....**9**

8. Other willow species with greater canopy cover than *Salix petiolaris* (basket willow) **11**

9. *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. 241)**

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

10. Shrub species other than *Salix petiolaris* (basket willow) with at least 10 percent canopy cover, ***AND*** *Cornus stolonifera* (red-osier dogwood) and other willow species, individually or in combination, with at least 1 percent canopy cover ..... ***Salix petiolaris/Cornus stolonifera*** **(basket willow/red-osier dogwood) Habitat Type (p. 247)**

10. Shrub species other than *Salix petiolaris* (basket willow) with less than 10 percent canopy cover, ***OR*** *Cornus stolonifera* (red-osier dogwood) and other willow species, in combination, with less than 1 percent canopy cover. .....***Salix petiolaris*** **(basket willow) Community Type (p. 253)**

11. Individual ***non-willow shrub species*** with greater canopy cover than any ***individual willow shrub species***. **GO TO THE NON-WILLOW SHRUB KEY** ..... **(p. 36)**

11. Individual ***willow species*** with greater canopy cover than any individual ***non-willow shrub species*****.....12**

12. *Salix amygdaloides* (peach-leaved willow) with greater canopy cover than other individual willow species..... .....***Salix amygdaloides*** **(peach-leaved willow) Community Type (p. 186)**

12. Another willow species with greater canopy cover than *Salix amygdaloides* (peach-leaved willow).....**13**

13. *Salix exigua* (sandbar willow) with greater canopy cover than any other individual willow species .... ***Salix exigua*** **(sandbar willow) Community Type (p. 218)**

13. Other individual willow species with greater canopy cover than *Salix exigua* (sandbar willow). **14**

14. 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.

14. 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

1. *Artemisia cana* (silver sagebrush) with at least 10 percent canopy cover. ..... ……***Artemisia cana/Agropyron smithii*** **(silver sagebrush/western wheat grass) Habitat Type (p. 267)**

1. *Artemisia cana* (silver sagebrush) with less than 10 percent canopy cover. **2**

2. *Sarcobatus vermiculatus* (greasewood) with at least 10 percent canopy cover. ....***Sarcobatus vermiculatus/Agropyron smithii*** **(greasewood/western wheat grass) Habitat Type (p. 293)**

2. *Sarcobatus vermiculatus* (greasewood) with less than 10 percent canopy cover. **3**

3. *Betula occidentalis* (water birch) with at least 15 percent canopy cover ***AND WITH*** the greatest canopy cover in the tallest layer. ..... ***Betula occidentalis*** **(water birch) Community Type (p. 272)**

3. *Betula occidentalis* (water birch) with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **4**

4. *Shepherdia argentea* (thorny buffaloberry) with at least 15 percent canopy cover ***AND WITH*** the greatest cover in the tallest layer. ..... ***Shepherdia argentea*** **(thorny buffaloberry) Community Type (p. 297)**

4. *Shepherdia argentea* (thorny buffaloberry) with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **5**

5. *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. 277)**

5. *Cornus stolonifera* (red-osier dogwood) with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **6**

6. *Crataegus rotundifolia* (round-leaved hawthorn) or *C. douglasii* (Douglas hawthorn), individually or in combination, with at least 15 percent canopy cover ***AND WITH*** the greatest canopy cover in the tallest layer……..
.....***Crataegus rotundifolia*** **(round-leaved hawthorn) Community Type (p. 280)**

6. *Crataegus rotundifolia* (round-leaved hawthorn) or *C. douglasii* (Douglas hawthorn), individually or in combination, with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer…….**7**

7. *Prunus virginiana* (choke cherry) with at least 15 percent canopy cover ***AND WITH*** the greatest canopy cover in the tallest layer..... ***Prunus virginiana*** **(choke cherry) Community Type (p. 287)**

7. *Prunus virginiana* (choke cherry) with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer……**8**

8. *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. 283)**

8. *Elaeagnus commutata* (silverberry) with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **9**

9. *Rosa woodsii* (common wild rose) or *R. acicularis* (prickly rose), individually or in combination, with at least 15 percent canopy cover ***AND WITH*** the greatest canopy cover in the tallest layer.....
..... ***Rosa woodsii*** **(common wild rose) Community Type (p. 290)**

9. *Rosa woodsii* (common wild rose) or *R. acicularis* (prickly rose), individually or in combination, with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **10**

10. *Symphoricarpos occidentalis* (buckbrush) or *S. albus* (snowberry) individually or in combination, with at least 15 percent canopy cover ***AND WITH*** the greatest canopy cover in the tallest layer.....
.....***Symphoricarpos occidentalis*** **(buckbrush) Community Type (p. 303)**

10. *Symphoricarpos occidentalis* (buckbrush) or *S. albus* (snowberry), individually or in combination, with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer.....**11**

11. 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.

11. 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. Sedges (*Carex* species) with a combined canopy cover of at least 25 percent.....**Sedge Key (p. 38)**

1. Sedges (*Carex* species) without a combined canopy cover of at least 25 percent.....**Non-Sedge Key (p. 39)**

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. 314)**

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. 325)**

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. 309)**

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

4. *Carex lanuginosa* (woolly sedge) or *C. lasiocarpa* (hairy-fruited sedge), individually or in combination, with greater canopy cover than all other sedge species.....***Carex lanuginosa*** **(woolly sedge) Habitat Type (p. 319)**

4. *Carex lanuginosa* (woolly sedge) or *C. lasiocarpa* (hairy-fruited sedge), in combination, 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. 387)**

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. 378)**

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

3. *Eleocharis palustris* (creeping spike-rush) with at least 25 percent canopy cover..... …….....***Eleocharis palustris* (creeping spike-rush) Habitat Type (p. 349)**

3. *Eleocharis palustris* (creeping spike-rush) with less than 25 percent canopy cover **4**

4. *Phalaris arundinacea* (reed canary grass) with at least 25 percent canopy cover..... ….....***Phalaris arundinacea* (reed canary grass) Habitat Type (p. 362)**

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

5. *Scirpus paludosus* (prairie bulrush) with at least 15 percent canopy cover..... ……..... ***Scirpus paludosus* (prairie bulrush) Habitat Type (p. 381)**

5. *Scirpus paludosus* (prairie bulrush) with less than 15 percent canopy cover **6**

6. *Calamagrostis inexpansa* (northern reedgrass) or *C. stricta* (narrow reedgrass), individually or in combination, with at least 25 percent canopy cover.....***Calamagrostis stricta* (narrow reedgrass) Community Type (p. 339)**

6. *Calamagrostis inexpansa* (northern reedgrass) or *C. stricta* (narrow reedgrass), in combination, with less than 25 percent canopy cover **7**

7. *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) with at least 15 percent canopy cover..... ……..... ***Puccinellia nuttalliana*** **(Nuttall's salt-meadow grass) Habitat Type (p. 373)**

7. *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) with less than 15 percent canopy cover. **8**

8. *Scirpus pungens* (three-square rush) with at least 15 percent canopy cover…… .... ***Scirpus pungens*** **(three-square rush) Habitat Type (p. 384)**

8. *Scirpus pungens* (three-square rush) with less than 15 percent canopy cover..... **9**

9. *Deschampsia cespitosa* (tufted hair grass) with at least 15 percent canopy cover .... ***Deschampsia cespitosa*** **(tufted hair grass) Habitat Type (p. 342)**

9. *Deschampsia cespitosa* (tufted hair grass) with less than 15 percent canopy cover. **10**

10. *Distichlis stricta* (salt grass) with at least 15 percent canopy cover..... ..... ***Distichlis stricta*** **(salt grass) Habitat Type (p. 346)**

10. *Distichlis stricta* (salt grass) with less than 15 percent canopy cover **11**

11. *Agropyron smithii* (western wheat grass) with at least 25 percent canopy cover..... ..... …….***Agropyron smithii*** **(western wheat grass) Habitat Type (p. 331)**

11. *Agropyron smithii* (western wheat grass) with less than 25 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. *Polygonum coccineum* (water smartweed) and *P. amphibium* (water smartweed), individually or in combination, with a greater canopy cover than any other individual herbaceous species ..... ……..***Polygonum coccineum*** **(water smartweed) Community Type (p. 371)**

1. Other individual herbaceous species with a greater canopy cover than *Polygonum coccineum* (water smartweed) and *P. amphibium* (water smartweed)..... **2**

2. *Salicornia europaea* (samphire) with a greater canopy cover than any other individual herbaceous species…..... ……..***Salicornia europaea*** **(samphire) Community Type (p. 376)**

2. Other individual herbaceous species with greater canopy cover than *Salicornia europaea* (samphire). **3**

3. *Juncus balticus* (wire rush) with a greater canopy cover than any other individual herbaceous species..... ..... ***Juncus balticus*** **(wire rush) Community Type (p. 358)**

3. Other individual herbaceous species with a greater canopy cover than *Juncus balticus* (wire rush)..... **4**

4. *Hordeum jubatum* (foxtail barley) with a greater canopy cover than any other individual herbaceous species..... ……..***Hordeum jubatum*** **(foxtail barley) Community Type (p. 354)**

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

5. *Glycyrrhiza lepidota* (wild licorice) with a greater canopy cover than any other individual herbaceous species……. .....***Glycyrrhiza lepidota*** **(wild licorice) Community Type (p. 352)**

5. Other individual herbaceous species with a greater canopy cover than *Glycyrrhiza lepidota* (wild licorice). **6**

6. *Poa pratensis* (Kentucky bluegrass) with a greater canopy cover than any other individual herbaceous species..... .....***Poa pratensis*** **(Kentucky bluegrass) Community Type (p. 367)**

6. Other individual herbaceous species with a greater canopy cover than *Poa pratensis* (Kentucky bluegrass). **7**

7. *Bromus inermis* (smooth brome) with a greater canopy cover than any other individual herbaceous species..... .....***Bromus inermis*** **(smooth brome) Community Type (p. 335)**

7. Other individual herbaceous species with a greater canopy cover than *Bromus inermis* (smooth brome). **8**

8. 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.

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

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 = 11

LOCATION AND ASSOCIATED LANDFORMS

Within the Grassland Natural Region of Alberta, the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type is a minor to incidental type at low to mid elevations along the northern edges of the study area, and at higher elevations in the Central and Foothills Parkland Subregions and in the Cypress Hills. This type characteristically occurs on flat, low lying sites with poor drainage. It also occurs on gentle toe slopes, seeps, stream terraces, and on high elevation basins adjacent to lakes, fens, and wet meadows having low gradient meandering streams. Boundaries with adjacent types are often distinct.

VEGETATION

Picea glauca (white spruce) is the only coniferous tree species present, typically forming a closed canopy. Also present may be *Populus tremuloides* (aspen) and *Populus balsamifera* (balsam poplar). Shrub species coverage is low. The canopy coverage of the herbaceous layer is high, dominated by *Equisetum arvense* (common horsetail). The sometimes-extreme micro-relief caused by windthrow root crown pits and mounds helps to account for high species richness with a mix of upland and wetland species (Table 4).

Table 4. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 late seral to climax stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index [1]
	Average	Range		
Trees				
Betula papyrifera (white birch)	3	0-3	14	6
Picea glauca (white spruce)	74	0-90	100	86
Populus balsamifera (balsam poplar)	2	0-3	57	11
Populus tremuloides (aspen)	3	0-3	14	6
Shrubs				
Alnus tenuifolia (river alder)	5	0-10	43	15
Amelanchier alnifolia (saskatoon)	1	0-1	29	5
Berberis repens (creeping mahonia)	1	0-1	14	4
Cornus canadensis (bunchberry)	2	0-3	57	11
Cornus stolonifera (red-osier dogwood)	2	0-3	43	9
Linnaea borealis (twinflower)	1	0-3	57	8
Lonicera involucrata (bracted honeysuckle)	2	0-3	29	8
Ribes hudsonianum (northern black currant)	2	0-3	29	8
Ribes oxyacanthoides (northern gooseberry)	1	0-1	14	4
Rosa spp. (rose)	2	1-3	100	14
Rubus arcticus (dwarf raspberry)	3	0-3	14	6
Rubus pubescens (dewberry)	2	0-3	57	11

Table 4. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 late seral to climax stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type

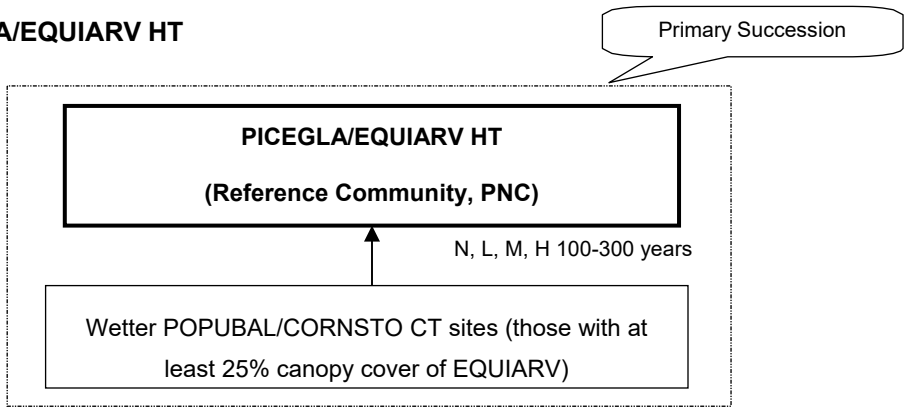
Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Salix bebbiana (beaked willow)	1	0-1	43	7
Salix myrtillifolia (myrtle-leaved willow)	1	0-1	14	4
Salix spp. (willow)	1	0-1	14	4
Shepherdia canadensis (Canada buffaloberry)	1	0-1	29	5
Symphoricarpos albus (snowberry)	1	0-1	29	5
Symphoricarpos occidentalis (buckbrush)	1	0-1	29	5
Graminoids				
Bromus vulgaris (woodland brome)	1	0-1	14	4
Calamagrostis canadensis (bluejoint)	5	0-10	29	12
Carex concinna (beautiful sedge)	1	0-1	14	4
Carex deweyana (Dewey's sedge)	1	0-1	14	4
Carex disperma (two-seeded sedge)	5	0-10	43	15
Carex praticola (meadow sedge)	1	0-1	14	4
Carex rossii (Ross' sedge)	1	0-1	14	4
Carex sprengelii (Sprengel's sedge)	1	0-1	14	4
Carex vaginata (sheathed sedge)	2	0-3	29	8
Cinna latifolia (drooping wood-reed)	1	0-1	14	4
Poa palustris (fowl bluegrass)	1	0-1	14	4
Poa pratensis (Kentucky bluegrass)	2	0-3	29	8
Schizachne purpurascens (purple oat grass)	10	0-10	14	12
Trisetum cernuum (nodding trisetum)	1	0-1	14	4
Forbs				
Actaea rubra (red and white baneberry)	1	0-3	43	7
Aralia nudicaulis (wild sarsaparilla)	1	0-1	14	4
Aster ciliolatus (Lindley's aster)	1	0-1	14	4
Aster conspicuus (showy aster)	1	0-1	14	4
Aster spp. (aster)	1	0-1	14	4
Astragalus spp. (milk vetch)	1	0-1	14	4
Caltha palustris (marsh-marigold)	1	0-1	14	4
Cirsium arvense (Canada thistle)	1	0-1	14	4
Cypripedium spp. (lady's-slipper)	1	0-1	14	4
Disporum trachycarpum (fairybells)	1	0-1	14	4
Epilobium angustifolium (common fireweed)	1	0-1	43	7
Fragaria virginiana (wild strawberry)	1	0-1	57	8
Galium boreale (northern bedstraw)	1	0-1	43	7
Galium triflorum (sweet-scented bedstraw)	1	0-3	71	8
Geranium richardsonii (wild white geranium)	1	0-3	57	8
Geum aleppicum (yellow avens)	3	0-3	14	6
Geum macrophyllum (large-leaved yellow avens)	1	0-1	14	4
Habenaria obtusata (blunt-leaved bog orchid)	1	0-1	14	4
Heracleum lanatum (cow parsnip)	1	0-1	29	5
Lathyrus ochroleucus (cream-colored vetchling)	2	0-3	43	9
Mertensia paniculata (tall lungwort)	1	0-1	43	7
Mitella nuda (bishop's-cap)	4	0-10	57	15
Moneses uniflora (one-flowered wintergreen)	1	0-1	14	4
Osmorhiza chilensis (blunt-fruited sweet cicely)	1	0-1	29	5
Osmorhiza depauperata (spreading sweet cicely)	1	0-3	43	7
Petasites palmatus (palmate-leaved coltsfoot)	3	0-3	43	11
Pyrola asarifolia (common pink wintergreen)	1	0-1	14	4
Ranunculus abortivus (small-flowered buttercup)	1	0-1	14	4
Ranunculus acris (tall buttercup)	1	0-1	14	4
Senecio pauperculus (balsam groundsel)	2	0-3	29	8

Table 4. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 late seral to climax stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type

Species	Percent Canopy Cover Average	Range	Constancy (Frequency)	Prominence Index [1]
Senecio pseudaureus (thin-leaved ragwort)	1	0-1	14	4
Smilacina racemosa (false Solomon's-seal)	1	0-1	14	4
Smilacina stellata (star-flowered Solomon's-seal)	1	0-1	43	7
Smilacina trifolia (three-leaved Solomon's-seal)	10	0-10	14	12
Taraxacum officinale (common dandelion)	1	0-3	43	7
Thalictrum occidentale (western meadow rue)	2	0-3	29	8
Thalictrum venulosum (veiny meadow rue)	3	0-3	14	6
Urtica dioica (common nettle)	1	0-1	14	4
Valeriana dioica (northern valerian)	1	0-1	14	4
Vicia americana (wild vetch)	1	0-1	14	4
Viola adunca (early blue violet)	1	0-1	14	4
Viola canadensis (western Canada violet)	11	0-30	43	22
Viola renifolia (kidney-leaved violet)	1	0-1	14	4
Zizia aptera (heart-leaved Alexanders)	1	0-1	14	4
Unknown Moss	20	0-20	14	17
Ferns and Allies				
Equisetum arvense (common horsetail)	45	0-90	86	62
Equisetum scirpoides (dwarf scouring-rush)	10	0-10	14	12
Equisetum sylvaticum (woodland horsetail)	40	0-40	14	24

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

Figure 3. PICEGLA/EQUIARV HT



Successional Pathway Diagram of PICEGLA/EQUIARV Sites in Southern Alberta Grasslands

Reference Community = PICEGLA/EQUIARV HT

Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
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

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site. It is based on the assumption that hydrologic potential does not change. The hydrology can change when fluvial deposition raises the elevation of the floodplain, causing the higher terraces to become too dry to support riparian species. The most likely vegetation potential to result from such a change in hydrology would be either a *Populus tremuloides* (aspen) upland type or a *Picea glauca* (white spruce) upland type. The time span is estimated for the stand to become dominated under undisturbed conditions by at least 50 percent cover of climax (or overstory indicator) species.

SUCCESSIONAL INFORMATION

Populus balsamifera (balsam poplar) and *Populus tremuloides* (aspen) may be abundant in earlier seral stands along with seedling and sapling *Picea glauca* (white spruce). Following disturbance, the understories of later seral stands appear to shift to heavier cover of *Equisetum arvense* (common horsetail) and greater presence of such forbs as *Geranium richardsonii* (wild white geranium) and *Geum* species (yellow avens and large-leaved yellow avens). Figure 3 is a generalized schematic of the successional pathway followed on sites of this type.

SOILS

Parent material is usually alluvium and soils are generally Brunisols, Chernozems, 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). Soils textures vary little between clay loam and silt loam with coarse fragments common throughout. Water tables typically remain within 1 m (39 in) of the surface throughout the growing season.

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 the various *Salix* species (willow) types. Adjacent drier types may be dominated by the *Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) habitat type, the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) community type, or a *Picea glauca* upland type.

MANAGEMENT INFORMATION

Livestock

Herbage production can be moderate to high. However, these sites have little or no value for livestock other than shading. Soils are relatively sensitive to disturbance and cattle can easily churn the wet soil and destroy plant cover as well as limit tree seedling establishment (Youngblood and others 1985b).

Timber

Timber productivity is moderate (Pfister and others 1977, Steele and others 1983) but offers limited potential due to the extremely fragile sites. Due to high water tables, the trees are extremely susceptible to windthrow and soil loss may follow all forms of timber harvesting. Possible options for timber harvesting includes winter logging with at least 60 cm (around 24 in) of snow on the ground, designated skid trails, and winching (Pfister and Sherwood 1989). However, according to Steele and others (1983), even if logged when the ground is frozen to reduce equipment impacts, water tables can rise, creating additional problems in site management. Elevated water tables resulting from harvesting activity may cause regeneration problems.

Wildlife

Deer, elk, and moose show moderate winter use of this type. During the summer months, black bear use these sites for wallows. Big game may use this habitat type, especially during the rutting season (Youngblood and others 1985b). Other wildlife, especially small mammals and avian species, make high use of these sites due to their structural diversity. Great blue herons are known to nest in *Picea* (spruce) stands in Montana, if a high degree of isolation during nesting is possible (Parker 1980). Osprey will nest in old growth *Picea* (spruce) (Snow 1973).

Fisheries

Those stands of the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type adjacent to streams provide hiding, thermal cover, and streambank stability for fish.

Fire

Fire susceptibility is low. 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.

Recreational Uses and Considerations

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

OTHER STUDIES

Beckingham and Archibald (1996) describe similar community types in the Boreal Mixedwood, the Boreal Highlands, and Sub arctic 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 and others (1996) also describe similar community types for the Lower Foothills, Upper Foothills, and Montane Natural Subregions of Southwestern 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/Cornus stolonifera Habitat Type
(White Spruce/Red-Osier Dogwood Habitat Type)

PICEGLA/CORNSTO
Number of Stands Sampled = 11
Number of Stands Sampled in Alberta = 11

LOCATION AND ASSOCIATED LANDFORMS

Within the Grassland Natural Region of Alberta, the *Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) habitat type is a minor to incidental type at low to mid elevations along the northern edges of the study area, and at higher elevations in the Central and Foothills Parkland Subregions and in the Cypress Hills. This type occurs on moist sites on gently undulating or flat alluvial benches, on terraces bordering streams, and in steep wooded draws leading into river valleys.

VEGETATION

The relatively closed overstory contains mature *Picea glauca* (white spruce). Some sites may in earlier seral

stage have considerable cover of *Populus balsamifera* (balsam poplar) or *Populus tremuloides* (aspen) present. Stand species richness may be high, but constancy and cover for most species is low. Shrub cover can be abundant and herbaceous cover may range from sparse to high. Many stands have considerable cover of the exotic disturbance increaser species *Poa pratense* (Kentucky bluegrass) and *Taraxacum officinale* (dandelion) (Table 5).

Table 5. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 late seral to climax stands of the *Picea glauca/Cornus stolonifera* (red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Betula papyrifera (white birch)	7	0-20	64	21
Picea glauca (white spruce)	24	3-60	100	49
Populus balsamifera (balsam poplar)	33	0-70	73	49
Populus tremuloides (aspen)	21	0-70	55	34
Shrubs				
Alnus tenuifolia (river alder)	8	0-20	55	21
Amelanchier alnifolia (saskatoon)	3	0-10	73	15
Cornus canadensis (bunchberry)	2	0-3	45	9
Cornus stolonifera (red-osier dogwood)	10	1-30	100	32
Corylus cornuta (beaked hazelnut)	3	0-3	9	5
Elaeagnus commutata (silverberry)	12	0-20	18	15
Linnaea borealis (twinflower)	3	0-10	55	13
Lonicera dioica (twining honeysuckle)	1	0-1	18	4
Lonicera involucrata (bracted honeysuckle)	3	0-10	55	13
Prunus virginiana (choke cherry)	1	0-3	27	5
Ribes americanum (wild black currant)	3	0-3	9	5
Ribes lacustre (bristly black currant)	1	0-3	36	6
Ribes oxyacanthoides (northern gooseberry)	2	0-3	36	8
Ribes triste (wild red currant)	3	0-3	18	7
Rosa spp. (rose)	7	1-20	100	26
Rubus idaeus (wild red raspberry)	6	0-10	73	21
Rubus pubescens (dewberry)	4	0-10	64	16
Salix bebbiana (beaked willow)	10	0-10	18	13
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	9
Salix myrtillifolia (myrtle-leaved willow)	1	0-1	9	3
Salix pseudomonticola (false mountain willow)	1	0-1	18	4
Salix scouleriana (Scouler's willow)	1	0-3	36	6
Shepherdia canadensis (Canada buffaloberry)	1	0-3	36	6

Table 5. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 late seral to climax stands of the *Picea glauca/Cornus stolonifera* (red-osier dogwood) habitat type

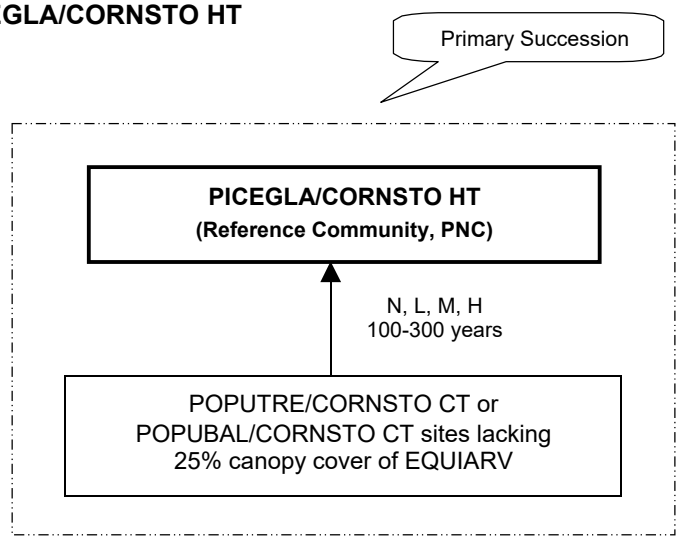
Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Symphoricarpos spp. (buckbrush)	2	0-1	82	13
Viburnum edule (low-bush cranberry)	8	0-20	64	23
Graminoids				
Agropyron repens (quack grass)	5	0-10	18	9
Agropyron trachycaulum (slender wheat grass)	1	0-1	9	3
Bromus altissimus (Canada brome)	1	0-1	9	3
Bromus ciliatus (fringed brome)	1	0-1	18	4
Bromus inermis (smooth brome)	7	0-10	18	11
Calamagrostis canadensis (bluejoint)	4	0-10	55	15
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	36	8
Elymus innovatus (hairy wild rye)	3	0-3	9	5
Glyceria striata (fowl manna grass)	3	0-3	9	5
Unknown Grass	1	0-1	9	3
Oryzopsis asperifolia (white-grained mountain rice grass)	3	0-3	9	5
Phleum pratense (timothy)	2	0-3	18	6
Poa palustris (fowl bluegrass)	10	0-20	18	13
Poa pratensis (Kentucky bluegrass)	2	0-3	36	8
Schizachne purpurascens (purple oat grass)	1	0-1	18	4
Trisetum cernuum (nodding trisetum)	3	0-3	9	5
Forbs				
Achillea millefolium (common yarrow)	1	0-1	9	3
Achillea sibirica (many-flowered yarrow)	1	0-1	18	4
Actaea rubra (red and white baneberry)	1	0-1	18	4
Agrimonia striata (agrimony)	1	0-1	9	3
Aquilegia spp. (columbine)	1	0-1	9	3
Aralia nudicaulis (wild sarsaparilla)	12	0-30	64	28
Aster ciliolatus (Lindley's aster)	3	0-3	9	5
Aster conspicuus (showy aster)	2	0-3	55	10
Aster hesperius (western willow aster)	3	0-3	9	5
Aster laevis (smooth aster)	1	0-3	27	5
Aster spp. (aster)	2	0-3	18	6
Chrysanthemum leucanthemum (ox-eye daisy)	1	0-1	9	3
Cicuta maculata (water-hemlock)	2	0-3	18	6
Circaea alpina (small enchanter's nightshade)	1	0-1	9	3
Cirsium arvense (Canada thistle)	1	0-1	9	3
Disporum trachycarpum (fairybells)	1	0-1	9	3

Table 5. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 late seral to climax stands of the *Picea glauca/Cornus stolonifera* (red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Epilobium angustifolium (common fireweed)	1	0-3	55	7
Fragaria virginiana (wild strawberry)	3	0-10	64	14
Galeopsis tetrahit (hemp-nettle)	20	0-20	9	13
Galium boreale (northern bedstraw)	1	0-1	73	9
Galium triflorum (sweet-scented bedstraw)	2	0-10	64	11
Geranium richardsonii (wild white geranium)	2	0-3	18	6
Geum macrophyllum (large-leaved yellow avens)	3	0-3	9	5
Habenaria spp. (bog orchid)	1	0-1	9	3
Heracleum lanatum (cow parsnip)	1	0-1	27	5
Lappula squarrosa (bluebur)	1	0-1	9	3
Lathyrus ochroleucus (cream-colored vetchling)	1	0-3	55	7
Maianthemum canadense (wild lily-of-the-valley)	1	0-1	36	6
Mentha arvensis (wild mint)	3	0-3	9	5
Mertensia paniculata (tall lungwort)	1	0-1	55	7
Mitella nuda (bishop's-cap)	1	0-3	36	6
Osmorhiza depauperata (spreading sweet cicely)	1	0-1	27	5
Petasites palmatus (palmate-leaved coltsfoot)	2	0-3	45	9
Pyrola asarifolia (common pink wintergreen)	2	0-10	45	9
Ranunculus abortivus (small-flowered buttercup)	1	0-1	9	3
Scutellaria galericulata (marsh skullcap)	1	0-1	9	3
Senecio pauperculus (balsam groundsel)	1	0-1	9	3
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
Stellaria longipes (long-stalked chickweed)	1	0-1	9	3
Taraxacum officinale (common dandelion)	2	0-3	45	9
Thalictrum spp. (meadow rue)	1	0-1	9	3
Thalictrum venulosum (veiny meadow rue)	5	0-10	27	12
Trientalis borealis (northern starflower)	1	0-1	27	5
Urtica dioica (common nettle)	2	0-3	18	6
Veronica americana (American brooklime)	1	0-1	9	3
Vicia americana (wild vetch)	1	0-3	73	9
Viola adunca (early blue violet)	1	0-1	9	3
Viola canadensis (western Canada violet)	3	0-3	9	5
Viola orbiculata (evergreen violet)	2	0-3	18	6
Ferns and Allies				
Equisetum arvense (common horsetail)	5	0-10	73	19

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

Figure 4. PICEGLA/CORNSTO HT



Successional Pathway Diagram of PICEGLA/CORNSTO Sites in Southern Alberta Grasslands Reference Community = PICEGLA/CORNSTO HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
EQUIARV	*Equisetum arvense* (common horsetail)
PICEGLA/CORNSTO HT	*Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) Habitat Type
POPUBAL/CORNSTO CT	*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) Community Type
POPUTRE/CORNSTO CT	*Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) Community Type

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site. It is based on the assumption that hydrologic potential does not change. The hydrology can change when fluvial deposition raises the elevation of the floodplain, causing the higher terraces to become too dry to support riparian species. The most likely vegetation potential to result from such a change in hydrology would be either a *Populus tremuloides* (aspen) upland type or a *Picea glauca* (white spruce) upland type. The time span is estimated for the stand to become dominated under undisturbed conditions by at least 50 percent cover of climax (or overstory indicator) species.

SUCCESSIONAL INFORMATION

Wildfire is often cited as a major agent of disturbance in forested lands of western 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 say that *Picea glauca* (white spruce) acts much like a pioneer species in establishing quickly on disturbed sites and has limited ability to reproduce within established forests. *Populus balsamifera* (balsam poplar) or *Populus tremuloides* (aspen) may form a major component of the overstory. Shrub cover is typically moderate in late seral, undisturbed stands. Herbaceous cover is moderate and diverse.

On sites where poplar trees (*Populus* species) gain early domination, young spruce (*Picea* species) establish and grow slowly under the closed canopy. This means the poplar stage of seral succession can be very long, 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). Figure 4 is a generalized schematic of the

typical successional pathway followed on sites of this type.

SOILS

Parent material is usually alluvium and soils are generally Brunisols, Chernozems, 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). Soils textures vary little between clay loam and silt loam with coarse fragments common throughout. Water tables typically remain within 1 m (39 in) of the surface throughout the growing season.

ADJACENT COMMUNITIES

The *Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) habitat type is the driest of the low elevation *Picea* (spruce) wetland types. Adjacent wetter types may include the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type or several of the various *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* (pine) species.

MANAGEMENT INFORMATION

Livestock

Herbage production is low to moderate. The dense overstory tends to limit forage production, thereby limiting utility to livestock other than as thermal cover. Livestock do browse several of the shrub species associated with this type. Livestock browsing of *Cornus stolonifera* (red-osier dogwood) may be quite high, causing a reduction of cover of this species and more things like *Rosa* species (rose) and *Symphoricarpos* species (buckbrush).

Timber

Timber productivity is moderate. Streamside locations and high water tables may restrict feasibility of timber harvest.

Wildlife

Deer, elk, and moose use this type for winter cover. Some sites may show sustained heavy use by moose and elk. *Cornus stolonifera* (red-osier dogwood) is highly preferred by wildlife and livestock as browse. Its abundance is a direct indication of past and current use levels.

Fisheries

Those stands of the *Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) 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 low. 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 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.

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).

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.

OTHER STUDIES

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. A *Picea/Cornus stolonifera* (spruce/red-osier dogwood) habitat type is described by Hansen and others (1995) for the mountains and foothills of Montana. Similar communities have been described for eastern Idaho and western Wyoming (Youngblood and others 1985b) and for Utah and southeastern Idaho (Padgett and others 1989).

Acer negundo/Prunus virginiana Habitat Type
(Manitoba Maple/Choke Cherry Habitat Type)

ACERNEG/PRUNVIR
Number of Stands Sampled = 35
Number of Stands Sampled in Alberta = 3

LOCATION AND ASSOCIATED LANDFORMS

The *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type is an incidental type in Alberta, occurring in the southeastern part of the province in the Dry Mixedgrass Subregion, where it represents the northwestern range extension of this tree species. This habitat type occurs along streams, rivers, lakes, springs, and ponds where it occupies terraces, fans, or floodplain positions. It is sometimes found in V-shaped ravines (also called woody draws) where sites may be only occasionally flooded by overland flows.

In the prairie ecoregion of Canada, where the brown and dark brown soils of the Chernozemic order usually support grassland or shrubland vegetation, taller woodland vegetation is generally confined to stream courses or other landscape positions where landform and topography permit accumulation of moisture in excess of local incident precipitation (Hansen and Hoffman 1988). Sites can be found on higher (older) terraces of the South Saskatchewan River and Ross Creek. On sites released from grazing, the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type may re-establish in areas presently dominated by *Symphoricarpos occidentalis* (buckbrush), *Glycyrrhiza lepidota* (wild licorice), *Agropyron smithii* (western wheat grass) habitat type, and some wetter sites of the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type.

VEGETATION

The tree layer of the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type is dominated by *Acer negundo* (Manitoba maple). *Populus balsamifera* (balsam popular), *Populus deltoides* (plains cottonwood), and/or *Salix amygdaloides* (peach-leaved willow) may dominate seral stands of this type. In sharply cut, V-shaped ravines, the largest trees are near the centre or bottom of the ravines where there is more soil moisture and protection from drying wind.

In relatively undisturbed late seral to climax stands, the undergrowth is comprised of two layers. The taller and more conspicuous shrub layer (2 to 3 m [6-10 ft] in height) is dominated by *Prunus virginiana* (choke cherry). Associated shrubs include *Amelanchier alnifolia* (saskatoon), and *Cornus stolonifera* (red-osier dogwood). The second (lower) layer frequently has short shrubs such as *Symphoricarpos occidentalis* (buckbrush), *Rosa woodsii* (common wild rose), and *Ribes* species (currant); and herbaceous species such as *Bromus inermis* (smooth brome), *Elymus virginicus* (Virginia wild rye), *Carex sprengelii* (Sprengel's sedge), *Viola canadensis* (western Canada violet), and *Thalictrum venulosum* (veiny meadow rue) (Table 6).

Table 6. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 10 late seral to climax stands of the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Acer negundo (Manitoba maple)	82	60-98	100	91
Fraxinus pennsylvanica (green ash)	2	0-3	20	6
Populus balsamifera (balsam poplar)	1	0-1	10	3
Populus tremuloides (aspen)	10	0-10	10	10
Shrubs				
Amelanchier alnifolia (saskatoon)	7	0-10	40	17
Cornus stolonifera (red-osier dogwood)	5	0-10	50	16
Corylus cornuta (beaked hazelnut)	1	0-1	10	3
Crataegus rotundifolia (round-leaved hawthorn)	3	0-3	10	5
Prunus virginiana (choke cherry)	27	0-60	90	49
Rhus radicans (poison ivy)	3	0-3	10	5
Ribes americanum (wild black currant)	7	0-10	20	12
Ribes lacustre (bristly black currant)	4	0-10	30	11
Ribes oxyacanthoides (northern gooseberry)	2	0-3	40	9
Rosa spp. (rose)	2	0-3	50	10
Rubus idaeus (wild red raspberry)	5	0-10	30	12
Salix petiolaris (basket willow)	3	0-3	10	5
Symphoricarpos occidentalis (buckbrush)	7	0-20	90	25
Viburnum opulus (high-bush cranberry)	10	0-10	10	10
Graminoids				
Agropyron pectiniforme (crested wheat grass)	1	0-1	10	3
Agropyron smithii (western wheat grass)	22	0-40	20	21
Agrostis stolonifera (redtop)	1	0-1	10	3
Agropyron trachycaulum (slender wheat grass)	10	0-10	10	10
Bromus inermis (smooth brome)	17	0-30	60	32

Table 6. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 10 late seral to climax stands of the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Carex aquatilis (water sedge)	1	0-1	10	3
Carex athrostachya (long-bracted sedge)	10	0-10	10	10
Carex sprengelii (Sprengel's sedge)	25	0-40	50	35
Cinna latifolia (drooping wood-reed)	10	0-10	10	10
Elymus virginicus (Virginia wild rye)	14	0-30	60	29
Phalaris arundinacea (reed canary grass)	30	0-30	10	17
Poa pratensis (Kentucky bluegrass)	2	0-3	40	9
Trisetum cernuum (nodding trisetum)	3	0-3	10	5
Forbs				
Actaea rubra (red and white baneberry)	7	0-10	20	12
Anemone cylindrica (long-fruited anemone)	5	0-10	30	12
Aralia nudicaulis (wild sarsaparilla)	42	0-80	20	29
Artemisia absinthium (absinthe wormwood)	1	0-1	10	3
Aster hesperius (western willow aster)	1	0-1	10	3
Atriplex prostrata (prostrate saltbush)	3	0-3	10	5
Botrychium virginianum (Virginia grape fern)	1	0-1	10	3
Carduus nutans (nodding thistle)	1	0-1	10	3
Chenopodium fremontii (Fremont's goosefoot)	10	0-10	10	10
Chenopodium rubrum (red goosefoot)	1	0-1	10	3
Chenopodium salinum (oak-leaved goosefoot)	1	0-1	10	3
Cirsium arvense (Canada thistle)	1	0-1	10	3
Disporum trachycarpum (fairybells)	1	0-1	20	4
Galium boreale (northern bedstraw)	5	0-10	20	10
Galium trifidum (small bedstraw)	5	0-10	30	12
Galium triflorum (sweet-scented bedstraw)	2	0-3	40	9
Geranium richardsonii (wild white geranium)	1	0-1	20	4
Hackelia americana (nodding stickseed)	1	0-1	10	3

Table 6. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 10 late seral to climax stands of the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Heracleum lanatum (cow parsnip)	5	0-10	30	12
Lappula squarrosa (bluebur)	3	0-3	10	5
Osmorhiza chilensis (blunt-fruited sweet cicely)	1	0-1	10	3
Sanicula marilandica (snakeroot)	2	0-3	20	6
Sium suave (water parsnip)	1	0-1	10	3
Smilax herbacea (Carrion flower)	1	0-3	50	7
Smilacina stellata (star-flowered Solomon's-seal)	4	0-10	40	13
Solidago canadensis (Canada goldenrod)	5	0-10	30	12
Solidago missouriensis (low goldenrod)	1	0-1	10	3
Sonchus arvensis (perennial sow-thistle)	1	0-1	20	4
Stachys palustris (marsh hedge-nettle)	3	0-3	10	5
Taraxacum officinale (common dandelion)	5	0-10	20	10
Thalictrum occidentale (western meadow rue)	1	0-1	10	3
Thalictrum venulosum (veiny meadow rue)	12	0-50	60	27
Urtica dioica (common nettle)	3	0-3	50	12
Viola canadensis (western Canada violet)	8	0-20	60	22

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

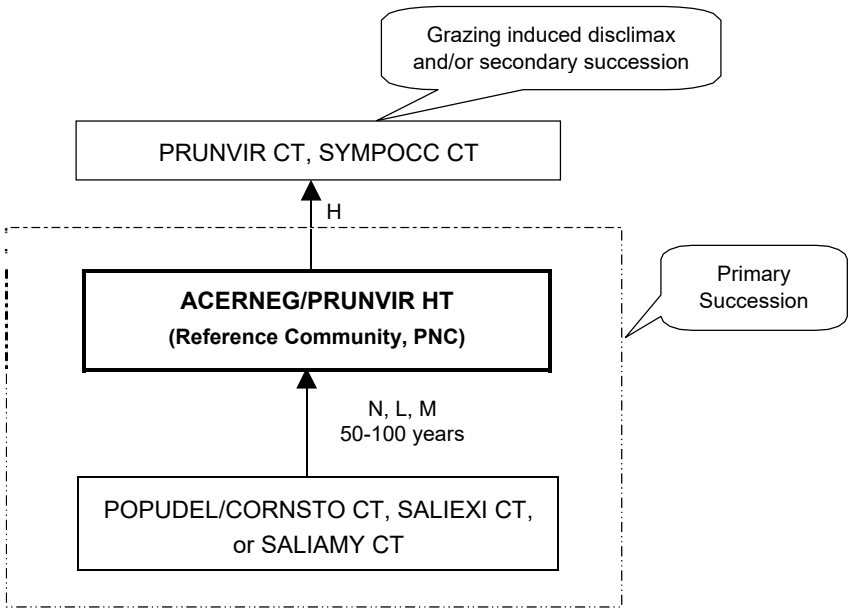
SUCCESSIONAL INFORMATION

Primary Successional Stages

Primary successional stages of the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type may be any of a variety of types, including communities dominated by *Populus deltoides* (plains cottonwood), *Salix exigua* (sandbar willow), or *Salix amygdaloides* (peach-leaved willow). Figure 5 is a generalized schematic of the successional pathway followed on sites of this type.

Early Seral Stage—An early seral stage on a primary successional site, such as a recently deposited alluvial bar, may support the *Populus deltoides* (plains cottonwood)/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type.

Figure 5. ACERNEG/PRUNVIR HT



Successional Pathway Diagram of ACERNEG/PRUNVIR Sites in Southern Alberta Grasslands
Reference Community = ACERNEG/PRUNVIR HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
ACERNEG/PRUNVIR HT	*Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) Habitat Type
POPUDEL/CORNSTO CT	*Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) Community Type
SYMPOCC CT	*Symphorocarpos occidentalis* (buckbrush) Community Type
PRUNVIR CT	*Prunus virginiana* (choke cherry) Community Type
SALIEXI CT	*Salix exigua* (sandbar willow) Community Type
SALIAMY CT	*Salix amygdaloides* (peach-leaved willow) Community Type

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic potential does not change. Likely causes of such hydrologic change might be lowering of the local water table by wetland drainage for agricultural development or drying of the site by reduction of the overstory canopy. The time span is estimated for the stand to become dominated under undisturbed conditions by at least 50 percent cover of climax (or overstory indicator) species.

Mid-Seral Stage—Through time, under limited light disturbance, the stand will progress to a mature stand of *Populus deltoides* (plains cottonwood) representing the *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus deltoides* (plains cottonwood) stand would become dominated by *Acer negundo* (Manitoba maple). As the *Populus deltoides* overstory matures, opens up, and finally becomes decadent, the *Acer negundo* is ready to replace it.

Late Seral to Climax (PNC) Stage—As a cottonwood stand dies, primary succession toward other communities will occur unless the riverine process of flooding deposits new sediments suitable for cottonwood seedling establishment. In the absence of such sediment deposition, primary succession will continue from the

Populus deltoides/Cornus stolonifera (plains cottonwood/red-osier dogwood) community type toward the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type.

Secondary Successional Stages

Late Seral to Climax (PNC) Stage—The presence or absence of a particular understory community may aid in determining the degree of disturbance (both present and historical disturbance) on a site. In a relatively undisturbed stand of the climax community of this type, the understory consists of two layers. *Prunus virginiana* (choke cherry), *Amelanchier alnifolia* (saskatoon), and *Cornus stolonifera* (red-osier dogwood) dominate a tall shrub layer (2-3 m [6-10 ft] in height). *Bromus inermis* (smooth brome), *Elymus virginicus* (Virginia wild rye), *Carex sprengelii* (Sprengel's sedge), *Galium boreale* (northern bedstraw), *Viola canadensis* (western Canada violet), and *Thalictrum venulosum* (veiny meadow rue) are most frequently found in the lower, herbaceous layer. Relatively undisturbed stands will have all age classes of tree species present (seedlings, saplings, pole, and mature).

Mid-Seral Stage—Maintaining even moderate levels of grazing can sharply reduce regeneration of trees. Sapling and pole size trees will begin to show signs of damage. Reducing seedling and sapling age classes of the overstory tree species will cause a decline of the tree population. If a moderate to heavy level of disturbance is continued over an extended period, the trees will eventually be eliminated from the site.

In addition to its impact on the tree layer, grazing greatly reduces both abundance and canopy cover of the understory layer of desirable shrubs and herbaceous species. Less desirable species such as *Symphoricarpos occidentalis* (buckbrush), *Rosa woodsii* (common wild rose), *Crataegus rotundifolia* (round-leaved hawthorn), *Bromus inermis* (smooth brome), and *Poa pratensis* (Kentucky bluegrass) will invade or increase in the stand.

Under heavy grazing pressure, tree reproduction is often severely restricted or eliminated. At this stage, most tree saplings and pole sizes are eliminated by trampling and/or rubbing, or browsed until dead. High levels of grazing cause the stand to become open. This allows sun-tolerant, less desirable species such as *Symphoricarpos occidentalis* (buckbrush), *Rosa woodsii* (common wild rose) *Cirsium arvense* (Canada thistle), and *Poa pratensis* (Kentucky bluegrass) to dominate (Table 7). Many sites supporting the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type in the northern Great Plains are in this state, or in the severely overgrazed state (discussed in the following paragraph).

Early Seral Stage—Prolonged periods of severe overgrazing result in a stand of older decadent trees with a very open understory. This understory may be so severely altered that most of even the less desirable species, such as *Symphoricarpos occidentalis* (buckbrush), *Rosa* species (rose), *Crataegus rotundifolia* (round-leaved hawthorn), and *Poa pratensis* (Kentucky bluegrass) are also eliminated, leaving large areas of exposed soil. When a stand is at this stage, the prospect of returning the site to its former state is very low. Restoration would be extremely expensive. Therefore, if a manager wants to maintain the trees, the most cost effective way is to change management ***BEFORE*** the site is so degraded.

Severely disturbed *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) sites may become dominated by the *Shepherdia argentea* (thorny buffaloberry), *Crataegus rotundifolia* (round-leaved hawthorn), *Rosa woodsii* (common wild rose), or *Symphoricarpos occidentalis* (buckbrush) community types. Close observation of any remnant woody

species, such as *Acer negundo*, will aid in determination of site potential.

Table 7. Average canopy cover, range of canopy cover, and constancy for species recorded in the 25 disturbed and/or early to mid-seral stands of the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Acer negundo (Manitoba maple)	59	20 - 98	100	77
Fraxinus pennsylvanica (green ash)	1	0 - 1	8	3
Populus balsamifera (balsam poplar)	70	0 - 70	4	17
Populus deltoides (plains cottonwood)	68	0 - 90	16	33
Populus tremuloides (aspen)	20	0 - 20	4	9
Ulmus americana (American Elm)	20	0 - 20	4	9
Shrubs				
Amelanchier alnifolia (Saskatoon)	1	0 - 3	24	5
Artemisia cana (silver sagebrush)	3	0 - 3	4	3
Betula occidentalis (water birch)	40	0 - 40	4	13
Clematis ligusticifolia (western clematis)	2	0 - 3	8	4
Clematis occidentalis (purple clematis)	3	0 - 3	4	3
Cornus stolonifera (red-osier dogwood)	13	0 - 40	44	24
Corylus cornuta (beaked hazelnut)	1	0 - 1	4	2
Lonicera involucrata (bracted honeysuckle)	10	0 - 10	4	6
Prunus americana (wild plum)	12	0 - 20	8	10
Prunus pensylvanica (pin cherry)	10	0 - 10	4	6
Prunus virginiana (choke cherry)	19	0 - 50	64	35
Rhus radicans (poison ivy)	3	0 - 3	4	3
Ribes americanum (wild black currant)	2	0 - 3	12	5
Ribes aureum (golden currant)	8	0 - 20	12	10
Ribes lacustre (bristly black currant)	10	0 - 10	4	6
Ribes oxyacanthoides (northern gooseberry)	10	0 - 20	12	11
Ribes spp. (currant)	2	0 - 3	12	5
Ribes triste (wild red currant)	10	0 - 10	4	6

Table 7. Average canopy cover, range of canopy cover, and constancy for species recorded in the 25 disturbed and/or early to mid-seral stands of the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Rosa woodsii (common wild rose)	31	0 - 80	44	37
Rosa spp. (rose)	6	0 - 10	24	12
Rubus idaeus (wild red raspberry)	3	0 - 3	8	5
Salix amygdaloides (peach-leaved willow)	40	0 - 60	8	18
Salix exigua (sandbar willow)	7	0 - 10	8	7
Salix lutea (yellow willow)	23	0 - 40	12	17
Symphoricarpos occidentalis (buckbrush)	19	0 - 60	56	33
Graminoids				
Agropyron repens (quack grass)	20	0 - 20	4	9
Agropyron smithii (western wheat grass)	28	0 - 40	24	26
Agrostis stolonifera (redtop)	2	0 - 3	8	4
Bromus inermis (smooth brome)	36	0 - 90	60	46
Bromus japonicus (Japanese chess)	10	0 - 20	12	11
Bromus tectorum (downy chess)	11	0 - 20	12	11
Carex pensylvanica (sun-loving sedge)	1	0 - 1	4	2
Carex sprengelii (Sprengel's sedge)	42	0 - 80	8	18
Carex spp. (sedge)	60	0 - 60	4	15
Elymus glaucus (smooth wild rye)	1	0 - 1	4	2
Elymus virginicus (Virginia wild rye)	40	0 - 70	12	22
Hordeum jubatum (foxtail barley)	20	0 - 20	4	9
Muhlenbergia racemosa (marsh muhly)	40	0 - 40	4	13
Phalaris arundinacea (reed canary grass)	3	0 - 3	4	3
Phleum pratense (timothy)	20	0 - 20	4	9
Poa bulbosa (Bulbous Bluegrass)	30	0 - 30	4	11
Poa palustris (fowl bluegrass)	3	0 - 3	4	3
Poa pratensis (Kentucky bluegrass)	13	0 - 40	28	19
Stipa comata (needle-and-thread)	14	0 - 20	12	13

Table 7. Average canopy cover, range of canopy cover, and constancy for species recorded in the 25 disturbed and/or early to mid-seral stands of the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Forbs				
Achillea millefolium (common yarrow)	1	0 - 3	12	3
Actaea rubra (red and white baneberry)	10	0 - 10	4	6
Ambrosia trifida (great ragweed)	1	0 - 1	4	2
Anemone cylindrica (long-fruited anemone)	3	0 - 3	4	3
Apocynum spp. (dogbane)	1	0 - 1	4	2
Aralia nudicaulis (wild sarsaparilla)	20	0 - 20	4	9
Arctium lappa (great burdock)	1	0 - 1	8	3
Arctium minus (common burdock)	23	0 - 40	16	19
Artemisia campestris (plains wormwood)	1	0 - 1	4	2
Asclepias speciosa (showy milkweed)	2	0 - 3	8	4
Asperugo procumbens (madwort)	40	0 - 40	4	13
Aster ciliolatus (Lindley's aster)	1	0 - 1	4	2
Aster hesperius (western willow aster)	10	0 - 10	4	6
Aster spp. (aster)	1	0 - 1	4	2
Camelina microcarpa (small-seeded false flax)	1	0 - 1	4	2
Campanula rotundifolia (harebell)	10	0 - 10	4	6
Chenopodium fremontii (Fremont's goosefoot)	1	0 - 1	4	2
Chenopodium salinum (oak-leaved goosefoot)	30	0 - 30	4	11
Cicuta maculata (water-hemlock)	1	0 - 1	8	3
Cirsium arvense (Canada thistle)	7	0 - 20	28	14
Cirsium vulgare (bull thistle)	1	0 - 1	4	2
Collomia linearis (narrow-leaved collomia)	10	0 - 10	4	6
Convolvulus sepium (wild morning-glory)	1	0 - 1	4	2
Cynoglossum officinale (hound's-tongue)	2	0 - 3	8	4
Descurainia sophia (flixweed)	1	0 - 1	4	2
Echinocystis lobata (wild cucumber)	3	0 - 3	4	3

Table 7. Average canopy cover, range of canopy cover, and constancy for species recorded in the 25 disturbed and/or early to mid-seral stands of the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Fragaria virginiana (wild strawberry)	1	0 - 1	4	2
Galeopsis tetrahit (hemp-nettle)	3	0 - 3	4	3
Galium boreale (northern bedstraw)	3	0 - 3	4	3
Galium triflorum (sweet-scented bedstraw)	4	0 - 10	16	8
Geum macrophyllum (large-leaved yellow avens)	1	0 - 1	8	3
Glycyrrhiza lepidota (wild licorice)	5	0 - 10	16	9
Grindelia squarrosa (gumweed)	10	0 - 10	4	6
Heracleum lanatum (cow parsnip)	37	0 - 70	8	17
Humulus lupulus (common hop)	10	0 - 20	8	9
Lactuca serriola (prickly lettuce)	20	0 - 20	4	9
Lappula squarrosa (bluebur)	1	0 - 1	4	2
Lathyrus ochroleucus (cream-colored vetchling)	3	0 - 3	4	3
Lepidium spp. (pepper-cress)	10	0 - 10	4	6
Maianthemum canadense (wild lily-of-the-valley)	1	0 - 1	4	2
Medicago lupulina (black medick)	1	0 - 1	4	2
Melilotus alba (white sweet-clover)	1	0 - 1	4	2
Melilotus officinalis (yellow sweet-clover)	10	0 - 10	4	6
Mentha arvensis (wild mint)	4	0 - 10	12	7
Mertensia spp. (bluebell)	10	0 - 10	4	6
Nepeta cataria (catnip)	1	0 - 3	12	3
Osmorhiza chilensis (blunt-fruited sweet cicely)	2	0 - 3	8	4
Plantago major (common plantain)	1	0 - 1	4	2
Polygonum coccineum (water smartweed)	1	0 - 1	4	2
Potentilla spp. (cinquefoil)	1	0 - 1	4	2
Rumex crispus (curled dock)	3	0 - 3	4	3
Saussurea americana (American saw-wort)	3	0 - 3	4	3
Sisymbrium loeselii (tall hedge mustard)	1	0 - 1	4	2

Table 7. Average canopy cover, range of canopy cover, and constancy for species recorded in the 25 disturbed and/or early to mid-seral stands of the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Smilax herbacea (Carrion flower)	2	0 - 3	8	4
Smilacina stellata (star-flowered Solomon's-seal)	3	0 - 10	20	8
Solidago canadensis (Canada goldenrod)	7	0 - 20	24	13
Sonchus arvensis (perennial sow-thistle)	5	0 - 10	8	6
Stachys palustris (marsh hedge-nettle)	1	0 - 1	4	2
Taraxacum officinale (common dandelion)	1	0 - 3	24	5
Thalictrum occidentale (western meadow rue)	1	0 - 1	4	2
Thalictrum venulosum (veiny meadow rue)	9	0 - 30	20	13
Thlaspi arvense (stinkweed)	3	0 - 3	4	3
Urtica dioica (common nettle)	3	0 - 10	40	11
Vicia americana (wild vetch)	1	0 - 1	12	3
Viola canadensis (western Canada violet)	3	0 - 3	12	6
Ferns and Allies				
Equisetum hyemale (common scouring-rush)	1	0 - 1	4	2

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

Flooding is generally infrequent on sites occupied by *Acer negundo* (Manitoba maple), but the species is very tolerant of flooding. Soils are typically Regosols or Chernozems. Textures range from clay loam to sandy loam. Water tables are generally near the soil surface in spring or after storm events but commonly fall below 1 m (39 in) during dry periods.

ADJACENT COMMUNITIES

Adjacent drier sites may be occupied by the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type, the *Prunus virginiana* (choke cherry) community type, the *Bromus inermis* (smooth brome) community type, or by a variety of upland species. Wetter sites may be occupied by the *Salix lutea/Cornus stolonifera* (yellow willow/dogwood) habitat type, by *Typha latifolia* (common cattail), *Scirpus* species (bulrushes), or *Eleocharis* species (spike rushes).

MANAGEMENT INFORMATION

Livestock

If the long-term management objective is maintenance of the tree stand, then managers need to key on the seedling reproduction of *Acer negundo* (Manitoba maple), or the stand will eventually be eliminated.

On relatively undisturbed sites, dense stands of the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type limit access by livestock due to their understory density. As the stands open up, livestock access will increase. Valuable benefits this habitat type provides to livestock producers are: shade, water source, palatable forage, protection from seasonal storms, and calving grounds. Because the *Acer negundo/Prunus virginiana* habitat type covers a small portion of the landscape, and because of its high wildlife value (see the Wildlife section), these sites may become focal points of conflict between livestock and wildlife management.

Livestock producers should reduce or eliminate hot season use in this type. This can be accomplished by placing salt on the uplands away from wooded areas, by removing water sources from wooded areas, and in some cases, by using cross fencing (drift fencing) placed perpendicular to the long axis of the stand at appropriate distance intervals. This method is most appropriate for stands located in V-shaped draws or ravines. These short fences will prevent livestock from trailing down the middle of the stand. On disturbed sites, it may be necessary to fence out an area for five or more years in order to allow regeneration of trees and shrubs. After the goal of regeneration is reached on one area, a different portion of the stand may be fenced out.

The use of these sites as winter feeding grounds can have mixed results. In some cases, proper winter use will have little impacts on the stand. However, if livestock numbers are high, trampling and rubbing can have a detrimental impact on the woody plants. If livestock use is high when the frost is going out of the ground, a great deal of churning and compaction can occur on the soft soil.

Over the years, there has been some debate whether *Prunus virginiana* (choke cherry) leaves are poisonous to livestock. The leaves and seeds have sugars that contain cyanide. These cyanide sugars are not directly poisonous, but when the plant material is chewed and digested, enzymes cause the release of hydrogen cyanide (Ode Pers. Comm. 1987). In high concentrations, hydrogen cyanide is a metabolic poison to most animals. It has recently been shown that livestock can acquire the ability to detoxify hydrogen cyanide by consuming small amounts of it over an extended period. Therefore, *Prunus virginiana* will poison livestock only if consumed in large quantity without prior conditioning.

Wildlife

In the Prairie Ecoregion, woody draws are very important to wildlife, even though they represent a very small fraction of total area (about 1-2 percent). Situated to collect more moisture than normal incident precipitation, these draws are more productive than the surrounding uplands (Thomas and others 1979). Woody draws offer wildlife thermal cover, nesting habitat, a water source, summer and winter forage, secure travel corridors, and hiding cover (Ames 1977, Hansen and others 1984, Hansen and Hoffman 1988, Severson and Boldt 1978). Woody draws are important year round habitat for mule deer, provide critical winter habitat for whitetail deer (Severson and Carter 1978, Swenson 1981), and serve as fawning areas for whitetail and mule deer. During fall and winter, these woody draws also provide critical habitat for sharptailed grouse.

Woody draws provide essential habitat for a large number of nongame wildlife species. Grosz and others (1981) found that woody draws are the centre of activity for most species and are critically important to many species

during the stressful winter months. They also found that, in comparison to adjacent uplands, these sites support a greater diversity and density of birds. In northwestern North Dakota, Hopkins (1985) counted bird species nesting in woody draws, and found that, although it had lower species diversity than cottonwood forests, the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type supported a much higher density of breeding pairs. Finally, these woody draws provide important habitat for coyote, weasel, bobcat, and red fox (Swenson 1981, Sieg and others 1985).

If the long-term management objective is to maintain trees on the site, then managers need to focus on regeneration success of the tree species.

Fisheries

The woody species associated with the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type provide important streambank stability, thermal cover, and nutrients.

Fire

Acer negundo (Manitoba maple) and most of the important shrub species in the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type produce sprouts from the root crown when the main trunk is damaged. The fact that these woody species can sprout prolifically suggests that this habitat type is adapted to fire and perhaps to periodic stand regeneration by fire. However, the role of fire in this habitat type is still not well understood.

Soil Management and Rehabilitation Opportunities

Sites adjacent to streams are extremely vulnerable to bank sloughing, particularly when soils are moist. Excessive livestock presence will increase soil compaction and decrease stability and water holding capacity. Management should emphasize the importance of maintaining understory shrubs.

Where revegetation with woody species is desired, *Acer negundo* (Manitoba maple), *Prunus virginiana* (choke cherry), *Amelanchier alnifolia* (saskatoon), and *Ribes* species (currants and gooseberries) are well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well-drained soils. Growth rates are usually moderate to rapid, and the roots of established seedlings become effective stabilizers of alluvial deposits.

Recreational Uses and Considerations

Recreational developments and transportation corridors are common in this type due to its proximity to streams. Recreational opportunities are excellent for fishing, hunting, and observing a variety of bird species.

The fruit of *Prunus virginiana* (choke cherry) is highly regarded for making wine and jelly, but one must harvest ahead of the birds (Johnson and Nichols 1982). Aboriginal people ate the fruit fresh or preserved it by drying. They also combined it with venison and buffalo meat to make mincemeat, and they used the berries for medicinal purposes.

Care must be taken when locating structures within this type. Campgrounds and structures have been seriously damaged by floods, or lost altogether—as on Ross Creek near Irvine in 1998.

OTHER STUDIES

Hansen and others (1995) describe this type for the northern Great Plains in eastern Montana. Lawrence and Romo (1994) describe an *Acer negundo* community type on the Matador Research Station in southwestern Saskatchewan.

Populus angustifolia/Cornus stolonifera Community Type

(Narrow-leaf Cottonwood/Red-Osier Dogwood Community Type)

POPUANG/CORNSTO

Number of Stands Sampled = 17

Number of Stands Sampled in Alberta = 4

LOCATION AND ASSOCIATED LANDFORMS

The *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type is a minor to incidental type at low to mid elevations in the foothills and riparian bottoms in the Mixedgrass Natural Subregion of southwestern Alberta. *Populus angustifolia* (narrow-leaf cottonwood) occurs at intermediate elevations, occupying sites between the elevational optimums for *Populus balsamifera* (balsam poplar) and *Populus deltoides* (plains cottonwood). This type occurs on alluvial deposits along major streams and rivers. In general, these sites are recent sediment deposits, such as point bars, sidebars, mid channel bars, delta bars, and islands. Stands co-dominated by *Populus angustifolia* (narrow-leaf cottonwood) and *Populus balsamifera* (balsam poplar) are described by Rood and others (1998) as far north as the Bow River near Carseland.

VEGETATION

This type is characterized by an overstory of cottonwoods over potentially dense and diverse undergrowth of shrubs and herbs. *Populus deltoides* (plains cottonwood) and *Populus balsamifera* (balsam poplar) may be present, along with a variety of hybrids, but are subordinate to *Populus angustifolia* (narrow-leaf cottonwood). For purposes of this classification, all hybrids having morphological characteristics close to those of *Populus angustifolia* are treated as that species. *Cornus stolonifera* (red-osier dogwood) is the diagnostic shrub for this type. Table 8 lists the species recorded in what are considered less disturbed sites, but many still include significant amounts of disturbance increaser herbaceous species, such as *Poa pratensis* (Kentucky bluegrass) and *Cirsium arvense* (Canada thistle).

Table 8. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Populus x *acuminata* (lance-leaf cottonwood)	10	0-10	17	13
Populus angustifolia (narrow-leaf cottonwood)	45	30-60	100	67
Populus balsamifera (balsam poplar)	10	0-10	17	13
Shrubs				
Amelanchier alnifolia (saskatoon)	10	0-20	50	22

Table 8. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Arctostaphylos uva-ursi (common bearberry)	7	0-10	33	15
Betula occidentalis (water birch)	1	0-3	50	7
Clematis ligusticifolia (western clematis)	3	0-3	17	7
Cornus stolonifera (red-osier dogwood)	27	3-60	100	52
Elaeagnus commutata (silverberry)	7	0-10	50	19
Potentilla fruticosa (shrubby cinquefoil)	10	0-10	17	13
Prunus virginiana (choke cherry)	5	0-10	50	16
Ribes oxyacanthoides (northern gooseberry)	1	0-1	17	4
Ribes spp. (currant)	1	0-1	17	4
Rosa acicularis (prickly rose)	20	0-20	17	18
Rosa woodsii (common wild rose)	30	0-40	33	31
Rosa spp. (rose)	2	0-3	50	10
Rubus idaeus (wild red raspberry)	3	0-3	17	7
Salix exigua (sandbar willow)	40	0-40	17	26
Salix lucida (shining willow)	2	0-3	33	8
Symphoricarpos occidentalis (buckbrush)	11	0-20	83	30
Graminoids				
Agrostis stolonifera (redtop)	21	0-30	50	32
Agropyron trachycaulum (slender wheat grass)	2	0-3	33	8
Calamagrostis spp. (reed grass)	1	0-1	17	4
Carex lanuginosa (woolly sedge)	3	0-3	33	10
Dactylis glomerata (orchard grass)	1	0-1	17	4
Elymus virginicus (Virginia wild rye)	3	0-3	17	7
Phalaris arundinacea (reed canary grass)	12	0-20	33	20
Phleum pratense (timothy)	3	0-3	17	7
Poa palustris (fowl bluegrass)	1	0-1	17	4

Table 8. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Poa pratensis (Kentucky bluegrass)	9	0-20	83	27
Stipa columbiana (Columbia needle grass)	2	0-3	33	8
Forbs				
Achillea millefolium (common yarrow)	1	0-1	17	4
Anemone multifida (cut-leaved anemone)	1	0-1	17	4
Apocynum cannabinum (Indian hemp)	1	0-1	17	4
Aster ciliolatus (Lindley's aster)	1	0-1	17	4
Aster laevis (smooth aster)	1	0-1	33	6
Campanula rotundifolia (harebell)	1	0-1	17	4
Cirsium arvense (Canada thistle)	7	0-20	67	22
Fragaria virginiana (wild strawberry)	1	0-3	50	7
Galium boreale (northern bedstraw)	1	0-1	17	4
Geranium richardsonii (wild white geranium)	1	0-1	17	4
Glycyrrhiza lepidota (wild licorice)	7	0-20	67	22
Heracleum lanatum (cow parsnip)	10	0-20	33	18
Humulus lupulus (common hop)	1	0-1	17	4
Lysimachia ciliata (fringed loosestrife)	3	0-3	17	7
Mentha arvensis (wild mint)	3	0-3	33	10
Monarda fistulosa (wild bergamot)	1	0-1	17	4
Pyrola asarifolia (common pink wintergreen)	1	0-1	17	4
Ranunculus acris (tall buttercup)	1	0-1	17	4
Rumex crispus (curled dock)	3	0-3	17	7
Smilacina stellata (star-flowered Solomon's-seal)	2	0-3	67	12
Solidago canadensis (Canada goldenrod)	7	0-20	67	22
Solidago spp. (goldenrod)	10	0-10	33	18
Sonchus arvensis (perennial sow-thistle)	10	0-10	17	13

Table 8. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Taraxacum officinale (common dandelion)	1	0-1	50	7
Thalictrum occidentale (western meadow rue)	1	0-1	17	4
Thalictrum venulosum (veiny meadow rue)	1	0-1	33	6
Thermopsis rhombifolia (golden bean)	3	0-3	17	7
Urtica dioica (common nettle)	3	0-3	17	7
Vicia americana (wild vetch)	1	0-1	17	4
Viola adunca (early blue violet)	1	0-1	17	4
Zizia aptera (heart-leaved Alexanders)	1	0-1	17	4
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0-1	33	6
Equisetum laevigatum (smooth scouring-rush)	20	0-20	17	18

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

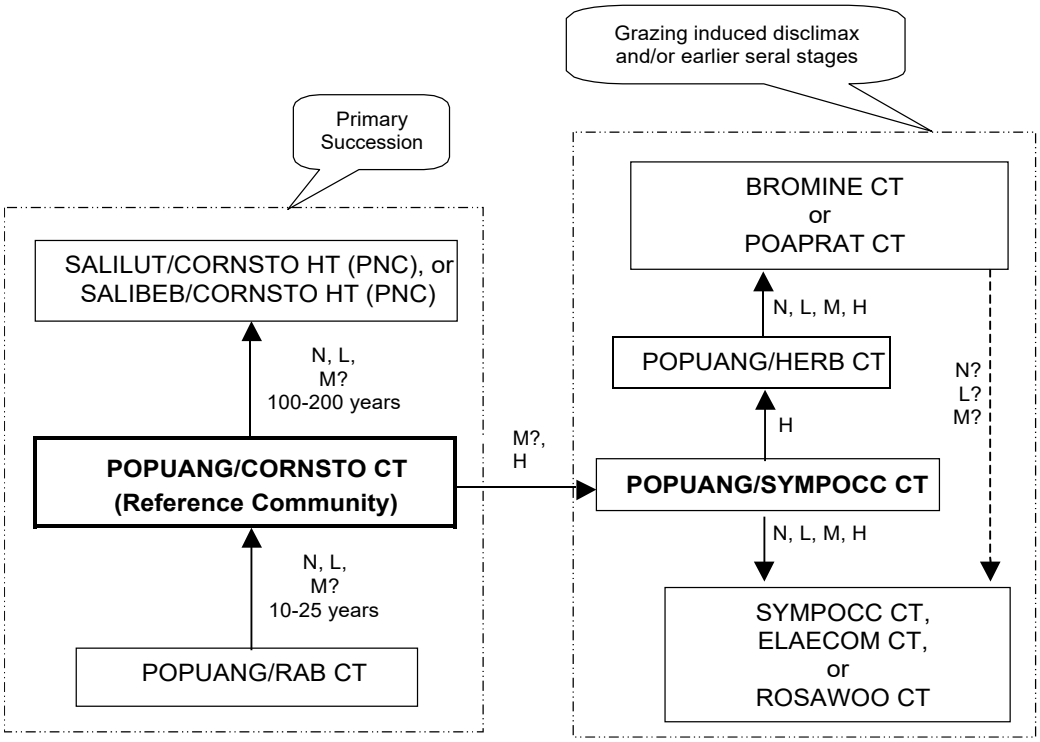
SUCCESSIONAL INFORMATION

The mature *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type is a mid-seral stage of primary succession. Potential for sites of this type may include the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type on the eastern side of its range (lower slopes of the Cypress Hills), *Salix bebbiana* (beaked willow), *Salix lutea* (yellow willow) throughout the range, and *Picea glauca* (white spruce) or perhaps *Pseudotsuga menziesii* (Douglas fir) on the extreme western side of the range. Figure 6 is a generalized schematic of the successional pathway followed on sites of this type.

Primary Successional Stages

Cottonwoods are a pioneering species that for establishment require moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, sidebars, mid channel bars, delta bars, and islands along major streams. Since cottonwoods are a pioneering species, and do not regenerate in their own shade, they are considered a seral species and do not represent the climax vegetation or potential for the site. Many stands may appear to have some limited regeneration, especially in open areas. However, it is important to understand that these young plants represent root sprouts (asexual reproduction), not establishment by seeds (sexual reproduction). These sprouts may prolong the life of the stand, but will not perpetuate it. If the site is left undisturbed, in time the cottonwoods will be replaced by a later successional stage.

Figure 6. POPUANG/CORNSTO CT



Successional Pathway Diagram of POPUANG Sites in Southern Alberta Grasslands
Reference Community = POPUANG/CORNSTO CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY

POPUANG/CORNSTO CT	*Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) Comm. Type
POPUANG/SYMPOCC CT	*Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) Comm. Type
POPUANG/RAB CT	*Populus angustifolia/*Recent Alluvial Bar (narrow-leaf cottonwood/Recent Alluvial Bar) Comm. Type
POPUANG/HERB CT	*Populus angustifolia/*Herbaceous (narrow-leaf cottonwood/Herbaceous) Community Type
SALILUT/CORNSTO HT	*Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) Habitat Type
SALIBEB/CORNSTO HT	*Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) Habitat Type
SYMPOCC CT	*Symphoricarpos occidentalis* (buckbrush) Community Type
PRUNVIR CT	*Prunus virginiana* (choke cherry) Community Type
ELAECOM CT	*Elaeagnus commutata* (silverberry) Community Type
ROSAWOO CT	*Rosa woodsii* (common wild rose) Community Type
BROMINE CT	*Bromus inermis* (smooth brome) Community Type
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic potential does not change. The most likely such hydrologic change would be fluvial buildup of the floodplain, resulting in a terrace site too dry to support willows..The time span is estimated for the stand to become dominated under undisturbed conditions by at least 50 percent cover of climax (or overstory indicator) species. Cottonwood stands do not regenerate themselves in situ, therefore the seral progression is not reversible. We see no evidence to indicate that willows can re-establish themselves on a site after it becomes dominated by non willow species.

Erosion and deposition along a river help maintain plant community diversity on its floodplain. 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, or climax (PNC) successional stage. If the migration rate is high, few stands progress to late successional stage. Near the outer edges of the floodplain, effect of the river is reduced, allowing more late 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 band or terrace supporting a vegetation community of a different age. The bands generally are progressively older as one moves away from the channel and onto higher terraces. Parts of the floodplain may remain undisturbed long enough for their elevation to increase enough with respect to the channel that they are rarely, if ever, flooded. These are considered old, mature alluvial terraces, and may continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage—The *Populus angustifolia*/Recent Alluvial Bar (narrow-leaf cottonwood/Recent Alluvial Bar) community type is the earliest seral stage of this type, establishing on freshly deposited alluvium.

Mid-Seral Stage—If disturbance (either human-caused or natural) does not eliminate or alter the stand, the *Populus angustifolia* (narrow-leaf cottonwood)/Recent Alluvial Bar community type will progress to the relatively undisturbed mid-seral stage, *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type.

Late Seral to Climax (PNC) Stage—As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediment suitable for a new generation of cottonwood seedlings. In the absence of sediment deposition, at lower elevations succession continues from the *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type to the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type or the *Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) habitat type. In the foothills around the Cypress Hills the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type can succeed. In other instances, this community type will be seral to *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type or the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type.

Secondary Successional Stages

The presence or absence of a particular understory community may aid in determining degree of disturbance (present and historical) on a site. On relatively undisturbed sites, the *Populus angustifolia* (narrow-leaf cottonwood) understory will contain a diverse, dense tall shrub layer dominated by such species as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), various *Salix* species (willows), and *Ribes* (currants and gooseberries).

With moderate grazing or browsing *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) will increase with a corresponding decrease in abundance and canopy cover of *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and *Ribes* (currants and gooseberries). If

grazing or browsing pressures continue, the more desirable shrubs will be eliminated, leaving *Symphoricarpos occidentalis* and *Rosa* species to form a nearly impenetrable understory. This is the *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type stage of disturbance-caused secondary succession. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory converted to herbaceous, dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs. This extremely disturbed stage is the *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) community type.

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 stand becomes decadent with widely spaced, dying cottonwoods. The site can become open and dry enough to change the potential to an upland type, as indicated by the presence of upland species. Such conversion may be slow due to persistence of some of the sod forming grasses. Remnant riparian shrubs and graminoids, if present will help indicate potential undergrowth composition.

Once the stand has converted from a shrub-dominated understory to one dominated by introduced herbaceous species, the potential for returning the site to its former state (shrub dominated) is very difficult. 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 shrub-dominated understory, the most cost effective way is to change the management ***BEFORE*** the site is too degraded.

SOILS

Populus angustifolia (narrow-leaf cottonwood) generally occurs along streams with large amounts of coarse substrates such as cobbles and gravels. Soils are typically Regosols with up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Brunisols and Chernozems can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m (39 in) 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 water table. Soils are generally well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment of rapidly moving, highly aerated groundwater. This type of substrate is common to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often the *Salix exigua* (sandbar willow) community type. Stands of *Salix amygdaloides* (peach-leaved willow) and *Salix lucida* (shining willow) may border this type. The *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) community type or the *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type may be adjacent on disturbed sites.

MANAGEMENT INFORMATION

Livestock

Forage production ranges from low to moderate due to the dense nature of the stands of the *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type. Stands in good to excellent health (condition) often support dense

thickets of shrubs, limiting the available forage. *Cornus stolonifera* (red-osier dogwood) is an "ice cream" plant to livestock and wildlife. Its abundance is a direct indication of past and current use levels. In some sites, livestock browsing of *Cornus stolonifera* may be quite high.

Sites are often subjected to heavy grazing pressure because of their gentle topography and ease of access. With moderate to heavy prolonged grazing pressure, palatable shrubs will be eliminated leaving mostly *Symphoricarpos occidentalis* (buckbrush) and *Rosa* (rose) species as the dominant understory. At this stage, the stand has been converted to the *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) disturbance-caused community type. If continued disturbance is severe, these shrubs also will be eliminated, and the stand converted to the *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) disturbance-caused community type (see the discussion under the Seral Stages section).

Timber

The timber productivity of all cottonwood types is moderate to high due to favorable moisture conditions. Complete stand removal will likely result in a shrub-dominated community with extremely limited, if any, cottonwood regeneration. The occasional sprouts from stumps are unlikely to reach maturity.

Wildlife

Ungulates, especially whitetail deer, are common residents of these communities. Songbirds, raptors, and small mammals are also common, due to high structural diversity and abundant food sources. *Populus angustifolia* (narrow-leaf cottonwood) and *Cornus stolonifera* (red-osier dogwood) are often browsed by moose (Costain 1989) and used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

Fisheries

The streamside location of this community type provides thermal cover, debris recruitment, and streambank stability. Its importance cannot be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section). *Cornus stolonifera* (red-osier dogwood) and associated shrub species are excellent in controlling streambank erosion. This is particularly important on higher gradient streams where scouring by seasonal flooding is a factor.

Fire

The *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type is susceptible to fire during the late summer and fall. *Populus angustifolia* and shrubs associated with this type are adapted to light, and under some conditions, to fires of moderate intensity. Many of these species can produce new sprouts after a burn. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria:

1) The particular species of cottonwood. In general, *Populus angustifolia* (narrow-leaf cottonwood) has a greater sprouting capability than *Populus balsamifera* (balsam poplar), which in turn has a greater sprouting capability than *Populus deltoides* (plains cottonwood).
2) The age of the trees. As cottonwoods mature, the sprouting potential decreases. As the trees reach late maturity, sprouting potential is very limited.
3) Location of the water table. In general, the higher the water table is during the growing season, the greater the survivability of resprouts.

Therefore, if a manager wants to extend the life of a cottonwood 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 is excluded from all livestock grazing for at least five years and that wildlife browsing be closely monitored.

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, these shrubs sprout from the surviving rhizomes or stolons (runners) (Fischer and Bradley 1987).

Soil Management and Rehabilitation Opportunities

Coarse textured soils are not as susceptible to compaction. This community type is subject to recurring scouring by floods and alluvium deposition. However, 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 very important on higher gradient streams.

Managers should maintain a buffer of *Populus angustifolia* (narrow-leaf cottonwood) community types adjacent to rivers and streams. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize streambanks, and dissipate flood energy.

If the site still has a high water table, a dramatic change in management (i.e. elimination of livestock 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 completely gone, the opportunity to re-establish an understory of desirable shrubs may have been lost.

Where revegetation with shrubs is the goal, some desirable species such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) 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 effectively stabilize recently bare soil. Remember: If the canopy cover of trees in the stand has opened up too much and/or the water table has been severely lowered, revegetation success with desirable woody species will be low.

When considering rehabilitation of stands with fire, see the discussion above in the Fire Management section about the inherent problems of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand is excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988):

1) Do not plant cottonwoods on saline or alkaline sites.
2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer.
3) Make cuttings from open stands of young, rapidly growing trees. Use only cuttings that are four years old or less. Make cuttings long enough to provide 1 to 2 m (3 to 6 ft) of top length left above the soil surface (see #6 and #7 below). Remove lower branches, leaving only the tip and top two side branches.
4) Make cuttings when the plants are completely dormant.
5) Soak the cuttings in water for 10 to 14 days.
6) Auger holes to the depth of the lowest anticipated growing season water table level.

7) Place cuttings in the augered holes on the same day they are removed from the soak. Set the butt to the lowest level anticipated that the growing season groundwater will drop.
8) Back fill the holes carefully to avoid leaving air pockets.
9) Place tree guards around the cuttings if rodent or rabbit damage is likely.
10) As buds begin to swell along the cuttings, remove them from the lower two-thirds of the cutting.
11) Plantings must be protected from livestock grazing and big game browsing for two or three growing seasons. Beaver control may also be needed.

Recreational Uses and Considerations

Because of proximity to streams and flat topography, recreational developments and transportation corridors are common in this type. Opportunities are excellent in this type for fishing, big game, and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures in this type. Some campgrounds have been seriously damaged by floods or lost altogether.

OTHER STUDIES

A *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type was described in Montana by Hansen and others (1995). A similar community type was described by Youngblood and others (1985b) for eastern Idaho and western Wyoming, and by Padgett and others (1989) for Utah and southeastern Idaho. Major undergrowth shrubs were *Cornus stolonifera* (red-osier dogwood), *Betula occidentalis* (water birch), and *Salix bebbiana* (beaked willow).

Populus angustifolia/Recent Alluvial Bar Community Type
(Narrow-leaf Cottonwood/Recent Alluvial Bar Community Type)

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

LOCATION AND ASSOCIATED LANDFORMS

The *Populus angustifolia*/Recent Alluvial Bar (narrow-leaf cottonwood/Recent Alluvial Bar) community type is a minor to incidental type at low to mid elevations in the foothills and riparian bottoms of the Mixedgrass Natural Subregion of southwestern Alberta. *Populus angustifolia* (narrow-leaf cottonwood) occurs at intermediate elevations, occupying sites between the elevational optimums of *Populus balsamifera* (balsam poplar) and *Populus deltoides* (plains cottonwood). This type occurs on alluvial deposits along major streams and rivers. In general, these sites are recent sediment deposits, such as point bars, sidebars, mid channel bars, delta bars, and islands. Major dams that control peak flows on rivers have been shown to adversely affect the success of cottonwood tree establishment (Bradley and Smith 1986, Rood and Mahoney 1991).

VEGETATION

This type is dominated by seedlings and/or saplings of *Populus angustifolia* (narrow-leaf cottonwood), or is co-dominated by cottonwoods and *Salix exigua* (sandbar willow). *Populus deltoides* (plains cottonwood) and/or *Populus balsamifera* (balsam poplar) may be present, but are subordinate to *Populus angustifolia*. The understory is dominated by an assortment of grasses such as *Agrostis stolonifera* (redtop) and *Phleum pratense* (timothy) (Table 9).

Table 9. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 4 stands of the *Populus angustifolia*/ recent Alluvial Bar community type that are relatively undisturbed by livestock or wildlife.

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Populus angustifolia (narrow-leaf cottonwood)	33	20-40	100	57
Populus balsamifera (balsam poplar)	20	0-20	25	22
Pseudotsuga menziesii (Douglas-fir)	1	0-1	25	5
Shrubs				
Arctostaphylos uva-ursi (common bearberry)	1	0-1	25	5
Betula occidentalis (water birch)	3	0-3	25	9
Dryas drummondii (yellow mountain avens)	30	0-40	50	39
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	25	5
Salix exigua (sandbar willow)	31	0-80	75	48
Salix lutea (yellow willow)	5	0-10	50	16
Graminoids				
Agropyron spp. (wheat grass)	1	0-1	25	5
Agrostis stolonifera (redtop)	15	0-20	50	27
Agropyron trachycaulum (slender wheat grass)	3	0-3	25	9
Carex praegracilis (graceful sedge)	1	0-1	25	5
Carex spp. (sedge)	1	0-1	25	5
Juncus balticus (wire rush)	1	0-1	25	5
Phleum pratense (timothy)	1	0-1	25	5
Poa pratensis (Kentucky bluegrass)	10	0-10	25	16
Poa spp. (bluegrass)	3	0-3	25	9
Stipa columbiana (Columbia needle grass)	1	0-1	25	5

Table 9. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 4 stands of the *Populus angustifolia*/ recent Alluvial Bar community type that are relatively undisturbed by livestock or wildlife.

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Forbs				
Artemisia dracunculus (dragonwort)	3	0-3	50	12
Aster ascendens (western aster)	1	0-1	25	5
Aster spp. (aster)	1	0-1	25	5
Cirsium arvense (Canada thistle)	1	0-1	25	5
Comandra umbellata (bastard toadflax)	1	0-1	25	5
Epilobium spp. (willowherb)	20	0-20	25	22
Glycyrrhiza lepidota (wild licorice)	20	0-20	25	22
Heterotheca villosa (golden aster)	1	0-1	25	5
Melilotus alba (white sweet-clover)	2	0-3	50	10
Oxytropis spp. (locoweed)	3	0-3	25	9
Solidago spp. (goldenrod)	10	0-10	25	16
Solidago missouriensis (low goldenrod)	3	0-3	25	9
Ferns and Allies				
Equisetum arvense (common horsetail)	12	0-20	50	24
Equisetum hyemale (common scouring-rush)	1	0-1	25	5

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Populus angustifolia*/Recent Alluvial Bar (narrow-leaf cottonwood/Recent Alluvial Bar) community type is an early seral (pioneer) stage of primary succession.

Primary Successional Stages

Cottonwoods are a pioneering species that for establishment require moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, sidebars, mid channel bars, delta bars, and islands along major streams. Since cottonwoods are a pioneering species, and do not regenerate in their own shade, they are considered a seral species and do not represent the climax vegetation or potential for the site. Many stands may appear to have some limited regeneration, especially in open areas. However, it is important to understand that these young plants represent root sprouts (asexual reproduction), not establishment by seeds (sexual reproduction). These sprouts may prolong the life of the stand, but will not

perpetuate it. If the site is left undisturbed, in time the cottonwoods will be replaced by a later successional stage.

Erosion and deposition along a river help maintain plant community diversity on its floodplain. 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, or climax (PNC) successional stage. If the migration rate is high, few stands progress to late successional stage. Near the outer edges of the floodplain, effect of the river is reduced, allowing more late 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 band or terrace supporting a vegetation community of a different age. The bands generally are progressively older as one moves away from the channel and onto higher terraces. Parts of the floodplain may remain undisturbed long enough for their elevation to increase enough with respect to the channel that they are rarely, if ever, flooded. These are considered old, mature alluvial terraces, and may continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage—The *Populus angustifolia*/Recent Alluvial Bar (narrow-leaf cottonwood/Recent Alluvial Bar) community type is an early seral stage.

Mid-Seral Stage—If disturbance (either human-caused or natural) does not eliminate or alter the stand, the *Populus angustifolia*/Recent Alluvial Bar community type will progress to the relatively undisturbed mid-seral stage, *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type.

Late Seral to Climax (PNC) Stage—As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediment suitable for a new generation of cottonwood seedlings. In the absence of sediment deposition, at lower elevations succession continues from the *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type to the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type or the *Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) habitat type. In the foothills around the Cypress Hills the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type can succeed. In other instances, this community type will be seral to *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type or the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type.

Secondary Successional Stages

The normal primary successional sequence (described above) may be altered due to varying degrees of grazing and browsing pressure. Moderate, prolonged grazing and browsing will shift to the disturbance-caused *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type. Severe, prolonged grazing and browsing pressure may eliminate all deciduous tree seedlings and may eliminate the undergrowth of shrub species. This severely disturbed stage of secondary succession is called the *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/herbaceous) community type. In this situation, the overstory of *Populus angustifolia* (narrow-leaf cottonwood) still matures and becomes open, now with an understory dominated by herbaceous species. Finally the stand becomes decadent with widely spaced, dying cottonwoods. The site is so open and dry that the

potential may have changed to one of a variety of upland types.

Stands of the *Populus angustifolia*/Recent Alluvial Bar (narrow-leaf cottonwood/Recent Alluvial Bar) community type are very susceptible to natural dynamics of the river, and may be drowned or swept away after just a year or two of growth. Ice can have a great impact on these recently deposited bars. Ice can influence the floodplain by either of two ways: 1) mechanical damage, or 2) flooding (inundation). Mechanical damage can mean any of the following: a) the laying down or bending over of the young trees, b) shearing off of the stems, c) pulling roots from the ground by movement of ice frozen around the stems, and d) tilting or pushing over of mature trees.

Cottonwood seedlings and saplings are very susceptible to defoliation by livestock. If livestock pressure is too great, the stand can be partially or totally eliminated. In many situations, livestock utilization has eliminated stands of newly established cottonwood seedlings. Beaver and wild ungulates can also have a severe impact on young cottonwood stands.

SOILS

Populus angustifolia (narrow-leaf cottonwood) generally occurs along streams with large amounts of coarse substrates such as cobbles and gravels. Soils are typically Regosols with up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Brunisols and Chernozems can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m (39 in) of the soil surface in summer, but soils can remain moist due to capillary action. Soils are generally well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment of rapidly moving, highly aerated groundwater. This type of substrate is common to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often the *Salix exigua* (sandbar willow) community type. Stands of *Salix amygdaloides* (peach-leaved willow) and *Salix lucida* (shining willow) may border this type. Adjacent undisturbed sites may have the *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type. The *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) community type or the *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type may be adjacent on disturbed sites.

MANAGEMENT INFORMATION

Livestock

Forage production is low to moderate. Stands in good to excellent health (condition) often support dense thickets of cottonwoods and associated shrub species thereby limiting the amount of available forage. These stands are very susceptible to defoliation by livestock. If establishment of new cottonwood stands is a management objective, livestock impacts should be closely monitored. In some situations, it may be advisable to eliminate grazing use until the cottonwoods have grown beyond reach of the livestock.

Wildlife

The *Populus angustifolia*/Recent Alluvial Bar (narrow-leaf cottonwood/Recent Alluvial Bar) community type provides valuable cover, shade, and food for a variety of species. Big game use may be high, depending upon the time of year. *Populus angustifolia* is used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

Fisheries

The streamside location of the *Populus angustifolia*/Recent Alluvial Bar (narrow-leaf cottonwood/Recent Alluvial Bar) community type is valuable for fisheries by providing streambank stability.

Fire

The *Populus angustifolia*/Recent Alluvial Bar (narrow-leaf cottonwood/Recent Alluvial Bar) community type is susceptible to fire. In general, cottonwood seedlings, and to a lesser degree, cottonwood saplings do not have an extensive root system or thick bark and may be killed by fire.

Soil Management and Rehabilitation Opportunities

The coarse textured substrates are not susceptible to compaction. This community type is subject to recurrent scouring by floods and alluvium deposition. Managers should maintain a buffer strip of cottonwood dominated community types adjacent streams. These buffer strips filter out sediment, stabilize streambanks, and slow flood waters.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988):

1) Do not plant cottonwoods on saline or alkaline sites.
2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer.
3) Make cuttings from open stands of young, rapidly growing trees. Use only cuttings that are four years old or less. Make cuttings long enough to provide 1 to 2 m (3 to 6 ft) of top length left above the soil surface (see #6 and #7 below). Remove lower branches, leaving only the tip and top two side branches.
4) Make cuttings when the plants are completely dormant.
5) Soak the cuttings in water for 10 to 14 days.
6) Auger holes to the depth of the lowest anticipated growing season water table level.
7) Place cuttings in the augered holes on the same day they are removed from the soak. Set the butt to the lowest level anticipated that the growing season groundwater will drop.
8) Back fill the holes carefully to avoid leaving air pockets.
9) Place tree guards around the cuttings if rodent or rabbit damage is likely.
10) As buds begin to swell along the cuttings, remove them from the lower two-thirds of the cutting.
11) Plantings must be protected from livestock grazing and big game browsing for two or three growing seasons. Beaver control may also be needed.

Recreational Uses and Considerations

Recreational opportunities 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.

OTHER STUDIES

The *Populus angustifolia*/Recent Alluvial Bar (narrow-leaf cottonwood/Recent Alluvial Bar) community type is described by Hansen and others (1995).

Populus angustifolia/Symphoricarpos occidentalis Community Type
(Narrow-leaf Cottonwood/Buckbrush Community Type)

POPUANG/SYMPOCC
Number of Stands Sampled = 9
Number of Stands Sampled in Alberta = 4

LOCATION AND ASSOCIATED LANDFORMS

The *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type is a minor to incidental type at low to mid elevations in the foothills and riparian bottoms in the Mixedgrass Natural Subregion of southwestern Alberta. *Populus angustifolia* (narrow-leaf cottonwood) occurs at intermediate elevations, occupying sites between the elevational optimums of *Populus balsamifera* (balsam poplar) and *Populus deltoides* (plains cottonwood). This type occurs on alluvial deposits along major streams and rivers. In general, these sites are recent sediment deposits, such as point bars, sidebars, mid channel bars, delta bars, and islands.

VEGETATION

This community type is a grazing disclimax. Moderate grazing pressure favors the increase of *Symphoricarpos occidentalis* (buckbrush), *Elaeagnus commutata* (silverberry), and *Rosa* species (rose). The most common herbaceous species found in this type are often exotic disturbance-increasers (Table 10).

