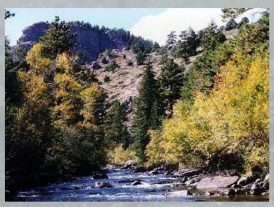

Field Guide to the Wetland and Riparian Plant Associations of Colorado

Natural Heritage Program
COLORADO

Colorado State University
Knowledge to Go Places

Field Guide to the Wetland and Riparian Plant Associations of Colorado

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March 2003

Front page photos (from top), HGM subclasses are discussed in the report:

1. Depressional (1) - Snow Mesa, Hinsdale Co. *Colorado Natural Areas Program file photo.*
2. Slope (1) - iron fen at Chattanooga, San Juan Co. *Colorado Natural Areas Program file photo.*
3. Flats (1) - Stinking Spring, Rio Blanco Co. *Colorado Natural Areas Program file photo.*
4. Riverine (3, 4) - North St. Vrain Creek, Boulder Co. *By Ron West.*
5. Riverine (5) - plains cottonwood riparian forest at Big Sandy Creek, Cheyenne Co. *By Gwen Kittel.*
6. Depressional (2, 3) - playa lake at Pawnee National Grasslands. *By Ric Hupalo.*

Background photo: Kettle Lakes Research Natural Area, Jackson Co. *By Janet Coles.*

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DATA COLLECTION:

We gratefully acknowledge the hard work of all field crew members (1990-2000): Marion Reid, Sylvia Gindele, Brian Stanford, Nan Lederer, Margaret Condron, Sam Hammer, Todd Barker, Maureen DeCoursey, Susan Spackman, Renée Rondeau, Dan Randolph, Julie Burt, Erika VanWie, Amy McMullen, Lea Spears, Mary Damm, Bill Grantham, Danielle Zoellner, Lisa Tasker, Sandy Scheck, Kathy Carsey, Camille Richard, Marty Aitken, Mindy Smith, Doug Grant, Steve Kettler, Mark Duff, Maggie March, John Sanderson, Denise Culver, Georgia Doyle, Ric Hupalo, and Joe Rocchio.

Funding for the Colorado Wetland Classification and Characterization was provided by a Wetland Program Grant from the Colorado Department of Natural Resources with funds from the U.S. Environmental Protection Agency, Region VIII. We would like to thank Alex Chappell of the Colorado Division of Wildlife, Kimberly Seymour of the Department of Natural Resources, and Ed Stearns and Sarah Fowler of the U.S. Environmental Protection Agency for their continued support.

This project would not have been possible without the many landowners and managers, public, private, and tribal, who welcomed us on to their lands and provided invaluable information about their properties. Their cooperation made it possible to sample a broad range of Colorado's wetland resources.

This document should be cited as: Carsey, K., G. Kittel, K. Decker, D. J. Cooper, and D. Culver. 2003. *Field Guide to the Wetland and Riparian Plant Associations of Colorado.* Colorado Natural Heritage Program, Fort Collins, CO.

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The photos on pages 146 and 414 are © Br. Alfred Brousseau, Saint Mary's College of California. Other photos of plant associations were provided by Kathy Carsey, Janet Coles, Dr. David Cooper, Claire DeLeo, and the Colorado Natural Heritage Program files.

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INTRODUCTION

In order to manage, restore and protect Colorado wetlands adequately, we must know which types exist, their functions and attributes, relative frequency or rarity, and distribution across the landscape. By providing a comprehensive tool for the identification of wetland and riparian plant associations in the field, this guide is intended to assist land owners and managers to protect wetland habitat and wetland-dependent species, and to establish a basis for focusing wetland research, land management, and conservation efforts where they will be most effective and beneficial.

This guide follows the U.S. Fish and Wildlife Service (USFWS) definition of wetlands (Cowardin et al. 1979). According to that definition 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." USFWS-defined wetlands must have *one or more* of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes (wetland plants); (2) the substrate is predominantly undrained hydric soil; and/or (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. Many of the associations described here would not be considered "jurisdictional wetlands" under Section 404 of the Clean Water Act.