Table 10. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 stands of the *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Acer negundo (Manitoba maple)	2	0 - 3	22	7
Fraxinus pennsylvanica (green ash)	3	0 - 3	11	6
Pinus contorta (lodgepole pine)	1	0 - 1	11	3
Populus angustifolia (narrow-leaf cottonwood)	57	40 - 80	100	75
Populus deltoides (plains cottonwood)	20	0 - 20	11	15
Shrubs				
Amelanchier alnifolia (saskatoon)	17	0 - 30	56	31
Clematis ligusticifolia (western clematis)	3	0 - 10	56	13
Clematis occidentalis (purple clematis)	1	0 - 1	11	3

Table 10. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 stands of the *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Cornus stolonifera (red-osier dogwood)	1	0 - 1	22	5
Crataegus rotundifolia (round-leaved hawthorn)	20	0 - 20	11	15
Elaeagnus commutata (silverberry)	1	0 - 1	11	3
Juniperus scopulorum (Rocky Mountain juniper)	3	0 - 3	11	6
Prunus virginiana (choke cherry)	17	0 - 50	56	31
Rhus radicans (poison ivy)	1	0 - 1	11	3
Ribes oxyacanthoides (northern gooseberry)	2	0 - 3	33	8
Ribes spp. (currant)	1	0 - 1	22	5
Rosa woodsii (common wild rose)	20	0 - 20	22	21
Rosa spp. (rose)	12	0 - 30	56	26
Rubus idaeus (wild red raspberry)	10	0 - 10	11	10
Salix amygdaloides (peach-leaved willow)	10	0 - 10	11	10
Salix boothii (Booth's willow)	3	0 - 3	11	6
Salix exigua (sandbar willow)	12	0 - 20	22	16
Salix lutea (yellow willow)	2	0 - 3	22	7
Shepherdia argentea (thorny buffaloberry)	3	0 - 3	11	6
Symphoricarpos occidentalis (buckbrush)	13	0 - 30	89	34
Graminoids				
Agropyron repens (quack grass)	20	0 - 20	11	15
Agrostis scabra (rough hair grass)	20	0 - 20	11	15
Agrostis stolonifera (redtop)	8	0 - 20	33	16
Agropyron trachycaulum (slender wheat grass)	2	0 - 3	33	8
Bromus inermis (smooth brome)	15	0 - 60	67	32
Elymus glaucus (smooth wild rye)	1	0 - 1	11	3
Elymus virginicus (Virginia wild rye)	12	0 - 20	22	16
Juncus balticus (wire rush)	40	0 - 40	11	21
Muhlenbergia racemosa (marsh muhly)	1	0 - 1	11	3

Table 10. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 stands of the *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Phleum pratense (timothy)	3	0 - 3	11	6
Poa palustris (fowl bluegrass)	17	0 - 30	22	19
Poa pratensis (Kentucky bluegrass)	26	0 - 60	67	42
Poa spp. (bluegrass)	1	0 - 1	11	3
Forbs				
Arctium minus (common burdock)	15	0 - 20	22	18
Asclepias spp. (milkweed)	1	0 - 1	11	3
Asparagus officinalis (asparagus)	1	0 - 1	11	3
Aster laevis (smooth aster)	3	0 - 3	11	6
Aster spp. (aster)	2	0 - 3	22	7
Chenopodium fremontii (Fremont's goosefoot)	1	0 - 1	11	3
Cirsium arvense (Canada thistle)	6	0 - 20	56	18
Cirsium spp. (thistle)	3	0 - 3	11	6
Cynoglossum officinale (hound's-tongue)	1	0 - 1	11	3
Epilobium angustifolium (common fireweed)	20	0 - 20	11	15
Galium boreale (northern bedstraw)	1	0 - 1	11	3
Glycyrrhiza lepidota (wild licorice)	17	0 - 60	44	27
Helianthus nuttallii (common tall sunflower)	3	0 - 3	11	6
Hesperis matronalis (dame's rocket)	1	0 - 1	11	3
Iris missouriensis (western blue flag)	1	0 - 1	11	3
Lactuca serriola (prickly lettuce)	3	0 - 3	11	6
Lysimachia ciliata (fringed loosestrife)	1	0 - 1	11	3
Medicago sativa (alfalfa)	20	0 - 20	11	15
Parietaria pensylvanica (American pellitory)	1	0 - 1	11	3
Polygonum convolvulus (wild buckwheat)	1	0 - 1	11	3
Sanicula marilandica (snakeroot)	1	0 - 1	11	3
Smilacina stellata (star-flowered Solomon's-seal)	2	0 - 3	33	8

Table 10. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 stands of the *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Solidago canadensis (Canada goldenrod)	7	0 - 10	22	12
Solidago gigantea (late goldenrod)	40	0 - 40	11	21
Sonchus arvensis (perennial sow-thistle)	1	0 - 1	11	3
Taraxacum officinale (common dandelion)	3	0 - 3	22	8
Thalictrum venulosum (veiny meadow rue)	1	0 - 1	11	3
Thermopsis rhombifolia (golden bean)	1	0 - 1	11	3
Urtica dioica (common nettle)	2	0 - 3	22	7
Vicia americana (wild vetch)	2	0 - 3	22	7
Viola canadensis (western Canada violet)	1	0 - 1	11	3
Ferns and Allies				
Equisetum arvense (common horsetail)	30	0 - 30	11	18

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type is a moderately disturbed secondary successional stage of the mid-seral *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type.

Primary Successional Stages

Cottonwoods are a pioneering species that requires moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, sidebars, mid channel bars, delta bars, and islands. Since cottonwoods do not regenerate in their own shade and require moist, barren, fully exposed, newly deposited alluvial material as a suitable seedbed, they are considered a seral species and do not represent the climax community (PNC) for the site. Many stands may appear to have limited regeneration, especially in the open areas. However, it is important to understand that these young seedlings and saplings represent sprouts (asexual reproduction) and not establishment by seeds (sexual reproduction). These sprouts may help prolong the life span of the stand, but will not perpetuate or maintain the stand. In time, the cottonwood stand will be replaced by a later successional stage.

The erosional and depositional pattern of a river helps maintain the diversity of plant communities on the floodplain. The distribution of various communities depends on the way the river meanders. In turn, the rate of meandering determines the proportion of floodplain communities considered to be in the pioneer or early seral, mid-seral, late seral, or climax (PNC) stage of

succession. Where the river meanders frequently, few stands progress to later successional stages. Near the outer edges of the floodplain, the effect of the river is less pronounced, allowing later successional stages to develop. Typically, rivers meander like a whip or snake across their floodplain. Lateral movement of the river initiates a dynamic series of vegetation events. As water moves downstream, it erodes established banks, typically covered with riparian or wetland vegetation in different stages of development, on outside curves and deposits fresh alluvial materials on the point bars of inside curves. Each new deposit of alluvium forms a distinct band or terrace with each band being even aged and with gaps in ages between the bands. The ages of the bands are progressively older on older terraces. As the river moves away from sites of previous deposition and continues to downcut, the amount of soil water recharge from channel seepages decreases, making these sites (terraces) drier. If certain portions of the floodplain remain undisturbed for a long enough period of time, their relief with respect to the river may increase to a point where they are only rarely flooded, if at all. These terraces are considered old or mature alluvial terraces and can continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage—The *Populus angustifolia*/Recent Alluvial Bar (narrow-leaf cottonwood/Recent Alluvial Bar) community type is the earliest seral stage of this type, establishing on freshly deposited alluvium.

Mid-Seral Stage—If disturbance (either human-caused or natural) does not eliminate or alter the stand, the *Populus angustifolia*/Recent Alluvial Bar community type will progress to the relatively undisturbed mid-seral stage, *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type.

Late Seral to Climax (PNC) Stage—As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediment suitable for a new generation of cottonwood seedlings. In the absence of sediment deposition, at lower elevations succession continues from the *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type to the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type or the *Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) habitat type. In the foothills around the Cypress Hills the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type can succeed. In other instances, this community type will be seral to *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type or the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type.

Secondary Successional Stages

The presence or absence of a particular understory community may aid in determining degree of disturbance (present and historical) on a site. On relatively undisturbed sites, the *Populus angustifolia* (narrow-leaf cottonwood) understory will contain a diverse, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), various *Salix* species (willows), and *Ribes* (currants and gooseberries).

With moderate grazing or browsing *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) will increase with a corresponding decrease in abundance and canopy cover of *Cornus stolonifera*, *Amelanchier alnifolia*, *Prunus virginiana*, and *Ribes*. If grazing or browsing pressures continue, the more desirable shrubs will be eliminated, leaving *Symphoricarpos occidentalis* and *Rosa* species to form a nearly impenetrable

understory. This is the *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type stage of disturbance-caused secondary succession. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory converted to herbaceous, dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs. This extremely disturbed stage is the *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) community type.

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 stand becomes decadent with widely spaced, dying cottonwoods. The site can become open and dry enough to change the potential to an upland type, as indicated by the presence of upland species. Such conversion may be slow due to persistence of some of the sod forming grasses. Remnant riparian shrubs and graminoids, if present will help indicate potential undergrowth composition.

Once the stand has converted from a shrub-dominated understory to one dominated by introduced herbaceous species, the potential for returning the site to its former state (shrub dominated) is very difficult. 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 shrub-dominated understory, the most cost effective way is to change the management ***BEFORE*** the site is too degraded.

SOILS

Populus angustifolia (narrow-leaf cottonwood) generally occurs along streams with large amounts of coarse substrates such as cobbles and gravels. Soils are typically Regosols with up to 1 m (39 in.) of mineral soil overlying river gravel and/or cobbles. Brunisols and Chernozems can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m (39 in.) 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 water table. Soils are generally well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment of rapidly moving, highly aerated groundwater. This type of substrate is common to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often the *Salix exigua* (sandbar willow) community type. Stands of *Salix amygdaloides* (peach-leaved willow) and *Salix lucida* (shining willow) may border this type. The *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type may be adjacent on relatively undisturbed sites. The *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type may be adjacent on disturbed sites.

MANAGEMENT INFORMATION

Livestock

Forage production ranges from low to moderate in the dense shrub understory in these stands. Forage production in dense thickets of *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) is low. Stands may be so dense that they prevent most livestock use. If the shrub understory is reduced by continual prolonged grazing or browsing, stands open and forage production increases due to the disturbance-caused increase of *Poa*

pratensis (Kentucky bluegrass), *Phleum pratense* (timothy), and/or *Bromus inermis* (smooth brome). The palatability of *Symphoricarpos occidentalis* (buckbrush) ranges from low to fair for cattle and sheep (Wasser 1982, Johnson and Nichols 1982), and the leaves of *Rosa woodsii* (common wild rose) are considered fair to good livestock forage, particularly for sheep (Johnson and Nichols 1982).

Timber

The timber productivity of all cottonwood types is moderate to high due to favorable moisture conditions. Complete stand removal will likely result in a shrub-dominated community with extremely limited, if any, cottonwood regeneration. The occasional sprouts from stumps are unlikely to reach maturity.

Wildlife

Ungulates, especially whitetail deer, are common residents of these communities. Songbirds, raptors, and small mammals are also common, due to high structural diversity and abundance of food. *Populus angustifolia* (narrow-leaf cottonwood) and *Rosa* species (rose) are used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

The moderate structural understory diversity in these altered shrub understories provides thermal and hiding cover for big game and upland bird species. The palatability of *Symphoricarpos occidentalis* (buckbrush) is rated as good for deer and elk (Wasser 1982, Johnson and Nichols 1982). Deer and elk may browse heavily on *Rosa woodsii* (common wild rose), while the persistent fruit (rose hips) provides fall and winter food for birds, small mammals, and bears, which disperse the seeds. *Rosa woodsii* (common wild rose) is very tolerant of grazing but can be dwarfed and thinned by intense browsing during season long use.

Fisheries

By its streamside location, this community type provides important thermal cover, debris, and streambank stability for streams. Its importance cannot be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section). *Symphoricarpos occidentalis* (buckbrush) and *Rosa woodsii* (common wild rose) are excellent in controlling erosion along streams due to their rhizomatous nature. This is particularly important on higher gradient streams where scouring by seasonal flooding is possible.

Fire

The *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type is susceptible to fire during the late summer and fall. *Populus angustifolia* (narrow-leaf cottonwood) and shrubs associated with this type are adapted to light, and under some conditions, to fires of moderate intensity. Many of these species can produce new sprouts after a burn. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria:

1) The particular species of cottonwood. In general, *Populus angustifolia* (narrow-leaf cottonwood) has a greater sprouting capability than *Populus balsamifera* (balsam poplar), which in turn has a greater sprouting capability than *Populus deltoides* (plains cottonwood).
2) The age of the trees. As cottonwoods mature, the sprouting potential decreases. As the trees reach late maturity, sprouting potential is very limited.
3) Location of the water table. In general, the higher the water table is during the growing season, the greater the survivability of resprouts.

Therefore, if a manager wants to extend the life of a cottonwood 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 is excluded from all livestock grazing for at least five years and that wildlife browsing be closely monitored.

Symphoricarpos occidentalis (buckbrush) is tolerant of fire. It can be injured by fire but usually sprouts, with stands becoming denser afterward. It is such a strong competitor, particularly in dense colonies, that it is not very compatible with most herbaceous vegetation. *Rosa woodsii* (common wild rose) is typically top-killed by fire, but root crowns and underground rhizomes survive low- or moderate-severity fires. However, the shallow root crowns of *Rosa woodsii* are susceptible to injury, and populations consequently decrease following high-severity fire. *Rosa woodsii* recovery varies with fire severity. Top-killed plants will sprout from the root crown and underground surviving rhizomes (USDA IFSL 1995).

Soil Management and Rehabilitation Opportunities

Coarse textured soils are not as susceptible to compaction. This community type is subject to recurring scouring by floods and alluvium deposition. However, 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 very important on higher gradient streams.

Managers should maintain a buffer of *Populus angustifolia* (narrow-leaf cottonwood) community types adjacent to rivers and streams. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize streambanks, and dissipate flood energy.

If the site still has a high water table, a dramatic change in management (i.e. elimination of livestock 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 completely gone, the opportunity to re-establish an understory of desirable shrubs may have been lost.

Where revegetation with shrubs is the goal, some desirable species such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) 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 effectively stabilize recently bare soil. Remember: If the canopy cover of trees in the stand has opened up too much and/or the water table has been severely lowered, revegetation success with desirable woody species will be low.

When considering rehabilitation of stands with fire, see the discussion above in the Fire Management section about the inherent problems of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand is excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988):

1) Do not plant cottonwoods on saline or alkaline sites.
2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer.
3) Make cuttings from open stands of young, rapidly growing trees. Use only cuttings that are four years old or less. Make cuttings long enough to provide 1 to 2 m (3 to 6 ft) of top length left above the soil

surface (see #6 and #7 below). Remove lower branches, leaving only the tip and top two side branches.

4) Make cuttings when the plants are completely dormant.
5) Soak the cuttings in water for 10 to 14 days.
6) Auger holes to the depth of the lowest anticipated growing season water table level.
7) Place cuttings in the augered holes on the same day they are removed from the soak. Set the butt to the lowest level anticipated that the growing season groundwater will drop.
8) Back fill the holes carefully to avoid leaving air pockets.
9) Place tree guards around the cuttings if rodent or rabbit damage is likely.
10) As buds begin to swell along the cuttings, remove them from the lower two-thirds of the cutting.
11) Plantings must be protected from livestock grazing and big game browsing for two or three growing seasons. Beaver control may also be needed.

Symphoricarpos occidentalis (buckbrush) is well adapted for revegetating disturbed sites due to its habit of growing in dense clonal stands. It does best on moist, well-drained soils, which have not been excessively disturbed. Once established, it grows at a moderate rate and spreads rapidly by root sprouts. Nursery grown seedlings, rooted cuttings, or wildlings are the preferred planting materials. Critical, erodible sites may require that grazing be completely excluded during establishment. Animal populations and stocking rates should be balanced with forage supply on noncritical sites after establishment (Wasser 1982).

Rosa woodsii (common wild rose) is valuable for revegetating disturbed sites along streambanks and seeps. It is easily established from nursery grown stock, root cuttings, or transplanting.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game, and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures within this type. Some campgrounds in Montana have been seriously damaged by floods or lost altogether.

Symphoricarpos occidentalis (buckbrush) is an important food source for upland birds due to fruits that persist into the winter. 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 *Rosa woodsii* (common wild rose) community type. However, *Rosa woodsii* is useful for planting in recreation areas as a biological barrier to protect physical structures, young and delicate plants, and to direct traffic.

OTHER STUDIES

Hansen and others (1995) described a *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type for the Northern Great Plains of Montana. A similar community type was described by Youngblood and others (1985b) for eastern Idaho and western Wyoming, and by Padgett and others (1989) for Utah and southeastern Idaho. Major undergrowth shrubs were *Cornus stolonifera* (red-osier dogwood), *Betula occidentalis* (water birch), and *Salix bebbiana* (beaked willow).

Populus angustifolia/Herbaceous Community Type
(Narrow-leaf Cottonwood/Herbaceous Community Type)

POPUANG

Number of Stands Sampled = 6

Number of Stands Sampled in Alberta = 4

LOCATION AND ASSOCIATED LANDFORMS

The *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) community type is a minor to incidental type at low to mid elevations in the foothills and riparian bottoms in the Mixedgrass Natural Subregion of southwestern Alberta. *Populus angustifolia* (narrow-leaf cottonwood) occurs at intermediate elevations, occupying sites between the elevational optimums of *Populus balsamifera* (balsam poplar) and *Populus deltoides* (plains cottonwood). This type occurs on alluvial deposits along major streams and rivers. In general, these sites are recent sediment deposits, such as point bars, sidebars, mid channel bars, delta bars, and islands.

The *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) community type is more common than the small sample size suggests, and occurs on alluvial terraces along larger streams and rivers. It is found on flat terraces at low elevations where woody species have been removed mechanically or by grazing and is the severely altered stage resulting from disturbance of the *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type.

VEGETATION

The *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) community type is a grazing or browsing disclimax characterized by a two layer structure of mature, widely spaced *Populus angustifolia* over grasses such as *Poa pratensis* (Kentucky bluegrass), *Bromus inermis* (smooth brome), and *Phleum pratense* (timothy). Shrub species are absent or present only as remnant, scattered individuals. *Taraxacum officinale* (common dandelion) and *Achillea millefolium* (common yarrow) are common forbs (Table 11).

Table 11. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Populus angustifolia (narrow-leaf cottonwood)	43	10 - 90	100	66
Populus tremuloides (aspen)	1	0 - 1	17	4
Shrubs				
Amelanchier alnifolia (saskatoon)	5	0 - 10	33	13

Table 11. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Clematis ligusticifolia (western clematis)	10	0 - 10	17	13
Cornus stolonifera (red-osier dogwood)	1	0 - 1	17	4
Elaeagnus commutata (silverberry)	3	0 - 3	17	7
Rosa woodsii (common wild rose)	1	0 - 1	17	4
Rosa spp. (rose)	2	0 - 3	33	8
Salix exigua (sandbar willow)	2	0 - 3	33	8
Salix lutea (yellow willow)	1	0 - 1	17	4
Shepherdia argentea (thorny buffaloberry)	1	0 - 1	17	4
Symphoricarpos occidentalis (buckbrush)	4	0 - 10	67	16
Graminoids				
Agropyron smithii (western wheat grass)	5	0 - 10	33	13
Agropyron spicatum (bluebunch wheat grass)	1	0 - 1	17	4
Agrostis stolonifera (redtop)	2	0 - 3	33	8
Bromus inermis (smooth brome)	53	0 - 90	67	60
Carex utriculata (beaked sedge)	1	0 - 1	17	4
Elymus canadensis (Canada wild rye)	3	0 - 3	17	7
Festuca ovina (sheep fescue)	70	0 - 70	17	34
Festuca scabrella (rough fescue)	40	0 - 40	17	26
Juncus balticus (wire rush)	1	0 - 1	17	4
Poa compressa (Canada bluegrass)	3	0 - 3	17	7
Poa palustris (fowl bluegrass)	1	0 - 1	17	4
Poa pratensis (Kentucky bluegrass)	14	0 - 20	50	26
Forbs				
Achillea millefolium (common yarrow)	1	0 - 1	17	4
Apocynum cannabinum (Indian hemp)	2	0 - 3	50	10
Artemisia ludoviciana (prairie sagewort)	1	0 - 1	17	4
Asclepias speciosa (showy milkweed)	1	0 - 1	17	4

Table 11. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Aster ericoides (tufted white prairie aster)	3	0 - 3	17	7
Aster falcatus (creeping white prairie aster)	1	0 - 1	33	6
Aster laevis (smooth aster)	1	0 - 1	17	4
Chrysanthemum leucanthemum (ox-eye daisy)	1	0 - 1	17	4
Cirsium arvense (Canada thistle)	2	0 - 3	33	8
Cirsium vulgare (bull thistle)	1	0 - 1	17	4
Glycyrrhiza lepidota (wild licorice)	2	0 - 3	50	10
Grindelia squarrosa (gumweed)	1	0 - 1	17	4
Helianthus nuttallii (common tall sunflower)	10	0 - 10	17	13
Medicago lupulina (black medick)	40	0 - 40	17	26
Melilotus alba (white sweet-clover)	3	0 - 3	17	7
Polygonum coccineum (water smartweed)	3	0 - 3	17	7
Senecio indecorus (rayless ragwort)	1	0 - 1	17	4
Solidago canadensis (Canada goldenrod)	2	0 - 3	33	8
Thermopsis rhombifolia (golden bean)	10	0 - 10	17	13
Xanthium strumarium (cocklebur)	1	0 - 1	17	4

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) community type represents a severely disturbed secondary successional stage of the mid-seral *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type.

Primary Successional Stages

Cottonwoods are a pioneering species that for establishment require moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, sidebars, mid channel bars, delta bars, and islands along major streams. Since cottonwoods are a pioneering species, and do not regenerate in their own shade, they are considered a seral species and do not represent the climax vegetation or potential for the site. Many stands may appear to have some limited regeneration, especially in open areas. However, it is important to understand that these young plants represent root sprouts (asexual reproduction), not establishment by seeds (sexual reproduction). These

sprouts may prolong the life of the stand, but will not perpetuate it. If the site is left undisturbed, in time the cottonwoods will be replaced by a later successional stage.

Erosion and deposition along a river help maintain plant community diversity on its floodplain. 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, or climax (PNC) successional stage. If the migration rate is high, few stands progress to late successional stage. Near the outer edges of the floodplain, effect of the river is reduced, allowing more late 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 band or terrace supporting a vegetation community of a different age. The bands generally are progressively older as one moves away from the channel and onto higher terraces. Parts of the floodplain may remain undisturbed long enough for their elevation to increase enough with respect to the channel that they are rarely, if ever, flooded. These are considered old, mature alluvial terraces, and may continue to development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage—The *Populus angustifolia*/Recent Alluvial Bar (narrow-leaf cottonwood/Recent Alluvial Bar) community type is the earliest seral stage of this type, establishing on freshly deposited alluvium.

Mid-Seral Stage—If disturbance (either human-caused or natural) does not eliminate or alter the stand, the *Populus angustifolia*/Recent Alluvial Bar (narrow-leaf cottonwood/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage, *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type.

Late Seral to Climax (PNC) Stage—As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediment suitable for a new generation of cottonwood seedlings. In the absence of sediment deposition, at lower elevations succession continues from the *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type to the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type or the *Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) habitat type. In the foothills around the Cypress Hills the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type can succeed. In other instances, this community type will be seral to *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type or the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type.

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The presence or absence of a particular understory community may aid in determining degree of disturbance (present and historical) on a site. On relatively undisturbed sites, the *Populus angustifolia* (narrow-leaf cottonwood) understory will contain a diverse, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), various *Salix* species (willows), and *Ribes* (currants and gooseberries).

With moderate grazing or browsing *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) will increase with a corresponding decrease in abundance and canopy cover of *Cornus stolonifera*, *Amelanchier*

alnifolia, *Prunus virginiana*, and *Ribes*. If grazing or browsing pressures continue, the more desirable shrubs will be eliminated, leaving *Symphoricarpos occidentalis* and *Rosa* species to form a nearly impenetrable understory. This is the *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type stage of disturbance-caused secondary succession. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory converted to herbaceous, dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs. This extremely disturbed stage is the *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) community type.

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 stand becomes decadent with widely spaced, dying cottonwoods. The site can become open and dry enough to change the potential to an upland type, as indicated by the presence of upland species. Such conversion may be slow due to persistence of some of the sod forming grasses. Remnant riparian shrubs and graminoids, if present will help indicate potential undergrowth composition.

Once the stand has converted from a shrub-dominated understory to one dominated by introduced herbaceous species, the potential for returning the site to its former state (shrub dominated) is very difficult. 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 shrub-dominated understory, the most cost effective way is to change the management ***BEFORE*** the site is too degraded.

SOILS

Populus angustifolia (narrow-leaf cottonwood) generally occurs along streams with large amounts of coarse substrates such as cobbles and gravels. Soils are typically Regosols with up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Brunisols and Chernozems can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m (39 in) 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 water table. Soils are generally well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment of rapidly moving, highly aerated groundwater. This type of substrate is common to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often the *Salix exigua* (sandbar willow) community type. Stands of *Salix amygdaloides* (peach-leaved willow) and *Salix lucida* (shining willow) may border this type. The *Populus angustifolia/Cornus stolonifera* (narrow-leaf cottonwood/red-osier dogwood) community type may be adjacent on relatively undisturbed sites. The *Populus angustifolia/Symphoricarpos occidentalis* (narrow-leaf cottonwood/buckbrush) community type may be adjacent on disturbed sites.

MANAGEMENT INFORMATION

Livestock

The *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) community type provides moderate levels of spring and summer forage. Heavy grazing and trampling tend to maintain the open structure of this community type and continued dominance of the

undergrowth by *Poa pratensis* (Kentucky bluegrass), *Agrostis stolonifera* (redtop), *Agropyron repens* (quackgrass), *Phleum pratense* (timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs. This community type is commonly used as a winter feed ground by ranchers. *Poa pratensis*, *Agrostis stolonifera*, *Agropyron repens*, *Phleum pratense*, and *Bromus inermis* are palatable and moderately productive grasses, especially when soil moisture levels are high. They can tolerate a high level of defoliation. Herbage production is moderate. *Poa pratensis* is well adapted to grazing and is considered an invader and an increaser, especially if grazing intensities and durations are severe (Wasser 1982). This species can produce new shoots from existing tillers or rhizomes. Grazing practices influence the growth form present (Volland 1978). A high density of weak, low vigor tillers results under season-long grazing. Stem densities are emphasized over biomass aboveground. Early season rest can increase the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass will tend to be greater.

Timber

The timber productivity of all cottonwood types is moderate to high due to favorable moisture conditions. Complete stand removal will likely result in a graminoid-dominated community with extremely limited, if any, cottonwood regeneration. The occasional sprouts from stumps are unlikely to reach maturity.

Wildlife

This type is a source of early spring forage for deer and elk. Cover value is limited because of the typically open, two layered structure. Birds are common, and larger cottonwoods provide nest sites. Large accipiters and cavity nesters may inhabit this type (Youngblood and others 1985b). Great blue herons nest in large cottonwood stands if isolation during the nesting period is possible. Colonial nest sites are used for many years if left undisturbed (Parker 1980). Osprey will also use this type for nesting (Zarn 1974).

Fisheries

The streamside location of this type is important in providing thermal cover, debris recruitment, and streambank stability. Its importance cannot be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section).

Fire

This type will burn when conditions are dry, such as fall or in late winter if snow accumulations are minimal. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria:

1) The particular species of cottonwood. In general, *Populus angustifolia* (narrow-leaf cottonwood) has a greater sprouting capability than *Populus balsamifera* (balsam poplar), which in turn has a greater sprouting capability than *Populus deltoides* (plains cottonwood).
2) The age of the trees. As cottonwoods mature, the sprouting potential decreases. As the trees reach late maturity, sprouting potential is very limited.
3) Location of the water table. In general, the higher the water table is during the growing season, the greater the survivability of resprouts.

Therefore, if a manager wants to extend the life of a cottonwood 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 is excluded from all livestock grazing for at least five years and that wildlife browsing be closely monitored.

Early spring (late March-April) or late-season (late summer-fall) fire can increase *Bromus inermis* (smooth brome) productivity, especially when *Bromus inermis* has become sod-bound. Late spring fire generally damages

cool-season grasses such as *Bromus inermis* and *Poa pratensis* (Kentucky bluegrass) (USDA IFSL 1995). Intense burns during active growing periods can be used to control stands of *Poa pratensis* (Kentucky bluegrass) (Wasser 1982). Late spring fires, after plants have been growing for about a month or more, are the most damaging to Kentucky bluegrass. Cool fires conducted when plants are dormant have little effect on *Poa pratensis*, but it cannot withstand frequent spring burning, and may be eliminated from sites that are burned annually for several years (USDA IFSL 1995).

Soil Management and Rehabilitation Opportunities

Coarse textured soils are not as susceptible to compaction. This community type is subject to recurring scouring by floods and alluvium deposition. However, 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 very important on higher gradient streams.

Managers should maintain a buffer of *Populus angustifolia* (narrow-leaf cottonwood) community types adjacent to rivers and streams. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize streambanks, and dissipate flood energy.

If the site still has a high water table, a dramatic change in management (i.e. elimination of livestock 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 completely gone, the opportunity to re-establish an understory of desirable shrubs may have been lost.

Where revegetation with shrubs is the goal, some desirable species such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) 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 effectively stabilize recently bare soil. Remember: If the canopy cover of trees in the stand has opened up too much and/or the water table has been severely lowered, revegetation success with desirable woody species will be low.

When considering rehabilitation of stands with fire, see the discussion above in the Fire Management section about the inherent problems of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand is excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988):

1) Do not plant cottonwoods on saline or alkaline sites.
2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer.
3) Make cuttings from open stands of young, rapidly growing trees. Use only cuttings that are four years old or less. Make cuttings long enough to provide 1 to 2 m (3 to 6 ft) of top length left above the soil surface (see #6 and #7 below). Remove lower branches, leaving only the tip and top two side branches.
4) Make cuttings when the plants are completely dormant.
5) Soak the cuttings in water for 10 to 14 days.
6) Auger holes to the depth of the lowest anticipated growing season water table level.

7) Place cuttings in the augered holes on the same day they are removed from the soak. Set the butt to the lowest level anticipated that the growing season groundwater will drop.
8) Back fill the holes carefully to avoid leaving air pockets.
9) Place tree guards around the cuttings if rodent or rabbit damage is likely.
10) As buds begin to swell along the cuttings, remove them from the lower two-thirds of the cutting.
11) Plantings must be protected from livestock grazing and big game browsing for two or three growing seasons. Beaver control may also be needed.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game, and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures within this type. Some campgrounds have been seriously damaged by floods or lost altogether.

OTHER STUDIES

A *Populus angustifolia*/Herbaceous (narrow-leaf cottonwood/Herbaceous) community type is described by Hansen and others (1995). A similar community type was identified by Youngblood and others (1985b) for eastern Idaho and western Wyoming, by Padgett and others (1989) for Utah and southeastern Idaho, and by Chadde and others (1988) for northern Yellowstone National Park.

Populus balsamifera/Cornus stolonifera Community Type
(Balsam Poplar/Red-Osier Dogwood Community Type)

POPUBAL/CORNSTO
Number of Stands Sampled = 44
Number of Stands Sampled in Alberta = 23

LOCATION AND ASSOCIATED LANDFORMS

The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type is a minor to incidental type at low to mid elevations in all of southern Alberta, except for the Dry Mixedgrass Natural Subregion in the southeastern corner of the province. In the Grassland Ecoregion, this type occurs on alluvial terraces of major streams and rivers, and around lakes and ponds. *Populus balsamifera* (balsam poplar) occurs at higher elevations and more northern latitudes than *Populus angustifolia* (narrow-leaf cottonwood), which in turn occurs at higher elevations than *Populus deltoides* (plains cottonwood). In the Parkland Natural Region *Populus balsamifera* (balsam poplar) often occurs in mixed stands with *Populus tremuloides* (aspen).

VEGETATION

This type is characterized by an overstory of poplars dominating a potentially dense and diverse understory of shrubs and herbaceous plants. *Populus deltoides* (plains cottonwood) and *Populus angustifolia* (narrow-leaf cottonwood) may be present on sites in the southern part of the study area, but are subordinate to *Populus balsamifera* (balsam poplar).

Cornus stolonifera (red-osier dogwood) is the diagnostic shrub for this type. A wide variety of herbaceous species is usually present on undisturbed sites (Table 12). Most sites of this type have been vegetatively altered to some degree by human usage, which induces a greater presence of such species as *Symphoricarpos occidentalis* (buckbrush), *Bromus inermis* (smooth brome), and *Poa pratensis* (Kentucky bluegrass) at the expense of more palatable native species.

Table 12. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 18 stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Betula papyrifera (white birch)	5	0-10	22	10
Picea glauca (white spruce)	2	0-1	22	7
Populus balsamifera (balsam poplar)	67	40-90	100	82
Populus tremuloides (aspen)	3	0-10	28	9
Shrubs				
Alnus tenuifolia (river alder)	16	0-60	44	27
Amelanchier alnifolia (saskatoon)	8	0-30	50	20
Betula occidentalis (water birch)	2	0-3	11	5
Clematis ligusticifolia (western clematis)	1	0-1	6	2
Cornus canadensis (bunchberry)	1	0-1	11	3
Cornus stolonifera (red-osier dogwood)	34	3-70	100	58
Corylus cornuta (beaked hazelnut)	3	0-3	6	4
Crataegus douglasii (Douglas hawthorn)	3	0-3	6	4
Elaeagnus commutata (silverberry)	3	0-3	6	4
Lonicera spp. (honeysuckle)	3	0-3	6	4
Lonicera dioica (twining honeysuckle)	5	0-10	17	9
Lonicera involucrata (bracted honeysuckle)	1	0-1	6	2

Table 12. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 18 stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Prunus virginiana (choke cherry)	17	0-40	44	27
Rhus radicans (poison ivy)	3	0-3	6	4
Ribes americanum (wild black currant)	10	0-20	11	10
Ribes hudsonianum (northern black currant)	1	0-1	6	2
Ribes lacustre (bristly black currant)	1	0-1	6	2
Ribes oxyacanthoides (northern gooseberry)	2	0-3	17	6
Ribes spp. (currant)	3	0-3	6	4
Ribes triste (wild red currant)	1	0-1	6	2
Rosa spp. (rose)	11	0-40	94	32
Rubus idaeus (wild red raspberry)	7	0-30	39	17
Rubus pubescens (dewberry)	1	0-3	39	6
Salix bebbiana (beaked willow)	4	0-10	22	9
Salix discolor (pussy willow)	1	0-1	6	2
Salix lucida (shining willow)	1	0-1	6	2
Salix lutea (yellow willow)	2	0-3	22	7
Salix planifolia (flat-leaved willow)	1	0-3	17	4
Salix scouleriana (Scouler's willow)	1	0-1	11	3
Shepherdia canadensis (Canada buffaloberry)	1	0-1	6	2
Symphoricarpos albus (snowberry)	3	0-3	6	4
Symphoricarpos spp. (buckbrush)	2	0-3	33	8
Symphoricarpos occidentalis (buckbrush)	9	0-40	33	17
Viburnum edule (low-bush cranberry)	4	0-10	33	11
Viburnum opulus (high-bush cranberry)	10	0-10	6	8
Graminoids				
Agropyron dasystachyum (northern wheat grass)	4	0-10	17	8
Agropyron repens (quack grass)	3	0-3	6	4
Agrostis stolonifera (redtop)	3	0-3	6	4

Table 12. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 18 stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Bromus inermis (smooth brome)	1	0-3	50	7
Bromus anomalus (nodding brome)	1	0-1	6	2
Calamagrostis canadensis (bluejoint)	2	0-3	39	9
Carex praegracilis (graceful sedge)	1	0-1	6	2
Carex sprengelii (Sprengel's sedge)	3	0-3	6	4
Elymus glaucus (smooth wild rye)	1	0-1	6	2
Festuca saximontana (Rocky Mountain fescue)	1	0-1	6	2
Phalaris arundinacea (reed canary grass)	10	0-10	6	8
Phleum pratense (timothy)	3	0-3	6	4
Poa compressa (Canada bluegrass)	10	0-10	6	8
Poa pratensis (Kentucky bluegrass)	5	0-10	17	9
Schizachne purpurascens (purple oat grass)	1	0-1	6	2
Stipa viridula (green needle grass)	20	0-20	6	11
Forbs				
Achillea millefolium (common yarrow)	1	0-1	11	3
Achillea sibirica (many-flowered yarrow)	1	0-1	11	3
Actaea rubra (red and white baneberry)	5	0-20	22	10
Allium cernuum (nodding onion)	1	0-1	6	2
Anemone canadensis (Canada anemone)	1	0-1	6	2
Aralia nudicaulis (wild sarsaparilla)	16	0-80	39	25
Arctium lappa (great burdock)	1	0-1	6	2
Arnica chamissonis (leafy arnica)	3	0-3	6	4
Aster ascendens (western aster)	10	0-10	6	8
Aster ciliolatus (Lindley's aster)	10	0-10	6	8
Aster conspicuus (showy aster)	1	0-1	39	6
Aster hesperius (western willow aster)	1	0-1	11	3
Aster laevis (smooth aster)	1	0-1	6	2

Table 12. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 18 stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Chenopodium salinum (oak-leaved goosefoot)	1	0-1	6	2
Cirsium arvense (Canada thistle)	2	0-3	11	5
Cirsium vulgare (bull thistle)	1	0-1	6	2
Delphinium glaucum (tall larkspur)	1	0-1	6	2
Disporum trachycarpum (fairybells)	1	0-1	6	2
Epilobium angustifolium (common fireweed)	5	0-10	11	7
Fragaria virginiana (wild strawberry)	2	0-3	22	7
Galeopsis tetrahit (hemp-nettle)	1	0-1	6	2
Galium boreale (northern bedstraw)	3	0-10	28	9
Galium triflorum (sweet-scented bedstraw)	2	0-3	33	8
Geranium richardsonii (wild white geranium)	1	0-1	6	2
Geum aleppicum (yellow avens)	1	0-1	6	2
Heracleum lanatum (cow parsnip)	1	0-1	11	3
Lathyrus ochroleucus (cream-colored vetchling)	3	0-10	39	11
Lysimachia ciliata (fringed loosestrife)	1	0-1	11	3
Maianthemum canadense (wild lily-of-the-valley)	1	0-1	6	2
Medicago lupulina (black medick)	1	0-1	6	2
Medicago sativa (alfalfa)	3	0-3	6	4
Mentha arvensis (wild mint)	1	0-1	6	2
Mertensia paniculata (tall lungwort)	1	0-3	22	5
Mitella nuda (bishop's-cap)	1	0-1	6	2
Moehringia lateriflora (blunt-leaved sandwort)	1	0-1	6	2
Petasites palmatus (palmate-leaved coltsfoot)	1	0-3	22	5
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	6	2
Psoralea esculenta (Indian breadroot)	1	0-1	6	2
Pyrola asarifolia (common pink wintergreen)	1	0-1	6	2
Ranunculus spp. (ranunculus)	3	0-3	6	4

Table 12. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 18 stands of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Senecio foetidus (marsh butterweed)	1	0-1	6	2
Smilacina stellata (star-flowered Solomon's-seal)	3	0-10	72	15
Solidago canadensis (Canada goldenrod)	2	0-3	39	9
Solidago spp. (goldenrod)	1	0-1	6	2
Solidago gigantea (late goldenrod)	1	0-1	6	2
Sonchus arvensis (perennial sow-thistle)	3	0-3	6	4
Stachys palustris (marsh hedge-nettle)	2	0-3	11	5
Taraxacum ceratophorum (northern dandelion)	1	0-1	6	2
Taraxacum officinale (common dandelion)	1	0-3	28	5
Thalictrum spp. (meadow rue)	3	0-3	6	4
Thalictrum venulosum (veiny meadow rue)	4	0-10	28	11
Thermopsis rhombifolia (golden bean)	10	0-10	6	8
Urtica dioica (common nettle)	2	0-3	11	5
Vicia americana (wild vetch)	1	0-1	39	6
Vicia spp. (vetch)	1	0-1	6	2
Viola canadensis (western Canada violet)	3	0-10	22	8
Viola renifolia (kidney-leaved violet)	1	0-1	6	2
Ferns and Allies				
Equisetum arvense (common horsetail)	8	0-30	61	22
Equisetum laevigatum (smooth scouring-rush)	1	0-1	11	3
Equisetum sylvaticum (woodland horsetail)	40	0-40	6	15

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type represents a mid-seral stage of primary succession. Figure 7 is a generalized schematic of the successional pathway followed on sites of this type.

Primary Successional Stages

Cottonwoods are a pioneering species that for establishment require moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, sidebars, mid channel bars, delta bars, and islands along major streams. Since cottonwoods are a pioneering species, and do not regenerate in their own shade, they are considered a seral species and do not represent the climax vegetation or potential for the site. Many stands may appear to have some limited regeneration, especially in open areas.

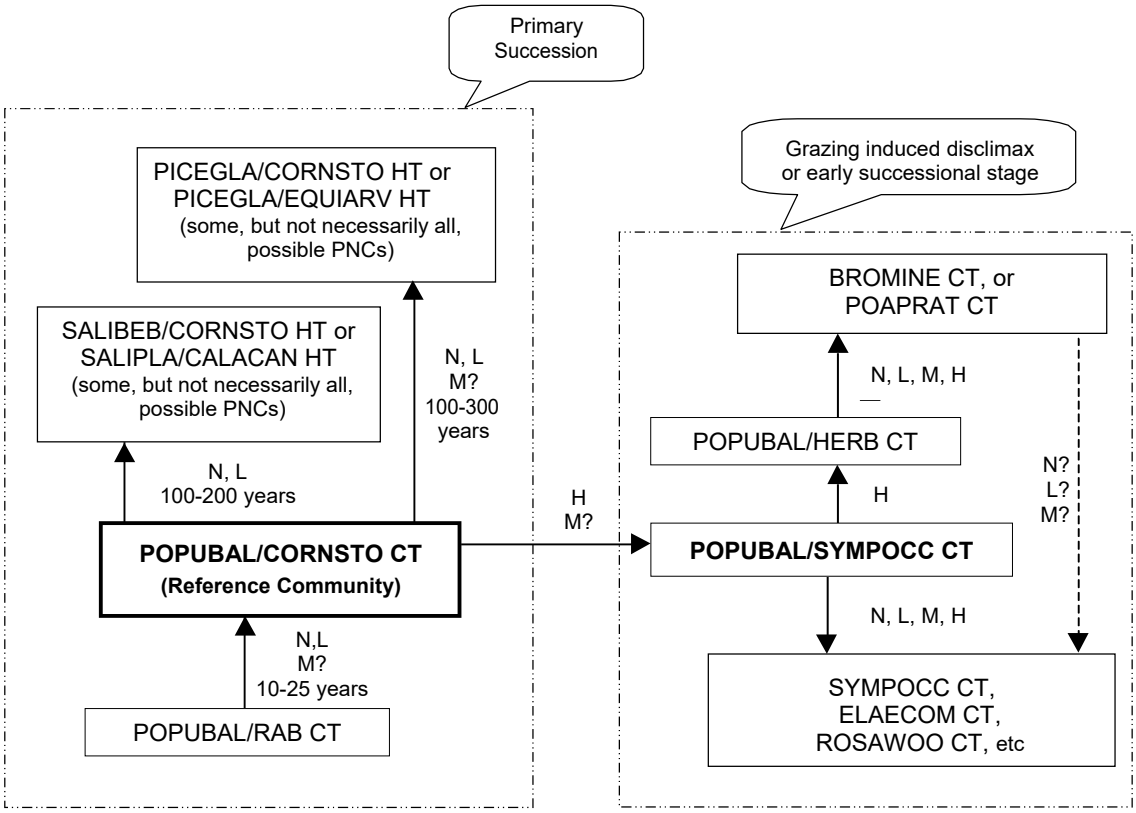
However, it is important to understand that these young plants represent root sprouts (asexual reproduction), not establishment by seeds (sexual reproduction). These sprouts may prolong the life of the stand, but will not perpetuate it. If the site is left undisturbed, in time the cottonwoods will be replaced by a later successional stage.

Erosion and deposition along a river help maintain plant community diversity on its floodplain. 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, or climax (PNC) successional stage. If the migration rate is high, few stands progress to late successional stage. Near the outer edges of the floodplain, effect of the river is reduced, allowing more late 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 band or terrace supporting a vegetation community of a different age. The bands generally are progressively older as one moves away from the channel and onto higher terraces. Parts of the floodplain may remain undisturbed long enough for their elevation to increase enough with respect to the channel that they are rarely, if ever, flooded. These are considered old, mature alluvial terraces, and may continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage—The *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type is the earliest seral stage of this type.

Mid-Seral Stage—If disturbance (human-caused or natural) does not eliminate the stand, the *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage, *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type. Normally, the understory under a pole to mature *Populus balsamifera* (balsam poplar) stand is dominated by young plants of other tree species climax to the site, such as *Picea glauca* (white spruce) or *Populus tremuloides* (aspen). If no climax tree species are present, the stand may progress to a tall shrub type dominated by *Salix bebbiana* (beaked willow). As the *Populus balsamifera* overstory matures, becomes open, and finally, decadent, these species are ready to replace them.

Figure 7. POPUBAL/CORNSTO CT



Successional Pathway Diagram of POPUBAL Sites in Southern Alberta Grasslands
Reference Community = POPUBAL/CORNSTO CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
POPUBAL/CORNSTO CT	*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) Community Type
POPUBAL/SYMPOCC CT	*Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) Community Type
POPUBAL/RAB CT	*Populus balsamifera/*Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) Community Type
POPUBAL/HERB CT	*Populus balsamifera/*Herbaceous (balsam poplar/Herbaceous) Community Type
SALIBEB/CORNSTO HT	*Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) Habitat Type
SALIPLA/CALACAN HT	*Salix planifolia/Calamagrostis canadensis* (flat-leaved willow/bluejoint) Habitat Type
PICEGLA/EQUIARV HT	*Picea glauca/Equisetum arvense* (white spruce/common horsetail) Habitat Type
PICEGLA/CORNSTO HT	*Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) Habitat Type
SYMPOCC CT	*Symphoricarpos occidentalis* (buckbrush) Community Type
ELAECOM CT	*Elaeagnus commutata* (silverberry) Community Type
ROSAWOO CT	*Rosa woodsii* (common wild rose) Community Type
BROMINE CT	*Bromus inermis* (smooth brome) Community Type
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic potential does not change.The most likely such hydrologic change would be fluvial buildup of the floodplain, resulting in a terrace site too dry to support willows.The time span is estimated for the stand to become dominated under undisturbed conditions by at least 50 percent cover of climax (or overstory indicator) species.Cottonwood stands do not regenerate themselves in situ, therefore the seral progression is not reversible. We see no evidence to indicate that willows can re-establish themselves on a site after it becomes dominated by non willow species.

Late Seral to Climax (PNC) Stage—As the cottonwood stand dies, primary succession toward a climax community progresses unless flooding deposits new sediment suitable for cottonwood seedlings. In the absence of such deposition at an opportune time, succession continues from the *Populus balsamifera/*

Cornus stolonifera (balsam poplar/red-osier dogwood) community type to a habitat type dominated by one of such species as *Picea glauca* (white spruce), *Populus tremuloides* (aspen), or *Salix bebbiana* (beaked willow).

Secondary Successional Stages

The presence or absence of a particular understory community may aid in determining degree of disturbance (present and historical) on a site. On relatively undisturbed sites, the *Populus balsamifera* (balsam poplar) understory will contain a diverse, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), various *Salix* species (willows), and *Ribes* (currants and gooseberries).

With moderate grazing or browsing, *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) will increase with a corresponding decrease in abundance and canopy cover of *Cornus stolonifera*, *Amelanchier alnifolia*, *Prunus virginiana*, and *Ribes*. If grazing or browsing pressures continue, the more desirable shrubs will be eliminated, leaving *Symphoricarpos occidentalis* and *Rosa* species to form a nearly impenetrable understory. This is the *Populus balsamifera/ Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type stage of disturbance- caused secondary succession. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory converted to herbaceous, dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs. This extremely disturbed stage is the *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) community type.

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 stand becomes decadent with widely spaced, dying cottonwoods. The site can become open and dry enough to change the potential to an upland type, as indicated by the presence of upland species. Such conversion may be slow due to persistence of some of the sod forming grasses. Remnant riparian shrubs and graminoids, if present will help indicate potential undergrowth composition.

Once the stand has converted from a shrub-dominated understory to one dominated by introduced herbaceous species, the potential for returning the site to its former state (shrub dominated) is very difficult. 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 shrub-dominated understory, the most cost effective way is to change the management ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Regosols with up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Brunisols and Chernozems can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m (39 in) 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 water table. Soils are generally well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment of rapidly moving, highly aerated groundwater. This type of substrate is common to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often the *Salix exigua* (sandbar willow) community type or the *Typha latifolia* (common cattail) and *Eleocharis* (spikesedge) dominated

habitat types. Stands of *Salix amygdaloides* (peach-leaved willow) and *Salix lucida* (shining willow) may border this type. The *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) community type or the *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type may be adjacent on disturbed sites, or by a variety of upland species on 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 forage. *Cornus stolonifera* is an "ice cream" plant to livestock and wildlife. Its abundance is a direct indication of past and current use levels. In some sites, livestock browsing of *Cornus stolonifera* may be quite high.

Sites are often subjected to heavy grazing pressure because of their gentle topography and ease of access. With moderate to heavy prolonged grazing pressure, palatable shrubs will be eliminated leaving mostly *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species as the dominant understory. At this stage, the stand has been converted to the *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) disturbance-caused community type. If continued disturbance is severe, these shrubs also will be eliminated, and the stand converted to the *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) disturbance-caused community type (see the discussion under the Seral Stages section).

Timber

The timber productivity of all cottonwood types is moderate to high due to favorable moisture conditions. Complete stand removal will likely result in a shrub-dominated community with extremely limited, if any, cottonwood regeneration. The occasional sprouts from stumps are unlikely to reach maturity.

Wildlife

The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type provides valuable cover, shade, and food for a variety of species. Big game use may be high, depending upon the time of year. The spreading crown of *Populus balsamifera* (balsam poplar) provides sites for huge platform-like stick nests of bald eagles and ospreys (Arno and Hammerly 1984) and for great blue herons (Parker 1980). Canada geese occasionally use the nests previously built by bald eagles and osprey. A variety of birds and mammals, such as woodpeckers, great horned owls, wood ducks, and raccoons, nest in trunk cavities. *Populus balsamifera* (balsam poplar) and *Cornus stolonifera* (red-osier dogwood) are often eaten by moose (Costain 1989) and used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

Fisheries

Due to the streamside location of the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type, it provides thermal cover, debris, and streambank stability. Its importance cannot be emphasized enough (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. This is particularly important on the higher gradient streams where scouring by seasonal flooding may occur.

Fire

The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type is susceptible to fire during the late summer and fall. *Populus balsamifera* and shrubs associated with this type are adapted to light, and under some conditions, to fires of moderate intensity. Many of these species can produce new sprouts after a burn. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria:

1) The particular species of cottonwood. In general, *Populus angustifolia* (narrow-leaf cottonwood) has a greater sprouting capability than *Populus balsamifera* (balsam poplar), which in turn has a greater sprouting capability than *Populus deltoides* (plains cottonwood).
2) The age of the trees. As cottonwoods mature, the sprouting potential decreases. As the trees reach late maturity, sprouting potential is very limited.
3) Location of the water table. In general, the higher the water table is during the growing season, the greater the survivability of resprouts.

Therefore, if a manager wants to extend the life of a cottonwood 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 is excluded from all livestock grazing for at least five years and that wildlife browsing be closely monitored.

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, these shrubs sprout from the surviving rhizomes or stolons (runners) (Fischer and Bradley 1987).

Soil Management and Rehabilitation Opportunities

Coarse textured soils are not as susceptible to compaction. This community type is subject to recurring scouring by floods and alluvium deposition. However, 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 very important on higher gradient streams.

Managers should maintain a buffer of *Populus balsamifera* (balsam poplar) community types adjacent to rivers and streams. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize streambanks, and dissipate flood energy.

If the site still has a high water table, a dramatic change in management (i.e. elimination of livestock 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 completely gone, the opportunity to re-establish an understory of desirable shrubs may have been lost.

Where revegetation with shrubs is the goal, some desirable species such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) 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 effectively stabilize recently bare soil. Remember: If the canopy cover of trees in the stand has opened up too much and/or the water table has been severely lowered, revegetation success with desirable woody species will be low.

When considering rehabilitation of stands with fire, see the discussion above in the Fire Management section about the inherent problems of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand is excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988):

1) Do not plant cottonwoods on saline or alkaline sites.
2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer.
3) Make cuttings from open stands of young, rapidly growing trees. Use only cuttings that are four years old or less. Make cuttings long enough to provide 1 to 2 m (3 to 6 ft) of top length left above the soil surface (see #6 and #7 below). Remove lower branches, leaving only the tip and top two side branches.
4) Make cuttings when the plants are completely dormant.
5) Soak the cuttings in water for 10 to 14 days.
6) Auger holes to the depth of the lowest anticipated growing season water table level.
7) Place cuttings in the augered holes on the same day they are removed from the soak. Set the butt to the lowest level anticipated that the growing season groundwater would drop.
8) Back fill the holes carefully to avoid leaving air pockets.
9) Place tree guards around the cuttings if rodent or rabbit damage is likely.
10) As buds begin to swell along the cuttings, remove them from the lower two-thirds of the cutting.
11) Plantings must be protected from livestock grazing and big game browsing for two or three growing seasons. Beaver control may also be needed.

Recreational Uses and Considerations

Because of proximity to streams and flat topography, recreational developments and transportation corridors are common in this type. Opportunities are excellent in this type for fishing, big game, and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures in this type. Some campgrounds have been seriously damaged by floods or lost altogether.

OTHER STUDIES

The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type is described for the mountains, foothills, and intermountain valleys of Montana by Hansen and others (1995). Similar communities have been reported for western Montana (Foote 1965), central Oregon (Kovalchik 1987), and central Idaho (Tuhy and Jensen 1982). Moss (1932) found *Cornus stolonifera* (red-osier dogwood) to be the leading "characteristic" shrub species of the *Populus balsamifera* "consociation" in central Alberta.

Populus balsamifera/Recent Alluvial Bar Community Type
(Balsam Poplar/Recent Alluvial Bar Community Type)

POPUBAL

Number of Stands Sampled = 15

Number of Stands Sampled in Alberta = 3

LOCATION AND ASSOCIATED LANDFORMS

The *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type is a minor to incidental type at low to mid elevations in all of southern Alberta, except for the Dry Mixedgrass Natural Subregion in the southeastern corner of the province. This type occurs on alluvial terraces of streams and rivers, and around lakes and ponds where moist sediment deposits become exposed. *Populus balsamifera* (balsam poplar) occurs at higher elevations and more northern latitudes than *Populus angustifolia* (narrow-leaf cottonwood), which in turn occurs at higher elevations than *Populus deltoides* (plains cottonwood). In the Parkland Natural Region *Populus balsamifera* (balsam poplar) often occurs in mixed stands with *Populus tremuloides* (aspen). Major dams that control peak flows on rivers have been shown to adversely affect the success of cottonwood tree establishment (Bradley and Smith 1986, Rood and Mahoney 1991).

VEGETATION

This type is characterized by domination by seedlings or saplings of *Populus balsamifera* (balsam poplar), or co-domination by cottonwoods and *Salix exigua* (sandbar willow). *Populus deltoides* (plains cottonwood) and *Populus angustifolia* (narrow-leaf cottonwood) may be present but are subordinate to *Populus balsamifera* (balsam poplar). A wide variety of herbaceous species can occupy the understory (Table 13).

Table 13. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 stands of the *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Populus angustifolia (narrow-leaf cottonwood)	20	0-20	11	15
Populus balsamifera (balsam poplar)	49	10-80	100	70
Shrubs				
Alnus tenuifolia (river alder)	12	0-20	22	16
Amelanchier alnifolia (saskatoon)	1	0-1	11	3
Betula occidentalis (water birch)	3	0-3	11	6
Clematis ligusticifolia (western clematis)	1	0-1	11	3
Cornus canadensis (bunchberry)	40	0-40	11	21
Cornus stolonifera (red-osier dogwood)	1	0-1	11	3
Elaeagnus commutata (silverberry)	3	0-3	11	6
Prunus virginiana (choke cherry)	1	0-1	22	5
Rosa woodsii (common wild rose)	3	0-3	11	6

Table 13. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 stands of the *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Rosa spp. (rose)	1	0-1	11	3
Salix drummondiana (Drummond's willow)	1	0-1	11	3
Salix exigua (sandbar willow)	11	0-20	56	25
Salix lucida (shining willow)	10	0-10	11	10
Salix lutea (yellow willow)	10	0-20	22	15
Salix scouleriana (Scouler's willow)	3	0-3	11	6
Symphoricarpos occidentalis (buckbrush)	1	0-1	11	3
Graminoids				
Agropyron dasystachyum (northern wheat grass)	10	0-10	11	10
Agropyron repens (quack grass)	1	0-1	33	6
Agrostis stolonifera (redtop)	7	0-10	22	12
Bromus inermis (smooth brome)	3	0-3	11	6
Calamagrostis canadensis (bluejoint)	15	0-40	33	22
Dicanthelium acuminatum (hot-springs millet)	1	0-1	11	3
Elymus virginicus (Virginia wild rye)	1	0-1	11	3
Phleum pratense (timothy)	2	0-3	22	7
Poa compressa (Canada bluegrass)	2	0-3	22	7
Poa palustris (fowl bluegrass)	20	0-20	11	15
Poa pratensis (Kentucky bluegrass)	1	0-1	22	5
Forbs				
Apocynum cannabinum (Indian hemp)	3	0-3	11	6
Arctium minus (common burdock)	1	0-1	11	3
Aster hesperius (western willow aster)	3	0-3	11	6
Aster modestus (large northern aster)	3	0-3	11	6
Astragalus spp. (milk vetch)	1	0-1	11	3
Centaurea maculosa (spotted knapweed)	1	0-1	11	3
Chenopodium spp. (goosefoot)	1	0-1	11	3

Table 13. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 stands of the *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Cirsium arvense (Canada thistle)	1	0-1	11	3
Cynoglossum officinale (hound's-tongue)	1	0-1	11	3
Epilobium angustifolium (common fireweed)	3	0-3	11	6
Euphorbia esula (leafy spurge)	1	0-1	22	5
Gaillardia aristata (gaillardia)	1	0-1	11	3
Galium triflorum (sweet-scented bedstraw)	1	0-1	11	3
Heracleum lanatum (cow parsnip)	20	0-20	11	15
Lathyrus ochroleucus (cream-colored vetchling)	1	0-1	11	3
Medicago lupulina (black medick)	1	0-1	11	3
Medicago sativa (alfalfa)	10	0-10	11	10
Melilotus alba (white sweet-clover)	5	0-10	22	10
Melilotus officinalis (yellow sweet-clover)	1	0-1	11	3
Oxytropis spp. (locoweed)	1	0-1	11	3
Smilacina stellata (star-flowered Solomon's-seal)	3	0-3	33	10
Solidago canadensis (Canada goldenrod)	2	0-3	22	7
Solidago gigantea (late goldenrod)	3	0-3	11	6
Solidago missouriensis (low goldenrod)	1	0-1	11	3
Streptopus amplexifolius (clasping-leaved twisted-stalk)	3	0-3	11	6
Tanacetum vulgare (common tansy)	1	0-1	22	5
Taraxacum officinale (common dandelion)	1	0-1	44	7
Thalictrum occidentale (western meadow rue)	40	0-40	11	21
Thermopsis rhombifolia (golden bean)	1	0-1	11	3
Tragopogon dubius (common goat's-beard)	1	0-1	11	3
Vicia americana (wild vetch)	1	0-1	22	5
Viola spp. (violet)	1	0-1	11	3
Ferns and Allies				
Equisetum arvense (common horsetail)	2	0-3	22	7

Table 13. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 stands of the *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Equisetum laevigatum (smooth scouring-rush)	1	0-1	11	3

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type is an early seral (pioneer) stage of primary succession.

Primary Successional Stages

Cottonwoods are a pioneering species that for establishment require moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, sidebars, mid channel bars, delta bars, and islands along major streams. Since cottonwoods are a pioneering species, and do not regenerate in their own shade, they are considered a seral species and do not represent the climax vegetation or potential for the site. Many stands may appear to have some limited regeneration, especially in open areas. However, it is important to understand that these young plants represent root sprouts (asexual reproduction), not establishment by seeds (sexual reproduction). These sprouts may prolong the life of the stand, but will not perpetuate it. If the site is left undisturbed, in time the cottonwoods will be replaced by a later successional stage.

Erosion and deposition along a river help maintain plant community diversity on its floodplain. 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, or climax (PNC) successional stage. If the migration rate is high, few stands progress to late successional stage. Near the outer edges of the floodplain, effect of the river is reduced, allowing more late 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 band or terrace supporting a vegetation community of a different age. The bands generally are progressively older as one moves away from the channel and onto higher terraces. Parts of the floodplain may remain undisturbed long enough for their elevation to increase enough with respect to the channel that they are rarely, if ever, flooded. These are considered old, mature alluvial terraces, and may continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage—The *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type is the earliest seral stage of this type.

Mid-Seral Stage—If disturbance (human-caused or natural) does not eliminate the stand, the *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage, *Populus*

balsamifera/Cornus stolonifera (balsam poplar/red-osier dogwood) community type. Normally, the understory under a pole to mature *Populus balsamifera* (balsam poplar) stand is dominated by young plants of other tree species climax to the site, such as *Picea glauca* (white spruce) or *Populus tremuloides* (aspen). If no climax tree species are present, the stand may progress to a tall shrub type dominated by *Salix bebbiana* (beaked willow). As the *Populus balsamifera* overstory matures, becomes open, and finally, decadent, these species are ready to replace them.

Late Seral to Climax (PNC) Stage—As the cottonwood stand dies, primary succession toward a climax community progresses unless flooding deposits new sediment suitable for cottonwood seedlings. In the absence of such deposition at an opportune time, succession continues from the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type to a habitat type dominated by such species as *Picea glauca* (white spruce), *Populus tremuloides* (aspen), or *Salix bebbiana* (beaked willow).

Secondary Successional Stages

The normal primary successional sequence (described above) may be altered due to varying degrees of grazing and browsing pressures. Moderate, prolonged grazing and browsing will shift seral progression to the disturbance-caused *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type. Severe, prolonged grazing and browsing pressures may eliminate all tree seedlings and even the undergrowth of shrub species as well. This severely disturbed stage of secondary succession is called the *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) community type. In this situation, the overstory of *Populus balsamifera* (balsam poplar) still matures and becomes open with an understory dominated by herbaceous species. Finally the stand becomes decadent with widely spaced, dying cottonwoods. The site then is so open and dry that its potential may have changed to one of a variety of upland types.

Stands of the *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type are very susceptible to natural river dynamics. They may be flooded and eliminated after just a year or two of growth. Ice can also have a dramatic impact on these recently deposited alluvial bars. Ice can influence the floodplain by: 1) mechanical damage, or 2) flooding (inundation). Mechanical damage generally involves: a) the laying down or bending over of the young cottonwoods, b) the shearing off of the stems, c) the pulling from the ground of the roots by ice that freezes around the stems, and d) the tilting or pushing over of mature trees. Cottonwood seedlings and saplings are very susceptible to defoliation by livestock. If grazing pressure is too great, the stand can be eliminated. In many cases, livestock utilization has eliminated the establishment of new cottonwood stands. Beaver and wild ungulates can also have a dramatic impact on newly established cottonwood stands.

SOILS

Soils are typically Regosols with up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Brunisols and Chernozems can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m (39 in) of the soil surface in summer, but soils can remain moist due to capillary action. Soils are generally well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment of rapidly moving, highly aerated groundwater. This type of substrate is common to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often the *Salix exigua* (sandbar willow) community type or the *Typha latifolia* (common cattail) and *Eleocharis* (spikesedge) dominated habitat types. Any of the later seral (older) *Populus balsamifera* community types may be adjacent on slightly higher elevations. Stands of *Salix amygdaloides* (peach-leaved willow) and *Salix lucida* (shining willow) may also border this type upslope.

MANAGEMENT INFORMATION

Livestock

Forage production is low to moderate in this type. Stands in good to excellent health (condition) often support dense thickets of cottonwoods and associated shrubs, thereby limiting the amount of herbaceous forage. These stands are very susceptible to defoliation by livestock. If establishment of new cottonwood stands is a management objective, livestock impacts should be closely monitored. In some situations, it may be advisable to eliminate livestock use until the cottonwoods have grown out of reach of livestock.

Wildlife

The *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type provides valuable cover, shade, and food for a variety of wildlife species. Big game use may be high, depending upon the season. *Populus balsamifera* (balsam poplar) is used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

Fisheries

The streamside location of the *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type has fisheries value by providing shade and streambank stability.

Fire

The *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type is susceptible to fire. In general, cottonwood seedlings, and to a lesser degree, cottonwood saplings lack extensive roots or thick bark, and may therefore be severely damaged (or eliminated) by fire.

Soil Management and Rehabilitation Opportunities

The coarse textured substrates are not susceptible to compaction. This community type is subject to recurrent scouring by floods and alluvium deposition. Managers should maintain a buffer strip of cottonwood dominated community types adjacent streams. These buffer strips filter out sediment, stabilize streambanks, and slow flood waters.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988):

1) Do not plant cottonwoods on saline or alkaline sites.
2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer.
3) Make cuttings from open stands of young, rapidly growing trees. Use only cuttings that are four years old or less. Make cuttings long enough to provide 1 to 2 m (3 to 6 ft) of top length left above the soil surface (see #6 and #7 below). Remove lower branches, leaving only the tip and top two side branches.
4) Make cuttings when the plants are completely dormant.
5) Soak the cuttings in water for 10 to 14 days.
6) Auger holes to the depth of the lowest anticipated growing season water table level.
7) Place cuttings in the augered holes on the same day they are removed from the soak. Set the butt to the

lowest level anticipated that the growing season groundwater would drop.

8) Back fill the holes carefully to avoid leaving air pockets.
9) Place tree guards around the cuttings if rodent or rabbit damage is likely.
10) As buds begin to swell along the cuttings, remove them from the lower two-thirds of the cutting.
11) Plantings must be protected from livestock grazing and big game browsing for two or three growing seasons. Beaver control may also be needed.

Recreational Uses and Considerations

Recreational opportunities 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.

OTHER STUDIES

The *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type is described by Hansen and others (1995) for the mountains, foothills, and intermountain valleys of Montana.

Populus balsamifera/Symphoricarpos occidentalis Community Type
(Balsam Poplar/Buckbrush Community Type)

POPUBAL/SYMPOCC
Number of Stands Sampled = 24
Number of Stands Sampled in Alberta = 9

LOCATION AND ASSOCIATED LANDFORMS

The *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type is a minor to incidental type at low to mid elevations in all of southern Alberta, except for the Dry Mixedgrass Natural Subregion in the southeastern corner of the province. In the Grassland Ecoregion, this type occurs on alluvial terraces of major streams and rivers, and around lakes and ponds. *Populus balsamifera* (balsam poplar) occurs at higher elevations and more northern latitudes than *Populus angustifolia* (narrow-leaf cottonwood), which in turn occurs at higher elevations than *Populus deltoides* (plains cottonwood). In the Parkland Natural Region *Populus balsamifera* (balsam poplar) often occurs in mixed stands with *Populus tremuloides* (aspen).

VEGETATION

The *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type represents a grazing disclimax. This type is characterized by an overstory of cottonwoods over a potentially dense and diverse group of undergrowth shrubs and herbaceous plants. *Populus deltoides* (plains cottonwood) and *Populus angustifolia* (narrow-leaf cottonwood) may be present but are subordinate to *Populus balsamifera* (balsam poplar).

The type is characterized by an overstory of *Populus balsamifera* (balsam poplar) over an understory dominated by *Symphoricarpos occidentalis* (buckbrush) and/or *Rosa woodsii* (common wild rose) (Table 14).

Table 14. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 24 stands of the grazing or browsing disclimax *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Betula papyrifera (white birch)	3	0 - 3	4	3
Picea glauca (white spruce)	1	0 - 3	17	4
Populus angustifolia (narrow-leaf cottonwood)	20	0 - 20	4	9
Populus balsamifera (balsam poplar)	59	30 - 90	100	77
Populus tremuloides (aspen)	1	0 - 3	21	5
Pseudotsuga menziesii (Douglas-fir)	2	0 - 3	8	4
Shrubs				
Alnus tenuifolia (river alder)	5	0 - 10	17	9
Amelanchier alnifolia (saskatoon)	7	0 - 60	58	20
Arctostaphylos uva-ursi (common bearberry)	1	0 - 1	8	3
Betula glandulosa (bog birch)	10	0 - 10	4	6
Betula occidentalis (water birch)	8	0 - 20	13	10
Clematis occidentalis (purple clematis)	1	0 - 1	4	2
Cornus stolonifera (red-osier dogwood)	1	0 - 1	25	5
Corylus cornuta (beaked hazelnut)	10	0 - 10	4	6
Crataegus douglasii (Douglas hawthorn)	55	0 - 90	8	21
Crataegus rotundifolia (round-leaved hawthorn)	20	0 - 20	4	9
Dryas drummondii (yellow mountain avens)	10	0 - 10	4	6
Elaeagnus commutata (silverberry)	16	0 - 30	29	22
Juniperus communis (ground juniper)	1	0 - 1	4	2
Juniperus scopulorum (Rocky Mountain juniper)	1	0 - 1	4	2
Linnaea borealis (twinflower)	1	0 - 1	4	2
Lonicera involucrata (bracted honeysuckle)	1	0 - 1	13	4
Potentilla fruticosa (shrubby cinquefoil)	1	0 - 3	17	4
Prunus virginiana (choke cherry)	5	0 - 10	29	12
Rhus radicans (poison ivy)	1	0 - 1	4	2

Table 14. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 24 stands of the grazing or browsing disclimax *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Ribes inerme (mountain gooseberry)	3	0 - 3	4	3
Ribes oxyacanthoides (northern gooseberry)	4	0 - 20	38	12
Ribes spp. (currant)	2	0 - 3	8	4
Rosa spp. (rose)	16	0 - 50	88	38
Rubus arcticus (dwarf raspberry)	1	0 - 1	4	2
Rubus idaeus (wild red raspberry)	5	0 - 20	17	9
Rubus parviflorus (thimbleberry)	20	0 - 20	8	13
Salix bebbiana (beaked willow)	4	0 - 20	29	11
Salix boothii (Booth's willow)	2	0 - 3	8	4
Salix drummondiana (Drummond’s willow)	1	0 - 1	8	3
Salix exigua (sandbar willow)	2	0 - 3	17	6
Salix lucida (shining willow)	12	0 - 20	8	10
Salix lutea (yellow willow)	10	0 - 20	8	9
Salix melanopsis (willow)	1	0 - 1	4	2
Salix myrtillifolia (myrtle-leaved willow)	1	0 - 1	8	3
Salix pseudomonticola (false mountain willow)	7	0 - 10	8	7
Shepherdia canadensis (Canada buffaloberry)	4	0 - 10	29	11
Spiraea betulifolia (white meadowsweet)	1	0 - 1	8	3
Symphoricarpos albus (snowberry)	1	0 - 1	4	2
Symphoricarpos occidentalis (buckbrush)	10	0 - 30	71	27
Graminoids				
Agropyron spp. (wheat grass)	1	0 - 1	4	2
Agropyron repens (quack grass)	2	0 - 3	8	4
Agropyron smithii (western wheat grass)	15	0 - 20	8	11
Agrostis spp. (Agrostis)	3	0 - 3	4	3
Agrostis stolonifera (redtop)	28	0 - 60	17	22
Agropyron trachycaulum (slender wheat grass)	3	0 - 3	17	7

Table 14. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 24 stands of the grazing or browsing disclimax *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Bromus anomalus (nodding brome)	1	0 - 1	4	2
Bromus carinatus (keeled brome)	2	0 - 3	8	4
Bromus ciliatus (fringed brome)	2	0 - 3	13	5
Bromus inermis (smooth brome)	15	0 - 40	33	22
Bromus spp. (brome)	3	0 - 3	4	3
Calamagrostis canadensis (bluejoint)	2	0 - 3	8	4
Carex microglochin (short-awned sedge)	1	0 - 1	8	3
Carex pachystachya (sedge)	1	0 - 1	4	2
Carex praegracilis (graceful sedge)	3	0 - 3	4	3
Carex utriculata (beaked sedge)	1	0 - 1	4	2
Carex sprengelii (Sprengel's sedge)	3	0 - 3	8	5
Deschampsia cespitosa (tufted hair grass)	2	0 - 3	8	4
Eleocharis compressa (flattened spike-rush)	3	0 - 3	4	3
Elymus glaucus (smooth wild rye)	10	0 - 20	8	9
Festuca rubra (red fescue)	3	0 - 3	8	5
Unknown Grass	3	0 - 3	4	3
Hierochloe odorata (sweet grass)	1	0 - 1	4	2
Juncus balticus (wire rush)	1	0 - 1	4	2
Luzula parviflora (small-flowered wood-rush)	1	0 - 1	4	2
Phleum pratense (timothy)	16	0 - 80	42	26
Poa compressa (Canada bluegrass)	3	0 - 3	4	3
Poa cusickii (early bluegrass)	1	0 - 1	4	2
Poa nervosa (Wheeler's bluegrass)	3	0 - 3	4	3
Poa palustris (fowl bluegrass)	6	0 - 20	21	11
Poa pratensis (Kentucky bluegrass)	20	0 - 50	75	39
Stipa comata (needle-and-thread)	20	0 - 20	4	9
Stipa viridula (green needle grass)	3	0 - 3	4	3

Table 14. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 24 stands of the grazing or browsing disclimax *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Forbs				
Achillea millefolium (common yarrow)	2	0 - 3	42	9
Actaea rubra (red and white baneberry)	1	0 - 3	13	4
Agrimonia striata (agrimony)	3	0 - 3	4	3
Allium cernuum (nodding onion)	1	0 - 1	8	3
Allium spp. (onion)	1	0 - 1	4	2
Anemone cylindrica (long-fruited anemone)	1	0 - 1	13	4
Anemone multifida (cut-leaved anemone)	1	0 - 1	4	2
Angelica arguta (white angelica)	1	0 - 1	8	3
Artemisia campestris (plains wormwood)	1	0 - 1	4	2
Artemisia ludoviciana (prairie sagewort)	1	0 - 1	8	3
Aster ascendens (western aster)	1	0 - 1	4	2
Aster ciliolatus (Lindley's aster)	10	0 - 10	4	6
Aster conspicuus (showy aster)	1	0 - 1	8	3
Aster hesperius (western willow aster)	7	0 - 10	8	7
Aster laevis (smooth aster)	3	0 - 10	21	8
Aster modestus (large northern aster)	3	0 - 3	4	3
Aster puniceus (purple-stemmed aster)	1	0 - 1	4	2
Aster spp. (aster)	1	0 - 1	8	3
Aster subspicatus (leafy-bracted aster)	3	0 - 3	17	7
Astragalus americanus (American milk vetch)	1	0 - 1	4	2
Athyrium filix-femina (lady fern)	3	0 - 3	4	3
Campanula rotundifolia (harebell)	1	0 - 1	8	3
Castilleja coccinea (scarlet paintbrush)	1	0 - 1	4	2
Castilleja spp. (paintbrush)	1	0 - 1	8	3
Castilleja miniata (common red paintbrush)	3	0 - 3	4	3
Chrysanthemum leucanthemum (ox-eye daisy)	1	0 - 1	13	4

Table 14. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 24 stands of the grazing or browsing disclimax *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Cirsium arvense (Canada thistle)	7	0 - 20	21	12
Cirsium spp. (thistle)	1	0 - 1	4	2
Disporum trachycarpum (fairybells)	3	0 - 3	4	3
Epilobium angustifolium (common fireweed)	1	0 - 3	21	5
Erigeron spp. (erigeron)	1	0 - 1	4	2
Erigeron speciosus (showy fleabane)	1	0 - 1	4	2
Euphorbia esula (leafy spurge)	1	0 - 1	4	2
Fragaria virginiana (wild strawberry)	2	0 - 3	42	9
Galium aparine (cleavers)	1	0 - 1	4	2
Galium boreale (northern bedstraw)	3	0 - 10	25	9
Galium triflorum (sweet-scented bedstraw)	1	0 - 3	17	4
Geranium spp. (geranium)	1	0 - 1	4	2
Geranium richardsonii (wild white geranium)	5	0 - 10	21	10
Geranium viscosissimum (sticky purple geranium)	1	0 - 1	4	2
Geum macrophyllum (large-leaved yellow avens)	1	0 - 1	4	2
Glycyrrhiza lepidota (wild licorice)	1	0 - 1	4	2
Habenaria dilatata (tall white bog orchid)	1	0 - 1	8	3
Hackelia jessicae (Jessica's stickseed)	1	0 - 1	4	2
Heracleum lanatum (cow parsnip)	2	0 - 3	17	6
Heterotheca villosa (golden aster)	1	0 - 1	4	2
Hieracium umbellatum (narrow-leaved hawkweed)	1	0 - 1	8	3
Lactuca serriola (prickly lettuce)	1	0 - 1	4	2
Lathyrus ochroleucus (cream-colored vetchling)	6	0 - 30	29	13
Linaria vulgaris (butter-and-eggs)	1	0 - 1	4	2
Linum lewisii (wild blue flax)	1	0 - 1	4	2
Melilotus alba (white sweet-clover)	2	0 - 3	8	4
Melilotus officinalis (yellow sweet-clover)	1	0 - 1	4	2

Table 14. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 24 stands of the grazing or browsing disclimax *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Mentha arvensis (wild mint)	1	0 - 1	4	2
Mertensia spp. (bluebell)	1	0 - 1	4	2
Mertensia paniculata (tall lungwort)	2	0 - 3	13	5
Monarda fistulosa (wild bergamot)	1	0 - 1	8	3
Montia spp. (montia)	1	0 - 1	4	2
Osmorhiza chilensis (blunt-fruited sweet cicely)	5	0 - 10	13	8
Osmorhiza depauperata (spreading sweet cicely)	1	0 - 3	13	4
Osmorhiza occidentalis (western sweet cicely)	10	0 - 20	8	9
Petasites palmatus (palmate-leaved coltsfoot)	3	0 - 3	4	3
Potentilla gracilis (graceful cinquefoil)	1	0 - 1	8	3
Prunella vulgaris (heal-all)	1	0 - 1	4	2
Pyrola asarifolia (common pink wintergreen)	4	0 - 10	13	7
Sanicula marilandica (snakeroot)	1	0 - 1	13	4
Senecio pauperculus (balsam groundsel)	1	0 - 3	17	4
Senecio pseudaureus (thin-leaved ragwort)	12	0 - 20	8	10
Smilacina stellata (star-flowered Solomon's-seal)	3	0 - 20	67	14
Solidago canadensis (Canada goldenrod)	3	0 - 10	17	7
Solidago spp. (goldenrod)	20	0 - 20	4	9
Solidago gigantea (late goldenrod)	2	0 - 3	8	4
Solidago graminifolia (flat-topped goldenrod)	1	0 - 1	4	2
Solidago missouriensis (low goldenrod)	5	0 - 20	21	10
Sonchus arvensis (perennial sow-thistle)	1	0 - 3	13	4
Taraxacum ceratophorum (northern dandelion)	1	0 - 1	4	2
Taraxacum officinale (common dandelion)	3	0 - 20	54	13
Thalictrum dasycarpum (tall meadow rue)	3	0 - 3	4	3
Thalictrum occidentale (western meadow rue)	28	0 - 80	17	22
Thalictrum venulosum (veiny meadow rue)	1	0 - 1	21	5

Table 14. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 24 stands of the grazing or browsing disclimax *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Thermopsis rhombifolia (golden bean)	5	0 - 10	13	8
Trifolium hybridum (alsike clover)	1	0 - 1	4	2
Trifolium spp. (clover)	1	0 - 1	4	2
Trifolium pratense (red clover)	8	0 - 20	13	10
Trifolium repens (white clover)	13	0 - 40	21	17
Urtica dioica (common nettle)	2	0 - 3	8	4
Vicia americana (wild vetch)	2	0 - 3	29	8
Viola adunca (early blue violet)	1	0 - 1	8	3
Viola spp. (violet)	12	0 - 20	8	10
Viola canadensis (western Canada violet)	1	0 - 1	13	4
Ferns and Allies				
Equisetum arvense (common horsetail)	10	0 - 50	38	19
Equisetum laevigatum (smooth scouring-rush)	1	0 - 1	4	2

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type represents a moderately disturbed secondary successional stage of the mid-seral *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type.

Primary Successional Stages

Cottonwoods are a pioneering species that for establishment require moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, sidebars, mid channel bars, delta bars, and islands along major streams. Since cottonwoods are a pioneering species, and do not regenerate in their own shade, they are considered a seral species and do not represent the climax vegetation or potential for the site. Many stands may appear to have some limited regeneration, especially in open areas. However, it is important to understand that these young plants represent root sprouts (asexual reproduction), not establishment by seeds (sexual reproduction). These sprouts may prolong the life of the stand, but will not perpetuate it. If the site is left undisturbed, in time the cottonwoods will be replaced by a later successional stage.

Erosion and deposition along a river help maintain plant community diversity on its floodplain. 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, or climax (PNC) successional stage. If the migration rate is high, few stands progress to late successional stage. Near the outer edges of the floodplain, effect of the river is reduced, allowing more late 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 band or terrace supporting a vegetation community of a different age. The bands generally are progressively older as one moves away from the channel and onto higher terraces. Parts of the floodplain may remain undisturbed long enough for their elevation to increase enough with respect to the channel that they are rarely, if ever, flooded. These are considered old, mature alluvial terraces, and may continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage—The *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type is the earliest seral stage of this type.

Mid-Seral Stage—If disturbance (human-caused or natural) does not eliminate the stand, the *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage, *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type. Normally, the understory under a pole to mature *Populus balsamifera* (balsam poplar) stand is dominated by young plants of other tree species climax to the site, such as *Picea glauca* (white spruce) or *Populus tremuloides* (aspen). If no climax tree species are present, the stand may progress to a tall shrub type dominated by *Salix bebbiana* (beaked willow). As the *Populus balsamifera* overstory matures, becomes open, and finally, decadent, these species are ready to replace them.

Late Seral to Climax (PNC) Stage—As the cottonwood stand dies, primary succession toward a climax community progresses unless flooding deposits new sediment suitable for cottonwood seedlings. In the absence of such deposition at an opportune time, succession continues from the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type to a habitat type dominated by such species as *Picea glauca* (white spruce), *Populus tremuloides* (aspen), or *Salix bebbiana* (beaked willow).

Secondary Successional Stages

The presence or absence of a particular understory community may aid in determining degree of disturbance (present and historical) on a site. On relatively undisturbed sites, the *Populus balsamifera* (balsam poplar) understory will contain a diverse, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), various *Salix* species (willows), and *Ribes* (currants and gooseberries). With moderate grazing or browsing *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) will increase with a corresponding decrease in abundance and canopy cover of *Cornus stolonifera*, *Amelanchier alnifolia*, *Prunus virginiana*, and *Ribes*. If grazing or browsing pressures continue, the more desirable shrubs will be eliminated, leaving *Symphoricarpos occidentalis* and *Rosa* species to form a nearly impenetrable understory. This is the *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type stage of disturbance-caused secondary succession. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory

converted to herbaceous, dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs. This extremely disturbed stage is the *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) community type.

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 stand becomes decadent with widely spaced, dying cottonwoods. The site can become open and dry enough to change the potential to an upland type, as indicated by the presence of upland species. Such conversion may be slow due to persistence of some of the sod forming grasses. Remnant riparian shrubs and graminoids, if present will help indicate potential undergrowth composition.

Once the stand has converted from a shrub-dominated understory to one dominated by introduced herbaceous species, the potential for returning the site to its former state (shrub dominated) is very difficult. 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 shrub-dominated understory, the most cost effective way is to change the management ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Regosols with up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Brunisols and Chernozems can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m (39 in) 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 water table. Soils are generally well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment of rapidly moving, highly aerated groundwater. This type of substrate is common to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often the *Salix exigua* (sandbar willow) community type or the *Typha latifolia* (common cattail) and *Eleocharis* (spikesedge) dominated habitat types. Stands of *Salix amygdaloides* (peach-leaved willow) and *Salix lucida* (shining willow) may border this type. The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) or the *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) community types may be on adjacent sites, or there may be a variety of upland species on adjacent drier sites.

MANAGEMENT INFORMATION

Livestock

Forage production ranges from low to moderate in the dense shrub understory in these stands. Forage production in dense thickets of *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) is low. Stands may be so dense that they prevent most livestock use. If the shrub understory is reduced by continual prolonged grazing or browsing, stands open and forage production increases due to the disturbance-caused increase of *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (timothy), and/or *Bromus inermis* (smooth brome). The palatability of *Symphoricarpos occidentalis* (buckbrush) ranges from low to fair for cattle and sheep (Wasser 1982, Johnson and Nichols 1982), and the leaves of *Rosa woodsii* (common wild rose) are considered fair to good livestock forage, particularly for sheep (Johnson and Nichols 1982).

Timber

The timber productivity of all cottonwood types is moderate to high due to favorable moisture conditions. Complete stand removal will likely result in a shrub-dominated community with extremely limited, if any, cottonwood regeneration. The occasional sprouts from stumps are unlikely to reach maturity.

Wildlife

The *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type provides valuable cover, shade, and food for a variety of species. Big game use may be high, depending upon the time of year. The spreading crown of *Populus balsamifera* (balsam poplar) provides sites for huge platform-like stick nests of bald eagles and ospreys (Arno and Hammerly 1984) and for great blue herons (Parker 1980). Canada geese occasionally use the nests previously built by bald eagles and osprey. A variety of birds and mammals, such as woodpeckers, great horned owls, wood ducks, and raccoons, nest in trunk cavities. *Populus balsamifera* (balsam poplar) and *Rosa woodsii* (common wild rose) are used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

The moderate structural understory diversity of *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) provides thermal and hiding cover for big game and upland bird species. The palatability of *Symphoricarpos occidentalis* (buckbrush) is rated as good for deer and elk (Wasser 1982, Johnson and Nichols 1982). Deer and elk may browse heavily on *Rosa woodsii* (common wild rose), while the persistent fruit (rose hips) provides fall and winter food for birds, small mammals, and bears, which disperse the seeds. *Rosa woodsii* (common wild rose) is strongly grazing tolerant but can be dwarfed and thinned by intense browsing or defoliation by season long use.

Fisheries

The streamside location of the *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type makes it very important in providing thermal cover, debris, and streambank stability. Its importance cannot be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section). *Symphoricarpos occidentalis* (buckbrush) and *Rosa woodsii* (common wild rose) are excellent in controlling erosion along streams due to their rhizomatous nature. This is particularly important on higher gradient streams where scouring by seasonal flooding is possible.

Fire

The *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type is susceptible to fire during the late summer and fall. *Populus angustifolia* (narrow-leaf cottonwood) and shrubs associated with this type are adapted to light, and under some conditions, to fires of moderate intensity. Many of these species can produce new sprouts after a burn. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria:

1) The particular species of cottonwood. In general, *Populus angustifolia* (narrow-leaf cottonwood) has a greater sprouting capability than *Populus balsamifera* (balsam poplar), which in turn has a greater sprouting capability than *Populus deltoides* (plains cottonwood).
2) The age of the trees. As cottonwoods mature, the sprouting potential decreases. As the trees reach late maturity, sprouting potential is very limited.
3) Location of the water table. In general, the higher the water table is during the growing season, the greater the survivability of resprouts.

Therefore, if a manager wants to extend the life of a cottonwood 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 is excluded from all livestock grazing for at least five years and that wildlife browsing be closely monitored.

Symphoricarpos occidentalis (buckbrush) is tolerant of fire. It can be injured by fire but usually sprouts, with stands becoming denser afterward. It is such a strong competitor, particularly in dense colonies, that it is not very compatible with most herbaceous vegetation. *Rosa woodsii* (common wild rose) is typically top-killed by fire, but root crowns and underground rhizomes survive low- or moderate-severity fires. However, the shallow root crowns of *Rosa woodsii* are susceptible to injury, and populations consequently decrease following high-severity fire. *Rosa woodsii* recovery varies with fire severity. Top-killed plants will sprout from the root crown and underground surviving rhizomes (USDA IFSL 1995).

Soil Management and Rehabilitation Opportunities

Coarse textured soils are not as susceptible to compaction. This community type is subject to recurring scouring by floods and alluvium deposition. However, 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 very important on higher gradient streams.

Managers should maintain a buffer of *Populus balsamifera* (balsam poplar) community types adjacent to rivers and streams. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize streambanks, and dissipate flood energy.

If the site still has a high water table, a dramatic change in management (i.e. elimination of livestock 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 completely gone, the opportunity to re-establish an understory of desirable shrubs may have been lost.

Where revegetation with shrubs is the goal, some desirable species such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) 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 effectively stabilize recently bare soil. Remember: If the canopy cover of trees in the stand has opened up too much and/or the water table has been severely lowered, revegetation success with desirable woody species will be low.

When considering rehabilitation of stands with fire, see the discussion above in the Fire Management section about the inherent problems of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand is excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988):

1) Do not plant cottonwoods on saline or alkaline sites.
2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer.
3) Make cuttings from open stands of young, rapidly growing trees. Use only cuttings that are four years

old or less. Make cuttings long enough to provide 1 to 2 m (3 to 6 ft) of top length left above the soil surface (see #6 and #7 below). Remove lower branches, leaving only the tip and top two side branches.

4) Make cuttings when the plants are completely dormant.
5) Soak the cuttings in water for 10 to 14 days.
6) Auger holes to the depth of the lowest anticipated growing season water table level.
7) Place cuttings in the augered holes on the same day they are removed from the soak. Set the butt to the lowest level anticipated that the growing season groundwater will drop.
8) Back fill the holes carefully to avoid leaving air pockets.
9) Place tree guards around the cuttings if rodent or rabbit damage is likely.
10) As buds begin to swell along the cuttings, remove them from the lower two-thirds of the cutting.
11) Plantings must be protected from livestock grazing and big game browsing for two or three growing seasons. Beaver control may also be needed.

Symphoricarpos occidentalis (buckbrush) is well adapted for revegetating disturbed sites due to its habit of growing in dense clonal stands. It does best on moist, well-drained soils, which have not been excessively disturbed. Once established, it grows at a moderate rate and spreads rapidly by root sprouts. Nursery grown seedlings, rooted cuttings, or wildlings are the preferred planting materials. Critical, erodible sites may require that grazing be completely excluded during establishment. Animal populations and stocking rates should be balanced with forage supply on noncritical sites after establishment (Wasser 1982).

Rosa woodsii (common wild rose) is valuable for revegetating disturbed sites along streambanks and seeps. It is easily established from nursery grown stock, root cuttings, or transplanting.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game, and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures within this type. Some campgrounds in Montana have been seriously damaged by floods or lost altogether.

Symphoricarpos occidentalis (buckbrush) is an important food source for upland birds due to fruits that persist into the winter. 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 *Rosa woodsii* (common wild rose) community type. However, *Rosa woodsii* (common wild rose) is useful for planting in recreation areas as a biological barrier to protect physical structures, young and delicate plants, and to direct traffic.

OTHER STUDIES

The *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type is described by Hansen and others (1995) for the mountains, foothills, and intermountain valleys of Montana. Similar communities have been reported for western Montana (Foote 1965), central Oregon (Kovalchik 1987), and central Idaho (Tuhy and Jensen 1982).

Populus balsamifera/Herbaceous Community Type
(Balsam Poplar/Herbaceous Community Type)

POPUBAL

Number of Stands Sampled = 19

Number of Stands Sampled in Alberta = 7

LOCATION AND ASSOCIATED LANDFORMS

The *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) community type is a minor to incidental type at low to mid elevations in all of southern Alberta, except for the Dry Mixedgrass Natural Subregion in the southeastern corner of the province. In the Grassland Ecoregion, this type occurs on alluvial terraces of major streams and rivers, and around lakes and ponds. *Populus balsamifera* (balsam poplar) occurs at higher elevations and more northern latitudes than *Populus angustifolia* (narrow-leaf cottonwood), which in turn occurs at higher elevations than *Populus deltoides* (plains cottonwood). In the Parkland Natural Region *Populus balsamifera* (balsam poplar) often occurs in mixed stands with *Populus tremuloides* (aspen).

VEGETATION

The *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) community type is a grazing or browsing disclimax community type characterized by a two layer structure of mature, widely spaced *Populus balsamifera* (balsam poplar) over an understory of grasses dominated by *Bromus inermis* (smooth brome), *Poa pratensis* (Kentucky bluegrass), or *Phleum pratense* (timothy). Some shrub species may be present as remnant, scattered individuals (Table 15).

Table 15. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 12 stands of the grazing or browsing disclimax *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Fraxinus pennsylvanica (green ash)	1	0 - 1	17	4
Populus deltoides (plains cottonwood)	65	40 - 98	100	81
Shrubs				
Amelanchier alnifolia (saskatoon)	1	0 - 1	17	4
Artemisia cana (silver sagebrush)	3	0 - 3	8	5
Clematis ligusticifolia (western clematis)	1	0 - 1	8	3
Cornus stolonifera (red-osier dogwood)	1	0 - 1	25	5
Elaeagnus angustifolia (Russian olive)	1	0 - 1	17	4
Parthenocissus quinquefolia (Virginia creeper)	2	0 - 3	17	6
Prunus virginiana (choke cherry)	1	0 - 1	8	3
Rhus radicans (poison ivy)	1	0 - 3	25	5
Rhus trilobata (skunkbush)	1	0 - 1	8	3

Table 15. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 12 stands of the grazing or browsing disclimax *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Ribes aureum (golden currant)	1	0 - 1	8	3
Rosa spp. (rose)	1	0 - 1	42	6
Salix amygdaloides (peach-leaved willow)	1	0 - 1	42	6
Salix exigua (sandbar willow)	5	0 - 10	17	9
Salix lutea (yellow willow)	2	0 - 3	17	6
Shepherdia argentea (thorny buffaloberry)	1	0 - 3	33	6
Symphoricarpos occidentalis (buckbrush)	3	0 - 10	58	13
Vitis riparia (riverbank grape)	1	0 - 1	17	4
Graminoids				
Agropyron repens (quack grass)	10	0 - 20	58	24
Agropyron smithii (western wheat grass)	18	0 - 30	25	21
Agrostis stolonifera (redtop)	2	0 - 3	17	6
Agropyron trachycaulum (slender wheat grass)	40	0 - 40	8	18
Bromus inermis (smooth brome)	27	0 - 70	50	37
Bromus japonicus (Japanese chess)	1	0 - 1	8	3
Calamovilfa longifolia (sand grass)	3	0 - 3	25	9
Carex atherodes (awned sedge)	1	0 - 1	8	3
Elymus canadensis (Canada wild rye)	12	0 - 20	58	26
Hordeum jubatum (foxtail barley)	2	0 - 3	17	6
Muhlenbergia racemosa (marsh muhly)	16	0 - 20	33	23
Phalaris arundinacea (reed canary grass)	3	0 - 3	8	5
Poa palustris (fowl bluegrass)	12	0 - 20	17	14
Poa pratensis (Kentucky bluegrass)	20	0 - 20	17	18
Poa spp. (bluegrass)	3	0 - 3	8	5
Spartina pectinata (prairie cord grass)	10	0 - 10	8	9
Forbs				
Ambrosia psilostachya (perennial ragweed)	3	0 - 3	8	5
Apocynum cannabinum (Indian hemp)	8	0 - 10	25	14
Artemisia absinthium (absinthe wormwood)	7	0 - 10	17	11
Artemisia ludoviciana (prairie sagewort)	1	0 - 1	25	5
Asclepias speciosa (showy milkweed)	1	0 - 1	8	3
Asclepias verticillata (whorled milkweed)	1	0 - 1	8	3
Aster ericoides (tufted white prairie aster)	1	0 - 1	8	3
Aster spp. (aster)	2	0 - 3	17	6
Cirsium arvense (Canada thistle)	1	0 - 1	25	5
Euphorbia esula (leafy spurge)	1	0 - 1	8	3
Glycyrrhiza lepidota (wild licorice)	5	0 - 20	83	20
Grindelia squarrosa (gumweed)	1	0 - 1	25	5

Table 15. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 12 stands of the grazing or browsing disclimax *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Helenium autumnale (sneezeweed)	1	0 - 1	8	3
Helianthus nuttallii (common tall sunflower)	3	0 - 3	8	5
Melilotus alba (white sweet-clover)	6	0 - 20	33	14
Melilotus officinalis (yellow sweet-clover)	1	0 - 1	17	4
Petalostemon spp. (prairie-clover)	1	0 - 1	8	3
Potentilla anserina (silverweed)	1	0 - 1	8	3
Rumex triangulivalvis (narrow-leaved dock)	1	0 - 1	8	3
Smilacina stellata (star-flowered Solomon's-seal)	3	0 - 3	8	5
Solidago canadensis (Canada goldenrod)	9	0 - 20	33	17
Solidago gigantea (late goldenrod)	7	0 - 10	17	11
Taraxacum officinale (common dandelion)	1	0 - 1	8	3
Thermopsis rhombifolia (golden bean)	7	0 - 10	17	11
Vicia americana (wild vetch)	1	0 - 3	25	5
Xanthium strumarium (cocklebur)	3	0 - 3	8	5
Ferns and Allies				
Equisetum arvense (common horsetail)	8	0 - 20	25	14

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) community type represents a severely disturbed secondary successional stage of the mid-seral *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type.