The unit of classification used here is the **plant association**, the most basic level of the U.S. National Vegetation Classification (USNVC) standard. The USNVC: 1) is vegetation-based, 2) uses a systematic approach, 3) emphasizes natural vegetation, 4) emphasizes existing vegetation, 5) uses a combined physiognomic-floristic hierarchy, identifying vegetation units at scales practical for conservation, and 6) is appropriate for mapping at multiple scales (Grossman et al. 1998). The upper levels of the USNVC (beginning with the most inclusive) including class, subclass, group, subgroup and formation are physiognomic, based on growth form characteristics and environmental factors. The lowest levels, alliance and association, are floristic, based on dominant or diagnostic species names.

Each association is assigned a name based on the scientific names of the diagnostic species that have a high degree of constancy. To ensure consistency of plant species nomenclature, the scientific and common names of plant species follow the standards developed by Kartesz (1994) , as reported and updated in the PLANTS database (USDA NRCS 2002). Provisional community names are updated as additional information becomes available. In a few cases, common names used are regionally recognized names rather than USDA names.

In the association names, plant species used in the name occurring in the same stratum are separated by the "-" symbol, and those occurring in different strata of the vegetation are separated by the "/" symbol (e.g., *Quercus macrocarpa/Corylus cornuta-Corylus americana* Woodland).

As a rule, the diagnostic species for associations are consistently present (constant) in occurrences of the community. In situations where a diagnostic species is not consistently present in occurrences of a community, that species is placed in parentheses. For example *Populus deltoides-(Salix amygdaloides)/Salix exigua*

Woodland means *Populus deltoides* and *Salix exigua* are present in most of the stands while *Salix amygdaloides* may not be.

In cases where the scientific name of a diagnostic species has recently changed or has alternate accepted versions, the alternate name may be included in the association name in parenthesis with an "=".

Profiles of 184 associations are presented in this guide. These associations are based on floristic data from samples collected in thousands of vegetation stands throughout Colorado. In spite of the large sample size, sampling efforts were not necessarily uniform across all habitat types of the state, and data gaps remain. For instance, aquatic plant associations are not included due to a lack of samples. A list of associations which are not described in this guide which need further verification is presented on page 440, and there are undoubtedly additional types which have yet to be identified. In additon, many of the associations described here may be further subdivided in the future.

This guide covers wetland and riparian associations occurring within the boundaries of the state of Colorado, although many of the associations included here are also found in neighboring states. Data, descriptions and photos are compiled from a variety of sources too numerous to list here. For full citations, see Carsey et al. (2003).

A dichotomous key to the wetland and riparian associations of Colorado begins on page 17. Associations are divided into seven major groups, depending on stature and habit of the dominant plants. Upon determining the association of interest, the reader is directed to a two-page profile of the association which includes a photo, descriptive information, and a table of species cover values. Profiles are arranged alphabetically by scientific name within each group. A few associations occur in more than one group; these profiles are located in the first group in which they occur, and the corresponding page number is noted in the table of contents for each group.

Because species identification is a critical requirement for the identification of most associations, drawings of dominant species are included where possible. However, for many species more detailed information will be required, and the reader is urged to consult the many keys and field guides available for this purpose. A list of particularly helpful references is included in Appendix A, on page 443.

The classification on which this guide is based compiled plot data from 4527 samples collected by wetland researchers throughout Colorado (see Carsey et al. (2003) for details). In acknowledgment of dependence of wetland types upon hydrologic regime and geomorphic setting and processes, a framework of regional hydrogeomorphic (HGM) subclasses proposed by Cooper (1998) was used for data stratification. Plots were assigned to one of nine HGM groups, based on the presence of indicator species originally determined by Cooper. Within these groups, tabular analysis, based on the procedures suggested by Mueller-Dombois and Ellenberg (1974) was used to identify plant associations, and, in conjunction with expert knowledge of state and regional ecologists, used to assign samples to an association type. See Hupalo et al. (2000) and Carsey et al. 2001 for details of the classification process.

Wetlands by hydrogeomorphic (HGM) class and subclass

Cooper (1998) investigated the relationship between geomorphology, wetland vegetation, and wetland functions, and produced a first approximation of hydrogeomorphic (HGM) classes and subclasses for Colorado wetlands. He described four hydrogeomorphic classes in Colorado: riverine, slope, depression, and mineral soil flats. Within a geographic region, HGM wetland classes are further subdivided into subclasses. A subclass includes all those wetlands that have similar characteristics and perform similar functions. Riparian areas, loosely defined as streamside vegetation communities, may include depressional, slope, or mineral flats associations as well as riverine associations. Position on the landscape and source of the water supporting the wetland are the critical factors distinguishing the four types.

In the construction of this classification and guide, associations were assigned to HGM groups. Because the HGM classification groups wetland types that have similar characteristics and perform similar functions, it can be used to assist land managers to develop functional evaluations as well as to classify and evaluate the biodiversity of the wetlands under their jurisdiction. Most plant associations occur in only one subclass. However, there are associations that occur in two or even three subclasses.

Any classification is an artificial description of the functioning of complex systems. In some cases, determination of the HGM type may be difficult. In fact, Cooper identified problems in defining the boundaries of certain HGM classes in Colorado (Cooper 1998). Assigning functions to HGM classes and subclasses is also complicated. Detailed functional assessments are necessary to completely describe the functions performed by particular wetlands (Cooper 1998, Brinson 1993).

A complete list of the associations in each subclass appears in Appendix A on page 443.

Mineral Soil Flats Wetlands

Mineral Soil Flats occur on relatively flat ground and are supported by precipitation and surface runoff.

Flats Subclass 1 (F1)
Cooper (1998) describes one Mineral Soil Flats subclass (F1), but suggests that this type may need to be divided when more data are available. Mineral soil flats occasionally have standing water and more frequently have a seasonally high water table. Soils are often saline due to evaporation of water containing high concentrations of dissolved solutes. Geomorphic setting includes flat sites or very shallow basins. In Colorado, mineral soil flats are especially common in South Park and the San Luis Valley, and are also found on the eastern plains, along the Front Range, in North Park, and at lower elevations on the Western Slope. Elevations of sampled stands range from 3,820 to 9,500 feet (1,160-2,900 meters). Twelve plant associations were identified in the Mineral Soil Flats subclass. All are dominated by native plant species that are tolerant of saline and alkaline soils.

Depressional Wetlands

We combined Cooper's five depressional subclasses into three groups: D1, D2/3, and D4/5. Depressional wetlands occur in shallow or deeper depressions and are supported by the water filling the depression.

Depressional Subclass 1 (D1)
Depressional wetlands in subclass 1 occur in mid-to-high elevation basins with peat soils and on lake fringes with or without peat soils. We identified two plant associations in this subclass. Cooper (1998) suggests that basin peatland and lake fringe types are functionally different and should be separated into different subclasses when sufficient data are available.

Depressional Subclasses 2 and 3 (D2/3)
Depressional wetlands in subclasses 2 and 3 are usually found at lower elevations and are permanently or semi-permanently flooded. The subclass includes reservoir and pond margins as well as marshes (Cooper 1998) and includes cattail, bulrush and other tall reed, sedge, grass, and rush-dominated herbaceous vegetation. We identified 16 plant associations in this subclass. All are herbaceous and able to tolerate saturated soils (seasonally, temporarily or semipermanently flooded). All but one (*Bidens cernua-Bidens frondosa)* of these associations are dominated by native graminoid species.