Primary Successional Stages

Cottonwoods are a pioneering species that for establishment require moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, sidebars, mid channel bars, delta bars, and islands along major streams. Since cottonwoods are a pioneering species, and do not regenerate in their own shade, they are considered a seral species and do not represent the climax vegetation or potential for the site. Many stands may appear to have some limited regeneration, especially in open areas. However, it is important to understand that these young plants represent root sprouts (asexual reproduction), not establishment by seeds (sexual reproduction). These sprouts may prolong the life of the stand, but will not perpetuate it. If the site is left undisturbed, in time the cottonwoods will be replaced by a later successional stage.

Erosion and deposition along a river help maintain plant community diversity on its floodplain. 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, or climax (PNC) successional stage. If the migration

rate is high, few stands progress to late successional stage. Near the outer edges of the floodplain, effect of the river is reduced, allowing more late 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 band or terrace supporting a vegetation community of a different age. The bands generally are progressively older as one moves away from the channel and onto higher terraces. Parts of the floodplain may remain undisturbed long enough for their elevation to increase enough with respect to the channel that they are rarely, if ever, flooded. These are considered old, mature alluvial terraces, and may continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage—The *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type is the earliest seral stage of this type.

Mid-Seral Stage—If disturbance (human-caused or natural) does not eliminate the stand, the *Populus balsamifera*/Recent Alluvial Bar (balsam poplar/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage, *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type. Normally, the understory under a pole to mature *Populus balsamifera* (balsam poplar) stand is dominated by young plants of other tree species climax to the site, such as *Picea glauca* (white spruce) or *Populus tremuloides* (aspen). If no climax tree species are present, the stand may progress to a tall shrub type dominated by *Salix bebbiana* (beaked willow). As the *Populus balsamifera* overstory matures, becomes open, and finally, decadent, these species are ready to replace them.

Late Seral to Climax (PNC) Stage—As the cottonwood stand dies, primary succession toward a climax community progresses unless flooding deposits new sediment suitable for cottonwood seedlings. In the absence of such deposition at an opportune time, succession continues from the *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type to a habitat type dominated by such species as *Picea glauca* (white spruce), *Populus tremuloides* (aspen), or *Salix bebbiana* (beaked willow).

Secondary Successional Stages

The presence or absence of a particular understory community may aid in determining degree of disturbance (present and historical) on a site. On relatively undisturbed sites, the *Populus balsamifera* (balsam poplar) understory will contain a diverse, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), various *Salix* species (willows), and *Ribes* (currants and gooseberries).

With moderate grazing or browsing, *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) will increase with a corresponding decrease in abundance and canopy cover of *Cornus stolonifera*, *Amelanchier alnifolia*, *Prunus virginiana*, and *Ribes*. If grazing or browsing pressures continue, the more desirable shrubs will be eliminated, leaving *Symphoricarpos occidentalis* and *Rosa* species to form a nearly impenetrable understory. This is the *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type stage of disturbance-caused secondary succession. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory converted to herbaceous, dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (timothy), *Bromus inermis* (smooth brome), and a variety

of “weedy” forbs. This extremely disturbed stage is the *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) community type.

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 stand becomes decadent with widely spaced, dying cottonwoods. The site can become open and dry enough to change the potential to an upland type, as indicated by the presence of upland species. Such conversion may be slow due to persistence of some of the sod forming grasses. Remnant riparian shrubs and graminoids, if present will help indicate potential undergrowth composition.

Once the stand has converted from a shrub-dominated understory to one dominated by introduced herbaceous species, the potential for returning the site to its former state (shrub dominated) is very difficult. 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 shrub-dominated understory, the most cost effective way is to change the management ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Regosols with up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Brunisols and Chernozems can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m (39 in) 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 water table. Soils are generally well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment of rapidly moving, highly aerated groundwater. This type of substrate is common to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often the *Salix exigua* (sandbar willow) community type or the *Typha latifolia* (common cattail) and *Eleocharis* (spikesedge) dominated habitat types. Stands of *Salix amygdaloides* (peach-leaved willow) and *Salix lucida* (shining willow) may border this type. The *Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) community type or the *Populus balsamifera/Symphoricarpos occidentalis* (balsam poplar/buckbrush) community type may be on adjacent sites. Nearby drier communities may include a variety of upland communities.

MANAGEMENT INFORMATION

Livestock

The *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) community type provides moderate levels of spring and summer forage. Heavy grazing and trampling tend to maintain the open (park-like) structure of this community type and the continued undergrowth dominance by *Bromus inermis* (smooth brome), *Poa pratensis* (Kentucky bluegrass) *Phleum pratense* (timothy), and a variety of “weedy” forbs. This community type is often used by the ranching community as winter feeding ground. *Bromus inermis* (smooth brome), *Poa pratensis* (Kentucky bluegrass), and *Phleum pratense* (timothy) are palatable and moderately productive, especially when soil moisture levels are high. They tolerate a high degree of defoliation, and herbage production is moderate. *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 produces new shoots from existing tillers or rhizomes, and grazing practice can influence its growth form (Volland 1978). A high density of weak, low vigor tillers

results from season long grazing. Stem densities are emphasized over aboveground biomass. Early season rest increases the vigor of individual plants. Fewer new shoots may be produced, but total aboveground biomass tends to be greater.

Timber

The timber productivity of all cottonwood types is moderate to high due to favorable moisture conditions. Complete stand removal will likely result in a shrub-dominated community with extremely limited, if any, cottonwood regeneration. The occasional sprouts from stumps are unlikely to reach maturity.

Wildlife

This type is a source of early spring forage for deer and elk. Cover value is limited because of the typically open, two layered structure. Many kinds of birds are common since food and cover are available on the ground and in the trees. Great blue herons nest in large cottonwood stands if isolation during the nesting period is possible. Colonial nest sites are used for many years if left undisturbed (Parker 1980). Osprey will also use this type for nesting (Zarn 1974).

Fisheries

The streamside location of this type makes it important in providing thermal cover, debris, and streambank stability. Its importance cannot be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section).

Fire

This type will burn when conditions are dry, such as fall or in late winter if snow accumulations are minimal. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria:

1) The particular species of cottonwood. In general, *Populus angustifolia* (narrow-leaf cottonwood) has a greater sprouting capability than *Populus balsamifera* (balsam poplar), which in turn has a greater sprouting capability than *Populus deltoides* (plains cottonwood).
2) The age of the trees. As cottonwoods mature, the sprouting potential decreases. As the trees reach late maturity, sprouting potential is very limited.
3) Location of the water table. In general, the higher the water table is during the growing season, the greater the survivability of resprouts.

Therefore, if a manager wants to extend the life of a cottonwood 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 is excluded from all livestock grazing for at least five years and that wildlife browsing be closely monitored.

Early spring (late March-April) or late-season (late summer-fall) fire can increase *Bromus inermis* (smooth brome) productivity, especially when *Bromus inermis* has become sod-bound. Late spring fire generally damages cool-season grasses such as *Bromus inermis* and *Poa pratensis* (Kentucky bluegrass) (USDA IFSL 1995). Intense burns during active growing periods can be used to control stands of *Poa pratensis* (Kentucky bluegrass) (Wasser 1982). Late spring fires, after plants have been growing for about a month or more, are the most damaging to Kentucky bluegrass. Cool fires conducted when plants are dormant have little effect on *Poa pratensis*, but it cannot withstand frequent spring burning, and may be eliminated from sites that are burned annually for several years (USDA IFSL 1995).

Soil Management and Rehabilitation Opportunities

Coarse textured soils are not as susceptible to compaction. This community type is subject to recurring scouring by floods and alluvium deposition. However, 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 very important on higher gradient streams.

Managers should maintain a buffer of *Populus angustifolia* (narrow-leaf cottonwood) community types adjacent to rivers and streams. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize streambanks, and dissipate flood energy.

If the site still has a high water table, a dramatic change in management (i.e. elimination of livestock 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 completely gone, the opportunity to re-establish an understory of desirable shrubs may have been lost.

Where revegetation with shrubs is the goal, some desirable species such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) 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 effectively stabilize recently bare soil. Remember: If the canopy cover of trees in the stand has opened up too much and/or the water table has been severely lowered, revegetation success with desirable woody species will be low.

When considering rehabilitation of stands with fire, see the discussion above in the Fire Management section about the inherent problems of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand is excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988):

1) Do not plant cottonwoods on saline or alkaline sites.
2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer.
3) Make cuttings from open stands of young, rapidly growing trees. Use only cuttings that are four years old or less. Make cuttings long enough to provide 1 to 2 m (3 to 6 ft) of top length left above the soil surface (see #6 and #7 below). Remove lower branches, leaving only the tip and top two side branches.
4) Make cuttings when the plants are completely dormant.
5) Soak the cuttings in water for 10 to 14 days.
6) Auger holes to the depth of the lowest anticipated growing season water table level.
7) Place cuttings in the augered holes on the same day they are removed from the soak. Set the butt to the lowest level anticipated that the growing season groundwater will drop.
8) Back fill the holes carefully to avoid leaving air pockets.
9) Place tree guards around the cuttings if rodent or rabbit damage is likely.
10) As buds begin to swell along the cuttings, remove them from the lower two-thirds of the cutting.
11) Plantings must be protected from livestock grazing and big game browsing for two or three growing seasons. Beaver control may also be needed.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation

corridors are common within this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures within this type. Some campgrounds have been seriously damaged by floods or lost altogether.

OTHER STUDIES

The *Populus balsamifera*/Herbaceous (balsam poplar/Herbaceous) community type is described by Hansen and others (1995) for the mountains, foothills, and intermountain valleys of Montana. Similar communities have been reported for western Montana (Foote 1965), central Oregon (Kovalchik 1987), and central Idaho (Tuhy and Jensen 1982).

Populus deltoides/Cornus stolonifera Community Type
(Plains Cottonwood/Red-Osier Dogwood Community Type)

POPUDEL/CORNSTO
Number of Stands Sampled = 16
Number of Stands Sampled in Alberta = 9

LOCATION AND ASSOCIATED LANDFORMS

The *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type is a minor type at low elevations in the southern part of central and eastern Alberta in the Dry Mixedgrass Natural Region. This type occurs on older alluvial bars of major streams and rivers. *Populus deltoides* (plains cottonwood) is found at the lowest elevation of the three riverine *Populus* (poplar and cottonwood) species found in Alberta. Stands may be extensive on major river floodplain terraces, such as along the Milk, South Saskatchewan, and Red Deer rivers.

VEGETATION

The *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type is characterized by an overstory of *Populus deltoides* (plains cottonwood) over a dense, diverse understory of shrubs and herbs. The species composition of the type and constancy of occurrence of relatively undisturbed stands is given in Table 16.

Table 16. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 10 stands of the *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Fraxinus pennsylvanica (green ash)	2	0-3	20	6
Populus x acuminata (lance-leaf cottonwood)	90	0-90	10	30
Populus angustifolia (narrow-leaf cottonwood)	20	0-20	10	14

Table 16. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 10 stands of the *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type that are relatively undisturbed by livestock or wildlife

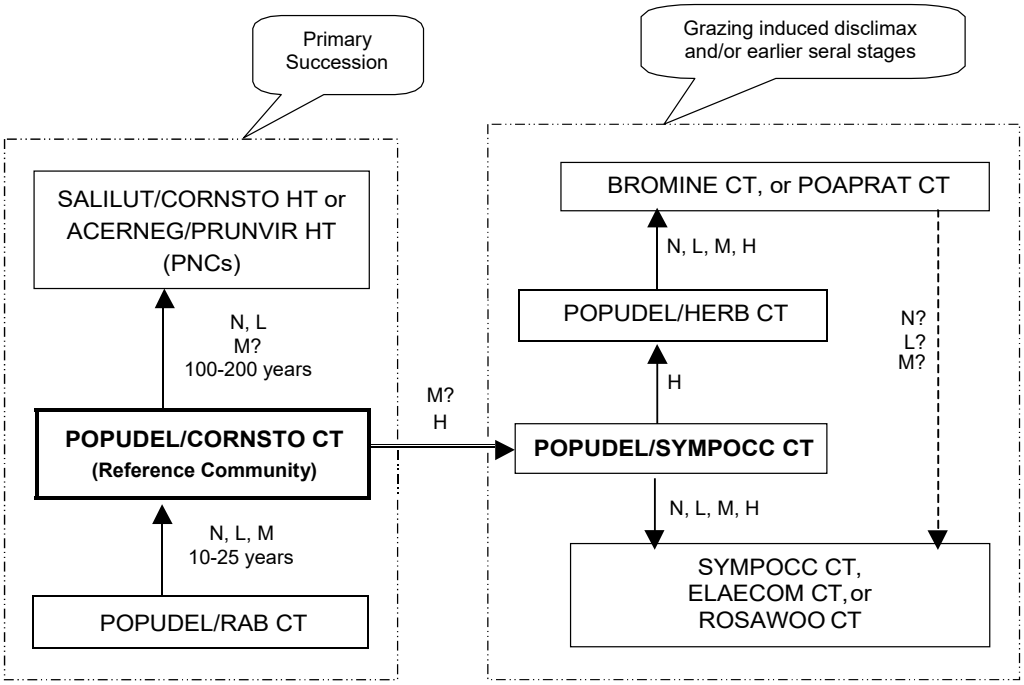
Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Populus balsamifera (balsam poplar)	25	0-40	20	22
Populus deltoides (plains cottonwood)	62	0-90	90	75
Shrubs				
Alnus tenuifolia (river alder)	10	0-10	10	10
Amelanchier alnifolia (saskatoon)	1	0-1	20	4
Betula occidentalis (water birch)	1	0-1	10	3
Clematis ligusticifolia (western clematis)	3	0-3	10	5
Cornus stolonifera (red-osier dogwood)	50	3-98	100	71
Prunus virginiana (choke cherry)	12	0-40	40	22
Rhus trilobata (skunkbush)	1	0-1	10	3
Ribes aureum (golden currant)	2	0-3	20	6
Ribes oxyacanthoides (northern gooseberry)	1	0-1	10	3
Rosa spp. (rose)	9	0-30	90	28
Salix amygdaloides (peach-leaved willow)	3	0-3	10	5
Salix exigua (sandbar willow)	40	0-80	20	28
Salix lutea (yellow willow)	19	0-60	90	41
Shepherdia argentea (thorny buffaloberry)	1	0-1	10	3
Symphoricarpos occidentalis (buckbrush)	2	0-3	60	11
Graminoids				
Agropyron dasystachyum (northern wheat grass)	50	0-50	10	22
Agropyron repens (quack grass)	20	0-20	10	14
Agropyron smithii (western wheat grass)	10	0-10	10	10
Agropyron trachycaulum (slender wheat grass)	1	0-1	10	3
Bromus inermis (smooth brome)	27	0-50	30	28
Carex lanuginosa (woolly sedge)	2	0-3	20	6
Carex sprengelii (Sprengel's sedge)	1	0-1	10	3
Elymus canadensis (Canada wild rye)	1	0-1	20	4
Hordeum jubatum (foxtail barley)	20	0-20	10	14
Muhlenbergia racemosa (marsh muhly)	1	0-1	10	3
Forbs				
Anemone cylindrica (long-fruited anemone)	10	0-10	10	10
Apocynum cannabinum (Indian hemp)	3	0-3	10	5
Apocynum spp. (dogbane)	3	0-3	10	5
Aralia nudicaulis (wild sarsaparilla)	10	0-10	10	10
Artemisia absinthium (absinthe wormwood)	1	0-1	10	3
Aster ericoides (tufted white prairie aster)	1	0-1	10	3
Cirsium arvense (Canada thistle)	3	0-3	10	5
Clintonia uniflora (corn lily)	1	0-1	10	3

Table 16. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 10 stands of the *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Euphorbia esula (leafy spurge)	20	0-20	10	14
Galium triflorum (sweet-scented bedstraw)	3	0-3	10	5
Geranium richardsonii (wild white geranium)	3	0-3	10	5
Glycyrrhiza lepidota (wild licorice)	7	0-20	30	14
Lysimachia ciliata (fringed loosestrife)	10	0-10	10	10
Maianthemum canadense (wild lily-of-the-valley)	1	0-1	10	3
Melilotus alba (white sweet-clover)	12	0-20	20	15
Monarda fistulosa (wild bergamot)	1	0-1	10	3
Smilacina stellata (star-flowered Solomon's-seal)	11	0-40	60	26
Solidago canadensis (Canada goldenrod)	22	0-60	60	36
Taraxacum officinale (common dandelion)	1	0-1	20	4
Thalictrum occidentale (western meadow rue)	1	0-1	10	3
Thermopsis rhombifolia (golden bean)	1	0-1	10	3
Vicia americana (wild vetch)	2	0-3	40	9

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

Figure 8. POPUDEL/CORNSTO CT



Successional Pathway Diagram of POPUDEL Sites in Southern Alberta Grasslands
Reference Community = POPUDEL/CORNSTO CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
POPUDEL/CORNSTO CT	*Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) Community Type
POPUDEL/SYMPOCC CT	*Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) Community Type
POPUDEL/RAB CT	*Populus deltoides/*Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) Community Type
POPUDEL/HERB CT	*Populus deltoides/*Herbaceous (plains cottonwood/Herbaceous) Community Type
ACERNEG/PRUNVIR HT	*Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) Habitat Type
SALILUT/CORNSTO HT	*Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) Habitat Type
SYMPOCC CT	*Symphoricarpos occidentalis* (buckbrush) Community Type
ELAECOM CT	*Elaeagnus commutata* (silverberry) Community Type
ROSAWOO CT	*Rosa woodsii* (common wild rose) Community Type
AGROSMI HT	*Agropyron smithii* (western wheatgrass) Habitat Type
BROMINE CT	*Bromus inermis* (smooth brome) Community Type
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site.It is based on the assumption that the hydrologic potential does not change.The most likely such hydrologic change would be fluvial buildup of the floodplain, resulting in a terrace site too dry to support willows.The time span is estimated for the stand to become dominated under undisturbed conditions by at least 50 percent cover of climax (or overstory indicator) species. Cottonwood stands do not regenerate themselves in situ, therefore the seral progression is not reversible.We see no evidence to indicate that willows can re-establish themselves on a site after it becomes dominated by non willow species.

SUCCESSIONAL INFORMATION

The *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type is a mid-seral stage of primary succession. Figure 8 is a generalized schematic of the successional pathway followed on sites of this type.

Primary Successional Stages

Cottonwoods are pioneering species that for establishment require moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, sidebars, mid channel bars, delta bars, and islands along major streams. Young stands originate at low elevation relative to the stream base flow level; but as the floodplain aggrades over time, older stands become situated on terraces at higher elevations above the base flow level (Bradley and Smith 1986).

Since *Populus deltoides* (plains cottonwood) is a pioneering species, and does not regenerate in its own shade, it is considered a seral species and does not represent the climax vegetation or potential for the site. Many stands may appear to have some limited regeneration, especially in open areas. However, it is important to understand that these young plants represent root sprouts (asexual reproduction), not establishment by seeds (sexual reproduction). These sprouts may prolong the life of the stand, but will not perpetuate it. If the site is left undisturbed, in time the cottonwoods will be replaced by a later successional stage.

Early Seral Stage—The *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type is the initial seral stage of this type.

Mid-Seral Stage—If disturbance (human-caused or natural) does not alter or eliminate the stand, the *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type will progress to the mid-seral stage *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type. The understory of pole to mature *Populus deltoides* (plains cottonwood) may be dominated by young *Acer negundo* (Manitoba maple), or in some cases *Fraxinus pennsylvanica* (green ash), trees.

Erosion and deposition along a river help maintain plant community diversity on its floodplain. 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, or climax (PNC) successional stage. If the migration rate is high, few stands progress to late successional stage. Near the outer edges of the floodplain, effect of the river is reduced, allowing more late 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 band or terrace supporting a vegetation community of a different age. The bands generally are progressively older as one moves away from the channel and onto higher terraces. Parts of the floodplain may remain undisturbed long enough for their elevation to increase enough with respect to the channel that they are rarely, if ever, flooded. These are considered old, mature alluvial terraces, and may continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Late Seral to Climax (PNC) Stage—As the cottonwood stand dies, primary succession toward later seral communities will occur unless a flood deposits new

sediment suitable for cottonwood seedlings. In the absence of this event, succession continues from the *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type toward some habitat type (potential vegetation of the site). If the cottonwood understory has *Acer negundo* (Manitoba maple) or *Fraxinus pennsylvanica* (green ash) present as the *Populus deltoides* overstory matures, becomes open, and then decadent, the *Acer* or the *Fraxinus* will replace the cottonwoods. The stand then goes to the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) or the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/choke cherry) habitat type. In many cases when no climax tree species are present, the cottonwood mid seral stage will progress to a shrub habitat type, such as the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type or the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type.

Secondary Successional Stages

The presence or absence of a particular understory community can aid in determining degree of disturbance (present or historic) on a site. On relatively undisturbed sites, the understory under a *Populus deltoides* (plains cottonwood) community will be a diverse, dense layer of shrubs dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries). This stage is the *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type.

With moderate levels of grazing or browsing, *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) will increase, and a corresponding decrease in *Cornus stolonifera*, *Amelanchier alnifolia*, *Prunus virginiana*, and *Ribes* will occur. If browsing pressure continues, the more desirable shrubs will be eliminated, leaving *Symphoricarpos occidentalis* and *Rosa* species, which can form a nearly impenetrable understory. This stage of disturbance-caused secondary succession is the *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) community type. If very severe disturbance continues, ***ALL*** shrubs can be eliminated and the understory converted to herbaceous domination by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs. This severely altered state is the *Populus deltoides*/Herbaceous (plains cottonwood/Herbaceous) community type. In this situation, the overstory of *Populus deltoides* still matures and becomes open with an herbaceous understory. Finally the stand becomes one of widely spaced, dying cottonwoods. The site now can be so open and dry that its potential changes from trees or tall shrubs to one of the drier riparian types: the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat type, or the *Agropyron smithii* (western wheat grass) habitat type.

Once the stand has been converted from a shrub-dominated understory to one dominated by introduced herbaceous species, the capacity of the site to return to its former state is very limited. It may be possible, but will require drastic change in management and may be very costly. Therefore, if a manager wants to maintain the stand in a state of shrub understory domination, the most cost effective way is to change management ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Regosols, usually with up to 1 m (39 in) of fine textured mineral material overlying sand or gravel. Brunisols and Chernozems can also be found on older sites of relatively longer stability where time has allowed more development to occur. Texture varies from

silt loam to silty clay. Water tables drop below 1 m (39 in) of the surface in summer, but surface horizons often remain moist due to fine textures, associated low permeability, and dense shading by woody plants. As evidence of periodic saturation, redox concentrations (mottles) are common in the surface horizon and decrease with depth. These soils are generally poorly drained with a high available water content.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including the *Salix exigua* (sandbar willow) community type, types dominated by *Salix lutea* (yellow willow), or the *Typha latifolia* (common cattail), *Scirpus* species (bulrushes), and *Eleocharis* (spikesedge) habitat types. In some situations, this type may be adjacent to open water.

Adjacent drier communities may be the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat type, the *Agropyron smithii* (western wheat grass) habitat type, or by a variety of upland communities.

MANAGEMENT INFORMATION

Livestock

Forage production ranges from low to moderate due to the dense nature of the stands of the *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type. Stands in good to excellent health (condition) often support dense thickets of shrubs, limiting the available forage. *Cornus stolonifera* (red- osier dogwood) is an “ice cream” plant to livestock and wildlife. Its abundance is a direct indication of past and current use levels. In some sites, livestock browsing of *Cornus stolonifera* may be quite high.

Sites are often subjected to heavy grazing pressure because of their gentle topography and ease of access. With moderate to heavy prolonged grazing pressure, palatable shrubs will be eliminated leaving mostly *Symphoricarpos occidentalis* (buckbrush) and *Rosa* (rose) species as the dominant understory. At this stage, the stand has been converted to the *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) disturbance-caused community type. If continued disturbance is severe, these shrubs also will be eliminated, and the stand converted to the *Populus deltoides*/Herbaceous (plains cottonwood/Herbaceous) disturbance-caused community type (see the discussion under the Seral Stages section).

Timber

The timber productivity of all cottonwood types is moderate to high due to favorable moisture conditions. Complete stand removal will likely result in a shrub-dominated community with extremely limited, if any, cottonwood regeneration. The occasional sprouts from stumps are unlikely to reach maturity.

Wildlife

The *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type provides valuable cover, shade, and food for a variety of species. Use by big game, such as whitetail deer and mule deer, may be high, depending upon the time of year. The spreading crown of *Populus deltoides* (plains cottonwood) provides sites for huge platform-like stick nests of bald eagles and ospreys (Arno and Hammerly 1984) and for great blue herons (Parker 1980). Canada geese occasionally use the nests previously built by bald eagles and osprey. A variety of birds and mammals, such as woodpeckers, great horned owls, wood ducks, and raccoons, nest in trunk cavities. *Populus deltoides* and *Cornus stolonifera* (red-osier dogwood) are used by beaver for food and building materials (Allen 1983).

Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

Fisheries

The streamside location of this type is very important by providing thermal cover, debris, and streambank stability. Its importance cannot be emphasized enough (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.

Fire

The *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type is susceptible to fire during late summer and fall. *Populus deltoides* and its associated shrubs are adapted to light, and in some instances moderate intensity fires, and may produce new sprouts after a burn. The ability of cottonwoods to produce new sprouts after fire seems to depend upon three criteria:

1) The particular species of cottonwood. In general, *Populus angustifolia* (narrow-leaf cottonwood) has a greater sprouting capability than *Populus balsamifera* (balsam poplar), which in turn has a greater sprouting capability than *Populus deltoides* (plains cottonwood).
2) The age of the trees. As cottonwoods mature, the sprouting potential decreases. As the trees reach late maturity, sprouting potential is very limited.
3) Location of the water table. In general, the higher the water table is during the growing season, the greater the survivability of resprouts.

Therefore, if a manager wants to extend the life of a cottonwood 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 is excluded from all livestock grazing for at least five years and that wildlife browsing be closely monitored.

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, these shrubs sprout from the surviving rhizomes or stolons (runners) (Fischer and Bradley 1987).

Soil Management and Rehabilitation Opportunities

Fine textured soils are susceptible to compaction problems. This community type is subject to recurring scouring by floods and alluvium deposition. However, 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 very important on higher gradient streams.

Managers should maintain a buffer of *Populus deltoides* (plains cottonwood) community types adjacent to rivers and streams. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize streambanks, and dissipate flood energy.

If the site still has a high water table, a dramatic change in management (i.e. elimination of livestock 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 completely gone, the opportunity to re-establish an understory of desirable shrubs may have been lost.

Where revegetation with shrubs is the goal, some desirable species such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) 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 effectively stabilize recently bare soil. Remember: If the canopy cover of trees in the stand has opened up too much and/or the water table has been severely lowered, revegetation success with desirable woody species will be low.

When considering rehabilitation of stands with fire, see the discussion above in the Fire Management section about the inherent problems of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand is excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988):

1) Do not plant cottonwoods on saline or alkaline sites.
2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer.
3) Make cuttings from open stands of young, rapidly growing trees. Use only cuttings that are four years old or less. Make cuttings long enough to provide 1 to 2 m (3 to 6 ft) of top length left above the soil surface (see #6 and #7 below). Remove lower branches, leaving only the tip and top two side branches.
4) Make cuttings when the plants are completely dormant.
5) Soak the cuttings in water for 10 to 14 days.
6) Auger holes to the depth of the lowest anticipated growing season water table level.
7) Place cuttings in the augered holes on the same day they are removed from the soak. Set the butt to the lowest level anticipated that the growing season groundwater would drop.
8) Back fill the holes carefully to avoid leaving air pockets.
9) Place tree guards around the cuttings if rodent or rabbit damage is likely.
10) As buds begin to swell along the cuttings, remove them from the lower two-thirds of the cutting.
11) Plantings must be protected from livestock grazing and big game browsing for two or three growing seasons. Beaver control may also be needed.

Recreational Uses and Considerations

Because of proximity to streams and flat topography, recreational developments and transportation corridors are common in this type. Opportunities are excellent in this type for fishing, big game, and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures in this type. Some campgrounds have been seriously damaged by floods or lost altogether.

OTHER STUDIES

The *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type is described by Hansen and others (1995) for the Great Plains part of Montana. Similar communities were described by Nelson (1961), Jorgensen (1979), Boggs (1984), and Hansen and others (1984).

Populus deltoides/Recent Alluvial Bar Community Type
(Plains Cottonwood/Recent Alluvial Bar Community Type)

POPUDEL

Number of Stands Sampled = 34

Number of Stands Sampled in Alberta = 8

LOCATION AND ASSOCIATED LANDFORMS

The *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type is a minor type at low elevations in the southern part of central and eastern Alberta in the Dry Mixedgrass Natural Region. The type occurs on recent alluvial bars of streams and rivers. *Populus deltoides* (plains cottonwood) is found at the lowest elevation of the three riverine *Populus* (poplar and cottonwood) species found in Alberta. Stands may be extensive on major river floodplain terraces, such as along the Milk, South Saskatchewan, and Red Deer rivers. Major dams that control peak flows on rivers have been shown to adversely affect the success of cottonwood tree establishment (Bradley and Smith 1986, Rood and Mahoney 1991).

VEGETATION

This type is dominated by seedlings or saplings of *Populus deltoides* (plains cottonwood), or is co-dominated by cottonwoods and *Salix exigua* (sandbar willow). *Populus balsamifera* (balsam poplar) and *Populus angustifolia* (narrow-leaf cottonwood) may be present but are subordinate to *Populus deltoides* (plains cottonwood). The herbaceous understory is a diverse group (Table 17).

Table 17. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 16 stands of the *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Fraxinus pennsylvanica (green ash)	1	0-1	6	2
Populus angustifolia (narrow-leaf cottonwood)	30	0-30	6	13
Populus deltoides (plains cottonwood)	31	3-60	100	56
Shrubs				
Cornus stolonifera (red-osier dogwood)	1	0-1	6	2
Rhus radicans (poison ivy)	1	0-1	6	2
Ribes aureum (golden currant)	1	0-1	6	2
Rosa spp. (rose)	3	0-3	13	6
Salix amygdaloides (peach-leaved willow)	7	0-40	50	19
Salix exigua (sandbar willow)	14	0-60	94	36
Salix lutea (yellow willow)	5	0-10	19	10
Graminoids				
Agropyron repens (quack grass)	3	0-3	13	6
Agropyron smithii (western wheat grass)	70	0-70	6	20

Table 17. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 16 stands of the *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Agrostis stolonifera (redtop)	10	0-10	6	8
Agropyron trachycaulum (slender wheat grass)	10	0-10	6	8
Bromus inermis (smooth brome)	1	0-1	6	2
Calamovilfa longifolia (sand grass)	3	0-3	6	4
Carex lanuginosa (woolly sedge)	1	0-1	6	2
Distichlis stricta (salt grass)	1	0-1	6	2
Echinochloa crusgalli (barnyard grass)	6	0-20	25	12
Eleocharis palustris (creeping spike-rush)	2	0-3	13	5
Elymus canadensis (Canada wild rye)	5	0-20	31	12
Hordeum jubatum (foxtail barley)	1	0-3	19	4
Muhlenbergia racemosa (marsh muhly)	20	0-20	6	11
Panicum capillare (witch grass)	1	0-1	6	2
Phalaris arundinacea (reed canary grass)	50	0-50	6	17
Poa pratensis (Kentucky bluegrass)	1	0-1	6	2
Polypogon monspeliensis (rabbitfoot grass)	1	0-1	6	2
Scirpus pungens (three-square rush)	60	0-60	6	19
Setaria viridis (green foxtail)	1	0-1	6	2
Spartina pectinata (prairie cord grass)	3	0-3	6	4
Sporobolus cryptandrus (sand dropseed)	20	0-20	6	11
Forbs				
Apocynum cannabinum (Indian hemp)	1	0-1	6	2
Artemisia absinthium (absinthe wormwood)	1	0-1	6	2
Asclepias verticillata (whorled milkweed)	3	0-3	6	4
Aster ericoides (tufted white prairie aster)	2	0-3	13	5
Chenopodium album (lamb's-quarters)	1	0-1	13	4
Cirsium arvense (Canada thistle)	5	0-10	13	8
Coreopsis tinctoria (common tickseed)	1	0-1	6	2
Euphorbia esula (leafy spurge)	1	0-1	6	2
Euphorbia glyptosperma (ridge-seeded spurge)	1	0-1	6	2
Glycyrrhiza lepidota (wild licorice)	2	0-10	31	8
Gnaphalium palustre (marsh cudweed)	1	0-1	6	2
Gutierrezia sarothrae (broomweed)	1	0-1	6	2
Helenium autumnale (sneezeweed)	1	0-1	6	2
Helianthus couplandii (Coupland's annual sunflower)	3	0-3	6	4
Melilotus alba (white sweet-clover)	1	0-3	19	4
Melilotus officinalis (yellow sweet-clover)	3	0-3	6	4
Mentha arvensis (wild mint)	1	0-1	6	2
Plantago major (common plantain)	1	0-1	13	4

Table 17. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 16 stands of the *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Plantago patagonica (Pursh's plantain)	1	0-1	6	2
Polygonum coccineum (water smartweed)	3	0-3	31	10
Polygonum monspeliense (knotweed)	10	0-20	13	11
Potentilla gracilis (graceful cinquefoil)	30	0-30	6	13
Potentilla paradoxa (bushy cinquefoil)	1	0-1	13	4
Rumex crispus (curled dock)	2	0-3	13	5
Rumex maritimus (golden dock)	2	0-3	19	6
Rumex triangulivalvis (narrow-leaved dock)	1	0-1	13	4
Solidago canadensis (Canada goldenrod)	3	0-3	6	4
Sonchus asper (prickly annual sow-thistle)	1	0-1	13	4
Sonchus spp. (sow-thistle)	1	0-1	6	2
Taraxacum officinale (common dandelion)	1	0-1	13	4
Vicia americana (wild vetch)	1	0-1	6	2
Xanthium strumarium (cocklebur)	27	0-50	13	19
Ferns and Allies				
Equisetum arvense (common horsetail)	10	0-20	13	11

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type represents an early seral (pioneer) stage of primary succession.

Primary Successional Stages

Cottonwoods are a pioneering species that for establishment require moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, sidebars, mid channel bars, delta bars, and islands along major streams. Since cottonwoods are a pioneering species, and do not regenerate in their own shade, they are considered a seral species and do not represent the climax vegetation or potential for the site. Many stands may appear to have some limited regeneration, especially in open areas. However, it is important to understand that these young plants represent root sprouts (asexual reproduction), not establishment by seeds (sexual reproduction). These sprouts may prolong the life of the stand, but will not perpetuate it. If the site is left undisturbed, in time the cottonwoods will be replaced by a later successional stage.

Erosion and deposition along a river help maintain plant community diversity on its floodplain. 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, or climax (PNC) successional stage. If the migration rate is high, few stands progress to late successional stage. Near the outer edges of the floodplain, effect of the river

is reduced, allowing more late 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 band or terrace supporting a vegetation community of a different age. The bands generally are progressively older as one moves away from the channel and onto higher terraces. Parts of the floodplain may remain undisturbed long enough for their elevation to increase enough with respect to the channel that they are rarely, if ever, flooded. These are considered old, mature alluvial terraces, and may continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage—The *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type is the initial seral stage of this type.

Mid-Seral Stage—If disturbance (human-caused or natural) does not alter or eliminate the stand, the *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type will progress to the mid-seral stage *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type. The understory of pole to mature *Populus deltoides* may be dominated by young *Acer negundo* (Manitoba maple), or in some cases *Fraxinus pennsylvanica* (green ash), trees.

Late Seral to Climax (PNC) Stage—As the cottonwood stand dies, primary succession toward later seral communities will occur unless a flood deposits new sediment suitable for cottonwood seedlings. In the absence of this event, succession continues from the *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type toward some habitat type (potential vegetation of the site). If the cottonwood understory has *Acer negundo* (Manitoba maple) or *Fraxinus pennsylvanica* (green ash) present as the *Populus deltoides* (plains cottonwood) overstory matures, becomes open, and then decadent, the *Acer* or the *Fraxinus* will replace the cottonwoods. The stand then goes to the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) or the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/choke cherry) habitat type. In many cases when no climax tree species are present, the cottonwood mid seral stage will progress to a shrub habitat type, such as the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type or the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type.

Secondary Successional Stages

The normal primary successional sequence (described above) may be altered due to varying degrees of grazing and browsing pressure. Moderate, prolonged grazing and browsing will shift to the disturbance-caused *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) community type. Severe, prolonged grazing and browsing pressure may eliminate all deciduous tree seedlings and may eliminate the undergrowth of shrub species. This severely disturbed stage of secondary succession is called the *Populus deltoides*/Herbaceous (plains cottonwood/herbaceous) community type. In this situation, the overstory of *Populus deltoides* still matures and becomes open, now with an understory dominated by herbaceous species. Finally the stand becomes decadent with widely spaced, dying cottonwoods. The site is so open and dry that the potential may have changed to one of a variety of upland types.

Stands of the *Populus deltoides/Symphoricarpos occidentalis* community type are very susceptible to natural dynamics of the river, and may be drowned or

swept away after just a year or two of growth. Ice can have a great impact on these recently deposited bars. Ice can influence the floodplain by either of two ways: 1) mechanical damage, or 2) flooding (inundation). Mechanical damage can mean any of the following: a) the laying down or bending over of the young trees, b) shearing off of the stems, c) pulling roots from the ground by movement of ice frozen around the stems, and d) tilting or pushing over of mature trees.

Cottonwood seedlings and saplings are very susceptible to defoliation by livestock. If livestock pressure is too great, the stand can be partially or totally eliminated. In many situations, livestock utilization has eliminated stands of newly established cottonwood seedlings. Beaver and wild ungulates can also have a severe impact on young cottonwood stands.

SOILS

Soils are typically Regosols, are deep and formed in recent alluvium. Surface horizons are typically fine textured (silty clay to clay), overlying a stratified, coarse textured substratum of some sand or gravels. The water table is generally at or near the soil surface, although in late summer it may drop below 50 cm (20 in) of the soil surface. Surface horizons generally remain moist due to capillary action. Soils are poorly drained, permeability is slow, and available water is high.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including the *Salix exigua* (sandbar willow) community type, types dominated by *Salix lutea* (yellow willow), or the *Typha latifolia* (common cattail), *Scirpus* species (bulrushes), and *Eleocharis* (spikesedge) habitat types. In some situations, this type may be adjacent to open water.

Adjacent drier communities may be the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat type, the *Agropyron smithii* (western wheat grass) habitat type, or by a variety of upland communities.

MANAGEMENT INFORMATION

Livestock

Forage production is low to moderate. Stands in good to excellent health (condition) often support dense thickets of cottonwoods and associated shrub species thereby limiting the amount of available forage. These stands are very susceptible to defoliation by livestock. If establishment of new cottonwood stands is a management objective, livestock impacts should be closely monitored. In some situations, it may be advisable to eliminate grazing use until the cottonwoods have grown beyond reach of the livestock.

Wildlife

The *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type provides valuable cover, shade, and food for a variety of species. Big game use may be high, depending upon the time of year. *Populus deltoides* is used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

Fisheries

The streamside location of this type is important in providing future thermal cover, debris, and streambank stability. Its importance cannot be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section).

Fire

The *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type is susceptible to fire. In general, cottonwood seedlings, and to a lesser degree, cottonwood saplings do not have an extensive root system or thick bark and may be killed by fire.

Soil Management and Rehabilitation Opportunities

Fine textured soils are susceptible to compaction problems. This community type is subject to recurring scouring by floods and alluvium deposition. However, 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 very important on higher gradient streams.

Managers should maintain a buffer of *Populus deltoides* (plains cottonwood) community types adjacent to rivers and streams. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize streambanks, and dissipate flood energy.

If the site still has a high water table, a dramatic change in management (i.e. elimination of livestock 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 completely gone, the opportunity to re-establish an understory of desirable shrubs may have been lost.

Where revegetation with shrubs is the goal, some desirable species such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) 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 effectively stabilize recently bare soil. Remember: If the canopy cover of trees in the stand has opened up too much and/or the water table has been severely lowered, revegetation success with desirable woody species will be low.

When considering rehabilitation of stands with fire, see the discussion above in the Fire Management section about the inherent problems of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand is excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988):

1) Do not plant cottonwoods on saline or alkaline sites.
2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer.
3) Make cuttings from open stands of young, rapidly growing trees. Use only cuttings that are four years old or less. Make cuttings long enough to provide 1 to 2 m (3 to 6 ft) of top length left above the soil surface (see #6 and #7 below). Remove lower branches, leaving only the tip and top two side branches.
4) Make cuttings when the plants are completely dormant.
5) Soak the cuttings in water for 10 to 14 days.
6) Auger holes to the depth of the lowest anticipated growing season water table level.
7) Place cuttings in the augered holes on the same day they are removed from the soak. Set the butt to the lowest level anticipated that the growing season groundwater would drop.

8) Back fill the holes carefully to avoid leaving air pockets.
9) Place tree guards around the cuttings if rodent or rabbit damage is likely.
10) As buds begin to swell along the cuttings, remove them from the lower two-thirds of the cutting.
11) Plantings must be protected from livestock grazing and big game browsing for two or three growing seasons. Beaver control may also be needed.

Recreational Uses and Considerations

Because of proximity to streams and flat topography, recreational developments and transportation corridors are common in this type. Opportunities are excellent in this type for fishing, big game and waterfowl hunting, and observing a variety of bird species.

OTHER STUDIES

A *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type is described by Hansen and others (1995) for the Great Plains portion of Montana.

Populus deltoides/Symphoricarpos occidentalis Community Type
(Plains Cottonwood/Buckbrush Community Type)

POPUDEL/SYMPOCC
Number of Stands Sampled = 25
Number of Stands Sampled in Alberta = 6

LOCATION AND ASSOCIATED LANDFORMS

The *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) community type is a minor type at low elevations in the southern part of central and eastern Alberta in the Dry Mixedgrass Natural Region. This type occurs on older alluvial bars of major streams and rivers. *Populus deltoides* (plains cottonwood) is found at the lowest elevation of the three riverine *Populus* (poplar and cottonwood) species found in Alberta. Stands may be extensive on major river floodplain terraces, such as along the Milk, South Saskatchewan, and Red Deer rivers.

VEGETATION

The *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) community type represents a grazing disclimax. It is characterized by an overstory of *Populus deltoides* (plains cottonwood) above an understory dominated by short shrubs such as, *Symphoricarpos occidentalis* (buckbrush) or *Rosa* (rose) species (Table 18).

Table 18. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in the 25 sampled stands of the grazing disclimax *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Acer negundo (Manitoba maple)	1	0 - 1	4	2
Fraxinus pennsylvanica (green ash)	1	0 - 1	24	5
Populus angustifolia (narrow-leaf cottonwood)	20	0 - 20	4	9
Populus balsamifera (balsam poplar)	20	0 - 20	8	13
Populus deltoides (plains cottonwood)	51	20 - 90	100	71
Shrubs				
Amelanchier alnifolia (saskatoon)	1	0 - 3	12	3
Artemisia cana (silver sagebrush)	3	0 - 3	12	6
Chrysothamnus viscidiflorus (green rabbitbrush)	1	0 - 3	12	3
Clematis ligusticifolia (western clematis)	7	0 - 40	28	14
Cornus stolonifera (red-osier dogwood)	1	0 - 1	20	4
Elaeagnus angustifolia (Russian olive)	1	0 - 1	12	3
Juniperus scopulorum (Rocky Mountain juniper)	1	0 - 3	28	5
Parthenocissus quinquefolia (Virginia creeper)	2	0 - 3	24	7
Prunus virginiana (choke cherry)	9	0 - 30	24	15
Rhus radicans (poison ivy)	17	0 - 20	24	20
Rhus trilobata (skunkbush)	2	0 - 3	16	6
Ribes aureum (golden currant)	2	0 - 3	20	6
Ribes oxyacanthoides (northern gooseberry)	5	0 - 10	8	6
Ribes spp. (currant)	1	0 - 1	4	2
Rosa spp. (common wild rose)	24	0 - 98	80	44
Salix amygdaloides (peach-leaved willow)	3	0 - 10	20	8
Salix exigua (sandbar willow)	37	0 - 80	20	27
Salix lutea (yellow willow)	13	0 - 60	28	19
Sarcobatus vermiculatus (greasewood)	10	0 - 10	4	6
Shepherdia argentea (thorny buffaloberry)	11	0 - 90	44	22
Symphoricarpos occidentalis (buckbrush)	28	0 - 80	88	50
Vitis riparia (riverbank grape)	10	0 - 20	16	13
Graminoids				
Agropyron dasystachyum (northern wheat grass)	3	0 - 3	4	3
Agropyron pectiniforme (crested wheat grass)	3	0 - 3	8	5
Agropyron repens (quack grass)	4	0 - 10	24	10
Agropyron smithii (western wheat grass)	32	0 - 70	28	30
Agrostis stolonifera (redtop)	14	0 - 40	12	13
Agropyron trachycaulum (slender wheat grass)	10	0 - 10	4	6
Bouteloua gracilis (blue grama)	1	0 - 1	4	2
Bromus inermis (smooth brome)	14	0 - 60	52	27

Table 18. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in the 25 sampled stands of the grazing disclimax *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Bromus japonicus (Japanese chess)	10	0 - 10	4	6
Bromus tectorum (downy chess)	20	0 - 20	4	9
Carex lanuginosa (woolly sedge)	3	0 - 3	4	3
Carex rossii (Ross' sedge)	3	0 - 3	4	3
Carex sprengelii (Sprengel's sedge)	3	0 - 3	4	3
Eleocharis palustris (creeping spike-rush)	1	0 - 1	4	2
Elymus canadensis (Canada wild rye)	9	0 - 20	44	20
Hordeum jubatum (foxtail barley)	8	0 - 20	16	11
Muhlenbergia racemosa (marsh muhly)	5	0 - 20	28	12
Poa interior (inland bluegrass)	3	0 - 3	4	3
Poa juncifolia (alkali bluegrass)	1	0 - 1	4	2
Poa palustris (fowl bluegrass)	15	0 - 40	12	13
Poa pratensis (Kentucky bluegrass)	22	0 - 60	24	23
Poa spp. (bluegrass)	11	0 - 20	16	13
Polypogon monspeliensis (rabbitfoot grass)	3	0 - 3	4	3
Setaria viridis (green foxtail)	1	0 - 1	4	2
Spartina pectinata (prairie cord grass)	3	0 - 3	4	3
Stipa comata (needle-and-thread)	5	0 - 10	8	6
Stipa viridula (green needle grass)	1	0 - 3	12	3
Forbs				
Achillea millefolium (common yarrow)	1	0 - 1	8	3
Ambrosia psilostachya (perennial ragweed)	3	0 - 3	4	3
Anemone cylindrica (long-fruited anemone)	1	0 - 1	4	2
Apocynum androsaemifolium (spreading dogbane)	20	0 - 20	4	9
Apocynum cannabinum (Indian hemp)	1	0 - 1	4	2
Artemisia ludoviciana (prairie sagewort)	1	0 - 3	24	5
Asclepias speciosa (showy milkweed)	1	0 - 1	4	2
Asclepias verticillata (whorled milkweed)	1	0 - 1	12	3
Asparagus officinalis (asparagus)	1	0 - 1	4	2
Campanula rotundifolia (harebell)	1	0 - 1	4	2
Centaurea repens (Russian knapweed)	3	0 - 3	4	3
Chenopodium spp. (goosefoot)	3	0 - 3	8	5
Cirsium arvense (Canada thistle)	6	0 - 20	32	14
Descurainia sophia (flixweed)	10	0 - 10	4	6
Euphorbia esula (leafy spurge)	40	0 - 40	4	13
Glycyrrhiza lepidota (wild licorice)	5	0 - 20	44	15
Grindelia squarrosa (gumweed)	2	0 - 3	8	4
Medicago sativa (alfalfa)	20	0 - 20	4	9

Table 18. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in the 25 sampled stands of the grazing disclimax *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Melilotus alba (white sweet-clover)	11	0 - 30	12	11
Melilotus officinalis (yellow sweet-clover)	12	0 - 20	8	10
Mentha arvensis (wild mint)	3	0 - 3	4	3
Moehringia lateriflora (blunt-leaved sandwort)	1	0 - 1	4	2
Plantago major (common plantain)	3	0 - 3	4	3
Ratibida columnifera (prairie coneflower)	1	0 - 1	4	2
Rumex crispus (curled dock)	10	0 - 20	8	9
Rumex maritimus (golden dock)	1	0 - 1	4	2
Smilacina stellata (star-flowered Solomon's-seal)	7	0 - 20	32	15
Solidago canadensis (Canada goldenrod)	12	0 - 20	8	10
Solidago spp. (goldenrod)	3	0 - 3	4	3
Solidago gigantea (late goldenrod)	8	0 - 20	16	11
Sonchus arvensis (perennial sow-thistle)	28	0 - 80	12	18
Taraxacum officinale (common dandelion)	1	0 - 3	12	3
Thermopsis rhombifolia (golden bean)	10	0 - 20	8	9
Tragopogon dubius (common goat's-beard)	1	0 - 1	4	2
Vicia americana (wild vetch)	2	0 - 3	20	6
Viola adunca (early blue violet)	3	0 - 3	4	3
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0 - 1	8	3
Equisetum laevigatum (smooth scouring-rush)	1	0 - 1	4	2

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) community type is a moderately disturbed secondary successional stage of the mid-seral *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type.

Primary Successional Stages

Cottonwoods are a pioneering species that for establishment require moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, sidebars, mid channel bars, delta bars, and islands along major streams. Since cottonwoods are a pioneering species, and do not regenerate in their own shade, they are considered a seral species and do not represent the climax vegetation or potential for the site. Many stands may appear to have some limited regeneration, especially in open areas. However, it is important to understand that these young plants represent root sprouts (asexual reproduction), not establishment by seeds (sexual reproduction). These sprouts may prolong the life of the stand, but will not perpetuate it. If the site is left undisturbed, in time the

cottonwoods will be replaced by a later successional stage.

Erosion and deposition along a river help maintain plant community diversity on its floodplain. 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, or climax (PNC) successional stage. If the migration rate is high, few stands progress to late successional stage. Near the outer edges of the floodplain, effect of the river is reduced, allowing more late 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 band or terrace supporting a vegetation community of a different age. The bands generally are progressively older as one moves away from the channel and onto higher terraces. Parts of the floodplain may remain undisturbed long enough for their elevation to increase enough with respect to the channel that they are rarely, if ever, flooded. These are considered old, mature alluvial terraces, and may continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage—The *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type is the initial seral stage of this type.

Mid-Seral Stage—If disturbance (human-caused or natural) does not alter or eliminate the stand, the *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type will progress to the mid-seral stage *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type. The understory of pole to mature *Populus deltoides* (plains cottonwood) may be dominated by young *Acer negundo* (Manitoba maple), or in some cases *Fraxinus pennsylvanica* (green ash), trees.

Late Seral to Climax (PNC) Stage—As the cottonwood stand dies, primary succession toward later seral communities will occur unless a flood deposits new sediment suitable for cottonwood seedlings. In the absence of this event, succession continues from the *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type toward some habitat type (potential vegetation of the site). If the cottonwood understory has *Acer negundo* (Manitoba maple) or *Fraxinus pennsylvanica* (green ash) present as the *Populus deltoides* overstory matures, becomes open, and then decadent, the *Acer* or the *Fraxinus* will replace the cottonwoods. The stand then goes to the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) or the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/choke cherry) habitat type. In many cases when no climax tree species are present, the cottonwood mid seral stage will progress to a shrub habitat type, such as the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type or the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type.

Secondary Successional Stages

The presence or absence of a particular understory community can aid in determining degree of disturbance (present or historic) on a site. On relatively undisturbed sites, the understory under a *Populus deltoides* community will be a diverse, dense layer of shrubs dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries). This stage is the *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type.

With moderate levels of grazing or browsing, *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) will increase, and a corresponding decrease in *Cornus stolonifera*, *Amelanchier alnifolia*, *Prunus virginiana*, and *Ribes* will occur. If browsing pressure continues, the more desirable shrubs will be eliminated, leaving *Symphoricarpos occidentalis* and *Rosa* species, which can form a nearly impenetrable understory. This stage of disturbance-caused secondary succession is the *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) community type. If very severe disturbance continues, ***ALL*** shrubs can be eliminated and the understory converted to herbaceous domination by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs. This severely altered state is the *Populus deltoides*/Herbaceous (plains cottonwood/Herbaceous) community type. In this situation, the overstory of *Populus deltoides* still matures and becomes open with an herbaceous understory. Finally the stand becomes one of widely spaced, dying cottonwoods. The site now can be so open and dry that its potential changes from trees or tall shrubs to one of the drier riparian types: the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat type, or the *Agropyron smithii* (western wheat grass) habitat type.

Once the stand has been converted from a shrub-dominated understory to one dominated by introduced herbaceous species, the capacity of the site to return to its former state is very limited. It may be possible, but will require drastic change in management and may be very costly. Therefore, if a manager wants to maintain the stand in a state of shrub understory domination, the most cost effective way is to change management ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Regosols, usually with up to 1 m (39 in) of fine textured mineral material overlying sand or gravel. Brunisols and Chernozems can also be found on older sites of relatively longer stability where time has allowed more development to occur. Texture varies from silt loam to silty clay. Water tables drop below 1 m (39 in) of the surface in summer, but surface horizons often remain moist due to fine textures, associated low permeability, and dense shading by woody plants. As evidence of fluctuating water table, redox concentrations (mottles) are common in these soils, which are generally poorly drained with high available water content.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including the *Salix exigua* (sandbar willow) community type, types dominated by *Salix lutea* (yellow willow), or the *Typha latifolia* (common cattail), *Scirpus* species (bulrushes), and *Eleocharis* (spikesedge) habitat types. In some situations, this type may be adjacent to open water.

Adjacent drier communities may be the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat type, the *Agropyron smithii* (western wheat grass) habitat type, or by a variety of upland communities.

MANAGEMENT INFORMATION

Livestock

Forage production ranges from low to moderate due to the dense shrub understory within the stands. Forage production from dense thickets of *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) is low. Stands may be so dense that they preclude most livestock

use. As the shrub understory is reduced by prolonged heavy utilization, the stands open and forage production actually increases due to the replacement by *Agropyron smithii* (western wheat grass), *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (timothy), *Bromus inermis* (smooth brome), etc. Palatability of *Symphoricarpos occidentalis* (buckbrush) ranges from low to fair for cattle and sheep (Wasser 1982, Johnson and Nichols 1982), and the leaves of *Rosa woodsii* (common wild rose) are considered fair to good livestock forage, particularly for sheep (Johnson and Nichols 1982).

Timber

The timber productivity of all cottonwood types is moderate to high due to favorable moisture conditions. Complete stand removal will likely result in a shrub-dominated community with extremely limited, if any, cottonwood regeneration. The occasional sprouts from stumps are unlikely to reach maturity.

Wildlife

The *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) community type provides valuable cover, shade, and food for a variety of species. Big game use, by such species as whitetail and mule deer, may be high, depending upon the time of year. The spreading crown of *Populus deltoides* (plains cottonwood) provides sites for the huge platform-like stick nests of bald eagles and ospreys (Arno and Hammerly 1984) and for great blue herons (Parker 1980). Canada geese occasionally use the nests previously built by bald eagles and osprey. A variety of birds and mammals, such as woodpeckers, great horned owls, wood ducks, and raccoons, nest in trunk cavities. *Populus deltoides* (plains cottonwood) is used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

The moderate structural diversity of the *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) understory provides thermal and hiding cover for big game and upland bird species. The palatability of *Symphoricarpos occidentalis* is rated good for deer and elk (Wasser 1982, Johnson and Nichols 1982). Deer and elk may browse heavily on *Rosa woodsii* (common wild rose), and the persistent fruit (rose hips) provide fall and winter food for birds, small mammals, and bears, which disperse the seeds. *Rosa woodsii* (common wild rose) is highly tolerant of grazing, but can be dwarfed and thinned by intense season long use.

Fisheries

The streamside location of the *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) community type provides very important thermal cover, debris, and streambank stability. Its importance cannot be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section). Their rhizomatous nature makes *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) excellent in controlling erosion along streams.

Fire

The *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) community type is susceptible to fire during the late summer and fall. *Populus deltoides* and shrubs associated with this type are adapted to light, and under some conditions, to fires of moderate intensity. Many of these species can produce new sprouts after a burn. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria:

1) The particular species of cottonwood. In general, *Populus angustifolia* (narrow-leaf cottonwood) has a greater sprouting capability than *Populus balsamifera* (balsam poplar), which in turn has a greater sprouting

capability than *Populus deltoides* (plains cottonwood).

2) The age of the trees. As cottonwoods mature, the sprouting potential decreases. As the trees reach late maturity, sprouting potential is very limited.
3) Location of the water table. In general, the higher the water table is during the growing season, the greater the survivability of resprouts.

Therefore, if a manager wants to extend the life of a cottonwood 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 is excluded from all livestock grazing for at least five years and that wildlife browsing be closely monitored.

Symphoricarpos occidentalis (buckbrush) is tolerant of fire. It can be injured by fire but usually sprouts, with stands becoming denser afterward. It is such a strong competitor, particularly in dense colonies, that it is not very compatible with most herbaceous vegetation. *Rosa woodsii* (common wild rose) is typically top-killed by fire, but root crowns and underground rhizomes survive low- or moderate-severity fires. However, the shallow root crowns of *Rosa woodsii* are susceptible to injury, and populations consequently decrease following high-severity fire. *Rosa woodsii* recovery varies with fire severity. Top-killed plants will sprout from the root crown and underground surviving rhizomes (USDA IFSL 1995).

Soil Management and Rehabilitation Opportunities

Fine textured soils are susceptible to compaction problems. This community type can be subject to some recurring scouring by floods and alluvium deposition. However, stands are relatively stable because of the strong rooting action of the associated species. Management should emphasize the importance of the understory shrub layer in streambank stabilization. This is particularly important on higher gradient stream channels where scouring by seasonal flooding occurs.

Managers should maintain a buffer strip of the *Populus deltoides* (plains cottonwood) dominated community types adjacent to rivers and streams. These buffer strips reduce sedimentation, stabilize streambanks, and slow flood waters.

If the stand still has a high water table, a dramatic change in management (i.e. elimination of livestock grazing and close monitoring of wildlife impacts) ***MAY*** allow the remnant shrub population to sprout and re-invade the stand. However, if the water table has dropped dramatically and the shrubs have been eliminated, the opportunity to re-establish a shrub understory dominated by desirable shrubs may be lost.

Where revegetation with woody shrub species is wanted, desirable shrubs such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) 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 effectively stabilize recent bare alluvium. Remember: If the canopy cover of the trees in the stand has opened up too much and/or the water table has been lowered dramatically, the success of revegetation with desirable woody shrub species will be low.

For rehabilitation of stands by the use of fire, see the discussion in the Fire Management section about the limitations of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand is excluded from all livestock grazing for at least

five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988): 1). Do not plant cottonwoods in saline or alkaline sites. 2). Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer. 3). Make cuttings from stands of open, young, rapidly growing trees, using only cuttings that are four years old or less. Remove the side branches, leaving only the tip and next two lower side branches. 4). Make the cuttings when the plants are completely dormant. 5). Soak the cuttings in water for 10 to 14 days. 6). Auger holes to a depth of the lowest anticipated growing season water table. 7). Place the cuttings in the augered holes the same day they are removed from the soak. Set the butt at the lowest anticipated growing season groundwater depth. Select cuttings of a length, which provides 1 to 2 m (3 to 6 ft) of cutting to remain above the soil surface. 8). Back fill the holes carefully to avoid air pockets. 9). Place tree guards around the cuttings if rodent or rabbit damage is anticipated. 10). As buds begin to swell along the cuttings, wipe them off the lower two-thirds of the cutting. 11). Plantings must be excluded from livestock grazing and big game browsing for two to three growing seasons. Some beaver control may be needed.

Symphoricarpos occidentalis (buckbrush) is well adapted for revegetating sites. Commonly growing in dense colony stands makes it suitable for disturbed land stabilization. It does best on moist, well-drained soils, which have not been excessively disturbed. Once established, it grows at a moderate rate and spreads rapidly by root sprouts. Nursery grown seedlings, rooted cuttings, or wildlings are the preferred planting materials. Critical, erosive sites may need complete exclusion from grazing during establishment, and animal populations and stocking rates should be balanced with forage supply on noncritical sites after establishment (Wasser 1982).

Rosa woodsii (common wild rose) is valuable for revegetating disturbed sites along streambanks and seeps. It is easily established from nursery-grown stock, root cuttings, or transplanted materials.

Recreational Uses and Considerations

Because of its proximity to streams and flat topography, recreational developments and transportation corridors are common in this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures within this type. Some campgrounds have been seriously damaged by floods or lost altogether.

Symphoricarpos occidentalis (buckbrush) is an important food source for upland birds due to fruits that persist into the winter. 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 *Rosa woodsii* community type. However, *Rosa woodsii* is useful for planting in recreation areas as a biological barrier to protect physical structures, young and delicate plants, and to direct traffic.

OTHER STUDIES

The *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) community type is described by Hansen and others (1995) for the northern Great Plains portion of Montana. Similar communities were described by Nelson (1961), Jorgensen (1979), Boggs (1984), and Hansen and others (1984).

Populus deltoides/Herbaceous Community Type
(Plains Cottonwood/Herbaceous Community Type)

POPUDEL

Number of Stands Sampled = 12

Number of Stands Sampled in Alberta = 5

LOCATION AND ASSOCIATED LANDFORMS

The *Populus deltoides*/Herbaceous (plains cottonwood/Herbaceous) community type is a minor type at low elevations in the southern part of central and eastern Alberta in the Dry Mixedgrass Natural Region. This type occurs on older alluvial bars of major streams and rivers. *Populus deltoides* (plains cottonwood) is found at the lowest elevation of the three riverine *Populus* (poplar and cottonwood) species found in Alberta. Stands may be extensive on major river floodplain terraces, such as along the Milk, South Saskatchewan, and Red Deer rivers.

VEGETATION

The *Populus deltoides*/Herbaceous (plains cottonwood/Herbaceous) community type is a grazing or browsing disclimax community type characterized by two structural layers: a mature, widely spaced *Populus deltoides* (plains cottonwood) over an herbaceous understory typically dominated by exotic and disturbance-increaser species. Shrub species are absent or present only as remnant, scattered individuals (Table 19).

Table 19. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 12 stands of the grazing induced *Populus deltoides*/Herbaceous (plains cottonwood/Herbaceous) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Fraxinus pennsylvanica (green ash)	1	0 - 1	17	4
Populus deltoides (plains cottonwood)	65	40 - 98	100	81
Shrubs				
Amelanchier alnifolia (saskatoon)	1	0 - 1	17	4
Artemisia cana (silver sagebrush)	3	0 - 3	8	5
Clematis ligusticifolia (western clematis)	1	0 - 1	8	3
Cornus stolonifera (red-osier dogwood)	1	0 - 1	25	5
Elaeagnus angustifolia (Russian olive)	1	0 - 1	17	4
Parthenocissus quinquefolia (Virginia creeper)	2	0 - 3	17	6
Prunus virginiana (choke cherry)	1	0 - 1	8	3
Rhus radicans (poison ivy)	1	0 - 3	25	5
Rhus trilobata (skunkbush)	1	0 - 1	8	3
Ribes aureum (golden currant)	1	0 - 1	8	3
Rosa spp. (rose)	1	0 - 1	42	6

Table 19. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 12 stands of the grazing induced *Populus deltoides*/Herbaceous (plains cottonwood/Herbaceous) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Salix amygdaloides (peach-leaved willow)	1	0 - 1	42	6
Salix exigua (sandbar willow)	5	0 - 10	17	9
Salix lutea (yellow willow)	2	0 - 3	17	6
Shepherdia argentea (thorny buffaloberry)	1	0 - 3	33	6
Symphoricarpos occidentalis (buckbrush)	3	0 - 10	58	13
Vitis riparia (riverbank grape)	1	0 - 1	17	4
Graminoids				
Agropyron repens (quack grass)	10	0 - 20	58	24
Agropyron smithii (western wheat grass)	18	0 - 30	25	21
Agrostis stolonifera (redtop)	2	0 - 3	17	6
Agropyron trachycaulum (slender wheat grass)	40	0 - 40	8	18
Bromus inermis (smooth brome)	27	0 - 70	50	37
Bromus japonicus (Japanese chess)	1	0 - 1	8	3
Calamovilfa longifolia (sand grass)	3	0 - 3	25	9
Carex atherodes (awned sedge)	1	0 - 1	8	3
Elymus canadensis (Canada wild rye)	12	0 - 20	58	26
Hordeum jubatum (foxtail barley)	2	0 - 3	17	6
Muhlenbergia racemosa (marsh muhly)	16	0 - 20	33	23
Phalaris arundinacea (reed canary grass)	3	0 - 3	8	5
Poa palustris (fowl bluegrass)	12	0 - 20	17	14
Poa pratensis (Kentucky bluegrass)	20	0 - 20	17	18
Poa spp. (bluegrass)	3	0 - 3	8	5
Spartina pectinata (prairie cord grass)	10	0 - 10	8	9
Forbs				
Ambrosia psilostachya (perennial ragweed)	3	0 - 3	8	5
Apocynum cannabinum (Indian hemp)	8	0 - 10	25	14
Artemisia absinthium (absinthe wormwood)	7	0 - 10	17	11
Artemisia ludoviciana (prairie sagewort)	1	0 - 1	25	5
Asclepias speciosa (showy milkweed)	1	0 - 1	8	3
Asclepias verticillata (whorled milkweed)	1	0 - 1	8	3
Aster ericoides (tufted white prairie aster)	1	0 - 1	8	3
Aster spp. (aster)	2	0 - 3	17	6
Cirsium arvense (Canada thistle)	1	0 - 1	25	5
Euphorbia esula (leafy spurge)	1	0 - 1	8	3
Glycyrrhiza lepidota (wild licorice)	5	0 – 20	83	20
Grindelia squarrosa (gumweed)	1	0 – 1	25	5
Helenium autumnale (sneezeweed)	1	0 – 1	8	3
Helianthus nuttallii (common tall sunflower)	3	0 – 3	8	5

Table 19. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 12 stands of the grazing induced *Populus deltoides*/Herbaceous (plains cottonwood/Herbaceous) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Melilotus alba (white sweet-clover)	6	0 – 20	33	14
Melilotus officinalis (yellow sweet-clover)	1	0 – 1	17	4
Petalostemon spp. (prairie-clover)	1	0 – 1	8	3
Potentilla anserina (silverweed)	1	0 – 1	8	3
Rumex triangulivalvis (narrow-leaved dock)	1	0 – 1	8	3
Smilacina stellata (star-flowered Solomon's-seal)	3	0 – 3	8	5
Solidago canadensis (Canada goldenrod)	9	0 – 20	33	17
Solidago gigantea (late goldenrod)	7	0 – 10	17	11
Taraxacum officinale (common dandelion)	1	0 – 1	8	3
Thermopsis rhombifolia (golden bean)	7	0 – 10	17	11
Vicia americana (wild vetch)	1	0 – 3	25	5
Xanthium strumarium (cocklebur)	3	0 – 3	8	5
Ferns and Allies				
Equisetum arvense (common horsetail)	8	0 – 20	25	14

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Populus deltoides*/Herbaceous (plains cottonwood/Herbaceous) community type represents a severely disturbed secondary successional stage of the mid-seral *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type.

Primary Successional Stages

Cottonwoods are a pioneering species that for establishment require moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, sidebars, mid channel bars, delta bars, and islands along major streams. Since cottonwoods are a pioneering species, and do not regenerate in their own shade, they are considered a seral species and do not represent the climax vegetation or potential for the site. Many stands may appear to have some limited regeneration, especially in open areas. However, it is important to understand that these young plants represent root sprouts (asexual reproduction), not establishment by seeds (sexual reproduction). These sprouts may prolong the life of the stand, but will not perpetuate it. If the site is left undisturbed, in time the cottonwoods will be replaced by a later successional stage.

Erosion and deposition along a river help maintain plant community diversity on its floodplain. 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, or climax (PNC) successional stage. If the migration rate is high, few stands progress to late successional stage. Near the outer edges of the floodplain, effect of the river is reduced, allowing more late 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 band or terrace supporting a vegetation community of a different age. The bands generally are progressively older as one moves away from the channel and onto higher terraces. Parts of the floodplain may remain undisturbed long enough for their elevation to increase enough with respect to the channel that they are rarely, if ever, flooded. These are considered old, mature alluvial terraces, and may continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage—The *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type is the initial seral stage of this type.

Mid-Seral Stage—If disturbance (human-caused or natural) does not alter or eliminate the stand, the *Populus deltoides*/Recent Alluvial Bar (plains cottonwood/Recent Alluvial Bar) community type will progress to the mid-seral stage *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type. The understory of pole to mature *Populus deltoides* (plains cottonwood) may be dominated by young *Acer negundo* (Manitoba maple), or in some cases *Fraxinus pennsylvanica* (green ash), trees.

Late Seral to Climax (PNC) Stage—As the cottonwood stand dies, primary succession toward later seral communities will occur unless a flood deposits new sediment suitable for cottonwood seedlings. In the absence of this event, succession continues from the *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type toward some habitat type (potential vegetation of the site). If the cottonwood understory has *Acer negundo* (Manitoba maple) or *Fraxinus pennsylvanica* (green ash) present as the *Populus deltoides* (plains cottonwood) overstory matures, becomes open, and then decadent, the *Acer* or the *Fraxinus* will replace the cottonwoods. The stand then goes to the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) or the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/choke cherry) habitat type. In many cases when no climax tree species are present, the cottonwood mid seral stage will progress to a shrub habitat type, such as the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type or the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type.

Secondary Successional Stages

The presence or absence of a particular understory community can aid in determining degree of disturbance (present or historic) on a site. On relatively undisturbed sites, the understory under a *Populus deltoides* (plains cottonwood) community will be a diverse, dense layer of shrubs dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries). This stage is called the *Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) community type.

With moderate levels of grazing or browsing, *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose) will increase, and a corresponding decrease in *Cornus stolonifera*, *Amelanchier alnifolia*, *Prunus virginiana*, and *Ribes* will occur. If browsing pressure continues, the more desirable shrubs will be eliminated, leaving *Symphoricarpos occidentalis* and *Rosa* species, which can form a nearly impenetrable understory. This stage of disturbance-caused secondary succession is the *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/buckbrush) community type. If very severe disturbance continues, ***ALL*** shrubs can be eliminated and the understory converted to herbaceous domination by

species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs. This severely altered state is the *Populus deltoides*/Herbaceous (plains cottonwood/Herbaceous) community type. In this situation, the overstory of *Populus deltoides* still matures and becomes open with an herbaceous understory. Finally the stand becomes one of widely spaced, dying cottonwoods. The site now can be so open and dry that its potential changes from trees or tall shrubs to one of the drier riparian types: the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat type, or the *Agropyron smithii* (western wheat grass) habitat type.

Once the stand has been converted from a shrub-dominated understory to one dominated by introduced herbaceous species, the capacity of the site to return to its former state is very limited. It may be possible, but will require drastic change in management and may be very costly. Therefore, if a manager wants to maintain the stand in a state of shrub understory domination, the most cost effective way is to change management ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Regosols, usually with up to 1 m (39 in) of fine textured mineral material overlying sand or gravel. Brunisols and Chernozems can also be found on older sites of relatively longer stability where time has allowed more development to occur. Texture varies from silt loam to silty clay. Water tables drop below 1 m (39 in) of the surface in summer. Redox concentrations (mottles) are rare in these soils. Soils are generally poorly drained with high available water early in the growing season, but usually dry out quickly due to the lack of shading by shrub species.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including the *Salix exigua* (sandbar willow) community type, types dominated by *Salix lutea* (yellow willow), or the *Typha latifolia* (common cattail), *Scirpus* species (bulrushes), and *Eleocharis* (spikesedge) habitat types. In some situations, this type may be adjacent to open water.

Adjacent drier communities may be the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat type, the *Agropyron smithii* (western wheat grass) habitat type, or by a variety of upland communities.

MANAGEMENT INFORMATION

Livestock

The *Populus deltoides*/Herbaceous (plains cottonwood/Herbaceous) community type provides moderate levels of spring and summer forage. Heavy grazing and trampling tend to maintain the open (park-like) structure of this community type and maintains dominance by the grasses and "weedy" forbs. This community type is often used by the ranchers as a winter feeding ground. *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (timothy), and *Bromus inermis* (smooth brome) are palatable and moderately productive grasses, especially when soil moisture is high, and they tolerate a high degree of defoliation. *Poa pratensis* (Kentucky bluegrass) is well adapted to grazing and is considered an increaser and an invader, especially if grazing intensities and durations are severe (Wasser 1982). This species can produce new shoots from existing tillers or rhizomes. Grazing practices influence the growth form of *Poa pratensis* (Volland 1978). A high density of weak, low vigor tillers results from season long grazing. Stem densities are emphasized over aboveground biomass.

Early season rest increases the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater.

Timber

The timber productivity of all cottonwood types is moderate to high due to favorable moisture conditions. Complete stand removal will likely result in a shrub-dominated community with extremely limited, if any, cottonwood regeneration. The occasional sprouts from stumps are unlikely to reach maturity.

Wildlife

This type is a source of early spring forage for deer and elk. Cover value is limited because of the open structure. Many kinds of birds are common since food and cover is available both on the ground and in the trees. Great blue herons nest in large cottonwood stands if isolation during the nesting period is possible. Colonial nest sites are used for many years if left undisturbed (Parker 1980). Osprey will also use this type for nesting (Zarn 1974).

Fisheries

The streamside location of this type is important in providing thermal cover, debris, and streambank stability. Its importance cannot be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section).

Fire

This type will burn when conditions are dry, such as fall or in late winter if snow accumulations are minimal. The ability of cottonwoods to produce new sprouts after fire seems to depend upon three criteria:

1) The particular species of cottonwood. In general, *Populus angustifolia* (narrow-leaf cottonwood) has a greater sprouting capability than *Populus balsamifera* (balsam poplar), which in turn has a greater sprouting capability than *Populus deltoides* (plains cottonwood).
2) The age of the trees. As cottonwoods mature, the sprouting potential decreases. As the trees reach late maturity, sprouting potential is very limited.
3) Location of the water table. In general, the higher the water table is during the growing season, the greater the survivability of resprouts.

Therefore, if a manager wants to extend the life of a cottonwood 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 is excluded from all livestock grazing for at least five years and that wildlife browsing be closely monitored. *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, these shrubs sprout from the surviving rhizomes or stolons (runners) (Fischer and Bradley 1987).

Soil Management and Rehabilitation Opportunities

Fine textured soils are susceptible to compaction problems. This community type is subject to recurring scouring by floods and alluvium deposition. These stands are relatively less stable because of the removal of the strong root systems of shrub species. Management should emphasize the importance of understory shrubs in streambank stabilization.

Managers should maintain a buffer of *Populus deltoides* (plains cottonwood) community types adjacent to rivers and streams. These buffers provide wildlife habitat, reduce sediment loading in the stream, stabilize streambanks, and dissipate flood energy.

If the site still has a high water table, a dramatic change in management (i.e. elimination of livestock 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 completely gone, the opportunity to re-establish an understory of desirable shrubs may have been lost.

Where revegetation with shrubs is the goal, some desirable species such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (choke cherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) 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 effectively stabilize recently bare soil. Remember: If the canopy cover of trees in the stand has opened up too much and/or the water table has been severely lowered, revegetation success with desirable woody species will be low.

When considering rehabilitation of stands with fire, see the discussion above in the Fire Management section about the inherent problems of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand is excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988):

1) Do not plant cottonwoods on saline or alkaline sites.
2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer.
3) Make cuttings from open stands of young, rapidly growing trees. Use only cuttings that are four years old or less. Make cuttings long enough to provide 1 to 2 m (3 to 6 ft) of top length left above the soil surface (see #6 and #7 below). Remove lower branches, leaving only the tip and top two side branches.
4) Make cuttings when the plants are completely dormant.
5) Soak the cuttings in water for 10 to 14 days.
6) Auger holes to the depth of the lowest anticipated growing season water table level.
7) Place cuttings in the augered holes on the same day they are removed from the soak. Set the butt to the lowest level anticipated that the growing season groundwater will drop.
8) Back fill the holes carefully to avoid leaving air pockets.
9) Place tree guards around the cuttings if rodent or rabbit damage is likely.
10) As buds begin to swell along the cuttings, remove them from the lower two-thirds of the cutting.
11) Plantings must be protected from livestock grazing and big game browsing for two or three growing seasons. Beaver control may also be needed.

Recreational Uses and Considerations

Because of proximity to streams and flat topography, recreational developments and transportation corridors are common in this type. Opportunities are excellent in this type for fishing, big game and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures in this type. Some campgrounds have been seriously damaged by floods or lost altogether.

OTHER STUDIES

Hansen and others (1995) described the *Populus deltoides*/Herbaceous (plains cottonwood/Herbaceous) community type for the Northern Great Plains of Montana. Similar communities were described by Nelson (1961), Jorgensen (1979), Boggs (1984), and Hansen and others (1984).

Populus tremuloides/Cornus stolonifera Habitat Type
(Aspen/Red-Osier Dogwood Habitat Type)

POPUTRE/CORNSTO
Number of Stands Sampled = 22
Number of Stands Sampled in Alberta = 15

LOCATION AND ASSOCIATED LANDFORMS

Populus tremuloides (aspen) is found at the drier end of the wetness ranking of 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/climax type in the Parkland Natural Region where *Picea glauca* (white spruce) is not generally found. The type is also found in minor to incidental occurrence in the more moist Fescue Subregions of the Grassland Natural Region and the Lower Foothills Subregion. It occurs most frequently around pothole depressions, but also near streams and rivers on alluvial terraces and steep valley walls, and near springs and seeps on the part of the prairie generally having dark brown soils. Farther north, as one nears the Boreal Ecoregion, and to the west as one enters the Upper Foothills Subregion, the aspen is seral to communities dominated by *Picea glauca* (white spruce).

VEGETATION

This type is characterized by an overstory of *Populus tremuloides* (aspen) dominating an undergrowth of dense *Salix* species (willows), *Cornus stolonifera* (red-osier dogwood), and other shrubs (Table 20).

Table 20. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 late seral to climax 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				
Betula papyrifera (white birch)	1	0-1	13	4
Picea glauca (white spruce)	1	0-1	13	4
Populus angustifolia (narrow-leaf cottonwood)	10	0-10	13	11
Populus balsamifera (balsam poplar)	27	0-50	25	26
Populus tremuloides (aspen)	50	10-90	100	71
Shrubs				
Amelanchier alnifolia (saskatoon)	11	3-20	100	33
Arctostaphylos uva-ursi (common bearberry)	1	0-1	13	4

Table 20. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 late seral to climax stands of the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Betula occidentalis (water birch)	1	0-1	25	5
Clematis occidentalis (purple clematis)	2	0-3	25	7
Cornus stolonifera (red-osier dogwood)	22	3-70	100	47
Corylus cornuta (beaked hazelnut)	3	0-3	25	9
Elaeagnus commutata (silverberry)	3	0-3	13	6
Lonicera spp. (honeysuckle)	3	0-3	13	6
Lonicera involucrata (bracted honeysuckle)	1	0-1	13	4
Prunus pensylvanica (pin cherry)	1	0-1	13	4
Prunus virginiana (choke cherry)	11	0-30	88	31
Ribes americanum (wild black currant)	10	0-10	13	11
Ribes oxyacanthoides (northern gooseberry)	1	0-3	38	6
Rosa spp. (rose)	5	1-20	100	22
Rubus idaeus (wild red raspberry)	9	0-20	63	24
Rubus parviflorus (thimbleberry)	20	0-20	13	16
Rubus pubescens (dewberry)	1	0-1	13	4
Salix bebbiana (beaked willow)	10	0-20	38	19
Salix scouleriana (Scouler's willow)	3	0-3	13	6
Shepherdia canadensis (Canada buffaloberry)	2	0-3	25	7
Spiraea alba (narrow-leaved meadowsweet)	1	0-1	13	4
Spiraea betulifolia (white meadowsweet)	1	0-1	13	4
Symphoricarpos albus (snowberry)	5	0-10	38	14
Symphoricarpos occidentalis (buckbrush)	4	0-10	63	16
Viburnum edule (low-bush cranberry)	7	0-10	25	13
Graminoids				
Agropyron dasystachyum (northern wheat grass)	1	0-1	13	4
Agropyron trachycaulum (slender wheat grass)	1	0-1	13	4
Bromus inermis (smooth brome)	10	0-10	13	11
Calamagrostis canadensis (bluejoint)	2	0-3	25	7
Calamagrostis spp. (reed grass)	10	0-10	13	11
Carex deweyana (Dewey's sedge)	1	0-1	13	4
Carex praegracilis (graceful sedge)	1	0-1	25	5
Carex sprengelii (Sprengel's sedge)	2	0-3	38	9
Carex spp. (sedge)	1	0-1	13	4
Elymus glaucus (smooth wild rye)	1	0-1	13	4
Festuca idahoensis (bluebunch fescue)	1	0-1	13	4
Unknown Grass (grass)	1	0-1	13	4
Poa pratensis (Kentucky bluegrass)	7	0-10	38	16

Table 20. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 late seral to climax stands of the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Forbs				
Achillea millefolium (common yarrow)	1	0-1	25	5
Actaea rubra (red and white baneberry)	2	0-3	25	7
Agrimonia striata (agrimony)	1	0-1	13	4
Angelica arguta (white angelica)	1	0-1	13	4
Aralia nudicaulis (wild sarsaparilla)	8	0-10	50	20
Aster ciliolatus (Lindley's aster)	1	0-3	50	7
Aster conspicuus (showy aster)	1	0-1	25	5
Disporum trachycarpum (fairybells)	1	0-1	50	7
Epilobium angustifolium (common fireweed)	1	0-1	25	5
Fragaria virginiana (wild strawberry)	1	0-3	63	8
Galium boreale (northern bedstraw)	4	0-10	50	14
Galium triflorum (sweet-scented bedstraw)	2	0-3	50	10
Geranium richardsonii (wild white geranium)	4	0-10	38	12
Geum macrophyllum (large-leaved yellow avens)	1	0-1	25	5
Heracleum lanatum (cow parsnip)	2	0-3	25	7
Lilium philadelphicum (western wood lily)	1	0-1	13	4
Medicago lupulina (black medick)	1	0-1	13	4
Mertensia paniculata (tall lungwort)	2	0-3	25	7
Mitella nuda (bishop's-cap)	3	0-3	13	6
Orthilia secunda (one-sided wintergreen)	1	0-1	25	5
Osmorhiza chilensis (blunt-fruited sweet cicely)	1	0-1	13	4
Pyrola asarifolia (common pink wintergreen)	1	0-3	50	7
Ranunculus abortivus (small-flowered buttercup)	3	0-3	13	6
Sanicula marilandica (snakeroot)	1	0-1	13	4
Senecio pauperculus (balsam groundsel)	3	0-3	13	6
Senecio pseudaureus (thin-leaved ragwort)	3	0-3	13	6
Silene menziesii (Menzies' catchfly)	1	0-1	13	4
Smilacina stellata (star-flowered Solomon's-seal)	1	0-3	88	9
Solidago spp. (goldenrod)	1	0-1	25	5
Taraxacum officinale (common dandelion)	1	0-1	25	5
Thalictrum spp. (meadow rue)	1	0-1	25	5
Thalictrum occidentale (western meadow rue)	1	0-1	13	4
Thalictrum venulosum (veiny meadow rue)	1	0-3	38	6
Urtica dioica (common nettle)	1	0-1	25	5
Vicia americana (wild vetch)	1	0-1	63	8
Viola spp. (violet)	1	0-1	13	4
Viola canadensis (western Canada violet)	10	0-10	38	19
Zizia aptera (heart-leaved Alexanders)	1	0-1	13	4

Table 20. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 late seral to climax stands of the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Ferns and Allies				
Equisetum arvense (common horsetail)	2	0-3	25	7

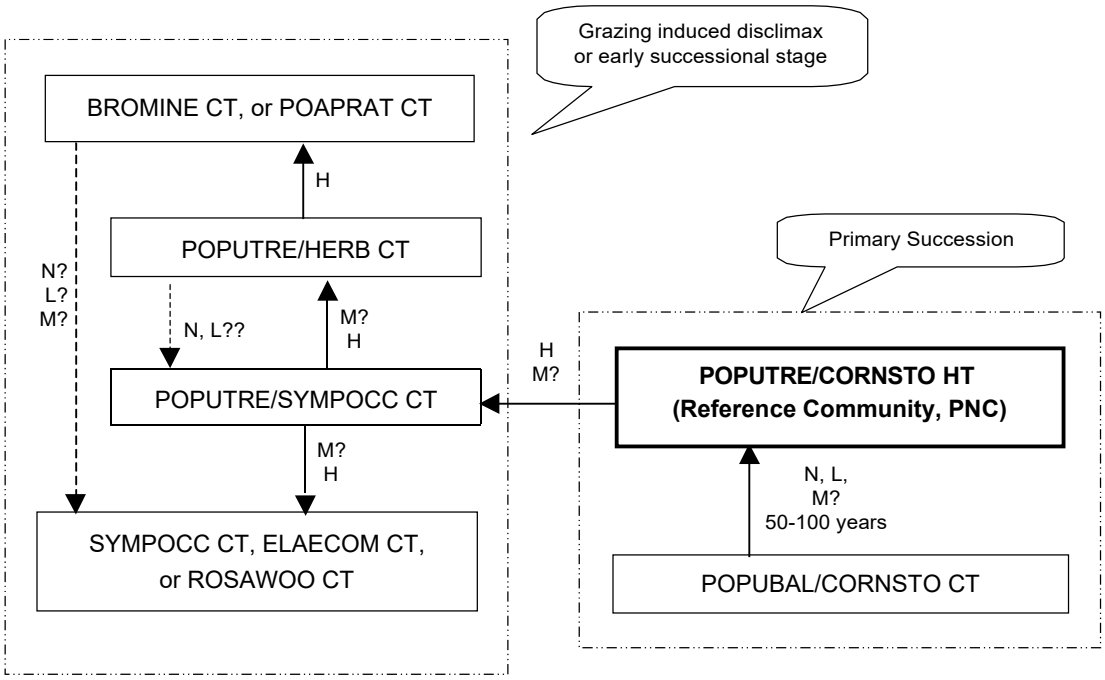
[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

This type is the late seral/climax stage of vegetation on sites dominated by *Populus tremuloides* (aspen) in the Grassland Ecoregion of Canada. As one nears the Boreal Ecoregion to the north or the Upper Foothills Subregion to the west, it appears that this community is seral to the *Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) habitat type. In these areas near the transition to forest with more conifer, *Populus tremuloides* (aspen) seems to be seral to *Picea glauca* (white spruce) (Moss 1932, 1955, Beckingham and others 1996, Beckingham and Archibald 1996). Figure 9 is a generalized schematic of the successional pathway followed on sites of this type.

High levels of grazing and browsing by livestock and wildlife will reduce the coverages and successful reproduction of *Populus tremuloides* and the various shrubs associated with this type, while increasing the coverages of disturbance-caused herbaceous species. In extreme cases, a loss of the woody understory may occur, and the stand will take on the appearance of the grazing or browsing disclimax *Populus tremuloides*/Herbaceous (aspen/Herbaceous) community type (Table 21).

Figure 9. POPUTRE/CORNSTO HT



Successional Pathway Diagram of POPUTRE/CORNSTO HT Sites in Southern Alberta Grasslands
Reference Community = POPUTRE/CORNSTO HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
POPUBAL/CORNSTO CT	*Populus balsamifera/Cornus stolonifera* (plains cottonwood/red-osier dogwood) Community Type
POPUTRE/CORNSTO CT	*Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) Habitat Type
POPUTRE /SYMPOCC CT	*Populus tremuloides/Symphoricarpos occidentalis* (aspen/buckbrush) Community Type
POPUTRE /HERB CT	*Populus tremuloides/*Herbaceous (aspen/Herbaceous) Community Type
SYMPOCC CT	*Symphoricarpos occidentalis* (buckbrush) Community Type
ELAECOM CT	*Elaeagnus commutata* (silverberry) Community Type
ROSAWOO CT	*Rosa woodsii* (common wild rose) Community Type
BROMINE CT	*Bromus inermis* (smooth brome) Community Type
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic potential does not change. Likely causes of such hydrologic change would be lowering of the local water table by wetland drainage for agricultural development or drying of the site by reduction of the overstory canopy. The time span is estimated for the stand to become dominated under undisturbed conditions by at least 50 percent cover of climax (or overstory indicator) species. We see few indicators that willows or such late seral species as CORNSTO can become re-established on sites that have become dominated by rhizomatous, disturbance induced species (i.e., SYMPOCC, ROSAWOO, ELAECOM, BROMINE, POAPRAT).

Table 21. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 14 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)	21	0 - 60	21	21
Populus tremuloides (aspen)	64	10 - 90	100	80
Shrubs				
Amelanchier alnifolia (saskatoon)	9	0 - 20	50	21
Clematis occidentalis (purple clematis)	3	0 - 3	21	8
Cornus stolonifera (red-osier dogwood)	19	0 - 60	71	37
Prunus virginiana (choke cherry)	7	0 - 20	50	19
Ribes oxyacanthoides (northern gooseberry)	4	0 - 10	79	18
Rosa spp. (rose)	12	0 - 30	100	35
Rubus idaeus (wild red raspberry)	11	0 - 30	64	27
Salix bebbiana (beaked willow)	12	0 - 50	64	28
Symphoricarpos albus (snowberry)	5	0 - 10	21	10
Symphoricarpos occidentalis (buckbrush)	22	0 - 50	71	40
Graminoids				
Bromus inermis (smooth brome)	36	0 - 90	64	48
Carex sprengelii (Sprengel's sedge)	2	0 - 3	21	6
Phleum pratense (timothy)	4	0 - 10	36	12
Poa palustris (fowl bluegrass)	2	0 - 3	21	6
Poa pratensis (Kentucky bluegrass)	18	0 - 40	57	32
Forbs				
Achillea millefolium (common yarrow)	1	0 - 3	21	5
Actaea rubra (red and white baneberry)	1	0 - 1	21	5
Cirsium arvense (Canada thistle)	5	0 - 20	36	13
Unknown Forb	2	0 - 3	21	6
Fragaria virginiana (wild strawberry)	3	0 - 3	50	12
Galium boreale (northern bedstraw)	3	0 - 3	64	14
Galium triflorum (sweet-scented bedstraw)	1	0 - 3	29	5
Geranium richardsonii (wild white geranium)	2	0 - 3	50	10
Geum macrophyllum (large-leaved yellow avens)	1	0 - 3	29	5
Heracleum lanatum (cow parsnip)	1	0 - 3	21	5
Lathyrus ochroleucus (cream-colored vetchling)	1	0 - 1	43	7
Monarda fistulosa (wild bergamot)	1	0 - 1	21	5
Smilacina stellata (star-flowered Solomon's-seal)	6	0 - 20	64	20
Solidago canadensis (Canada goldenrod)	1	0 - 3	36	6
Taraxacum officinale (common dandelion)	2	0 - 3	64	11
Thalictrum venulosum (veiny meadow rue)	4	0 - 10	57	15
Vicia americana (wild vetch)	2	0 - 10	57	11

Table 21. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 14 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]
Viola canadensis (western Canada violet)	8	0 - 10	29	15
Ferns and Allies				
Equisetum arvense (common horsetail)	11	0 - 20	21	15

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

Soils are typically dark brown Chernozems. Sites adjacent to streams are often shallow Regosols overlying river cobbles. Soil textures vary from silt loam to sand. Water tables average 30 cm (12 in) below the surface in mid-summer but water depths of several stands were greater than one meter. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often dominated by *Carex atherodes* (awned sedge), *Salix bebbiana* (beaked willow), *Salix petiolaris* (basket willow), or occasionally *Populus balsamifera* (balsam poplar). Drier sites are uplands dominated by steppe vegetation.

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 heavy 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 herbaceous layer of this type.

Cornus stolonifera (red-osier dogwood) is considered an "ice cream" plant by livestock and wildlife. Its utilization is a direct indication of past and current use levels. In some areas, livestock browsing of *Cornus stolonifera* (red-osier dogwood) may be quite high.

Overuse by livestock will result in a reduced vigor by the willows present, as illustrated by highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site.

Timber

Most timber harvest is salvage for fuelwood. Overstory removal will result in sprouting of young aspen that are susceptible to grazing pressure.

Wildlife

The *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type, although often covering only small areas, has high value as wildlife cover and feeding areas. Beaver, if present, may make heavy use of *Populus tremuloides* (aspen) stands (Allen 1983). Wild ungulates such as deer and elk browse young suckers and

occasionally feed on the bark of older trees. Use by elk during spring, fall, and winter periods is often moderate to heavy (Kufeld 1973). *Populus tremuloides* (aspen) and *Cornus stolonifera* (red-osier dogwood) are highly preferred by moose (Costain 1989). Use of this type as bedding grounds by wildlife is also common.

Numerous bird species frequent communities dominated by *Populus tremuloides* (aspen). Common species nesting and feeding in this type include flickers, chickadees, sapsuckers, and woodpeckers (Flack 1976).

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.

Fire

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) (Jones and DeByle 1985). Brown (1984) provides information for using prescribed fire in stands of *Populus tremuloides* (aspen). Protection of newly burned or cleared sites from beaver and grazing animals may be necessary for successful reproduction.

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).

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 and gooseberries) 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.

Recreational Uses and Considerations

Fishing and birding opportunities are often good. Campsites should be located away from stands of this type because of wet soils and large mosquito populations.

OTHER STUDIES

A *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type is described by Hansen and others (1995). A *Populus tremuloides* community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan.

Populus tremuloides/Symphoricarpos occidentalis Community Type
(Aspen/Buckbrush Community Type)

POPUTRE/SYMPOCC

Number of Stands Sampled = 9

Number of Stands Sampled in Alberta = 3

CAUTION—Not all sites dominated by *Populus tremuloides* (aspen) 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 Landforms section.

LOCATION AND ASSOCIATED LANDFORMS

The *Populus tremuloides/Symphoricarpos occidentalis* (aspen/buckbrush) community type is a minor early-to-mid seral type resulting from long term light-to-moderate disturbance to stands of *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type in the Parkland Natural Region where *Picea glauca* (white spruce) is not generally found. The type also occurs incidentally in the more moist Fescue Subregions of the Grassland Natural Region and the Lower Foothills Subregion. Like the other aspen types found on the prairie, this type occurs around pothole depressions, near streams and rivers on alluvial terraces and steep valley walls, or near springs and seeps. Farther north, as one nears the Boreal Ecoregion, and to the west as one enters the Upper Foothills Subregion, the aspen is seral to communities dominated by *Picea glauca* (white spruce).