Depressional Subclasses 4 and 5 (D4/5)
Depressional wetlands in subclasses 4 and 5 occur in low elevation basins that are temporarily or intermittently flooded. Subclass 5 wetlands may be flooded very occasionally, sometimes only once every five to ten years as in the case of playa lakes. Perennial vegetation may be poorly developed and the depression bottom may be barren. This type may include abandoned beaver ponds, small irrigation ponds and playa lakes. They occurred between 4,500 and 8,000 feet (1,370-2,440 meters), but were uncommon above 7,500 feet (2,290 meters). We identified 13 plant associations in the Depressional 4/5 subclass. All are dominated by forbs or graminoids.

Slope Wetlands

We group Cooper's four subclasses of slope wetlands into two types here, S1/2 and S3/4. Slope wetlands occur on gentle to moderate slopes and are supported by groundwater.

Slope Subclasses 1 and 2 (S1/2)
Slope wetlands in subclass 1 are alpine and subalpine fens and wet meadows on non-calcareous substrates. Subclass 2 wetlands are subalpine and montane fens and wet meadows on calcareous substrates. Both types may be dominated by woody or herbaceous species and may have organic or mineral soils. Wetlands in slope subclass 1 are very common and widespread in mountainous regions of the state. Slope 2 wetlands are much less common and are known mainly from the meadows and fens in South Park. Wetlands in these two subclasses occurred in our dataset between 7,900 and 13,080 feet (2,400-3,990 meters). We identified 42 plant associations in these two subclasses. Two uncommon wetland types occur in this subclass: extreme rich fens and iron fens. Extreme rich fens currently are documented from South Park in Colorado (Cooper 1996, Sanderson and March 1996). The water supporting extreme rich fens is rich in calcium, magnesium, and other minerals and plant nutrients. Probably because of these unusual conditions, extreme rich fens in South Park support at least two rare plant communities, fourteen rare plants and nine rare invertebrates (Sanderson and March 1996). Iron fens occur in the Colorado mineral belt. Waters supporting these fens have high concentrations of iron and very acidic water. Only a limited suite of plants can grow in the acid conditions of these fens.

Slope Subclasses 3 and 4 (S3/4)
The Slope 3 subclass includes wet meadows at middle elevations in the mountains with a seasonally high water table and dominated by herbaceous plants. Slope 4 wetlands occur at lower elevations, but also have a seasonally high water table supporting herbaceous or occasionally shrub associations. They may occur on floodplains or at springs and may be supported by irrigation. They are widespread throughout the state. We identified 18 plant associations in the Slope 3/4 subclass, occurring between 3,950 and 12,300 feet (12,00-3,750 meters), although most were below 9,500 feet (2,900 meters). Most are seasonally or temporarily flooded and dominated by graminoid species. Two are temporarily flooded shrubland types.

Riverine Wetlands

Riverine wetlands occur along rivers and streams. Overbank stream flow is the main source of water maintaining the riverine wetland vegetation. Riverine wetlands are important for flood control, maintaining water quality, stabilizing stream banks, and providing habitat for fish and other wildlife (Hansen et al. 1988, Brinson et al. 1981). Riparian areas are used extensively for domestic livestock grazing, gravel mining, recreation, transportation and residential development.

Riverine Subclass 1 (R1)
Wetlands in subclass R1 typically occur along steep-gradient, low-order streams and springs on coarse-textured substrate. They are especially common in the subalpine zone, but also occur on the plains (Cooper 1998). Elevation of stands ranged from 7,700 to 12,000 feet (2,350-3,660 meters). Thirteen R1 plant associations were identified, mostly subalpine types. The vegetation at the headwaters of streams at lower elevations have received less attention.