VEGETATION

The *Populus tremuloides/Symphoricarpos occidentalis* (aspen/buckbrush) community type results from grazing or browsing disturbance of the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type. This type is what is left after most of the more palatable woody plants under a *Populus tremuloides* (aspen) overstory have been eliminated by large ungulate browsing. *Populus tremuloides* dominates the overstory. Shrubs such as *Cornus stolonifera* (red-osier dogwood), *Alnus tenuifolia* (river alder), *Prunus virginiana* (choke cherry), and *Salix* species (willows) are absent or present in only very small amounts. Other shrubs, such as *Symphoricarpos occidentalis* (buckbrush), *Crataegus* species (hawthorn), *Elaeagnus commutata* (silverberry), *Rosa woodsii* (common wild rose), and *Ribes* species (currents) dominate the understory (Table 22).

Table 22. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 sampled stands of the grazing or browsing disclimax *Populus tremuloides/Symphoricarpos occidentalis* (aspen/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Acer negundo (Manitoba maple)	3	0 - 3	11	6
Populus balsamifera (balsam poplar)	45	0 - 50	22	32
Populus tremuloides (aspen)	74	40 - 98	100	86

Table 22. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 sampled stands of the grazing or browsing disclimax *Populus tremuloides/Symphoricarpos occidentalis* (aspen/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Shrubs				
Amelanchier alnifolia (Saskatoon)	5	0 - 10	56	17
Cornus stolonifera (red-osier dogwood)	2	0 - 3	56	11
Corylus cornuta (beaked hazelnut)	40	0 - 40	11	21
Lonicera involucrata (bracted honeysuckle)	20	0 - 20	11	15
Prunus virginiana (choke cherry)	5	0 - 10	44	15
Ribes americanum (wild black currant)	10	0 - 20	22	15
Ribes lacustre (bristly black currant)	1	0 - 1	11	3
Ribes oxyacanthoides (northern gooseberry)	2	0 - 3	22	7
Ribes spp. (currant)	1	0 - 1	11	3
Rosa spp. (rose)	8	0 - 20	67	23
Rubus idaeus (wild red raspberry)	10	0 - 10	22	15
Rubus parviflorus (thimbleberry)	20	0 - 20	11	15
Salix bebbiana (beaked willow)	2	0 - 3	22	7
Salix lutea (yellow willow)	1	0 - 1	11	3
Salix petiolaris (basket willow)	1	0 - 1	11	3
Salix scouleriana (Scouler's willow)	1	0 - 1	11	3
Spiraea betulifolia (white meadowsweet)	1	0 - 1	11	3
Symphoricarpos albus (snowberry)	20	0 - 20	11	15
Symphoricarpos spp. (buckbrush)	16	0 - 30	78	35
Symphoricarpos occidentalis (buckbrush)	60	0 - 60	11	26
Graminoids				
Agropyron pectiniforme (crested wheat grass)	1	0 - 1	11	3
Agropyron repens (quack grass)	10	0 - 10	11	11
Agropyron smithii (western wheat grass)	20	0 - 20	11	15
Agrostis stolonifera (redtop)	3	0 - 3	11	6
Agropyron trachycaulum (slender wheat grass)	3	0 - 3	11	6
Bromus carinatus (keeled brome)	3	0 - 3	11	6
Bromus ciliatus (fringed brome)	1	0 - 1	11	3
Bromus inermis (smooth brome)	52	0 - 98	44	48
Bromus spp. (brome)	1	0 - 1	11	3
Bromus vulgaris (woodland brome)	1	0 - 1	11	3
Calamagrostis canadensis (bluejoint)	3	0 - 3	11	6
Carex sprengelii (Sprengel's sedge)	5	0 - 10	22	11
Elymus glaucus (smooth wild rye)	20	0 - 20	11	15
Elymus virginicus (Virginia wild rye)	3	0 - 3	33	10

Table 22. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 sampled stands of the grazing or browsing disclimax *Populus tremuloides/Symphoricarpos occidentalis* (aspen/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Festuca spp. (fescue)	10	0 - 10	11	11
Juncus balticus (wire rush)	3	0 - 3	11	6
Phleum pratense (timothy)	7	0 - 10	22	12
Poa pratensis (Kentucky bluegrass)	12	0 - 20	22	16
Trisetum canescens (tall trisetum)	1	0 - 1	11	3
Trisetum cernuum (nodding trisetum)	3	0 - 3	11	6
Forbs				
Achillea millefolium (common yarrow)	1	0 - 3	33	6
Actaea rubra (red and white baneberry)	8	0 - 20	44	19
Angelica arguta (white angelica)	2	0 - 60	11	26
Artemisia ludoviciana (prairie sagewort)	3	0 - 3	11	6
Aster ciliolatus (Lindley's aster)	10	0 - 10	11	11
Aster engelmannii (elegant aster)	1	0 - 1	11	3
Aster ericoides (tufted white prairie aster)	1	0 - 1	11	3
Aster subspicatus (leafy-bracted aster)	1	0 - 1	22	5
Chenopodium fremontii (Fremont's goosefoot)	3	0 - 3	11	6
Cirsium arvense (Canada thistle)	2	0 - 3	22	7
Disporum hookeri (Oregon fairybells)	1	0 - 1	11	3
Disporum trachycarpum (fairybells)	2	0 - 3	22	7
Epilobium angustifolium (common fireweed)	1	0 - 1	11	3
Unknown Forb	3	0 - 3	22	8
Fragaria virginiana (wild strawberry)	1	0 - 3	44	7
Galium boreale (northern bedstraw)	1	0 - 1	33	6
Galium triflorum (sweet-scented bedstraw)	1	0 - 3	44	7
Geranium richardsonii (wild white geranium)	2	0 - 3	44	9
Geum aleppicum (yellow avens)	2	0 - 3	22	7
Geum macrophyllum (large-leaved yellow avens)	2	0 - 3	22	7
Glycyrrhiza lepidota (wild licorice)	2	0 - 3	33	8
Grindelia squarrosa (gumweed)	1	0 - 1	11	3
Hackelia americana (nodding stickseed)	1	0 - 1	11	3
Hackelia jessicae (Jessica's stickseed)	1	0 - 1	11	3
Heracleum lanatum (cow parsnip)	10	0 - 20	22	15
Lathyrus ochroleucus (cream-colored vetchling)	5	0 - 10	33	13
Listera caurina (western twayblade)	1	0 - 1	11	3
Osmorhiza chilensis (blunt-fruited sweet cicely)	3	0 - 3	11	6
Osmorhiza depauperata (spreading sweet cicely)	1	0 - 1	11	3
Osmorhiza occidentalis (western sweet cicely)	20	0 - 20	11	15
Pedicularis bracteosa (western lousewort)	1	0 - 1	22	5

Table 22. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 sampled stands of the grazing or browsing disclimax *Populus tremuloides/Symphoricarpos occidentalis* (aspen/buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Plantago major (common plantain)	1	0 - 1	11	3
Senecio pauperculus (balsam groundsel)	3	0 - 3	11	6
Senecio pseudaureus (thin-leaved ragwort)	1	0 - 1	11	3
Senecio triangularis (brook ragwort)	3	0 - 3	11	6
Silene menziesii (Menzies' catchfly)	1	0 - 1	11	3
Sisymbrium loeselii (tall hedge mustard)	1	0 - 1	11	3
Smilacina stellata (star-flowered Solomon's-seal)	1	0 - 1	44	7
Sonchus arvensis (perennial sow-thistle)	10	0 - 10	11	11
Stachys palustris (marsh hedge-nettle)	3	0 - 3	11	6
Stellaria americana (American chickweed)	1	0 - 1	11	3
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0 - 1	22	5
Taraxacum officinale (common dandelion)	5	0 - 10	33	13
Thalictrum occidentale (western meadow rue)	2	0 - 3	22	7
Thalictrum venulosum (veiny meadow rue)	5	0 - 10	33	13
Trifolium repens (white clover)	1	0 - 1	11	3
Urtica dioica (common nettle)	2	0 - 3	44	9
Valeriana dioica (northern valerian)	3	0 - 3	11	6
Verbascum thapsus (common mullein)	3	0 - 3	11	6
Vicia americana (wild vetch)	1	0 - 3	33	6
Viola canadensis (western Canada violet)	5	0 - 10	33	13
Ferns and Allies				
Equisetum arvense (common horsetail)	20	0 - 20	11	15

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

This community type reflects past periods of prolonged animal use. The *Populus tremuloides/Symphoricarpos occidentalis* (aspen/buckbrush) community type represents a grazing or browsing disclimax of the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type. The original shrub understory has been altered, and continued disturbance may further change the community by eliminating the shrub component and leaving only herbaceous species. Careful observation of physical and vegetative characteristics may aid in determining potential of the site.

SOILS

Soils are typically dark brown Chernozems. Sites adjacent to streams are often shallow Regosols overlying river cobbles. Soil textures vary from silt loam to sand. Water tables average 30 cm (12 in) below the surface in mid-summer but water depths of several stands were greater than one meter. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout

the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often dominated by *Carex atherodes* (awned sedge), *Salix bebbiana* (beaked willow), *Salix petiolaris* (basket willow), or occasionally *Populus balsamifera* (balsam poplar). Drier sites are uplands dominated by grassland steppe vegetation.

MANAGEMENT INFORMATION

Livestock

This type is a valuable source of browse and forage for livestock and wildlife. Livestock use this type for shade and as bedding ground. However, persistent grazing and trampling have already caused compositional and structural changes. Conversion back to the original vegetation is unlikely to occur simply by altering the grazing regime.

Timber

Most timber harvest is salvageable for fuelwood. Overwood removal will result in sprouting of young aspen from suckers. Stand development necessitates protection of young aspen from browsing.

Wildlife

The moderate structural understory diversity, primarily of *Symphoricarpos occidentalis* (buckbrush) and *Rosa woodsii* (common wild rose), does provide thermal and hiding cover for big game and upland bird species. Deer may use this type for early season forage. Beaver, if present, may make heavy use of *Populus tremuloides* (aspen) stands (Allen 1983). Wild ungulates browse young suckers and occasionally feed on the bark of older trees. Use by elk during spring, fall, and winter periods is often moderate to heavy (Kufeld 1973). *Populus tremuloides* (aspen) is highly preferred by moose (Costain 1989). The palatability of *Symphoricarpos occidentalis* (buckbrush) is rated as good for deer and elk (Wasser 1982, Johnson and Nichols 1982). Deer and elk may browse heavily on *Rosa woodsii* (common wild rose), while the persistent fruit (rose hips) provides fall and winter food for birds, small mammals, and bears, which disperse the seeds. *Rosa woodsii* (common wild rose) is strongly grazing tolerant but can be dwarfed and thinned by intense browsing or defoliation by season long use.

Use of this type as bedding grounds by wildlife is common. Birds such as red-shafted flickers are common, and often nest in cavities of larger aspen. Understory species such as *Agropyron repens* (quackgrass), *Rosa* species (rose), and *Symphoricarpos* species (snowberry) provide food and cover for small mammals and birds, upland game and waterfowl (Dittberner and Olson 1983).

Fire

Populus tremuloides (aspen) responds to fire by producing large numbers of vigorous root suckers. However, livestock and large ungulates should be kept out of newly burned stands if successful regeneration is desired.

Soil Management and Rehabilitation Opportunities

Moist, fine textured soils are easily compacted and disturbed by livestock in spring and after rain events. Soil compaction is minimal on dry coarse textured 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 roots of *Populus tremuloides* effectively stabilize soils.

Recreational Uses and Considerations

If stands are extensive, this community type may provide good campground locations. Overstory aspen provide shade in an often otherwise treeless environment. However, successful aspen reproduction is likely to be reduced or eliminated by trampling. Fencing of selected areas to allow suckers to grow is recommended.

OTHER STUDIES

The *Populus tremuloides/Symphoricarpos occidentalis* (aspen/buckbrush) community type has not been described by others. A *Populus tremuloides/Symphoricarpos albus/Elymus glaucous* (aspen/snowberry/smooth wild rye) community type is described by Kovalchik (1987) in Oregon. A *Populus tremuloides* community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan.

Populus tremuloides/Herbaceous Community Type
(Aspen/Herbaceous)

POPUTRE
Number of Stands Sampled = 10
Number of Stands Sampled in Alberta = 6

CAUTION—Not all sites dominated by *Populus tremuloides* (aspen) 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 Landforms section.

LOCATION AND ASSOCIATED LANDFORMS

The *Populus tremuloides*/Herbaceous (aspen/Herbaceous) community type is a minor early-to-mid seral type resulting from long term moderate-to-severe disturbance to stands of *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type in the Parkland Natural Region where *Picea glauca* (white spruce) is not generally found. The type also occurs incidentally in the more moist Fescue Subregions of the Grassland Natural Region and the Lower Foothills Subregion. Like the other aspen types found on the prairie, this type occurs around pothole depressions, near streams and rivers on alluvial terraces and steep valley walls, or near springs and seeps. Farther north, as one nears the Boreal Ecoregion, and to the west as one enters the Upper Foothills Subregion, the aspen is seral to communities dominated by *Picea glauca* (white spruce).

VEGETATION

The *Populus tremuloides*/Herbaceous (aspen/Herbaceous) community type represents a grazing or browsing disclimax. This type is what is left after most of the woody plants under a *Populus tremuloides* (aspen) overstory have been eliminated by some kind of disturbance—usually grazing. *Populus tremuloides* dominates the overstory. Shrubs such as *Cornus stolonifera* (red-osier dogwood), *Alnus tenuifolia* (river alder), *Prunus virginiana* (choke cherry), and *Salix*

species (willows) are absent or present only in limited amounts, due to high grazing and browsing pressure. The herbaceous layer is heavily represented by exotic, disturbance-increaser species (Table 23).

Table 23. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 11 stands of the grazing or browsing disclimax *Populus tremuloides*/Herbaceous (aspen/Herbaceous) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Picea glauca (white spruce)	1	0 - 1	18	4
Populus balsamifera (balsam poplar)	1	0 - 1	9	3
Populus tremuloides (aspen)	86	60 - 98	100	93
Shrubs				
Amelanchier alnifolia (Saskatoon)	1	0 - 1	18	4
Betula glandulosa (bog birch)	1	0 - 1	9	3
Elaeagnus commutata (silverberry)	1	0 - 1	9	3
Lonicera utahensis (red twinberry)	1	0 - 1	9	3
Prunus virginiana (choke cherry)	1	0 - 1	9	3
Ribes lacustre (bristly black currant)	1	0 - 1	9	3
Ribes oxyacanthoides (northern gooseberry)	2	0 - 3	36	8
Rosa woodsii (common wild rose)	10	0 - 10	9	9
Rosa spp. (rose)	5	0 - 10	55	17
Rubus idaeus (wild red raspberry)	7	0 - 10	18	11
Salix bebbiana (beaked willow)	1	0 - 3	27	5
Salix lutea (yellow willow)	3	0 - 3	9	5
Symphoricarpos albus (snowberry)	1	0 - 1	9	3
Symphoricarpos occidentalis (buckbrush)	5	0 - 10	64	18
Graminoids				
Agropyron repens (quack grass)	14	0 - 30	27	19
Agrostis scabra (rough hair grass)	3	0 - 3	9	5
Agrostis stolonifera (redtop)	1	0 - 1	9	3
Agropyron trachycaulum (slender wheat grass)	3	0 - 3	18	7
Bromus anomalus (nodding brome)	1	0 - 1	9	3
Bromus ciliatus (fringed brome)	1	0 - 1	9	3
Bromus inermis (smooth brome)	21	0 - 90	55	34
Calamagrostis canadensis (bluejoint)	35	0 - 70	18	25
Calamagrostis stricta (narrow reed grass)	3	0 - 3	18	7
Carex lanuginosa (woolly sedge)	20	0 - 20	9	13
Carex spp. (sedge)	1	0 - 1	9	3
Elymus canadensis (Canada wild rye)	1	0 - 1	9	3
Elymus virginicus (Virginia wild rye)	1	0 - 1	9	3
Hordeum jubatum (foxtail barley)	1	0 - 1	18	4
Juncus balticus (wire rush)	3	0 - 3	9	5

Table 23. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 11 stands of the grazing or browsing disclimax *Populus tremuloides*/Herbaceous (aspen/Herbaceous) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Muhlenbergia richardsonis (mat muhly)	1	0 - 1	9	3
Phleum pratense (timothy)	19	0 - 30	45	29
Poa palustris (fowl bluegrass)	12	0 - 30	36	21
Poa pratensis (Kentucky bluegrass)	29	0 - 98	64	43
Trisetum spp. (trisetum)	3	0 - 3	9	5
Forbs				
Achillea millefolium (common yarrow)	2	0 - 3	18	6
Actaea rubra (red and white baneberry)	1	0 - 1	18	4
Agoseris glauca (yellow false dandelion)	1	0 - 1	9	3
Arabis glabra (tower mustard)	1	0 - 1	9	3
Artemisia ludoviciana (prairie sagewort)	1	0 - 1	9	3
Aster ciliolatus (Lindley's aster)	7	0 - 10	18	11
Aster eatonii (Eaton's aster)	3	0 - 3	9	5
Aster hesperius (western willow aster)	1	0 - 3	27	5
Aster laevis (smooth aster)	3	0 - 3	18	7
Campanula rotundifolia (harebell)	1	0 - 1	9	3
Carduus nutans (nodding thistle)	1	0 - 1	9	3
Cirsium arvense (Canada thistle)	2	0 - 3	64	11
Cirsium vulgare (bull thistle)	1	0 - 1	9	3
Epilobium angustifolium (common fireweed)	1	0 - 1	18	4
Fragaria virginiana (wild strawberry)	7	0 - 10	18	11
Galeopsis tetrahit (hemp-nettle)	3	0 - 3	9	5
Galium boreale (northern bedstraw)	1	0 - 3	55	7
Geranium richardsonii (wild white geranium)	5	0 - 10	36	13
Geum aleppicum (yellow avens)	1	0 - 1	9	3
Hackelia americana (nodding stickseed)	1	0 - 1	9	3
Heracleum lanatum (cow parsnip)	20	0 - 40	18	19
Lathyrus ochroleucus (cream-colored vetchling)	2	0 - 3	18	6
Medicago lupulina (black medick)	1	0 - 1	9	3
Mentha arvensis (wild mint)	3	0 - 3	9	5
Mertensia paniculata (tall lungwort)	3	0 - 3	9	5
Osmorhiza chilensis (blunt-fruited sweet cicely)	1	0 - 1	9	3
Osmorhiza depauperata (spreading sweet cicely)	1	0 - 1	9	3
Penstemon procerus (slender blue beardtongue)	1	0 - 1	9	3
Perideridia gairdneri (squawroot)	1	0 - 1	9	3
Plantago major (common plantain)	1	0 - 1	9	3
Potentilla gracilis (graceful cinquefoil)	1	0 - 1	18	4
Potentilla norvegica (rough cinquefoil)	3	0 - 3	9	5

Table 23. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 11 stands of the grazing or browsing disclimax *Populus tremuloides*/Herbaceous (aspen/Herbaceous) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Ranunculus spp. (ranunculus)	1	0 - 1	9	3
Rhinanthus minor (yellow rattle)	1	0 - 1	9	3
Rumex crispus (curled dock)	2	0 - 3	18	6
Senecio pauperculus (balsam groundsel)	1	0 - 1	9	3
Smilacina stellata (star-flowered Solomon's-seal)	1	0 - 1	9	3
Solidago canadensis (Canada goldenrod)	5	0 - 10	18	9
Sonchus asper (prickly annual sow-thistle)	1	0 - 1	9	3
Stachys palustris (marsh hedge-nettle)	1	0 - 1	9	3
Stellaria longipes (long-stalked chickweed)	1	0 - 1	9	3
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0 - 1	9	3
Taraxacum officinale (common dandelion)	3	0 - 10	64	14
Thalictrum occidentale (western meadow rue)	2	0 - 3	18	6
Thalictrum venulosum (veiny meadow rue)	4	0 - 10	27	10
Tragopogon dubius (common goat's-beard)	1	0 - 1	9	3
Trifolium repens (white clover)	3	0 - 3	9	5
Urtica dioica (common nettle)	2	0 - 3	18	6
Vicia americana (wild vetch)	2	0 - 3	45	9
Viola adunca (early blue violet)	1	0 - 1	9	3
Viola spp. (violet)	1	0 - 1	9	3
Viola canadensis (western Canada violet)	1	0 - 1	18	4
Ferns and Allies				
Equisetum arvense (common horsetail)	5	0 - 10	18	9

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

This community type reflects past periods of prolonged animal use. The *Populus tremuloides*/Herbaceous (aspen/Herbaceous) community type represents a grazing or browsing disclimax of the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) habitat type or *Populus tremuloides/Symphoricarpos occidentalis* (aspen/buckbrush) community type. Loss of the original undergrowth dominants has occurred, and reproduction of *Populus tremuloides* (aspen) has been severely limited. Careful observation of physical and vegetative characteristics may aid in determining the site's potential.

SOILS

Soils are typically dark brown Chernozems. Sites adjacent to streams are often shallow Regosols overlying river cobbles. Soil textures vary from silt loam to sand. Water tables average 30 cm (12 in) below the surface in mid-summer but water depths of several stands were greater than one meter. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout

the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often dominated by *Carex atherodes* (awned sedge), *Salix bebbiana* (beaked willow), *Salix petiolaris* (basket willow), or occasionally *Populus balsamifera* (balsam poplar). Drier sites are uplands dominated by steppe vegetation.

MANAGEMENT INFORMATION

Livestock

This type is a valuable source of browse and forage for livestock and wildlife. Livestock 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 (smooth brome) is a highly palatable and productive grass, especially early in the season when it is green. *Bromus inermis* is well adapted to grazing and is considered an invader. Streambanks with *Bromus inermis* are susceptible to sloughing. Many stands of this type are dominated by, or have a large component of, *Poa pratensis* (Kentucky bluegrass). This grass responds to grazing similarly to *Bromus inermis*.

Timber

Most timber harvest is salvageable for fuelwood. Overwood removal will result in sprouting of young aspen from suckers. Stand development necessitates protection of young aspen from browsing.

Wildlife

Deer may use this type for early season forage. Cover value for big game is limited because of the typically open, two layered structure. Beaver, if present, may make heavy use of *Populus tremuloides* (aspen) stands (Allen 1983). Wild ungulates such as deer and elk browse young suckers and occasionally feed on the bark of older trees. Use by elk during spring, fall, and winter periods is often moderate to heavy (Kufeld 1973). *Populus tremuloides* (aspen) is highly preferred by moose (Costain 1989). Use of this type as bedding grounds by wildlife is also common. Birds such as red-shafted flickers are common, and often nest in cavities of larger aspen. Understory species such as *Agropyron repens* (quackgrass), *Rosa* species (rose), and *Symphoricarpos* species (snowberry) provide food and cover for small mammals and birds, upland game and waterfowl (Dittberner and Olson 1983).

Fire

Populus tremuloides (aspen) responds to fire by producing large numbers of vigorous root suckers. However, livestock and large ungulates should be kept out of newly burned stands if successful regeneration is desired. *Bromus inermis* (smooth brome) is little harmed by fires, especially when moisture levels are adequate to dampen soil temperatures during the burn. However, it is intolerant of burning during the active growth stages and can be successfully controlled by late spring burning. Cool burns will have little effect on *Bromus inermis* (Wasser 1982), but late spring burns may lower tiller densities (Dix and Smeins 1967) and may be used to control this species (Wasser 1982). Many stands of this type are dominated by, or have a large component of, *Poa pratensis* (Kentucky bluegrass). This grass responds to fire similarly to *Bromus inermis*.

Soil Management and Rehabilitation Opportunities

Moist, fine textured soils are easily compacted and disturbed by livestock in spring and after rain events. Soil compaction is minimal on dry coarse textured 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 roots of *Populus tremuloides* effectively stabilize soils.

On the other hand, *Bromus inermis* (smooth brome) is not very effective in stabilizing streambanks (Youngblood and others 1985b). Bank undercutting and sloughing may occur, especially when soils are wet or stands weakened by excessive grazing.

Recreational Uses and Considerations

If stands are extensive, this community type may provide good campground locations. Overstory aspen provide shade in an often otherwise treeless environment. However, successful aspen reproduction is likely to be reduced or eliminated by trampling. Fencing of selected areas to allow suckers to grow is recommended.

OTHER STUDIES

The *Populus tremuloides*/Herbaceous (aspen/Herbaceous) community type has not been previously described. A *Populus tremuloides* community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan.

Salix amygdaloides Community Type
(Peach-leaved willow Community Type)

SALIAMY

Number of Stands Sampled = 26

Number of Stands Sampled in Alberta = 5

LOCATION AND ASSOCIATED LANDFORMS

The *Salix amygdaloides* (peach-leaved willow) community type is an incidental type at low elevations in southeastern Alberta in the Dry Mixedgrass Subregion. It occurs as a narrow band or irregularly shaped community in backwater areas, abandoned meander channels, overflow channels, and along pond and lake margins. In other cases, it occurs as small, isolated clumps immediately adjacent to streams and rivers of the region.

VEGETATION

The *Salix amygdaloides* (peach-leaved willow) community type consists of a tree layer dominated by the short statured *Salix amygdaloides* (peach-leaved willow). Generally associated with this overstory are *Salix exigua* (sandbar willow), *Salix lutea* (yellow willow), and *Rosa woodsii* (common wild rose). The herbaceous understory may include species such as *Poa palustris* (fowl bluegrass), *Phalaris arundinacea* (reed canary grass), and *Glycyrrhiza lepidota* (wild licorice) (Table 24).

Table 24. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Salix amygdaloides* (peach-leaved willow) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Fraxinus pennsylvanica (green ash)	3	0 - 3	17	7
Populus deltoides (plains cottonwood)	3	0 - 3	33	10
Shrubs				
Betula occidentalis (water birch)	3	0 - 3	17	7
Cornus stolonifera (red-osier dogwood)	16	0 - 40	67	33
Ribes aureum (golden currant)	1	0 - 1	17	4
Ribes oxyacanthoides (northern gooseberry)	3	0 - 3	17	7
Rosa woodsii (common wild rose)	3	0 - 3	17	7
Rosa spp. (rose)	15	0 - 30	33	22
Salix amygdaloides (peach-leaved willow)	55	40 - 60	100	74
Salix exigua (sandbar willow)	11	0 - 30	50	23
Salix lutea (yellow willow)	33	0 - 80	67	47

Table 24. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Salix amygdaloides* (peach-leaved willow) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shepherdia argentea (thorny buffaloberry)	10	0 - 10	17	13
Symphoricarpos occidentalis (buckbrush)	20	0 - 20	17	18
Graminoids				
Agropyron pectiniforme (crested wheat grass)	1	0 - 1	17	4
Agropyron repens (quack grass)	3	0 - 3	33	10
Agropyron smithii (western wheat grass)	60	0 - 60	17	32
Agrostis stolonifera (redtop)	3	0 - 3	50	12
Agropyron trachycaulum (slender wheat grass)	3	0 - 3	17	7
Bromus inermis (smooth brome)	3	0 - 3	33	10
Bromus tectorum (downy chess)	1	0 - 1	17	4
Carex lanuginosa (woolly sedge)	3	0 - 3	17	7
Elymus canadensis (Canada wild rye)	1	0 - 1	17	4
Hordeum jubatum (foxtail barley)	1	0 - 1	17	4
Phalaris arundinacea (reed canary grass)	24	0 - 60	50	35
Poa palustris (fowl bluegrass)	27	0 - 60	67	43
Poa pratensis (Kentucky bluegrass)	3	0 - 3	50	12
Spartina pectinata (prairie cord grass)	1	0 - 1	17	4
Forbs				
Apocynum cannabinum (Indian hemp)	15	0 - 20	33	22
Apocynum spp. (dogbane)	1	0 - 1	17	4
Artemisia absinthium (absinthe wormwood)	3	0 - 3	33	10
Aster brachyactis (rayless aster)	1	0 - 1	17	4
Aster spp. (aster)	20	0 - 20	17	18
Bidens cernua (nodding beggarticks)	3	0 - 3	17	7
Cicuta maculata (water-hemlock)	20	0 - 20	17	18
Cirsium arvense (Canada thistle)	5	0 - 10	50	16
Fragaria virginiana (wild strawberry)	1	0 - 1	17	4
Geranium spp. (geranium)	3	0 - 3	17	7
Glycyrrhiza lepidota (wild licorice)	60	0 - 60	17	32
Kochia scoparia (summer-cypress)	3	0 - 3	17	7
Lactuca serriola (prickly lettuce)	1	0 - 1	17	4
Lycopus asper (western water-horehound)	20	0 - 20	17	18
Melilotus alba (white sweet-clover)	40	0 - 40	17	26
Melilotus officinalis (yellow sweet-clover)	22	0 - 40	33	27
Mentha arvensis (wild mint)	7	0 - 20	50	19
Parietaria pensylvanica (American pellitory)	3	0 - 3	17	7
Petasites sagittatus (arrow-leaved coltsfoot)	1	0 - 1	17	4
Plantago major (common plantain)	1	0 - 1	17	4

Table 24. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 stands of the *Salix amygdaloides* (peach-leaved willow) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Polygonum coccineum (water smartweed)	1	0 - 1	17	4
Potentilla anserina (silverweed)	1	0 - 1	17	4
Potentilla spp. (cinquefoil)	20	0 - 20	17	18
Sanicula marilandica (snakeroot)	1	0 - 1	17	4
Smilacina stellata (star-flowered Solomon's-seal)	7	0 - 10	33	15
Solidago canadensis (Canada goldenrod)	5	0 - 10	33	13
Sonchus asper (prickly annual sow-thistle)	3	0 - 3	17	7
Urtica dioica (common nettle)	3	0 - 3	17	7
Vicia americana (wild vetch)	1	0 - 1	33	6
Ferns and Allies				
Equisetum arvense (common horsetail)	22	0 – 40	33	27

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

In most situations, the *Salix amygdaloides* (peach-leaved willow) community type represents a successional stage of a *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type, or the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type. Figure 10 is a generalized schematic of the successional pathway followed on sites of this type.

Disturbance Stages

Higher levels of disturbance tend to increase those disturbance-related species already present. If the disturbance includes trampling and/or rubbing by livestock, the weak, multi-stemmed nature of *Salix amygdaloides* (peach-leaved willow) will yield in a great deal of downed wood. This fallen wood tends to restrict livestock use. Other sites may be wet enough to preclude most types of disturbances.

SOILS

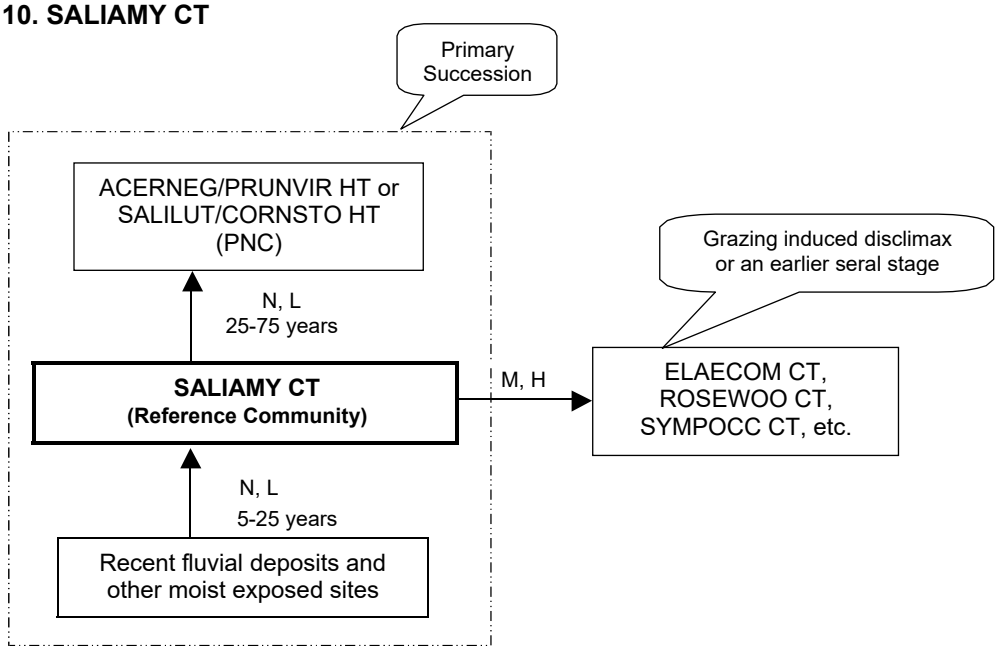
Soils are commonly Regosols or Chernozems. This community type occurs on a wide range of soil textures except heavy clay. Water tables are usually within 1 m (39 in) of the soil surface throughout the growing season. *Salix amygdaloides* (peach-leaved willow) can tolerate weakly saline and alkaline soils, poor soil drainage, and prolonged flooding.

ADJACENT COMMUNITIES

Wetter sites may be *Typha latifolia* (common cattail), *Scirpus* species (bulrush), *Eleocharis* species (spike rush), *Spartina pectinata* (prairie cordgrass), or *Phalaris arundinacea* (reed canary grass) habitat types. Adjacent drier sites may be dominated by the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type, the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type, or the

Fraxinus pennsylvanica/Prunus virginiana (green ash/choke cherry) habitat type. In other situations, drier sites may be the *Rosa woodsii* (common wild rose), *Symphoricarpos occidentalis* (buckbrush), or the *Shepherdia argentea* (thorny buffaloberry) community types.

Figure 10. SALIAMY CT



Successional Pathway Diagram for SALIAMY Sites the Southern Alberta Grasslands
Reference Community = SALIAMY CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
SALIAMY CT	*Salix amygdaloides* (peach-leaved willow) Community Type
ACERNEG/PRUNVIR HT	*Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) Habitat Type
SALILUT/CORNSTO HT	*Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) Habitat Type
SYMPOCC CT	*Symphorocarpos occidentalis* (buckbrush) Community Type
ELAECOM CT	*Elaegnus commutata* (silverberry) Community Type
ROSAWOO CT	*Rosa woodsii* (common wild rose) Community Type

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic potential does not Such hydrologic change could be a fluvial buildup of the floodplain, resulting in a terrace site too dry to riparian species, or it could be removal of the overstory canopy by grazing or for agriculture.The time span is estimated for the stand to become dominated under undisturbed conditions by at least 50 percent cover climax (or overstory indicator) species.

MANAGEMENT INFORMATION

Livestock

Wet conditions associated with *Salix amygdaloides* (peach-leaved willow) stands generally limit livestock use. However, during wet periods livestock use can lead to the churning of soil or soil compaction.

Wildlife

The high degree of structural diversity in the *Salix amygdaloides* (peach-leaved willow) community type provides excellent thermal and hiding cover for wildlife.

Fisheries

The *Salix amygdaloides* (peach-leaved willow) community type provides limited thermal cover for fish. However, it is an effective stabilizer of streambanks and managers should attempt to protect them.

Fire

Most fires kill only aboveground plant parts of *Salix amygdaloides* (peach-leaved willow). However, severe fires can completely remove soil organic layers, leaving roots exposed and charred, and thus eliminating basal sprouting. Generally, *Salix amygdaloides* (peach-leaved willow) will resprout from its roots following fire, but the species is a prolific seeder, and off-site plants are important seed sources for revegetating burned areas. Due to their proximity to water or high water tables, *Salix amygdaloides* (peach-leaved willow) communities may serve as natural fire breaks (USDA IFSL 1995).

Soil Management and Rehabilitation Opportunities

High water tables and seasonal flooding should limit activities and development in most of these stands. Care must be taken in the placement of roads and other developments in sites of this type.

Recreational Uses and Considerations

The *Salix amygdaloides* (peach-leaved willow) community type provides excellent opportunities for viewing wildlife species. However, the dense nature of most healthy stands and the high water tables associated with them tend to make access difficult.

OTHER STUDIES

The *Salix amygdaloides* (peach-leaved willow) community type is described by Hansen and others (1995) for Montana.

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

SALIBEB/CAREATH

Number of Stands Sampled = 14

Number of Stands Sampled in Alberta = 10

LOCATION AND ASSOCIATED LANDFORMS

The *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type is a minor to incidental type in all parts of the study area except the Dry Mixedgrass Subregion. It occupies moist to wet areas on alluvial terraces and near springs, seeps, and subirrigated meadows that are characterized by fine textured soils and poor drainage.

VEGETATION

The *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type is a climax community dominated by *Salix bebbiana* in the tallest layer and *Carex atherodes* (awned sedge) or *Carex utriculata* (beaked sedge) in a very moist herbaceous understory (Table 25). Stands of this type may have significant amounts of tall shrub cover, including *Cornus stolonifera* (red-osier dogwood).

Table 25. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 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	17	4
Populus balsamifera (balsam poplar)	1	0-1	17	4
Shrubs				
Betula glandulosa (bog birch)	3	0-3	17	7
Betula occidentalis (water birch)	1	0-1	17	4
Cornus stolonifera (red-osier dogwood)	2	0-3	33	8
Ribes lacustre (bristly black currant)	1	0-1	17	4
Ribes oxyacanthoides (northern gooseberry)	1	0-1	17	4
Rosa spp. (rose)	1	0-3	50	7
Salix bebbiana (beaked willow)	53	20-80	100	73
Salix drummondiana (Drummond's willow)	3	0-3	17	7
Salix lutea (yellow willow)	3	0-3	17	7
Salix maccalliana (velvet-fruited willow)	1	0-1	17	4
Salix myrtillifolia (myrtle-leaved willow)	12	0-20	33	20
Salix petiolaris (basket willow)	17	0-30	33	24
Salix planifolia (flat-leaved willow)	3	0-3	33	10
Salix pseudomonticola (false mountain willow)	1	0-1	17	4
Symphoricarpos occidentalis (buckbrush)	2	0-3	33	8

Table 25. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 late seral to climax stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type

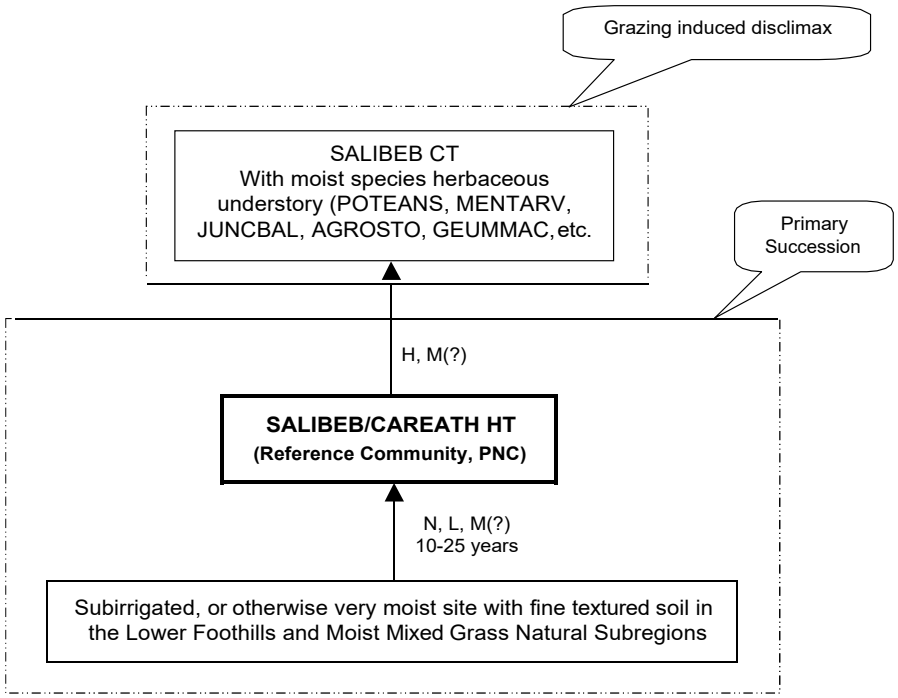
Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Agropyron smithii (western wheat grass)	1	0-1	17	4
Alopecurus occidentalis (alpine foxtail)	3	0-3	17	7
Bromus inermis (smooth brome)	20	0-20	33	26
Calamagrostis canadensis (bluejoint)	10	0-10	33	18
Carex aquatilis (water sedge)	10	0-10	17	13
Carex atherodes (awned sedge)	33	0-80	83	52
Carex lanuginosa (woolly sedge)	3	0-3	17	7
Carex norvegica (Norway sedge)	10	0-10	17	13
Carex utriculata (beaked sedge)	35	0-60	33	34
Juncus balticus (wire rush)	20	0-20	17	18
Poa palustris (fowl bluegrass)	1	0-1	17	4
Poa pratensis (Kentucky bluegrass)	3	0-3	17	7
Scirpus microcarpus (small-fruited bulrush)	1	0-1	17	4
Forbs				
Angelica arguta (white angelica)	3	0-3	17	7
Aster borealis (marsh aster)	1	0-1	17	4
Aster laevis (smooth aster)	10	0-10	17	13
Cicuta maculata (water-hemlock)	1	0-1	17	4
Cirsium arvense (Canada thistle)	1	0-1	33	6
Epilobium angustifolium (common fireweed)	1	0-1	17	4
Fragaria vesca (woodland strawberry)	1	0-1	17	4
Fragaria virginiana (wild strawberry)	1	0-1	17	4
Galium boreale (northern bedstraw)	1	0-1	17	4
Geum aleppicum (yellow avens)	10	0-10	17	13
Geum macrophyllum (large-leaved yellow avens)	3	0-3	17	7
Heracleum lanatum (cow parsnip)	1	0-1	17	4
Mentha arvensis (wild mint)	3	0-3	33	10
Mertensia paniculata (tall lungwort)	3	0-3	17	7
Mitella nuda (bishop's-cap)	3	0-3	17	7
Pedicularis bracteosa (western lousewort)	1	0-1	17	4
Pedicularis groenlandica (elephant's-head)	1	0-1	17	4
Petasites sagittatus (arrow-leaved coltsfoot)	3	0-3	17	7
Polygonum coccineum (water smartweed)	20	0-20	17	18
Polygonum convolvulus (wild buckwheat)	1	0-1	17	4
Potentilla gracilis (graceful cinquefoil)	1	0-1	17	4
Rumex occidentalis (western dock)	1	0-1	17	4
Sanicula marilandica (snakeroot)	1	0-1	17	4

Table 25. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 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]
Smilacina stellata (star-flowered Solomon's-seal)	5	0-10	33	13
Solidago canadensis (Canada goldenrod)	10	0-10	17	13
Solidago rigida (stiff goldenrod)	1	0-1	17	4
Sonchus arvensis (perennial sow-thistle)	1	0-1	17	4
Sonchus spp. (sow-thistle)	3	0-3	17	7
Spiranthes romanzoffiana (hooded ladies'-tresses)	1	0-1	17	4
Taraxacum officinale (common dandelion)	3	0-3	17	7
Thalictrum occidentale (western meadow rue)	3	0-3	17	7
Vicia americana (wild vetch)	1	0-1	50	7
Viola spp. (violet)	3	0-3	17	7
Ferns and Allies				
Equisetum arvense (common horsetail)	18	0-40	50	30
Equisetum fluviatile (swamp horsetail)	10	0-10	17	13

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

Figure 11. SALIBEB/CAREATH HT



Successional Pathway Diagram of Very Moist SALIBEB Sites in Southern Alberta Grasslands
Reference Community = SALIBEB/CAREATH HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
SALIBEB/CAREATH HT	*Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) Habitat Type
SALIBEB CT	*Salix bebbiana* (beaked willow) Community Type
AGROSTO	*Agrostis stolonifera* (redtop)
POTEANS	*Potentilla anserina* (silverweed)
GEUMMAC	*Geum macrophyllum* (large-leaved yellow avens)
JUNCBAL	*Juncus balticus* (wire rush)
MENTARV	*Mentha arvensis* (wild mint)

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic potential does not change. Such hydrologic change could be a fluvial buildup of the floodplain, resulting in a terrace site too dry to support riparian species, or it could be removal of the overstory canopy by grazing or for agriculture. The time span is estimated for the stand to become dominated under undisturbed conditions by at least 50 percent cover of climax (or overstory indicator) species.

SUCCESSIONAL INFORMATION

With prolonged moderate to heavy grazing pressure, the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type will lose its *Carex* understory to a more diverse set of generally drier disturbance-increasers such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (common timothy), and *Taraxacum officinale* (common dandelion) (Table 26). This disturbance has the effect of drying out the site and results in the grazing disclimax *Salix bebbiana* (beaked willow) community type. Figure 11 is a generalized schematic of the successional pathway followed on sites of this type.

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

Salix bebbiana is considered a pioneer species in Montana (USDA IFSL 1995), but this does not easily explain the extensive stands on moist slopes in the Lower Foothills Subregion. Once established, the species may persist in areas with moist site conditions or frequent disturbance such as fire or flooding (USDA IFSL 1995). In fluvial situations, channel changes that reduce water availability may prevent further germination and establishment of *Salix bebbiana* within established stands. The species has low shade tolerance, and therefore may decrease in cover as tree species, such as *Populus balsamifera* (balsam poplar), *Populus tremuloides* (aspen), and *Picea glauca* (white spruce) become established.

Table 26. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 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)	1	0 - 1	13	4
Larix laricina (tamarack)	1	0 - 1	13	4
Picea glauca (white spruce)	1	0 - 1	13	4
Populus tremuloides (aspen)	1	0 - 1	13	4
Shrubs				
Betula glandulosa (bog birch)	10	0 - 10	13	11
Betula occidentalis (water birch)	1	0 - 1	13	4
Cornus stolonifera (red-osier dogwood)	2	0 - 3	25	7
Elaeagnus commutata (silverberry)	1	0 - 1	13	4
Lonicera dioica (twining honeysuckle)	1	0 - 1	13	4
Potentilla fruticosa (shrubby cinquefoil)	3	0 - 3	13	6
Ribes inerme (mountain gooseberry)	1	0 - 1	13	4
Ribes oxyacanthoides (northern gooseberry)	1	0 - 1	25	5
Ribes spp. (currant)	1	0 - 1	13	4
Rosa woodsii (common wild rose)	20	0 - 20	13	16
Rosa spp. (rose)	1	0 - 1	25	5
Rubus arcticus (dwarf raspberry)	1	0 - 1	13	4
Rubus idaeus (wild red raspberry)	1	0 - 1	13	4
Salix bebbiana (beaked willow)	49	10 - 80	100	70
Salix boothii (Booth's willow)	10	0 - 10	13	11

Table 26. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 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]
Salix candida (hoary willow)	1	0 - 1	13	4
Salix lutea (yellow willow)	7	0 - 10	25	13
Salix petiolaris (basket willow)	20	0 - 20	25	22
Salix planifolia (flat-leaved willow)	1	0 - 1	13	4
Salix pseudomonticola (false mountain willow)	2	0 - 3	25	7
Salix serissima (autumn willow)	7	0 - 10	25	13
Symphoricarpos occidentalis (buckbrush)	10	0 - 20	25	16
Graminoids				
Agrostis spp. (Agrostis)	1	0 - 1	13	4
Agrostis stolonifera (redtop)	13	0 - 20	50	25
Agropyron trachycaulum (slender wheat grass)	5	0 - 10	25	11
Alopecurus occidentalis (alpine foxtail)	3	0 - 3	13	6
Alopecurus pratensis (meadow foxtail)	10	0 - 10	13	11
Beckmannia syzigachne (slough grass)	10	0 - 20	25	16
Bromus inermis (smooth brome)	10	0 - 20	25	16
Calamagrostis stricta (narrow reed grass)	10	0 - 10	13	11
Carex aquatilis (water sedge)	5	0 - 10	25	11
Carex atherodes (awned sedge)	21	0 - 40	38	28
Carex lanuginosa (woolly sedge)	2	0 - 3	25	7
Carex praegracilis (graceful sedge)	1	0 - 1	13	4
Carex utriculata (beaked sedge)	23	0 - 60	75	42
Carex spp. (sedge)	1	0 - 1	13	4
Deschampsia cespitosa (tufted hair grass)	1	0 - 1	13	4
Festuca saximontana (Rocky Mountain fescue)	1	0 - 1	13	4
Glyceria grandis (common tall manna grass)	40	0 - 40	13	23
Glyceria striata (fowl manna grass)	10	0 - 10	13	11
Hordeum jubatum (foxtail barley)	1	0 - 1	25	5
Juncus balticus (wire rush)	15	0 - 40	50	27
Phalaris arundinacea (reed canary grass)	20	0 - 20	13	16
Phleum pratense (timothy)	8	0 - 20	50	20
Poa interior (inland bluegrass)	1	0 - 1	13	4
Poa palustris (fowl bluegrass)	5	0 - 10	38	14
Poa pratensis (Kentucky bluegrass)	3	0 - 3	25	9
Scirpus microcarpus (small-fruited bulrush)	1	0 - 1	25	5
Forbs				
Achillea millefolium (common yarrow)	1	0 - 1	38	6
Achillea ptarmica (sneezewort yarrow)	3	0 - 3	13	6
Actaea rubra (red and white baneberry)	1	0 - 1	13	4

Table 26. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 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]
Anemone cylindrica (long-fruited anemone)	1	0 - 1	13	4
Angelica arguta (white angelica)	18	0 - 40	38	26
Aster ascendens (western aster)	20	0 - 20	13	16
Aster borealis (marsh aster)	1	0 - 1	13	4
Aster conspicuus (showy aster)	3	0 - 3	13	6
Aster eatonii (Eaton's aster)	3	0 - 3	13	6
Aster laevis (smooth aster)	1	0 - 1	13	4
Aster modestus (large northern aster)	10	0 - 10	13	11
Chrysanthemum leucanthemum (ox-eye daisy)	1	0 - 1	13	4
Cicuta maculata (water-hemlock)	12	0 - 20	25	17
Cirsium arvense (Canada thistle)	5	0 - 10	25	11
Epilobium ciliatum (northern willowherb)	3	0 - 3	13	6
Erigeron philadelphicus (Philadelphia fleabane)	3	0 - 3	13	6
Fragaria vesca (woodland strawberry)	1	0 - 1	13	4
Fragaria virginiana (wild strawberry)	1	0 - 1	25	5
Galium boreale (northern bedstraw)	1	0 - 1	25	5
Galium trifidum (small bedstraw)	1	0 - 1	13	4
Geranium richardsonii (wild white geranium)	3	0 - 3	25	9
Geum aleppicum (yellow avens)	1	0 - 1	13	4
Geum macrophyllum (large-leaved yellow avens)	3	0 - 10	63	14
Habenaria spp. (bog orchid)	1	0 - 1	13	4
Heracleum lanatum (cow parsnip)	11	0 - 20	38	20
Lysimachia ciliata (fringed loosestrife)	2	0 - 3	25	7
Medicago lupulina (black medick)	1	0 - 1	13	4
Mentha arvensis (wild mint)	10	0 - 40	63	25
Mertensia paniculata (tall lungwort)	1	0 - 1	13	4
Mimulus guttatus (yellow monkeyflower)	20	0 - 20	13	16
Monarda fistulosa (wild bergamot)	3	0 - 3	13	6
Parnassia palustris (northern grass-of-parnassus)	1	0 - 1	13	4
Petasites sagittatus (arrow-leaved coltsfoot)	10	0 - 20	38	19
Polygonum coccineum (water smartweed)	3	0 - 3	13	6
Potentilla anserina (silverweed)	1	0 - 1	13	4
Potentilla norvegica (rough cinquefoil)	1	0 - 1	13	4
Pyrola asarifolia (common pink wintergreen)	1	0 - 1	13	4
Ranunculus acris (tall buttercup)	10	0 - 10	13	11
Rumex occidentalis (western dock)	1	0 - 1	13	4
Rumex spp. (dock; sorrel)	1	0 - 1	13	4
Senecio pauperculus (balsam groundsel)	1	0 - 1	13	4

Table 26. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 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]
Senecio triangularis (brook ragwort)	3	0 - 3	13	6
Smilacina stellata (star-flowered Solomon's-seal)	1	0 - 1	25	5
Solidago canadensis (Canada goldenrod)	22	0 - 40	25	23
Solidago missouriensis (low goldenrod)	1	0 - 1	13	4
Stachys palustris (marsh hedge-nettle)	1	0 - 1	13	4
Stellaria calycantha (northern stitchwort)	1	0 - 1	13	4
Taraxacum officinale (common dandelion)	4	0 - 10	38	12
Thalictrum venulosum (veiny meadow rue)	1	0 - 1	25	5
Trifolium repens (white clover)	10	0 - 10	13	11
Urtica dioica (common nettle)	1	0 - 1	13	4
Vicia americana (wild vetch)	2	0 - 3	50	10
Viola spp. (violet)	3	0 - 3	13	6
Viola palustris (marsh violet)	1	0 - 1	13	4
Viola renifolia (kidney-leaved violet)	20	0 - 20	13	16
Ferns and Allies				
Equisetum arvense (common horsetail)	21	0 - 80	63	36
Equisetum fluviatile (swamp horsetail)	1	0 - 1	13	4

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

Soils are commonly dark brown to black Chernozems, but can intergrade to soils of the Organic order under conditions favorable for organic matter accumulation. Soil texture varies little from clay loam to sandy loam. Water tables are usually within 1 m (39 in) of the soil surface throughout summer. Redoximorphic features (mottles or gleyed soil) are also common within 1 m (39 in) of the soil surface. Estimated available water ranges from low to high.

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. Drier sites may support such types as the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type, the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) community type, the *Bromus inermis* (smooth brome) community type, or upland species.

MANAGEMENT INFORMATION

Livestock

Stands of the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type are often populated by widely spaced shrubs, allowing for easy livestock access. Forage production is moderate to high, and as a result, heavy use by livestock is common. The moist, fine textured soils are extremely susceptible to trampling damage, becoming compacted and hummocked with prolonged presence of livestock. In some stands, the

willows may have a reduced vigor, indicated by highlining, clubbing, or decadent clumps. With continued overuse, willows can show a sharp decline in vigor and may be eventually eliminated from the site.

Frisina (1991) states that for a grazing program to be successful, it must meet the basic biological requirements of the plants present. These are photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed. It is during the long growing season rest periods that these essential biological processes of food production and storage, reproduction, and seedling establishment occur. In some instances, additional periods of rest may be required to improve or maintain a plant community.

Wildlife

Where the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type occurs on winter game ranges, browsing of *Salix bebbiana* by wild ungulates is often high enough to reduce plant vigor and regeneration. Gaffney (1941) reported that *Salix bebbiana* is a highly valuable browse for elk, with heavy utilization common. Continued use may lead to conversion to an herbaceous community such as the *Poa palustris* (fowl bluegrass) and *Poa pratensis* (Kentucky bluegrass) community types. Moose and beaver also heavily utilize most species of willow.

Fisheries

The importance of 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.

Fire

Salix bebbiana (beaked willow) sprouts rapidly 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 available mineral soil seedbeds become occupied by faster growing herbaceous species and mosses. Prescribed burning is a common wildlife management tool used to rejuvenate decadent *Salix bebbiana* (beaked willow) communities (USDA IFSL 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.

Salix bebbiana is valuable for revegetating streambanks. Cuttings are best taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and more than 1 cm (0.5 in) 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.

OTHER STUDIES

The *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type has not been described by others. A similar *Salix bebbiana/* mesic graminoid (beaked willow/mesic graminoid) community type was identified by Padgett and others (1989) in Utah, with undergrowth dominated by *Poa pratensis* (Kentucky bluegrass) and other mesic grasses. Chadde and others (1988) defined a *Salix bebbiana/Agrostis stolonifera* (beaked willow/redtop) community type for northern Yellowstone National Park. A *Salix bebbiana* 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 = 25

Number of Stands Sampled in Alberta = 9

LOCATION AND ASSOCIATED LANDFORMS

The *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type is a major type in the Lower Foothills Subregion, and a minor to incidental type throughout the remaining portions of the study area. In the southeastern, Dry Mixedgrass Subregion, this type yields to the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type on lotic (stream floodplain) systems. To the northeast, in the Parkland Natural Region, this type yields to the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type around depressional wetlands.

VEGETATION

The *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type is a climax community dominated by *Salix bebbiana* in the tallest layer and *Cornus stolonifera* (red-osier dogwood) in a moist, tall shrub understory (Table 27).

Table 27. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 10 late seral to climax stands of the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Acer negundo (Manitoba maple)	1	0-1	10	3
Betula papyrifera (white birch)	10	0-10	10	10
Populus tremuloides (aspen)	1	0-3	30	5

Table 27. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 10 late seral to climax stands of the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Shrubs				
Amelanchier alnifolia (saskatoon)	5	0-10	30	12
Cornus stolonifera (red-osier dogwood)	33	10-70	100	57
Elaeagnus commutata (silverberry)	2	0-3	20	6
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	10	3
Prunus virginiana (choke cherry)	3	0-3	20	8
Ribes americanum (wild black currant)	2	0-3	20	6
Ribes hudsonianum (northern black currant)	3	0-3	10	5
Ribes lacustre (bristly black currant)	3	0-3	10	5
Ribes oxyacanthoides (northern gooseberry)	4	0-10	30	11
Ribes spp. (currant)	1	0-1	10	3
Ribes viscosissimum (sticky currant)	1	0-1	10	3
Rosa spp. (rose)	8	0-20	70	24
Rubus idaeus (wild red raspberry)	2	0-3	20	6
Rubus pubescens (dewberry)	3	0-3	10	5
Salix bebbiana (beaked willow)	61	30-90	100	78
Salix exigua (sandbar willow)	3	0-3	10	5
Salix petiolaris (basket willow)	10	0-10	10	10
Salix pseudomonticola (false mountain willow)	30	0-30	10	17
Shepherdia canadensis (Canada buffaloberry)	1	0-1	10	3
Symphoricarpos spp. (buckbrush)	5	0-10	20	10
Symphoricarpos occidentalis (buckbrush)	7	0-20	50	19
Graminoids				
Agropyron repens (quack grass)	3	0-3	10	5
Agrostis stolonifera (redtop)	8	0-20	40	18
Beckmannia syzigachne (slough grass)	3	0-3	10	5
Bromus inermis (smooth brome)	6	0-10	50	17
Calamagrostis canadensis (bluejoint)	12	0-20	20	15
Carex atherodes (awned sedge)	25	0-30	20	22
Carex bebbii (Bebb's sedge)	10	0-10	10	10
Carex lanuginosa (woolly sedge)	1	0-1	10	3
Carex microglochin (short-awned sedge)	1	0-1	10	3
Carex petasata (pasture sedge)	3	0-3	10	5
Carex praegracilis (graceful sedge)	3	0-3	10	5
Carex praticola (meadow sedge)	3	0-3	10	5
Carex utriculata (beaked sedge)	3	0-3	10	5
Carex sartwellii (Sartwell's sedge)	3	0-3	10	5
Carex sprengelii (Sprengel's sedge)	1	0-1	10	3

Table 27. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 10 late seral to climax stands of the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Elymus glaucus (smooth wild rye)	1	0-1	10	3
Glyceria grandis (common tall manna grass)	20	0-20	10	14
Glyceria striata (fowl manna grass)	10	0-10	10	10
Phalaris arundinacea (reed canary grass)	23	0-30	30	26
Phleum pratense (timothy)	5	0-10	30	12
Poa palustris (fowl bluegrass)	4	0-10	30	11
Poa pratensis (Kentucky bluegrass)	5	0-10	60	17
Forbs				
Achillea millefolium (common yarrow)	1	0-1	20	4
Achillea sibirica (many-flowered yarrow)	1	0-1	10	3
Actaea rubra (red and white baneberry)	1	0-1	20	4
Agastache spp. (giant-hyssop)	3	0-3	10	5
Anemone canadensis (Canada anemone)	3	0-3	10	5
Anemone cylindrica (long-fruited anemone)	3	0-3	10	5
Artemisia absinthium (absinthe wormwood)	3	0-3	10	5
Aster ascendens (western aster)	1	0-1	10	3
Aster ciliolatus (Lindley's aster)	10	0-10	10	10
Aster conspicuus (showy aster)	3	0-3	10	5
Aster eatonii (Eaton's aster)	3	0-3	10	5
Aster ericoides (tufted white prairie aster)	3	0-3	10	5
Aster laevis (smooth aster)	2	0-3	20	6
Aster subspicatus (leafy-bracted aster)	1	0-1	10	3
Castilleja spp. (paintbrush)	1	0-1	10	3
Cicuta maculata (water-hemlock)	7	0-10	20	12
Cirsium arvense (Canada thistle)	1	0-3	30	5
Cirsium spp. (thistle)	1	0-1	10	3
Epilobium angustifolium (common fireweed)	7	0-10	30	14
Epilobium ciliatum (northern willowherb)	1	0-1	10	3
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	10	3
Unknown Forb	1	0-3	30	5
Fragaria virginiana (wild strawberry)	1	0-3	50	7
Galium boreale (northern bedstraw)	2	0-3	40	9
Galium triflorum (sweet-scented bedstraw)	1	0-1	20	4
Geranium richardsonii (wild white geranium)	2	0-3	40	9
Geranium viscosissimum (sticky purple geranium)	1	0-1	10	3
Geum macrophyllum (large-leaved yellow avens)	2	0-3	30	8
Heracleum lanatum (cow parsnip)	1	0-1	10	3
Lactuca pulchella (common blue lettuce)	1	0-1	10	3

Table 27. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 10 late seral to climax stands of the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type

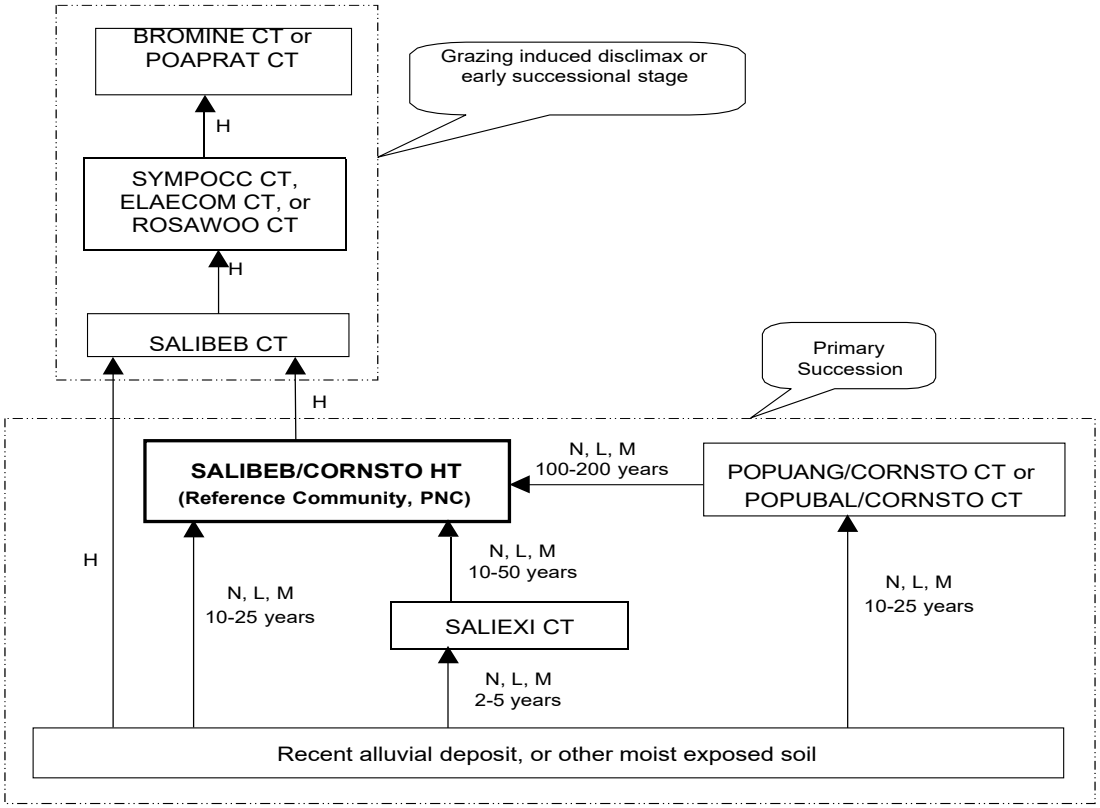
Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Lathyrus ochroleucus (cream-colored vetchling)	1	0-1	20	4
Lysimachia ciliata (fringed loosestrife)	1	0-1	10	3
Mentha arvensis (wild mint)	5	0-10	30	12
Mertensia paniculata (tall lungwort)	1	0-1	10	3
Moehringia lateriflora (blunt-leaved sandwort)	1	0-1	10	3
Osmorhiza depauperata (spreading sweet cicely)	3	0-3	10	5
Osmorhiza spp. (sweet cicely)	1	0-1	10	3
Polygonum coccineum (water smartweed)	1	0-1	10	3
Potentilla gracilis (graceful cinquefoil)	1	0-1	10	3
Pyrola asarifolia (common pink wintergreen)	3	0-3	10	5
Ranunculus macounii (Macoun's buttercup)	1	0-1	10	3
Rorippa palustris (marsh yellow cress)	1	0-1	10	3
Rumex crispus (curled dock)	1	0-1	10	3
Sanicula marilandica (snakeroot)	1	0-1	10	3
Scutellaria galericulata (marsh skullcap)	1	0-1	10	3
Smilacina stellata (star-flowered Solomon's-seal)	3	0-10	70	14
Solidago canadensis (Canada goldenrod)	5	0-10	30	12
Solidago graminifolia (flat-topped goldenrod)	1	0-1	10	3
Solidago missouriensis (low goldenrod)	30	0-40	20	24
Sonchus arvensis (perennial sow-thistle)	3	0-3	10	5
Stachys palustris (marsh hedge-nettle)	7	0-10	30	14
Stellaria longipes (long-stalked chickweed)	1	0-1	10	3
Taraxacum officinale (common dandelion)	1	0-3	50	7
Thalictrum dasycarpum (tall meadow rue)	1	0-1	10	3
Thalictrum occidentale (western meadow rue)	10	0-10	10	10
Thalictrum venulosum (veiny meadow rue)	8	0-10	30	15
Trifolium spp. (clover)	3	0-3	10	5
Trifolium repens (white clover)	1	0-1	10	3
Urtica dioica (common nettle)	2	0-3	40	9
Vicia americana (wild vetch)	1	0-3	60	8
Viola spp. (violet)	1	0-1	10	3
Viola canadensis (western Canada violet)	8	0-20	30	15
Ferns and Allies				
Equisetum arvense (common horsetail)	7	0-20	60	20

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

With prolonged moderate to heavy grazing pressure, the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type will lose its tall/moist shrub understory to a more diverse set of shorter/drier shrub species and disturbance-increaser herbaceous species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (timothy), and *Cirsium arvense* (Canada thistle) (Table 28). This disturbance has the effect of drying out the site and results in the grazing disclimax *Salix bebbiana* (beaked willow) community type. Figure 12 is a generalized schematic of the successional pathway followed on sites of this type.

Figure 12. SALIBEB/CORNSTO HT



Successional Pathway Diagram of SALIBEB Sites in the Southern Alberta Grasslands
Reference Community = SALIBEB/CORNSTO HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
POPUBAL/CORNSTO CT	*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) Community Type
POPUANGCORNSTO CT	*Populus angustifolia/Cornus stolonifera* (narrow-leaved cottonwood/red-osier dogwood) Community Type
SALIBEB/CORNSTO HT	*Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) Habitat Type
SALIBEB CT	*Salix bebbiana*(beaked willow) Community Type
SALIEXI CT	*Salix exigua* (sandbar willow) Community Type
SYMPOCC CT	*Symphorocarpos occidentalis* (buckbrush) Community Type
ELAECOM CT	*Elaegnus commutata* (silverberry) Community Type
ROSAWOO CT	*Rosa woodsii* (common wild rose) Community Type
BROMINE CT	*Bromus inermis* (smooth brome) Community Type
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site.It is based on the assumption that the hydrologic potential does not change. Such hydrologic change could be a fluvial buildup of the floodplain, resulting in a terrace site too dry to support riparian species, or it could be removal of the overstory canopy by grazing or for agriculture.The time span is estimated for the stand to become dominated under undisturbed conditions by at least 50 percent cover of climax (or overstory indicator) species.

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

Table 28. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 15 early seral or disturbed stands of the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Populus balsamifera (balsam poplar)	1	0 - 1	7	3
Populus tremuloides (aspen)	1	0 - 1	7	3
Shrubs				
Amelanchier alnifolia (saskatoon)	3	0 - 3	7	5
Betula occidentalis (water birch)	1	0 - 1	13	4
Cornus stolonifera (red-osier dogwood)	21	3 - 40	100	46
Elaeagnus commutata (silverberry)	2	0 - 3	13	5
Juniperus horizontalis (creeping juniper)	60	0 - 60	7	20
Potentilla fruticosa (shrubby cinquefoil)	2	0 - 3	13	5
Prunus virginiana (choke cherry)	2	0 - 3	13	5
Rhus radicans (poison ivy)	3	0 - 3	7	5
Ribes americanum (wild black currant)	3	0 - 3	13	6
Ribes oxyacanthoides (northern gooseberry)	2	0 - 3	27	7
Ribes spp. (currant)	1	0 - 1	7	3
Rosa woodsii (common wild rose)	3	0 - 3	13	6
Rosa spp. (rose)	7	0 - 20	67	22
Rubus idaeus (wild red raspberry)	5	0 - 10	27	12
Rubus pubescens (dewberry)	1	0 - 1	7	3
Salix bebbiana (beaked willow)	60	10 - 90	100	77
Salix candida (hoary willow)	1	0 - 1	7	3
Salix exigua (sandbar willow)	7	0 - 10	13	10
Salix lutea (yellow willow)	20	0 - 20	7	12
Salix petiolaris (basket willow)	11	0 - 20	27	17
Salix planifolia (flat-leaved willow)	45	0 - 50	13	24

Table 28. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 15 early seral or disturbed stands of the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shepherdia canadensis (Canada buffaloberry)	1	0 - 1	7	3
Spiraea alba (narrow-leaved meadowsweet)	1	0 - 1	7	3
Symphoricarpos albus (snowberry)	3	0 - 3	7	5
Symphoricarpos occidentalis (buckbrush)	11	0 - 30	60	26
Graminoids				
Agropyron smithii (western wheat grass)	5	0 - 10	13	8
Agrostis stolonifera (redtop)	14	0 - 20	20	17
Agropyron trachycaulum (slender wheat grass)	5	0 - 10	13	8
Beckmannia syzigachne (slough grass)	10	0 - 20	20	14
Bromus inermis (smooth brome)	27	0 - 90	60	40
Calamagrostis canadensis (bluejoint)	16	0 - 20	27	21
Carex aquatilis (water sedge)	3	0 - 3	7	5
Carex atherodes (awned sedge)	5	0 - 10	27	12
Carex praegracilis (graceful sedge)	3	0 - 3	7	5
Carex utriculata (beaked sedge)	3	0 - 3	7	5
Deschampsia cespitosa (tufted hair grass)	1	0 - 1	7	3
Eleocharis acicularis (needle spike-rush)	1	0 - 1	7	3
Festuca saximontana (Rocky Mountain fescue)	1	0 - 1	7	3
Glyceria borealis (northern manna grass)	20	0 - 20	7	12
Glyceria spp. (manna grass)	20	0 - 20	7	12
Glyceria striata (fowl manna grass)	35	0 - 60	13	21
Unknown Grass	1	0 - 1	7	3
Juncus balticus (wire rush)	3	0 - 3	7	5
Juncus torreyi (Torrey's rush)	10	0 - 10	7	8
Muhlenbergia filiformis (slender muhly)	3	0 - 3	7	5
Phalaris arundinacea (reed canary grass)	4	0 - 10	20	9
Phleum pratense (timothy)	5	0 - 10	33	13
Poa palustris (fowl bluegrass)	2	0 - 3	20	6
Poa pratensis (Kentucky bluegrass)	14	0 - 30	53	27
Forbs				
Achillea millefolium (common yarrow)	3	0 - 3	7	5
Achillea sibirica (many-flowered yarrow)	1	0 - 1	7	3
Actaea rubra (red and white baneberry)	1	0 - 1	7	3
Agastache spp. (giant-hyssop)	1	0 - 1	7	3
Anaphalis margaritacea (pearly everlasting)	3	0 - 3	7	5
Anemone cylindrica (long-fruited anemone)	10	0 - 10	7	8
Artemisia campestris (plains wormwood)	1	0 - 1	7	3
Aster ascendens (western aster)	3	0 - 3	7	5

Table 28. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 15 early seral or disturbed stands of the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Aster borealis (marsh aster)	3	0 - 3	7	5
Aster eatonii (Eaton's aster)	3	0 - 3	7	5
Aster ericoides (tufted white prairie aster)	7	0 - 10	13	10
Aster hesperius (western willow aster)	1	0 - 1	13	4
Aster spp. (aster)	1	0 - 1	7	3
Castilleja spp. (paintbrush)	1	0 - 1	7	3
Castilleja miniata (common red paintbrush)	1	0 - 1	7	3
Chrysanthemum leucanthemum (ox-eye daisy)	1	0 - 1	7	3
Cicuta maculata (water-hemlock)	7	0 - 10	20	12
Cirsium arvense (Canada thistle)	3	0 - 10	33	10
Cynoglossum officinale (hound's-tongue)	3	0 - 3	7	5
Epilobium angustifolium (common fireweed)	2	0 - 3	20	6
Epilobium ciliatum (northern willowherb)	10	0 - 10	7	8
Erigeron philadelphicus (Philadelphia fleabane)	1	0 - 1	7	3
Unknown Forb	7	0 - 10	13	10
Fragaria virginiana (wild strawberry)	2	0 - 3	33	8
Galium boreale (northern bedstraw)	2	0 - 3	13	5
Galium triflorum (sweet-scented bedstraw)	4	0 - 10	27	10
Geranium spp. (geranium)	2	0 - 3	13	5
Geranium richardsonii (wild white geranium)	1	0 - 3	20	4
Geum aleppicum (yellow avens)	1	0 - 1	13	4
Geum macrophyllum (large-leaved yellow avens)	1	0 - 1	7	3
Glycyrrhiza lepidota (wild licorice)	3	0 - 3	13	6
Hedysarum alpinum (alpine hedysarum)	3	0 - 3	7	5
Heracleum lanatum (cow parsnip)	1	0 - 1	7	3
Hieracium umbellatum (narrow-leaved hawkweed)	1	0 - 1	7	3
Iris missouriensis (western blue flag)	3	0 - 3	7	5
Lactuca serriola (prickly lettuce)	1	0 - 1	7	3
Lathyrus ochroleucus (cream-colored vetchling)	1	0 - 3	27	5
Lysimachia ciliata (fringed loosestrife)	3	0 - 3	7	5
Mentha arvensis (wild mint)	1	0 - 3	27	5
Osmorhiza depauperata (spreading sweet cicely)	1	0 - 1	7	3
Plantago major (common plantain)	1	0 - 1	7	3
Polygonum coccineum (water smartweed)	2	0 - 3	13	5
Potentilla gracilis (graceful cinquefoil)	1	0 - 1	20	4
Potentilla spp. (cinquefoil)	3	0 - 3	7	5
Pyrola asarifolia (common pink wintergreen)	4	0 - 10	20	9
Ranunculus acris (tall buttercup)	1	0 - 1	7	3

Table 28. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 15 early seral or disturbed stands of the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Ranunculus gmelinii (yellow water crowfoot)	5	0 - 10	13	8
Rorippa palustris (marsh yellow cress)	3	0 - 3	7	5
Senecio pauperculus (balsam groundsel)	1	0 - 1	13	4
Sium suave (water parsnip)	1	0 - 1	7	3
Smilacina stellata (star-flowered Solomon's-seal)	3	0 - 10	47	12
Solidago canadensis (Canada goldenrod)	5	0 - 10	47	15
Solidago graminifolia (flat-topped goldenrod)	1	0 - 1	7	3
Sonchus arvensis (perennial sow-thistle)	13	0 - 20	33	21
Sonchus spp. (sow-thistle)	10	0 - 10	7	8
Stachys palustris (marsh hedge-nettle)	1	0 - 1	13	4
Stellaria longifolia (long-leaved chickweed)	1	0 - 1	7	3
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0 - 1	13	4
Taraxacum officinale (common dandelion)	3	0 - 10	40	11
Thalictrum spp. (meadow rue)	3	0 - 3	7	5
Thalictrum occidentale (western meadow rue)	1	0 - 1	7	3
Thalictrum venulosum (veiny meadow rue)	4	0 - 10	20	9
Trifolium repens (white clover)	3	0 - 3	7	5
Urtica dioica (common nettle)	4	0 - 10	27	10
Vicia americana (wild vetch)	2	0 - 3	20	6
Viola canadensis (western Canada violet)	2	0 - 3	13	5
Ferns and Allies				
Equisetum arvense (common horsetail)	8	0 - 20	27	15

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

Soils are commonly dark brown to black Chernozems, but can intergrade to soils of the Organic order under conditions favorable for organic matter accumulation. Soil texture varies little from clay loam to sandy loam. Water tables are usually within 1 m (39 in) of the soil surface throughout summer. Redoximorphic features (mottles or gleyed soil) are also common within 1 m (39 in) of the soil surface. Estimated available water ranges from low to high.

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 the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) community type or upland species.

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 various species associated with this type is often high, and cattle use may be heavy 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 also browse the young willow shoots and, 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. Its abundance, and growth form is a direct indication of past and current use levels. Overuse by livestock will reduce vigor of the willows, as indicated by highlined or clubbed growth forms and dead clumps. With continued overuse, willows will show a sharp decline in vigor and may be eventually eliminated from the site.

Frisina (1991) states that for a grazing program to be successful, it must meet the basic biological requirements of the plants present. These are photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed. It is during the long growing season rest periods that these essential biological processes of food production and storage, reproduction, and seedling establishment occur. In some instances, additional periods of rest may be required to improve or maintain a plant community.

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 vigor and regeneration. Gaffney (1941) reported that *Salix bebbiana* is a highly valuable browse for elk, with heavy utilization common. Continued use may lead to conversion to an herbaceous understory such as the *Poa palustris* (fowl bluegrass), *Poa pratensis* (Kentucky bluegrass), or *Bromus inermis* (smooth brome). Moose and beaver also heavily utilize *Salix bebbiana* (beaked willow).

Fisheries

The importance of 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.

Fire

Salix bebbiana (beaked willow) sprouts rapidly 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 available mineral soil seedbeds become occupied by faster growing herbaceous species and mosses. Prescribed burning is a common wildlife management tool used to rejuvenate decadent *Salix bebbiana* (beaked willow) communities (USDA IFSL 1995).

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 susceptible to trampling damage, especially when soils are fine textured or wet. Deferring grazing until sites are drier can reduce trampling and compaction problems (Marlow 1984).

Salix bebbiana is valuable for revegetating streambanks. Cuttings are best taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and more than 1 cm (0.5 in) 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.

OTHER STUDIES

The *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type has not been described by others. A *Salix bebbiana* community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan with *Cornus stolonifera* (red-osier dogwood) as a significant constituent.

Salix bebbiana Community Type
(Beaked Willow Community Type)

SALIBEB
Number of Stands Sampled = 22
Number of Stands Sampled in Alberta = 16

LOCATION AND ASSOCIATED LANDFORMS

The *Salix bebbiana* (beaked willow) community type is a major type in the Lower Foothills Subregion and a minor to incidental type in all other parts of the study area, except the Dry Mixedgrass Subregion. It occupies alluvial terraces and moist to wet areas near springs, seeps, and subirrigated meadows that have undergone long terms of heavy livestock usage.

VEGETATION

The *Salix bebbiana* (beaked willow) community type represents a browsing/grazing disclimax 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* dominates this community type over a diverse group of disturbance-related herbaceous species, including many exotics (Table 29).

Table 29. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent or more of the 27 sampled stands of the grazing disclimax *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)	3	0 - 3	7	5
Picea spp. (spruce)	1	0 - 1	4	2
Picea glauca (white spruce)	1	0 - 1	15	4
Populus balsamifera (balsam poplar)	3	0 - 10	15	7
Populus tremuloides (aspen)	1	0 - 1	4	2
Shrubs				
Amelanchier alnifolia (saskatoon)	2	0 - 3	19	6
Betula occidentalis (water birch)	3	0 - 3	4	3
Cornus stolonifera (red-osier dogwood)	1	0 - 1	22	5
Corylus cornuta (beaked hazelnut)	3	0 - 3	4	3
Elaeagnus commutata (silverberry)	3	0 - 3	4	3
Linnaea borealis (twinflower)	3	0 - 3	4	3
Lonicera involucrata (bracted honeysuckle)	2	0 - 3	19	6
Lonicera utahensis (red twinberry)	1	0 - 1	4	2
Potentilla fruticosa (shrubby cinquefoil)	1	0 - 3	22	5
Ribes americanum (wild black currant)	1	0 - 1	7	3
Ribes lacustre (bristly black currant)	3	0 - 3	4	3
Ribes oxyacanthoides (northern gooseberry)	6	0 - 20	41	16
Ribes spp. (currant)	3	0 - 3	7	5
Ribes triste (wild red currant)	1	0 - 1	4	2
Rosa woodsii (common wild rose)	2	0 - 3	7	4
Rosa spp. (rose)	3	0 - 10	56	13
Rubus idaeus (wild red raspberry)	7	0 - 40	26	13
Rubus parviflorus (thimbleberry)	1	0 - 1	4	2
Rubus pubescens (dewberry)	1	0 - 3	11	3
Salix bebbiana (beaked willow)	56	20 - 98	100	75
Salix discolor (pussy willow)	10	0 - 10	4	6
Salix drummondiana (Drummond's willow)	3	0 - 3	4	3
Salix lutea (yellow willow)	8	0 - 20	11	9
Salix maccalliana (velvet-fruited willow)	3	0 - 3	4	3
Salix myrtillifolia (myrtle-leaved willow)	9	0 - 20	22	14
Salix petiolaris (basket willow)	8	0 - 20	15	11
Salix planifolia (flat-leaved willow)	9	0 - 20	26	15
Salix pseudomonticola (false mountain willow)	7	0 - 20	30	14
Salix scouleriana (Scouler's willow)	10	0 - 10	4	6
Shepherdia canadensis (Canada buffaloberry)	10	0 - 10	4	6

Table 29. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent or more of the 27 sampled stands of the grazing disclimax *Salix bebbiana* (beaked willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Symphoricarpos albus (snowberry)	5	0 - 10	7	6
Symphoricarpos spp. (buckbrush)	1	0 - 1	4	2
Symphoricarpos occidentalis (buckbrush)	17	0 - 50	19	18
Graminoids				
Agrostis exarata (spike redtop)	3	0 - 3	4	3
Agropyron repens (quack grass)	1	0 - 3	15	4
Agrostis scabra (rough hair grass)	1	0 - 1	4	2
Agropyron smithii (western wheat grass)	10	0 - 10	4	6
Agrostis spp. (Agrostis)	1	0 - 1	7	3
Agrostis stolonifera (redtop)	5	0 - 10	11	7
Agropyron trachycaulum (slender wheat grass)	1	0 - 3	22	5
Alopecurus aequalis (short-awned foxtail)	3	0 - 3	4	3
Alopecurus occidentalis (alpine foxtail)	3	0 - 3	11	6
Bromus ciliatus (fringed brome)	3	0 - 10	37	11
Bromus inermis (smooth brome)	24	0 - 80	22	23
Calamagrostis canadensis (bluejoint)	9	0 - 40	44	20
Calamagrostis stricta (narrow reed grass)	2	0 - 3	11	5
Carex aquatilis (water sedge)	3	0 - 3	4	3
Carex atherodes (awned sedge)	2	0 - 3	7	4
Carex curta (short sedge)	1	0 - 1	4	2
Carex lanuginosa (woolly sedge)	1	0 - 3	11	3
Carex microglochin (short-awned sedge)	2	0 - 3	11	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	3
Carex scopulorum (Holm’s Rocky Mountain sedge)	20	0 - 20	4	9
Carex sprengelii (Sprengel's sedge)	1	0 - 1	4	2
Deschampsia cespitosa (tufted hair grass)	2	0 - 3	11	5
Elymus glaucus (smooth wild rye)	5	0 - 10	7	6
Elymus virginicus (Virginia wild rye)	1	0 - 1	4	2
Festuca pratensis (meadow fescue)	3	0 - 3	4	3
Festuca subulata (fescue)	1	0 - 1	4	2
Glyceria striata (fowl manna grass)	11	0 - 40	19	14
Hordeum jubatum (foxtail barley)	1	0 - 1	4	2
Juncus balticus (wire rush)	26	0 - 80	22	24
Oryzopsis asperifolia (white-grained mountain rice grass)	1	0 - 1	4	2
Phleum pratense (timothy)	12	0 - 50	59	27
Poa palustris (fowl bluegrass)	9	0 - 50	37	18

Table 29. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent or more of the 27 sampled stands of the grazing disclimax *Salix bebbiana* (beaked willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Poa pratensis (Kentucky bluegrass)	12	0 - 30	63	27
Schizachne purpurascens (purple oat grass)	3	0 - 3	4	3
Forbs				
Achillea millefolium (common yarrow)	1	0 - 3	48	7
Actaea rubra (red and white baneberry)	1	0 - 3	19	4
Allium schoenoprasum (wild chives)	1	0 - 1	7	3
Anemone cylindrica (long-fruited anemone)	1	0 - 1	4	2
Angelica arguta (white angelica)	1	0 - 1	11	3
Aralia nudicaulis (wild sarsaparilla)	7	0 - 10	7	7
Arctium spp. (burdock)	3	0 - 3	4	3
Artemisia ludoviciana (prairie sagewort)	1	0 - 1	4	2
Aster ascendens (western aster)	2	0 - 3	7	4
Aster borealis (marsh aster)	1	0 - 3	15	4
Aster ciliolatus (Lindley's aster)	2	0 - 3	15	5
Aster conspicuus (showy aster)	2	0 - 3	11	5
Aster eatonii (Eaton's aster)	10	0 - 10	4	6
Aster ericoides (tufted white prairie aster)	1	0 - 3	11	3
Aster hesperius (western willow aster)	1	0 - 1	7	3
Aster laevis (smooth aster)	3	0 - 10	30	9
Aster modestus (large northern aster)	2	0 - 3	15	5
Aster subspicatus (leafy-bracted aster)	3	0 - 3	7	5
Campanula rotundifolia (harebell)	1	0 - 1	4	2
Castilleja spp. (paintbrush)	2	0 - 3	7	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 maculata (water-hemlock)	1	0 - 1	4	2
Circaea alpina (small enchanter's nightshade)	40	0 - 40	4	13
Cirsium arvense (Canada thistle)	2	0 - 10	48	10
Cirsium scariosum (thistle)	1	0 - 1	4	2
Convolvulus arvensis (field bindweed)	1	0 - 1	4	2
Delphinium glaucum (tall larkspur)	1	0 - 3	19	4
Disporum trachycarpum (fairybells)	1	0 - 1	4	2
Epilobium angustifolium (common fireweed)	1	0 - 3	30	5
Epilobium ciliatum (northern willowherb)	1	0 - 3	15	4
Erigeron philadelphicus (Philadelphia fleabane)	1	0 - 1	4	2
Erysimum cheiranthoides (wormseed mustard)	1	0 - 1	4	2

Table 29. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent or more of the 27 sampled stands of the grazing disclimax *Salix bebbiana* (beaked willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Unknown Forb	1	0 - 1	4	2
Fragaria virginiana (wild strawberry)	1	0 - 3	52	7
Galeopsis tetrahit (hemp-nettle)	1	0 - 1	4	2
Galium boreale (northern bedstraw)	1	0 - 3	37	6
Galium trifidum (small bedstraw)	20	0 - 20	4	9
Galium triflorum (sweet-scented bedstraw)	2	0 - 3	22	7
Geranium spp. (geranium)	2	0 - 3	7	4
Geranium richardsonii (wild white geranium)	4	0 - 10	37	12
Geum aleppicum (yellow avens)	2	0 - 3	11	5
Geum macrophyllum (large-leaved yellow avens)	3	0 - 10	44	11
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	7	3
Hackelia floribunda (large-flowered stickseed)	1	0 - 1	4	2
Halenia deflexa (spurred gentian)	1	0 - 1	4	2
Helianthus nuttallii (common tall sunflower)	1	0 - 1	4	2
Heracleum lanatum (cow parsnip)	7	0 - 20	37	16
Lappula spp. (bluebur)	1	0 - 1	4	2
Lathyrus ochroleucus (cream-colored vetchling)	1	0 - 3	19	4
Lysimachia ciliata (fringed loosestrife)	1	0 - 1	4	2
Medicago lupulina (black medick)	1	0 - 1	4	2
Mentha arvensis (wild mint)	3	0 - 10	22	8
Mertensia paniculata (tall lungwort)	5	0 - 10	11	7
Mitella nuda (bishop's-cap)	1	0 - 1	7	3
Osmorhiza chilensis (blunt-fruited sweet cicely)	1	0 - 1	4	2
Osmorhiza depauperata (spreading sweet cicely)	1	0 - 1	4	2
Osmorhiza occidentalis (western sweet cicely)	1	0 - 1	4	2
Pedicularis bracteosa (western lousewort)	3	0 - 3	4	3
Perideridia gairdneri (squawroot)	1	0 - 1	7	3
Petasites palmatus (palmate-leaved coltsfoot)	2	0 - 3	7	4
Petasites sagittatus (arrow-leaved coltsfoot)	5	0 - 10	7	6
Plantago major (common plantain)	1	0 - 1	15	4
Polygonum lapathifolium (pale persicaria)	1	0 - 1	4	2
Potentilla anserina (silverweed)	1	0 - 1	4	2
Potentilla gracilis (graceful cinquefoil)	1	0 - 3	15	4
Potentilla norvegica (rough cinquefoil)	3	0 - 3	4	3
Pyrola asarifolia (common pink wintergreen)	1	0 - 1	4	2
Ranunculus acris (tall buttercup)	20	0 - 20	4	9

Table 29. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent or more of the 27 sampled stands of the grazing disclimax *Salix bebbiana* (beaked willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Ranunculus sceleratus (celery-leaved buttercup)	3	0 - 3	4	3
Rumex occidentalis (western dock)	1	0 - 1	4	2
Sanicula marilandica (snakeroot)	1	0 - 1	7	3
Scutellaria galericulata (marsh skullcap)	1	0 - 1	4	2
Senecio eremophilus (cut-leaved ragwort)	1	0 - 1	4	2
Senecio foetidus (marsh butterweed)	3	0 - 3	4	3
Senecio pauperculus (balsam groundsel)	1	0 - 3	22	5
Senecio pauciflorus (few-flowered ragwort)	3	0 - 3	4	3
Senecio triangularis (brook ragwort)	1	0 - 1	4	2
Sisymbrium loeselii (tall hedge mustard)	1	0 - 1	4	2
Sium suave (water parsnip)	3	0 - 3	4	3
Smilacina racemosa (false Solomon's-seal)	1	0 - 1	7	3
Smilacina stellata (star-flowered Solomon's-seal)	1	0 - 3	33	6
Solidago canadensis (Canada goldenrod)	4	0 - 20	26	10
Solidago gigantea (late goldenrod)	2	0 - 3	7	4
Solidago missouriensis (low goldenrod)	7	0 - 10	11	9
Sonchus arvensis (perennial sow-thistle)	25	0 - 50	7	13
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	37	9
Stellaria calycantha (northern stitchwort)	1	0 - 1	7	3
Stellaria longipes (long-stalked chickweed)	1	0 - 1	4	2
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0 - 3	11	3
Taraxacum officinale (common dandelion)	3	0 - 20	70	14
Thalictrum spp. (meadow rue)	1	0 - 1	4	2
Thalictrum occidentale (western meadow rue)	4	0 - 20	19	9
Thalictrum venulosum (veiny meadow rue)	2	0 - 3	22	7
Thlaspi arvense (stinkweed)	1	0 - 1	4	2
Trifolium repens (white clover)	12	0 - 50	22	16
Urtica dioica (common nettle)	2	0 - 10	33	8
Vicia americana (wild vetch)	1	0 - 3	63	8
Viola spp. (violet)	1	0 - 1	7	3
Viola canadensis (western Canada violet)	1	0 - 1	11	3
Viola palustris (marsh violet)	2	0 - 3	7	4
Zizia aptera (heart-leaved Alexanders)	1	0 - 1	4	2
Ferns and Allies				
Equisetum fluviatile (swamp horsetail)	1	0 - 1	4	2
Equisetum spp. (horsetail)	1	0 - 1	4	2

Table 29. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent or more of the 27 sampled stands of the grazing disclimax *Salix bebbiana* (beaked willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Equisetum arvense (common horsetail)	5	0 - 30	52	16

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

In most cases the *Salix bebbiana* (beaked willow) community type is a browsing/grazing disclimax of either the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type or the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type.

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

SOILS

Soils are commonly dark brown to black Chernozems, but can intergrade to soils of the Organic order under conditions favorable for organic matter accumulation. Soil texture varies little from clay loam to sandy loam. Water tables are usually within 1 m (39 in) of the soil surface throughout summer. Redoximorphic features (mottles or gleyed soil) are also common within 1 m (39 in) of the soil surface. Estimated available water ranges from low to high.

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. Drier sites may support such types as the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) community type or upland species.

MANAGEMENT INFORMATION

Livestock

Stands of the *Salix bebbiana* (beaked willow) community type are often populated by widely spaced shrubs, allowing for easy livestock access. Forage production is moderate to high, and as a result, heavy use by livestock is common. The moist, fine textured soils are extremely susceptible to trampling damage, becoming compacted and hummocked with prolonged presence of livestock. In some stands the willows may have a reduced vigor, indicated by highlining, clubbing, or decadent clumps. With continued overuse, willows can show a sharp decline in vigor and may be eventually eliminated from the site.

Frisina (1991) states that for a grazing program to be successful, it must meet the basic biological requirements of the plants present. These are photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed. It is during the long growing season rest periods that these essential biological processes of food production and storage, reproduction, and seedling establishment occur. In some instances, additional periods of rest may be required to improve or maintain a plant community.

Wildlife

Where this community type occurs on winter game ranges, browsing of *Salix bebbiana* (beaked willow) is often high enough to reduce both plant vigor and regeneration. Gaffney (1941) reported that *Salix bebbiana* (beaked willow) is a highly valuable browse for elk, with heavy utilization common. Continued use may lead to a conversion to herbaceous communities such as the *Poa palustris* (fowl bluegrass) and *Poa pratensis* (Kentucky bluegrass) community types. Moose and beaver heavily utilize most species of willow.

Fisheries

The importance of 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.

Fire

Salix bebbiana (beaked willow) sprouts rapidly 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 available mineral soil seedbeds become occupied by faster growing herbaceous species and mosses. Prescribed burning is a common wildlife management tool used to rejuvenate decadent *Salix bebbiana* (beaked willow) communities (USDA IFSL 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 fine textured or 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.

Salix bebbiana is valuable for revegetating streambanks. Cuttings are best taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and more than 1 cm (0.5 in) 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.

OTHER STUDIES

A *Salix bebbiana* (beaked willow) community type is described by Hansen and others (1995) for Montana. A similar *Salix bebbiana* (beaked willow) community type was identified by Padgett and others (1989) in Utah, with an undergrowth dominated by *Poa pratensis* (Kentucky

bluegrass) and other mesic grasses. Chadde and others (1988) defined a *Salix bebbiana/Agrostis stolonifera* (beaked willow/redtop) community type for northern Yellowstone National Park. A *Salix bebbiana* community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan.

Salix exigua Community Type
(Sandbar Willow Community Type)

SALIEXI

Number of Stands Sampled = 70

Number of Stands Sampled in Alberta = 13

LOCATION AND ASSOCIATED LANDFORMS

The *Salix exigua* (sandbar willow) community type is a minor to incidental, widespread type at low to mid elevations throughout most of Alberta. Typical sites of this type are moist alluvial deposits subject to frequent annual flooding, ditches, and lakeshores. As one approaches the Parkland Natural Region going north, *Salix exigua* gives way to *Salix petiolaris* (basket willow) as the dominant willow around depressional (lotic) wetlands.

VEGETATION

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), *Rosa* species (rose), and *Prunus virginiana* (choke cherry). *Salix lutea* (yellow willow) may be present, indicating a possible successional trend toward a communities dominated by that species. The herbaceous layer may include a wide variety of pioneering species (Table 30).

Table 30. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 18 stands of the *Salix exigua* (sandbar willow) community type that are relatively undisturbed by livestock or wildlife

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)	1	0-1	6	2
Populus deltoides (plains cottonwood)	1	0-1	11	3
Shrubs				
Cornus stolonifera (red-osier dogwood)	1	0-3	17	4
Rosa woodsii (common wild rose)	3	0-3	6	4
Rosa spp. (rose)	1	0-3	22	5
Salix amygdaloides (peach-leaved willow)	3	0-3	6	4
Salix exigua (sandbar willow)	86	40-98	100	93

Table 30. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 18 stands of the *Salix exigua* (sandbar willow) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	range	(Frequency)	Index [1]
Salix lutea (yellow willow)	2	0-3	11	5
Salix petiolaris (basket willow)	3	0-3	6	4
Symphoricarpos occidentalis (buckbrush)	1	0-1	11	3
Graminoids				
Agropyron smithii (western wheat grass)	2	0-3	22	7
Agrostis stolonifera (redtop)	21	0-80	22	21
Agropyron trachycaulum (slender wheat grass)	3	0-3	6	4
Bromus inermis (smooth brome)	5	0-10	17	9
Carex aquatilis (water sedge)	30	0-30	6	13
Carex lanuginosa (woolly sedge)	3	0-3	6	4
Carex utriculata (beaked sedge)	80	0-80	6	22
Echinochloa crusgalli (barnyard grass)	20	0-20	6	11
Elymus canadensis (Canada wild rye)	20	0-20	6	11
Elymus virginicus (Virginia wild rye)	12	0-20	11	11
Hordeum jubatum (foxtail barley)	2	0-3	11	5
Phalaris arundinacea (reed canary grass)	79	0-98	11	29
Poa palustris (fowl bluegrass)	20	0-20	11	15
Poa pratensis (Kentucky bluegrass)	2	0-3	11	5
Scirpus pungens (three-square rush)	1	0-1	6	2
Spartina gracilis (alkali cord grass)	80	0-80	6	22
Spartina pectinata (prairie cord grass)	40	0-80	17	26
Forbs				
Apocynum androsaemifolium (spreading dogbane)	3	0-3	6	4
Apocynum cannabinum (Indian hemp)	2	0-3	17	6
Artemisia dracunculus (dragonwort)	1	0-1	6	2
Artemisia ludoviciana (prairie sagewort)	1	0-1	6	2
Aster ericoides (tufted white prairie aster)	1	0-1	6	2
Aster spp. (aster)	3	0-3	6	4
Bidens cernua (nodding beggarticks)	1	0-1	6	2
Chenopodium album (lamb's-quarters)	1	0-1	6	2
Cirsium arvense (Canada thistle)	2	0-3	11	5
Crepis tectorum (annual hawk's-beard)	1	0-1	6	2
Epilobium ciliatum (northern willowherb)	3	0-3	6	4
Glycyrrhiza lepidota (wild licorice)	5	0-10	17	9
Helianthus nuttallii (common tall sunflower)	3	0-3	6	4
Lycopus asper (western water-horehound)	1	0-1	6	2
Melilotus officinalis (yellow sweet-clover)	3	0-3	6	4
Mentha arvensis (wild mint)	2	0-3	11	5

Table 30. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 18 stands of the *Salix exigua* (sandbar willow) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	range	(Frequency)	Index [1]
Plantago major (common plantain)	1	0-1	6	2
Polygonum amphibium (water smartweed)	14	0-20	17	15
Polygonum coccineum (water smartweed)	3	0-3	6	4
Potentilla anserina (silverweed)	1	0-1	6	2
Potentilla argentea (silvery cinquefoil)	3	0-3	6	4
Pyrola asarifolia (common pink wintergreen)	1	0-1	6	2
Rumex crispus (curled dock)	1	0-1	6	2
Rumex maritimus (golden dock)	20	0-20	6	11
Rumex triangulivalvis (narrow-leaved dock)	1	0-1	6	2
Salsola kali (Russian-thistle)	1	0-1	6	2
Sium suave (water parsnip)	3	0-3	6	4
Solidago canadensis (Canada goldenrod)	2	0-3	22	7
Sonchus arvensis (perennial sow-thistle)	2	0-3	11	5
Sonchus asper (prickly annual sow-thistle)	3	0-3	6	4
Sonchus spp. (sow-thistle)	1	0-1	6	2
Taraxacum officinale (common dandelion)	2	0-3	17	6
Thermopsis rhombifolia (golden bean)	10	0-10	6	8
Trifolium repens (white clover)	1	0-1	6	2
Typha latifolia (common cattail)	3	0-3	6	4
Verbena hastata (blue vervain)	20	0-20	6	11
Vicia americana (wild vetch)	1	0-1	6	2
Xanthium strumarium (cocklebur)	2	0-3	17	6
Ferns and Allies				
Equisetum arvense (common horsetail)	13	0-20	22	17
Equisetum hyemale (common scouring-rush)	10	0-10	6	8

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

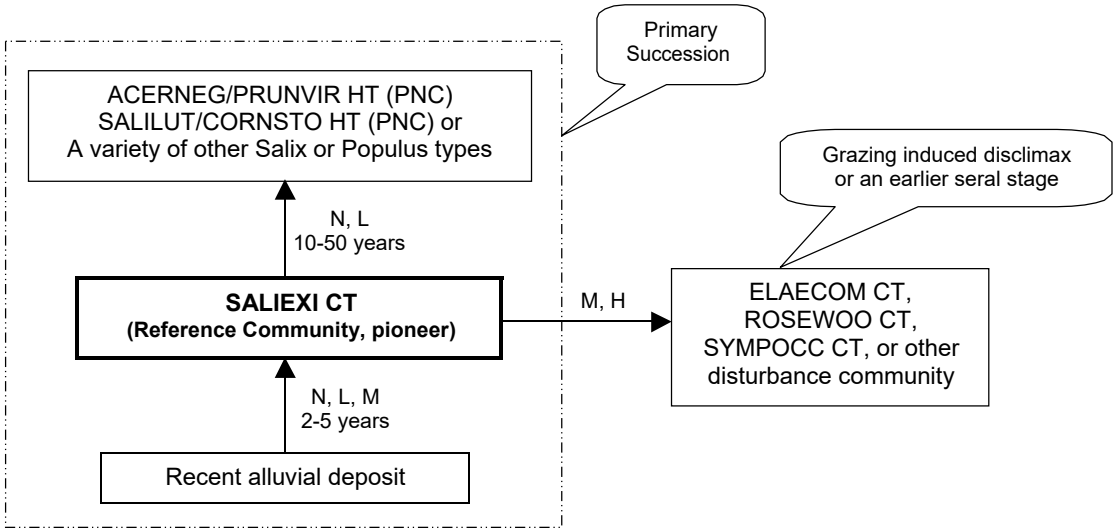
The *Salix exigua* (sandbar willow) community type is an early seral (pioneer) primary successional stage on newly deposited sediments that may persist under a regime of repeated fluvial disturbance. It commonly occurs in open stands of *Populus balsamifera* (balsam poplar), *Populus angustifolia* (narrow-leaf cottonwood), or *Populus deltoides* (plains cottonwood), as a fringe around dense cottonwood stands, or often in dense, monospecific stands. Figure 13 is a general schematic of the successional pathway followed on sites of this type.

Stands of *Salix exigua* are often seral to the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type or to the *Acer negundo/Prunus*

virginiana (Manitoba maple/choke cherry) habitat type along streams in southeastern Alberta.

Seedlings of both *Salix exigua* and *Populus deltoides* are typically established at the same time on alluvial mud flats. Initially, *Salix exigua* may grow faster than *Populus deltoides*. However, in a few years, saplings of *Populus deltoides* will outgrow *Salix exigua* and begin to dominate the overstory. As the dense overstory of *Populus deltoides* matures, *Salix exigua* is shaded out. While the *Salix exigua* is being shaded out, the understory is becoming dominated by seedlings, saplings, and pole size *Acer negundo* (Manitoba maple).

Figure 13. SALIEXI CT



Successional Pathway Diagram for SALIEXI Sites in the Southern Alberta Grasslands
Reference Community = SALIEXI CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
POPUBAL/CORNSTO CT	*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) Community Type
POPUANGCORNSTO CT	*Populus angustifolia/Cornus stolonifera* (narrow-leaved cottonwood/red-osier dogwood) Community Type
SALIBEB/CORNSTO HT	*Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) Habitat Type
SALIBEB CT	*Salix bebbiana* (beaked willow) Community Type
SALIEXI CT	*Salix exigua* (sandbar willow) Community Type
SYMPOCC CT	*Symphorocarpos occidentalis* (buckbrush) Community Type
ELAECOM CT	*Elaegnus commutata* (silverberry) Community Type
ROSAWOO CT	*Rosa woodsii* (common wild rose) Community Type
BROMINE CT	*Bromus inermis* (smooth brome) Community Type
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic potential does not change. Such hydrologic change could be a fluvial buildup of the floodplain, resulting in a terrace site too dry to support riparian species, or it could be removal of the overstory canopy by grazing or for agriculture.The time span is estimated for the stand to become dominated under undisturbed conditions by at least 50 percent cover of climax (or overstory indicator) species.

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 sites dominated by *Glycyrrhiza lepidota* (wild licorice) and *Agropyron smithii* (western wheat grass) following release from heavy grazing pressure, provided it has not been totally removed from the site. Heavy grazing may open up stands resulting in invasion by exotic species or less palatable native species (Table 31).

Table 31. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 52 disturbed stands of the *Salix exigua* (sandbar willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Acer negundo (Manitoba maple)	1	0 - 3	6	2
Fraxinus pennsylvanica (green ash)	2	0 - 3	4	3
Populus angustifolia (narrow-leaf cottonwood)	1	0 - 1	2	1
Populus deltoides (plains cottonwood)	5	0 - 20	12	8
Shrubs				
Artemisia cana (silver sagebrush)	10	0 - 10	2	4
Clematis ligusticifolia (western clematis)	3	0 - 3	4	3
Cornus stolonifera (red-osier dogwood)	13	0 - 50	29	19
Elaeagnus commutata (silverberry)	1	0 - 1	2	1
Prunus virginiana (choke cherry)	7	0 - 10	12	9
Ribes americanum (wild black currant)	20	0 - 20	2	6
Ribes aureum (golden currant)	18	0 - 40	6	10
Ribes hudsonianum (northern black currant)	20	0 - 20	2	6
Ribes oxyacanthoides (northern gooseberry)	2	0 - 3	4	3
Ribes spp. (currant)	3	0 - 3	2	2
Rosa acicularis (prickly rose)	60	0 - 60	2	11
Rosa woodsii (common wild rose)	31	0 - 60	27	29
Rosa spp. (rose)	10	0 - 50	19	14
Rubus idaeus (wild red raspberry)	1	0 - 1	2	1
Salix amygdaloides (peach-leaved willow)	2	0 - 3	8	4
Salix bebbiana (beaked willow)	1	0 - 1	2	1
Salix boothii (Booth's willow)	1	0 - 1	4	2
Salix exigua (sandbar willow)	77	40 - 98	100	88
Salix lutea (yellow willow)	3	0 - 10	21	8
Symphoricarpos occidentalis (buckbrush)	22	0 - 60	31	26
Graminoids				
Agropyron dasystachyum (northern wheat grass)	1	0 - 1	2	1
Agropyron repens (quack grass)	3	0 - 3	4	3

Table 31. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 52 disturbed stands of the *Salix exigua* (sandbar willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Agropyron smithii (western wheat grass)	26	0 - 70	23	24
Agrostis stolonifera (redtop)	20	0 - 80	17	18
Agropyron trachycaulum (slender wheat grass)	11	0 - 20	10	10
Alopecurus aequalis (short-awned foxtail)	1	0 - 1	2	1
Beckmannia syzigachne (slough grass)	2	0 - 3	4	3
Bromus inermis (smooth brome)	32	0 - 90	48	39
Bromus japonicus (Japanese chess)	1	0 - 1	2	1
Bromus tectorum (downy chess)	10	0 - 20	4	6
Carex atherodes (awned sedge)	9	0 - 30	8	8
Carex lanuginosa (woolly sedge)	3	0 - 3	4	3
Carex utriculata (beaked sedge)	1	0 - 1	2	1
Carex sprengelii (Sprengel's sedge)	3	0 - 3	2	2
Carex spp. (sedge)	3	0 - 3	2	2
Dactylis glomerata (orchard grass)	30	0 - 40	4	11
Deschampsia cespitosa (tufted hair grass)	1	0 - 1	2	1
Eleocharis palustris (creeping spike-rush)	30	0 - 30	2	8
Elymus canadensis (Canada wild rye)	13	0 - 40	8	10
Elymus piperi (giant wild rye)	17	0 - 30	4	8
Glyceria grandis (common tall manna grass)	1	0 - 1	2	1
Hordeum jubatum (foxtail barley)	4	0 - 20	19	9
Juncus balticus (wire rush)	7	0 - 10	4	5
Muhlenbergia asperifolia (scratch grass)	1	0 - 1	2	1
Phalaris arundinacea (reed canary grass)	15	0 - 50	19	17
Phleum pratense (timothy)	7	0 - 20	10	8
Poa compressa (Canada bluegrass)	1	0 - 1	2	1
Poa palustris (fowl bluegrass)	11	0 - 40	19	14
Poa pratensis (Kentucky bluegrass)	28	0 - 70	33	30
Poa spp. (bluegrass)	3	0 - 3	2	2
Scirpus pungens (three-square rush)	2	0 - 3	8	4
Stipa comata (needle-and-thread)	1	0 - 1	2	1
Stipa viridula (green needle grass)	1	0 - 1	2	1
Forbs				
Achillea millefolium (common yarrow)	1	0 - 1	2	1
Ambrosia psilostachya (perennial ragweed)	3	0 - 3	2	2
Apocynum androsaemifolium (spreading dogbane)	40	0 - 40	4	13
Apocynum cannabinum (Indian hemp)	1	0 - 1	2	1
Arctium spp. (burdock)	1	0 - 1	2	1
Arctium lappa (great burdock)	1	0 - 1	2	1
Arctium minus (common burdock)	3	0 - 3	2	2

Table 31. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 52 disturbed stands of the *Salix exigua* (sandbar willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Arnica amplexicaulis (stem-clasping arnica)	1	0 - 1	2	1
Artemisia absinthium (absinthe wormwood)	5	0 - 10	6	5
Artemisia biennis (biennial sagewort)	5	0 - 10	4	4
Artemisia dracunculus (dragonwort)	1	0 - 1	2	1
Artemisia ludoviciana (prairie sagewort)	3	0 - 10	10	5
Asclepias speciosa (showy milkweed)	1	0 - 1	2	1
Aster borealis (marsh aster)	2	0 - 3	8	4
Aster brachyactis (rayless aster)	3	0 - 3	2	2
Aster eatonii (Eaton's aster)	1	0 - 1	2	1
Aster ericoides (tufted white prairie aster)	2	0 - 3	4	3
Aster hesperius (western willow aster)	1	0 - 1	6	2
Aster laevis (smooth aster)	1	0 - 1	2	1
Chenopodium album (lamb's-quarters)	1	0 - 1	2	1
Chenopodium fremontii (Fremont's goosefoot)	10	0 - 10	2	4
Cicuta maculata (water-hemlock)	1	0 - 1	4	2
Cirsium arvense (Canada thistle)	14	0 - 60	44	25
Convolvulus arvensis (field bindweed)	2	0 - 3	4	3
Convolvulus sepium (wild morning-glory)	2	0 - 3	4	3
Cynoglossum officinale (hound's-tongue)	2	0 - 3	4	3
Descurainia pinnata (green tansy mustard)	1	0 - 1	2	1
Descurainia sophia (flixweed)	5	0 - 10	4	4
Epilobium ciliatum (northern willowherb)	2	0 - 3	4	3
Erysimum cheiranthoides (wormseed mustard)	3	0 - 3	2	2
Euphorbia esula (leafy spurge)	1	0 - 1	2	1
Unknown Forb	3	0 - 3	2	2
Galium aparine (cleavers)	10	0 - 20	4	6
Galium boreale (northern bedstraw)	3	0 - 3	2	2
Geum macrophyllum (large-leaved yellow avens)	1	0 - 1	2	1
Glycyrrhiza lepidota (wild licorice)	14	0 - 40	31	21
Helenium autumnale (sneezeweed)	1	0 - 1	2	1
Helianthus nuttallii (common tall sunflower)	1	0 - 1	2	1
Heracleum lanatum (cow parsnip)	10	0 - 20	4	6
Humulus lupulus (common hop)	3	0 - 3	2	2
Kochia scoparia (summer-cypress)	12	0 - 20	4	7
Lactuca pulchella (common blue lettuce)	1	0 - 1	2	1
Lycopus americanus (American water-horehound)	3	0 - 3	2	2
Melilotus alba (white sweet-clover)	9	0 - 40	10	9
Melilotus officinalis (yellow sweet-clover)	5	0 - 20	17	9
Mentha arvensis (wild mint)	9	0 - 20	10	9

Table 31. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 52 disturbed stands of the *Salix exigua* (sandbar willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Plantago major (common plantain)	1	0 - 1	4	2
Polygonum coccineum (water smartweed)	14	0 - 40	12	13
Polygonum lapathifolium (pale persicaria)	1	0 - 1	2	1
Potentilla anserina (silverweed)	3	0 - 3	6	4
Potentilla gracilis (graceful cinquefoil)	1	0 - 1	2	1
Potentilla norvegica (rough cinquefoil)	1	0 - 1	2	1
Potentilla paradoxa (bushy cinquefoil)	7	0 - 10	4	5
Potentilla rivalis (brook cinquefoil)	10	0 - 10	2	4
Rorippa sylvestris (creeping yellow cress)	20	0 - 20	2	6
Rumex crispus (curled dock)	6	0 - 20	8	7
Rumex occidentalis (western dock)	3	0 - 3	4	3
Rumex triangulivalvis (narrow-leaved dock)	2	0 - 3	4	3
Salsola kali (Russian-thistle)	12	0 - 20	4	7
Smilacina stellata (star-flowered Solomon's-seal)	5	0 - 10	4	4
Solidago canadensis (Canada goldenrod)	15	0 - 60	13	14
Solidago spp. (goldenrod)	2	0 - 3	4	3
Solidago gigantea (late goldenrod)	5	0 - 10	6	5
Solidago missouriensis (low goldenrod)	2	0 - 3	4	3
Solidago rigida (stiff goldenrod)	3	0 - 3	2	2
Sonchus arvensis (perennial sow-thistle)	10	0 - 20	10	10
Sonchus asper (prickly annual sow-thistle)	20	0 - 40	4	9
Sonchus spp. (sow-thistle)	1	0 - 1	4	2
Stachys palustris (marsh hedge-nettle)	2	0 - 3	6	3
Taraxacum officinale (common dandelion)	1	0 - 3	12	3
Thalictrum dasycarpum (tall meadow rue)	1	0 - 1	4	2
Thlaspi arvense (stinkweed)	1	0 - 1	2	1
Tragopogon dubius (common goat's-beard)	1	0 - 1	2	1
Trifolium repens (white clover)	2	0 - 3	4	3
Typha latifolia (common cattail)	7	0 – 10	4	5
Urtica dioica (common nettle)	1	0 - 3	10	3
Vicia americana (wild vetch)	12	0 – 20	4	7
Xanthium strumarium (cocklebur)	2	0 - 3	10	4
Ferns and Allies				
Equisetum arvense (common horsetail)	12	0 – 30	15	13

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

Soils are Regosols or rarely Chernozems, and may range from sandy gravels to heavy clays. Surface soils are usually moist in the spring and early summer; subsoils remain saturated throughout the growing season.

ADJACENT COMMUNITIES

Wetter communities are usually absent. Adjacent drier communities include the *Populus balsamifera* (balsam poplar), *Populus angustifolia* (narrow-leaf cottonwood), *Populus deltoides* (plains cottonwood), and *Salix lutea* (yellow willow) types.

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 vigor by the willows present, as illustrated by highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site. However, release from heavy grazing pressure will allow them to re-establish, provided they have not been totally removed from the site.

Frisina (1991) states that for a grazing program to be successful, it must meet the basic biological requirements of the plants present. These are photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed. It is during the long growing season rest periods that these essential biological processes of food production and storage, reproduction, and seedling establishment occur. In some instances, additional periods of rest may be required to improve or maintain a plant community.

Wildlife

Stands of this community type provide excellent thermal and hiding cover for many species of wildlife. *Salix exigua* (sandbar willow) is normally not as heavily browsed as other willow species. Beaver tends to heavily utilize *Salix exigua*.

Fisheries

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

The use of fire in this type as an improvement technique has been little studied. However, limited information indicates this type tends to sprout vigorously following fire. Quick, hot fires result in more sprouts than slower fires, which are potentially more damaging to the willows and tend to result in fewer sprouts.

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 willows in protecting the streambank.

Salix exigua 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* 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.

Salix exigua is highly adapted to most forms of disturbance. It is a prolific sprouter and will re-establish itself following release from heavy grazing pressure; provided it has not been totally removed from the site.

Degraded sites or exposed sand/gravel bars can be revegetated using *Salix exigua*. Cuttings should be rooted and grown in a nursery to best insure survival. *Salix exigua* 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 (12-20 in) long and >1 cm (0.5 in) in diameter produce best results. Shoots from cuttings can be expected to appear 10 days after planting.

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.

OTHER STUDIES

The *Salix exigua* (sandbar willow) community type is described by Hansen and others (1995) for Montana. Similar community types have been described by Norton and others (1981; Greys River, Wyoming), Mutz and Queiroz (1983; southeastern Idaho), Tuhy and Jensen (1982; central Idaho), Youngblood and others (1985b; eastern Idaho and western Wyoming), Padgett and others (1989; Utah and southeastern Idaho), Chadde and others (1988; northern Yellowstone National Park), and Szaro (1989; Arizona and New Mexico). Undergrowth composition described by these authors varied widely but was often composed of introduced grasses such as *Agrostis stolonifera* (redtop), *Poa palustris* (fowl bluegrass), and *Poa pratensis* (Kentucky bluegrass).

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

SALILUT/CORNSTO

Number of Stands Sampled = 23

Number of Stands Sampled in Alberta = 17

LOCATION AND ASSOCIATED LANDFORMS

The *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type is a minor to incidental type in the Mixedgrass Natural Region of southern Alberta on lotic (stream floodplain) systems. It is typically found as dense bands parallel to the channel on the lower floodplain terraces of major rivers in the region.

VEGETATION

The *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type is a climax community dominated by *Salix lutea* in the tallest layer and *Cornus stolonifera* (red-osier dogwood) in a moist, tall shrub understory (Table 32).

Table 32. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 late seral to climax stands of the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Populus deltoides (plains cottonwood)	3	0-3	29	9
Shrubs				
Alnus tenuifolia (river alder)	10	0-10	14	12
Amelanchier alnifolia (saskatoon)	3	0-3	14	6
Cornus stolonifera (red-osier dogwood)	34	10-70	100	58
Prunus virginiana (choke cherry)	1	0-1	29	5
Ribes aureum (golden currant)	1	0-1	14	4
Ribes hudsonianum (northern black currant)	3	0-3	14	6
Ribes oxyacanthoides (northern gooseberry)	1	0-3	71	8
Rosa woodsii (common wild rose)	1	0-1	14	4
Rosa spp. (rose)	14	0-30	71	32
Rubus idaeus (wild red raspberry)	3	0-3	14	6
Rubus pubescens (dewberry)	3	0-3	14	6
Salix bebbiana (beaked willow)	3	0-3	14	6
Salix exigua (sandbar willow)	6	0-10	57	18
Salix lutea (yellow willow)	59	30-80	100	77
Shepherdia argentea (thorny buffaloberry)	3	0-3	14	6
Symphoricarpos occidentalis (buckbrush)	6	0-10	57	18
Graminoids				
Agropyron dasystachyum (northern wheat grass)	30	0-30	14	20
Agropyron smithii (western wheat grass)	10	0-10	14	12

Table 32. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 late seral to climax stands of the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type

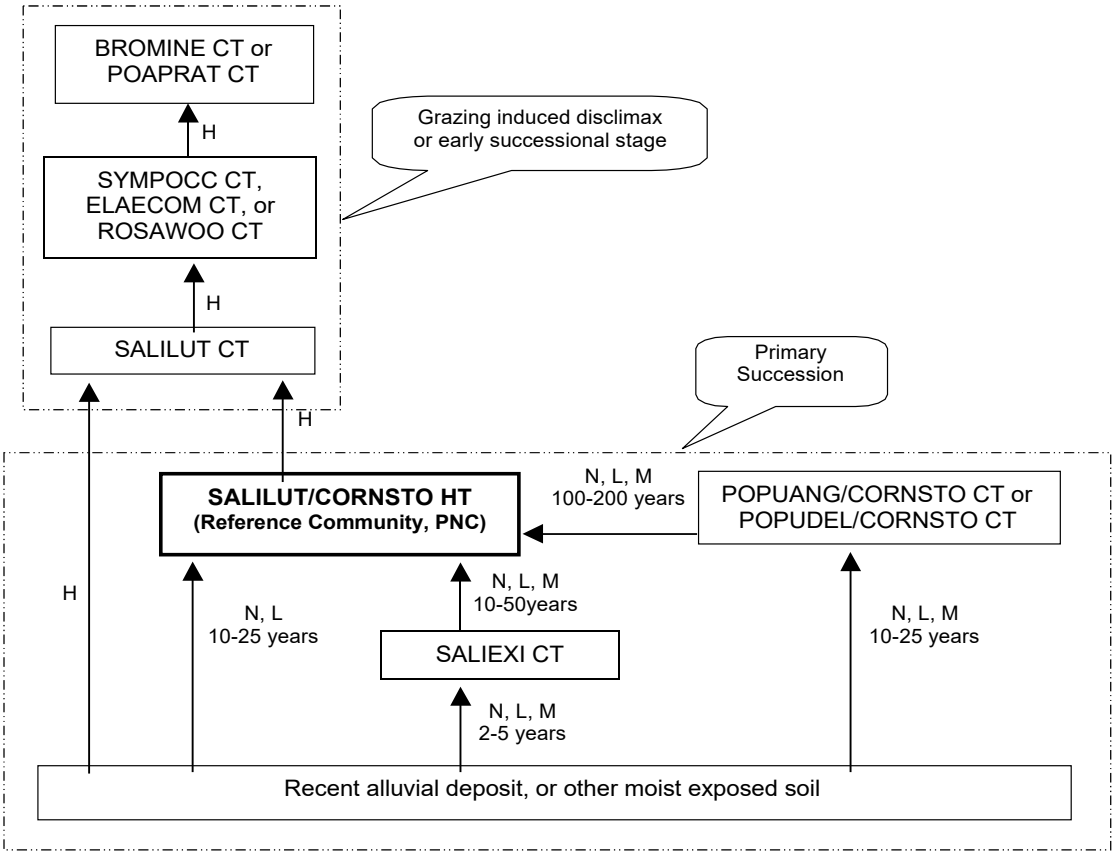
Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Agropyron trachycaulum (slender wheat grass)	3	0-3	14	6
Bromus inermis (smooth brome)	7	0-10	29	14
Carex sprengelii (Sprengel's sedge)	20	0-20	14	17
Deschampsia cespitosa (tufted hair grass)	3	0-3	14	6
Hordeum jubatum (foxtail barley)	3	0-3	14	6
Phalaris arundinacea (reed canary grass)	1	0-1	14	4
Poa palustris (fowl bluegrass)	3	0-3	14	6
Poa pratensis (Kentucky bluegrass)	3	0-3	14	6
Poa spp. (bluegrass)	3	0-3	14	6
Polypogon monspeliensis (rabbitfoot grass)	1	0-1	14	4
Sphenopholis intermedia (slender wedge grass)	10	0-10	14	12
Forbs				
Actaea rubra (red and white baneberry)	1	0-1	14	4
Anemone cylindrica (long-fruited anemone)	3	0-3	14	6
Apocynum spp. (dogbane)	10	0-10	14	12
Aralia nudicaulis (wild sarsaparilla)	10	0-10	14	12
Arctium minus (common burdock)	1	0-1	14	4
Cirsium arvense (Canada thistle)	4	0-10	43	13
Galium boreale (northern bedstraw)	20	0-20	14	17
Galium triflorum (sweet-scented bedstraw)	3	0-3	14	6
Glycyrrhiza lepidota (wild licorice)	1	0-1	14	4
Helianthus nuttallii (common tall sunflower)	1	0-1	14	4
Lysimachia ciliata (fringed loosestrife)	1	0-1	14	4
Mentha arvensis (wild mint)	2	0-3	29	8
Mentha spp. (mint)	3	0-3	14	6
Potentilla anserina (silverweed)	1	0-1	14	4
Scutellaria galericulata (marsh skullcap)	10	0-10	14	12
Smilacina stellata (star-flowered Solomon's-seal)	2	0-3	86	13
Solidago canadensis (Canada goldenrod)	5	0-10	29	12
Solidago spp. (goldenrod)	3	0-3	29	9
Solidago gigantea (late goldenrod)	1	0-1	14	4
Sonchus asper (prickly annual sow-thistle)	10	0-10	14	12
Stellaria crassifolia (fleshy stitchwort)	3	0-3	14	6
Taraxacum officinale (common dandelion)	1	0-1	14	4
Thalictrum spp. (meadow rue)	1	0-1	14	4
Urtica dioica (common nettle)	3	0-3	14	6
Vicia americana (wild vetch)	1	0-1	14	4
Viola canadensis (western Canada violet)	30	0-30	14	20

Table 32. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 late seral to climax stands of the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index [1]
	Average	Range		
Sphagnum spp. (sphagnum mosses)	60	0-60	14	29
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0-1	29	5

[1] Prominence Index is the square root of the product of Average Cover and Constancy values

Figure 14. SALILUT/CORNSTO HT



Successional Pathway Diagram of SALILUT Sites in the Southern Alberta Grasslands
Reference Community = SALILUT/CORNSTO HT
L = Light to No Grazing M = Moderate Grazing H = Heavy Grazing

NAME CODE KEY	
SALILUT/CORNSTO HT	*Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) Habitat Type
POPUDEL/CORNSTO CT	*Populus deltoides/Cornus stolonifera* (plains cottonwood/red-osier dogwood) Community Type
POPUANG/CORNSTO CT	*Populus angustifolia/Cornus stolonifera* (narrow-leaved cottonwood/red-osier dogwood) Community Type
SALILUT CT	*Salix lutea* (yellow willow) Community Type
SALIEXI CT	*Salix exigua* (sandbar willow) Community Type
SYMPOCC CT	*Symphorocarpos occidentalis* (buckbrush) Community Type
ELAECOM CT	*Elaegnus commutata* (silverberry) Community Type
ROSAWOO CT	*Rosa woodsii* (common wild rose) Community Type
BROMINE CT	*Bromus inermis* (smooth brome) Community Type
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic potential does not change. Such hydrologic change could be a fluvial buildup of the floodplain, resulting in a terrace site too dry to support riparian species, or it could be removal of the overstory canopy by grazing or for agriculture. The time span is estimated for the stand to become dominated under undisturbed conditions by at least 50 percent cover of climax (or overstory indicator) species.

SUCCESSIONAL INFORMATION

With prolonged moderate to heavy grazing pressure, the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type will lose its tall/moist shrub understory to a more diverse set of shorter/drier shrub species and disturbance-increaser herbaceous species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (timothy), and *Cirsium arvense* (Canada thistle) (Table 33). This disturbance has the effect of drying out the site and results in the grazing disclimax *Salix lutea* (yellow willow) community type. Figure 14 is a general schematic of the successional pathway followed on sites of this type.

SOILS

Soils are commonly dark brown to black Chernozems, but can intergrade to soils of the Organic order under conditions favorable for organic matter accumulation. Soil texture varies little from clay loam to sandy loam. Water tables are usually within 1 m (39 in) of the soil surface throughout summer. Redoximorphic features (mottles or gleyed soil) are also common within 1 m (39 in) of the soil surface. Estimated available water ranges from low to high.

ADJACENT COMMUNITIES

Adjacent wetter sites may be dominated by the *Salix exigua* (sandbar willow) community type, *Carex* (sedge) species, the *Eleocharis palustris* (creeping spike-rush) habitat type, or open water. Drier sites may support a variety of types including the *Populus deltoides* (Plains cottonwood) dominated community types, or the *Symphoricarpos occidentalis* (buckbrush) community type.

Table 33. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of 16 early seral or disturbed stands of the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Fraxinus pennsylvanica (green ash)	1	0 - 1	6	2
Populus angustifolia (narrow-leaf cottonwood)	3	0 - 3	6	4
Populus balsamifera (balsam poplar)	2	0 - 3	25	7
Populus deltoides (plains cottonwood)	1	0 - 1	6	2
Populus tremuloides (aspen)	3	0 - 3	6	4
Shrubs				
Alnus tenuifolia (river alder)	17	0 - 30	13	15
Amelanchier alnifolia (saskatoon)	8	0 - 20	38	17
Betula occidentalis (water birch)	60	0 - 60	6	19
Clematis ligusticifolia (western clematis)	12	0 - 20	13	12
Cornus stolonifera (red-osier dogwood)	18	3 - 40	100	42
Elaeagnus commutata (silverberry)	1	0 - 3	31	6
Lonicera dioica (twining honeysuckle)	1	0 - 1	6	2
Lonicera involucrata (bracted honeysuckle)	3	0 - 3	13	6

Table 33. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of 16 early seral or disturbed stands of the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Lonicera utahensis (red twinberry)	3	0 - 3	6	4
Prunus virginiana (choke cherry)	4	0 - 10	19	9
Ribes aureum (golden currant)	10	0 - 10	6	8
Ribes oxyacanthoides (northern gooseberry)	2	0 - 3	25	7
Rosa spp. (rose)	11	0 - 40	81	30
Rubus idaeus (wild red raspberry)	3	0 - 3	6	4
Salix candida (hoary willow)	3	0 - 3	6	4
Salix drummondiana (Drummond's willow)	3	0 - 3	6	4
Salix exigua (sandbar willow)	22	0 - 50	63	37
Salix lucida (shining willow)	3	0 - 3	6	4
Salix lutea (yellow willow)	27	10 - 60	100	52
Salix petiolaris (basket willow)	10	0 - 10	6	8
Salix planifolia (flat-leaved willow)	30	0 - 30	6	13
Salix pseudomonticola (false mountain willow)	3	0 - 3	6	4
Shepherdia argentea (thorny buffaloberry)	4	0 - 10	19	9
Symphoricarpos occidentalis (buckbrush)	16	0 - 20	63	32
Graminoids				
Agropyron dasystachyum (northern wheat grass)	3	0 - 3	6	4
Agrostis exarata (spike redtop)	1	0 - 1	6	2
Agropyron repens (quack grass)	4	0 - 10	25	10
Agrostis stolonifera (redtop)	20	0 - 20	6	11
Agropyron trachycaulum (slender wheat grass)	5	0 - 10	13	8
Bromus inermis (smooth brome)	33	0 - 70	63	46
Calamagrostis canadensis (bluejoint)	3	0 - 3	19	8
Carex praegracilis (graceful sedge)	1	0 - 1	6	2
Deschampsia cespitosa (tufted hair grass)	1	0 - 1	6	2
Elymus virginicus (Virginia wild rye)	1	0 - 1	6	2
Glyceria grandis (common tall manna grass)	1	0 - 1	6	2
Unknown Grass	3	0 - 3	6	4
Juncus balticus (wire rush)	13	0 - 20	19	16
Phalaris arundinacea (reed canary grass)	3	0 - 3	6	4
Poa palustris (fowl bluegrass)	2	0 - 3	31	8
Poa pratensis (Kentucky bluegrass)	6	0 - 20	44	16
Forbs				
Actaea rubra (red and white baneberry)	1	0 - 1	6	2
Apocynum spp. (dogbane)	1	0 - 1	6	2
Aralia nudicaulis (wild sarsaparilla)	2	0 - 3	13	5
Arctium minus (common burdock)	3	0 - 3	13	6

Table 33. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of 16 early seral or disturbed stands of the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Aster borealis (marsh aster)	1	0 - 1	13	4
Chenopodium fremontii (Fremont's goosefoot)	3	0 - 3	6	4
Cicuta maculata (water-hemlock)	2	0 - 3	13	5
Cirsium arvense (Canada thistle)	4	0 - 10	44	13
Cirsium spp. (thistle)	1	0 - 1	6	2
Disporum trachycarpum (fairybells)	1	0 - 1	6	2
Epilobium angustifolium (common fireweed)	1	0 - 1	6	2
Unknown Forb	3	0 - 3	6	4
Fragaria virginiana (wild strawberry)	1	0 - 1	6	2
Geranium richardsonii (wild white geranium)	2	0 - 3	19	6
Glycyrrhiza lepidota (wild licorice)	3	0 - 10	50	12
Hackelia americana (nodding stickseed)	1	0 - 1	6	2
Helianthus nuttallii (common tall sunflower)	1	0 - 1	6	2
Heracleum lanatum (cow parsnip)	1	0 - 1	6	2
Lysimachia ciliata (fringed loosestrife)	10	0 - 10	6	8
Melilotus alba (white sweet-clover)	2	0 - 3	13	5
Melilotus officinalis (yellow sweet-clover)	3	0 - 3	6	4
Petasites palmatus (palmate-leaved coltsfoot)	3	0 - 3	6	4
Polygonum coccineum (water smartweed)	1	0 - 1	6	2
Potentilla anserina (silverweed)	1	0 - 1	6	2
Pyrola asarifolia (common pink wintergreen)	3	0 - 3	6	4
Sisymbrium loeselii (tall hedge mustard)	1	0 - 1	6	2
Smilacina stellata (star-flowered Solomon's-seal)	4	0 - 10	44	13
Solidago canadensis (Canada goldenrod)	2	0 - 3	25	7
Solidago spp. (goldenrod)	5	0 - 10	31	12
Solidago gigantea (late goldenrod)	7	0 - 10	13	10
Sonchus arvensis (perennial sow-thistle)	2	0 - 3	13	5
Sonchus spp. (sow-thistle)	2	0 - 3	19	6
Stachys palustris (marsh hedge-nettle)	1	0 - 1	6	2
Tanacetum vulgare (common tansy)	10	0 - 10	6	8
Taraxacum officinale (common dandelion)	1	0 - 1	6	2
Thalictrum venulosum (veiny meadow rue)	2	0 - 3	13	5
Trifolium spp. (clover)	1	0 - 1	6	2
Urtica dioica (common nettle)	20	0 - 20	6	11
Vicia americana (wild vetch)	5	0 - 20	44	15
Viola adunca (early blue violet)	1	0 - 1	6	2
Viola canadensis (western Canada violet)	1	0 - 1	6	2

Table 33. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of 16 early seral or disturbed stands of the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Ferns and Allies				
Equisetum arvense (common horsetail)	3	0 - 10	31	10

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

MANAGEMENT INFORMATION

Livestock

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 willow shoots; and, combined with trampling and soil compaction, they can alter the age structure and vegetation composition of this type.

Cornus stolonifera (red-osier dogwood) is considered an "ice cream" plant by livestock and wildlife. Its abundance, and growth form is a direct indication of past and current use levels. Overuse by livestock will reduce vigor of the willows, as indicated by highlined or clubbed growth forms and dead clumps. With continued overuse, willows will show a sharp decline in vigor and may be eventually eliminated from the site.

Frisina (1991) states that for a grazing program to be successful, it must meet the basic biological requirements of the plants present. These are photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed. It is during the long growing season rest periods that these essential biological processes of food production and storage, reproduction, and seedling establishment occur. In some instances, additional periods of rest may be required to improve or maintain a plant community.

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 also heavily utilize *Salix lutea*.

Fisheries

The importance of 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.

Fire

Salix lutea (yellow willow) will sprout vigorously following fire, especially in wetter stands. Quick, hot fires result in more sprouts than slower fires, which tend to be more damaging to willows, and to result in fewer sprouts (USDA IFSL 1995). After burning, the site should be protected from livestock grazing for at least 2 to 3 years to avoid damaging the young, palatable regrowth.

Soil Management and Rehabilitation Opportunities

The *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type receives high use by wildlife and cattle. Soils and streambanks are susceptible to

trampling damage, especially when soils are 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 (12-20 in) long and more than 1 cm (0.5 in) 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.

OTHER STUDIES

The *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type has not been described by others. Hansen and others (1995) describe a *Salix lutea/Carex utriculata* (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 lutea Community Type
(Yellow Willow Community Type)

SALILUT
Number of Stands Sampled = 10
Number of Stands Sampled in Alberta = 10

LOCATION AND ASSOCIATED LANDFORMS

The *Salix lutea* (yellow willow) community type is a minor to incidental type in the Mixedgrass Natural Region of southern Alberta on lotic (stream floodplain) systems. It typically is found as a band parallel to the channel on the lower floodplain terraces of major rivers in the region.

VEGETATION

The *Salix lutea* (yellow willow) community type represents a browsing/grazing disclimax after long disturbance of a site of the *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type. *Salix lutea* dominates a diverse group of disturbance-related herbaceous species, including many exotics (Table 34).

Table 34. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 10 sampled stands of the *Salix lutea* (yellow willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Populus balsamifera (balsam poplar)	1	0 - 3	30	5
Populus tremuloides (aspen)	1	0 - 1	10	3
Shrubs				
Alnus tenuifolia (river alder)	3	0 - 3	20	8

Table 34. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 10 sampled stands of the *Salix lutea* (yellow willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Amelanchier alnifolia (saskatoon)	10	0 - 10	10	10
Clematis ligusticifolia (western clematis)	1	0 - 1	10	3
Cornus stolonifera (red-osier dogwood)	1	0 - 1	20	4
Elaeagnus commutata (silverberry)	11	0 - 30	30	18
Prunus virginiana (choke cherry)	1	0 - 1	20	4
Ribes oxyacanthoides (northern gooseberry)	2	0 - 3	20	6
Rosa spp. (rose)	14	0 - 40	50	26
Salix bebbiana (beaked willow)	10	0 - 10	10	10
Salix exigua (sandbar willow)	35	0 - 90	70	49
Salix lucida (shining willow)	17	0 - 20	30	23
Salix lutea (yellow willow)	37	10 - 80	100	61
Salix myrtillifolia (myrtle-leaved willow)	1	0 - 1	10	3
Salix planifolia (flat-leaved willow)	3	0 - 3	10	5
Symphoricarpos occidentalis (buckbrush)	10	0 - 20	40	20
Graminoids				
Agropyron dasystachyum (northern wheat grass)	3	0 - 3	10	5
Agropyron repens (quack grass)	1	0 - 1	10	3
Agrostis scabra (rough hair grass)	10	0 - 10	20	14
Agropyron smithii (western wheat grass)	1	0 - 1	10	3
Agrostis stolonifera (redtop)	10	0 - 20	30	17
Agropyron trachycaulum (slender wheat grass)	1	0 - 1	10	3
Beckmannia syzigachne (slough grass)	1	0 - 1	10	3
Bromus inermis (smooth brome)	7	0 - 10	20	12
Calamagrostis canadensis (bluejoint)	10	0 - 10	20	14
Carex crawfordii (Crawford's sedge)	3	0 - 3	10	5
Carex deweyana (Dewey's sedge)	1	0 - 1	10	3
Carex lanuginosa (woolly sedge)	1	0 - 1	10	3
Carex praegracilis (graceful sedge)	1	0 - 1	10	3
Cinna latifolia (drooping wood-reed)	1	0 - 1	10	3
Elymus canadensis (Canada wild rye)	1	0 - 1	30	5
Festuca pratensis (meadow fescue)	3	0 - 3	10	5
Hordeum jubatum (foxtail barley)	1	0 - 3	30	5
Juncus alpinoarticulatus (alpine rush)	1	0 - 1	10	3
Juncus balticus (wire rush)	2	0 - 3	30	8
Juncus nevadensis (Nevada rush)	3	0 - 3	10	5
Phalaris arundinacea (reed canary grass)	30	0 - 30	10	17
Phleum pratense (timothy)	3	0 - 3	10	5
Poa palustris (fowl bluegrass)	9	0 - 20	50	21
Poa pratensis (Kentucky bluegrass)	7	0 - 20	60	20

Table 34. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 10 sampled stands of the *Salix lutea* (yellow willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Scirpus microcarpus (small-fruited bulrush)	7	0 - 10	20	12
Scirpus paludosus (prairie bulrush)	3	0 - 3	10	5
Scirpus pungens (three-square rush)	1	0 - 1	10	3
Spartina pectinata (prairie cord grass)	3	0 - 3	10	5
Forbs				
Achillea millefolium (common yarrow)	1	0 - 1	2	1
Ambrosia psilostachya (perennial ragweed)	3	0 - 3	2	2
Apocynum androsaemifolium (spreading dogbane)	40	0 - 40	4	13
Apocynum cannabinum (Indian hemp)	1	0 - 1	2	1
Arctium spp. (burdock)	1	0 - 1	2	1
Arctium lappa (great burdock)	1	0 - 1	2	1
Arctium minus (common burdock)	3	0 - 3	2	2
Arnica amplexicaulis (stem-clasping arnica)	1	0 - 1	2	1
Artemisia absinthium (absinthe wormwood)	5	0 - 10	6	5
Artemisia biennis (biennial sagewort)	5	0 - 10	4	4
Artemisia dracunculus (dragonwort)	1	0 - 1	2	1
Artemisia ludoviciana (prairie sagewort)	3	0 - 10	10	5
Asclepias speciosa (showy milkweed)	1	0 - 1	2	1
Aster borealis (marsh aster)	2	0 - 3	8	4
Aster brachyactis (rayless aster)	3	0 - 3	2	2
Aster eatonii (Eaton's aster)	1	0 - 1	2	1
Aster ericoides (tufted white prairie aster)	2	0 - 3	4	3
Aster hesperius (western willow aster)	1	0 - 1	6	2
Aster laevis (smooth aster)	1	0 - 1	2	1
Chenopodium album (lamb's-quarters)	1	0 - 1	2	1
Chenopodium fremontii (Fremont's goosefoot)	10	0 - 10	2	4
Cicuta maculata (water-hemlock)	1	0 - 1	4	2
Cirsium arvense (Canada thistle)	14	0 - 60	44	25
Convolvulus arvensis (field bindweed)	2	0 - 3	4	3
Convolvulus sepium (wild morning-glory)	2	0 - 3	4	3
Cynoglossum officinale (hound's-tongue)	2	0 - 3	4	3
Descurainia pinnata (green tansy mustard)	1	0 - 1	2	1
Descurainia sophia (flixweed)	5	0 - 10	4	4
Epilobium ciliatum (northern willowherb)	2	0 - 3	4	3
Erysimum cheiranthoides (wormseed mustard)	3	0 - 3	2	2
Euphorbia esula (leafy spurge)	1	0 - 1	2	1
Unknown Forb	3	0 - 3	2	2
Galium aparine (cleavers)	10	0 - 20	4	6
Galium boreale (northern bedstraw)	3	0 - 3	2	2

Table 34. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 10 sampled stands of the *Salix lutea* (yellow willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Geum macrophyllum (large-leaved yellow avens)	1	0 - 1	2	1
Glycyrrhiza lepidota (wild licorice)	14	0 - 40	31	21
Helenium autumnale (sneezeweed)	1	0 - 1	2	1
Helianthus nuttallii (common tall sunflower)	1	0 - 1	2	1
Heracleum lanatum (cow parsnip)	10	0 - 20	4	6
Humulus lupulus (common hop)	3	0 - 3	2	2
Kochia scoparia (summer-cypress)	12	0 - 20	4	7
Lactuca pulchella (common blue lettuce)	1	0 - 1	2	1
Lycopus americanus (American water-horehound)	3	0 - 3	2	2
Melilotus alba (white sweet-clover)	9	0 - 40	10	9
Melilotus officinalis (yellow sweet-clover)	5	0 - 20	17	9
Mentha arvensis (wild mint)	9	0 - 20	10	9
Plantago major (common plantain)	1	0 - 1	4	2
Polygonum amphibium (water smartweed)	14	0 - 40	12	13
Polygonum lapathifolium (pale persicaria)	1	0 - 1	2	1
Potentilla anserina (silverweed)	3	0 - 3	6	4
Potentilla gracilis (graceful cinquefoil)	1	0 - 1	2	1
Potentilla norvegica (rough cinquefoil)	1	0 - 1	2	1
Potentilla paradoxa (bushy cinquefoil)	7	0 - 10	4	5
Potentilla rivalis (brook cinquefoil)	10	0 - 10	2	4
Rorippa sylvestris (creeping yellow cress)	20	0 - 20	2	6
Rumex crispus (curled dock)	6	0 - 20	8	7
Rumex occidentalis (western dock)	3	0 - 3	4	3
Rumex triangulivalvis (narrow-leaved dock)	2	0 - 3	4	3
Salsola kali (Russian-thistle)	12	0 - 20	4	7
Smilacina stellata (star-flowered Solomon's-seal)	5	0 - 10	4	4
Solidago canadensis (Canada goldenrod)	15	0 - 60	13	14
Solidago spp. (goldenrod)	2	0 - 3	4	3
Solidago gigantea (late goldenrod)	5	0 - 10	6	5
Solidago missouriensis (low goldenrod)	2	0 - 3	4	3
Solidago rigida (stiff goldenrod)	3	0 - 3	2	2
Sonchus arvensis (perennial sow-thistle)	10	0 - 20	10	10
Sonchus asper (prickly annual sow-thistle)	20	0 - 40	4	9
Sonchus spp. (sow-thistle)	1	0 - 1	4	2
Stachys palustris (marsh hedge-nettle)	2	0 - 3	6	3
Taraxacum officinale (common dandelion)	1	0 - 3	12	3
Thalictrum dasycarpum (tall meadow rue)	1	0 - 1	4	2
Thlaspi arvense (stinkweed)	1	0 - 1	2	1
Tragopogon dubius (common goat's-beard)	1	0 - 1	2	1

Table 34. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 10 sampled stands of the *Salix lutea* (yellow willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trifolium repens (white clover)	2	0 - 3	4	3
Typha latifolia (common cattail)	7	0 - 10	4	5
Urtica dioica (common nettle)	1	0 - 3	10	3
Vicia americana (wild vetch)	12	0 - 20	4	7
Xanthium strumarium (cocklebur)	2	0 - 3	10	4
Ferns and Allies				
Equisetum arvense (common horsetail)	12	0 – 30	15	13

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

If browsing pressure is heavy, willow cover will decrease, resulting in more open communities. Grazing pressure by livestock will cause a decrease in the more desirable grasses such as *Agropyron trachycaulum* (slender wheat grass) with a corresponding increase in introduced or less desirable species such as *Poa pratensis* (Kentucky bluegrass), *Bromus inermis* (smooth brome), or *Cirsium arvense* (Canada thistle).

SOILS

These soils are either Regosols or Chernozems ranging in texture from silt loam to clay and are saturated early in spring, often remaining moist throughout the growing season.

ADJACENT COMMUNITIES

Adjacent wetter sites may be dominated by the *Salix exigua* (sandbar willow) community type, the *Juncus balticus* (wire rush) community type, *Scirpus pungens* (three-square rush) habitat type, or open water. Drier sites may support a variety of types including the *Populus deltoides* dominated community types, or the *Symphoricarpos occidentalis* (buckbrush) community type.

MANAGEMENT INFORMATION

Livestock

Because forage production is high, the *Salix lutea* (yellow willow) community type may be an important source of summer forage. Foliage is most palatable when young, but wet conditions early in the grazing season may limit use by livestock. Due to the high forage production and highly palatable grasses, many of these sites receive heavy summer and fall use, especially after uplands have been grazed or become dried. Under season-long grazing, more desirable grasses may be replaced by *Poa pratensis* (Kentucky bluegrass) or *Bromus inermis* (smooth brome). To maintain vigor and prevent damage to soils and vegetation, grazing should be deferred until soils dry and limited to levels ranging from light to moderate.

Overuse by livestock will result in a reduced vigor by the willows present, as indicated by highlining, clubbing, or dead willow clumps. With continued overuse, willows show a sharp decline in vigor and may be eliminated from the site.

To minimize undesired changes in community composition and structure, pasture management should be keyed on the forage available from, and physical

conditions in this type and stands of other riparian or wetland communities. Use of this concept (of the riparian or wetland pasture) has led to some success in maintaining or improving the health of riparian or wetland vegetation (Kinch 1987).

Frisina (1991) states that for a grazing program to be successful, it must meet the basic biological requirements of the plants present. These are photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed. It is during the long growing season rest periods that these essential biological processes of food production and storage, reproduction, and seedling establishment occur. In some instances, additional periods of rest may be required to improve or maintain a plant community.

Wildlife

Wild ungulates use the *Salix lutea* (yellow willow) community type for summer and winter forage. Winter elk use may be heavy (Gaffney 1941). Dense stands provide excellent thermal and hiding cover for many wildlife species.

Beaver perform a vital role in the health and maintenance of riparian ecosystems. Beaver dams assist in controlling the channel downcutting, bank erosion, and sediment loading (Gordon and others 1992). When beaver construct a dam, they raise the water table in the vicinity, providing water for hydrophytic species such as willows and sedges. The beaver dam also slows down flow of the water, which allows suspended sediment to be deposited behind the dam. The combined effect of sediment deposition and plant production is to create a wetland environment excellent for waterfowl and fish habitat. The policy of land managers has often been to trap and kill beaver. Beaver populations may require regulation, but because these animals produce such desirable habitat and provide so many beneficial stream functions, their removal from a riparian system should be considered carefully.

Fisheries

Where adjacent to streams, the *Salix lutea* (yellow willow) community type effectively stabilizes soils, forms overhanging canopies for shading the channel, and stabilizes undercut banks, enhancing fish habitat. The importance of willows in streambank protection, cover, and thermal protection for fisheries cannot be over emphasized. The herbaceous understory serves to filter sediments during high flows, thereby contributing to building of streambanks.

Fire

Prescribed burning in the *Salix lutea* (yellow willow) community type is an effective method of rejuvenating decadent clumps. The willow species most often present in this type sprout vigorously following fire, especially in wetter stands. Quick, hot fires result in more sprouts than slower fires, which tend to be more damaging to willows, and to result in fewer sprouts.

After burning, the site should be protected from livestock grazing for at least 2 to 3 years to avoid damaging the young, palatable regrowth.

Soil Management and Rehabilitation Opportunities

Soils on the *Salix lutea* (yellow willow) community type are easily damaged from trampling by livestock if grazed when moist. This disturbance often leads to compaction, streambank sloughing, damage to vegetation, and premature drying of the soil surface. Woody species provide the best streambank protection. Herbaceous species rarely afford sufficient stream bank protection to any but the smallest streams. Management should emphasize the importance of willows in protecting the streambank.

Salix lutea (yellow willow) is useful in streambank stabilization and revegetation projects (Platts and others 1987). Cuttings should be rooted and grown in a nursery to insure best chance for survival. *Salix lutea* produces an abundance of roots, mostly along the lower one-third of the cut stem. Cuttings are best taken in the spring from two to four year old dormant wood. Cuttings 30-50 cm (12-20 in) long and >1 cm (0.5 in) in diameter produce best results. Shoots from cuttings can be expected to appear 10 days after planting.

Recreational Uses and Considerations

Recreational opportunities are limited because of the small size of these stands and the high density of *Salix lutea* (yellow willow). These areas are frequently flooded, making necessary additional consideration when planning roads, campsites, or any activities involving permanent or semipermanent investments.

OTHER STUDIES

Hansen and others (1995) described a *Salix lutea* (yellow willow) community type for Montana. Youngblood and others (1985b) identified a *Salix lutea* (yellow willow) community type in eastern Idaho and western Wyoming.

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

SALIPET/CAREATH

Number of Stands Sampled = 12

Number of Stands Sampled in Alberta = 5

LOCATION AND ASSOCIATED LANDFORMS

The *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type is a major type in the Central Parkland Subregion, and a minor to incidental type in all remaining portions of the study area, except for the Mixedgrass and Dry Mixedgrass Subregions. It occurs around sloughs, depressional wetlands, and wet meadows, typically in a narrow band, or ring, defining a particular moisture position between open water and/or sedges and the drier *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type. This type once occupied far more areas before the Parkland Ecoregion was developed agriculturally.

VEGETATION

This type is dominated by a dense, closed canopy of *Salix petiolaris* (basket willow) over a sparse understory that includes *Carex atherodes* (awned sedge) (Table 35). Stands may include small amounts of other shrubs, but undisturbed stands have little shrub presence other than the *Salix petiolaris*. This type occupies the wettest sites that support shrub growth around slough and pothole wetlands. It occurs adjacent to and just upslope from wetter, open *Carex atherodes* stands.

Table 35. Average canopy cover, range of canopy cover, and constancy for species recorded in 7 late seral to climax 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				
Cornus stolonifera (red-osier dogwood)	2	0-3	29	8
Salix bebbiana (beaked willow)	3	0-3	14	6
Salix petiolaris (basket willow)	96	90-98	100	98
Graminoids				
Bromus inermis (smooth brome)	1	0-1	14	4
Carex atherodes (awned sedge)	24	3-60	100	49
Carex petasata (pasture sedge)	3	0-3	14	6
Carex utriculata (beaked sedge)	1	0-1	14	4
Unknown grass	1	0-1	29	5
Phalaris arundinacea (reed canary grass)	1	0-1	14	4
Poa palustris (fowl bluegrass)	12	0-20	29	19
Forbs				
Aster hesperius (western willow aster)	1	0-1	14	4
Cirsium arvense (Canada thistle)	1	0-1	43	7
Geum macrophyllum (large-leaved yellow avens)	1	0-1	14	4
Mentha arvensis (wild mint)	2	0-3	29	8
Polygonum coccineum (water smartweed)	3	0-3	14	6
Potentilla norvegica (rough cinquefoil)	1	0-1	14	4
Rumex occidentalis (western dock)	1	0-1	14	4
Scutellaria galericulata (marsh skullcap)	1	0-1	14	4
Sonchus arvensis (perennial sow-thistle)	3	0-3	29	9

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type is a very densely growing community of many-stemmed, fast growing, and short-lived willows. Undisturbed older stands of *Salix petiolaris* have about equal components of dead stems and young replacement stems. We believe this willow to be a pioneer species able to colonize suitable sites and perpetuate a stand as long as conditions remain suitable. The clonal nature of these stands allows them to shift topographic position in response to slow changes in moisture regime, such as the gradual filling of a slough during its evolutionary process. Figure 15 is a general schematic of the successional pathway followed on sites of this type.

Livestock and wild ungulates readily browse these stands, but have difficulty penetrating them. Therefore, disturbance by these agents is generally 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 *Bromus inermis* (smooth brome), *Cirsium arvense* (Canada thistle), and *Solidago canadensis* (Canada goldenrod) (Table 36). Ultimately, continued severe browsing pressure will open

the stand and replace the *Carex atherodes* (awned sedge) with the disturbance-related, and drier, herbaceous species.

The soils of the Parkland Ecoregion uplands are extremely valuable for farming; therefore, many of the sloughs, with their associated woody vegetation, have not been much affected by grazing. The greatest effects on these sites from surrounding agricultural practice is drainage and clearing for tillage, increased sedimentation, and accelerated accumulation of agricultural chemicals from the adjacent farmed land.

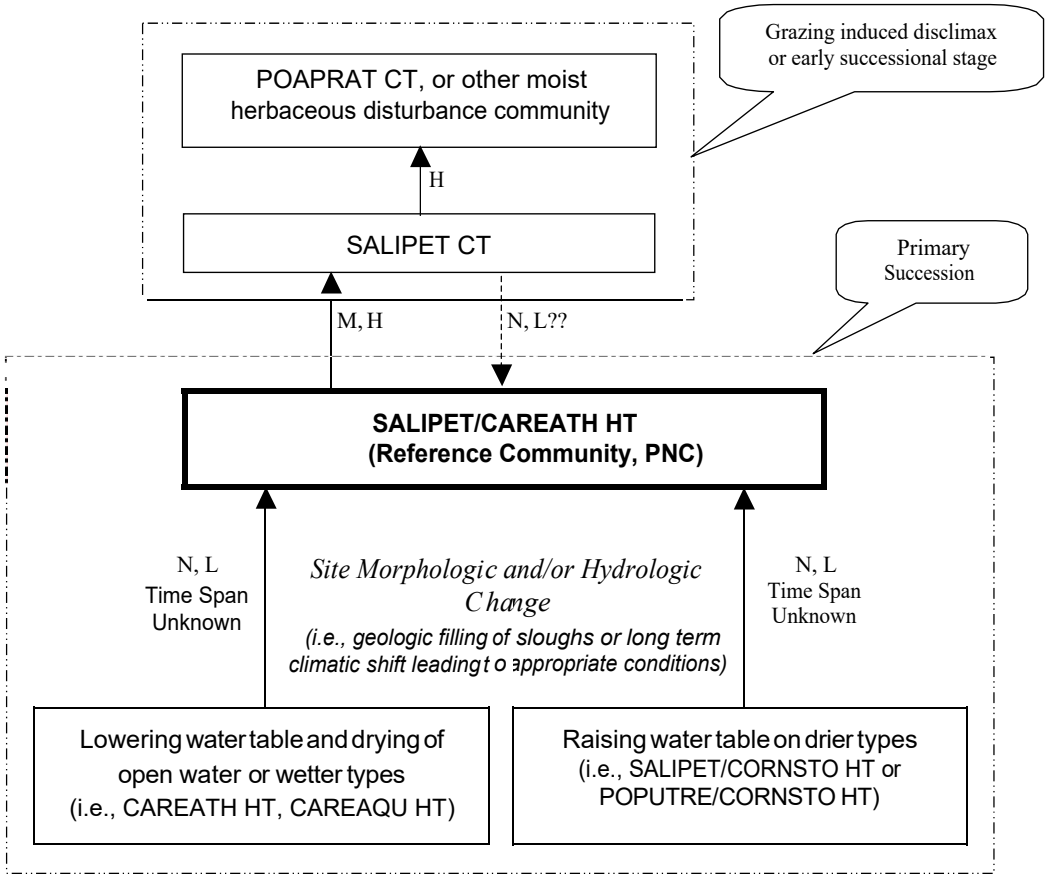
SOILS

Soils are commonly dark brown to black Chernozems, but can intergrade to soils of the Organic order under conditions favorable for organic matter accumulation. Soil textures vary from clay loam to sandy loam. Water tables are usually within 1 m (39 in) of the soil surface throughout summer. Redoximorphic features (mottles or gleyed soil) are common within 1 m (39 in) of the soil surface on sites of this type.

ADJACENT COMMUNITIES

Adjacent wetter sites may support either the *Carex atherodes* (awned sedge) habitat type, any of several other emergent herbaceous types, or be open water. Adjacent drier sites may support the *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type, the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) community type, or the *Salix petiolaris* (basket willow) community type. Other communities on adjacent drier sites may include the *Bromus inermis* (smooth brome) community type, the *Agrostis stolonifera* (redtop) community type, or developed agricultural land.

Figure 15. SALIPET/CAREATH HT



Successional Pathway Diagram of SALIPET Sites in the Southern Alberta Grasslands
Reference Community = SALIPET/CAREATH HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
SALIPET/CORNSTO HT	*Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) Habitat Type
SALIPET/CAREATH HT	*Salix petiolaris/Carex atherodes* (basket willow/awned sedge) Habitat Type
POPUTRE/CORNSTO HT	*Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) Habitat Type
SALIPET CT	*Salix petiolaris* (basket willow) Community Type
CAREATH HT	*Carex atherodes* (awned sedge) Habitat Type
CAREAQU HT	*Carex aquatilis* (water sedge) Habitat Type
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic potential does not change. Such hydrologic change could be the drainage of the wetland for agriculture, or the reduction of overstory canopy. The time span is unknown for the stand to become dominated under undisturbed conditions by at least 50 percent cover of climax (or overstory indicator) species.

Table 36. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of 5 early seral or disturbed 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	40	9
Cornus stolonifera (red-osier dogwood)	15	0 - 20	40	24
Ribes oxyacanthoides (northern gooseberry)	2	0 - 3	40	9
Ribes spp. (currant)	1	0 - 1	20	4
Rosa spp. (rose)	4	0 - 10	60	15
Rubus arcticus (dwarf raspberry)	3	0 - 3	20	8
Salix bebbiana (beaked willow)	3	0 - 3	20	8
Salix lutea (yellow willow)	1	0 - 1	20	4
Salix petiolaris (basket willow)	81	50 - 98	100	90
Salix planifolia (flat-leaved willow)	3	0 - 3	40	11
Symphoricarpos occidentalis (buckbrush)	3	0 - 3	20	8
Graminoids				
Agropyron smithii (western wheat grass)	1	0 - 1	20	4
Agrostis stolonifera (redtop)	5	0 - 10	60	17
Alopecurus occidentalis (alpine foxtail)	10	0 - 10	20	14
Bromus inermis (smooth brome)	20	0 - 20	20	20
Carex aquatilis (water sedge)	10	0 - 10	20	14
Carex atherodes (awned sedge)	18	0 - 40	60	33
Carex prairea (prairie sedge)	20	0 - 20	20	20
Carex utriculata (beaked sedge)	7	0 - 10	40	17
Festuca saximontana (Rocky Mountain fescue)	3	0 - 3	20	8
Poa palustris (fowl bluegrass)	5	0 - 10	40	14
Poa pratensis (Kentucky bluegrass)	20	0 - 20	20	20
Scirpus paludosus (prairie bulrush)	1	0 - 1	20	4
Scolochloa festucacea (spangletop)	3	0 - 3	20	8
Forbs				
Achillea millefolium (common yarrow)	1	0 - 1	40	6
Anemone cylindrica (long-fruited anemone)	20	0 - 20	20	20
Artemisia biennis (biennial sagewort)	1	0 - 1	20	4
Aster spp. (aster)	10	0 - 10	20	14
Caltha palustris (marsh-marigold)	10	0 - 10	20	14
Cirsium arvense (Canada thistle)	3	0 - 3	60	13
Cynoglossum officinale (hound's-tongue)	3	0 - 3	20	8
Unknown Forb	1	0 - 1	20	4
Galium boreale (northern bedstraw)	2	0 - 3	40	9
Gentiana affinis (prairie gentian)	1	0 - 1	20	4
Geranium richardsonii (wild white geranium)	1	0 - 1	20	4

Table 36. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of 5 early seral or disturbed stands of the *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Geum macrophyllum (large-leaved yellow avens)	5	0 - 10	40	14
Lathyrus palustris (marsh vetchling)	1	0 - 1	20	4
Medicago lupulina (black medick)	1	0 - 1	20	4
Mentha arvensis (wild mint)	2	0 - 3	60	11
Polygonum coccineum (water smartweed)	1	0 - 1	40	6
Potentilla anserina (silverweed)	7	0 - 10	40	17
Rumex occidentalis (western dock)	3	0 - 3	20	8
Sium suave (water parsnip)	1	0 - 1	20	4
Sonchus arvensis (perennial sow-thistle)	18	0 - 40	60	33
Stachys palustris (marsh hedge-nettle)	1	0 - 1	20	4
Stellaria calycantha (northern stitchwort)	1	0 - 1	20	4
Taraxacum officinale (common dandelion)	1	0 - 3	60	8
Thalictrum venulosum (veiny meadow rue)	1	0 - 1	20	4
Vicia americana (wild vetch)	1	0 - 1	40	6
Unknown Moss (moss)	10	0 - 10	20	14

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

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 willow cover and altering the understory composition by introducing exotic and disturbance-related species.

Wildlife

These dense willow communities, associated with *Carex* (sedge) meadows and topographic 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 willow species occupies a streambank position, it should be protected and promoted. The importance of willows in streambank stabilization, cover, and thermal protection for fisheries cannot be over emphasized.

Fire

At this date, we know little about the response of *Salix petiolaris* (basket willow) to being burned, but suspect that, like most willow species, it readily sprouts from rootstocks after fire that has not burned extremely hot.

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.

OTHER STUDIES

The *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type has not been described by others.

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

SALIPET/CORNSTO

Number of Stands Sampled = 10

Number of Stands Sampled in Alberta = 5

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 and an incidental type in all remaining portions of the study area, except for the Mixedgrass and Dry Mixedgrass Subregions. It occurs around sloughs, depressional wetlands, and wet meadows, typically in a narrow band, or ring, between the wetter *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type and the drier *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) community type. This type once occupied far more sites before the Parkland Ecoregion became developed agriculturally.

VEGETATION

The *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type is often adjacent to and above the slightly wetter *Salix petiolaris/Carex atherodes* (basket willow/awned sedge) habitat type. It has a slightly less dense canopy of *Salix petiolaris* and significantly more cover of other shrub species. In an undisturbed state, this type is dominated by a dense canopy of *Salix petiolaris* (basket willow) with *Cornus stolonifera* (red-osier dogwood) and/or other willow species (Table 37). *Salix petiolaris* stands occupy the wettest sites that support shrub growth around slough and pothole wetlands.

Table 37. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 3 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				
Cornus stolonifera (red-osier dogwood)	35	0-50	67	48
Ribes oxyacanthoides (northern gooseberry)	1	0-1	33	6
Rosa spp. (rose)	1	0-1	33	6
Salix bebbiana (beaked willow)	3	0-3	67	14
Salix lutea (yellow willow)	3	0-3	33	10

Table 37. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 3 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]
Salix petiolaris (basket willow)	87	80-90	100	93
Symphoricarpos occidentalis (buckbrush)	20	0-20	33	26
Graminoids				
Bromus inermis (smooth brome)	3	0-3	67	14
Carex atherodes (awned sedge)	2	0-3	67	12
Carex sychnocephala (long-beaked sedge)	3	0-3	33	10
Poa palustris (fowl bluegrass)	1	0-1	33	6
Forbs				
Arnica chamissonis (leafy arnica)	3	0-3	33	10
Epilobium angustifolium (common fireweed)	1	0-1	33	6
Epilobium ciliatum (northern willowherb)	1	0-1	33	6
Unknown forb	1	0-1	33	6
Fragaria virginiana (wild strawberry)	1	0-1	33	6
Galium triflorum (sweet-scented bedstraw)	1	0-1	33	6
Mentha arvensis (wild mint)	1	0-1	33	6
Sonchus spp. (sow-thistle)	2	0-3	67	12
Urtica dioica (common nettle)	1	0-1	33	6

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

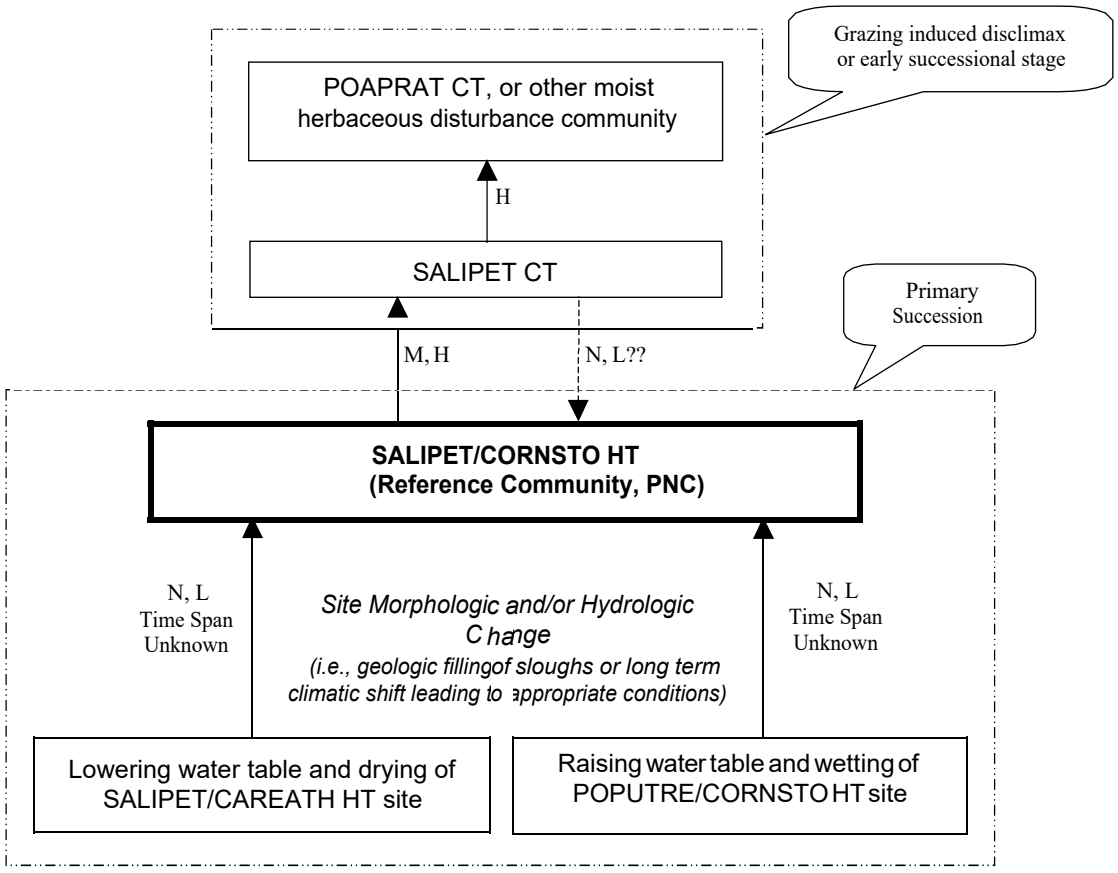
SUCCESSIONAL INFORMATION

The *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type is a densely growing community of many-stemmed, fast growing, and short-lived willows and other shrubs—mostly *Cornus stolonifera*. Undisturbed older stands of *Salix petiolaris* have about equal components of dead stems and young replacement stems. We believe this willow to be a pioneer species able to colonize suitable sites and perpetuate a stand as long as conditions remain suitable. The clonal nature of these stands allows them to shift topographic position in response to slow changes in moisture regime, such as the gradual filling of a slough during its evolutionary process. Figure 16 is a general schematic of the successional pathway followed by sites of this type.

Livestock and wild ungulates readily browse these stands, having the effect of increasing disturbance-related species such as *Rosa* (rose) species, *Symphoricarpos occidentalis* (buckbrush), *Bromus inermis* (smooth brome), *Cirsium arvense* (Canada thistle), and *Solidago canadensis* (Canada goldenrod) (Table 38).

The soils of the Parkland Ecoregion uplands are extremely valuable for farming, therefore many of the sloughs, with their associated woody vegetation, have been unaffected by grazing. The greatest effects on these sites from surrounding agricultural practice is drainage and clearing for tillage, increased sedimentation, and accelerated accumulation of agricultural chemicals from the adjacent farmed land.

Figure 16. SALIPET/CORNSTO HT



Successional Pathway Diagram of SALIPET Sites in the Southern Alberta Grasslands
Reference Community = SALIPET/CAREATH HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
SALIPET/CORNSTO HT	*Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) Habitat Type
SALIPET/CAREATH HT	*Salix petiolaris/Carex atherodes* (basket willow/awned sedge) Habitat Type
POPUTRE/CORNSTO HT	*Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) Habitat Type
SALIPET CT	*Salix petiolaris* (basket willow) Community Type
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic potential does not change. Such hydrologic change could be the drainage of the wetland for agriculture, or the reduction of overstory canopy. The time span is unknown for the stand to become dominated under undisturbed conditions by at least 50 percent cover of climax (or overstory indicator) species.

Table 38. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 early seral or disturbed 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	14	4
Picea glauca (white spruce)	1	0 - 1	14	4
Populus balsamifera (balsam poplar)	1	0 - 1	14	4
Shrubs				
Amelanchier alnifolia (saskatoon)	3	0 - 3	14	6
Betula occidentalis (water birch)	1	0 - 1	14	4
Clematis occidentalis (purple clematis)	3	0 - 3	14	6
Cornus stolonifera (red-osier dogwood)	31	0 - 60	43	37
Elaeagnus commutata (silverberry)	3	0 - 3	14	6
Prunus virginiana (choke cherry)	1	0 - 1	14	4
Ribes oxyacanthoides (northern gooseberry)	3	0 - 3	29	9
Rosa spp. (rose)	19	0 - 70	71	37
Rubus idaeus (wild red raspberry)	15	0 - 30	29	21
Salix bebbiana (beaked willow)	3	0 - 3	29	9
Salix exigua (sandbar willow)	35	0 - 60	29	32
Salix petiolaris (basket willow)	70	20 - 98	100	84
Salix planifolia (flat-leaved willow)	2	0 - 3	29	8
Symphoricarpos occidentalis (buckbrush)	9	0 - 30	57	23
Graminoids				
Agropyron smithii (western wheat grass)	1	0 - 1	14	4
Agrostis stolonifera (redtop)	15	0 - 20	29	21
Agropyron trachycaulum (slender wheat grass)	10	0 - 10	14	12
Bromus inermis (smooth brome)	38	0 - 90	86	57
Calamagrostis canadensis (bluejoint)	10	0 - 10	14	12
Carex bebbii (Bebb's sedge)	1	0 - 1	14	4
Carex praegracilis (graceful sedge)	1	0 - 1	14	4
Carex sprengelii (Sprengel's sedge)	1	0 - 1	14	4
Glyceria striata (fowl manna grass)	1	0 - 1	14	4
Hordeum jubatum (foxtail barley)	1	0 - 1	14	4
Phleum pratense (timothy)	10	0 - 10	14	12
Poa palustris (fowl bluegrass)	15	0 - 20	29	21
Poa pratensis (Kentucky bluegrass)	25	0 - 30	29	27
Forbs				
Achillea millefolium (common yarrow)	3	0 - 3	14	6
Anthemis cotula (mayweed)	3	0 - 3	14	6
Apocynum cannabinum (Indian hemp)	1	0 - 1	14	4
Aster ciliolatus (Lindley's aster)	3	0 - 3	14	6

Table 38. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 early seral or disturbed 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]
Cirsium arvense (Canada thistle)	2	0 - 3	43	9
Delphinium glaucum (tall larkspur)	1	0 - 1	14	4
Epilobium angustifolium (common fireweed)	3	0 - 3	14	6
Fragaria virginiana (wild strawberry)	3	0 - 3	14	6
Galium boreale (northern bedstraw)	1	0 - 1	14	4
Geum aleppicum (yellow avens)	3	0 - 3	29	9
Glycyrrhiza lepidota (wild licorice)	12	0 - 20	29	19
Heracleum lanatum (cow parsnip)	3	0 - 3	14	6
Hieracium umbellatum (narrow-leaved hawkweed)	3	0 - 3	14	6
Melilotus alba (white sweet-clover)	3	0 - 3	14	6
Polygonum coccineum (water smartweed)	10	0 - 10	14	12
Polygonum lapathifolium (pale persicaria)	3	0 - 3	14	6
Potentilla gracilis (graceful cinquefoil)	3	0 - 3	14	6
Potentilla norvegica (rough cinquefoil)	1	0 - 1	14	4
Potentilla palustris (marsh cinquefoil)	1	0 - 1	14	4
Rumex occidentalis (western dock)	2	0 - 3	29	8
Smilacina stellata (star-flowered Solomon's-seal)	1	0 - 1	43	7
Solidago canadensis (Canada goldenrod)	5	0 - 10	71	19
Sonchus arvensis (perennial sow-thistle)	10	0 - 20	29	17
Sonchus spp. (sow-thistle)	10	0 - 10	14	12
Stellaria longifolia (long-leaved chickweed)	1	0 - 1	14	4
Taraxacum officinale (common dandelion)	2	0 - 3	29	8
Thalictrum venulosum (veiny meadow rue)	7	0 - 10	43	17
Thermopsis rhombifolia (golden bean)	1	0 - 1	14	4
Urtica dioica (common nettle)	1	0 - 1	14	4
Vicia americana (wild vetch)	1	0 - 1	29	5
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0 - 1	29	5

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

Soils are commonly dark brown to black Chernozems, but can intergrade to soils of the Organic order under conditions favorable for organic matter accumulation. Soil textures vary from clay loam to sandy loam. Water tables are usually within 1 m (39 in) of the soil surface throughout summer. Redoximorphic features (mottles or gleyed soil) are common within 1 m (39 in) 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) community type, the *Bromus inermis* (smooth brome) community type, the *Agrostis stolonifera* (redtop) community type, or be 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 shrubs, but prolonged use will ultimately damage the community by reducing the woody cover and introducing disturbance-related species.

Wildlife

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

Fire

At this date, we know little about the response of *Salix petiolaris* (basket willow) to being burned, but suspect that, like most willow species, it readily sprouts from the rootstocks after fire that is not extremely hot.

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.

OTHER STUDIES

The *Salix petiolaris/Cornus stolonifera* (basket willow/red-osier dogwood) habitat type has not been described by others.

Salix petiolaris Community Type
(Basket Willow Community Type)

SALIPET

Number of Stands Sampled = 5

Number of Stands Sampled in Alberta = 2

LOCATION AND ASSOCIATED LANDFORMS

The *Salix petiolaris/*(basket willow) community type is a minor to incidental type in the Parkland and Foothills Natural Regions and the Northern and Foothills Fescue Subregions of the Grassland Natural Region. It occurs around sloughs, depressional wetlands, and wet meadows, typically in a narrow band, or ring, between wetter emergent herbaceous types, such as the *Carex atherodes* (awned sedge) habitat type, and the drier *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) community type. The frequency of occurrence on the landscape is greater than may be indicated by the small sample size.

VEGETATION

This type represents a disturbance-induced disclimax, usually from 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 opened by disturbance, resulting in a reduction of the dense tall shrub canopy and in an increase in disturbance related increaser species, such as *Rosa* (rose) species, *Sonchus arvensis* (perennial sow-thistle), *Bromus inermis* (smooth brome), *Cirsium arvense* (Canada thistle), and *Poa pratensis* (Kentucky bluegrass) (Table 39).

Table 39. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 5 sampled 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 occidentalis (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

Table 39. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 5 sampled stands of the *Salix petiolaris/*(basket willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Bromus inermis (smooth 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

Table 39. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 5 sampled stands of the *Salix petiolaris* (basket willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Triglochin maritima (seaside arrow-grass)	3	0 - 3	20	8
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 Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Salix petiolaris* (basket willow) community type is an early/mid-seral grazing disclimax 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.

SOILS

Soils are commonly dark brown to black Chernozems, but can intergrade to soils of the Organic order under conditions favorable for organic matter accumulation. Soil textures vary from clay loam to sandy loam. Water tables are usually within 1 m (39 in) of the soil surface throughout summer. Redoximorphic features (mottles or gleyed soil) are common within 1 m (39 in) 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) community type or the *Bromus inermis* (smooth brome) community type, the *Agrostis stolonifera* (redtop) community type, or be developed agricultural land.

MANAGEMENT INFORMATION

Livestock

Stands of this type have begun to be opened, allowing for easy livestock access. Forage productivity is also higher, resulting in potentially even heavier utilization, especially as upland vegetation dries. *Poa pratensis* (Kentucky bluegrass) is a palatable and moderately productive grass, especially when soil moisture levels are high, and tolerates a high degree of defoliation.

Overuse by livestock will result in damaged or dead clumps and reduce the vigor of the willows present. With continued overuse, 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 be successful, it must meet the basic biological requirements of the plants such as photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed. It is

during long growing season rest periods that the essential biological processes of food production and storage, reproduction, and seedling establishment take place. In some instances, additional periods of rest may be required to either improve or maintain a plant community.

Wildlife

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

Fire

At this date, we know little about the response of *Salix petiolaris* (basket willow) to being burned, but suspect that, like most willow species, 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* (smooth brome), are usually promoted by fire that does not burn extremely hot (USDA IFSL 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.

OTHER STUDIES

The *Salix petiolaris* (basket willow) community type has not been described by others.

Salix planifolia/Carex utriculata Habitat Type
(Flat-leaved Willow/Beaked Sedge Habitat Type)

SALIPLA/CAREUTR
Number of Stands Sampled = 17
Number of Stands Sampled in Alberta = 13

LOCATION AND ASSOCIATED LANDFORMS

The *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type is a minor type at mid elevations in the Lower Foothills Subregion of southwestern Alberta, and an incidental type in other, more generally moist, parts of the study area outside the Mixedgrass Subregions. The type is associated with meadows adjacent to lakes, streams, and springs. It is also located along broad valley bottoms and wet slopes. The sites are among the wettest sites supporting willows.

VEGETATION

This type is characterized by a moderate to heavy cover of *Salix planifolia* (flat-leaved willow) and a mix of other hydrophytic plants. (Table 40).

Table 40. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 late seral to climax stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Picea glauca (white spruce)	1	0-1	13	4
Shrubs				
Betula glandulosa (bog birch)	1	0-1	13	4
Ribes oxyacanthoides (northern gooseberry)	1	0-1	13	4
Ribes spp. (currant)	1	0-1	13	4
Salix bebbiana (beaked willow)	1	0-1	13	4
Salix boothii (Booth's willow)	1	0-1	13	4
Salix drummondiana (Drummond's willow)	1	0-1	13	4
Salix petiolaris (basket willow)	25	0-50	25	25
Salix planifolia (flat-leaved willow)	43	10-90	100	66
Vaccinium scoparium (grouseberry)	1	0-1	13	4
Graminoids				
Agrostis scabra (rough hair grass)	2	0-3	25	7
Alopecurus occidentalis (alpine foxtail)	10	0-10	13	11
Bromus inermis (smooth brome)	1	0-1	13	4
Calamagrostis canadensis (bluejoint)	35	0-80	50	42
Calamagrostis stricta (narrow reed grass)	1	0-1	13	4
Carex aquatilis (water sedge)	13	0-20	50	25
Carex atherodes (awned sedge)	17	0-40	50	29
Carex lanuginosa (woolly sedge)	1	0-1	13	4
Carex utriculata (beaked sedge)	34	0-90	75	50
Deschampsia cespitosa (tufted hair grass)	1	0-1	13	4
Unknown Grass	3	0-3	13	6
Poa palustris (fowl bluegrass)	1	0-1	13	4
Forbs				
Aster ascendens (western aster)	1	0-1	25	5
Aster laevis (smooth aster)	1	0-1	13	4
Aster subspicatus (leafy-bracted aster)	1	0-1	13	4
Epilobium angustifolium (common fireweed)	1	0-1	13	4
Epilobium ciliatum (northern willowherb)	1	0-1	13	4
Epilobium palustre (marsh willowherb)	3	0-3	13	6
Fragaria virginiana (wild strawberry)	1	0-1	13	4
Galium trifidum (small bedstraw)	2	0-3	25	7
Geum aleppicum (yellow avens)	1	0-1	25	5
Geum macrophyllum (large-leaved yellow avens)	3	0-3	13	6

Table 40. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 late seral to climax stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type

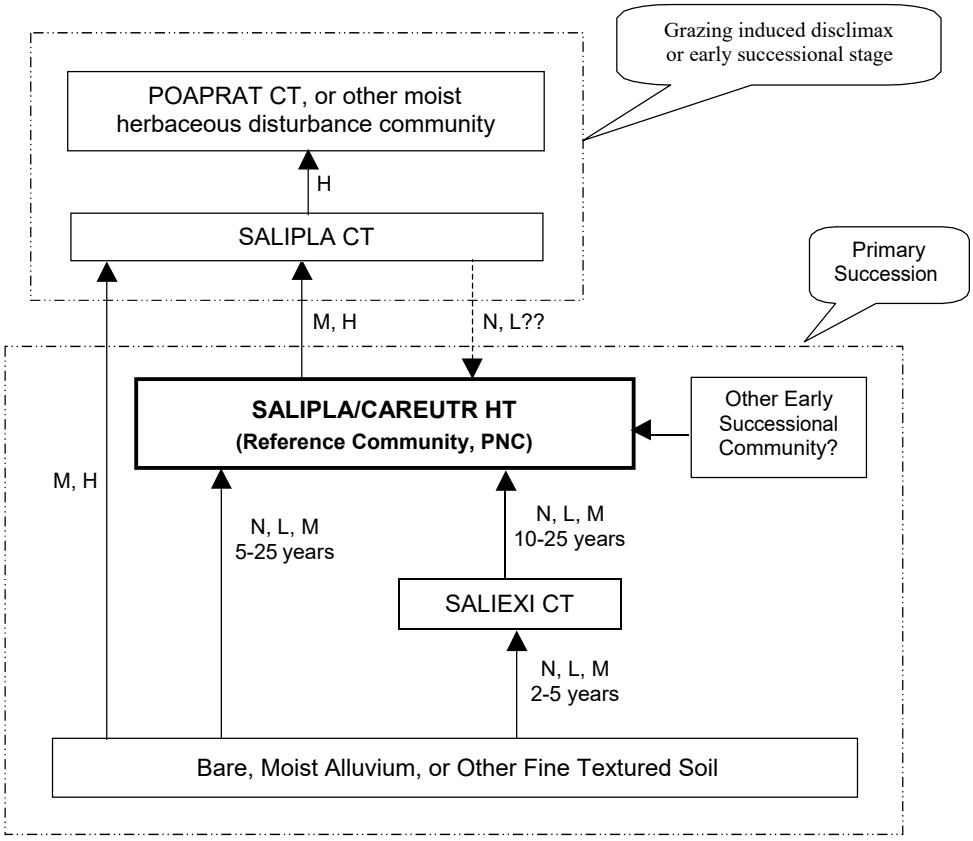
Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Mertensia paniculata (tall lungwort)	1	0-1	13	4
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	13	4
Polygonum lapathifolium (pale persicaria)	1	0-1	13	4
Potentilla gracilis (graceful cinquefoil)	1	0-1	13	4
Potentilla norvegica (rough cinquefoil)	1	0-1	13	4
Potentilla palustris (marsh cinquefoil)	3	0-3	13	6
Pyrola asarifolia (common pink wintergreen)	3	0-3	13	6
Senecio cymbalarioides (ragwort)	1	0-1	13	4
Senecio integerrimus (entire-leaved groundsel)	1	0-1	13	4
Stachys palustris (marsh hedge-nettle)	3	0-3	13	6
Stellaria longipes (long-stalked chickweed)	3	0-3	13	6
Thalictrum venulosum (veiny meadow rue)	1	0-1	13	4
Trifolium repens (white clover)	1	0-1	13	4
Urtica dioica (common nettle)	1	0-1	13	4
Valeriana dioica (northern valerian)	1	0-1	13	4
Ferns and Allies				
Equisetum fluviatile (swamp horsetail)	1	0-1	13	4

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

Moderate disturbance will result in a decrease of *Salix planifolia* (flat-leaved willow) and sedges, and an increase in *Juncus balticus* (Wire rush), *Poa pratensis* (Kentucky bluegrass), and forbs (Table 41). With continued overuse by livestock, the site will dry out, allowing other graminoids and forbs to take over the sites. On heavily disturbed sites adjacent to streams, streambed downcutting may lower the water table, causing the site to become drier and dominated by disturbance-related species. This condition is somewhat uncommon because of the ability of *Carex aquatilis* (water sedge) to reoccupy disturbed sites and because livestock tend to avoid the site when the soils are extremely wet. Water tables can be restored with stream rehabilitation efforts such as loose rock checkdams (Kovalchik 1987). Figure 17 is a general schematic of the successional pathway followed on sites of this type.

Figure 17. SALIPLA/CAREUTR HT



Successional Pathway Diagram of SALIPLA Sites in the Southern Alberta Grasslands
Reference Community = SALIPLA/CAREUTR HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
SALIPLA/CAREUTR HT	*Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) Habitat Type
SALIPLA CT	*Salix planifolia* (flat-leaved willow) Community Type
SALIEXI CT	*Salix exigua* (sandbar willow) Community Type
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type

Note: This diagram does not necessarily represent all possible successional pathways or potential communities for any given site. It is based on the assumption that the hydrologic potential does not change. Such hydrologic change could be a fluvial buildup of the floodplain, resulting in a terrace site too dry to support riparian species, or it could be removal of the overstory canopy by grazing or for agriculture. The time span is estimated for the stand to become dominated under undisturbed conditions by at least 50 percent cover of climax (or overstory indicator) species.

Table 41. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 early seral or disturbed stands of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Trees				
Picea glauca (white spruce)	1	0 - 1	33	6
Populus balsamifera (balsam poplar)	1	0 - 3	33	6
Shrubs				
Betula glandulosa (bog birch)	10	0 - 20	33	18
Rubus arcticus (dwarf raspberry)	3	0 - 3	33	10
Salix bebbiana (beaked willow)	2	0 - 3	67	12
Salix pedicellaris (bog willow)	1	0 - 1	33	6
Salix petiolaris (basket willow)	7	0 - 10	33	15
Salix planifolia (flat-leaved willow)	33	20 - 80	100	57
Salix pseudomonticola (false mountain willow)	4	0 - 10	44	13
Graminoids				
Agrostis scabra (rough hair grass)	2	0 - 3	33	8
Calamagrostis canadensis (bluejoint)	9	0 - 20	56	22
Carex aquatilis (water sedge)	38	0 - 70	44	41
Carex atherodes (awned sedge)	15	0 - 40	33	22
Carex utriculata (beaked sedge)	11	0 - 30	67	27
Poa palustris (fowl bluegrass)	11	0 - 20	33	19
Poa pratensis (Kentucky bluegrass)	8	0 - 20	44	19
Forbs				
Geum aleppicum (yellow avens)	5	0 - 10	33	13
Geum macrophyllum (large-leaved yellow avens)	2	0 - 3	33	8
Petasites sagittatus (arrow-leaved coltsfoot)	1	0 - 3	33	6
Potentilla palustris (marsh cinquefoil)	8	0 - 10	44	19
Rumex occidentalis (western dock)	1	0 - 1	33	6
Scutellaria galericulata (marsh skullcap)	1	0 - 1	33	6
Stellaria longipes (long-stalked chickweed)	1	0 - 1	33	6
Ferns and Allies				
Equisetum arvense (common horsetail)	9	0 – 30	56	22

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

Soils are typically Gleyed Regosols, Gleyed Humic Regosols, or Melanic Brunisols, generally consisting of accumulations of partially decomposed organic material overlying mineral horizons of alluvial sands, silts, and clays and occasionally gravels. The soils are gleyed at or near the upper boundary. Soils are very poorly drained with a high available water holding capacity. The sites typically are permanently saturated and may experience

shallow flooding in the spring and early summer. The rooting zones are generally saturated throughout the short growing season slowing decomposition and favouring the accumulation of additional organic matter. Soil pH is very strongly acid to slightly acid (pH 4.4 to 6.3).

ADJACENT COMMUNITIES

Adjacent wetter communities may include the *Carex utriculata* (beaked sedge), *Carex aquatilis* (water sedge), or the *Eleocharis pauciflora* (few-flowered spike-rush) habitat types, or the open water. Adjacent drier communities may include the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type or the *Picea glauca/Equisetum arvense* (white spruce/common horsetail) habitat type.

MANAGEMENT INFORMATION

Livestock

Estimated herbage production is moderate. Short growing seasons and continually wet soils limit livestock use until late summer and fall. *Carex utriculata* (beaked sedge) is palatable for cattle and horses (Lewis 1958, Hermann 1970). Season long grazing, especially when soils are saturated, will damage plants and soils.