Riverine Subclass 2 (R2)
Subclass R2 wetlands occur along middle elevation, moderate gradient, low- to mid-order streams on coarse and fine-textured substrates. They may contain beaver pond complexes. Preliminary analysis of this group identified 47 plant associations including coniferous and deciduous forests, shrublands, and herbaceous types. Stands occur between 6,100 and 12,300 feet (1,860-3,750 meters) but are most common between 7,500 and 11,000 feet (2,290-3,350 meters).

Riverine Subclasses 3 and 4 (R3/4)
Subclass R3 wetlands occur on middle elevation reaches of small and mid-order streams. They are often dominated by tall shrubs and trees. Subclass R4 wetlands occupy lower elevation canyons in the foothills and plateaus along larger rivers or small intermittent streams. Seventy-eight plant associations were identified in these two combined subclasses. These wetland sites have coarser soils and steeper gradients than subclass R5.

Riverine Subclass 5 (R5)
Subclass R5 wetlands typically occur on low elevation floodplains of mid- to high-order streams with fine-textured substrate and usually perennial, but occasionally intermittent, flow. In this dataset, stands in this subclass occurred mostly on the eastern plains, along the Front Range, the Animas drainage, and along the lower Yampa River on the Western Slope. Associations in this subclass are most common below 7,000 feet (2,130 meters) but may occur up to 9,800 feet (2,990 meters). Thirty-five plant associations were identified in the R5 subclass. They are dominated by shrublands, grasslands or deciduous woodlands.

Further research needed

This guide represents the first effort to establish a wetland classification for Colorado that includes all major wetland types found in the state. It includes both riparian and non-riparian wetlands as well as wetlands dominated by non-native plants. Colorado wetland types include riparian forests, woodlands, shrublands, and grasslands, emergent wetlands, wet meadows, fens, marshes, ephemeral pond and playa wetlands, hanging gardens, and seep and spring wetlands.

Because the data used in this classification were collected for a variety of projects and purposes, they do not constitute a uniform, random, or complete sample of the state's wetland diversity. In addition, although the dataset is large, it covers only a certain range of the habitats and geographic areas of the state. Many areas have not been surveyed and new wetland associations will likely be discovered when they are. As further information becomes available, it may become clear that some associations listed here need to be combined or divided.

A number of potential plant associations were identified on the basis of only one or two plots each (see list on page 440). Although these associations were uncommon in our dataset, many of them are expected to be more common across the landscape. Further investigation of these types should help clarify whether they are actually rare or merely have not yet been well documented.

We would like to alert the reader to a few types of wetlands that require further research for more complete description of their composition, function, and distribution in Colorado:

Playas: Shallow closed basins that are periodically or occasionally flooded. Species composition of playas varies considerably among and within stands depending on seasonal precipitation and degree of inundation. Several potential playa associations have been identified, but further inventory is needed to fully describe and classify the full suite of playa associations. Many may fall into the *Pascopyrum smithii-Eleocharis* spp. association described briefly for Colorado and Wyoming (NatureServe 2002). A *Buchloe dactyloides-Ratibida tagetes-Ambrosia linearis* association has also been described from a very limited area of southeast Colorado (Doyle et al. 2001).

Hanging gardens: Communities found on cliff walls or alcoves. One such association is described in this guide, the *Aquilegia micrantha-(Mimulus eastwoodiae)* Hanging Garden association. Nan Lederer (1994, unpublished paper for Colorado Natural Areas Program) described grotto associations at Castlewood Canyon State Park. In addition, Welsh (1989) has described hanging gardens from Utah. Another, the *Sullivantia hapemanii* var. *purpusii* association, occurs in western Colorado (CNHP 2002).

Alpine Wetlands:
A number of alpine wetland associations are described in this classification, primarily from the Colorado Front Range. Other alpine areas have been less systematically inventoried.

Floating and Submergent Wetlands:
Sanderson and Kettler (1996) and others have described some floating and submerged aquatic wetland associations. Our sample set did not include sufficient data to completely classify these types.

Finally, the HGM classes and subclasses for Colorado were identified recently and have been minimally tested, reviewed, and used by wetland scientists. Some subclass descriptions will need revision as more information becomes available. There is also a need to describe the functions performed by wetlands of the different HGM classes and subclasses. Some of the associations identified here were well documented in our data for one subclass, but also occurred in a few stands in other HGM subclasses. More work is needed to identify whether those associations actually belong in more than one subclass.

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Table 1: HGM classes as described in Cooper (1998).

HGM Subclass	Description	Common Species
Depressional 1	Mid-to-high elevation basins with peat soils and lake fringes with or without peat soils.	*Carex utriculata, Carex aquatilis*
Depressional 2	Permanently or semi-permanently flooded low elevation basins, including reservoir and pond margin wetlands as well as marshes.	*Typha* spp., *Scirpus* spp.
Depressional 3	Seasonally flooded, often low elevation basins that are dry for long periods.	*Eleocharis palustris*
Depressional 4	Low elevation basins flooded for short periods in the spring and early summer.	*Polygonum lapathifolium*
Depressional 5	Intermittently flooded low elevation basins that are not flooded annually or are largely barren of vegetation.	*Xanthium strumarium*
Flats 1	Middle to low elevation sites on mineral saline soil (due to evaporation) with a seasonal high water table near the ground surface and occasionally shallow standing water.	*Suaeda calceoliformis, Puccinellia nuttalliana, Sarcobatus vermiculatus*
Riverine 1	Steep gradient low order streams and springs on coarse-textured substrate. Very common in the subalpine zone.	*Mertensia ciliata, Senecio triangularis, Glyceria striata*
Riverine 2	Moderate gradient, low to middle order streams on coarse and fine-textured substrates. Often dominated by willow thickets and may contain beaver pond complexes.	*Salix monticola, Salix boothii, Heracleum maximum, Abies lasiocarpa* and *Picea engelmannii*
Riverine 3	Moderate gradient, middle elevation reaches of small and mid-order streams.	*Picea pungens, Populus angustifolia, Alnus incana* ssp. *tenuifolia*
Riverine 4	Stream reaches on larger rivers in low elevation canyons in the foothills and plateaus. Generally steep gradient and coarse soils.	*Acer negundo* var. *interius*
Riverine 5	Low elevation floodplains on mid-to-high order streams with fine-textured substrate and usually a perennial flow.	*Populus deltoides, Salix amygdaloides*
Slope 1	Alpine and subalpine fens and wet meadows on saturated non-calcareous substrates.	*Carex aquatilis, Carex scopulorum*
Slope 2	Subalpine and montane fens and wet meadows on saturated	*Eleocharis quinqueflora, Kobresia simpliciuscula,*

HGM Subclass	Description	Common Species
	calcareous substrates.	*Carex simulata*
Slope 3	Wet meadows at middle elevations in the mountain ecoregion with a seasonal high water table near the ground surface.	*Juncus balticus* var. *montanus*
Slope 4	Low elevation meadows with a seasonal high water table near the ground surface. May occur on floodplains or near springs.	*Carex nebrascensis*

KEY TO HYDROGEOMORPHIC CLASSES

1a. Wetland is topographically flat; precipitation is the main source of water. **Mineral Soil Flats Class (F1)**

1b. Wetland is not topographically flat and has a variety of water sources.....(2)

2a. Wetland is associated with a stream channel, floodplain, or terrace. **Riverine Class**

2b. Wetland is in a natural or artificial topographic depression (the depression may occur near a stream channel or on a floodplain or terrace) or on a slope .....(3)

3a. Wetland is located in a natural or artificial (dammed) topographic depression. **Depressional Class**

3b. Wetland is located on a topographic slope, primary source of water is groundwater. **Slope Class**

Key to Riverine Subclasses

1a. Associated stream is 1st or 2nd order, typically occurs at mid-to high elevations but can also be in the plains .....(2)