Forage value of *Carex utriculata* (beaked sedge) and *Carex aquatilis* (water sedge) is variable, depending upon season, previous grazing use, and extent of the site. On narrow riparian or wetland sites within extensive rangelands, sedge species are heavily utilized, particularly when upland species are cured, or distribution of the stock is poor.

Myers (1989) found that deferred and rest rotation grazing systems generally favor sedge species over willow species because woody species are vulnerable to longer duration use and to late summer/fall use. Woody species are vulnerable to pruning damage, while sedges are protected by a root reserve. Late summer and fall grazing should be carefully controlled.

Marlow (Pers. Comm. 1995) also feels that fall (October) grazing will have a negative impact on willows due to limited regrowth at the end of the growing season. However, he feels that rest and deferred rotation can have a positive effect on willows when cattle are properly managed. High use by wildlife in the fall can limit the amount of regrowth.

Frisina (1991) states that for a grazing program to be successful, it must allow the site to meet the basic biological requirements of the plants, such as photosynthesis, food storage, reproduction, and seedling establishment. To meet these requirements, long periods of rest are needed. It is during long growing season rest periods that the essential biological processes of food production and storage, reproduction, and seedling establishment occur.

Wildlife

Wildlife use of *Salix planifolia* (flat-leaved willow) may be moderate to heavy. On some sites, heavy winter use by moose has almost eliminated stems near or above the snow surface. However, due to the low stature of *Salix planifolia* (flat-leaved willow), winter use by ungulates is limited by deep snow.

Ungulate use of *Carex utriculata* (beaked sedge) may be moderate (Wing 1969). Waterfowl consume the seeds of sedges and use the wetter sites for nesting and cover.

Beaver perform a vital role in the health and maintenance of riparian ecosystems. Beaver dams assist in controlling the downcutting of channels, bank erosion, and the movement of sediment downstream (Gordon and others

1992). When beavers construct a dam, they raise the water table in the area, which provides water for hydrophytic plants such as willows and sedges. The beaver dam also slows down the water in the channel, which allows suspended sediment to be deposited behind the dam. The combination of sediment deposition and plant reproduction raises the channel bed, creating a wetland environment, which is excellent waterfowl and fish habitat.

Fisheries

The dense network of roots from the various willows and the rhizomatous sedges are effective in stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish. The willows provide valuable overhanging stream cover and shade. The importance of willows in streambank protection, cover, and thermal protection for fisheries cannot be emphasized too strongly.

Bank damage by livestock may be less during late season grazing than earlier when the site is wetter. However, late season grazing may remove valuable cover and shade needed by trout and reduce sediment-filtering capacity during spring runoff.

Fire

The response of *Salix planifolia* (flat-leaved willow) to burning has not been documented, and the degree of resprouting by *Salix planifolia* (flat-leaved willow) is unknown. However, use of this species for revegetation may be practical.

Burning of this type can temporarily increase productivity of *Carex utriculata* (beaked sedge) and *Carex aquatilis* (water sedge). However, nonuse by livestock during the year prior to burning is essential. Residual cover burns well in the spring, prior to the growing season. After burning, the site should be rested from livestock grazing for at least 2 to 3 years to avoid eliminating the young, palatable regrowth. Care should be taken when burning stands along streambanks because of the potential of damage to the excellent erosion protection provided by the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type.

Soil Management and Rehabilitation Opportunities

The *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type is only slightly resistant to trampling by livestock, big game, packstock, and campers. Rutting can be severe when packstock or hiker use occurs on wet soils. This can result in the development of multiple, parallel trails. Off road vehicles cause serious long-term damage. Care should be taken to maintain existing roads to help discourage off road travel. If new trails or roads are to be built, they should be located on the adjacent uplands.

On those sites adjacent to a first or second order stream, the use of rock checkdams to aid in the rehabilitation of degraded (de-watered) sites is an excellent cost effective approach. The rock dam will help raise the water table thereby allowing the willows and sedges to reclaim a degraded site.

Salix planifolia (flat-leaved willow) is valuable in revegetating disturbed streambanks. Cuttings should be first rooted then grown in a nursery to insure survival. 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 (12-20 in) long and >1 cm (0.5 in) in diameter produce the best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting.

Recreational Uses and Considerations

The high subalpine to alpine meadows provide excellent opportunities for viewing moose, and to a lesser degree, elk, deer, and waterfowl. Sites also provide access points for fishing. Heavy human use in the spring and summer can result in damaged soils, bank sloughing, and exposed soils along stream edges.

OTHER STUDIES

Hansen and others (1995) described a *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type at mid to high elevations in the mountains of central and southwestern Montana.

Salix planifolia Community Type
(Flat-leaved Willow Community Type)

SALIPLA

Number of Stands Sampled = 8

Number of Stands Sampled in Alberta = 7

LOCATION AND ASSOCIATED LANDFORMS

The *Salix planifolia* (flat-leaved willow) community type is a minor type at mid elevations in the Lower Foothills Subregion of southwestern Alberta, and an incidental type in other, more generally moist, parts of the study area outside the Mixedgrass Subregions. The type is an early seral, or disturbed, stage of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type associated with meadows adjacent to lakes, streams, and springs. It is also located along broad valley bottoms and wet slopes. The sites are among the wettest sites supporting willows.

VEGETATION

This type is characterized by a moderate to heavy cover of *Salix planifolia* (flat-leaved willow) and a mix of other hydrophytes, predominated by other willows and disturbance related herbaceous species (Table 42).

Table 42. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 8 stands sampled 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	38	6
Picea glauca (white spruce)	1	0-1	38	6
Populus balsamifera (balsam poplar)	2	0-3	25	7
Shrubs				
Betula glandulosa (bog birch)	11	0-20	38	20
Lonicera involucrata (bracted honeysuckle)	2	0-3	25	7
Ribes oxyacanthoides (northern gooseberry)	4	0-10	50	14
Rosa spp. (rose)	1	0-1	63	8
Rubus arcticus (dwarf raspberry)	2	0-3	25	7
Rubus pubescens (dewberry)	2	0-3	25	7

Table 42. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 8 stands sampled of the *Salix planifolia* (flat-leaved willow) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Salix bebbiana (beaked willow)	10	0-20	75	27
Salix myrtillifolia (myrtle-leaved willow)	13	0-20	50	25
Salix petiolaris (basket willow)	13	0-20	38	22
Salix planifolia (flat-leaved willow)	41	20-98	100	64
Salix pseudomonticola (false mountain willow)	7	0-20	63	21
Graminoids				
Bromus ciliatus (fringed brome)	1	0-1	25	5
Carex aquatilis (water sedge)	1	0-3	38	6
Carex atherodes (awned sedge)	1	0-1	38	6
Carex utriculata (beaked sedge)	1	0-3	38	6
Unknown Grass	7	0-10	25	13
Poa palustris (fowl bluegrass)	5	0-10	38	14
Poa pratensis (Kentucky bluegrass)	11	0-40	63	26
Scirpus microcarpus (small-fruited bulrush)	1	0-1	25	5
Forbs				
Angelica arguta (white angelica)	2	0-3	25	7
Aster hesperius (western willow aster)	1	0-1	25	5
Aster subspicatus (leafy-bracted aster)	2	0-3	25	7
Caltha palustris (marsh-marigold)	2	0-3	25	7
Cirsium arvense (Canada thistle)	1	0-1	50	7
Epilobium angustifolium (common fireweed)	2	0-3	25	7
Erigeron philadelphicus (Philadelphia fleabane)	1	0-1	38	6
Fragaria virginiana (wild strawberry)	6	0-10	50	17
Geranium richardsonii (wild white geranium)	2	0-3	25	7
Geum aleppicum (yellow avens)	1	0-1	50	7
Geum macrophyllum (large-leaved yellow avens)	5	0-10	38	14
Habenaria spp. (bog orchid)	1	0-1	38	6
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-3	38	6
Pyrola asarifolia (common pink wintergreen)	3	0-3	25	9
Scutellaria galericulata (marsh skullcap)	1	0-1	38	6
Smilacina stellata (star-flowered Solomon's-seal)	1	0-1	25	5
Taraxacum officinale (common dandelion)	3	0-3	38	11
Urtica dioica (common nettle)	2	0-3	25	7
Vicia americana (wild vetch)	1	0-1	50	7
Ferns and Allies				
Equisetum arvense (common horsetail)	4	0-10	50	14

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Salix planifolia* (flat-leaved willow) community type is an early seral, or disturbed, stage of the *Salix planifolia/Carex utriculata* (flat-leaved willow/beaked sedge) habitat type.

SOILS

Soils are commonly dark brown to black Chernozems, but can intergrade to soils of the Organic order under conditions favorable for organic matter accumulation. Soil textures vary from clay loam to sandy loam. Water tables are usually within 1 m (39 in) of the soil surface throughout summer. Redoximorphic features (mottles or gleyed soil) are common within 1 m (39 in) of the soil surface on sites of this type.

ADJACENT COMMUNITIES

Adjacent wetter sites may support the *Carex utriculata* (beaked sedge) or the *Carex atherodes* (awned sedge) habitat types, or any of several emergent herbaceous types, or be open water. Among the types on adjacent drier sites may be the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type, the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) community type, or developed agricultural land.

MANAGEMENT INFORMATION

Livestock

Stands of this type have begun to be opened, allowing for easy livestock access. Forage productivity is also higher, resulting in potentially even heavier utilization, especially as upland vegetation dries. *Poa pratensis* (Kentucky bluegrass) is a palatable and moderately productive grass, especially when soil moisture levels are high, and tolerates a high degree of defoliation.

Overuse by livestock will result in damaged or dead clumps and reduce the vigor of the willows present. With continued overuse, 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 be successful, it must meet the basic biological requirements of the plants such as photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed. It is during long growing season rest periods that the essential biological processes of food production and storage, reproduction, and seedling establishment take place. In some instances, additional periods of rest may be required to either improve or maintain a plant community.

Wildlife

These dense 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

When any willow species occupies a streambank position, it should be protected and promoted. The importance of willows in streambank stabilization, cover, and thermal protection for fisheries cannot be over emphasized.

Fire

At this date, we know little about the response of *Salix planifolia* (flat-leaved willow) to being burned, but suspect that, like most willow species, 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* (smooth brome), are usually promoted by fire that does not burn extremely hot (USDA IFSL 1995).

Soil Management and Rehabilitation Opportunities

Salix planifolia (flat-leaved 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.

OTHER STUDIES

Hansen and others (1995) described a *Salix planifolia/Carex aquatilis* (flat-leaved willow/water sedge) habitat type at mid to high elevations in the mountains of central and southwestern Montana.

Artemisia cana/Agropyron smithii Habitat Type
(Silver Sagebrush/Western Wheat Grass Habitat Type)

ARTECAN/AGROSMI
Number of Stands Sampled = 43
Number of Stands Sampled in Alberta = 8

CAUTION—Not all sites currently dominated by *Artemisia cana* (silver sagebrush) 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 Landforms section.

LOCATION AND ASSOCIATED LANDFORMS

The *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type occupies nearly level, older alluvial terraces on both broad and narrow floodplains and coalescing alluvial fans in valleys. It is a minor type found in the Dry Mixedgrass Subregion of southern Alberta. This type represents one of the driest of riparian types. Sites are located in deep, loamy, alluvial soils, or where overland flow or soil conditions (fine textured soils), or a combination of both, allow a greater than normal moisture regime. In some situations, fine textured soils have resulted in a perched water table. The *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type has been found to function as a disturbance-caused (disclimax) habitat type where site potential has been altered by prolonged heavy grazing.

VEGETATION

Artemisia cana (silver sagebrush) dominates the shrub layer and *Agropyron smithii* (western wheat grass) dominates the herbaceous layer. *Stipa viridula* (green needlegrass) is important in undisturbed sites (Table 43).

Table 43. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 late seral to climax stands of the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Shrubs				
Artemisia cana (silver sagebrush)	39	3-80	100	62
Atriplex nuttallii (Nuttall's atriplex)	1	0-1	11	3
Juniperus horizontalis (creeping juniper)	1	0-1	11	3
Ribes oxyacanthoides (northern gooseberry)	1	0-1	11	3
Rosa spp. (rose)	3	0-3	11	6
Symphoricarpos occidentalis (buckbrush)	2	0-3	22	7

Table 43. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 late seral to climax stands of the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type

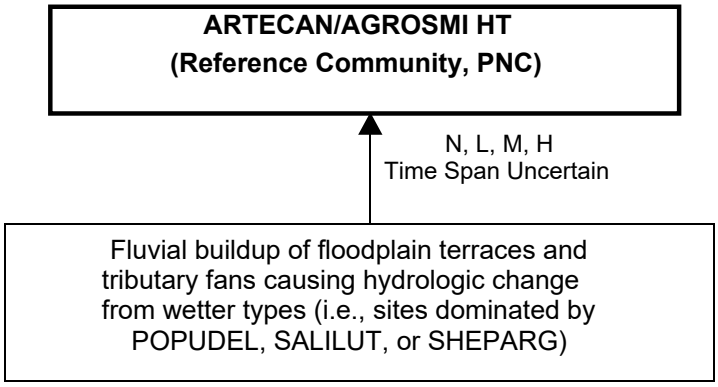
Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Agropyron pectiniforme (crested wheat grass)	1	0-1	11	3
Agropyron repens (quack grass)	1	0-1	11	3
Agropyron smithii (western wheat grass)	68	30-98	100	82
Agropyron trachycaulum (slender wheat grass)	2	0-3	33	8
Bouteloua gracilis (blue grama)	2	0-3	22	7
Bromus japonicus (Japanese chess)	10	0-10	11	10
Calamagrostis montanensis (plains reed grass)	10	0-10	11	10
Calamagrostis stricta (narrow reed grass)	1	0-1	22	5
Distichlis stricta (salt grass)	1	0-1	11	3
Koeleria macrantha (June grass)	5	0-10	33	13
Poa juncifolia (alkali bluegrass)	1	0-1	11	3
Stipa comata (needle-and-thread)	10	0-20	22	15
Stipa viridula (green needle grass)	7	0-30	67	22
Forbs				
Achillea millefolium (common yarrow)	2	0-3	56	11
Artemisia frigida (pasture sagewort)	1	0-3	33	6
Aster ericoides (tufted white prairie aster)	10	0-10	11	10
Chenopodium album (lamb's-quarters)	1	0-1	11	3
Conyza canadensis (Horseweed)	1	0-1	11	3
Erigeron annuus (whitetop)	1	0-1	11	3
Eurotia lanata (winter-fat)	1	0-1	11	3
Grindelia squarrosa (gumweed)	1	0-1	22	5
Gutierrezia sarothrae (broomweed)	1	0-1	11	3
Lactuca pulchella (common blue lettuce)	1	0-1	11	3
Melilotus officinalis (yellow sweet-clover)	1	0-3	33	6
Opuntia polyacantha (prickly-pear)	1	0-1	11	3
Parietaria pensylvanica (American pellitory)	1	0-1	11	3
Ratibida columnifera (prairie coneflower)	1	0-1	11	3
Sisymbrium altissimum (tumbling mustard)	1	0-1	11	3
Solidago canadensis (Canada goldenrod)	1	0-1	11	3
Sphaeralcea coccinea (scarlet mallow)	1	0-1	11	3
Taraxacum officinale (common dandelion)	1	0-1	11	3
Tragopogon dubius (common goat's-beard)	1	0-1	22	5
Vicia americana (wild vetch)	2	0-3	22	7

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

Following disturbance, *Poa pratensis* (Kentucky bluegrass), *Bromus inermis* (smooth brome), *Bouteloua gracilis* (blue grama), *Achillea millefolium* (common yarrow), and *Taraxacum officinale* (common dandelion) increase dramatically. Cover of *Agropyron smithii* (western wheat grass) and *Stipa viridula* (green needlegrass) decreases noticeably. Palatable species remaining in severely overgrazed stands are restricted to areas protected beneath the *Artemisia cana* (silver sagebrush) (Table 44). Figure 18 is a general schematic of the successional pathway followed on sites of this type.

Some sites may currently be dominated by widely spaced, decadent or dying cottonwoods with an understory of*Artemisia cana* (silver sagebrush), *Agropyron smithii* (western wheat grass), and *Symphoricarpos occidentalis* (buckbrush) present. This situation represents a mid/late seral primary successional stage of the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type. The old alluvial terrace supporting the early seral cottonwood community has become drier due to floodplain buildup, channel downcutting, or migration away from the site. Floods no longer reach the site with sufficient frequency or duration to enable repopulation with new cottonwoods.



Successional Pathway Diagram for ARTECAN Sites in Southern Alberta Grasslands
Reference Community = ARTECAN/AGROSMI HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
ARTECAN/AGROSMI HT	*Artemesia cana/Agropyron smithii* (silver sagebrush/western wheat grass) Habitat Type
POPUDEL	*Populus deltoides* (plains cottonwood)
SALILUT	*Salix lutea* (yellow willow)
SHEPARG	*Shepherdia argentea* (thorny buffaloberry)

Note: We are uncertain at this time about what communities may have served to pioneer on sites presently occupied by the ARTECAN/AGROSMI HT. Sites occupied by this type are likely to have progressed through a succession of morphological change, rather than vegetational succession.

Figure 18. ARTECAN/AGROSMI HT

Table 44. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 34 disturbed and/or early to mid-seral stands of the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Shrubs				
Artemisia cana (silver sagebrush)	33	1-60	100	57
Rosa woodsii (common wild rose)	2	0-3	33	8
Symphoricarpos occidentalis (buckbrush)	17	0-60	50	29
Graminoids				
Agropyron smithii (western wheat grass)	48	0-80	94	67
Bromus japonicus (Japanese chess)	21	0-60	26	23
Poa pratensis (Kentucky bluegrass)	25	0-60	38	31
Stipa viridula (green needle grass)	12	0-40	53	25
Forbs				
Achillea millefolium (common yarrow)	5	0-20	47	15
Artemisia frigida (pasture sagewort)	3	0-20	50	12
Vicia americana (wild vetch)	3	0-10	29	9

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

The *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type is very likely the potential for the site, but in some cases may be a grazing induced disclimax on a site that would otherwise have had natural potential for another climax community, such as one dominated by *Salix lutea* (yellow willow).

SOILS

Soils are Chernozems of texture varying little from clay loam to loam. *Artemisia cana* (silver sagebrush) is very tolerant of imperfect drainage, high water tables, and periodic flooding. Overland flows of spring runoff and storms help to recharge the water table. Redox concentrations (mottles) are common, indicating a fluctuating water table. Available water is estimated at moderate. Soil reaction ranges between slightly acidic to moderately alkaline (pH 6.0 to 8.0). Some sites sampled occurred on weakly saline soils.

ADJACENT COMMUNITIES

Adjacent wetter sites may be the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) or the *Agropyron smithii* (western wheat grass) habitat types. In other situations, wetter sites may be dominated by cottonwoods or willows. Adjacent drier sites are dominated by a variety of upland shrub and/or grassland communities.

MANAGEMENT INFORMATION

Livestock

Forage production is moderate to high. Palatability of *Artemisia cana* (silver sagebrush) is rated low for cattle and fair for sheep. However, *Agropyron smithii* (western wheat grass) is highly desired by livestock. *Agropyron smithii* is palatable and nutritious when green in the spring, and moderately so during other times of the year (Johnson and Nichols 1982). Vigorous rhizomes make *Agropyron smithii* (western wheat grass) one of the more tolerant of the desirable and abundant grasses to

drought and grazing pressure. However, overgrazing in May and June will decrease it. When growing conditions improve, such as following drought or overgrazing, this species may rapidly recolonize areas previously occupied.

Winter use of *Artemisia cana* by all types of grazing animals may be especially heavy when snow covers lower growing vegetation. Many sites of this type are used as winter feeding ground for livestock due to low elevation and the availability of water (e.g. springs, streams, etc.).

Herbicides have been effective in eliminating *Artemisia cana* and releasing the various grass species if applied when *Artemisia cana* is phenologically active. If grazing has eliminated the more desirable grasses, less desirable forbs may increase.

Wildlife

Palatability of *Artemisia cana* (silver sagebrush) is rated good for deer, elk, and antelope, especially in winter when snow covers lower growing vegetation. However, *Agropyron smithii* (western wheat grass) is highly desired by wildlife such as deer and antelope. *Agropyron smithii* (western wheat grass) is highly palatable and nutritious when green in the spring, and moderately so during other times of the year (Johnson and Nichols 1982).

The moderate degree of structural diversity of the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type provides thermal and hiding cover for big game and is important winter habitat for antelope. Therefore, heavy grazing pressure by livestock in this habitat type may have serious consequences for those wildlife species.

The *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type provides food and nesting cover for the sage grouse. The type has been identified as critically important habitat to the survival of this upland game bird, a species at risk in Alberta and Saskatchewan (Bristol 2000). This type also is utilized by many migratory songbirds, including the sage thrasher, another species at risk. This type also provides important foraging ground for burrowing owls and other open area raptors (Bristol 2000).

Fire

Artemisia cana (silver sagebrush) usually sprouts vigorously from root suckers following spring burns, with associated temporary increases in cover of palatable grasses (White and Currie 1982). Fall burns typically have higher shrub mortality and reduced vigor of *Artemisia cana* sprouts.

Agropyron smithii (western wheat grass) has a good tolerance to fire when in dormant state. It usually survives a fire during the growing season, but recovery may be delayed (Wasser 1982).

Soil Management and Rehabilitation Opportunities

Artemisia cana (silver sagebrush) may be useful in revegetating some degraded wetland sites. It is well adapted to newly exposed soils and tolerates short periods of flooding. *Artemisia cana* is used in seed mixtures for big game range restoration, highway right-of-way stabilization, beautification, and in mine reclamation work (Wasser 1982). Establishment is through direct seeding or the use of seedlings. Seedling success rates are typically high and growth rates are rapid. It is important to reduce competition by preparing a seedbed and to reduce animal stocking and weed competition during seedling establishment. Established plants provide a fair degree of soil stability.

Agropyron smithii (western wheat grass) is potentially valuable for revegetating disturbed or degraded wetland sites of appropriate type. Use of transplants will speed recovery, as seedlings are typically slow growing. However, once established, plants will quickly spread by rhizomes.

Recreational Uses and Considerations

Recreational potential is excellent for both big game and upland bird hunting. Sites may offer excellent opportunities for campsites or nature trails, if soils do not have much clay.

OTHER STUDIES

An *Artemisia cana* community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan. The *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type is also described by Hansen and others (1995) for the Great Plains portion of Montana. That work is an expanded description of the *Artemisia cana/Agropyron smithii* habitat type defined by Hansen and others (1984) and by Hansen and Hoffman (1988) in the region surrounding the common corners of western North and South Dakota, and eastern Montana and Wyoming. Similar types have been described for the northern Great Plains by Hanson and Whitman (1938), Mackie (1970), and Jorgensen (1979). Michalsky and others (1994) describe a Sagebrush-Western Wheatgrass- Prickly Pear Cactus vegetation type on the Grasslands National Park in extreme southern Saskatchewan.

Betula occidentalis Community Type
(Water Birch Community Type)

BETUOCC

Number of Stands Sampled = 22

Number of Stands Sampled in Alberta = 10

LOCATION AND ASSOCIATED LANDFORMS

The *Betula occidentalis* (water birch) community type is a minor to incidental type at low elevations in southern Alberta. Stands occupy alluvial terraces, streambanks, abandoned channels on river floodplains, moist areas around springs and seeps along valley toe slopes, sand dune areas, and around seeps on steep valley walls.

VEGETATION

Betula occidentalis dominates an almost closed overstory canopy of tall shrubs in this community type, usually including *Cornus stolonifera* (red-osier dogwood) and *Amelanchier alnifolia* (saskatoon). A diverse mixture of disturbance-related herbaceous species tends to dominate the lowest layer of the community type (Table 45).

Table 45. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in the 4 stands sampled of the *Betula occidentalis* (water birch) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Populus x acuminata (lance-leaf cottonwood)	3	0-3	25	9
Populus tremuloides (aspen)	1	0-1	25	5
Amelanchier alnifolia (saskatoon)	8	0-20	75	24
Shrubs				
Betula occidentalis (water birch)	53	40-70	100	73
Clematis ligusticifolia (western clematis)	1	0-3	75	9

Table 45. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in the 4 stands sampled of the *Betula occidentalis* (water birch) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Cornus stolonifera (red-osier dogwood)	21	3-30	100	46
Elaeagnus commutata (silverberry)	1	0-1	25	5
Juniperus communis (ground juniper)	1	0-1	25	5
Juniperus horizontalis (creeping juniper)	40	0-40	25	32
Lonicera tatarica (tatarian honeysuckle)	3	0-3	25	9
Prunus virginiana (choke cherry)	5	3-10	100	22
Ribes oxyacanthoides (northern gooseberry)	3	0-3	25	9
Rosa spp. (rose)	2	1-3	100	14
Salix bebbiana (beaked willow)	3	0-3	25	9
Salix lutea (yellow willow)	3	0-3	25	9
Shepherdia canadensis (thorny buffaloberry)	10	0-10	25	16
Symphoricarpos occidentalis (buckbrush)	11	0-20	75	29
Graminoids				
Agrostis stolonifera (redtop)	3	0-3	25	9
Bromus inermis (smooth brome)	20	0-20	25	22
Unknown Grass	3	0-3	25	9
Poa palustris (fowl bluegrass)	1	0-1	25	5
Poa pratensis (Kentucky bluegrass)	10	0-10	25	16
Forbs				
Achillea millefolium (common yarrow)	1	0-1	25	5
Actaea rubra (red and white baneberry)	1	0-1	25	5
Anemone spp. (anemone)	1	0-1	25	5
Aster laevis (smooth aster)	2	0-3	50	10
Cirsium arvense (Canada thistle)	3	0-3	25	9
Disporum trachycarpum (fairybells)	1	0-1	25	5
Fragaria virginiana (wild strawberry)	1	0-1	75	9
Galium boreale (northern bedstraw)	2	0-3	50	10
Galium triflorum (sweet-scented bedstraw)	3	0-3	25	9
Geranium richardsonii (wild white geranium)	3	0-3	25	9
Geum macrophyllum (large-leaved yellow avens)	1	0-1	25	5
Glycyrrhiza lepidota (wild licorice)	3	0-3	25	9
Lathyrus ochroleucus (cream-colored vetchling)	1	0-1	25	5
Orthilia secunda (one-sided wintergreen)	1	0-1	25	5
Pyrola asarifolia (common pink wintergreen)	3	0-3	25	9
Smilacina stellata (star-flowered Solomon's-seal)	6	1-20	100	24
Solidago canadensis (Canada goldenrod)	2	0-3	50	10
Sonchus spp. (sow-thistle)	1	0-1	25	5
Taraxacum officinale (common dandelion)	1	0-1	25	5

Table 45. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in the 4 stands sampled of the *Betula occidentalis* (water birch) community type that are relatively undisturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Vicia americana (wild vetch)	2	0-3	50	10
Ferns and Allies				
Equisetum arvense (common horsetail)	3	0-3	25	9

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

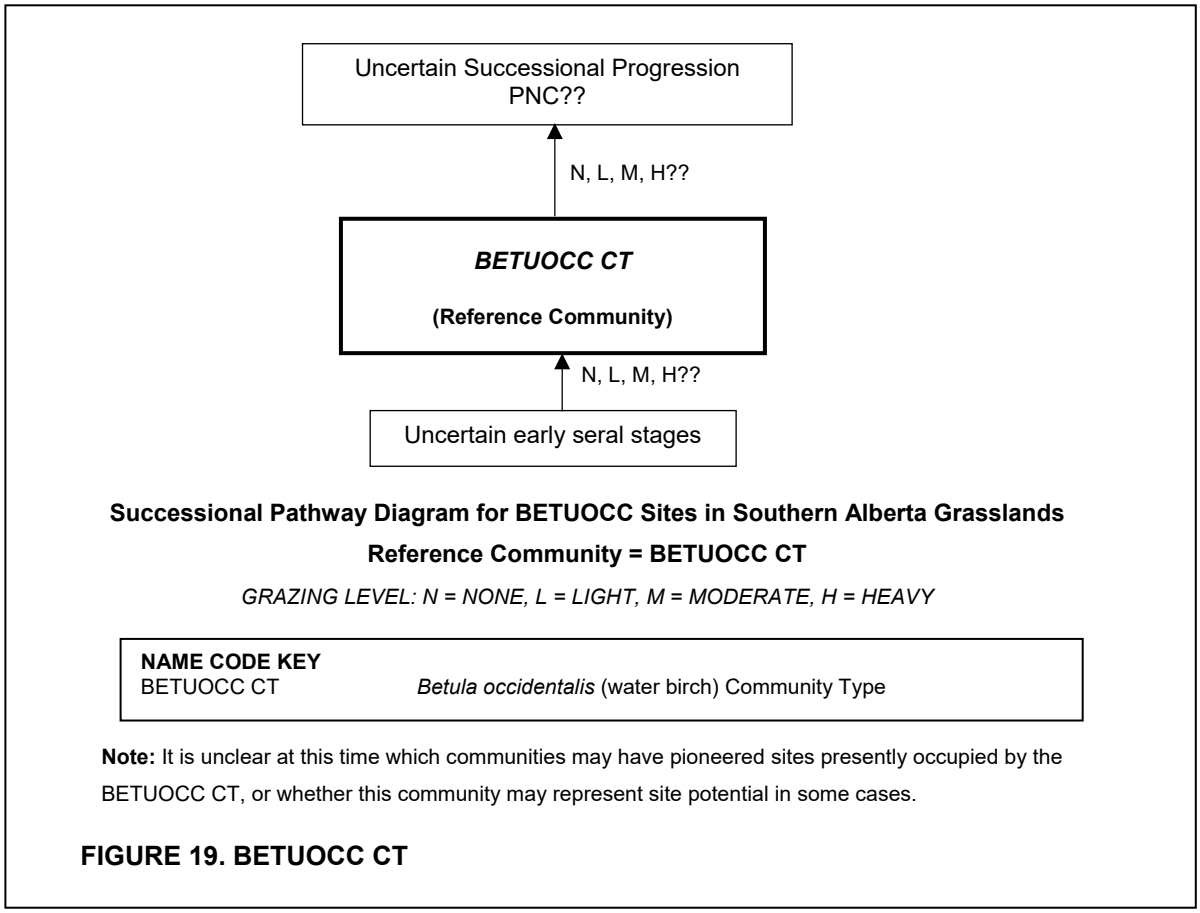


FIGURE 19. BETUOCC CT

SUCCESSIONAL INFORMATION

We believe the *Betula occidentalis* (water birch) community type may on some sites represent a late seral/climax community due to indications of the species' ability to reproduce itself on the site, and due to the lack of other taller late seral species coming into these sites to replace the birch. On several sites, the *Betula occidentalis* was regenerating by new sprouts at a rate to compensate for the amount of dead stems in each clump. Figure 19 is a general schematic of the successional pathway on sites of this type.

Stands are rare of this community in a relatively undisturbed state. Some sites presently dominated by *Betula occidentalis* may be seral to a *Salix lutea* (yellow

willow) type. Large cover of *Cornus stolonifera* (red-osier dogwood) is often associated with the *Betula occidentalis* community type. Although the 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* can not tell us the community on a site is unaltered, but only that it has been free from severe browsing for several years.

Heavy grazing pressures will prevent successful *Betula occidentalis* regeneration, cause reduction or elimination of other desirable shrubs, and cause an increase of disturbance-related herbaceous species (Table 46). This results in reduction of the site to the disturbed stage of the *Betula occidentalis* community type.

Table 46. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 18 stands sampled of the *Betula occidentalis* (water birch) community type that are disturbed by livestock or wildlife

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index [1]
	Average	Range		
Shrubs				
Amelanchier alnifolia (saskatoon)	5	0-10	33	13
Betula occidentalis (water birch)	64	30-98	100	80
Cornus stolonifera (red-osier dogwood)	9	0-40	72	25
Elaeagnus commutata (silverberry)	6	0-20	39	15
Prunus virginiana (choke cherry)	13	0-40	28	19
Ribes oxyacanthoides (northern gooseberry)	2	0-3	33	8
Rosa spp. (rose)	8	0-20	83	26
Salix bebbiana (beaked willow)	3	0-10	39	11
Shepherdia argentea (thorny buffaloberry)	7	0-20	28	14
Symphoricarpos occidentalis (buckbrush)	18	0-60	67	35
Graminoids				
Agrostis stolonifera (redtop)	25	0-60	28	26
Poa pratensis (Kentucky bluegrass)	29	0-80	50	38
Forbs				
Cirsium arvense (Canada thistle)	7	0-20	33	15
Fragaria virginiana (wild strawberry)	6	0-20	28	13
Galium boreale (northern bedstraw)	7	0-20	28	14
Smilacina stellata (star-flowered Solomon's-seal)	7	0-20	83	24
Solidago canadensis (Canada goldenrod)	8	0-20	39	18
Taraxacum officinale (common dandelion)	4	0-10	33	11
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0-3	28	5

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

Disturbance Stages

Betula occidentalis (water birch) is highly adapted to most forms of disturbance. However, heavy grazing may eliminate the more palatable native graminoids, thereby replacing them with introduced species or less palatable native species such as *Symphoricarpos occidentalis* (buckbrush), *Rosa woodsii* (common wild rose), *Poa pratensis* (Kentucky bluegrass), and *Cirsium arvense* (Canada thistle).

SOILS

Soils are most often thin Regosols overlying river cobbles or colluvium. Texture varies from loam to sand with abundant gravel throughout the profile. Water tables remain near the soil surface through out the summer. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment for rapid movement of highly aerated groundwater.

ADJACENT COMMUNITIES

Adjacent wetter communities may include the *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat type or the *Carex atherodes* (awned sedge) habitat type. Drier sites may include a wide variety of types including all three of the *Populus* species*/Cornus stolonifera* (cottonwood/red-osier dogwood) community types, or the shrubs: *Salix lutea* (yellow willow), *Shepherdia argentea* (thorny buffaloberry), *Symphoricarpos occidentalis* (buckbrush), and *Prunus virginiana* (choke cherry).

MANAGEMENT INFORMATION

Livestock

Forage productivity in the *Betula occidentalis* (water birch) community type varies inversely with density of the stand. Dense stands limit livestock use. Herbaceous species such as *Agrostis stolonifera* (redtop) and *Poa pratensis* (Kentucky bluegrass) provide spring forage. *Poa pratensis* is a palatable and moderately productive grass, especially when soil moisture levels are high, and it tolerates a high degree of defoliation. *Poa pratensis* 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 existing tillers or rhizomes. Grazing practice influences the growth form of the species (Volland 1978). A high density of weak tillers of low vigor comes of season-long grazing. Stem densities are emphasized over aboveground biomass. Early season rest increases the vigor of individual plants. Fewer shoots may be produced, but total above ground biomass tends to increase.

Wildlife

Linear stands of *Betula occidentalis* (water birch) provide shade, hiding cover, and secure travel corridors for numerous wildlife species. The species is normally only lightly browsed, but if other woody species are scarce, utilization will occur. Its structural diversity also has high wildlife habitat value, especially for birds (Youngblood and others 1985a).

Fire

Shoots of the thin barked *Betula occidentalis* (water birch) are readily killed by fire, but plants resprout from uninjured basal buds. *Poa pratensis* (Kentucky bluegrass) is damaged only by a hot, intense fire. Cool burns will have little effect on *Poa pratensis* (Volland and Dell 1981), but spring burns may reduce tiller density (Dix and Smeins 1967). Intense burns during active growing periods can be used to control stands of *Poa pratensis* (Wasser 1982).

Soil Management and Rehabilitation Opportunities

Coarse textured soils and high coarse fragment contents minimize most soil compaction problems. Management should carefully consider maintaining this type because of its excellent streambank stabilization values.

Recreational Uses and Considerations

Recreational value is mostly associated with fisheries in adjacent streams. Access is difficult if stands are very dense. Heavy use may increase bank sloughing.

OTHER STUDIES

A *Betula occidentalis* (water birch) community type is described by Hansen and others (1995) for western Montana. Chadde and others (1988) described a *Betula occidentalis* community type having a variety of undergrowth species. Padgett and others (1989) identified several *Betula occidentalis* community types for Utah. They are *Betula occidentalis/Cornus stolonifera* (water birch/red-osier dogwood), *Betula occidentalis/*Mesic Forb (water birch/Mesic Forb), and *Betula occidentalis/Poa pratensis* (water birch/Kentucky bluegrass) community types.

Cornus stolonifera Community Type
(Red-Osier Dogwood Community Type)

CORNSTO

Number of Stands Sampled = 14

Number of Stands Sampled in Alberta = 8

LOCATION AND ASSOCIATED LANDFORMS

The *Cornus stolonifera* (red-osier dogwood) community type is an incidental type at low to mid elevations throughout Alberta. This community type occurs on moist sites on alluvial benches as small dense thickets, narrow bands, or irregular patches.

VEGETATION

Undisturbed stands dominated by *Cornus stolonifera* community type form dense shrub communities covered by closed canopies of that species (Table 47). When disturbance occurs, stands become more open.

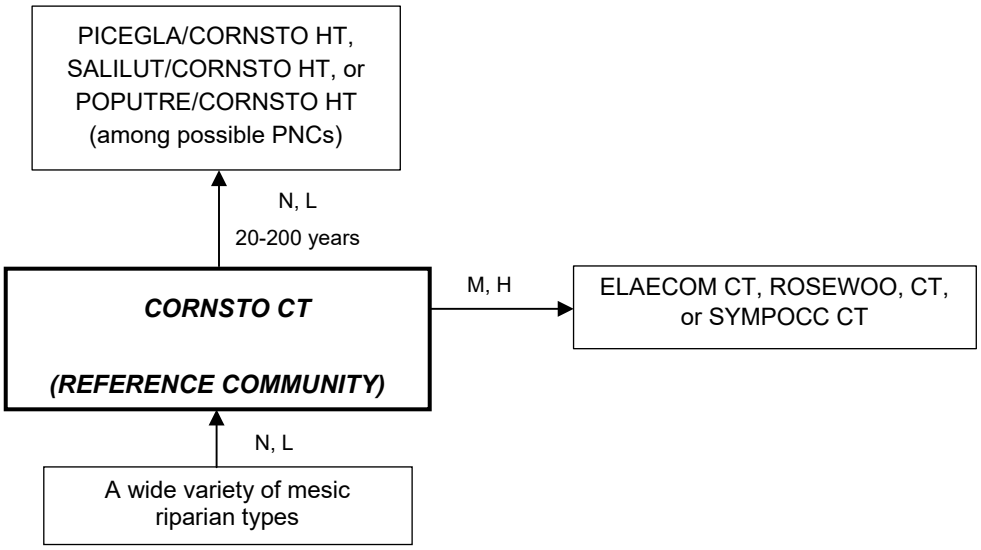
Table 47. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 14 stands sampled of the *Cornus stolonifera* (red-osier dogwood) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Cornus stolonifera (red-osier dogwood)	64	20 - 90	100	80
Elaeagnus commutata (silverberry)	6	0 - 10	29	13
Prunus virginiana (choke cherry)	18	0 - 50	29	23
Rosa spp. (rose)	3	0 - 10	57	13
Salix exigua (sandbar willow)	1	0 - 3	29	5
Symphoricarpos occidentalis (buckbrush)	7	0 - 10	50	19
Graminoids				
Bromus inermis (smooth brome)	11	0 - 20	29	18
Poa palustris (fowl bluegrass)	3	0 - 10	36	10
Forbs				
Cirsium arvense (Canada thistle)	3	0 - 10	43	11

Table 47. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 14 stands sampled of the *Cornus stolonifera* (red-osier dogwood) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Galium triflorum (sweet-scented bedstraw)	2	0 – 10	36	8
Smilacina 278anadens (star-flowered Solomon's-seal)	1	0 – 3	50	7
Solidago 278anadensis (Canada goldenrod)	3	0 – 10	29	9
Urtica dioica (common nettle)	6	0 – 20	36	15

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.



Successional Pathway Diagram for CORNSTO Sites in the Southern Alberta Grasslands

Reference Community = CORNSTO CT

Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
CORNSTO CT	*Cornus stolonifera* (red-osier dogwood) Community Type
POPUBAL/CORNSTO CT	*Populus balsamifera/Cornus stolonifera* (balsam poplar/red-osier dogwood) Community Type
SALILUT/CORNSTO HT	*Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) Habitat Type
PICEGLA/CORNSTO HT	*Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) Habitat Type
SYMPOCC CT	*Symphorocarpos occidentalis* (buckbrush) Community Type

Note: It is unclear at this time which communities may have pioneered sites presently occupied by the CORNSTO CT.

FIGURE 20. CORNSTO CT

SUCCESSIONAL INFORMATION

The *Cornus stolonifera* (red-osier dogwood) community type may represent an early primary successional stage that colonizes stream bars and adjacent floodplains. It seems to be successional to such types as the *Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) habitat type and perhaps also to the *Salix lutea* (yellow willow) or the *Salix bebbiana* (beaked willow) types. Figure 20 is a general schematic of the successional pathway on sites of this type.

With severe grazing/browsing pressure, dense stands of *Cornus stolonifera* will be opened up so that disturbance-related species can invade. *Cornus stolonifera* is a highly preferred browse species for livestock and wild ungulates. Under heavy utilization the *Cornus stolonifera* 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* (smooth brome) taking advantage of the increased sunlight in the opened stand.

Although this species 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* can not tell us the community on a site is unaltered, but only that it has been free from severe browsing for several years.

SOILS

Soils are commonly young Brunisols or Regosols with little or no development. Texture varies little from clay loam to sandy loam with abundant coarse fragments throughout the soil profile. Water tables are usually within 1 m (39 in) of the soil surface throughout summer. Redoximorphic features (mottles or gleyed soil) are common within 1 m (39 in) of the soil surface. Estimated available water ranges from low to moderate. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities may include younger cottonwood community types, *Salix exigua* (sandbar willow), *Carex atherodes* (awned sedge), or open water. Adjacent drier communities may include *Prunus virginiana* (choke cherry), *Rosa* species (rose), *Symphoricarpos occidentalis* (buckbrush) or a variety of upland communities.

MANAGEMENT INFORMATION

Livestock

Forage production is moderate to high. Dense stands may inhibit access by livestock. *Cornus stolonifera* (red-osier dogwood) is highly preferred by livestock and wildlife, and its abundance can be a direct indication of past use levels. In some areas, livestock browsing of *Cornus stolonifera* may be quite high.

Wildlife

Cornus stolonifera (red-osier dogwood) is eaten by moose (Costain 1989) and by deer. Beaver may use it for food and building materials (Allen 1983). The dense stands provide hiding and thermal cover for small mammals and birds.

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.

Fire

Above ground foliage of *Cornus stolonifera* (red-osier dogwood) 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. After a fire, the shrubs sprout from surviving rhizomes or stolons (runners) (Fischer and Bradley 1987). Red-osier

dogwood generally increases following fire, and it may invade a recently burned area from adjacent unburned areas, but it may take some time before resprouting red-osier dogwood regains its former cover and volume. In moist forests of British Columbia, red-osier dogwood appears to increase in abundance following logging and burning (USDA IFSL 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 importance of *Cornus stolonifera* 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, by transplanting rooted cuttings, or nursery grown seedlings. Its rapid growth quickly stabilizes deteriorated streambanks.

Recreational Uses and Considerations

Due to the frequency of flooding, campsites and buildings should be located elsewhere. However, this community type offers good opportunities for viewing wildlife.

OTHER STUDIES

The *Cornus stolonifera* (red-osier dogwood) community type is described by Hansen and others (1995) for western Montana. Youngblood and others (1985b) described two similar community types for eastern Idaho and western Wyoming. Padgett and others (1989) also described a *Cornus stolonifera* community type for Utah and southeastern Idaho.

Crataegus rotundifolia Community Type
(Round-leaved Hawthorn Community Type)

CRATROT

Number of Stands Sampled = 14

Number of Stands Sampled in Alberta = 2

CAUTION—Not all sites currently dominated by *Crataegus rotundifolia* (round-leaved hawthorn) 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 Landforms section.

Note: The *Crataegus rotundifolia* community type includes all combinations of *C. rotundifolia* and *C. douglasii* due to similarities in environmental conditions and management concerns.

LOCATION AND ASSOCIATED LANDFORMS

The *Crataegus rotundifolia* (round-leaved hawthorn) community type is an incidental type on sites disturbed by long term heavy grazing at low to mid elevations primarily in southeastern Alberta. Greatest occurrence is along foothill drainages and valley bottoms in and surrounding the Cypress Hills. The type may be found on

alluvial terraces along streams and rivers throughout the region, or on slopes immediately below a spring or seep.

VEGETATION

The *Crataegus rotundifolia* (round-leaved hawthorn) community type is a grazing disclimax. It tends to develop small, dense thickets that are virtually impenetrable. Communities dominated by *Crataegus rotundifolia* may have sparse understories of *Rosa* species (rose), *Prunus virginiana* (choke cherry), or *Symphoricarpos occidentalis* (buckbrush). Severe, prolonged disturbance can open up these stands from the outer edges, allowing *Rosa* species, *Symphoricarpos occidentalis*, *Bromus inermis* (smooth brome), and *Poa pratensis* (Kentucky bluegrass) to increase (Table 48).

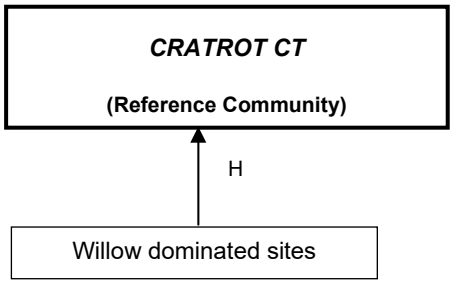
Table 48. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 25 percent or more of the 14 sampled stands of the grazing disclimax *Crataegus rotundifolia* (round-leaved hawthorn) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Amelanchier alnifolia (saskatoon)	2	0 - 3	36	8
Cornus stolonifera (red-osier dogwood)	1	0 - 3	29	5
Crataegus rotundifolia (round-leaved hawthorn)	78	30 - 98	100	88
Prunus virginiana (choke cherry)	13	0 - 30	71	30
Ribes oxyacanthoides (northern gooseberry)	4	0 - 20	43	13
Rosa spp. (rose)	7	0 - 20	79	24
Symphoricarpos occidentalis (buckbrush)	19	0 - 60	93	42
Graminoids				
Agropyron smithii (western wheat grass)	11	0 - 30	29	18
Bromus inermis (smooth brome)	18	0 - 40	36	25
Carex sprengelii (Sprengel's sedge)	20	0 - 40	50	32
Poa pratensis (Kentucky bluegrass)	35	0 - 80	64	47
Forbs				
Galium boreale (northern bedstraw)	6	0 - 20	36	15
Smilacina stellata (star-flowered Solomon's-seal)	3	0 - 10	50	12
Urtica dioica (common nettle)	8	0 - 30	43	19

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Crataegus rotundifolia* (round-leaved hawthorn) community type is a mid-seral grazing disclimax. It may be a seral stage of the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type or a *Salix lutea/Cornus stolonifera* (yellow willow/red-osier dogwood) habitat type. Careful observation of site characteristics and any other remnant woody species can help in the determining site potential. *Crataegus rotundifolia* is a long-lived species that can maintain a long tenure on a site. Figure 21 is a general schematic of the successional pathway followed by sites of this type.



Successional Pathway Diagram for CRATROT Sites in Southern Alberta Grasslands

Reference Community = CRATROT CT

Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY
CRATROT CT *Crataegus rotundifolia* (round-leaved hawthorn) Community Type

Note: We suspect that this species may represent site potential in some cases, while in other cases its dominance appears to be due to grazing disturbance of a SALILUT or SALIBEB community, mostly llimited to the vicinity of the Cypress Hills.

FIGURE 21. CRATROT CT

Severe disturbance leads to large amounts of *Rosa woodsii* (common wild rose), *Symphoricarpos occidentalis* (buckbrush), *Bromus inermis* (smooth brome), and *Poa pratensis* (Kentucky bluegrass).

SOILS

Soils are Regosols and Chernozems. Texture ranges from clay loam to sandy loam. Water tables are generally within 1 m (39 in) of the soil surface during spring runoff or after storm events but can fall below 1 m during dry periods. Flooding durations are usually brief, but the *Crataegus rotundifolia* (round-leaved hawthorn) community type is tolerant of poorly drained soils and prolonged flooding.

ADJACENT COMMUNITIES

Adjacent wetter communities may include cottonwood or willow types, or the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type. Adjacent drier communities are typically dominated by upland communities.

MANAGEMENT INFORMATION

Livestock

Forage production from dense thickets is low. Stands may be so dense as to preclude most livestock use. However, cattle will eat *Crataegus* (hawthorn) foliage within reach, as well as associated herbaceous species. Heavy grazing and browsing pressure will cause an increase in *Rosa woodsii* (common wild rose), *Symphoricarpos occidentalis* (buckbrush), *Bromus inermis* (smooth brome), and *Poa pratensis* (Kentucky bluegrass). Excessive disturbance may cause large areas of exposed soil.

Wildlife

Stands of *Crataegus rotundifolia* (round-leaved hawthorn) community type have a high structural diversity, providing thermal and hiding cover for deer. Trails can be observed in most stands. This community type also supports a rich bird population even during winter. Berries of *Crataegus rotundifolia* dry on the twigs

and supply food for birds and small mammals. The characteristic branching of *Crataegus rotundifolia* is especially good cover and nesting sites for birds such as magpies and thrushes. Upland game birds such as grouse and pheasants frequently use this community type.

Fire

Crataegus rotundifolia (round-leaved hawthorn) is fire tolerant. The species has shallow, much branched rhizomatous roots that will sprout and sucker after removal of above ground stems.

Soil Management and Rehabilitation Opportunities

The sprouting capability of *Crataegus rotundifolia* (round-leaved hawthorn), along with the strongly rhizomatous nature of many of the associated species makes the *Crataegus rotundifolia* community type an excellent soil stabilizer.

Recreational Uses and Considerations

Nature trails will be routed around dense stands of this type. However, *Crataegus rotundifolia* (round-leaved hawthorn) may be valuable for planting as a biological barrier to protect physical structures, fragile natural areas, and to direct foot traffic.

OTHER STUDIES

The *Crataegus rotundifolia* (round-leaved hawthorn) community type has not been described elsewhere. Hansen and others (1995) described a *Crataegus succulenta* (succulent hawthorn) community type for Montana. A *Crataegus chrysocarpa* (fireberry hawthorn) community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan.

Elaeagnus commutata Community Type
(Silverberry Community Type)

ELAECOM
Number of Stands Sampled = 20
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 Landforms section.

LOCATION AND ASSOCIATED LANDFORMS

The *Elaeagnus commutata* (silverberry) community type is a common, major type at low to mid elevations throughout the Grassland Natural Region and a minor to incidental type elsewhere in the study area. It occurs on alluvial floodplain terraces, in V-shaped ravines and swale-like depressions where overland flows provide additional moisture, and on hillsides where seeps or snow accumulations provide the additional moisture.

Elaeagnus commutata occurs in a variety of habitats including forests with *Picea glauca* (white spruce), *Populus tremuloides* (aspen), *Populus* species (poplar and cottonwoods), *Salix* species (willow), as well as in all

subregions of the Grassland Ecoregion. This species is an 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 poor to support trees or taller shrubs.

VEGETATION

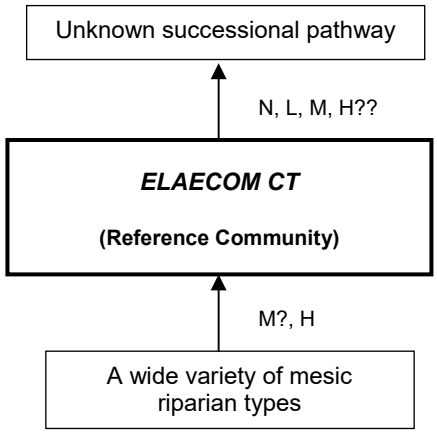
The *Elaeagnus commutata* (silverberry) community type is dominated by a clonal stand of *Elaeagnus commutata* in a dense thicket that tends to enlarge itself by sending up new shoots at the stand periphery. For this reason stands of this type often show a somewhat mounded shape, with taller plants near the centre and younger plants around the edge—much like *Populus tremuloides* (aspen), but usually no more than about 2-3 meters (6-10 feet) tall.

Although *Elaeagnus commutata* is a native species, this community (stands dominated by the species) seems to be strongly associated with disturbance. The species with the greatest constancy associated with *Elaeagnus commutata* are those we consider disturbance-related, such as *Rosa* species (rose), *Symphoricarpos occidentalis* (buckbrush), *Bromus inermis* (smooth brome), and *Poa pratensis* (Kentucky bluegrass) (Table 49).

Table 49. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 25 percent or more of the 20 sampled stands of the *Elaeagnus commutata* (silverberry) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Elaeagnus commutata (silverberry)	58	30 - 98	100	76
Rosa spp. (rose)	13	0 - 40	70	30
Symphoricarpos occidentalis (buckbrush)	16	0 - 30	70	33
Graminoids				
Agropyron trachycaulum (slender wheat grass)	9	0 - 40	25	15
Bromus inermis (smooth brome)	34	0 - 90	70	49
Juncus balticus (wire rush)	14	0 - 20	25	19
Poa pratensis (Kentucky bluegrass)	30	0 - 70	70	46
Stipa viridula (green needle grass)	2	0 - 3	25	7
Forbs				
Achillea millefolium (common yarrow)	4	0 - 10	40	13
Aster ericoides (tufted white prairie aster)	3	0 - 3	35	10
Cirsium arvense (Canada thistle)	7	0 - 20	40	17
Fragaria virginiana (wild strawberry)	3	0 - 10	25	9
Smilacina stellata (star-flowered Solomon's-seal)	3	0 - 10	30	9
Solidago canadensis (Canada goldenrod)	7	0 - 20	30	14
Taraxacum officinale (common dandelion)	5	0 - 10	35	13

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.



Successional Pathway Diagram for ELAECOM Sites in Southern Alberta Grasslands

Reference Community = ELAECOM CT

Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY
ELAECOM CT *Elaegnus commutata* (silverberry) Community Type

Note: The ELAECOM CT on riparian sites seems to result from grazing disturbance to a variety of mesic riparian tree and shrub types. ELAECOM dominates upland sites as well, and it is unclear at this time whether the species represents site potential in some cases.

FIGURE 22. ELAECOM CT

SUCCESSIONAL INFORMATION

The *Elaeagnus commutata* (silverberry) community type is an early seral stage that may in some situations be a grazing disclimax of the *Picea glauca/Cornus stolonifera* (white spruce/red-osier dogwood) habitat type, the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type, or one of the willow types. On other sites, the *Elaeagnus commutata* community type may represent a long-lived community not strongly influenced by grazing pressure. Sites dominated by *Elaeagnus commutata* that do not also have abundant cover of species known to be associated with long term grazing disturbance are exceedingly rare. Figure 22 is a general schematic of the successional pathway followed by sites of this type.

Disturbance Stages

Disturbance-related species such as *Rosa* species (rose), *Symphoricarpos occidentalis* (buckbrush), *Bromus inermis* (smooth brome), and *Poa pratensis* (Kentucky bluegrass) are generally associated with the *Elaeagnus commutata* (silverberry) community type. *Elaeagnus commutata* 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* are rarely impacted negatively by browsing pressure.

SOILS

Soils are quite variable and include Regosols and Chernozems. The *Elaeagnus commutata* (silverberry) community type occurs on virtually all soil textures. This

community type is tolerant of imperfectly drained soils and short duration floods, but is intolerant of prolonged floods and permanent high water tables.

ADJACENT COMMUNITIES

Adjacent wetter communities may include the cottonwood, the *Salix exigua* (sandbar willow), or the *Salix amygdaloides* (peach-leaved willow) community types, the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type, or one of the *Populus tremuloides* (aspen) dominated types. Other adjacent communities may include *Salix lutea* (yellow willow) or *Salix bebbiana* (beaked willow) dominated types, *Prunus virginiana* (choke cherry), or *Symphoricarpos occidentalis* (buckbrush). Adjacent drier communities are typically dominated by upland 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 *Agropyron smithii* (western wheat grass) and *Poa pratensis* (Kentucky bluegrass). The palatability of *Elaeagnus commutata* appears to be very low.

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 palatability of *Elaeagnus commutata* is unknown for deer and elk. The persistent fruits are likely to have some wildlife value.

Fisheries

This community type offers streambank stabilization due to the rhizomatous nature of *Elaeagnus commutata* (silverberry), but otherwise little value for fish or fish habitat.

Fire

Elaeagnus commutata (silverberry) is probably killed by severe fires. *Elaeagnus commutata* 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* may increase after fire, but cover usually decreases and recovers slowly. In the Canadian prairie *Elaeagnus commutata* is listed as a species seriously harmed by spring and fall burns (USDA IFSL 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.

Recreational Uses and Considerations

The recreational value of *Elaeagnus commutata* (silverberry) is minimal beyond the pleasant aroma of the blossoms in the spring.

OTHER STUDIES

An *Elaeagnus commutata* (silverberry) community type is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan. Communities dominated by *Elaeagnus commutata* were identified by Adams and others (1997) on the Suffield Canadian Forces Base.

Prunus virginiana Community Type
(Choke Cherry Community Type)

PRUNVIR

Number of Stands Sampled = 25

Number of Stands Sampled in Alberta = 9

LOCATION AND ASSOCIATED LANDFORMS

The *Prunus virginiana* (choke cherry) community type is a minor type at low to mid elevations along streams, rivers, lakes, and ponds throughout southern Alberta often occupying the driest part of the riparian area or wetland. Stands may also be located on hillsides immediately below a spring or seep. The community type occurs as small dense thickets, narrow bands, or irregular patches.

VEGETATION

Relatively undisturbed stands of the *Prunus virginiana* (choke cherry) community type form dense, monospecific thickets with few other shrubs or understory species associated (Table 50).

Table 50. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 25 sampled stands of the *Prunus virginiana* (choke cherry) community type

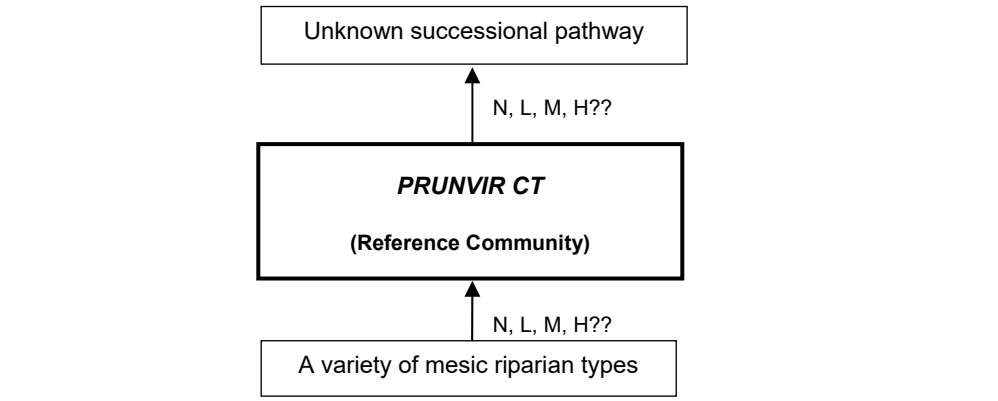
Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Amelanchier alnifolia (saskatoon)	8	0 – 20	44	19
Prunus virginiana (choke cherry)	73	20 – 98	100	85
Ribes oxyacanthoides (northern gooseberry)	3	0 – 10	28	9
Rosa spp. (rose)	5	0 – 10	68	18
Symphoricarpos occidentalis (buckbrush)	14	0 – 50	84	34
Graminoids				
Bromus inermis (smooth brome)	33	0 – 98	44	38
Poa pratensis (Kentucky bluegrass)	8	0 – 40	52	20
Forbs				
Smilacina stellata (star-flowered Solomon's-seal)	4	0 – 20	28	11
Urtica dioica (common nettle)	1	0 – 3	36	6

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

Some stands of the *Prunus virginiana* (choke cherry) community type seem to represent a mid-seral grazing disclimax stage of one of the *Salix bebbiana* (beaked willow) or *Salix lutea* (yellow willow) habitat types, the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type, or the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) community type. These stands tend to be more open with greater cover of disturbance-related species. Increased disturbance of this type leads to increased *Rosa* species (rose), *Symphoricarpos occidentalis* (buckbrush), and *Poa pratensis* (Kentucky bluegrass). Careful observation of site characteristics and remnant plant species will assist in

the determination of site potential. Figure 23 is a general schematic of the successional pathway followed by sites of this type.



Successional Pathway Diagram for PRUNVIR Sites in the Southern Alberta Grasslands

Reference Community = PRUNVIR CT

Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
PRUNVIR CT	*Prunus virginiana* (choke cherry) Community Type

Note: This species may represent site potential in some cases, and some sites dominated by PRUNVIR are upland sites.

FIGURE 23. PRUNVIR CT

SOILS

Soils include Regosols and Chernozems. Texture ranges from silt to sandy loam. The *Prunus virginiana* (choke cherry) community type is most common on well-drained, older, more developed soils that afford good rooting depth and higher fertility. This type can tolerate weak salinity, but cannot tolerate poor drainage and prolonged flooding.

ADJACENT COMMUNITIES

Adjacent wetter communities may include the cottonwood, *Salix exigua* (sandbar willow), *Salix lutea* (yellow willow), or *Salix amygdaloides* (peach-leaved willow) community types, or the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) or *Salix bebbiana/Carex atherodes* (beaked willow/awned sedge) habitat types. Adjacent drier communities typically are the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type, the *Rosa woodsii* (common wild rose) or *Symphoricarpos occidentalis* (buckbrush) community types, or upland communities.

MANAGEMENT INFORMATION

Livestock

In dense, monotypic stands, forage production from the *Prunus virginiana* (choke cherry) community type is low. The palatability of *Prunus virginiana* ranges from poor to fair for both cattle and sheep, although livestock losses due to poisoning sometimes occur. Livestock normally do not eat fatal quantities except

when other forage is scarce (Wasser 1982, Johnson and Nichols 1982). Over the years there has been some debate whether *Prunus virginiana* leaves are poisonous to livestock. The leaves and seeds have sugars that contain cyanide. These cyanide sugars are not directly poisonous, but when the plant material is chewed and digested, enzymes cause the release of hydrogen cyanide (Ode, Pers. Comm. 1987). In high concentrations hydrogen cyanide is a metabolic poison to most animals. It has recently been shown that livestock can acquire the ability to detoxify hydrogen cyanide by consuming small amounts of it over an extended period. Therefore, *Prunus virginiana* will poison livestock only if consumed in large quantity without prior conditioning.

Wildlife

The moderate structural diversity of the *Prunus virginiana* (choke cherry) community type provides thermal and hiding cover for livestock, big game, and upland bird species. *Prunus virginiana* palatability rates fair to good as big game browse. In some instances, dwarfed and thinned communities can result from winter concentration of game animals. As stands open and herbaceous species increase due to disturbance, the forage value for livestock and wildlife increases accordingly. *Prunus virginiana* is moderately tolerant of browsing.

Prunus virginiana is among our most important wildlife food plants. The fruits are relished by birds and mammals. This shrub is rated as one of the best sources of winter browse for deer and elk (Ode Pers. Comm. 1987). This is due to an increased protein content in the stems during fall and winter. Furthermore, the leaves and stems are higher in carbohydrates, calcium, and phosphorus than other native shrubs.

Fisheries

Prunus virginiana (choke cherry) provides excellent thermal cover for fish and for controlling erosion along streams.

Fire

Prunus virginiana (choke cherry) will survive all but a hot, intense fire. The species has an aggressive root system and vigorously sprouts from surviving root crowns after fire (and occasionally from rhizomes). Plant frequencies typically increase on most sites in response to fire. Although aerial portions are readily killed, the majority of plants survive fire due to perennating buds located on root crowns and rhizomes. Generalized information indicates that choke cherry is well adapted to fire when fires occur during plant dormancy and under high soil moisture conditions (USDA IFSL 1995).

Soil Management and Rehabilitation Opportunities

Disturbed areas can be revegetated with *Prunus virginiana* (choke cherry) with nursery-grown stock or rooted cuttings. Adapted to a wide variety of sites, transplant success rates are typically high.

Recreational Uses and Considerations

The fruit of *Prunus virginiana* (choke cherry) is highly regarded for making wine and tasty jelly, but one must harvest ahead of the birds (Johnson and Nichols 1982). Aboriginal people ate the fruit fresh or preserved it by drying. In addition, they combined it with venison and buffalo meat to make mincemeat. They also used the berries for medicinal purposes.

Because of the density of branches, twigs, and heavy foliage, communities dominated by *Prunus virginiana* provide excellent screens in recreation areas. Because of their fruits, they also provide excellent opportunities for viewing a variety of wildlife.

OTHER STUDIES

A *Prunus virginiana* (choke cherry) community type is

described by Hansen and others (1995) for Montana, and a *Prunus virginiana* community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan.

Rosa woodsii Community Type
(Common Wild Rose Community Type)

ROSAWOO

Number of Stands Sampled = 15

Number of Stands Sampled in Alberta = 6

CAUTION—Not all sites currently dominated by *Rosa woodsii* (common wild rose) 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 Landforms section.

Note: The *Rosa woodsii* community type includes all combinations of *Rosa woodsii* and *Rosa acicularis* (prickly rose) due to similarities in environmental conditions and management concerns.

LOCATION AND ASSOCIATED LANDFORMS

The *Rosa woodsii* (common wild rose) community type is a minor type at low to mid elevations in Alberta. It occurs on alluvial terraces along streams and rivers. Stands are also located in V-shaped ravines and swale-like depressions where overland flows provide additional moisture. In other cases stands may be located on hillsides immediately below a spring or seep.

VEGETATION

The *Rosa woodsii* (common wild rose) community type represents a grazing disclimax. It usually forms dense, often impenetrable stands. In some instances, the stands contain only *Rosa* species, while in most cases, stands take on a two-layer appearance. The upper layer is comprised of *Rosa* species. The second layer, which is only slightly shorter than the rose layer, is comprised of dense clones of *Symphoricarpos occidentalis* (buckbrush). Any herbaceous layer is likely to be dominated by *Poa pratensis* (Kentucky bluegrass) (Table 51).

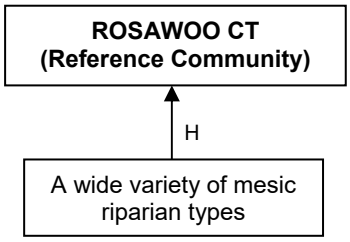
Table 51. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 25 percent or more of the 15 sampled stands of the grazing disclimax *Rosa woodsii* (common wild rose) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Rosa spp. (rose)	58	20 – 90	100	76
Salix exigua (sandbar willow)	5	0 – 20	33	13
Symphoricarpos occidentalis (buckbrush)	35	3 – 80	100	59
Graminoids				
Agropyron repens (quack grass)	3	0-3	33	10

Table 51. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 25 percent or more of the 15 sampled stands of the grazing disclimax *Rosa woodsii* (common wild rose) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Graminoids				
Agropyron smithii (western wheat grass)	7	0 – 20	33	15
Bromus inermis (smooth brome)	16	0 – 40	47	27
Elymus canadensis (Canada wild rye)	2	0 – 3	40	9
Muhlenbergia racemosa (marsh muhly)	2	0 – 3	27	7
Poa pratensis (Kentucky bluegrass)	27	0 – 60	33	30
Forbs				
Glycyrrhiza lepidota (wild licorice)	3	0 – 10	33	10

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.



Successional Pathway Diagram for ROSAWOO Sites in the Southern Alberta Grasslands
Reference Community = ROSAWOO CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY
ROSAWOO CT *Rosa woodsii* (common wild rose) Community Type

Note: The ROSAWOO CT on riparian sites is usually the result of grazing disturbance to any of a variety of mesic riparian tree and shrub types.

Figure 24. ROSAWOO CT

SUCCESSIONAL INFORMATION

In southern Alberta, the *Rosa woodsii* (common wild rose) community type represents a mid-seral grazing disclimax stage of a habitat type dominated by *Salix bebbiana* (beaked willow) or *Salix lutea* (yellow willow), the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type, or the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) community type. Careful observation of site characteristics and remnant plant species will assist in the determining site potential. Figure 24 is a general schematic of the successional pathway followed by sites of this type.

The thorny nature of *Rosa* species 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* (smooth brome), *Poa pratensis* (Kentucky bluegrass), and *Achillea millefolium* (common yarrow) will invade.

SOILS

Soils vary from dry, young Regosols to better developed Chernozems. Texture varies from silt loam to sandy loam. Soils are commonly well drained and nonsaline. *Rosa woodsii* (common wild rose) is intolerant of poor drainage, high water tables, and prolonged flooding (Wasser 1982).

ADJACENT COMMUNITIES

Adjacent wetter communities may include the cottonwood, *Salix exigua* (sandbar willow), or *Salix amygdaloides* (peach-leaved willow) community types, the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) or the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) community types, or a type dominated by *Salix bebbiana* (beaked willow) or *Salix lutea* (yellow willow). Adjacent drier communities are typically dominated by upland species.

MANAGEMENT INFORMATION

Livestock

Forage production from dense thickets of the *Rosa woodsii* (common wild rose) community type is low. Stands may be so dense that they exclude most livestock use. However, the leaves of *Rosa woodsii* are considered fair to good livestock forage, particularly for sheep (Johnson and Nichols 1982).

Wildlife

Stands of the *Rosa woodsii* (common wild rose) community type provide good structural diversity for thermal and hiding cover. Deer and elk may browse heavily on *Rosa woodsii*, and the persistent fruit (hips) provides fall and winter food for birds, small mammals, and bears, which disperse the seeds. *Rosa woodsii* is strongly grazing tolerant but can be dwarfed and thinned by intense browsing or defoliation during season long use.

Fire

Rosa woodsii (common wild rose) is strongly fire tolerant, except for smouldering fires with heavy volumes of surface fuel. The species has a shallow and much branched rhizomatous root system that will readily sprout and sucker. This sprouting capability of *Rosa woodsii* makes it a good soil stabilizer. This is especially important given the severe disturbance common to areas colonized by this community type.

Rosa woodsii is typically top-killed by fire. Root crowns and underground rhizomes survive low- or moderate-severity fires. However, the shallow root crowns are susceptible to injury, and populations consequently decrease following high-severity fire. *Rosa woodsii* is usually favoured by low-severity fire. It can persist after low- to moderate-severity fire because of its ability to sprout from undamaged or buried root crowns and rhizomes (USDA IFSL 1995).

Soil Management and Rehabilitation Opportunities

Rosa woodsii is valuable for revegetating disturbed sites along streambanks and seeps. It is easily established from nursery-grown stock, root cuttings, or transplanted materials.

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 woodsii* is useful for planting in recreation areas as a biological barrier to

protect physical structures, young and delicate plants, or to direct traffic.

OTHER STUDIES

A *Rosa woodsii* (common wild rose) community type is described by Hansen and others (1995) for Montana, and a *Rosa* species community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan. Michalsky and others (1994) describe a Rose-Buckbrush vegetation type on the Grasslands National Park in extreme southern Saskatchewan.

Sarcobatus vermiculatus/Agropyron smithii Habitat Type
(Greasewood/Western Wheat Grass Habitat Type)

SARCVER/AGROSMI

Number of Stands Sampled = 14

Number of Stands Sampled in Alberta = 2

LOCATION AND ASSOCIATED LANDFORMS

The *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat type occupies nearly level, older alluvial terraces on both broad and narrow floodplains and coalescing alluvial fans in valleys. It may also occur on rather broad expanses along flat lakeshores and playas. It is an incidental type in southeastern Alberta. This habitat type represents one of the driest extremes of the riparian or wetland zone. Sites are found where either overland flow or soil conditions (fine textured, poorly drained saline or alkaline), or a combination of both, provide a moisture regime that exceeds the incident precipitation. In many situations, the fine textured soils have resulted in a perched water table.

VEGETATION

Floristically, sites appear similar to the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type with the substitution of *Sarcobatus vermiculatus* for *Artemisia cana*. *Sarcobatus vermiculatus* (greasewood) dominates the shrub layer and *Agropyron smithii* dominates the herbaceous layer. Canopy cover of *Sarcobatus vermiculatus* is low, yet the stature of the plant compared to associated vegetation creates a shrubland appearance. *Sarcobatus vermiculatus* is among the most alkali tolerant of the native shrubs (Johnson and Nichols 1982) (Table 52).

Table 52. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 14 stands of the *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index [1]
	Average	Range		
Shrubs				
Artemisia cana (silver sagebrush)	1	0-1	29	5
Atriplex nuttallii (Nuttall's atriplex)	1	0-1	7	3

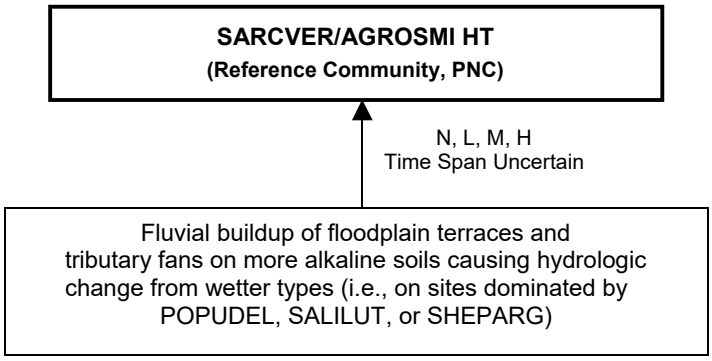
Table 52. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 14 stands of the *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Sarcobatus vermiculatus (greasewood)	35	20-60	100	59
Graminoids				
Agropyron pectiniforme (crested wheat grass)	2	0-3	14	5
Agropyron smithii (western wheat grass)	56	0-98	79	67
Bouteloua gracilis (blue grama)	7	0-20	21	12
Bromus japonicus (Japanese chess)	57	0-80	43	50
Bromus tectorum (downy chess)	12	0-20	14	13
Carex filifolia (thread-leaved sedge)	20	0-20	7	12
Distichlis stricta (salt grass)	25	0-60	36	30
Hordeum jubatum (foxtail barley)	17	0-60	29	22
Poa canbyi (Canby bluegrass)	20	0-20	14	17
Poa juncifolia (alkali bluegrass)	80	0-80	7	24
Poa pratensis (Kentucky bluegrass)	40	0-80	29	34
Poa sandbergii (Sandberg bluegrass)	3	0-3	7	5
Puccinellia nuttalliana (Nuttall's salt-meadow grass)	34	0-80	21	27
Sporobolus cryptandrus (sand dropseed)	1	0-1	7	3
Stipa comata (needle-and-thread)	2	0-3	14	5
Stipa viridula (green needle grass)	3	0-3	14	6
Forbs				
Achillea millefolium (common yarrow)	10	0-20	14	12
Artemisia frigida (pasture sagewort)	2	0-3	14	5
Atriplex argentea (silver saltbush)	3	0-3	7	5
Camelina microcarpa (small-seeded false flax)	3	0-3	14	6
Chenopodium album (lamb's-quarters)	3	0-3	7	5
Chenopodium fremontii (Fremont's goosefoot)	1	0-1	14	4
Chenopodium leptophyllum (narrow-leaved goosefoot)	3	0-3	7	5
Cirsium arvense (Canada thistle)	20	0-20	7	12
Descurainia pinnata (green tansy mustard)	60	0-60	7	20
Grindelia squarrosa (gumweed)	1	0-1	7	3
Kochia scoparia (summer-cypress)	1	0-1	14	4
Lactuca serriola (prickly lettuce)	3	0-3	7	5
Opuntia fragilis (brittle prickly-pear)	1	0-1	7	3
Opuntia polyacantha (prickly-pear)	6	0-20	29	13
Sisymbrium loeselii (tall hedge mustard)	1	0-1	7	3
Suaeda calceoliformis (western sea-blite)	30	0-30	7	14
Taraxacum officinale (common dandelion)	10	0-20	14	12
Tragopogon dubius (common goat's-beard)	2	0-3	29	8

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

Continued overgrazing reduces the amounts of *Agropyron smithii* (western wheat grass) while allowing *Sarcobatus vermiculatus* (greasewood), *Bouteloua gracilis* (blue grama), *Poa pratensis* (Kentucky bluegrass), *Bromus tectorum* (downy chess), and *Hordeum jubatum* (foxtail barley) to increase. Heavy spring and summer grazing will cause a decrease in *Sarcobatus vermiculatus*. Figure 25 is a general schematic of the successional pathway followed by sites of this type.



Successional Pathway Diagram for SARCVER Sites in the Southern Alberta Grasslands
Reference Community = SARCVER/AGROSMI HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
SARCVER/AGROSMI HT	*Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) Habitat Type
POPUDEL	*Populus deltoids* (plains cottonwood)
SALILUT	*Salix lutea* (yellow willow)
SHEPARG	*Shepherdia argentea* (thorny buffaloberry)

Note: We are uncertain at this time about what communities may have served to pioneer on sites presently occupied by the ARTECAN/AGROSMI HT. Sites occupied by this type are likely to have progressed through a succession of morphological change, rather than vegetational succession.

Figure 25. SARCVER/AGROSMI HT

SOILS

Soils are poorly drained, saline, or alkaline. Texture ranges from silt to clay. *Sarcobatus vermiculatus* (greasewood) is among the most alkali tolerant native shrubs (Johnson and Nichols 1982). *Sarcobatus vermiculatus* can tolerate surface flooding for up to 40 days before showing effects of low oxygen concentration in the rooting zone. High water tables are common, typically within 25 to 30 cm (10 to 12 in) of the soil surface.

ADJACENT COMMUNITIES

Adjacent wetter sites may be the *Distichlis stricta* (salt grass) habitat type, or the *Acer negundo/Prunus virginiana* (Manitoba maple/common choke cherry) habitat types. In other situations, wetter sites may be dominated by cottonwoods or willows. Adjacent drier sites are dominated by a variety of upland shrub and/or grassland communities.

MANAGEMENT INFORMATION

Livestock

Forage production of the *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat type ranges from low to moderate, depending on abundance of palatable grasses. Although not very palatable, *Sarcobatus vermiculatus* may be browsed by cattle in the winter (Mueggler and Stewart 1980, Johnson and Nichols 1982). Herbage has a high alkaline content, making it advisable to augment *Sarcobatus vermiculatus* forage with additional feed and to provide adequate water. *Sarcobatus vermiculatus* is moderately poisonous to sheep and cattle. Sheep are often poisoned in the fall by eating large amounts of fallen leaves. Toxicity increases in the fall as the plants mature. Leaves contain oxalates of potassium and sodium, which can kill livestock in four to six hours after being eaten. Sheep may die from eating two pounds of leaves while cattle may survive up to three to four pounds of these leaves. Heavy spring and summer grazing will cause a decrease in *Sarcobatus vermiculatus*.

Agropyron smithii (western wheat grass) is highly desired by livestock. The species is palatable and nutritious when green in the spring, and moderately so at other times of the year (Johnson and Nichols 1982). Vigorous rhizomes make this species one of the more tolerant to grazing pressure and drought of the desirable and abundant grasses. However, overgrazing in May and June will decrease its abundance. When growing conditions improve, as is the case following drought or overgrazing, it may rapidly recolonize areas previously occupied.

Wildlife

Although not very palatable, *Sarcobatus vermiculatus* (greasewood) may be browsed somewhat by deer and antelope in the winter (Mueggler and Stewart 1980, Johnson and Nichols 1982). *Agropyron smithii* (western wheat grass) is palatable and nutritious in the spring, and moderately so at other times of the year (Johnson and Nichols 1982).

The low to moderate structural diversity of the *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat type provides limited thermal and hiding cover for ungulates and upland bird species. Big game use of this habitat type occurs primarily during winter months (Mackie 1970).

Fire

Sarcobatus vermiculatus (greasewood) is described as "slightly damaged to unharmed" by fire. Plants are rarely killed even when fire consumes aboveground vegetation, generally sprouting vigorously from the stem base or roots (USDA IFSL 1995). Rapid resprouting may lead to an increase in stem density. *Agropyron smithii* (western wheat grass) has a good tolerance to fire in the dormant state. It usually survives fires during the growing season but recovery may be delayed (Wasser 1982).

Soil Management and Rehabilitation Opportunities

Care must be taken with road building across the *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat type. Soils typically have a high clay content, causing problems with roadbed stability and travel when wet. Many motorists

have learned the hard way why locals do not drive across this habitat type during or just after a rain.

Sarcobatus vermiculatus may be appropriate in revegetating disturbed sites having saline or alkaline soils and high water tables. However, nursery-grown stock or transplanted wildlings may be difficult to establish in the field. Growth rates are typically slow. A deep rooting habit makes this species a good soil stabilizer.

Commonly used herbicides defoliate *Sarcobatus vermiculatus*, but they usually resprout causing the species to be a difficult one to control.

Agropyron smithii is potentially valuable for revegetating disturbed or degraded riparian or wetland sites. Using transplants will speed the recovery process as seedlings are typically slow growing. Once established, plants will quickly spread by rhizomes.

OTHER STUDIES

The *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat type is described by Hansen and others (1995) for eastern Montana. That description was an expanded description of the *Sarcobatus vermiculatus/Agropyron smithii* habitat type as defined by Hansen and Hoffman (1988). This habitat type was also described by Mueggler and Stewart (1980) and Mackie (1970) for portions of central and eastern Montana. Jorgensen (1979) described a similar habitat type for the Yellow Triangle region of Montana with the difference being the substitution of the ecologically similar *Agropyron dasystachyum* (northern wheat grass) for *Agropyron smithii*. Michalsky and others (1994) describe a Greasewood/Rillscale vegetation type on the Grasslands National Park in extreme southern Saskatchewan.

***Shepherdia argentea* Community Type**
(Thorny Buffaloberry Community Type)

SHEPARG
Number of Stands Sampled = 28
Number of Stands Sampled in Alberta = 9

LOCATION AND ASSOCIATED LANDFORMS

The *Shepherdia argentea* (thorny buffaloberry) community type is a minor type at low elevations in southern Alberta. It occurs on alluvial floodplain terraces along streams and rivers throughout the region. Stands can be found along the Milk, South Saskatchewan, and Red Deer Rivers. Stands are also located in V-shaped ravines and swale-like depressions where overland flows provide additional moisture. In some cases stands may also be located on hillsides immediately below a spring or seep.

VEGETATION

Although *Shepherdia argentea* (thorny buffaloberry) is native, we believe the *Shepherdia argentea* community type represents a grazing disclimax. It is recognized by dominance of the spine tipped shrub *Shepherdia argentea*, which forms dense, nearly impenetrable thickets, often to 3 m (10 ft) tall. The sparse understory shrub layer generally consists of *Symphoricarpos occidentalis* (buckbrush) and *Rosa* species (rose). The herbaceous understory is typically sparse (Table 53).

Table 53 Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 25 percent or more of the 28 sampled stands of the *Shepherdia argentea* (thorny buffaloberry) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Populus angustifolia (narrow-leaf cottonwood)	1	0 – 1	4	2
Populus balsamifera (balsam poplar)	1	0 – 1	4	2
Shrubs				
Amelanchier alnifolia (Saskatoon)	3	0 – 3	14	6
Clematis ligusticifolia (western clematis)	2	0 – 3	14	5
Cornus stolonifera (red-osier dogwood)	7	0 - 10	11	9
Crataegus rotundifolia (round-leaved hawthorn)	3	0 - 3	4	3
Juniperus horizontalis (creeping juniper)	3	0 - 3	4	3
Prunus virginiana (choke cherry)	11	0 - 30	14	12
Rhus radicans (poison ivy)	4	0 - 10	18	8
Rhus trilobata (skunkbush)	3	0 - 3	7	5
Ribes americanum (wild black currant)	20	0 - 20	4	9
Ribes aureum (golden currant)	35	0 - 60	14	22
Ribes oxyacanthoides (northern gooseberry)	1	0 - 3	29	5
Rosa acicularis (prickly rose)	3	0 - 3	4	3
Rosa woodsii (common wild rose)	15	0 - 60	32	22
Rosa spp. (rose)	15	0 - 70	50	27
Rubus idaeus (wild red raspberry)	15	0 - 20	7	10
Salix exigua (sandbar willow)	1	0 - 1	4	2
Salix lutea (yellow willow)	2	0 - 3	18	6
Sarcobatus vermiculatus (greasewood)	3	0 - 3	4	3
Shepherdia argentea (thorny buffaloberry)	76	40 - 98	100	87
Symphoricarpos occidentalis (buckbrush)	37	1 - 80	100	61
Graminoids				
Agropyron repens (quack grass)	1	0 - 1	4	2
Agropyron smithii (western wheat grass)	2	0 - 3	29	8
Agrostis stolonifera (redtop)	17	0 - 60	14	15
Agropyron trachycaulum (slender wheat grass)	12	0 - 20	21	16
Andropogon gerardii (big bluestem)	3	0 - 3	4	3
Bouteloua gracilis (blue grama)	3	0 - 3	4	3
Bromus inermis (smooth brome)	16	0 - 80	29	22
Bromus japonicus (Japanese chess)	40	0 - 40	4	13
Carex filifolia (thread-leaved sedge)	3	0 - 3	4	3
Elymus virginicus (Virginia wild rye)	17	0 - 30	7	11
Juncus balticus (wire rush)	2	0 - 3	7	4
Koeleria macrantha (June grass)	3	0 - 3	4	3
Phalaris arundinacea (reed canary grass)	3	0 - 3	4	3
Phleum pratense (timothy)	3	0 - 3	4	3

Table 53 Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 25 percent or more of the 28 sampled stands of the *Shepherdia argentea* (thorny buffaloberry) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Poa interior (inland bluegrass)	3	0 - 3	4	3
Poa pratensis (Kentucky bluegrass)	33	0 - 80	68	47
Poa spp. (bluegrass)	1	0 - 1	4	2
Stipa viridula (green needle grass)	1	0 - 1	7	3
Forbs				
Achillea millefolium (common yarrow)	9	0 - 40	39	19
Anemone canadensis (Canada anemone)	3	0 - 3	11	6
Apocynum cannabinum (Indian hemp)	1	0 - 1	4	2
Arctium minus (common burdock)	5	0 - 10	14	8
Artemisia frigida (pasture sagewort)	3	0 - 3	18	7
Artemisia ludoviciana (prairie sagewort)	2	0 - 3	29	8
Aster borealis (marsh aster)	1	0 - 1	4	2
Aster laevis (smooth aster)	3	0 - 3	4	3
Aster subspicatus (leafy-bracted aster)	1	0 - 1	4	2
Carduus nutans (nodding thistle)	1	0 - 1	4	2
Chenopodium album (lamb's-quarters)	3	0 - 3	7	5
Chenopodium capitatum (strawberry blite)	20	0 - 20	4	9
Chenopodium fremontii (Fremont's goosefoot)	1	0 - 1	4	2
Chenopodium salinum (oak-leaved goosefoot)	3	0 - 3	4	3
Cicuta maculata (water-hemlock)	1	0 - 1	4	2
Cirsium arvense (Canada thistle)	12	0 - 40	25	17
Cirsium undulatum (wavy-leaved thistle)	3	0 - 3	4	3
Convolvulus arvensis (field bindweed)	3	0 - 3	7	5
Convolvulus sepium (wild morning-glory)	1	0 - 1	4	2
Cynoglossum officinale (hound's-tongue)	1	0 - 1	4	2
Erigeron acris (northern daisy fleabane)	10	0 - 10	4	6
Euphorbia esula (leafy spurge)	3	0 - 3	4	3
Unknown Forb	2	0 - 3	7	4
Galium aparine (cleavers)	20	0 - 20	11	15
Galium boreale (northern bedstraw)	11	0 - 30	18	14
Galium triflorum (sweet-scented bedstraw)	1	0 - 1	7	3
Geranium richardsonii (wild white geranium)	1	0 - 1	4	2
Geum macrophyllum (large-leaved yellow avens)	3	0 - 3	4	3
Glycyrrhiza lepidota (wild licorice)	2	0 - 3	21	6
Grindelia squarrosa (gumweed)	1	0 - 1	4	2
Hackelia americana (nodding stickseed)	5	0 - 10	11	7
Heracleum lanatum (cow parsnip)	1	0 - 1	4	2
Lactuca pulchella (common blue lettuce)	3	0 - 3	4	3
Lappula squarrosa (bluebur)	2	0 - 3	11	5

Table 53 Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 25 percent or more of the 28 sampled stands of the *Shepherdia argentea* (thorny buffaloberry) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Liatris punctata (dotted blazingstar)	1	0 - 1	4	2
Medicago lupulina (black medick)	1	0 - 1	4	2
Melilotus officinalis (yellow sweet-clover)	3	0 - 3	4	3
Monarda fistulosa (wild bergamot)	7	0 - 20	21	12
Nepeta cataria (catnip)	2	0 - 3	14	5
Parietaria pensylvanica (American pellitory)	27	0 - 80	39	32
Salsola kali (Russian-thistle)	1	0 - 1	4	2
Sanicula marilandica (snakeroot)	3	0 - 3	7	5
Sisymbrium loeselii (tall hedge mustard)	2	0 - 3	7	4
Smilacina racemosa (false Solomon's-seal)	3	0 - 3	4	3
Smilacina stellata (star-flowered Solomon's-seal)	3	0 - 3	18	7
Solidago canadensis (Canada goldenrod)	5	0 - 10	11	7
Solidago gigantea (late goldenrod)	10	0 - 30	11	10
Sonchus arvensis (perennial sow-thistle)	5	0 - 10	7	6
Sonchus spp. (sow-thistle)	1	0 - 1	4	2
Taraxacum officinale (common dandelion)	2	0 - 3	14	5
Thalictrum venulosum (veiny meadow rue)	3	0 - 3	4	3
Trifolium aureum (yellow clover)	1	0 - 1	4	2
Urtica dioica (common nettle)	4	0 - 10	18	8
Vicia americana (wild vetch)	2	0 - 3	18	6
Viola adunca (early blue violet)	3	0 - 3	4	3
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0 - 1	4	2
Equisetum laevigatum (smooth scouring-rush)	3	0 - 3	4	3
Equisetum sylvaticum (woodland horsetail)	1	0 - 1	4	2

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

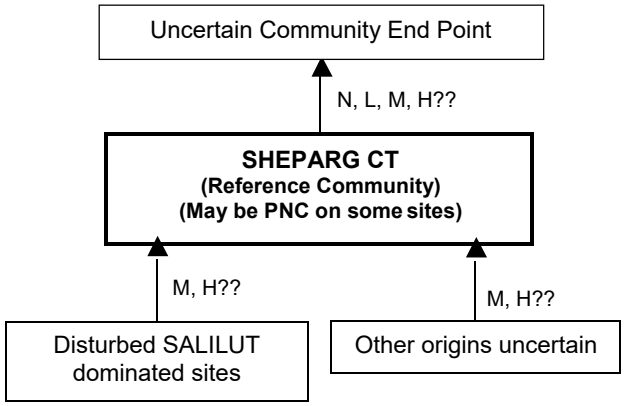
We believe that in most cases the *Shepherdia argentea* (thorny buffaloberry) community type represents a mid-seral grazing disclimax successional stage of a *Salix bebbiana* (beaked willow) or *Salix lutea* (yellow willow) habitat type or the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type. Careful observation of site characteristics and remnant plant species may assist in the determination of site potential. Figure 26 is a general schematic of the successional pathway followed by sites of this type.

There is some argument that this type may represent site potential in certain locations. Further study is needed on this type. Stands that are apparently little disturbed are the densest, having a closed canopy and very sparse understory. Prolonged disturbance by livestock and/or deer opens the stands, thereby allowing sunlight and

invasion by disturbance-related species such as *Symphoricarpos occidentalis* (buckbrush), *Rosa* species (rose), and *Poa pratensis* (Kentucky bluegrass).

SOILS

Soils are generally Regosols and Chernozems. The *Shepherdia argentea* (thorny buffaloberry) community type occurs on a wide range of soils but is most common in moist to seasonally wet, well-drained, fine textured soils. It seems to be tolerant of imperfect drainage and some flooding, but intolerant of prolonged flooding and permanently high water tables.



Successional Pathway Diagram for SHEPARG Sites in the Southern Alberta Grasslands
Reference Community = SHEPARG CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
SHEPARG CT	*Shepherdia argentea* (thorny buffaloberry) Community Type
SALILUT	*Salix lutea* (yellow willow)

Note: Note: It is unclear at this time which communities may have pioneered sites presently occupied by the SHEPARG CT, or whether this community may represent site potential in some cases. On other sites there are indications that its dominance is due to grazing disturbance of a SALILUT community.

Figure 26. SHEPARG CT

ADJACENT COMMUNITIES

Adjacent wetter communities may include any of the *Populus deltoides* (plains cottonwood) series, the *Salix exigua* (sandbar willow), or *Salix amygdaloides* (peach-leaved willow) community types, or the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) or *Fraxinus pennsylvanica/Prunus virginiana* (green ash/choke cherry) habitat types. Some wetter communities may include the *Salix lutea* (yellow willow) dominated habitat types. Adjacent drier communities are typically dominated by upland communities.

MANAGEMENT INFORMATION

Livestock

The *Shepherdia argentea* (thorny buffaloberry) community type is strongly resistant to grazing and browsing pressures due to thorny branches. Forage production for the dense, thorny, monotypic stands is quite low. As stands open, forage production increases due to the increase of *Poa pratensis* (Kentucky bluegrass). The palatability of *Shepherdia argentea* is generally poor for cattle and poor to fair for sheep.

Wildlife

The high structural diversity of the *Shepherdia argentea* (thorny buffaloberry) community type provides both thermal and hiding cover for livestock, big game, and upland bird species. Most stands have large numbers of animal trails. *Shepherdia argentea* is a valuable forage species for mule deer and pronghorn. It is browsed by mule deer in Montana and in North Dakota *Shepherdia argentea* is an important browse species in mule deer winter diets (USDA IFSL 1995).

In Montana, North Dakota, and South Dakota, *Shepherdia argentea* (thorny buffaloberry) fruits are eaten by sharp-tailed grouse, cedar waxwings, other passerine species, and small mammals. In the northern Great Plains, the fruit provides the best native winter food source for sharp-tailed grouse. In Montana, sharp-tailed grouse feed primarily on silver buffaloberry buds in the winter (USDA IFSL 1995). Loggerhead shrikes utilize this type for nesting and foraging (Bristol 2000).

Fire

Shepherdia argentea (thorny buffaloberry) is fairly fire tolerant in the dormant state due to sprouting rootstocks (Wasser 1982). It sprouts from the root crown following fire, but varying responses to fire have been reported. In northern mixed-grass prairies, *Shepherdia argentea* percent cover decreased after spring and summer fires. In the northern Great Plains prescribed fire may be useful for opening up shrub thickets or for triggering sprout reproduction of remnant shrubs in failing stands (USDA IFSL 1995).

Soil Management and Rehabilitation Opportunities

Shepherdia argentea (thorny buffaloberry) is adapted to revegetating disturbed sites having well drained saline or alkaline soils. Nursery grown stock is readily established and growth rates are moderate. Once established, this community type provides excellent soil stabilization.

Recreational Uses and Considerations

Recreational opportunities in this type are good to excellent for hunting deer and upland birds. These sites are also excellent areas for observing many other wildlife species. *Shepherdia argentea* (thorny buffaloberry) may be valuable for plantings where a barrier is desired. The fruits are quite tasty and are eaten by birds and small animals. Aboriginal people and European pioneers preserved the fruits for eating by drying. Today, many people use the fruits to make excellent pies, jams, and jellies.