1b. Associated stream is 3rd order or higher, typically occurs at lower elevation in the foothills, plains or plateaus..... (3)

2a. Stream is typically in the alpine or upper subalpine and has a steep gradient and coarse-textured substrate. **Riverine subclass 1 (R1)**

2b. Stream is in the subalpine or montane zone, has a moderate gradient and coarse or fine-textured substrate, often dominated by willows. **Riverine subclass 2 (R2)**

3a. Mid-to-high order streams at montane and lower elevations in the foohills, plains or plateaus, often dominated by shrubs or trees. **Riverine subclasses 3 and 4 (R3/4)**

3b. Low elevation floodplains with fine-textured substrate, dominated by shrublands, grasslands or deciduous woodlands. **Riverine subclass 5 (R5)**

Key to Depressional Subclasses

1a. Wetland occurs in mid-to-high elevation basins with peat soils or on lake fringes with or without peat soils. **Depressional subclass 1 (D1)**

1b. Wetland occurs at lower elevations and is either permanently or intermittently flooded ..... (2)

2a. Wetland is permanently or semi-permanently flooded, includes reservoirs, pond margins, marshes. **Depressional subclasses 2 and 3 (D2/3)**

2b. Wetland is temporarily or intermittently flooded, includes playas and reservoir or pond draw-down zones. **Depressional subclasses 4 and 5 (D4/5)**

Key to Slope Subclasses

1a. Wetland occurs in the montane or foothills zone or on the plains and has a seasonally high water table. **Slope subclasses 3 and 4 (S3/4)**

1b. Fen or wet meadow in the alpine or subalpine zone, with saturated soils... (2)

2a. Fen (peatland) or wet meadow (mineral soils) on non-calcareous substrate. **Slope subclass (S1)**

2b. Extreme rich fen on calcareous substrate, found mainly in South Park. **Slope subclass (S2)**

DICHOTOMOUS KEY TO THE WETLAND AND RIPARIAN PLANT ASSOCIATIONS OF COLORADO

User Guide: Read this first!

Step 1. Determine physiognomic type (Key to Physiognomic Groups). The first step to keying out a plant association (plant community), is to delineate the individual stand of homogenous vegetation or "patch-type" within the area. A homogenous stand of vegetation is one where the species are more or less evenly distributed, and fall within a consistent physiognomic type (tree, shrub or herbaceous dominated). Riparian areas are often complex mosaics of several plant associations, especially on broad meandering floodplains. They can also be simple linear bands of just one plant association. Determine the physiognomic type of the stand in question BEFORE keying to individual plant associations. For example, is the river lined with a forest with a shrub understory, or is the river lined with a band of shrubs (a shrubland type) and a forested plant association behind that (a forested type). How can you tell? See Key to Physiognomic Groups.

Step 2. **Keys to individual plant associations.** Cover values used in the keys are averages for a stand. They should be used as guidelines rather than rules. If near the cutoff between couplets, it is best to try the key in both directions. Once you arrive at an association name, go to the full association description for more information.

Step 3. If the stand vegetation is not identified by the key, the association can be considered Unclassified or can be given a provisional name based on the dominant species.

For predominately introduced types: Follow steps 1 and 2. Some introduced types are listed in the key. If the stand does not key to an association, identify the native vegetation and the native (or historic) plant association at the site if possible. If this determination can be made, the association may be labeled as this type and described as having an abundance of introduced plants. If native vegetation cannot be identified, give the association a provisional name based on the dominant plant species (usually the one providing the most cover). See Appendix B, Useful References (page 449) for guides which are useful in identifying introduced species.

forest - A community characterized by trees with their crowns overlapping, (generally forming at least 60% cover).

woodland - Open stands of trees with crowns not usually touching (generally forming 25-60% cover).