OTHER STUDIES

A *Shepherdia argentea* (thorny buffaloberry) community type is described by Hansen and others (1995) for Montana. Similar communities have been described for the northern Great Plains (Boldt and others 1978, Nelson 1961, Severson and Boldt 1978, Hansen and Hoffman 1988). A *Shepherdia argentea* community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan.

Symphoricarpos occidentalis Community Type
(Buckbrush Community Type)

SYMPOCC

Number of Stands Sampled = 29

Number of Stands Sampled in Alberta = 9

CAUTION—Not all sites currently dominated by *Symphoricarpos occidentalis* (buckbrush) 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 Landforms section.

LOCATION AND ASSOCIATED LANDFORMS

The *Symphoricarpos occidentalis* (buckbrush) community type is a major type at low to mid elevations in Alberta. It occurs on alluvial floodplain terraces along streams and rivers, in V-shaped ravines and swale-like depressions where overland flows provide additional moisture, and in some cases stands may be located on the hillsides immediately below a spring or seep.

VEGETATION

Typically, the roots of *Symphoricarpos occidentalis* (buckbrush) are densely branched and mostly near the soil surface. The species spreads by stout rhizomes to form dense thickets. The large, dense patches thrive in full sunlight and often exclude most other species except the common companion *Rosa woodsii* (common wild rose). Undergrowth is comprised principally of *Poa pratensis* (Kentucky bluegrass), which increases with disturbance as the stands become more open (Table 54).

Table 54. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 29 sampled stands of the *Symphoricarpos occidentalis* (buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Fraxinus pennsylvanica (green ash)	1	0 – 1	3	2
Shrubs				
Crataegus rotundifolia (round-leaved hawthorn)	1	0 – 1	3	2
Elaeagnus commutata (silverberry)	3	0 – 3	7	5
Juniperus horizontalis (creeping juniper)	90	0 – 90	3	16
Juniperus scopulorum (Rocky Mountain juniper)	1	0 – 1	3	2
Potentilla fruticosa (shrubby cinquefoil)	1	0 – 1	3	2
Ribes aureum (golden currant)	3	0 – 3	7	5
Ribes oxyacanthoides (northern gooseberry)	1	0 – 3	10	3
Rosa acicularis (prickly rose)	10	0 – 20	7	8
Rosa woodsii (common wild rose)	7	0 – 20	14	10
Rosa spp. (rose)	4	0 – 20	55	15
Salix exigua (sandbar willow)	1	0 – 1	3	2
Symphoricarpos occidentalis (buckbrush)	78	10 – 98	100	88

Table 54. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 29 sampled stands of the *Symphoricarpos occidentalis* (buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Graminoids				
Agropyron repens (quack grass)	5	0 – 10	7	6
Agropyron smithii (western wheat grass)	15	0 – 80	24	19
Agrostis stolonifera (redtop)	40	0 – 40	3	11
Agropyron trachycaulum (slender wheat grass)	3	0 – 3	10	5
Bouteloua gracilis (blue grama)	1	0 – 1	3	2
Bromus carinatus (keeled brome)	1	0 – 1	3	2
Bromus ciliatus (fringed brome)	3	0 – 3	3	3
Bromus inermis (smooth brome)	25	0 - 98	34	29
Bromus japonicus (Japanese chess)	15	0 - 20	7	10
Carex lanuginosa (woolly sedge)	13	0 - 20	10	11
Carex praegracilis (graceful sedge)	1	0 - 1	3	2
Carex sprengelii (Sprengel's sedge)	20	0 - 20	3	8
Carex spp. (sedge)	1	0 - 1	3	2
Elymus canadensis (Canada wild rye)	1	0 - 1	3	2
Elymus piperi (giant wild rye)	1	0 - 1	3	2
Hordeum jubatum (foxtail barley)	10	0 - 10	3	5
Juncus balticus (wire rush)	10	0 - 10	3	5
Koeleria macrantha (June grass)	1	0 - 1	3	2
Muhlenbergia richardsonis (mat muhly)	3	0 - 3	3	3
Phalaris arundinacea (reed canary grass)	1	0 - 1	3	2
Phleum pratense (timothy)	2	0 - 3	14	5
Poa compressa (Canada bluegrass)	40	0 - 40	3	11
Poa palustris (fowl bluegrass)	3	0 - 3	7	5
Poa pratensis (Kentucky bluegrass)	21	0 - 60	59	35
Stipa spp. (needle grass)	3	0 - 3	3	3
Stipa viridula (green needle grass)	9	0 - 20	10	9
Trisetum canescens (tall trisetum)	1	0 - 1	3	2
Forbs				
Achillea millefolium (common yarrow)	4	0 - 20	31	11
Ambrosia trifida (great ragweed)	3	0 - 3	3	3
Anemone cylindrica (long-fruited anemone)	1	0 - 1	3	2
Artemisia frigida (pasture sagewort)	1	0 - 1	10	3
Artemisia ludoviciana (prairie sagewort)	4	0 - 20	24	10
Aster ericoides (tufted white prairie aster)	2	0 - 3	7	4
Aster hesperius (western willow aster)	2	0 - 3	7	4
Astragalus flexuosus (slender milk vetch)	1	0 - 1	3	2
Campanula rotundifolia (harebell)	1	0 - 1	7	3
Chenopodium fremontii (Fremont's goosefoot)	2	0 - 3	7	4

Table 54. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 29 sampled stands of the *Symphoricarpos occidentalis* (buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Chenopodium leptophyllum (narrow-leaved goosefoot)	3	0 - 3	3	3
Cirsium arvense (Canada thistle)	8	0 - 20	28	15
Echinocystis lobata (wild cucumber)	1	0 - 1	3	2
Fragaria virginiana (wild strawberry)	5	0 - 10	7	6
Galium boreale (northern bedstraw)	2	0 - 3	10	4
Geranium viscosissimum (sticky purple geranium)	3	0 - 3	3	3
Geum aleppicum (yellow avens)	2	0 - 3	7	4
Geum triflorum (three-flowered avens)	10	0 - 10	3	5
Glycyrrhiza lepidota (wild licorice)	6	0 - 20	21	11
Helianthus nuttallii (common tall sunflower)	3	0 - 3	3	3
Heracleum lanatum (cow parsnip)	1	0 - 1	3	2
Lactuca pulchella (common blue lettuce)	1	0 - 1	3	2
Melilotus alba (white sweet-clover)	20	0 - 20	3	8
Melilotus officinalis (yellow sweet-clover)	1	0 - 1	3	2
Mentha arvensis (wild mint)	1	0 - 1	3	2
Monarda fistulosa (wild bergamot)	3	0 - 3	3	3
Opuntia polyacantha (prickly-pear)	1	0 - 1	3	2
Oxytropis splendens (showy locoweed)	1	0 - 1	3	2
Perideridia gairdneri (squawroot)	1	0 - 1	3	2
Polygonum coccineum (water smartweed)	1	0 - 1	3	2
Polygonum convolvulus (wild buckwheat)	1	0 - 1	3	2
Potentilla gracilis (graceful cinquefoil)	5	0 - 10	10	7
Rumex crispus (curled dock)	1	0 - 1	3	2
Rumex spp. (dock; sorrel)	1	0 - 1	3	2
Sisymbrium loeselii (tall hedge mustard)	1	0 - 1	3	2
Smilax herbacea (Carrion flower)	1	0 - 1	3	2
Smilacina stellata (star-flowered Solomon's-seal)	2	0 - 3	7	4
Solidago canadensis (Canada goldenrod)	1	0 - 3	17	4
Solidago missouriensis (low goldenrod)	10	0 - 20	7	8
Sonchus arvensis (perennial sow-thistle)	1	0 - 1	3	2
Sonchus asper (prickly annual sow-thistle)	3	0 - 3	3	3
Stachys palustris (marsh hedge-nettle)	10	0 - 10	3	5
Taraxacum officinale (common dandelion)	3	0 - 3	17	7
Thalictrum dasycarpum (tall meadow rue)	1	0 - 1	3	2
Thalictrum venulosum (veiny meadow rue)	1	0 - 1	3	2
Thlaspi arvense (stinkweed)	1	0 - 1	7	3
Tragopogon dubius (common goat's-beard)	2	0 - 3	7	4
Trifolium repens (white clover)	3	0 - 3	3	3
Urtica dioica (common nettle)	7	0 - 20	14	10

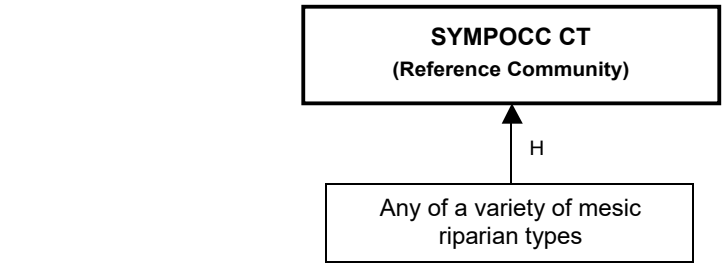
Table 54. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 29 sampled stands of the *Symphoricarpos occidentalis* (buckbrush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Vicia americana (wild vetch)	1	0 - 3	10	3
Viola canadensis (western Canada violet)	5	0 - 10	7	6
Ferns and Allies				
Equisetum arvense (common horsetail)	2	0 - 3	7	4
Equisetum laevigatum (smooth scouring-rush)	1	0 - 1	3	2

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The successional status of the *Symphoricarpos occidentalis* (buckbrush) community type is confusing. On many sites the *Symphoricarpos occidentalis* community type represents a mid-seral grazing disclimax stage of a *Salix bebbiana* (beaked willow) or *Salix lutea* (yellow willow) habitat type, the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) habitat type, or the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) community type. At other sites, the *Symphoricarpos occidentalis* community type seems to represent a long-lived mid-seral stage not influenced by heavy grazing pressures. Future work may bring insight into the ecological status of this community type. Figure 27 is a general schematic of the successional pathway followed by sites of this type.



Successional Pathway Diagram for SYMPOCC Sites in the Southern Alberta Grasslands
Reference Community = SYMPOCC CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY
SYMPOCC CT *Symphoricarpos occidentalis* (buckbrush) Community Type

Note: We think the SYMPOCC CT on riparian sites is a result of grazing disturbance to any one of a variety of mesic riparian tree and shrub types, but we suspect that SYMPOCC may be the potential natural community on some upland sites.

Figure 27. SYMPOCC CT

Disturbance Stages

Heavy grazing or browsing pressure will open up stands allowing disturbance species such as *Poa pratensis* (Kentucky bluegrass) to increase. Other disturbance-related species such as *Bromus inermis* (smooth brome), or *Achillea millefolium* (common yarrow) may invade.

SOILS

Soils are quite variable including Regosols and Chernozems. The *Symphoricarpos occidentalis* (buckbrush) community type is found on virtually all soil textures except sand. This community type is tolerant of imperfect drainage and short duration flooding, but is intolerant of long inundation and permanently high water tables. Soil reaction ranges between slightly acid to mildly alkaline (pH 6.0 to 8.0) (Wasser 1982).

ADJACENT COMMUNITIES

Adjacent wetter communities may include the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) or the *Populus tremuloides/Cornus stolonifera* (aspen/red-osier dogwood) community type, types dominated by *Salix bebbiana* (beaked willow) or *Salix lutea* (yellow willow), or the cottonwood, *Salix exigua* (sandbar willow), or *Salix amygdaloides* (peach-leaved willow) community types. Adjacent drier communities may be dominated by *Bromus inermis* (smooth brome) or upland communities.

MANAGEMENT INFORMATION

Livestock

Forage production for these dense, monotypic shrub stands is low. As stands open, forage production increases due to the presence of *Agropyron smithii* (western wheat grass), *Bromus inermis* (smooth brome), and *Poa pratensis* (Kentucky bluegrass). The palatability of *Symphoricarpos occidentalis* (buckbrush) ranges from low to fair for cattle and sheep (Wasser 1982, Johnson and Nichols 1982).

Wildlife

The moderate structural diversity of the *Symphoricarpos occidentalis* (buckbrush) community type provides thermal and hiding cover for big game and upland bird species. The palatability of *Symphoricarpos occidentalis* is rated good for deer and elk (Wasser 1982, Johnson and Nichols 1982).

Fisheries

This community type offers excellent streambank stabilization due to the rhizomatous nature of *Symphoricarpos occidentalis* (buckbrush).

Fire

Symphoricarpos occidentalis (buckbrush) sprouts vigorously from root crown and rhizomes after fire. Stands are usually more dense in burned than in adjacent unburned areas. Spring and fall fires induce sprouting, but frequent fires may reduce cover. In aspen parklands in Alberta, buckbrush sprouted 2 weeks after spring fire; by 3 months its canopy cover was greater on burned sites than on control plots. Annual burning may restrict expansion of *Symphoricarpos occidentalis* colonies onto native prairie grasslands. Periodic burning could create even-aged, youthful stands of the species, which may be more productive of wildlife forage and provide better cover (USDA IFSL 1995).

Soil Management and Rehabilitation Opportunities

Symphoricarpos occidentalis (buckbrush) is well adapted for revegetation of disturbed sites due to its habit of growing in dense, colonial stands. It does best on moist, well-drained soils, which have not been excessively disturbed. Once established, it grows at a moderate rate and spreads rapidly by root sprouts. Nursery grown seedlings, rooted cuttings, or wildlings are preferred for planting. Critical, erodible sites may need complete exclusion from grazing during planting establishment. Animal populations and stocking rates should be balanced

with an ample forage supply available on noncritical sites until after establishment is successful (Wasser 1982).

Recreational Uses and Considerations

Recreational opportunities are good to excellent for hunting big game and upland birds. Because the fruits persist into the winter, *Symphoricarpos occidentalis* is an important food source for upland birds.

OTHER STUDIES

A *Symphoricarpos occidentalis* (buckbrush) community type is described by Hansen and others (1995) for Montana. Similar communities have been described for Minnesota (Pelton 1953) and the northern Great Plains (Hansen and others 1984, Hansen and Hoffman 1988). A *Symphoricarpos occidentalis* community is described by Lawrence and Romo (1994) on the Matador Research Station in southern Saskatchewan. Michalsky and others (1994) describe several vegetation types with *Symphoricarpos occidentalis* (buckbrush) as a characteristic species on the Grasslands National Park in extreme southern Saskatchewan.

Carex aquatilis Habitat Type
(Water Sedge Habitat Type)

CAREAQU

Number of Stands Sampled = 16

Number of Stands Sampled in Alberta = 12

LOCATION AND ASSOCIATED LANDFORMS

The *Carex aquatilis* (water sedge) habitat type is an incidental type throughout Alberta, occurring in flat meadows or valley bottoms or depressions, usually immediately 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. Like the *Carex atherodes* habitat type, sites are often silted-in beaver ponds, old oxbow sloughs, or narrow bands adjacent to small streams.

VEGETATION

The *Carex aquatilis* (water sedge) habitat type is dominated by *Carex aquatilis*, but often has other wet site graminoid species associated (Table 55).

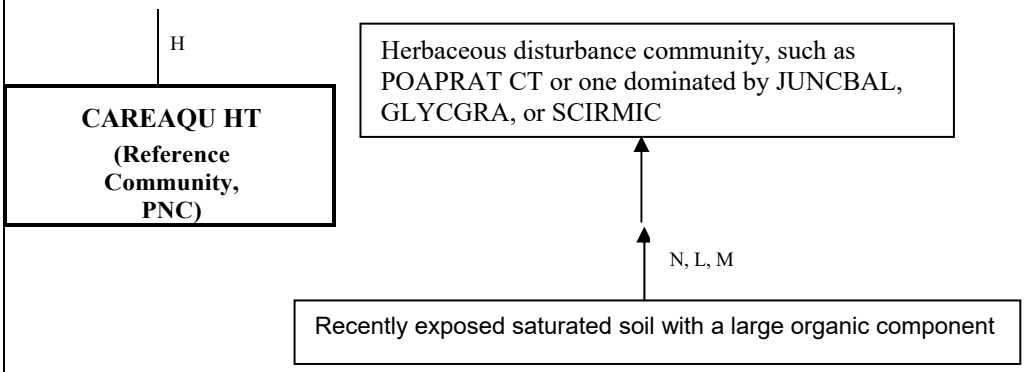
Table 55. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 10 late seral to climax stands of the *Carex aquatilis* (water sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Shrubs				
Salix pseudomonticola (false mountain willow)	1	0-1	10	3
Graminoids				
Calamagrostis stricta (narrow reed grass)	1	0-1	10	3
Carex aquatilis (water sedge)	85	50-98	100	92
Carex atherodes (awned sedge)	20	0-20	10	14
Carex utriculata (beaked sedge)	16	0-30	40	25
Deschampsia cespitosa (tufted hair grass)	1	0-1	10	3
Glyceria grandis (common tall manna grass)	1	0-1	10	3
Poa palustris (fowl bluegrass)	1	0-1	10	3
Forbs				
Aster borealis (marsh aster)	1	0-1	10	3
Caltha palustris (marsh-marigold)	20	0-20	10	14
Epilobium palustre (marsh willowherb)	10	0-10	10	10
Galium trifidum (small bedstraw)	1	0-1	10	3
Pedicularis groenlandica (elephant's-head)	3	0-3	10	5

Table 55. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 10 late seral to climax stands of the *Carex aquatilis* (water sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	10	3
Polygonum coccineum (water smartweed)	7	0-10	20	12
Potentilla palustris (marsh cinquefoil)	3	0-3	10	5
Rumex crispus (curled dock)	1	0-1	20	4
Scutellaria galericulata (marsh skullcap)	1	0-1	10	3
Viola spp. (violet)	1	0-1	10	3

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.



Successional Pathway Diagram of CAREAQU Sites in Southern Alberta Grasslands
Reference Community = CAREAQU HT

Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
CAREAQU HT	*Carex aquatilis* (water sedge) Habitat Type
GLYCGRA	*Glyceria grandis* (common tall manna grass)
JUNCBAL	*Juncus balticus* (wire rush)
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type
SCIRMIC	*Scirpus microcarpus* (small-fruited bulrush)

Note: This diagram is made with the assumption that hydrologic potential does not change. A wetter hydrologic regime would likely change potential of the site to the TYPHLAT HT or the SCIRACU HT. A drier hydrologic regime would likely change the site potential to a shrub type.

Figure 28. CAREAQU HT

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 as a climax species. High water table and a vigorous network of *Carex aquatilis* rhizomes inhibit establishment of most other species. In general, a high water table throughout the growing season restricts access by livestock. However, due to the palatability of *Carex aquatilis*, severe grazing pressures can greatly decrease the cover of the species while increasing cover of disturbance-related herbaceous species such as *Juncus balticus* (wire rush), *Poa pratensis* (Kentucky bluegrass), *Mentha arvensis* (wild mint), *Geum macrophyllum* (large-leaved yellow avens), and others (Table 56). Figure 28 is a general schematic of the successional pathway followed on sites of this type.

Table 56. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 14 disturbed and/or early to mid-seral stands of the *Carex aquatilis* (water sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Graminoids				
Carex aquatilis (water sedge)	70	40 - 98	100	84
Carex rostrata (beaked sedge)	7	0 - 20	29	14
Juncus balticus (wire rush)	15	0 - 50	36	23
Forbs				
Mentha arvensis (wild mint)	1	0 - 3	36	6
Scutellaria galericulata (marsh skullcap)	1	0 - 3	29	5
Ferns and Allies				
Equisetum fluviatile (swamp horsetail)	8	0 - 20	29	15

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

Soils of the *Carex aquatilis* (water sedge) phase are typically organic (Fibrisols, Mesisols, and Humisols). Chernozems are less frequently associated with this phase. Texture ranges from clay to sandy loam. Water tables are at or near the surface throughout the year. Water tables are often lower and can fall below 1 m (39 in) by mid-summer. This type appears less anaerobic than the *Carex atherodes* (awned sedge) habitat type. Soil reaction varies little between slightly acid and neutral (pH 6.0 to 7.0).

ADJACENT COMMUNITIES

Adjacent wetter sites support the *Carex atherodes* (awned sedge) or *Typha latifolia* (common cattail) habitat types. Drier sites support the *Salix bebbiana/Cornus stolonifera* (beaked willow/red-osier dogwood) habitat type, *Phalaris arundinacea* (reed canary grass) habitat type, and the *Juncus balticus* (wire rush), and *Poa pratensis* (Kentucky bluegrass) community types.

MANAGEMENT INFORMATION

Livestock

Livestock forage value of *Carex aquatilis* (water sedge) varies with season, previous grazing use, and areal extent of the site. On narrow riparian or wetland sites within large pastures, sedge species are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur. In general, 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 sufficient residual cover (Myers 1989).

Very wet soils may deter animal use until drying, however, if heavy 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 (Hermann 1975).

Frisina (1991) states that for a grazing program to succeed, it must meet the basic biological requirements of plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed. It is during long growing season rest periods that essential biological processes of food production and storage, reproduction, and seedling establishment occur. In some cases, additional periods of rest may be required to improve or maintain a plant community.

Wildlife

Elk may graze stands of *Carex aquatilis* (water sedge), but this species is not usually a major food source. Waterfowl consume the seeds of associated plants in this type.

Beaver perform a vital role in the health and maintenance of riparian ecosystems. Beaver dams assist in controlling the downcutting of channels, bank erosion, and the movement of sediment downstream (Gordon and others 1992). When beavers construct a dam, they raise the water table in the area, which provides water for hydrophytic plants such as willows and sedges. The beaver dam also slows down the water in the channel, which allows suspended sediment to be deposited behind the dam. The combination of sediment deposition and plant reproduction raises the channel bed, creating a wetland environment, which is excellent waterfowl and fish habitat. It has often been the policy of land managers to trap and kill beaver because they can be a nuisance. However, because beaver produce such desirable habitat and provide many beneficial stream functions, their removal needs to be carefully evaluated.

Fisheries

This habitat type is often located adjacent to waterways supporting trout fisheries. The rhizomatous growth habit of *Carex aquatilis* (water sedge) forms a dense sod, effectively stabilizing streambanks. Overhanging sod provides valuable cover and shade for fish.

Fire

The *Carex aquatilis* 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* (DeBenedetti and Parsons 1984).

Deschampsia cespitosa (tufted hair grass) is resistant to damage from fire (DeBenedetti and Parsons 1984). Root crowns are rarely damaged, even by hot, intense fires. However, repeated burning will favor the rhizomatous sedges. Burning should be postponed if livestock are present to avoid attracting animals to the young, palatable *Deschampsia cespitosa* regrowth. Care should be taken before burning stands along streambanks because of the excellent erosion protection this habitat type provides.

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 favorable for *Carex aquatilis*. Off-road vehicles cause 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, 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. However, if grazing or trailing impacts are severe, the heavy weight of the sod makes it susceptible to sloughing.

Although *Deschampsia cespitosa* (tufted hair grass) has a weak, fibrous root system of little value for streambank protection (Youngblood and others 1985b), *Juncus balticus* (wire rush) does produce a deep, fibrous root system with a mass of coarse, creeping rhizomes. Once established, these roots spread rapidly.

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 to allow at least 30 days for fall sedge regrowth should provide sufficient residual cover (Myers 1989).

Recreational Uses and Considerations

Recreational use is usually limited to the associated fishery. Heavy 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.

OTHER STUDIES

The *Carex aquatilis* (water sedge) habitat type is described by Thompson and Hansen (2000) for the Grassland Natural Region of southern Alberta and by Hansen and others (1995) for Montana.

Carex atherodes Habitat Type
(Awned Sedge Habitat Type)

CAREATH

Number of Stands Sampled = 32

Number of Stands Sampled in Alberta = 22

LOCATION AND ASSOCIATED LANDFORMS

The *Carex atherodes* (awned sedge) habitat type is a minor to major, widely distributed type throughout Alberta, becoming more important to the north. Sites may be in lentic situations around depressional wetlands, sloughs, potholes, and sites generally more alkaline than *Carex utriculata* (beaked sedge) sites. They may occur in standing water or on sites that become relatively dry during the later part of the growing season. Sites may be located where beaver ponds have filled with sediment. The *Carex atherodes* habitat type represents one of the wettest riparian and wetland communities.

VEGETATION

The *Carex atherodes* (awned sedge) habitat type in undisturbed condition is typically a monospecific stand of *Carex atherodes*, or a including lesser amount of *Carex utriculata* (beaked sedge) (Table 57). As stands become disturbed, disturbance-related herbaceous species get opportunity to come in, such as *Mentha arvensis* (wild mint), *Beckmannia syzigachne* (slough grass), and *Poa palustris* (fowl bluegrass).

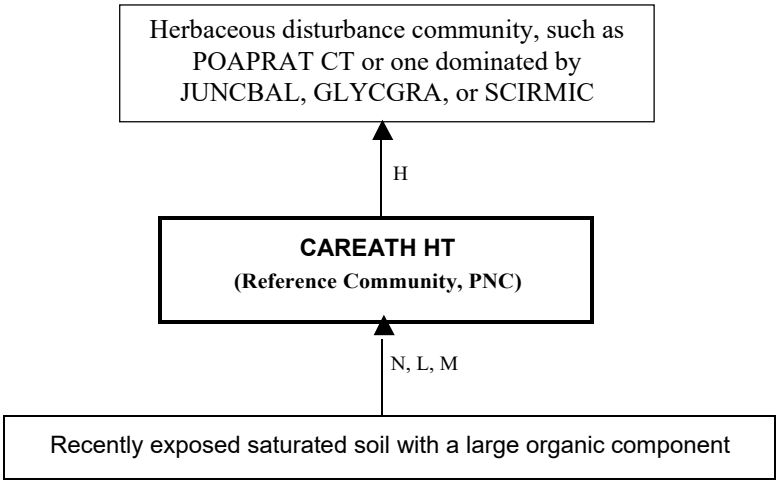
Table 57. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 30 late seral to climax stands of the *Carex atherodes* (awned sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Shrubs				
Salix planifolia (flat-leaved willow)	1	0-1	3	2
Graminoids				
Calamagrostis canadensis (bluejoint)	10	0-10	3	5
Carex aquatilis (water sedge)	10	0-30	10	10
Carex atherodes (awned sedge)	95	60-98	100	97
Carex utriculata (beaked sedge)	10	0-40	17	13
Carex spp. (sedge)	10	0-10	3	5
Glyceria grandis (common tall manna grass)	1	0-1	3	2
Hordeum jubatum (foxtail barley)	1	0-1	3	2

Table 57. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 30 late seral to climax stands of the *Carex atherodes* (awned sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Scirpus pungens (three-square rush)	1	0-1	3	2
Scolochloa festucacea (spangletop)	3	0-3	3	3
Forbs				
Caltha palustris (marsh-marigold)	3	0-3	3	3
Cicuta maculata (water-hemlock)	2	0-3	7	4
Circaea alpina (small enchanter's nightshade)	1	0-1	3	2
Galium trifidum (small bedstraw)	3	0-3	3	3
Geum aleppicum (yellow avens)	1	0-1	3	2
Lysimachia ciliata (fringed loosestrife)	3	0-3	3	3
Mentha arvensis (wild mint)	1	0-1	7	3
Petasites sagittatus (arrow-leaved coltsfoot)	1	0-1	3	2
Polygonum amphibium (water smartweed)	2	0-3	13	5
Polygonum arenastrum (common knotweed)	1	0-1	3	2
Polygonum coccineum (water smartweed)	2	0-3	10	4
Polygonum lapathifolium (pale persicaria)	1	0-1	3	2
Rumex occidentalis (western dock)	1	0-1	3	2
Sagittaria latifolia (broad-leaved arrowhead)	3	0-3	3	3
Scutellaria galericulata (marsh skullcap)	2	0-3	7	4
Sium suave (water parsnip)	1	0-1	7	3
Sonchus arvensis (perennial sow-thistle)	1	0-1	3	2
Urtica dioica (common nettle)	1	0-1	7	3
Ferns and Allies				
Equisetum fluviatile (swamp horsetail)	1	0-1	3	2

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.



Successional Pathway Diagram of CAREATH Sites in the Southern Alberta Grasslands
Reference Community = CAREATH HT

Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY

CAREATH HT	*Carex athrodes* (awned sedge) Habitat Type
GLYCGRA	*Glyceria grandis* (common tall manna grass)
JUNCBAL	*Juncus balticus* (wire rush)
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type
SCIRMIC	*Scirpus microcarpus* (small-fruited bulrush)

Note: This diagram is made with the assumption that hydrologic potential does not change. A wetter hydrologic regime would likely change potential of the site to the TYPHLAT HT or the SCIRACU HT. A drier hydrologic regime would likely change the site potential to a shrub type.

Figure 29. CAREATH HT

SUCCESSIONAL INFORMATION

Carex atherodes (awned sedge) functions as a pioneer colonizer of exposed mineral substrates, such as when a beaver dam breaks; and as a climax species. 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, severe grazing pressures can greatly decrease *Carex atherodes* cover, while increasing the cover of disturbance-related herbaceous species such as *Mentha arvensis* (wild mint), *Scirpus microcarpus* (small-fruited bulrush), and *Poa palustris* (fowl bluegrass). Severe disturbance may lower the water table and shift the site to domination by *Scirpus microcarpus* (small-fruited bulrush) or *Poa palustris* (Table 58). Figure 29 is a general schematic of the successional pathway followed by sites of this type.

Table 58. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of 12 early to mid seral or disturbed stands of the *Carex atherodes* (awned sedge) habitat type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Graminoids				
Carex atherodes (awned sedge)	73	30 - 98	100	85
Carex rostrata (beaked sedge)	8	0 - 10	25	14
Poa palustris (fowl bluegrass)	30	0 - 90	33	31
Scirpus microcarpus (small-fruited bulrush)	14	0 - 20	25	19
Forbs				
Mentha arvensis (wild mint)	3	0 - 3	25	9

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

A wide range of soils is associated with this type. Organic soils (Fibrisols, Mesisols, and Humisols) are most common and often have organic accumulations greater than 1 m (39 in) thick (Brichta 1987). Chernozems and Regosols are also associated with this type. Texture ranges from loamy 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. Available water is estimated at moderate to high.

ADJACENT COMMUNITIES

On many sites the *Carex atherodes* (awned 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 even wetter hydric regimes. Adjacent drier communities may include *Carex aquatilis* (water sedge), *Salix bebbiana* (beaked willow), *Potentilla fruticosa* (shrubby cinquefoil), *Juncus balticus* (wire rush), or *Poa palustris* (fowl bluegrass).

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 atherodes* (awned sedge) depends on season, previous grazing use, and areal extent of the site. On narrow riparian or wetland sites within large pastures, sedge species are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur. In general, 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 sufficient residual cover (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 heavy grazing does occur, there will be a marked decrease in such highly palatable species as *Deschampsia cespitosa* (tufted hair grass) and an increase in the less palatable *Juncus balticus* (wire rush). *Juncus balticus* is considered palatable early in the growing season when plants are young and tender. As stems mature and toughen, palatability declines (Hermann 1975).

Frisina (1991) states that for a grazing program to succeed, it must meet the basic biological requirements of plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed. It is during long growing season rest periods that essential biological processes of food production and storage, reproduction, and seedling establishment occur. In some cases, additional periods of rest may be required to improve or maintain a plant community.

Wildlife

Wildlife utilization of the *Carex atherodes* (awned sedge) habitat type is not well known at this time, although ecologic conditions are similar to those of the *Carex utriculata* (beaked sedge) habitat type.

Beaver perform a vital role in the health and maintenance of riparian ecosystems. Beaver dams assist in controlling the downcutting of channels, bank erosion, and the movement of sediment downstream (Gordon and others 1992). When beavers construct a dam, they raise the water table in the area, which provides water for hydrophytic plants such as willows and sedges. The beaver dam also slows down the water in the channel, which allows suspended sediment to be deposited behind the dam. The combination of sediment deposition and plant reproduction raises the channel bed, creating a wetland environment, which is excellent waterfowl and fish habitat. It has often been the policy of land managers to trap and kill beaver because they can be a nuisance. However, because beaver produce such desirable habitat and provide many beneficial stream functions, their removal needs to be carefully evaluated.

Fisheries

This type is found more frequently in lentic situations around depressional wetlands, sloughs, potholes, and sites generally more alkaline where fish habitat is not an issue.

Fire

More information on burning the *Carex atherodes* (awned

sedge) habitat type is still needed. Residual cover should burn well in early spring, prior to the growing season, or in the fall. Fire will reduce litter accumulations and temporarily increase productivity. Care should be taken before burning because of the excellent soil erosion protection this type provides. In extreme drought conditions there is danger of burning the peat layer of the soil and damaging the *Carex atherodes* 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 favorable for *Carex atherodes* (awned sedge). Off-road vehicles cause 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, sedges offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots. *Carex atherodes* 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 to allow at least 30 days for fall sedge regrowth should provide sufficient residual cover (Myers 1989).

Recreational Uses and Considerations

Recreational use is usually limited to the associated fishery. Heavy 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.

OTHER STUDIES

The *Carex atherodes* (awned sedge) habitat type is described by Thompson and Hansen (2000) for the Grassland Natural Region of southern Alberta. It is similar to the *Carex utriculata* (beaked sedge) habitat type described by Hansen and others (1995) in Montana.

Carex lanuginosa Habitat Type
(Woolly Sedge Habitat Type)

CARELAN

Number of Stands Sampled = 14

Number of Stands Sampled in Alberta = 5

LOCATION AND ASSOCIATED LANDFORMS

The *Carex lanuginosa* (woolly sedge) habitat type is an incidental type on the glaciated prairie of Alberta, primarily in the drier southeast part of the province. This type is generally associated with meadows, basins, glacial depressions (sloughs), and along lake margins that are anaerobically favourable to the buildup of deep organic soils.

VEGETATION

This type is dominated by *Carex lanuginosa* (woolly sedge). Also frequently present are *Calamagrostis* species (reed grass), *Juncus balticus* (wire rush), and *Agrostis stolonifera* (redtop) (Table 59).

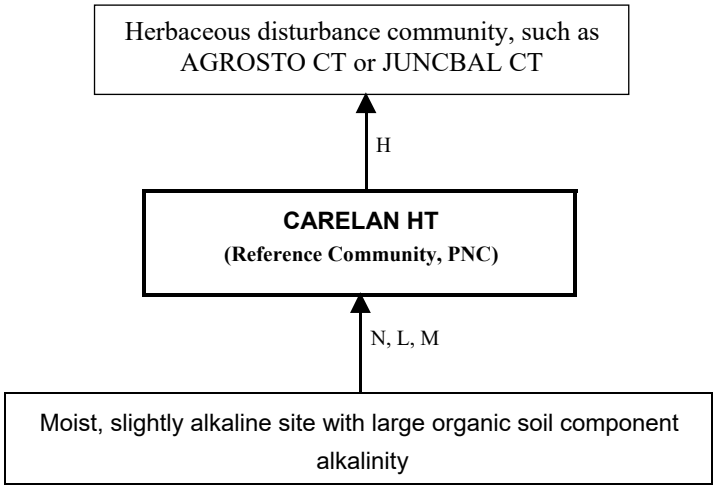
Table 59. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 5 late seral to climax stands of the *Carex lanuginosa* (beaked sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Calamagrostis stricta (narrow reed grass)	1	0 - 1	20	4
Carex lanuginosa (woolly sedge)	65	10 - 98	100	81
Carex lasiocarpa (hairy-fruited sedge)	20	0 - 20	20	20
Eleocharis palustris (creeping spike-rush)	30	0 - 30	20	24
Eriophorum polystachion (tall cotton grass)	10	0 - 10	20	14
Hierochloe odorata (sweet grass)	3	0 - 3	20	8
Hordeum jubatum (foxtail barley)	1	0 - 1	20	4
Scirpus pungens (three-square rush)	7	0 - 10	40	17
Forbs				
Lycopus asper (western water-horehound)	1	0 - 1	40	6
Typha latifolia (common cattail)	1	0 - 1	20	4

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

Moderate disturbance will increase cover of *Juncus balticus* (wire rush) and associated forbs. Severe disturbance may lower the water table and shift the site to domination by *Juncus balticus* (wire rush) or *Agrostis stolonifera* (redtop) (Table 60). Figure 30 is a general schematic of the successional pathway followed on sites of this type.



Successional Pathway Diagram of CARELAN Sites in Southern Alberta Grasslands
Reference Community = CARELAN HT

Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY
AGROSTO CT *Agrostis stolonifera* (redtop) Community Type
CARELAN HT *Carex lanuginosa* (wooly sedge) Habitat Type
JUNCBAL CT *Juncus balticus* (wire rush) Community Type

Note: This diagram is made with the assumption that hydrologic potential does not change. A wetter hydrologic regime would likely change potential of the site to the TYPHLAT HT or the SCIRACU HT. A drier hydrologic regime would likely change the site potential to a shrub type.

Figure 30. CARELAN HT

Table 60. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 early to mid seral or disturbed stands of the *Carex lanuginosa* (woolly sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Potentilla fruticosa (shrubby cinquefoil)	1	0 - 1	11	3
Rosa acicularis (prickly rose)	3	0 - 3	11	6
Rosa spp. (rose)	1	0 - 1	11	3
Salix bebbiana (beaked willow)	1	0 - 1	11	3
Graminoids				
Agropyron repens (quack grass)	10	0 - 10	11	10
Agrostis stolonifera (redtop)	13	0 - 40	44	24
Calamagrostis canadensis (bluejoint)	40	0 - 40	11	21
Calamagrostis stricta (narrow reed grass)	19	0 - 50	33	25
Carex atherodes (awned sedge)	3	0 - 3	11	6
Carex bebbii (Bebb's sedge)	10	0 - 10	11	10
Carex flava (yellow sedge)	3	0 - 3	11	6
Carex lanuginosa (woolly sedge)	51	10 - 98	100	71
Carex lasiocarpa (hairy-fruited sedge)	3	0 - 3	11	6
Carex praegracilis (graceful sedge)	3	0 - 3	11	6
Carex rostrata (beaked sedge)	20	0 - 20	11	15
Carex viridula (green sedge)	1	0 - 1	11	3
Deschampsia cespitosa (tufted hair grass)	10	0 - 10	11	10
Hordeum jubatum (foxtail barley)	2	0 - 3	22	7
Juncus balticus (wire rush)	53	0 - 80	33	42
Phalaris arundinacea (reed canary grass)	11	0 - 30	33	19
Phleum pratense (timothy)	10	0 - 10	11	10
Poa palustris (fowl bluegrass)	20	0 - 40	22	21
Poa pratensis (Kentucky bluegrass)	12	0 - 20	22	16
Scirpus pallidus (pale bulrush)	1	0 - 1	11	3
Scirpus pungens (three-square rush)	40	0 - 40	11	21
Forbs				
Allium schoenoprasum (wild chives)	1	0 - 1	11	3
Aster ascendens (western aster)	30	0 - 30	11	18
Cicuta maculata (water-hemlock)	18	0 - 40	33	24
Cirsium arvense (Canada thistle)	3	0 - 3	22	8
Cirsium vulgare (bull thistle)	3	0 - 3	11	6
Dodecatheon spp. (shooting star)	1	0 - 1	11	3
Galium boreale (northern bedstraw)	1	0 - 1	11	3
Gentiana affinis (prairie gentian)	1	0 - 1	11	3
Heracleum lanatum (cow parsnip)	3	0 - 3	11	6
Mentha arvensis (wild mint)	5	0 - 10	33	13

Table 60. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 early to mid seral or disturbed stands of the *Carex lanuginosa* (woolly sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Polygonum coccineum (water smartweed)	10	0 - 10	11	10
Potentilla anserina (silverweed)	20	0 - 40	22	21
Potentilla gracilis (graceful cinquefoil)	3	0 - 3	11	6
Potentilla palustris (marsh cinquefoil)	30	0 - 30	11	18
Ranunculus macounii (Macoun's buttercup)	1	0 - 1	11	3
Rumex crispus (curled dock)	1	0 - 1	11	3
Scutellaria galericulata (marsh skullcap)	1	0 - 1	11	3
Stachys palustris (marsh hedge-nettle)	3	0 - 3	11	6
Taraxacum officinale (common dandelion)	3	0 - 3	11	6
Ferns and Allies				
Equisetum arvense (common horsetail)	20	0 - 40	22	21

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

Soils are typically Organic (Fibrisols, Mesisols, and Humisols), with thick accumulations of partially decomposed sedges. Texture is predominantly loam. Drainage is poor to very poor. Sites are often flooded into July or August, with water tables remaining within the root zone throughout the growing season.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by the *Carex atherodes* (awned sedge) or the *Carex aquatilis* (water sedge) habitat types. Drier communities may be dominated by the *Deschampsia cespitosa* (tufted hair grass) habitat type or the *Juncus balticus* (wire rush) community type.

MANAGEMENT INFORMATION

Livestock

Estimated herbage production is moderate to high ranging from 1,000 to 3,000 lbs/acre dry weight (Kovalchik 1987). *Carex lanuginosa* (woolly sedge) is highly palatable to livestock and may attract earlier use than desired. Livestock tend to avoid the wet meadows or basins until they are surface dry, usually by mid summer. *Carex lanuginosa* (woolly sedge) can rapidly reoccupy moderately disturbed sites under a combination of rest and late season grazing. Livestock should be removed before 40 percent of the summer/fall forage has been utilized to insure an upward trend in ecological status (Kovalchik 1987).

Frisina (1991) states that for a grazing program to succeed, it must meet the basic biological requirements of plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed. It is during long growing season rest periods that essential biological processes of food production and storage, reproduction, and seedling establishment occur. In some cases, additional periods of rest may be required to improve or

maintain a plant community.

Wildlife

The *Carex lanuginosa* (woolly sedge) habitat type is generally flooded long enough to provide nesting habitat for waterfowl. However, it has limited use by songbirds and small mammals due to the lack of diversity and flooded soils. It is an important habitat for raptors, deer, and elk. Deer use the type for fawning.

Beaver perform a vital role in the health and maintenance of riparian ecosystems. Beaver dams assist in controlling the downcutting of channels, bank erosion, and the movement of sediment downstream (Gordon and others 1992). When beavers construct a dam, they raise the water table in the area, which provides water for hydrophytic plants such as willows and sedges. The beaver dam also slows down the water in the channel, which allows suspended sediment to be deposited behind the dam. The combination of sediment deposition and plant reproduction raises the channel bed, creating a wetland environment that is excellent waterfowl and fish habitat. It has often been the policy of land managers to trap and kill beaver because they can be a nuisance. However, because beaver produce such desirable habitat and provide many beneficial stream functions, their removal needs to be carefully evaluated.

Fire

Fire will help reduce litter accumulations and competitors. Dominant sedges of this habitat type are resistant to damage by fire except where hot fires penetrate the peat soil.

Soil Management and Rehabilitation Opportunities

Mechanical activities in this habitat type should be avoided because of the fragile nature of wet, organic soils. Livestock should be kept off these sites until surface soils are dry. Trails and roads should be located on the adjacent uplands.

Carex lanuginosa (woolly sedge) is useful for improving degraded sites. Its long, creeping rhizomes form a dense mat, effectively stabilizing streambank soils. Moderately disturbed sites can improve rapidly if protected.

Recreational Uses and Considerations

The sites provide good opportunities for viewing deer, elk, and waterfowl. Floodplain sites adjacent to streams are often used for fishing access.

OTHER STUDIES

The *Carex lanuginosa* (woolly sedge) habitat type is described by Hansen and others (1995) in Montana. This type is similar to the *Carex lanuginosa* (woolly sedge) and the *Carex lasiocarpa* (hairy-fruited sedge) associations described by Kovalchik (1987) for central Oregon. Padgett and others (1989) described a similar community for Utah and southeastern Idaho.

Carex utriculata Habitat Type
(Beaked Sedge Habitat Type)

CAREUTR

Number of Stands Sampled = 50

Number of Stands Sampled in Alberta = 24

LOCATION AND ASSOCIATED LANDFORMS

The *Carex utriculata* (beaked sedge) habitat type is a minor type at low to mid elevations in southwestern Alberta. This type is very similar to the *Carex atherodes* (awned sedge) habitat type in landscape position, soils, and hydrology. The two types differ primarily in dominant species and geographic distribution. The *Carex atherodes* habitat type is found generally more to the north of the *Carex utriculata*.

Carex utriculata sites are adjacent to low gradient streams in wide valley bottoms or associated with perennial seeps. It can occur in standing water or on sites that become relatively dry during the later part of the growing season. Many sites are located where beaver ponds have filled with sediment. The surface may occasionally be mounded. This micro topographic relief usually results from a buildup of *Carex* species (sedge) sod and downcutting of small channels by overland flow during spring runoff, or may be remnant channels used by beaver when water tables were higher. The *Carex utriculata* represents one of the wettest riparian and wetland communities.

VEGETATION

The *Carex utriculata* (beaked sedge) habitat type in undisturbed condition is typically a monospecific stand of dense *Carex utriculata*. Also present may be lesser amounts of *Carex atherodes* (awned sedge) or *Carex aquatilis* (water sedge) (Table 61).

Table 61. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 24 late seral to climax stands of the *Carex utriculata* (beaked sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Shrubs				
Cornus stolonifera (red-osier dogwood)	3	0-3	4	3
Salix exigua (sandbar willow)	1	0-1	4	2
Graminoids				
Beckmannia syzigachne (slough grass)	1	0-1	4	2
Calamagrostis canadensis (bluejoint)	1	0-1	13	4
Carex aquatilis (water sedge)	10	0-20	13	11
Carex atherodes (awned sedge)	8	0-10	13	10
Carex utriculata (beaked sedge)	91	70-98	100	95
Carex vesicaria (blister sedge)	1	0-1	4	2
Glyceria grandis (common tall manna grass)	1	0-1	13	4

Table 61. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 24 late seral to climax stands of the *Carex utriculata* (beaked sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Phalaris arundinacea (reed canary grass)	1	0-1	4	2
Poa palustris (fowl bluegrass)	1	0-1	4	2
Scirpus microcarpus (small-fruited bulrush)	1	0-1	8	3
Scirpus validus (common great bulrush)	1	0-1	4	2
Forbs				
Cicuta maculata (water-hemlock)	1	0-1	8	3
Cirsium arvense (Canada thistle)	1	0-1	4	2
Epilobium ciliatum (northern willowherb)	2	0-3	8	4
Geum macrophyllum (large-leaved yellow avens)	1	0-1	4	2
Mentha arvensis (wild mint)	3	0-3	8	5
Polygonum amphibium (water smartweed)	1	0-1	4	2
Polygonum coccineum (water smartweed)	3	0-3	4	3
Polygonum lapathifolium (pale persicaria)	1	0-1	4	2
Potentilla palustris (marsh cinquefoil)	1	0-3	13	4
Scutellaria galericulata (marsh skullcap)	1	0-1	4	2
Sonchus spp. (sow-thistle)	1	0-1	4	2
Typha latifolia (common cattail)	2	0-3	21	6
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0-1	4	2
Equisetum fluviatile (swamp horsetail)	2	0-3	8	4
Equisetum laevigatum (smooth scouring-rush)	1	0-1	4	2
Equisetum pratense (meadow horsetail)	1	0-1	4	2

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

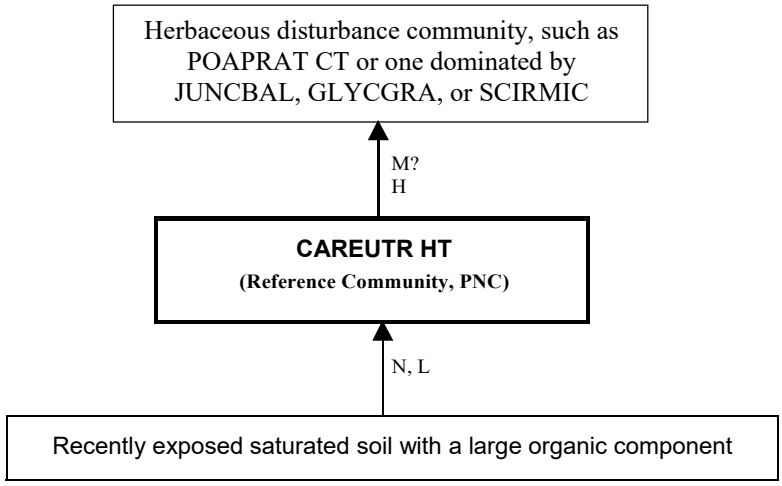
SUCCESSIONAL INFORMATION

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. 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, severe grazing pressures can greatly decrease *Carex utriculata* cover, while increasing the cover of disturbance-related herbaceous species such as *Scirpus microcarpus* (small-fruited bulrush), *Mentha arvensis* (wild mint), and *Epilobium ciliatum* (northern willowherb). Severe disturbance may lower the water table and shift the site to domination by *Scirpus microcarpus* (small-fruited bulrush) , *Juncus balticus* (wire rush), or one of the *Poa* species (Table 62). Figure 31 is a general schematic of the successional pathway followed on sites of this type.

SOILS

A wide range of soils is associated with this type. Organic soils (Fibrisols, Mesisols, and Humisols) are most common and often have organic accumulations greater

than 1 m (39 in) thick (Brichta 1987). Chernozems and Regosols are also associated with this type. Texture ranges from loamy 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. Empirically these soils appear more anaerobic than those of the *Carex aquatilis* (water sedge) habitat type. Available water is estimated at moderate to high. Soil reaction is slightly acid to neutral (pH 6.5 to 7.0).



Successional Pathway Diagram of CAREUTR Sites in Southern Alberta Grasslands
Reference Community = CAREUTR HT

Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
CAREUTR HT	*Carex utriculata* (beaked sedge) Habitat Type
GLYCGRA	*Glyceria grandis* (common tall manna grass)
JUNCBAL	*Juncus balticus* (wire rush)
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type
SCIRMIC	*Scirpus microcarpus* (small-fruited bulrush)

Note: This diagram is made with the assumption that hydrologic potential does not change. A wetter hydrologic regime would likely change potential of the site to the TYPHLAT HT or the SCIRACU HT. A drier hydrologic regime would likely change the site potential to a shrub type.

Figure 31. CAREUTR HT

Table 62. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of 26 early to mid seral or disturbed stands of the *Carex utriculata* (beaked sedge) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Graminoids				
Carex aquatilis (water sedge)	16	0 - 30	50	28
Carex rostrata (beaked sedge)	71	10 - 98	100	84
Forbs				
Epilobium ciliatum (northern willowherb)	9	0 - 40	27	16
Mentha arvensis (wild mint)	6	0 - 20	35	14
Polygonum amphibium (water smartweed)	7	0 - 20	27	14

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

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 even wetter hydric regimes. Adjacent drier communities may include *Carex aquatilis* (water sedge), *Salix bebbiana* (beaked willow), *Salix planifolia* (flat-leaved willow), *Juncus balticus* (wire rush), or *Poa palustris* (fowl bluegrass).

MANAGEMENT INFORMATION

Management of the *Carex utriculata* (beaked sedge) and *Carex atherodes* (awned sedge) habitat types are treated similarly.

Livestock

Livestock forage value of the *Carex utriculata* (beaked sedge) habitat type depends on season, previous grazing use, and areal extent of the site. On narrow riparian or wetland sites within large pastures, sedge species are heavily utilized, particularly when upland plants become cured, or where animal distribution and stocking rate problems occur.

In general, 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 sufficient residual cover (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 heavy grazing does occur, there will be a marked decrease in such highly palatable species as *Deschampsia cespitosa* (tufted hair grass) and an increase in the less palatable *Juncus balticus* (wire rush). *Juncus balticus* is considered palatable early in the growing season when plants are young and tender. As stems mature and toughen, palatability declines (Hermann 1975).

Frisina (1991) states that for a grazing program to succeed, it must meet the basic biological requirements of plants: photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed. It is during long growing season rest periods that essential biological processes of food production and storage, reproduction, and seedling establishment occur. In some cases, additional periods of rest may be required to improve or maintain a plant community.

Wildlife

Elk and moose may graze stands of this habitat type, especially if *Carex vesicaria* (blister sedge) is abundant.

Beaver perform a vital role in the health and maintenance of riparian ecosystems. Beaver dams assist in controlling the downcutting of channels, bank erosion, and the movement of sediment downstream (Gordon and others 1992). When beavers construct a dam, they raise the water table in the area, which provides water for hydrophytic plants such as willows and sedges. The beaver dam also slows down the water in the channel, which allows suspended sediment to be deposited behind the dam. The combination of sediment deposition and plant reproduction raises the channel bed, creating a wetland environment, which is excellent waterfowl and fish habitat. It has often been the policy of land managers to trap and kill beaver because they can be a nuisance. However, because beaver produce such desirable habitat and provide many beneficial stream functions, their removal needs to be carefully evaluated.

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

Fire consumes the aboveground tissue of *Carex utriculata* (beaked sedge), top-killing the plant. The rhizomes, however, survive most fires, even fires that consume organic soils. Herbage productivity temporarily increases after burning (USDA IFSL 1995).

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 IFSL 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* provides. Fires do little to change plant composition of beaked sedge communities (DeBenedetti and Parsons 1984).

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 favorable for *Carex utriculata* (beaked sedge). Off-road vehicles cause 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, sedges offer better streambank protection than grasses, primarily due to their stronger rhizomatous roots.

Carex utriculata 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 to allow at least 30 days for fall sedge regrowth should provide sufficient residual cover (Myers 1989).

Recreational Uses and Considerations

Recreational use is usually limited to the associated fishery. Heavy 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.

OTHER STUDIES

The *Carex utriculata* (beaked sedge) habitat type is described by Thompson and Hansen (2000) for the Grassland Natural Region of southern Alberta and by Hansen and others (1995) in Montana. Numerous other studies have identified similar communities, reflecting 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).

Agropyron smithii Habitat Type
(Western Wheat Grass Habitat Type)

AGROSMI

Number of Stands Sampled = 34

Number of Stands Sampled in Alberta = 9

CAUTION—Not all sites currently dominated by *Agropyron smithii* (western wheat grass) 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 Landforms section.

LOCATION AND ASSOCIATED LANDFORMS

The *Agropyron smithii* (western wheat grass) habitat type is a minor type found mostly in southeastern Alberta. This type may occupy the lowest level of a slight depression or a relatively flat alluvial fan position. Sites may be swales and nearly level alluvial terraces where either overland flow or soil conditions (fine textures), or a combination of both, provide more available moisture than surrounding uplands. In many situations, the fine textured soils have resulted in a perched water table.

VEGETATION

In the *Agropyron smithii* (western wheat grass) habitat type, *Agropyron smithii* typically occurs in nearly pure stands with limited presence of other species (Table 63).

Table 63. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 14 late seral to climax stands of the *Agropyron smithii* (western wheat grass) habitat type.

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Shrubs				
Artemisia cana (silver sagebrush)	1	0-1	7	3
Graminoids				
Agropyron smithii (western wheat grass)	89	80-98	100	94
Bouteloua curtipendula (sideoat grama)	1	0-1	7	3
Bromus inermis (smooth brome)	2	0-3	14	5
Bromus japonicus (Japanese chess)	1	0-1	7	3
Carex spp. (sedge)	1	0-1	7	3
Deschampsia cespitosa (tufted hair grass)	1	0-1	7	3
Hordeum jubatum (foxtail barley)	1	0-3	29	5
Poa palustris (fowl bluegrass)	1	0-1	7	3
Poa pratensis (Kentucky bluegrass)	3	0-3	7	5
Stipa comata (needle-and-thread)	1	0-1	7	3
Stipa viridula (green needle grass)	11	0-20	21	15

Table 63. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 14 late seral to climax stands of the *Agropyron smithii* (western wheat grass) habitat type.

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Forbs				
Achillea millefolium (common yarrow)	1	0-1	7	3
Artemisia frigida (pasture sagewort)	5	0-10	14	8
Artemisia ludoviciana (prairie sagewort)	1	0-1	7	3
Aster ascendens (western aster)	3	0-3	7	5
Atriplex spp. (atriplex)	1	0-1	7	3
Atriplex prostrata (prostrate saltbush)	1	0-1	7	3
Eurotia lanata (winter-fat)	3	0-3	7	5
Grindelia squarrosa (gumweed)	1	0-1	14	4
Kochia scoparia (summer-cypress)	3	0-3	7	5
Lactuca pulchella (common blue lettuce)	1	0-1	7	3
Linum lewisii (wild blue flax)	1	0-1	7	3
Melilotus officinalis (yellow sweet-clover)	2	0-3	14	5
Polygonum spp. (Knotweed; Smartweed; Bistort)	3	0-3	7	5
Rumex crispus (curled dock)	2	0-3	14	5
Rumex triangulivalvis (narrow-leaved dock)	1	0-1	7	3
Sonchus arvensis (perennial sow-thistle)	1	0-1	7	3
Sonchus asper (prickly annual sow-thistle)	1	0-1	14	4
Sphaeralcea coccinea (scarlet mallow)	3	0-3	7	5
Taraxacum officinale (common dandelion)	3	0-3	7	5
Tragopogon dubius (common goat's-beard)	1	0-1	7	3
Vicia americana (wild vetch)	2	0-3	21	6

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

Overgrazing of these sites will reduce the vigor and cover of *Agropyron smithii* (western wheat grass).

Severe overgrazing will convert the site to domination by less desirable species such as *Poa species* (bluegrass), *Artemisia ludoviciana* (prairie sagewort), *A. frigida* (pasture sagewort), and *Xanthium strumarium* (cocklebur) (Table 64). Figure 32 is a general schematic of the successional pathway followed on sites of this type.

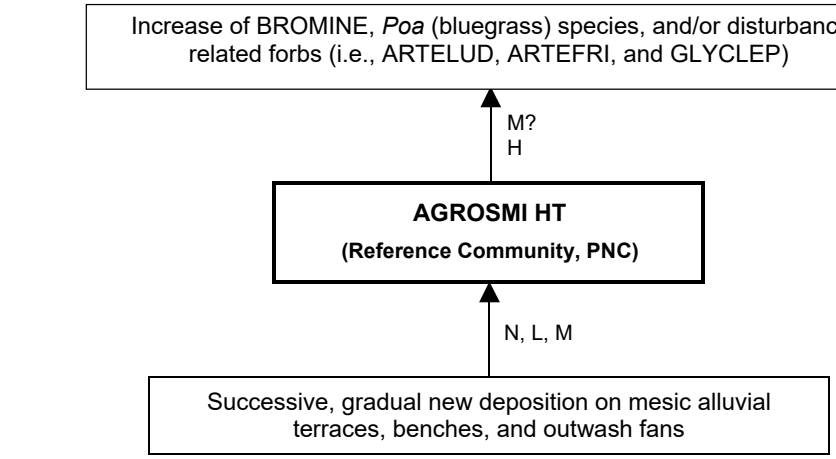
SOILS

Soil texture ranges from clay to silt loam. Drainage ranges from poor to very poor. Seasonal flooding is common in spring after snowmelt. Soil reaction varies widely from neutral to moderately alkaline (pH 7.0 to 8.5). Saline soils are also common.

ADJACENT COMMUNITIES

This type may occupy the lowest level of a slight depression or a relatively flat alluvial fan position, but adjacent wetter sites may include *Salix* species (willow) types, the *Shepherdia argentea* (thorny buffaloberry)

community type, the *Deschampsia cespitosa* (tufted hair grass) habitat type, or the *Hordeum jubatum* (foxtail barley) community type. Adjacent drier sites may support the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) or the *Sarcobatus vermiculatus/Agropyron smithii* (greasewood/western wheat grass) habitat types, or be dominated by upland species.



Successional Pathway Diagram for AGROSMI Sites in Southern Alberta Grasslands
Reference Community = AGROSMI HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
AGROSMI HT	*Agropyron smithii* (western wheat grass) Habitat Type
BROMINE	*Bromus inermis* (smooth brome)
ARTELUD	*Artemesia ludoviciana* (prairie sagewort)
ARTEFRI	*Artemesia frigida* (pasture sagewort)
GLYCLEP	*Glycyrrhiza lepidota* (wild licorice)

Note: Site conditions favouring AGROSMI are generally not created by single geomorphic events, but rather evolve over long periods as lower fluvial sites become gradually elevated, drier, and topped by finer soil texture through successive flooding events.

Figure 32. AGROSMI HT

Table 64. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 20 disturbed and/or early to mid-seral stands of the *Agropyron smithii* (western wheat grass) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Shrubs				
Artemisia cana (silver sagebrush)	1	0-3	40	6
Rosa spp. (rose)	1	0-3	25	5
Symphoricarpos occidentalis (buckbrush)	1	0-3	30	5

Table 64. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 20 disturbed and/or early to mid-seral stands of the *Agropyron smithii* (western wheat grass) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Agropyron smithii (western wheat grass)	70	40-98	100	84
Hordeum jubatum (foxtail barley)	7	0-10	25	13
Poa pratensis (Kentucky bluegrass)	17	0-40	25	21
Stipa viridula (green needle grass)	3	0-3	25	9
Forbs				
Achillea millefolium (common yarrow)	7	0-20	25	13
Artemisia ludoviciana (prairie sagewort)	5	0-20	25	11
Glycyrrhiza lepidota (wild licorice)	10	0-40	30	17

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

MANAGEMENT INFORMATION

Livestock

Forage production of the *Agropyron smithii* (western wheat grass) habitat type is moderate to high. *Agropyron smithii* is highly desired by livestock. This species is very palatable and nutritious when green in the spring, and moderately so during other times of the year (Johnson and Nichols 1982). In Montana, it is commonly cut for hay. Vigorous rhizomes make *Agropyron smithii* one of the more tolerant of the desirable and abundant grasses to grazing pressure and drought. However, overgrazing in May and June will decrease its abundance. When growing conditions improve following drought or overgrazing, it may rapidly recolonize areas previously occupied.

Wildlife

Hiding and thermal cover is minimal in this type. However, it may be used for nesting sites by a variety of waterfowl. The *Agropyron smithii* (western wheat grass) habitat type is highly desired by wildlife such as deer and antelope. It is palatable and nutritious when green in the spring, and moderately so during other times of the year (Johnson and Nichols 1982).

Fire

Agropyron smithii (western wheat grass) has a good tolerance to fire in the dormant state. It usually survives fires during the growing season but recovery may be delayed (Wasser 1982). A study investigating the effects of fire on *Agropyron smithii* found that vegetative propagation was enhanced immediately after burning, and growth returned to the level of unburned plots during the second growing season (USDA IFSL 1995). Although growth of new shoots is apparently retarded by early spring burning, this effect does not persist, as fall- and spring-burned plants have similar yields after mid-May. However, burns in the spring after new growth is initiated can severely injure this species. Annual spring burns favor the cool-season *Agropyron smithii*. Although height of the species is reduced by burning any time, plants increase in abundance and density after a fire. Fall burning also stimulates productivity but to a lesser degree. Forage quality can be improved with burning. (USDA IFSL 1995).

Soil Management and Rehabilitation Opportunities

Agropyron smithii (western wheat grass) is potentially valuable for revegetating some disturbed or degraded wetland sites in eastern and central Montana. Using transplants will speed the recovery process, as seedlings are typically slow growing. However, once established, plants quickly spread by rhizomes.

Agropyron smithii tolerates moderately severe drought if it is not greatly prolonged, surviving by rhizomes (Wasser 1982).

OTHER STUDIES

The *Agropyron smithii* (western wheat grass) habitat type is described by Hansen and others (1995) in Montana. Similar sites in the northern Great Plains have described by Hansen and others 1984 and Hansen and Hoffman 1988.

Bromus inermis Community Type
(Smooth Brome Community Type)

BROMINE

Number of Stands Sampled = 7

Number of Stands Sampled in Alberta = 2

LOCATION AND ASSOCIATED LANDFORMS

The *Bromus inermis* (smooth or awnless brome) community type is a minor, widespread type across southern Alberta. Stands are located on mesic alluvial terraces that were previously cultivated hay meadows or subjected to high grazing pressures. The species is exotic and quite aggressive across a wide range of site types. It can be especially abundant on alluvial benches along major stream floodplains.

VEGETATION

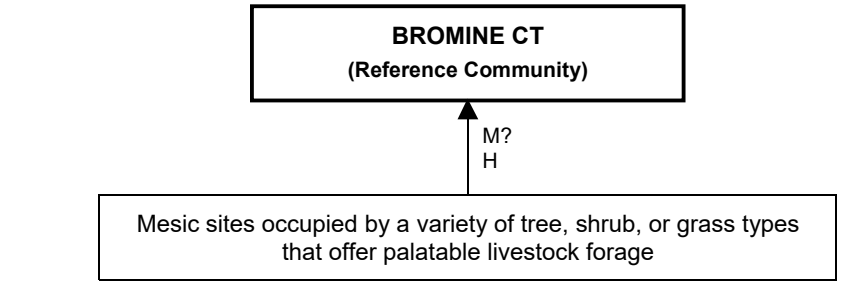
There are native and introduced elements within this species present in Alberta (Moss 1983). The native *Bromus inermis*, subspecies *pumpellianus* is difficult to distinguish in the field form the introduced subspecies *inermis*. The latter is a European meadow grass that is widely introduced and naturalized in North America. We do not differentiate between the two subspecies in this document.

Due to the aggressive nature of the species, and the high degree of disturbance on many suitable sites, *Bromus inermis* now dominates many sites in nearly pure stands. If these stands are not too severely grazed, they may be dominated entirely by *Bromus inermis*; otherwise, they may have a mixture of herbaceous “weedy” species including *Poa pratensis* (Kentucky bluegrass), *Agrostis stolonifera* (redtop), or disturbance-related forb species (Table 65). Stands of this type represent one of the drier of the herbaceous riparian or wetland community types.

Table 65. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 7 stands of the *Bromus inermis* (smooth brome) community type.

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Shrubs				
Rosa spp. (rose)	10	0-10	14	12
Symphoricarpos occidentalis (buckbrush)	10	0-10	14	12
Graminoids				
Agropyron smithii (western wheat grass)	3	0-3	14	6
Bromus inermis (smooth brome)	96	90-98	100	98
Forbs				
Alyssum desertorum (desert alyssum)	1	0-1	14	4
Cirsium arvense (Canada thistle)	1	0-1	14	4
Crepis tectorum (annual hawk's-beard)	1	0-1	14	4
Glycyrrhiza lepidota (wild licorice)	10	0-10	14	12
Medicago sativa (alfalfa)	3	0-3	14	6
Melilotus officinalis (yellow sweet-clover)	1	0-1	14	4
Polygonum coccineum (water smartweed)	10	0-10	14	12
Rumex crispus (curled dock)	3	0-3	14	6
Sonchus spp. (sow-thistle)	3	0-3	14	6
Taraxacum officinale (common dandelion)	1	0-1	14	4

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.



Successional Pathway Diagram for BROMINE Sites in Southern Alberta Grasslands
Reference Community = BROMINE CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY
BROMINE CT *Bromus inermis* (smooth brome) Community Type

Note: This species is a strong, aggressive competitor on a variety of site types. It can replace native herbaceous communities and understories of tree and shrub communities.

Figure 33. BROMINE CT

SUCCESSIONAL INFORMATION

The *Bromus inermis* (smooth brome) community type represents an early/mid-seral grazing disclimax of many types including the *Calamagrostis canadensis* (bluejoint), *Deschampsia cespitosa* (tufted hair grass), and the *Agropyron smithii* (western wheat grass) habitat types. Once a suitable site is disturbed, the extensive rhizome system of *Bromus inermis* allows it to rapidly spread and establish on these areas. It tolerates high levels of utilization, making replacement by former dominants very difficult. Close observation of sites on similar landscape positions may give insight to the climax community for the site. Figure 33 is a general schematic of the successional pathway followed on sites of this type.

SOILS

Soils are typically Brown and Dark Brown Chernozems or Regosols. *Bromus inermis* (smooth brome) thrives on moist, well-drained, finer textured soils. It does poorly on sandy or dense clay soils. *Bromus inermis* is generally intolerant of prolonged flooding, seasonally high water tables, or poor drainage. It is tolerant of weakly acidic to slightly alkaline soils.

ADJACENT COMMUNITIES

Wetter sites support a wide range of communities including those within the *Populus* (cottonwood), *Salix* (willow), *Potentilla fruticosa* (shrubby cinquefoil), *Carex utriculata* (beaked sedge), and *Juncus balticus* (wire rush) types. Adjacent drier sites may be dominated by a wide variety of upland species.

MANAGEMENT INFORMATION

Livestock

The *Bromus inermis* (smooth brome) community type has high forage value. *Bromus inermis* is highly palatable to livestock when green, but less so when it is cured (USDA Forest Service 1973). The species is a cool season grass. During the summer, it becomes semi-dormant until fall rains, but fall regrowth is seldom great (Paulsen and others 1968, Raese and Decker 1966).

Moderate grazing on the *Bromus inermis* community type in the spring and fall can complement ranges of native warm season species grazed during the summer. A rotational grazing system encourages more uniform grazing use. Periodic rest when *Bromus inermis* is actively growing helps maintain vigorous stands (Wasser 1982).

Bromus inermis is a highly competitive, sod-forming grass. It has a dense system of shallow, fibrous roots and rhizomes, and an extensive network of deeper roots on well-drained sites. However, high water tables that create saturated conditions within its rooting zone cause a decrease in number of roots and a reduction in overall vigor. Dense monocultures typically become sod-bound 3-5 years after establishment (Wasser 1982).

Grazing practices influence the growth form present. A high density of weak, low vigor tillers results from season-long grazing. Early season rest can increase the vigor of *Bromus inermis* stands. Fewer shoots may be produced, but total aboveground biomass tends to be greater. Streambanks with *Bromus inermis* stands are susceptible to hoof shear damage.

Wildlife

Elk and deer use the grasses and forbs of this type, especially in early spring when other forages have not yet greened (Gaffney 1941, Singer 1975). Waterfowl utilize *Bromus inermis* (smooth brome) for food and cover. Canada geese often graze young plants (Martin and others 1951). Upland game birds, small mammals, and small non-game birds also use this type for cover, but species diversity is typically low (Dittberner and Olson 1983).

Fisheries

The *Bromus inermis* (smooth brome) community type is not very effective in stabilizing streambanks. Bank undercutting and sloughing may occur, especially when soils are wet or stands are weakened by excessive grazing.

Fire

Early spring (late March-April) or late-season (late summer-fall) fire can increase *Bromus inermis* (smooth brome) productivity, especially if it has become sod-bound. Late spring fire generally damages cool-season grasses such as *Bromus inermis* (USDA IFSL 1995). This species is able to quickly resprout following burning because of its extensive network of rhizomes. However, it is intolerant of burning during the active growth stages and can be successfully controlled by late spring burning. Cool burns will have little effect on *Bromus inermis* (Wasser 1982).

Soil Management and Rehabilitation Opportunities

The potential for soil compaction is greatest in the spring when soils are moist. *Bromus inermis* (smooth brome) has an extensive rhizome system, but its shallow rooting characteristics in all but well drained sites make it only marginally effective in stabilizing streambanks. The potential for erosional problems associated with this community type can be quite high. Managers need to pay close attention to streambanks covered by *Bromus inermis* to detect early signs of streambank collapse. Once the streambank starts to laterally cut, little can be done to save it short of expensive reconstructive treatments.

So often on these degraded sites, water tables have dropped reach of the native riparian species, and these sites will continue to be dominated by introduced grasses. On those sites adjacent to a first or second order stream, the use of rock check dams to aid in the rehabilitation of degraded (de-watered) sites is an excellent cost-effective approach. The rock dam will help raise the water table thereby allowing the willows and sedges (under careful grazing management) to reclaim a degraded site.

OTHER STUDIES

The *Bromus inermis* (smooth brome) community type is described by Hansen and others (1995) in Montana.

Calamagrostis stricta Community Type

(Narrow Reedgrass Community Type)

CALASTR

Number of Stands Sampled = 8

Number of Stands Sampled in Alberta = 5

Note: The *Calamagrostis stricta* (narrow reedgrass) community type includes all combinations of *Calamagrostis stricta* (narrow reedgrass) and *C. inexpansa* (northern reedgrass).

LOCATION AND ASSOCIATED LANDFORMS

The *Calamagrostis stricta* (narrow reedgrass) community type is an incidental type at low to mid elevations in southern Alberta. The type occurs in wet meadows, basins, slightly saline depressions, and on alluvial terraces or benches of low gradient streams as one gets into the Parkland and Foothills Ecoregions.

VEGETATION

The diagnostic species of this community type are *Calamagrostis* species (reed grass), *Juncus balticus* (wire rush), and *Hordeum jubatum* (foxtail barley). Associated herbaceous species may include *Mentha arvensis* (wild mint) and *Polygonum amphibium* (water smartweed) (Table 66).

Table 66. Average canopy cover, range of canopy cover, constancy (frequency), and prominence index for species recorded in at least 25 percent of the 8 stands of the *Calamagrostis stricta* (narrow reedgrass) community type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Graminoids				
Calamagrostis inexpansa (northern reed grass)	60	0 - 90	38	48
Calamagrostis stricta (narrow reed grass)	68	0 - 98	63	65
Hordeum jubatum (foxtail barley)	6	0 - 20	75	21
Juncus balticus (wire rush)	22	0 - 60	75	41
Poa palustris (fowl bluegrass)	17	0 - 30	38	25
Forbs				
Cirsium arvense (Canada thistle)	1	0 - 3	38	6
Fragaria virginiana (wild strawberry)	1	0 - 1	25	5
Mentha arvensis (wild mint)	8	0 - 20	38	17
Polygonum amphibium (water smartweed)	1	0 - 3	38	6
Potentilla anserina (silverweed)	7	0 - 10	25	13
Sonchus spp. (sow-thistle)	5	0 - 10	25	11

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

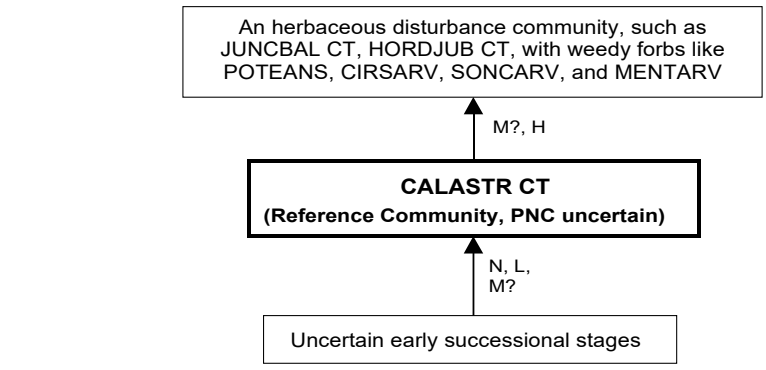
Moderate grazing reduces the reproductive potential and vigor of *Calamagrostis stricta* (narrow reedgrass) through reduced seedhead production and depletion of carbohydrate reserves. Under heavy grazing cover is reduced and other graminoids and forbs increase on the site. Severely disturbed dry sites become dominated by such graminoids as *Juncus balticus* (wire rush), *Hordeum jubatum* (foxtail barley), or *Poa palustris* (fowl bluegrass), and have an abundance of forbs such as *Mentha arvensis* (wild mint), *Potentilla anserina* (silverweed), and *Sonchus* species (sow-thistle). Severely disturbed moist sites generally become dominated by *Juncus balticus* (wire rush) and by an assortment of forbs. These disturbed stands begin to take on the appearance of the *Juncus balticus* (wire rush) or *Hordeum jubatum* (foxtail barley) community types. Figure 34 is a general schematic of the successional pathway followed on sites of this type.

SOILS

Soils are commonly Entisols (Aquents and Fluvents) or Inceptisols (Aquepts) (Mattson 1984). Parent materials are usually coarse textured alluvium along low gradient streams. Soil texture is finer (clay loam to sand) on sites adjacent to wet meadows. Plant available water is estimated at moderate to high, and soils remain moist through much of the growing season.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by *Carex utriculata* (beaked sedge), *C. atherodes* (awned sedge), or *C. aquatilis* (water sedge) habitat types. Adjacent drier communities may be dominated by *Deschampsia cespitosa* (tufted hairgrass).



Successional Pathway Diagram for CALASTR Sites in Southern Alberta Grasslands
Reference Community = CALASTR CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
CALASTR CT	*Calamagrostis stricta* (narrow reedgrass) Community Type
CIRSARV	*Cirsium arvensis* (Canada thistle)
HORDJUB CT	*Hordeum jubatum* (foxtail barley) Community Type
JUNCBAL CT	*Juncus balticus* (wire rush) Community Type
MENTARV	*Mentha arvensis* (wild mint)
POTEANS	*Potentilla anserina* (silverweed)
SONCARV	*Sonchus arvensis* (perennial sow-thistle)

Note: Seral progression on sites presently supporting stands of this type is not yet well understood. This type may be the potential natural community on some sites.

Figure 34. CALASTR CT

MANAGEMENT INFORMATION

Livestock

Forage production from the *Calamagrostis stricta* (narrow reedgrass) community type is moderate to high. Palatability varies from moderate to high, depending upon season and availability of other species (USDA Forest Service 1937). Foliage is most palatable when young, but wet conditions early in the grazing season limits use by livestock. Continued close utilization reduces production on the site.

The *Calamagrostis stricta* (narrow reedgrass) community type is generally moist until mid summer and is preferred as mid to late season pasture by livestock following forage depletion on adjacent uplands. Therefore, the season of use often coincides with the maturity of *C. stricta* (narrow reedgrass) and grazing by livestock can limit impact on meadows when done with moderation. However, grazing should be restricted when soils are moist, especially along streams where bank sloughing can occur.

In order to develop an upward trend in ecological status on moderately disturbed sites, time the season of use by livestock to both the drying of the soil surface and to the maturation of the seedheads. Livestock should be removed when 40 percent or less utilization of herbaceous forage is taken. *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 (Hermann 1975). In severely disturbed sites, more intensive rehabilitation strategies will be required due to the abundance of *Poa palustris* (fowl bluegrass), *Juncus balticus* (wire rush), and *Hordeum jubatum* (foxtail barley).

Frisina (1991) states that for a grazing program to be successful, it must meet the basic biological requirements of the plants such as photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed. It is during long growing season rest periods that the essential biological processes of food production and storage, reproduction, and seedling establishment take place. In some instances, additional periods of rest may be required to either improve or maintain a plant community.

Wildlife

Elk may make moderate summer use of *Calamagrostis* species (reed grass) and *Juncus balticus* (wire 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).

Repeated burning tends to favor rhizomatous species such as *Poa pratensis* (Kentucky bluegrass) and *Agropyron caninum* (bearded wheatgrass). Burning should be postponed if livestock are present to avoid attracting animals to young, palatable regrowth.

Soil Management and Rehabilitation Opportunities

Coarse textured soils do not have compaction problems. Sites with fine textured soils are susceptible to compaction, particular when moist. In most cases, roads and trails should be located on adjacent uplands. *Calamagrostis stricta* (narrow reedgrass) propagates itself by both seeds and rhizomes, making it a valuable species for stabilizing or rehabilitating disturbed sites.

OTHER STUDIES

Beckingham and Archibald (1996) and Beckingham and others (1996) describe rich fen community types dominated by *Calamagrostis* (reedgrass) species in the Boreal Mixedwood Ecoregion of Alberta and in the Mid-boreal Ecoregion of Saskatchewan. Hansen and others (1995) describe a *Calamagrostis canadensis* (bluejoint) habitat type in the mountains and foothills of Montana.

Deschampsia cespitosa Habitat Type
(Tufted Hair Grass Habitat Type)

DESCCES

Number of Stands Sampled = 14

Number of Stands Sampled in Alberta = 7

LOCATION AND ASSOCIATED LANDFORMS

The *Deschampsia cespitosa* (tufted hair grass) habitat type is an incidental type at low elevations in southeastern Alberta. The type occurs on a variety of landforms including basins, wet meadows, nearly level stream terraces, and seep areas.

VEGETATION

In southeastern Alberta *Deschampsia cespitosa* (tufted hair grass) appears associated mostly with alkali tolerant species. *Deschampsia cespitosa*, when undisturbed, usually forms a dense stand of individual tussocks. Associated species that increase with disturbance include *Hordeum jubatum* (foxtail barley), *Distichlis stricta* (salt grass), and *Poa palustris* (fowl bluegrass) (Table 67).

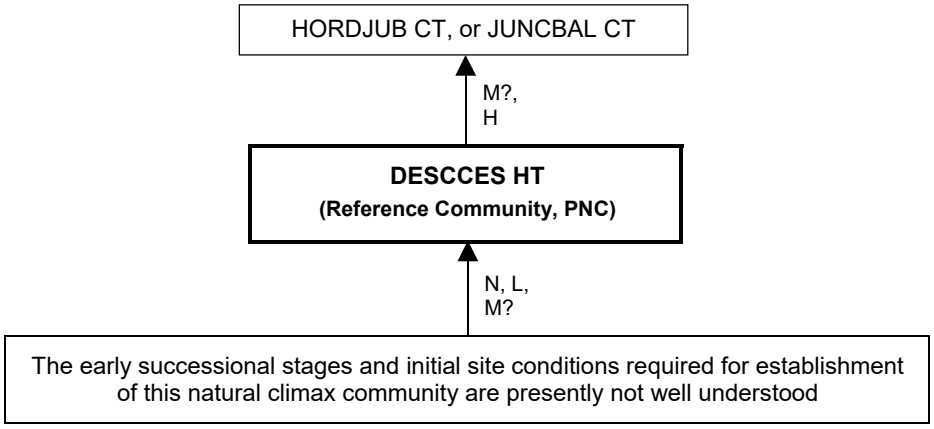
Table 67. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in recorded in 6 late seral to climax stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type.

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Agropyron smithii (western wheat grass)	1	0-1	17	4
Agropyron trachycaulum (slender wheat grass)	3	0-3	17	7
Deschampsia cespitosa (tufted hair grass)	77	60-90	100	88
Distichlis stricta (salt grass)	2	0-3	33	8
Eleocharis palustris (creeping spike-rush)	20	0-20	17	18
Hordeum jubatum (foxtail barley)	4	0-10	67	16
Juncus balticus (wire rush)	3	0-3	17	7
Scirpus pungens (three-square rush)	20	0-20	17	18
Forbs				
Kochia scoparia (summer-cypress)	1	0-1	17	4
Salicornia europaea (samphire)	3	0-3	17	7

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

We believe that *Deschampsia cespitosa* (tufted hair grass) was once much more abundant, but through long term heavy grazing, has been eliminated from much of its former area. On relatively undisturbed sites, *Deschampsia cespitosa* dominates over other herbaceous species. Litter is thick on drier sites but may be absent on moist sites. Moderate grazing lowers reproductive potential and vigor of *Deschampsia cespitosa* by reducing seed head production and depletion of carbohydrate reserves. Under heavy grazing, its vigor is further reduced until other species gain dominance. Severely disturbed dry sites become dominated by graminoids such as *Hordeum jubatum* (foxtail barley) and *Poa palustris* (fowl bluegrass), and have an abundance of disturbance-related forbs (Table 68). Figure 35 is a general schematic of the successional pathway followed on sites of this type.



Successional Pathway Diagram for DESCCES Sites in Southern Alberta Grasslands
Reference Community = DESCCES HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
DESCCES HT	*Deschampsia cespitosa* (tufted hair grass) Habitat Type
HORDJUB CT	*Hordeum jubatum* (foxtail barley) Community Type
JUNCBAL CT	*Juncus balticus* (wire rush) Community Type

Figure 35. DESCCES HT

Table 68. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 8 disturbed and/or early to mid-seral stands of the *Deschampsia cespitosa* (tufted hair grass) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Deschampsia cespitosa (tufted hair grass)	70	30-90	100	84
Hordeum jubatum (foxtail barley)	7	0-20	63	21
Juncus balticus (wire rush)	1	0-1	25	5
Poa palustris (fowl bluegrass)	10	0-10	25	16

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

Soils are generally Brown Chernozems and Regosols. Texture is commonly silt loam. Water tables at or slightly above the soil surface are common in spring, often dropping below 1 m (39 in) of the surface in summer on drier sites. Wetter stands, having yearlong water tables above 1 m (39 in) depth, commonly have some accumulation of organic material at the soil surface. Redox concentrations (mottles) near the soil surface are common, indicating a seasonally high water table.

ADJACENT COMMUNITIES

Adjacent wetter communities at mid elevation include the *Scirpus pungens* (three-square rush) and *Eleocharis palustris* (creeping spike-rush) habitat types. Adjacent drier communities include a variety of shrub and herbaceous types such as the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat grass) habitat type and the *Hordeum jubatum* (foxtail barley) community type.

MANAGEMENT INFORMATION

Livestock

Herbage production in the *Deschampsia cespitosa* (tufted hair grass) habitat type is moderate to high, ranging from 500 to 3,000 lbs/acre dry weight. Sites receive heavy livestock pressure because it typically dries in the upper soil and is relatively palatable, especially to cattle. Suitability for sheep is not as great because the type has few forbs. Under season long grazing, *Deschampsia cespitosa* (tufted hair grass) may be replaced by *Hordeum jubatum* (foxtail barley) and *Poa palustris* (fowl bluegrass). To maintain vigor and prevent damage to soils and vegetation, grazing should be deferred until soils dry. Light to moderate levels of grazing is most appropriate.

In order to develop an upward trend in ecological status on moderately disturbed sites, time the season of use by livestock to both the drying of the soil surface and to the maturation of the seed heads (Kovalchik 1987). Livestock should be removed before 40 percent of herbaceous forage is taken.

On severely disturbed sites, more intensive rehabilitation strategies will be required due to displacement of *Deschampsia cespitosa* (tufted hair grass) by *Hordeum jubatum* (foxtail barley), *Poa palustris* (fowl bluegrass), and disturbance-related forbs.

Frisina (1991) states that for a grazing program to be successful, it must meet the basic biological requirements

of the plants present. These are photosynthesis, food storage, reproduction, and seedling establishment. In order to meet these requirements, long periods of rest are needed. It is during the long growing season rest periods that these essential biological processes of food production and storage, reproduction, and seedling establishment occur. In some instances, additional periods of rest may be required to improve or maintain a plant community.

Wildlife

Sites supporting the *Deschampsia cespitosa* (tufted hair grass) habitat type provide food and cover for deer and waterfowl (Dittberner and Olson 1983). Care should be taken to avoid use conflicts between livestock and wildlife.

Fisheries

This type is usually separated from open water by a zone dominated by *Salix* species (willow) or *Carex* species (sedge). However, where it is adjacent to streams, the weak, fibrous root system of *Deschampsia cespitosa* (tufted hair grass) has little value for stabilizing streambanks (Youngblood and others 1985b).

Fire

Deschampsia cespitosa (tufted hair grass) is resistant to damage from fire (DeBenedetti and Parsons 1984). Root crowns are rarely damaged, even by hot, intense fires. However, repeated burning of this habitat type favors rhizomatous species such as *Poa palustris* (fowl bluegrass). Burning should be postponed if livestock are present, to avoid attracting animals to young, palatable regrowth of *Deschampsia cespitosa*.

Soil Management and Rehabilitation Opportunities

Moist soils are readily compacted by animal and vehicular traffic. Seasonally high water tables common to this type can make soils particularly susceptible to compaction. In most cases, roads and trails should be located on the uplands outside this type.

Although widely recommended for use in revegetation efforts, *Deschampsia cespitosa* (tufted hair grass) shows little potential for streambank rehabilitation due to its thin fibrous root structure (Youngblood and others 1985b).

Recreational Uses and Considerations

The sites provide opportunities for viewing big game during the summer and fall. Those sites adjacent to streams provide access points for fishing.

OTHER STUDIES

A *Deschampsia cespitosa* (tufted hair grass) habitat type is described by Hansen and others (1995) in Montana. Other similar communities have been described by Mueggler and Steward (1980) for western Montana (*Deschampsia cespitosa/Carex* species [tufted hair grass/sedge habitat type]), Youngblood and others (1985b) for eastern Idaho and western Wyoming, Kovalchik (1987) for central Oregon, Tuhy and Jensen (1982) for Idaho, Padgett and others (1989) for Utah and southeastern Idaho, Ratliff (1982) for the Sierra Nevada's in California, and Franklin and Dyrness (1973) for Oregon and Washington.

Distichlis stricta Habitat Type
(Saltgrass Habitat Type)

DISTSTR

Number of Stands Sampled = 25

Number of Stands Sampled in Alberta = 4

LOCATION AND ASSOCIATED LANDFORMS

The *Distichlis stricta* (saltgrass) habitat type is a minor type in southeastern Alberta. The type is found in saline or alkali basins, swales, pond and lake margins, and seep areas.

VEGETATION

The *Distichlis stricta* (saltgrass) habitat type is usually identified by a relatively pure stand of *Distichlis stricta* with scattered patches of *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) (Table 69).

Table 69. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 9 late seral to climax stands of the *Distichlis stricta* (saltgrass) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Deschampsia cespitosa (tufted hair grass)	3	0-3	11	6
Distichlis stricta (saltgrass)	64	50-80	100	80
Puccinellia nuttalliana (Nuttall's salt-meadow grass)	2	0-3	22	7
Forbs				
Salicornia europaea (samphire)	3	0-3	22	8
Salsola kali (Russian-thistle)	1	0-1	11	3
Suaeda calceoliformis (western sea-blite)	2	0-3	22	7
Triglochin maritima (seaside arrow-grass)	1	0-1	11	3

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

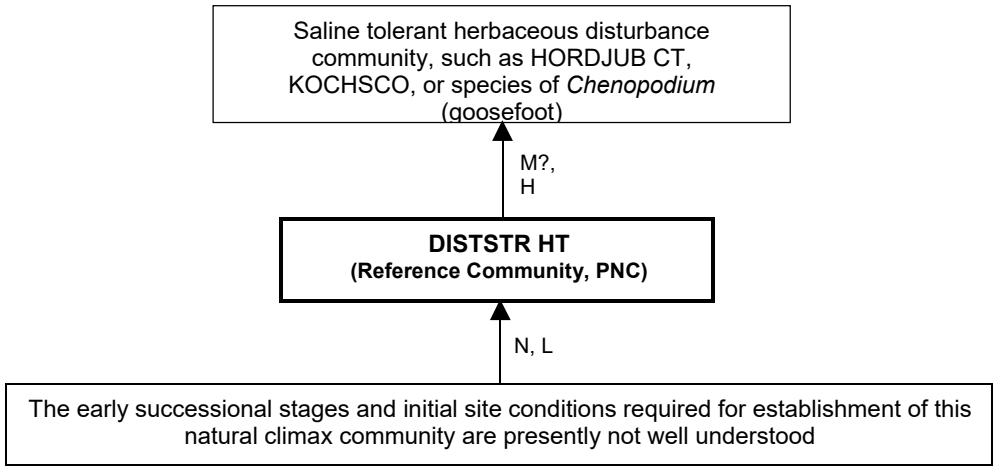
SUCCESSIONAL INFORMATION

High use of this habitat type will normally weaken associated perennial grasses, such as *Puccinellia nuttalliana* (Nuttall's salt-meadow grass). With prolonged heavy use, *Hordeum jubatum* (foxtail barley) and a variety of disturbance-related, alkali tolerant forbs may replace *Distichlis stricta* (saltgrass) (Table 70). Figure 36 is a general schematic of the successional pathway followed on sites of this type.

SOILS

Parent material is commonly alluvium. Soils are typically Brown Chernozems. Texture ranges from clay to silt loam. Water tables usually remain at or slightly below the

soil surface. Soil reaction is commonly alkaline (pH 8.0). Soils of this type characteristically have high concentrations of soluble salts (saline soils).



Successional Pathway Diagram for DISTSTR Sites in Southern Alberta Grasslands
Reference Community = DISTSTR HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY

DISTSTR HT	*Disticlis stricta* (saltgrass) Habitat Type
HORDJUB CT	*Hordeum jubatum* (foxtail barley) Community Type
KOCHSCO	*Kochia scoparia* (summer cypress)

Note: This species will colonize and occupy moderately saline/alkaline mesic sites.

Figure 36. DISTSTR HT

Table 70. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of 16 early to mid seral or disturbed stands of the *Distichlis stricta* (saltgrass) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Agropyron smithii (western wheat grass)	6	0-20	25	12
Distichlis stricta (salt grass)	65	20-98	100	81
Hordeum jubatum (foxtail barley)	9	0-40	50	21
Puccinellia nuttalliana (Nuttall's salt-meadow grass)	9	0-20	56	22
Forbs				
Grindelia squarrosa (gumweed)	2	0-3	31	8
Suaeda calceoliformis (western sea-blite)	22	0-80	25	23

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

ADJACENT COMMUNITIES

This type is often at the lowest (wettest) level of the local drainage. On other sites, the adjacent wetter communities may be dominated by the *Scirpus* species (bulrush), *Juncus balticus* (wire rush), or *Puccinellia nuttalliana* (Nuttall's salt-meadow grass). Drier communities may be dominated by *Sarcobatus vermiculatus* (greasewood), *Symphoricarpos occidentalis* (buckbrush), or a variety of upland communities.

MANAGEMENT INFORMATION

Livestock

Forage production in this type rates as low. *Distichlis stricta* (saltgrass) is not particularly palatable, but as other forages dry up, livestock may make considerable use of it (Johnson and Nichols 1982). On the other hand, the associated grass *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) is moderately palatable to livestock. With prolonged heavy use, *Hordeum jubatum* (foxtail barley) may replace *Distichlis stricta* (saltgrass) and *Puccinellia nuttalliana* (Nuttall's salt-meadow grass).

Wildlife

Due to the short stature of plants of the *Distichlis stricta* (saltgrass) habitat type, it is of limited value as wildlife habitat.

Fire

Fire is not much of a problem, nor does it have much utility, in this type due to the limited amounts of flammable fuels.

Soil Management and Rehabilitation Opportunities

The high clay content and saline nature common to these soils make them extremely susceptible to compaction. They present limitations to development. New trails or roads should be located on the adjacent uplands.

On degraded saline/alkaline sites, *Distichlis stricta* (saltgrass) can be transplanted. Its rhizomatous growth habit allows it to quickly spread across suitable sites.

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.

OTHER STUDIES

The *Distichlis stricta* (saltgrass) habitat type is described by Hansen and others (1995) for Montana. Hanson and Whitman (1938) described a similar type for western North Dakota. Daubenmire (1970) described a *Distichlis stricta* (saltgrass) habitat type consisting of a pure stand of *Distichlis stricta* (saltgrass) occurring in saline/alkaline areas of eastern Washington.

Eleocharis palustris Habitat Type
(Creeping Spike-Rush Habitat Type)

ELEOPAL

Number of Stands Sampled = 31

Number of Stands Sampled in Alberta = 6

Note: The *Eleocharis palustris* (creeping spike-rush) habitat type includes all combinations of *Eleocharis palustris* (creeping spike-rush) and *Eleocharis acicularis* (needle spike-rush) due to similarities in environmental conditions and management concerns.

LOCATION AND ASSOCIATED LANDFORMS

The *Eleocharis palustris* (creeping spike-rush) habitat type is a minor type in southeastern Alberta. It typically occurs on somewhat alkaline sites in narrow bands prone to yearly flooding, along stream, rivers, lake margins, and reservoirs.

VEGETATION

Typically, stands are almost pure *Eleocharis palustris* (creeping spike-rush). The small statured *Eleocharis acicularis* (needle spike-rush) is also common (Table 71).

Table 71. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 18 late seral to climax stands of the *Eleocharis palustris* (creeping spike-rush) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Beckmannia syzigachne (slough grass)	1	0-1	6	2
Carex atherodes (awned sedge)	1	0-1	6	2
Eleocharis palustris (creeping spike-rush)	88	60-98	100	94
Hordeum jubatum (foxtail barley)	1	0-1	11	3
Scirpus acutus (great bulrush)	1	0-1	6	2
Scirpus paludosus (prairie bulrush)	3	0-3	6	4
Scirpus pungens (three-square rush)	3	0-3	6	4
Forbs				
Polygonum amphibium (water smartweed)	3	0-3	11	6
Polygonum persicaria (lady's-thumb)	1	0-1	6	2
Polygonum ramosissimum (bushy knotweed)	1	0-1	6	2
Potamogeton gramineus (various-leaved pondweed)	1	0-1	6	2
Potentilla anserina (silverweed)	3	0-3	6	4
Ranunculus abortivus (small-flowered buttercup)	3	0-3	6	4
Ranunculus cymbalaria (seaside buttercup)	3	0-3	6	4
Rumex crispus (curled dock)	1	0-1	11	3

Table 71. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 18 late seral to climax stands of the *Eleocharis palustris* (creeping spike-rush) habitat type				
Rumex triangulivalvis (narrow-leaved dock)	3	0-3	6	4
Triglochin maritima (seaside arrow-grass)	3	0-3	6	4

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

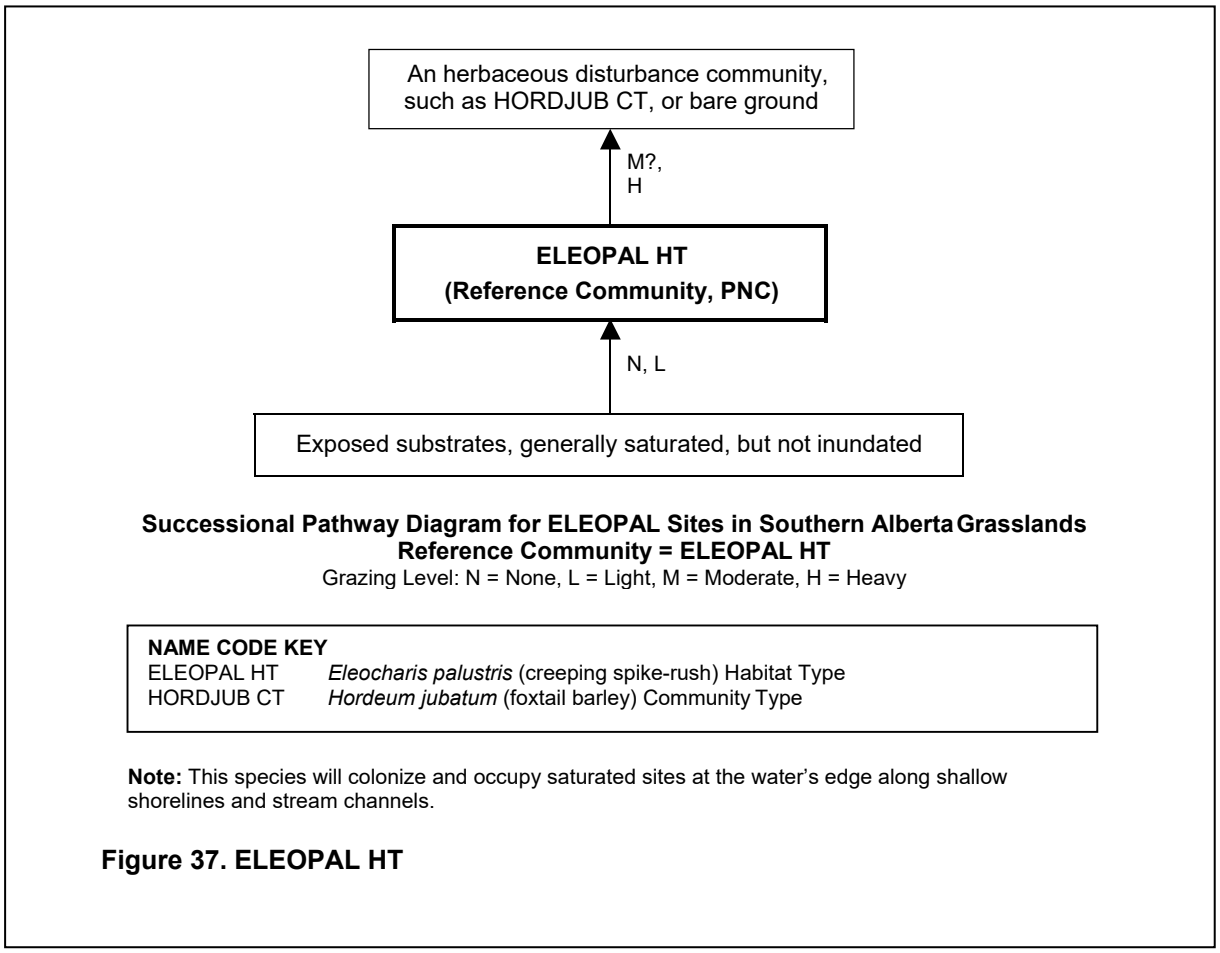


Figure 37. ELEOPAL HT

SUCCESSIONAL INFORMATION

Eleocharis palustris (creeping spike-rush) is an early colonizer of suitable habitats and can persist under wet conditions. Under continuous saturation and due to the aggressive characteristic of *Eleocharis palustris*, most other species are precluded. Figure 37 is a general schematic of the successional pathway followed on sites of this type.

Disturbance can dramatically increase the amount of increaser and invader species such as *Hordeum jubatum* (foxtail barley) (Table 72).

Table 72. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of 13 disturbed and/or early to mid-seral stands of the *Eleocharis palustris* (creeping spike-rush) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Beckmannia syzigachne (slough grass)	2	0-3	46	10
Eleocharis palustris (creeping spike-rush)	67	40-98	100	82

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

The *Eleocharis palustris* (creeping spike-rush) habitat type occurs on Organic soils, Chernozemic, and occasionally on Regosols. Organic accumulations at the surface are common. Texture is commonly fine silt or clay. These sites are generally inundated throughout much of the growing season.

ADJACENT COMMUNITIES

Adjacent wetter sites may support stands of *Scirpus acutus* (great bulrush) or are open water. Slightly drier riparian or wetland sites are dominated by graminoids such as *Carex atherodes* (awned sedge), *Juncus balticus* (wire rush), and *Poa palustris* (fowl bluegrass).

MANAGEMENT INFORMATION

Livestock

Seasonally wet conditions and the low palatability of *Eleocharis palustris* (creeping spike-rush) and *Eleocharis acicularis* (needle spike-rush) limit the grazing value of this type for livestock. Use of this type is often greater in drought years due to the limited availability and palatability of upland forage. Stands typically are so small that they are not important for their forage value.

Wildlife

Broader bands of this type along some streams, rivers, lakes, and reservoirs do provide valuable feeding and nesting areas for waterfowl. *Eleocharis palustris* (creeping spike-rush) and associated plants are a valuable source of food and cover for waterfowl.

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.

OTHER STUDIES

The *Eleocharis palustris* (creeping spike-rush) habitat type is described by Hansen and others (1995) in Montana. Similar communities have been described by Kovalchik (1987), Ratliff (1982), Chadde and others (1988), and by Padgett and others (1989).

Glycyrrhiza lepidota Community Type
(Wild Licorice Community Type)

GLYCLEP

Number of Stands Sampled = 6

Number of Stands Sampled in Alberta = 3

LOCATION AND ASSOCIATED LANDFORMS

The *Glycyrrhiza lepidota* (wild licorice) community type is a minor type of low elevation riparian or wetland environments throughout southern Alberta. This type occurs on sloping banks, low terraces, and recent alluvial deposits adjacent to streams and rivers.

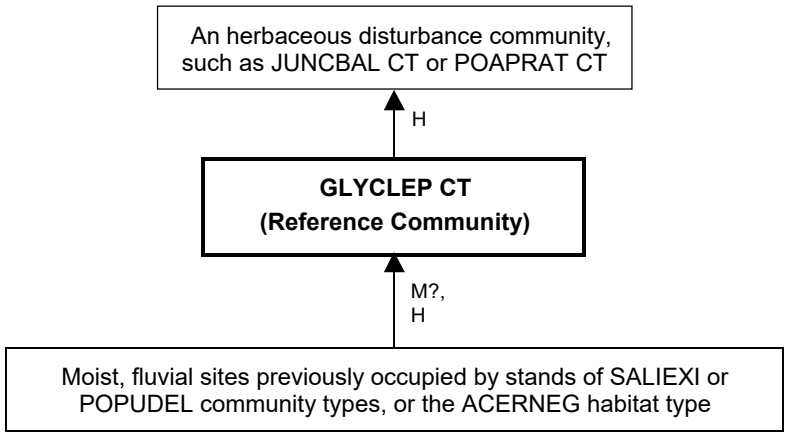
VEGETATION

Glycyrrhiza lepidota (wild licorice) dominates stands of this type. Common associates of this grazing disclimax include *Bromus inermis* (smooth brome), *Agropyron smithii* (western wheat grass), and *Elymus canadensis* (Canada wild rye) (Table 73).

Table 73 Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of 6 stands of the *Glycyrrhiza lepidota* (wild licorice) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Rosa spp. (rose)	3	0 - 3	33	10
Symphoricarpos occidentalis (buckbrush)	4	0 - 10	50	14
Graminoids				
Agropyron smithii (western wheat grass)	11	0 - 20	50	23
Bromus inermis (smooth brome)	23	0 - 80	83	44
Elymus canadensis (Canada wild rye)	5	0 - 10	33	13
Juncus balticus (wire rush)	7	0 - 10	33	15
Forbs				
Glycyrrhiza lepidota (wild licorice)	70	50 - 90	100	84

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.



Successional Pathway Diagram for GLYCLEP Sites in Southern Alberta Grasslands
Reference Community = GLYCLEP CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
ACERNEG	*Acer negundo* (Manitoba maple)
GLYCLEP CT	*Glycyrrhiza lepidota* (wild licorice) Community Type
JUNCBAL CT	*Juncus balticus* (wire rush) Community Type
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type
POPUDEL	*Populus deltoides* (plains cottonwood)
SALIEXI	*Salix exigua* (sandbar willow)

Note: This species will colonize and occupy extremely saline sites. Although it has a sparse canopy cover, nothing else in this region is adapted to compete on such extremely saline sites.

Figure 38. GLYCLEP CT

SUCCESSIONAL INFORMATION

The *Glycyrrhiza lepidota* (wild licorice) community type is in some cases an early seral pioneer community on recent alluvial deposits, and in other cases a grazing induced disclimax on sites formerly supporting the *Salix exigua* (sandbar willow) or cottonwood community types, or the *Acer negundo* (Manitoba maple) habitat type. This community type occurs over a wide range of environmental conditions and is considered an increaser due to its high tolerance to grazing. Figure 38 is a general schematic of the successional pathway followed on sites of this type.

SOILS

Soils typically are Regosols or rarely Brown Chernozems. Texture ranges from clay loam to sandy loam. Water tables are often at or near the soil surface in spring, but typically drop to 1 m (39 in) below the soil surface by late August.

ADJACENT COMMUNITIES

A variety of types occupy adjacent wetter sites, including the *Typha latifolia* (common cattail), *Scirpus acutus* (great bulrush), *Scirpus pungens* (three-square rush), and *Carex atherodes* (awned sedge) habitat types. The *Populus deltoides*/Herbaceous (plains cottonwood/Herbaceous) community type and *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheat

grass) habitat types are common on adjacent sites with similar or slightly drier moisture regimes.

MANAGEMENT INFORMATION

Livestock

Stands of this community type are productive, and the forage value is relatively high. *Glycyrrhiza lepidota* (wild licorice) has been reported to withstand heavy grazing. Our observations indicate it increases with moderate grazing and decreases with heavy grazing.

Wildlife

Glycyrrhiza lepidota (wild licorice) is rated as fair forage for deer.

Fisheries

Glycyrrhiza lepidota (wild licorice) produces a mass of coarse and creeping rhizomes, and once established, rapidly spreads. These soil-holding characteristics may make it valuable for stabilizing streambanks.

Soil Management and Rehabilitation Opportunities

Moist soils are readily compacted by animal and vehicular traffic. Sites with fine textured soils are more susceptible to compaction. Compaction of these soils can lower productivity and cause *Glycyrrhiza lepidota* (wild licorice) cover to increase.

The strong rhizomes of *Glycyrrhiza lepidota* are effective stabilizers of streambanks. Associated graminoids, such as *Bromus inermis* (smooth brome), *Scirpus pungens* (three-square rush), and *Agropyron smithii* (western wheat grass), of this type also provide some streambank protection.

OTHER STUDIES

The *Glycyrrhiza lepidota* (wild licorice) community type is described by Hansen and others (1995) for Montana.

Hordeum jubatum Community Type
(Foxtail Barley Community Type)

HORDJUB

Number of Stands Sampled = 17

Number of Stands Sampled in Alberta = 5

LOCATION AND ASSOCIATED LANDFORMS

The *Hordeum jubatum* (foxtail barley) community type is an incidental type at low elevations in southeastern Alberta. This community type occurs often in the drawdown zone of lakes and ponds or ephemeral depressions with moderately saline or alkali water. These sites are flooded during the early part of the growing season but the water table falls below the soil surface by late spring or early summer. These communities often occur in narrow bands concentric with the open water.

VEGETATION

Vegetative diversity is very low. *Hordeum jubatum* (foxtail barley) generally dominates with a few various alkali tolerant species, mostly forbs, occasionally present (Table 74). No other species occurred on more than four of the seventeen stands sampled.

Table 74. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 17 sampled stands of the *Hordeum jubatum* (foxtail barley) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Graminoids				
Agropyron smithii (western wheat grass)	12	0 - 20	12	12
Agrostis stolonifera (redtop)	10	0 - 10	6	8
Alopecurus aequalis (short-awned foxtail)	1	0 - 1	6	2
Beckmannia syzigachne (slough grass)	3	0 - 3	6	4
Distichlis stricta (saltgrass)	1	0 - 1	6	2
Eleocharis palustris (creeping spike-rush)	10	0 - 10	6	8
Unknown grass (grass)	3	0 - 3	6	4
Hordeum jubatum (foxtail barley)	84	40 - 98	100	92
Juncus balticus (wire rush)	1	0 - 1	6	2
Poa palustris (fowl bluegrass)	10	0 - 10	6	8
Puccinellia cusickii (Cusick's salt-meadow grass)	3	0 - 3	6	4
Puccinellia nuttalliana (Nuttall's salt-meadow grass)	3	0 - 10	24	8
Scirpus acutus (great bulrush)	1	0 - 1	6	2
Scirpus pungens (three-square rush)	3	0 - 3	6	4
Forbs				
Artemisia biennis (biennial sagewort)	3	0 - 3	6	4
Aster brachyactis (rayless aster)	3	0 - 3	12	6
Atriplex spp. (atriplex)	10	0 - 10	6	8
Atriplex prostrata (prostrate saltbush)	14	0 - 30	18	16
Chenopodium fremontii (Fremont's goosefoot)	18	0 - 40	18	18
Chenopodium spp. (goosefoot)	20	0 - 20	6	11
Chenopodium rubrum (red goosefoot)	1	0 - 1	6	2
Descurainia pinnata (green tansy mustard)	20	0 - 20	6	11
Glycyrrhiza lepidota (wild licorice)	1	0 - 1	6	2
Helianthus spp. (sunflower)	1	0 - 1	6	2
Kochia scoparia (summer-cypress)	2	0 - 3	12	5
Lactuca serriola (prickly lettuce)	3	0 - 3	6	4
Melilotus alba (white sweet-clover)	1	0 - 1	6	2
Mentha arvensis (wild mint)	1	0 - 1	6	2
Polygonum amphibium (water smartweed)	3	0 - 3	6	4
Ranunculus cymbalaria (seaside buttercup)	3	0 - 3	6	4
Rumex crispus (curled dock)	3	0 - 3	12	6
Rumex triangulivalvis (narrow-leaved dock)	1	0 - 1	6	2
Salicornia europaea (samphire)	2	0 - 3	24	7
Sonchus arvensis (perennial sow-thistle)	5	0 - 10	12	8
Taraxacum officinale (common dandelion)	1	0 - 1	6	2

Table 74. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 17 sampled stands of the *Hordeum jubatum* (foxtail barley) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Triglochin maritima (seaside arrow-grass)	1	0 - 1	6	2
Triglochin palustris (slender arrow-grass)	1	0 - 1	6	2

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

In many situations, the *Hordeum jubatum* (foxtail barley) community type represents an early seral (pioneer) stage that will be eventually taken over by a variety of later successional species. Close observation of similar sites may give insight to the climax community for the site. In other situations, the *Hordeum jubatum* community type may represent an early seral grazing disclimax of several habitat types, including the *Distichlis stricta* (saltgrass) habitat type, and the *Agropyron smithii* (western wheat grass) habitat type. Figure 39 is a general schematic of the successional pathway followed on sites of this type.

SOILS

Soils are typically fine textured and poorly to very poorly drained. Water tables remain at or slightly below the soil surface. On the Blackfeet Indian Reservation in Montana, Lesica and Shelly (1988) found conductivities to range from 2,150 to 41,000 uhmos/cm (a median of 16,350 uhmos/cm).

ADJACENT COMMUNITIES

Adjacent wetter communities are usually occupied by the *Eleocharis palustris* (creeping spike-rush) habitat type, the *Scirpus pungens* (three-square rush) habitat type, or open water.

Adjacent drier communities may be dominated by a variety of upland communities.

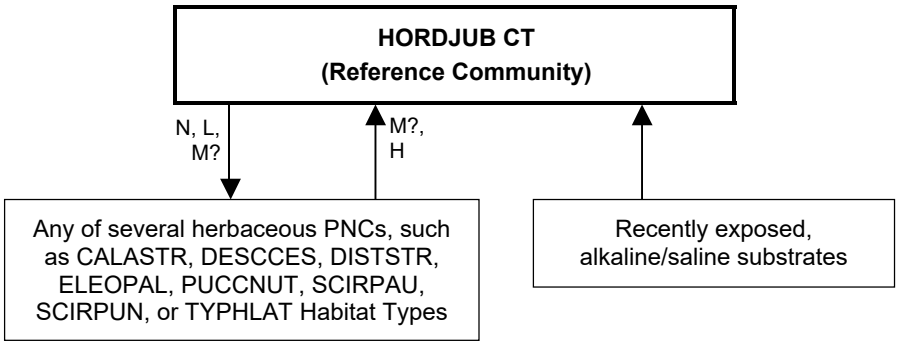
MANAGEMENT INFORMATION

Livestock

Herbage production from the *Hordeum jubatum* (foxtail barley) community type is low. Palatability of *Hordeum jubatum* when young is fair for livestock, but little use is made after seed heads develop (USDA Forest Service 1937, Johnson and Nichols 1982).

Hordeum jubatum (foxtail barley) is an increaser under excessive grazing pressure, and quickly invades suitable sites (USDA Forest Service 1937). Light to moderate grazing may allow desired species to regain dominance.

Consuming 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).



Successional Pathway Diagram for HORDJUB Sites in Southern Alberta Grasslands
Reference Community = HORDJUB CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
CALASTR	*Calamagrostis stricta* (narrow reed grass)
DESCCES	*Deschampsia cespitosa* (tufted hair grass)
DISTSTR	*Distichlis stricta* (saltgrass)
ELEOPAL	*Eleocharis palustris* (creeping spike-rush)
HORDJUB CT	*Hordeum jubatum* (foxtail barley) Community Type
PUCCNUT	*Puccinellia nuttaliana* (Nuttall's salt-meadow grass)
SCIRPAU	*Scirpus paludosus* (prairie bulrush)
SCIRPUN	*Scirpus pungens* (three-square rush)
TYPHLAT	*Typha latifolia* (common cattail)

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 heavy disturbance, will be replaced by one of several later seral herbaceous communities, depending on particular conditions of site hydrology and chemistry.

Figure 39. HORDJUB CT

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

Most management concerns associated with this type are concerning increased salinity. The presence or expansion of saline seep areas may indicate that upland vegetation, small grains, fallow fields, or excessive irrigation are not allowing the water table to drop to levels these sites have routinely experienced in the past. Excess water migrates through the soil, gathering soluble salts, and evaporating in depressions. The salts precipitate, concentrating over time, thereby restricting the number of plant species able to tolerate conditions on the site. It is important to note that saline areas also occur naturally in these conditions of arid climate, parent material, and local topography.

OTHER STUDIES

A similar community was described by Lesica and Shelly (1988) for the Blackfeet Indian Reservation.

Juncus balticus Community Type
(Wire Rush Community Type)

JUNCBAL

Number of Stands Sampled = 14

Number of Stands Sampled in Alberta = 7

LOCATION AND ASSOCIATED LANDFORMS

The *Juncus balticus* (wire or Baltic rush) community type is an incidental type of low to mid elevation riparian or wetland environments throughout Alberta. This type occurs near seeps, in meadows, and on alluvial terraces. Surface topography is usually level or sometimes undulating.

VEGETATION

The *Juncus balticus* (wire rush) community type is a grazing disclimax. *Juncus balticus* dominates the community. Common associates of this disturbance-caused type may include *Hordeum jubatum* (foxtail barley) and many occasional disturbance-related herbaceous species (Table 75).

Table 75. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 14 sampled stands of the grazing disclimax *Juncus balticus* (wire rush) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Trees				
Populus balsamifera (balsam poplar)	1	0 - 1	7	3

Table 75. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 14 sampled stands of the grazing disclimax *Juncus balticus* (wire rush) community type

Species	Percent Canopy Cover		Constancy (Frequency)	Prominence Index[1]
	Average	Range		
Shrubs				
Potentilla fruticosa (shrubby cinquefoil)	1	0 - 1	7	3
Salix exigua (sandbar willow)	1	0 - 1	7	3
Salix planifolia (flat-leaved willow)	1	0 - 1	7	3
Graminoids				
Agropyron dasystachyum (northern wheat grass)	3	0 - 3	7	5
Agropyron spicatum (bluebunch wheat grass)	10	0 - 10	7	8
Agrostis stolonifera (redtop)	2	0 - 3	14	5
Beckmannia syzigachne (slough grass)	3	0 - 3	7	5
Bromus inermis (smooth brome)	1	0 - 1	7	3
Calamagrostis canadensis (bluejoint)	4	0 - 10	21	9
Calamagrostis inexpansa (northern reed grass)	1	0 - 1	7	3
Calamagrostis stricta (narrow reed grass)	1	0 - 1	7	3
Carex lanuginosa (woolly sedge)	2	0 - 3	14	5
Carex rostrata (beaked sedge)	3	0 - 3	7	5
Deschampsia cespitosa (tufted hair grass)	3	0 - 3	14	6
Hordeum jubatum (foxtail barley)	17	0 - 60	50	29
Juncus balticus (wire rush)	84	60 - 98	100	92
Muhlenbergia asperifolia (scratch grass)	1	0 - 1	7	3
Phleum pratense (timothy)	1	0 - 1	7	3
Poa compressa (Canada bluegrass)	10	0 - 10	7	8
Poa palustris (fowl bluegrass)	12	0 - 20	14	13
Poa pratensis (Kentucky bluegrass)	10	0 - 20	14	12
Polypogon monspeliensis (rabbitfoot grass)	1	0 - 1	7	3
Puccinellia nuttalliana (Nuttall's salt-meadow grass)	1	0 - 1	7	3
Forbs				
Aster hesperius (western willow aster)	1	0 - 1	7	3
Cardamine pratensis (meadow bitter cress)	20	0 - 20	7	12
Cirsium arvense (Canada thistle)	1	0 - 1	7	3
Epilobium ciliatum (northern willowherb)	3	0 - 3	7	5
Epilobium glaberrimum (willowherb)	20	0 - 20	7	12
Glycyrrhiza lepidota (wild licorice)	1	0 - 1	7	3
Lactuca serriola (prickly lettuce)	10	0 - 10	7	8
Mentha arvensis (wild mint)	10	0 - 20	14	12
Polygonum amphibium (water smartweed)	3	0 - 3	14	6
Ranunculus cymbalaria (seaside buttercup)	3	0 - 3	7	5
Rumex occidentalis (western dock)	1	0 - 1	7	3
Senecio indecorus (rayless ragwort)	40	0 - 40	7	17
Solidago missouriensis (low goldenrod)	3	0 - 3	7	5

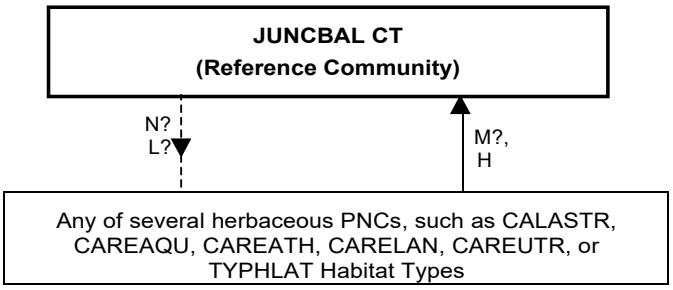
Table 75. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 14 sampled stands of the grazing disclimax *Juncus balticus* (wire rush) community type

Species	Percent Canopy Cover Average	Range	Constancy (Frequency)	Prominence Index[1]
Sonchus arvensis (perennial sow-thistle)	10	0-10	7	8
Sonchus uliginosus (smooth perennial sow-thistle)	1	0 - 1	7	3
Taraxacum officinale (common dandelion)	1	0 - 1	7	3
Triglochin maritima (seaside arrow-grass)	7	0 - 10	14	10
Ferns and Allies				
Equisetum arvense (common horsetail)	1	0 - 1	7	3

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Juncus balticus* (wire rush) community type represents a grazing disclimax. Numerous fence line contrasts illustrate that it acts as an increaser and/or an invader. This community type occurs over a wide range of environmental conditions. It usually increases on sites formally held by the *Deschampsia cespitosa* (tufted hair grass) or the *Carex aquatilis* (water sedge) habitat types. It is considered an increaser due to its high tolerance to grazing. Utilization of the *Juncus balticus* community type may be partially responsible for the numerous disturbance-related species often associated with it. In other situations, *Juncus balticus* appears to have increased with disturbance, replacing other riparian or wetland graminoids. Figure 40 is a general schematic of the successional pathway followed on sites of this type.



Successional Pathway Diagram for JUNCBAL Sites in Southern Alberta Grasslands
Reference Community = JUNCBAL CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY

CALASTR	*Calamagrostis stricta* (narrow reed grass)
CAREAQU	*Carex aquatilis* (water sedge)
CAREATH	*Carex athrodes* (awned sedge)
CARELAN	*Carex lanuginosa* (woolly sedge)
CAREUTR	*Carex utriculata* (beaked sedge)
JUNCBAL CT	*Juncus balticus* (wire rush) Community Type
SCIRPUN	*Scirpus pungens* (three-square rush)

Note: This species is a strong increaser on heavily grazed, moist sites. In many cases it acts as a grazing induced disclimax community that does not allow further successional progression on the site. It remains unclear whether other late seral species can reclaim sites currently dominated by JUNCBAL.

Figure 40. JUNCBAL CT

The presence of nearly pure stands of *Juncus balticus* usually indicates wetter phases of this type and sites which have been heavily grazed. *Deschampsia cespitosa* (tufted hair grass) occurs on sites of intermediate moisture, while *Poa* species (bluegrass) indicates drier conditions and previous site disturbance.

SOILS

Soils are Brown and Dark Brown Chernozems, or rarely Regosols. Texture ranges from silt to sandy loam. Water tables are often at or near the soil surface in early summer, but may drop below 50 cm (20 in) by late August. Soil reaction ranges from neutral to mildly alkaline (pH 7.0 to 8.0).

ADJACENT COMMUNITIES

A variety of types occupy adjacent wetter sites, including the *Salix* (willow) habitat and community types, and *Typha latifolia* (common cattail), *Scirpus acutus* (great bulrush), *Carex aquatilis* (water sedge), and *Carex atherodes* (awned sedge) habitat types. The *Carex lanuginosa* (woolly sedge) habitat type and the *Poa pratensis* (Kentucky bluegrass) community type are common on adjacent sites with similar or slightly drier moisture regimes.

Poa pratensis (Kentucky bluegrass) is a palatable and moderately productive grass, especially when soil moisture is high. It tolerates a high degree of defoliation. Herbage production is moderate. *Poa pratensis* (Kentucky bluegrass) is well adapted to grazing and is considered an increaser (Wasser 1982). This species can produce new shoots from both existing tillers and rhizomes. Grazing practices influence the growth form present (Volland 1978). A high density of weak, low vigor tillers results under season long grazing. Stem densities are emphasized over aboveground biomass. Grazing practices incorporating early season rest increase the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater.

Agrostis stolonifera (redtop) is tolerant of close usage due to its somewhat prostrate growth form, rhizomatous growth habit, and lower palatability than associated species.

MANAGEMENT INFORMATION

Livestock

Stands of this type are productive, but forage value is relatively low. Hermann (1975) reported grazing usage when plants were young and tender. As it matures, it is commonly avoided. Heavy grazing generally results in an increase of unpalatable forbs.

Wildlife

This type provides early season forage for wildlife, especially in stands having a large grass component.

Fisheries

Juncus balticus (wire rush) produces a deep and fibrous root system, with a mass of coarse, creeping rhizomes, and once established, rapidly spreads. These soil-holding characteristics make it valuable for stabilizing streambanks.

Fire

The limited information on the effects of fire on *Juncus balticus* (wire rush) suggests that is not harmed by cool fires. Associated species such as *Poa pratensis* (Kentucky bluegrass) are damaged only by hot, intense fire. Cool burns will have little effect on *Poa pratensis* (Volland and Dell 1981), but spring burns may lower tiller densities (Dix and Smeins 1967). Intense burns during active growing periods can severely damage stands of *Poa pratensis* (Wasser 1982).

Soil Management and Rehabilitation Opportunities

The fine textured soils associated with this community type are subject to compaction when moist, resulting in lower productivity and community compositional changes that favor *Juncus balticus* (wire rush).

The strong rhizomes of *Juncus balticus* (wire rush) effectively stabilize streambanks, especially where soils are coarse and otherwise unstable. Except for *Juncus balticus*, the associated graminoids of this type provide small streambank protection.

OTHER STUDIES

The *Juncus balticus* (wire rush) community type is described by Hansen and others (1995). Other studies of the region have identified similar *Juncus balticus* (wire rush) communities, including Norton and others (1981), Mattson (1984), Youngblood and others (1985b), Chadde and others (1988), and Padgett and others (1989).

Phalaris arundinacea Habitat Type
(Reed Canary Grass Habitat Type)

PHALARU

Number of Stands Sampled = 31

Number of Stands Sampled in Alberta = 5

LOCATION AND ASSOCIATED LANDFORMS

The *Phalaris arundinacea* (reed canary grass) habitat type is a minor type throughout Alberta. It occurs at low to mid elevations 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 forage, and readily escapes from pastures into riparian or wetland areas, displacing more desirable species.

VEGETATION

Stands are dominated by the tall *Phalaris arundinacea* (reed canary grass). *Phalaris arundinacea* is highly competitive with other riparian or wetland plants because of its heavy sod forming habit. Because of this, it tends to form dense, highly productive monospecific stands that spread radially (Apfelbaum and Sams 1987). Due to its location near stream channels on alluvial deposits, pioneer species may be present in varying amounts (Table 76).

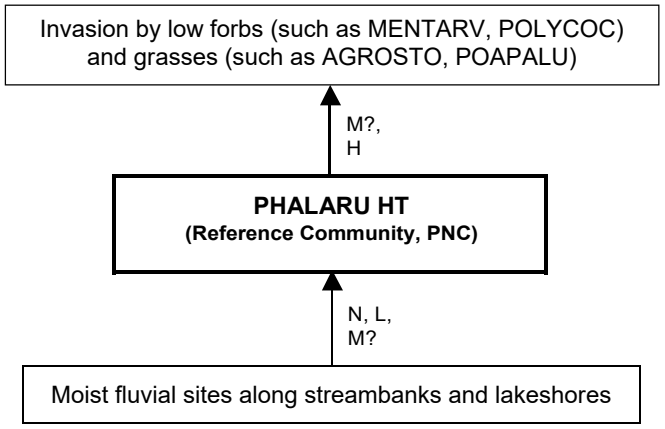
Table 76. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 21 late seral to climax, or undisturbed, stands of the *Phalaris arundinacea* (reed canary grass) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Trees				
Populus deltoides (plains cottonwood)	1	0-1	5	2
Shrubs				
Rubus idaeus (wild red raspberry)	1	0-1	5	2
Salix exigua (sandbar willow)	2	0-3	10	4

Table 76. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 21 late seral to climax, or undisturbed, stands of the *Phalaris arundinacea* (reed canary grass) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Shrubs				
Symphoricarpos albus (snowberry)	1	0-1	5	2
Graminoids				
Agropyron repens (quack grass)	1	0-1	5	2
Agrostis stolonifera (redtop)	1	0-1	5	2
Carex atherodes (awned sedge)	20	0-20	5	10
Carex vesicaria (blister sedge)	1	0-1	5	2
Hordeum jubatum (foxtail barley)	1	0-1	5	2
Phalaris arundinacea (reed canary grass)	96	90-98	100	98
Poa palustris (fowl bluegrass)	3	0-3	5	4
Poa pratensis (Kentucky bluegrass)	3	0-3	5	4
Forbs				
Apocynum cannabinum (Indian hemp)	1	0-1	10	3
Chenopodium album (lamb's-quarters)	1	0-1	5	2
Cirsium arvense (Canada thistle)	1	0-1	10	3
Mentha arvensis (wild mint)	7	0-10	14	10
Polygonum amphibium (water smartweed)	1	0-1	5	2
Rumex crispus (curled dock)	1	0-1	5	2
Urtica dioica (common nettle)	1	0-1	5	2
Xanthium strumarium (cocklebur)	1	0-1	5	2

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.



Successional Pathway Diagram for PHALARU Sites in Southern Alberta Grasslands
Reference Community = PHALARU HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
AGROSTO	*Agrostis stolonifera* (red top)
MENTARV	*Mentha arvensis* (wild mint)
PHALARU HT	*Phalaris arundinacea* (reed canary grass) Habitat Type
POAPALU	*Poa palustris* (fowl bluegrass)
POLYCOC	*Polygonum coccineum* (water smartweed)

Note: This aggressive species will colonize and occupy moist banks and shores along rivers and lakes. It forms a dense monospecific stand that excludes most competition.

Figure 41. PHALARU HT

SUCCESSIONAL INFORMATION

Phalaris arundinacea (reed canary grass) 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), and *Poa palustris* (fowl bluegrass) may invade the site (Table 77). Figure 41 is a general schematic of the successional pathway followed on sites of this type.

Table 77. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 10 disturbed and/or early to mid-seral stands of the *Phalaris arundinacea* (reed canary grass) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Phalaris arundinacea (reed canary grass)	89	50-98	100	94
Forbs				
Cirsium arvense (Canada thistle)	9	0-20	30	16
Polygonum coccineum (water smartweed)	8	0-10	30	15
Potentilla anserina (silverweed)	1	0-1	30	5
Ferns and Allies				
Equisetum arvense (common horsetail)	6	0-20	40	15

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

Soils are typically Regosols or less frequently, Chernozems with fine texture and reactions ranging from slightly acid to moderately alkaline (pH 6.5 to 8.0) (USDA Soil Conservation Service 1968). Soils are commonly poorly drained. 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. In fact, it is one of the most flood-tolerant of the cultivated grasses, yet it can withstand short summer droughts (Apfelbaum and Sams 1987).

ADJACENT COMMUNITIES

Adjacent wetter sites may include open water or the *Carex atherodes* (awned sedge), *Typha latifolia* (common cattail), *Scirpus acutus* (great bulrush), and *Eleocharis palustris* (creeping spike-rush) habitat types. Adjacent drier sites support a variety of species including: *Bromus inermis* (smooth brome), *Populus* (cottonwoods), *Salix* (willows), and the *Acer negundo/Prunus virginiana* (Manitoba maple/choke cherry) 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* is only low to moderate. It is most palatable when actively growing, and becomes less palatable in fall and winter. *Phalaris arundinacea* is strongly tolerant of grazing, except in the early growth stages. Increased alkaloid and fiber content with maturity cause a gradual decline in palatability. Grazing should begin when this species is about 30 cm (12 in) tall and soils have dried enough to minimize trampling damage (USDA Soil Conservation Service 1968). It is suggested that livestock producers graze it using intense stocking and a short rotation plan that leaves at least a 2-3 cm (5-8 in) stubble height. One management 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 (4 in) 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* completely dominates the stand.

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 also used by big game for forage and cover.

Fisheries

This habitat type can provide valuable spawning areas and hiding cover for many fish species.

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).

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* is becoming a threat to wetland areas supporting other native species. The effectiveness of control measures, such as burning and herbicide spraying, has not been determined. Chemical methods usually provide poor long-term control and are not always acceptable. The proximity of water tables creates high potential for water contamination. Even when chemical and mechanical control treatments are used, new seedlings can rapidly re-establish themselves from seeds in the soil.

OTHER STUDIES

The *Phalaris arundinacea* (reed canary grass) habitat type is described by Hansen and others (1995) for Montana.

Poa pratensis Community Type
(Kentucky bluegrass Community Type)

POAPRAT

Number of Stands Sampled = 8

Number of Stands Sampled in Alberta = 2

LOCATION AND ASSOCIATED LANDFORMS

The *Poa pratensis* (Kentucky bluegrass) community type is an incidental type in Alberta, with the best examples found on mesic alluvial terraces having been subjected to past abusive grazing. Although the species is widespread across southern Alberta as a member of disturbed, moist communities, sites dominated by *Poa pratensis* are not common.

VEGETATION

The *Poa pratensis* (Kentucky bluegrass) community type represents a grazing disclimax. *Poa pratensis* is a European meadow grass that is widely introduced and naturalized in North America. Stands may be almost pure *Poa pratensis*, or they may be a mixture of herbaceous "weedy" species dominated by *Poa pratensis*. This type represents one of the drier of the herbaceous riparian or wetland community types (Table 78).

Table 78. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 sampled stands of the grazing disclimax *Poa pratensis* (Kentucky bluegrass) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Rosa spp. (rose)	1	0 – 1	13	4
Salix petiolaris (basket willow)	1	0 – 1	13	4
Graminoids				
Agropyron dasystachyum (northern wheat grass)	1	0 – 1	13	4
Agropyron repens (quack grass)	12	0 – 20	25	17
Agrostis scabra (rough hair grass)	3	0 – 3	13	6
Agropyron spicatum (bluebunch wheat grass)	3	0 – 3	13	6
Agrostis stolonifera (redtop)	15	0 – 20	25	19
Agropyron trachycaulum (slender wheat grass)	1	0 – 1	13	4
Bromus inermis (smooth brome)	10	0 – 10	13	11
Carex atherodes (awned sedge)	1	0 – 1	13	4
Carex simulata (sedge)	1	0 – 1	13	4
Dactylis glomerata (orchard grass)	1	0 – 1	13	4
Distichlis stricta (salt grass)	3	0 – 3	13	6
Hordeum jubatum (foxtail barley)	3	0 – 3	13	6
Juncus balticus (wire rush)	20	0 – 30	38	28
Koeleria macrantha (June grass)	1	0 – 1	13	4
Phleum pratense (timothy)	9	0 – 20	38	18

Table 78. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 8 sampled stands of the grazing disclimax *Poa pratensis* (Kentucky bluegrass) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Poa palustris (fowl bluegrass)	30	0 – 30	13	20
Poa pratensis (Kentucky bluegrass)	79	60 – 98	100	89
Sphenopholis obtusata (prairie wedge grass)	1	0 – 1	13	4
Forbs				
Achillea millefolium (common yarrow)	10	0 – 20	25	16
Arnica chamissonis (leafy arnica)	20	0 – 20	13	16
Aster ascendens (western aster)	1	0 – 1	25	5
Aster brachyactis (rayless aster)	3	0 – 3	13	6
Aster ericoides (tufted white prairie aster)	20	0 – 20	13	16
Aster hesperius (western willow aster)	3	0 – 3	13	6
Astragalus miser (timber milk vetch)	10	0 – 10	13	11
Cerastium arvense (field mouse-ear chickweed)	1	0 – 1	13	4
Cirsium arvense (Canada thistle)	8	0 – 20	38	17
Cirsium scariosum (thistle)	1	0 – 1	13	4
Descurainia sophia (flixweed)	1	0 – 1	13	4
Grindelia squarrosa (gumweed)	1	0 – 1	13	4
Iris missouriensis (western blue flag)	1	0 – 1	25	5
Lactuca pulchella (common blue lettuce)	3	0 – 3	13	6
Linum lewisii (wild blue flax)	1	0 – 1	13	4
Medicago lupulina (black medick)	10	0 – 10	13	11
Melilotus alba (white sweet-clover)	10	0 – 10	13	11
Plantago major (common plantain)	20	0 – 20	13	16
Potentilla anserina (silverweed)	5	0 – 10	38	14
Potentilla gracilis (graceful cinquefoil)	1	0 – 1	25	5
Ferns and Allies				
Equisetum hyemale (common scouring-rush)	1	0 – 1	13	4

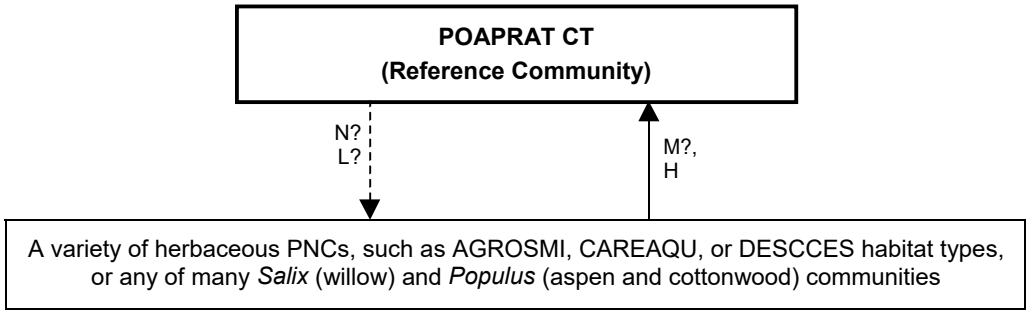
[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Poa pratensis* (Kentucky bluegrass) community type represents a grazing disclimax of an early/mid-seral secondary successional stage. Overgrazing has caused drastic changes on sites formerly dominated by native graminoids (Volland 1978). Once a suitable site is disturbed, the extensive rhizome system of *Poa pratensis* allows it to rapidly spread onto these areas. It also withstands high levels of utilization, making replacement by former dominants such as *Deschampsia cespitosa* (tufted hair grass) unlikely.

The *Poa pratensis* community type represents a disturbance seral stage of many types including the

Deschampsia cespitosa (tufted hair grass) and the *Agropyron smithii* (western wheat grass) habitat types. Close observation of similar sites may give insight to the climax community for the site. Figure 42 is a general schematic of the successional pathway followed on sites of this type.



Successional Pathway Diagram for POAPRAT Sites in Southern Alberta Grasslands
Reference Community = POAPRAT CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
AGROSMI	*Agropyron smithii* (western wheat grass)
CAREAQU	*Carex aquatilis* (water sedge)
DESCCES	*Deschampsia cespitosa* (tufted hair grass)
POAPRAT CT	*Poa pratensis* (Kentucky bluegrass) Community Type

Note: This species is a strong increaser on heavily grazed, mesic to moist sites. In many cases it acts as a grazing induced disclimax community that does not allow further successional progression on the site. It remains unclear whether other late seral species can reclaim sites currently dominated by POAPRAT.

Figure 42. POAPRAT CT

SOILS

Soils are typically Brown and Dark Brown Chernozems or occasionally Regosols. *Poa pratensis* (Kentucky bluegrass) thrives on moist, fertile sandy to clay alluvial 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. *Poa pratensis* 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.

ADJACENT COMMUNITIES

Wetter sites support a wide range of communities including those within the *Populus* (cottonwood), *Salix* (willow), *Potentilla fruticosa* (shrubby cinquefoil), *Carex utriculata* (beaked sedge), and *Juncus balticus* (wire rush) types. Adjacent drier sites may be dominated by a wide variety of upland species.

MANAGEMENT INFORMATION

Livestock

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. Fall regrowth can occur if moisture is sufficient and temperatures remain above freezing. *Poa pratensis* 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 both existing tillers and rhizomes. Grazing practices influence the growth form present (Volland 1978). A high density of weak, low vigor tillers results under season-long grazing. Early season rest increases the vigor 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 ineffective in stabilizing streambanks (Youngblood and others 1985b). Bank undercutting and sloughing may occur, especially when soils are wet or stands are weakened by excessive grazing.

Fire

Poa pratensis (Kentucky bluegrass) is well adapted to fire, and quickly resprouts after burning. However, it is intolerant of burning 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 to rested or lightly grazed stands. Cool burns will have little effect on *Poa pratensis* (Kentucky bluegrass) (Volland and Dell 1981), 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* 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. On those sites adjacent to a first or second order stream, the use of rock check dams to aid in the rehabilitation of degraded (de-watered) sites is an excellent and cost-effective approach. The rock dam will help raise the water table, thereby allowing willows and sedges to reclaim a degraded site.

OTHER STUDIES

The *Poa pratensis* (Kentucky bluegrass) community type is described by Hansen and others (1995) for Montana. A number of other researchers have identified similar *Poa pratensis* (Kentucky bluegrass) communities, including Norton and others (1981; Greys River, Wyoming), Ratliff (1982; Sierra Nevada, California), Youngblood and others (1985b; eastern Idaho and western Wyoming), and Padgett and others (1989; Utah and southeastern Idaho).

Polygonum coccineum Community Type
(Water Smartweed Community Type)

POLYCOC

Number of Stands Sampled = 11

Number of Stands Sampled in Alberta = 2

LOCATION AND ASSOCIATED LANDFORMS

The *Polygonum coccineum* (water smartweed) community type is a minor type in southern Alberta. It occupies shallow water along the edges of reservoirs, lakes, ponds, marshes, and often comprises the wettest community at the centre of shallow depressional wetlands.

VEGETATION

The *Polygonum coccineum* (water smartweed) community type is an aggressive invader of shallow water and exposed mud flats where there is minimal wave action. It forms dense, monospecific stands (Table 79).

Table 79. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in the 11 sampled stands of the *Polygonum coccineum* (water smartweed) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Shrubs				
Salix exigua (sandbar willow)	1	0 – 1	9	3
Graminoids				
Beckmannia syzigachne (slough grass)	20	0 – 20	9	13
Carex aquatilis (water sedge)	20	0 – 40	18	19
Carex atherodes (awned sedge)	5	0 – 10	18	9
Eleocharis palustris (creeping spike-rush)	3	0 – 3	9	5
Hordeum jubatum (foxtail barley)	3	0 – 3	9	5
Scirpus spp. (bulrush)	1	0 – 1	9	3
Forbs				
Polygonum coccineum (water smartweed)	94	80 – 98	100	97
Rumex crispus (curled dock)	3	0 – 3	9	5
Sagittaria cuneata (arum-leaved arrowhead)	1	0 – 1	9	3

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

The *Polygonum coccineum* (water smartweed) community type is an early seral (pioneer) primary successional stage of a variety of habitat types. Careful observation of site characteristics will aid in determining the potential of the site. Figure 43 is a general schematic of the successional pathway followed on sites of this type.

SOILS

The *Polygonum coccineum* (water smartweed) community type occurs on most soil textures from fine clay to sandy loam. The community type is intolerant of very saline or alkaline conditions. It is tolerant of frequent and prolonged flooding.

MANAGEMENT INFORMATION

Livestock

Herbage production of the *Polygonum coccineum* (water smartweed) community type rates low to moderate. The species has low palatability for livestock and wildlife.

Wildlife

Polygonum coccineum (water smartweed) has low palatability for wildlife. However, a wide variety of waterfowl may use these sites for nesting or nest building.

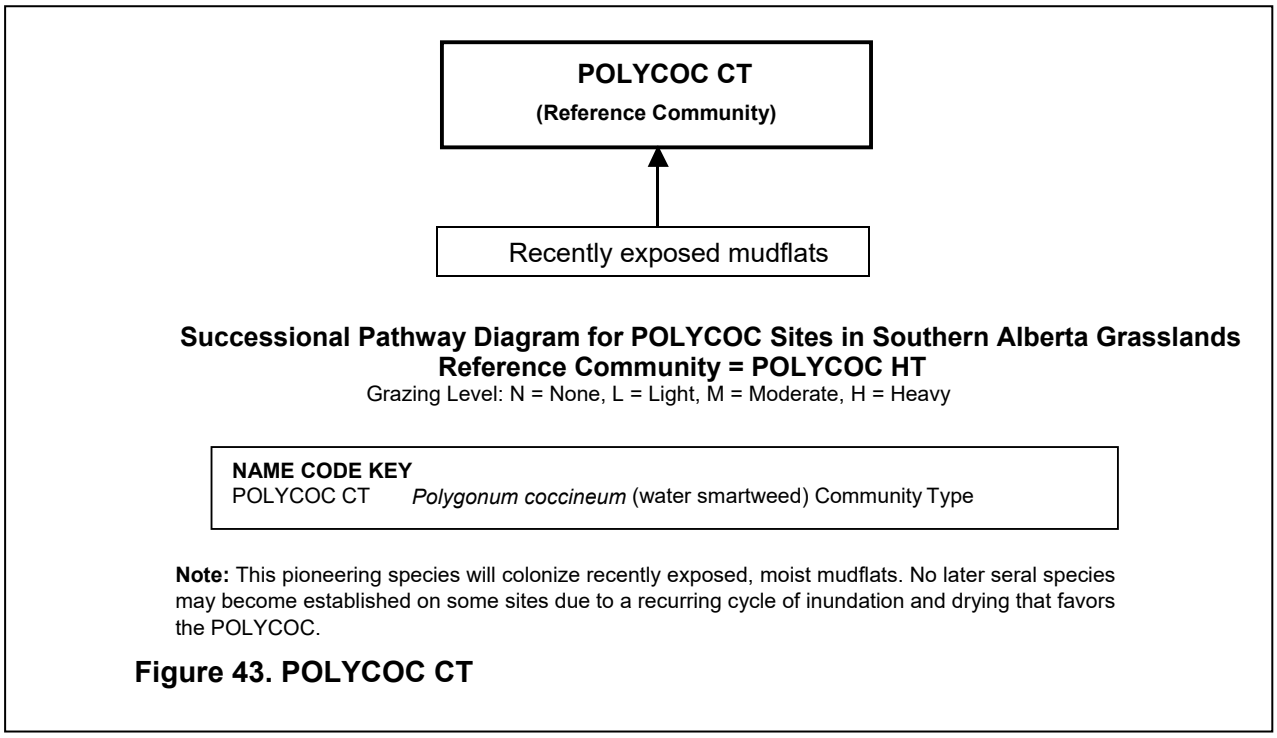


Figure 43. POLYCOC CT

ADJACENT COMMUNITIES

Adjacent wetter communities may be the *Typha latifolia* (common cattail) or the *Scirpus acutus* (great bulrush) habitat type, or open water. Adjacent drier communities are a wide variety of types including upland types.

Soil Management and Rehabilitation Opportunities

Shore vegetation around reservoirs is a mosaic or concentric series of bands of short-lived plant communities that survive one or more years before being eliminated by a combination of high water, grazing,

and/or seral succession. These shore communities are composed primarily of early seral species that become established when water levels are low. Repeated annual drawdowns perpetuate the disturbance and associated vegetation.

Shore vegetation is important as habitat for terrestrial wildlife, certain fish species, and for livestock. These communities also protect shores from erosion and enhance aesthetic quality of the shore environment.

OTHER STUDIES

A *Polygonum coccineum* (water smartweed) community type is described by Hansen and others (1995) for Montana. A number of authors have described similar communities for the prairie pothole region of North America (Van der Valk 1989).

Puccinellia nuttalliana Habitat Type
(Nuttall's Salt-Meadow Grass)

PUCCNUT

Number of Stands Sampled = 22

Number of Stands Sampled in Alberta = 8

LOCATION AND ASSOCIATED LANDFORMS

The *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type is a minor type in southeastern Alberta. The type is found in saline or alkali basins, swales, pond and lake margins, and seep areas.

VEGETATION

The *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type is usually identified by stands dominated by *Puccinellia nuttalliana* with frequent presence of *Distichlis stricta* (saltgrass) and *Hordeum jubatum* (foxtail barley) (Table 80).

Table 80. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 6 late seral to climax stands of the *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Distichlis stricta (salt grass)	40	0-40	50	45
Hordeum jubatum (foxtail barley)	2	0-3	33	8
Puccinellia nuttalliana (Nuttall's salt-meadow grass)	84	60-98	100	92
Scirpus paludosus (prairie bulrush)	3	0-3	17	7
Forbs				
Salicornia europaea (samphire)	3	0-3	17	7
Triglochin maritima (seaside arrow-grass)	3	0-3	17	7

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

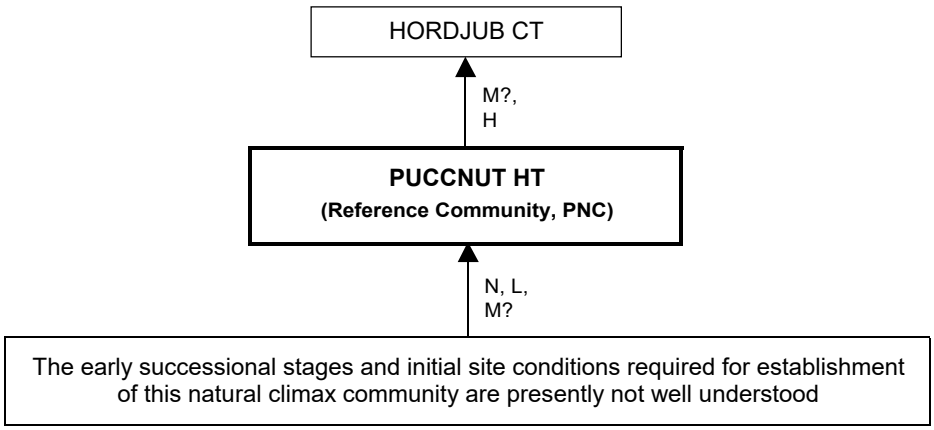
High grazing use of this habitat type will weaken the *Puccinellia nuttalliana* (Nuttall's salt-meadow grass). With prolonged heavy use, *Hordeum jubatum* (foxtail barley) and a variety of disturbance-related, alkali tolerant forbs increase (Table 81). Figure 44 is a general schematic of the successional pathway followed on sites of this type.

SOILS

Parent material is commonly alluvium. Soils are typically Brown Chernozems. Texture ranges from clay to silt loam. Water tables usually remain at or slightly below the soil surface. Soil reaction is commonly alkaline (pH 8.0). Soils of this type characteristically have high concentrations of soluble salts (saline soils).

ADJACENT COMMUNITIES

This type is often at the lowest (wettest) level of the local drainage. On other sites, adjacent wetter communities may be dominated by the *Scirpus pungens* (three-square rush). Drier communities may be dominated by *Sarcobatus vermiculatus* (greasewood), *Distichlis stricta* (saltgrass), or a variety of upland communities. Adjacent sites that are even more saline may be dominated by *Salicornia europaea* (samphire).



Successional Pathway Diagram for PUCCNUT Sites in Southern Alberta Grasslands
Reference Community = PUCCNUT HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
HORDJUB CT	*Hordeum jubatum* (foxtail barley) Community Type
PUCCNUT HT	*Puccinellia nuttaliana* (Nuttall's salt-meadow grass) Habitat Type

Note: This species will colonize and occupy moist, slightly to moderately alkaline sites, such as swales, depressions, and pond margins.

Figure 44. PUCCNUT HT

Table 81. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of 16 early to mid seral or disturbed stands of the *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Distichlis stricta (salt grass)	38	0-80	44	41
Hordeum jubatum (foxtail barley)	19	0-60	56	33
Puccinellia nuttalliana (Nuttall's salt-meadow grass)	75	50-98	100	87
Forbs				
Salicornia europaea (samphire)	10	0-20	31	18
Triglochin maritima (seaside arrow-grass)	8	0-20	25	14

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

MANAGEMENT INFORMATION

Livestock

Forage production in this type rates as moderate to low. *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) is moderately palatable to livestock. With prolonged heavy use, *Hordeum jubatum* (foxtail barley) may replace the *Puccinellia nuttalliana*.

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 these 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 be located elsewhere due to the high clay content of this type.

OTHER STUDIES

The *Puccinellia nuttalliana* (Nuttall Salt-meadow grass) dominance type is described by Hansen and others (1988) for Montana.

Salicornia europaea Community Type
(Samphire Community Type)

SALIEUR

Number of Stands Sampled = 14

Number of Stands Sampled in Alberta = 3

LOCATION AND ASSOCIATED LANDFORMS

The *Salicornia europaea* (samphire) community type is an incidental type at lower elevations in southeastern Alberta. The *Salicornia europaea* community type occurs in the drawdown zone of saline or alkaline seeps, basins, swales, and pond and lake margins. This zone is 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 drawdown zone supports narrow bands of different communities surrounding the open water. The soil surface is typically covered with salt crusts. Stands can be found near Pakowki Lake and on the Suffield Canadian Forces Base in the southeastern part of the province.

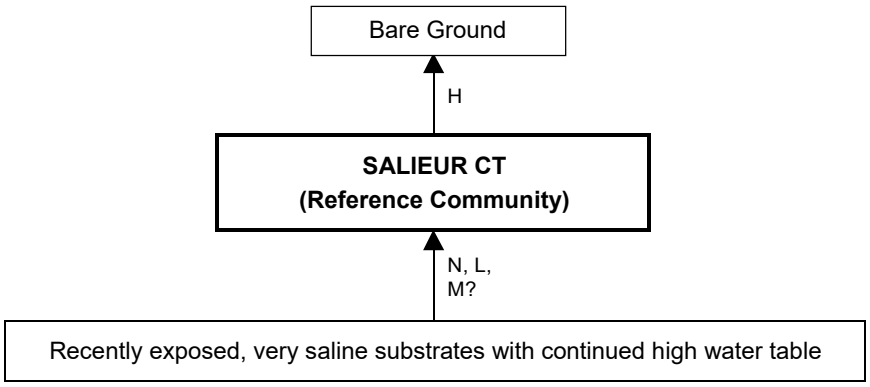
VEGETATION

Harsh soil conditions allow the annual, *Salicornia europaea* (samphire), to occur frequently in nearly pure stands. In some cases, *Distichlis stricta* (saltgrass), *Hordeum jubatum* (foxtail barley), and *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) may be present (Table 82).

Table 82. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in the 14 stands of the *Salicornia europaea* (samphire) community type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index[1]
Graminoids				
Deschampsia cespitosa (tufted hair grass)	3	0 - 3	7	5
Distichlis stricta (salt grass)	3	0 - 3	7	5
Hordeum jubatum (foxtail barley)	3	0 - 3	21	8
Puccinellia nuttalliana (Nuttall's salt-meadow grass)	2	0 - 3	29	8
Forbs				
Chenopodium leptophyllum (narrow-leaved goosefoot)	3	0 - 3	7	5
Kochia scoparia (summer-cypress)	2	0 - 3	14	5
Opuntia polyacantha (prickly-pear)	1	0 - 1	7	3
Polygonum convolvulus (wild buckwheat)	3	0 - 3	7	5
Polygonum ramosissimum (bushy knotweed)	1	0 - 1	7	3
Salicornia europaea (samphire)	69	30 - 90	100	83
Suaeda calceoliformis (western sea-blite)	20	0 - 20	7	12

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.



Successional Pathway Diagram for SALIEUR Sites in Southern Alberta Grasslands
Reference Community = SALIEUR CT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY	
SALIEUR CT	*Sailcornia europaea* (samphire) Community Type

Note: This species will colonize and occupy extremely saline sites. Although it has a sparse canopy cover, no other plant species in this region is adapted to grow in such extreme levels of salt in the soil.

Figure 45. SALIEUR CT

SUCCESSIONAL INFORMATION

The *Salicornia europaea* (samphire) community type is an early seral (pioneer) primary successional stage representing a variety of salt-tolerant site types. Limited information suggests that the *Salicornia europaea* community type may be successional to the *Distichlis stricta* (saltgrass) or the *Puccinellia nuttalliana* (Nuttall's salt-meadow grass) habitat types. The *Salicornia europaea* community type occupies the seasonal drawdown areas that are generally too wet for *Distichlis stricta*. Figure 45 is a general schematic of the successional pathway followed on sites of this type.

SOILS

Soils are generally Solonetzics. Texture is commonly clay. Soils are poorly to very poorly drained with water tables remaining slightly below the soil surface or dropping below 1 m (39 in) in some years. Water movement is slow enough that it evaporates and becomes concentrated with salts (sodium and magnesium sulfates), forming crusts on the surface and on objects protruding out of the water. Soil reaction is alkaline (pH 8.0) with high concentrations of soluble salts (saline soils).

ADJACENT COMMUNITIES

There are usually no wetter communities adjacent to *Salicornia europaea* (samphire) because in this region this species is the most alkali tolerant vascular plant species. Adjacent drier communities may be dominated by *Puccinellia nuttalliana* (Nuttall's salt-meadow grass), *Distichlis stricta* (saltgrass), or *Hordeum jubatum* (foxtail barley).

MANAGEMENT INFORMATION

Livestock

Forage production is very low. *Salicornia europaea* (samphire) is unpalatable, but associated grasses may provide limited forage.

Wildlife

Due to the extremely low forage production and short stature of the *Salicornia europaea* (samphire) (<1 dm in height [<4 in]), it is of little value to wildlife.

Soil Management and Rehabilitation Opportunities

Most management concerns associated with this type are centred around the increasing problems with saline seeps. The presence or expansion of seep areas may indicate that upland vegetation, small grains, fallow fields, or excess irrigation are not allowing the water table to drop to levels these sites have routinely experienced in the past. Excess water then flows through the soil, gathering soluble salts before evaporating in depressions. The salts remain, increasing in concentration over time, limiting the number of plant species able to tolerate this environment. However, it is important to note that saline areas occur naturally due to the arid climate, parent material, and local topography.

OTHER STUDIES

The *Salicornia europaea* (samphire) community type is described by Hansen and others (1995) for Montana. A similar community was described by Jorgensen (1979) for the Yellow Water Triangle of central Montana, and by Lesica and Shelly (1988) for the Blackfeet Indian Reservation.

Scirpus acutus Habitat Type
(Great Bulrush Habitat Type)

SCIRACU
Number of Stands Sampled = 41
Number of Stands Sampled in Alberta = 16

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.

LOCATION AND ASSOCIATED LANDFORMS

The *Scirpus acutus* (great bulrush) habitat type is a minor type occurring throughout Alberta. Typical locations include pond and lake margins in water up to 2 m (6.5 ft) deep.

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 largely absent or present in limited amounts (Table 83).

Table 83. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 26 late seral to climax stands of the *Scirpus acutus* (great bulrush) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Carex lanuginosa (woolly sedge)	1	0-1	4	2
Scirpus acutus (great bulrush)	88	0-98	81	84
Scirpus pungens (three-square rush)	1	0-1	4	2
Scirpus validus (common great bulrush)	70	0-80	19	36
Forbs				
Chenopodium album (lamb's-quarters)	1	0-1	4	2
Lemna minor (common duckweed)	3	0-3	4	3
Lycopus asper (western water-horehound)	3	0-3	4	3
Polygonum amphibium (water smartweed)	3	0-3	8	5
Rumex maritimus (golden dock)	3	0-3	4	3
Sagittaria cuneata (arum-leaved arrowhead)	1	0-1	8	3
Sium suave (water parsnip)	1	0-1	4	2
Typha latifolia (common cattail)	7	0-10	8	7

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SUCCESSIONAL INFORMATION

Scirpus acutus (great bulrush) and *Scirpus validus* (common great bulrush) are early colonizers of suitable habitats that are able to persist under wet conditions. Due to 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 have access to these sites. Disturbance promotes increases in such species as *Hordeum jubatum* (foxtail barley) and members of the *Polygonum* genus (Table 84). Figure 46 is a general schematic of the successional pathway followed on sites of this type.

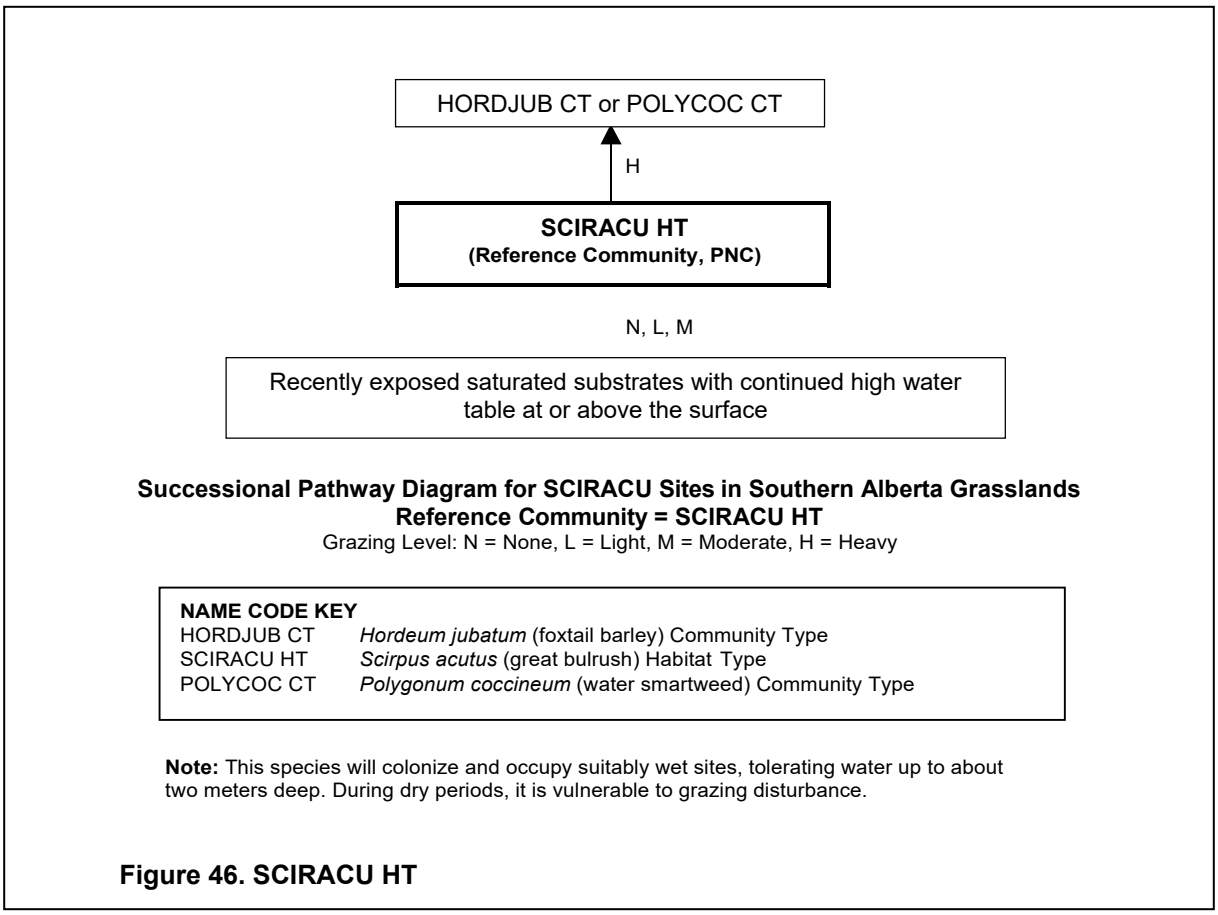


Figure 46. SCIRACU HT

Table 84. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 15 disturbed and/or early to mid-seral stands of the *Scirpus acutus* (great bulrush) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Hordeum jubatum (foxtail barley)	26	0-90	40	32
Scirpus acutus (great bulrush)	79	0-98	93	86

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

Soils are commonly Humic Gleysols or occasionally Organic. 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. Drier sites support the *Carex atherodes* (awned sedge), *Carex utriculata* (beaked sedge), *Carex aquatilis* (water sedge), *Poa pratensis* (Kentucky bluegrass), and *Salix* (willow) types.

MANAGEMENT INFORMATION

Livestock

Wet conditions 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 use the *Scirpus acutus* (great bulrush).

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* is a staple food for muskrats and is used in construction of their huts. Seeds of *Scirpus acutus* 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. *Triglochin maritimum* (seaside arrow-grass), if present, may be heavily grazed by elk.

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.

OTHER STUDIES

The *Scirpus acutus* (great bulrush) habitat type is described by Hansen and others (1995) for Montana. Similar communities dominated by *Scirpus acutus* (great bulrush) have been identified by Pierce and Johnson (1986) for west central Montana and by Chadde and others (1988) for northern Yellowstone National Park.

Scirpus paludosus Habitat Type
(Prairie Bulrush Habitat Type)

SCIRPAU

Number of Stands Sampled = 23

Number of Stands Sampled in Alberta = 7

LOCATION AND ASSOCIATED LANDFORMS

The *Scirpus paludosus* (prairie bulrush) habitat type is an incidental type in south-central Alberta. Sites are commonly located in alkaline or saline areas such as semi-permanently flooded shallow edges of marshes and ponds. The *Scirpus pungens* (three-square rush) habitat type occurs in similar positions on the landscape as the *Scirpus paludosus* habitat type, but has a slightly drier hydrologic regime.

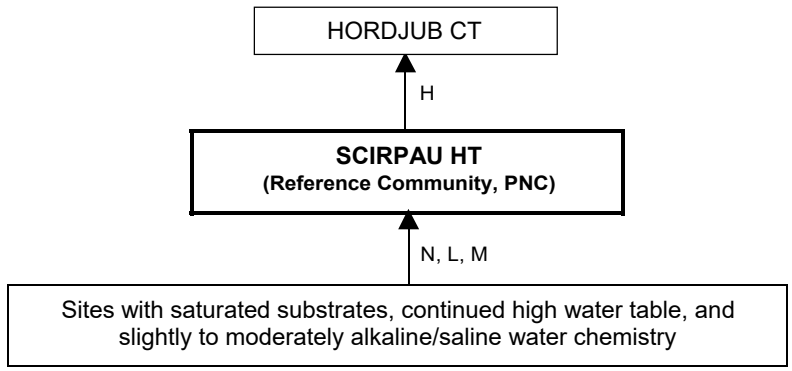
VEGETATION

The *Scirpus paludosus* (prairie bulrush) habitat type usually forms dense, monotypic stands. In some instances, limited amounts of the shorter *Eleocharis palustris* (creeping spike-rush) may be present (Table 85).

Table 85. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 18 late seral to climax stands of the *Scirpus paludosus* (prairie bulrush) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Eleocharis palustris (creeping spike-rush)	3	0-3	6	4
Hordeum jubatum (foxtail barley)	2	0-3	17	6
Puccinellia nuttalliana (Nuttall's salt-meadow grass)	1	0-1	11	3
Scirpus paludosus (prairie bulrush)	92	60-98	100	96
Scirpus validus (common great bulrush)	1	0-1	6	2
Forbs				
Atriplex spp. (atriplex)	1	0-1	6	2
Bassia hyssopifolia (five-hook bassia)	1	0-1	6	2
Chenopodium album (lamb's-quarters)	2	0-3	11	5

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.



Successional Pathway Diagram for SCIRPAU Sites in Southern Alberta Grasslands
Reference Community = SCIRPAU HT
Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY
HORDJUB CT *Hordeum jubatum* (foxtail barley) Community Type
SCIRPAU HT *Scirpus paludosus* (prairie bulrush) Habitat Type

Note: This species will become established on suitably wet substrates along shores, low floodplain sites, and wet meadows.

Figure 47. SCIRPAU HT

SUCCESSIONAL INFORMATION

Scirpus paludosus (prairie bulrush) is an early colonizer of suitable habitats and can persist on a site under wet conditions. Very wet conditions and low productivity usually inhibit most forms of disturbance, but disturbed stands show increases in *Hordeum jubatum* (foxtail barley) and forb species (Table 86). Figure 47 is a general schematic of the successional pathway followed on sites of this type.

Table 86. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of the 5 disturbed and/or early to mid-seral stands of the *Scirpus paludosus* (prairie bulrush) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Eleocharis palustris (creeping spike-rush)	11	0-20	60	26
Hordeum jubatum (foxtail barley)	8	0-20	60	22
Scirpus acutus (great bulrush)	3	0-3	40	11
Scirpus paludosus (prairie bulrush)	78	60-98	100	88

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

Soils are typically Humic Gleysols. Texture ranges from clay to loam. Water tables are high, often remaining above the soil surface throughout the growing season. Soils are poorly to very poorly drained with available water estimates ranging from moderate to high. Soil reaction is generally alkali (pH 8.5). Saline soils are also common to this habitat type.

ADJACENT COMMUNITIES

Adjacent wetter sites may be occupied by the *Typha latifolia* (common cattail) or the *Scirpus acutus* (great bulrush) habitat types, or by open water. Adjacent drier sites may include a wide variety of types such as the *Spartina pectinata* (prairie cordgrass) or the *Distichlis stricta* (saltgrass) habitat types, or the *Salicornia europaea* (samphire) community type.

MANAGEMENT INFORMATION

Livestock

Herbage production is moderate to very high. However, palatability is low to moderate. *Scirpus paludosus* (prairie bulrush) is seldom grazed by livestock or wildlife, provided other forage is available. However, if the site dries enough and upland forage is limited, livestock may heavily utilize these communities.

Wildlife

The *Scirpus paludosus* (prairie bulrush) habitat type is an important source of shade, hiding cover, and food for some wildlife species. *Scirpus paludosus* (prairie bulrush) is used by muskrats for construction of huts. Waterfowl use this type for nesting and hiding cover. Other birds, such as red-winged blackbirds and yellow-headed blackbirds, are common inhabitants. Deer also use this site type for hiding cover.

Fisheries

The *Scirpus paludosus* (prairie bulrush) habitat type buffers wind and wave action on bodies of water. Warm water fish may make use of this site type as spawning beds. Along streams, this site type helps to filter out sediments and build streambanks.

Soil Management and Rehabilitation Opportunities

The *Scirpus paludosus* (prairie bulrush) habitat type helps filter sediments to build streambanks. This type is fairly drought tolerant, and can persist through several years of dry conditions. *Scirpus paludosus* (prairie bulrush) 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.

OTHER STUDIES

The *Scirpus paludosus* (prairie bulrush) habitat type is described by Hansen and others (1995). Similar sites in the prairie pothole region of the northern Great Plains have been described by Van der Valk (1989).

Scirpus pungens Habitat Type
(Three-square Rush Habitat Type)

SCIRPUN

Number of Stands Sampled = 33

Number of Stands Sampled in Alberta = 11

LOCATION AND ASSOCIATED LANDFORMS

The *Scirpus pungens* (three-square rush) habitat type is a minor type throughout southern Alberta. Sites are located in wet areas such as along smaller streams (usually perennial), and at the edges of marshes and ponds. The *Scirpus paludosus* (prairie bulrush) habitat type occurs in similar, but slightly wetter, positions on the landscape.

VEGETATION

The *Scirpus pungens* (three-square rush) habitat type usually forms dense to sparse stands dominated by *Scirpus pungens* (Table 87).

Table 87. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 12 late seral to climax 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)	3	0-3	8	5
Graminoids				
Calamagrostis stricta (narrow reed grass)	3	0-3	8	5
Carex lanuginosa (woolly sedge)	3	0-3	8	5
Eleocharis acicularis (needle spike-rush)	1	0-1	8	3

Table 87. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 12 late seral to climax stands of the *Scirpus pungens* (three-square rush) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Hordeum jubatum (foxtail barley)	1	0-1	17	4
Scirpus paludosus (prairie bulrush)	1	0-1	8	3
Scirpus pungens (three-square rush)	91	70-98	100	95
Scirpus validus (common great bulrush)	1	0-1	8	3
Forbs				
Lycopus asper (western water-horehound)	1	0-1	8	3
Polygonum arenastrum (common knotweed)	1	0-1	8	3
Rumex crispus (curled dock)	1	0-1	8	3
Rumex triangulivalvis (narrow-leaved dock)	1	0-1	8	3
Typha latifolia (common cattail)	3	0-3	8	5
Xanthium strumarium (cocklebur)	3	0-3	8	5

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

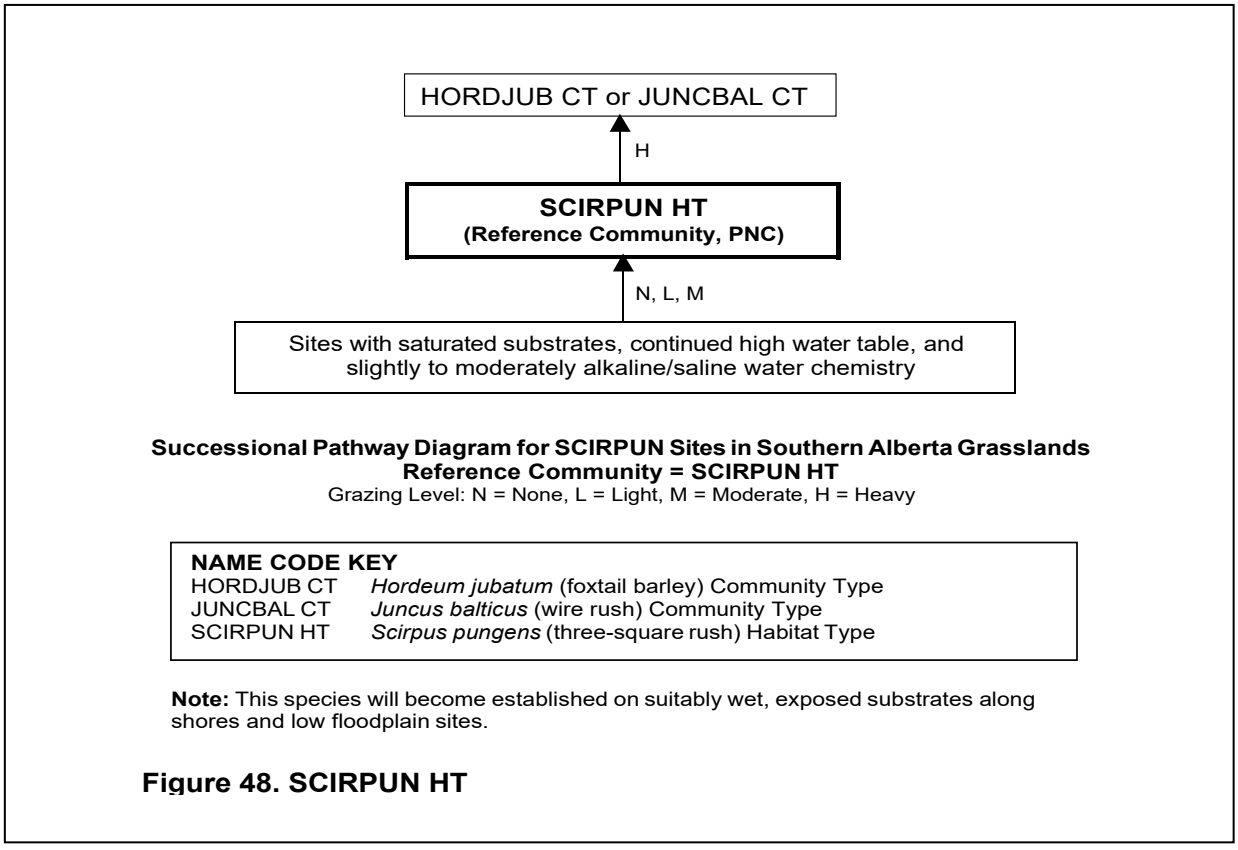


Figure 48. SCIRPUN HT

SUCCESSIONAL INFORMATION

Scirpus pungens (three-square rush) is an early colonizer of suitable habitats and is able to persist under wet conditions. Due to continual saturation and the aggressive habit of *Scirpus pungens*, most other species are precluded. Wet conditions usually limit most disturbance other than occasional trampling by livestock.

Disturbance can dramatically increase the amount of disturbance-related species such as *Hordeum jubatum* (foxtail barley), *Juncus balticus* (wire rush), and forb species (Table 88). Figure 48 is a general schematic of the successional pathway followed on sites of this type.

Table 88. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in at least 25 percent of 21 disturbed and/or early to mid-seral stands of the *Scirpus pungens* (three-square rush) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Eleocharis palustris (creeping spike-rush)	18	0-50	29	23
Hordeum jubatum (foxtail barley)	6	0-60	76	21
Scirpus pungens (three-square rush)	71	20-98	100	84

[1]Prominence Index is the square root of the product of Average Cover and Constancy values.

SOILS

Soils are typically Humic Gleysols. Texture ranges from clay to loam. Water tables are high, remaining within 1 m (39 in) of the soil surface throughout the year. Soils are rated as somewhat poorly drained to poorly drained. Soil reaction is typically alkali (pH 8.5). Saline soils are also common. Lesica and Shelly (1988) measured soil water conductivities of this type to range from 2,920 to 41,000 uhmos/cm (a median of 81,000 uhmos/cm) on the Blackfeet Indian Reservation in Montana.

ADJACENT COMMUNITIES

Adjacent wetter sites along streams are usually occupied by *Eleocharis palustris* (common spike sedge). Other adjacent wetter sites include open water, the *Typha latifolia* (common cattail), or the *Scirpus acutus* (great bulrush) habitat types. Adjacent drier sites include a wide variety of types, including the *Spartina pectinata* (prairie cordgrass), the *Distichlis stricta* (saltgrass), or the *Agropyron smithii* (western wheat grass) habitat types, and the *Salicornia europaea* (samphire) community type. In other situations, drier sites may be classified as upland sites.

MANAGEMENT INFORMATION

Livestock

Herbage production is high to very high. However, palatability is low to moderate. *Scirpus pungens* (three-square rush) is seldom grazed by livestock or wildlife if other forage is available or if the site is very wet. However, if water levels drop or upland forage is limited, livestock may heavily utilize these communities.

Wildlife

The *Scirpus pungens* (three-square rush) habitat type can be an important source of hiding cover and food for wildlife. *Scirpus pungens* 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. Deer also use this site type for hiding cover.

Fisheries

The *Scirpus pungens* (three-square rush) habitat type buffers wind and wave action on bodies of water. Warm water fish may make use of this site type as spawning beds. Along streams, this site type helps to filter out sediments and build streambanks.

Soil Management and Rehabilitation Opportunities

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* 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.

OTHER STUDIES

The *Scirpus pungens* (three-square rush) habitat type is described by Hansen and others (1995) for Montana. Lesica and Shelly (1988) described a similar community for the Blackfeet Indian Reservation. Similar sites in the prairie pothole region of the northern Great Plains have been described by Van der Valk (1989).

Typha latifolia Habitat Type
(Common Cattail Habitat Type)

TYPHLAT
Number of Stands Sampled = 53
Number of Stands Sampled in Alberta = 12

Note: The *Typha latifolia* (common cattail) habitat type includes all combinations of *Typha latifolia* (common cattail) and *Typha angustifolia* (narrow-leaved cattail) due to similarities in environmental conditions and management concerns.

LOCATION AND ASSOCIATED LANDFORMS

The *Typha latifolia* (common cattail) habitat type is a major type throughout Alberta. This type commonly occurs along lake and pond margins, ditches, oxbows, and backwater areas.

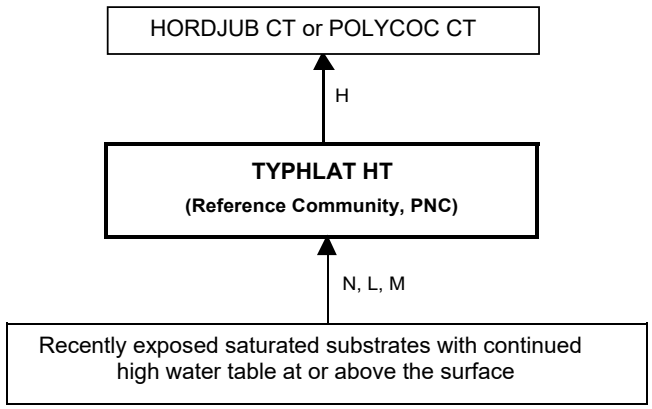
VEGETATION

Continually saturated or inundated conditions tend to limit species diversity within this type. *Typha latifolia* (common cattail) is dominant, with *Typha angustifolia* (narrow-leaved cattail) occurring in some stands (Table 89).

Table 89. Average canopy cover, range of canopy cover, constancy (frequency) and prominence index for species recorded in 37 late seral to climax stands of the *Typha latifolia* (common cattail) habitat type

Species	Percent Canopy Cover		Constancy	Prominence
	Average	Range	(Frequency)	Index [1]
Graminoids				
Eleocharis palustris (creeping spike-rush)	10	0-20	5	7
Scirpus acutus (great bulrush)	20	0-20	3	8
Scirpus validus (common great bulrush)	3	0-3	3	3
Forbs				
Cicuta maculata (water-hemlock)	1	0-1	3	2
Mentha arvensis (wild mint)	3	0-3	3	3
Polygonum coccineum (water smartweed)	3	0-3	5	4
Typha latifolia (common cattail)	92	80-98	100	9

[1] Prominence Index is the square root of the product of Average Cover and Constancy values.



Successional Pathway Diagram for TYPHLAT Sites in Southern Alberta Grasslands

Reference Community = TYPHLAT HT

Grazing Level: N = None, L = Light, M = Moderate, H = Heavy

NAME CODE KEY

HORDJUB CT	*Hordeum jubatum* (foxtail barley) Community Type
POLYCOC CT	*Polygonum coccineum* (water smartweed) Community Type
TYPHLAT HT	*Typha latifolia* (common cattail) Habitat Type

Note: This species will colonize and occupy suitably wet sites and persist with continued wet conditions. It is vulnurable to grazing disturbance during seasonal or climatic periods of low water.

Figure 49. TYPHLAT HT

SUCCESSIONAL INFORMATION

Typha latifolia (common cattail) and *Typha angustifolia* (narrow-leaved cattail) are early colonizers of suitable habitats and are able to persist under wet conditions. The species are well adapted to prolonged submergence of the roots and lower stems, but some period of bare soil exposure is required for germination and seedling establishment. Because seed production is extremely high, they are capable of rapid colonization of wet mineral soils. Due to the saturated soils and high water levels throughout the growing season, the sites are minimally impacted by most forms of disturbance. However, if the site does dry out, heavy livestock use can convert these stands to the *Hordeum jubatum* (foxtail barley) community type or some other slightly drier disturbance-related species dominance. Disturbance generally dramatically increases the number of forb species present. Figure 49 is a general schematic of the successional pathway followed on sites of this type.

SOILS

Soils are commonly Gleysols, often characterized by accumulations of organic matter overlying deposits of fine silt and clay. These types are commonly inundated with 30-100 cm (12-39 in) of water throughout the year. Redoximorphic features (mottling or gleying) in mineral horizons are common.

ADJACENT COMMUNITIES

Scirpus acutus (great bulrush) is a common dominant of sites with similar water regimes, although *Scirpus acutus* appears to tolerate more brackish conditions than *Typha latifolia* (common cattail). The *Carex atherodes* (awned sedge) habitat type frequently occupies adjacent drier sites.

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 heavily utilize this type.

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. 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 red-winged blackbirds.

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.

OTHER STUDIES

The *Typha latifolia* (common cattail) habitat type is described by Hansen and others (1995) for Montana. Pierce and Johnson (1986) and Chadde and others (1988) described similar *Typha latifolia* (common cattail) communities. A similar community was described by Padgett and others (1989) for Utah and southeastern Idaho.

OTHER POTENTIAL TYPES

Some stands sampled do not fit any of the types described in the text. Most of these are cases where the type is rarely present within the area, but may be more common in adjacent regions. Some of these "possible" types were not actually sampled in the Grassland Natural Region of Alberta, but stands were observed there. We feel that a minimum of three stands of a community needs to have been observed before consideration as a type for description and inclusion in the key. An example is the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/choke cherry) habitat type, of which two stands were sampled, but no more were observed.

The following is a list of types possibly occurring in the Grassland Natural Region of Alberta, but which we have not observed in more than rare abundance, or which we only suspect to be present:

***Fraxinus pennsylvanica/Prunus virginiana* (green ash/choke cherry) habitat type**—Stands of this type were found in Police Point Park, Medicine Hat. Wild growing individuals of *Fraxinus pennsylvanica* (green ash) were seen a few other places, but usually near a town where it might have escaped from domestication (i.e., around Fort Macleod and Magrath).

***Elaeagnus angustifolia* (Russian olive) community type**—I have observed only one stand of *Elaeagnus angustifolia* (Russian olive) extensive enough to contain a sample plot in all my travel so far across the Grassland Natural Region of Alberta. This stand is west of Hayes on Highway #524.

***Amelanchier alnifolia* (saskatoon) community type**—This commonly occurring shrub of riparian communities is seldom found in domination on large areas in the study area. One site was sampled in Alberta. It was more commonly found as dominant to the east in Saskatchewan, where the type was described.

***Salix candida* (hoary willow) community type**—Small *Salix candida* (hoary willow) stands were found in the Cypress Hills near Elkwater, Alberta and in Saskatchewan near Lac Pelletier. These stands contained *Cornus stolonifera* (red-osier dogwood), *Potentilla fruticosa* (shrubby cinquefoil), and *Carex aquatilis* (water sedge).

***Agrostis stolonifera* (redtop) community type**—This type was sampled only once in Alberta. The species occurs frequently as a moist site herbaceous component of disturbed to slightly disturbed sites of many other riparian and wetland types, but rarely as extensive pure stands.

***Glyceria borealis* (northern mannagrass) community type**—*Glyceria grandis* (common tall manna grass) is the only *Glyceria* species found dominating a site. This was a shallow depressional wetland in the Special Areas near Esther. Otherwise, *Glyceria striata* (fowl mannagrass) was found once with 40 percent canopy cover in a *Salix bebbiana* (beaked willow) stand. It is found with more frequency farther north in the Boreal Natural Region.

***Phragmites australis* (reed) habitat type**—I have observed *Phragmites australis* (reed) stands in the Lakeland district near Lac La Biche.

***Poa palustris* (fowl bluegrass) community type**—*Poa palustris* (fowl bluegrass) is widespread and abundant as a component of many riparian communities, but I have not found it dominant in a stand large enough to sample.

***Scolochloa festucacea* (spangletop) habitat type**—One stand was sampled in eastern Alberta near Esther.
This type is more common in Saskatchewan as a monospecific tall grass community on very moist, fresh water sites, such as road borrow pits.

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GLOSSARY

Abandoned Meander Channel. A former stream channel that was cut off from the rest of the river and typically lacks year long 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. The presence of these conditions is indicated by redoximorphic features.

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 1986). 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 which 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 because 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.

Emergent Plant. A rooted herbaceous plant species that has parts extending above a water surface.

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 fiber 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, which 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 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) 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 a vegetation based ecological site classification. It is based on 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. Nonwoody vegetation, such as graminoids and forbs.

Histic Epipedon. A 20 to 40 cm (8 to 16 in) soil layer at or near the surface that is saturated for 30 consecutive days or more during the growing season in most years and contains a minimum of 20 percent organic matter when no clay is present or a minimum of 30 percent of organic matter when 60 percent or more clay is present. Generally, a thin horizon of peat or muck is present if the soil has not been plowed.

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 aluminum, 4) ***C horizon*** — undisturbed, unaltered parent material.

Hydrology. The science dealing with the properties, distribution, and circulation of water.

Hydrophyte. Any macrophytic plant that grows in water or on a substrate that is at least potentially deficient in oxygen because 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 because 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, which 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.

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.

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 because 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, which 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 southwest Montana.

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 because 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, which 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).

Small Mountain Lake. A natural topographic depression collecting a body of water covering less than 8 ha (20 acres) with surface water.

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).

Riparian and Wetland Types of Alberta's Grassland Natural Region

1 The ***Artemisia cana/Agropyron smithii*** (silver sagebrush/western wheat grass) habitat type is found in southeastern Alberta in the Dry Mixedgrass Natural Subregion on fine textured alluvial terraces and outwash fans. It is characterized by an open dominance of ***Artemisia cana*** (silver sagebrush), with a solid cover of ***Agropyron smithii*** (western wheat grass) typically filling in between the shrubs.

2 The ***Bromus inermis*** (smooth brome) community type is found on mesic sites throughout Alberta, usually on disturbed sites or where planted in hay crops and/or pasture seed mixes. This species is an aggressive invader in the presence of disturbance after it is established in an area.

3 The ***Carex atherodes*** (awned sedge) habitat type is a major type in all of Alberta. It typically occurs as a dense, monospecific stand of ***Carex atherodes*** (awned sedge) in depressions, sloughs, and other low places with a high water table.

4 The ***Deschampsia cespitosa*** (tufted hairgrass) habitat type occurs on moist, moderately saline/alkaline sites on southeastern Alberta prairies.

5 The ***Elaeagnus commutata*** (silverberry) community type is widespread across Alberta on well-drained alluvial terraces and extending onto adjacent uplands.

6 The ***Rosa woodsii*** (common wild rose) community type is found on disturbed mesic sites in small patches throughout southern Alberta. It intergrades with the more generally northern ***Rosa acicularis*** (prickly rose) in more moist regions.

7 The ***Polygonum coccineum*** (water smartweed) community type is found in southern Alberta along moist, flat shorelines that are subjected to cyclic inundation and exposure to fluctuating water levels. It typically occurs as a monospecific, dense stand, but a variety of other pioneer or disturbance related herbaceous species might be present.

8 The ***Puccinellia nuttalliana*** (Nuttall's salt-meadow grass) habitat type is a minor type in southeastern Alberta. The type is found in saline or alkali basins, swales, ponds and lake margins, and seep areas.

9 The ***Salix exigua*** (sandbar willow) community type is a pioneering type that colonizes fresh alluvium along the banks of streams and rivers. It typically is accompanied by seedlings and saplings of other willow and/or deciduous tree species that may indicate the longer-term vegetation potential of the site.

10 The ***Scirpus paludosus*** (prairie bulrush) habitat type is found in southern Alberta in depressional wetlands that are saline/alkaline and saturated much of the growing season in most years. It is characterized by a monospecific stand of ***Scirpus paludosus*** (prairie bulrush), often interspersed with areas of shallow open water.

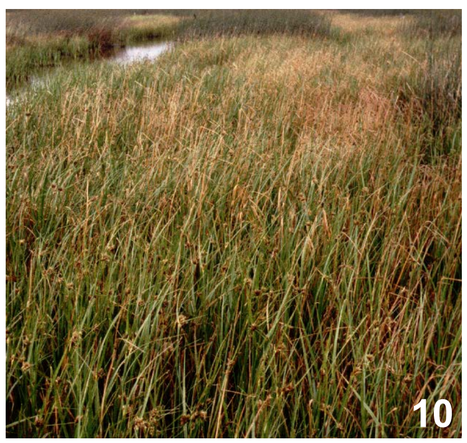
11 The ***Shepherdia argentea*** (thorny buffaloberry) community type is usually found on fine textured prairie bottomlands with slightly alkaline soils. The community is dominated by the dense and spiny overstory of ***Shepherdia argentea*** (thorny buffaloberry), and typically has a sparse understory of shade tolerant forbs and leaf litter.

12 The ***Symphoricarpos occidentalis*** (buckbrush) community type is a major type found throughout southern Alberta on alluvial floodplain terraces and other seasonally moist sites. Buckbrush dominates, with ***Rosa woodsii*** (common wild rose) and a variety of disturbance related herbaceous species usually also present.

13 The ***Typha latifolia*** (common cattail) habitat type is a major type throughout Alberta on lake margins and marshes where the water levels remain high.

14 The ***Salicornia europaea*** (samphire) community type is incidental at lower elevations in southeastern Alberta. It occurs in the drawdown zone of saline or alkaline seeps, basins, swales, ponds and lake margins. The zone is flooded in spring but the water level falls below the soil surface by late spring or early summer.

Cows and Fish, Alberta Riparian Habitat Program
2002, updated in 2020



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