Associations are placed in forest or woodland categories based on typical tree cover for the association. Tree cover in individual stands or parts of stands may occasionally fall outside the cover definitions given here.

forbs - Broad-leaved herbaceous plants that die back to the ground each year and are generally known as wildflowers.

graminoids - Grasses and grass-like plants such as sedges and rushes.

Key to Physiognomic Groups

1a. The stand has an overstory canopy of trees with at least 20% cover, or if less, trees have a greater canopy coverage than any combined shrub canopy component. Some riparian forest types include a narrow strip of shrubs along the stream bank with tree canopy overhead. Does the tree canopy directly overhang the shrub canopy? Are the trees and shrubs rooted in the same geomorphic landform? For example, a narrow strip of thinleaf alder can have a "backdrop" of spruce and fir trees, but if you look carefully, you will see that the spruce and fir trees are rooted in the stream bank with the thinleaf alders, making the stand a forested community ..... (2)

1b. The stand does not have any trees, or if trees are present, their overstory canopy is less than 20% or so, and if greater, not by much; the shrub canopy is the dominant structure of the community. Any trees present appear as isolated individuals or do not overhang the shrubs, and are not rooted in the same landform ..... (4)

2a. Conifer trees dominate the overstory canopy (if deciduous trees are present, they are less than one-half of the conifer canopy, usually <10%). If netleaf hackberry *(Celtis laevigata* var. *reticulata)* is the only tree, go to Group F. **Group A - Evergreen Riparian Forests and Woodlands**, page 19.

2b. Deciduous trees dominate the overstory canopy or are co-dominant with a conifer species ..... (3)

3a. Conifer trees are co-dominant with the deciduous trees. Conifers make up 25-50% of the total canopy cover (stands of deciduous trees with less than 10% conifers, or conifers make up less than one half of the deciduous cover, go to 3b). **Group B, Mixed Coniferous and Deciduous Forests and Woodlands**, page 22.

3b. Deciduous trees dominate. If conifers are present, they are less than one-half the deciduous canopy, usually <10% (if greater, go to 3a). If river hawthorn *(Crataegus rivularis)* is the only tree present, go to Group F. **Group C, Deciduous Dominated Forests and Woodlands**, page 23.

4a. The stand is dominated by shrubs, usually with a canopy cover of at least 20%. The density of shrubs ranges from very thick (a continuous canopy of overlapping or touching shrubs) to open (individual shrubs or clumps of shrubs that are evenly spaced throughout the stand). If the shrubs are unevenly clumped, the stand may be a mosaic of two communities. Do the same herbaceous species occur under the shrub canopy as between? Are the spaces between the shrubs smaller than the shrub clumps? If yes then it may be one plant association, if not, try keying each patch type separately ..... (5)

4b. The stand is dominated by herbaceous vegetation. If shrubs are present they are very widely spaced with less than 20% cover, or if more not by much, and may be nearly hidden by the herbaceous growth. **Group G, Herbaceous Vegetation**, page 40.

5a. Willows (*Salix* spp.) dominate the overstory. Other shrubs may be present,

but are less than half as abundant. Be careful here, sapling-sized *Populus angustifolia* can be mistaken for willows. *Populus angustifolia* has buds with several overlapping scales, white bark, and red nodes. If *Populus angustifolia* seedlings and saplings are dominant (>20%), go to Group C.. (6)

5b. Other, non-willow shrubs dominate the overstory (thinleaf alder, birch, shrubby cinqefoil, etc.). If willows are present, they are usually less abundant than the non-willow shrub species, or may be up to equal in abundance. **Group F, Non-willow Shrublands**, page 36.

6a. Shrubland with an average canopy over 1 meter (3 feet) in height, usually at montane, foothill and valley floor elevations. **Group D, Tall Willow Shrublands**, page 30.

6b. Shrubland with an average canopy less than 1 meter (3 feet) in height, typically at higher elevations, upper montane and subalpine environments. **Group E, Short Willow Shrublands**, page 34.

When keying a plant association, remember to estimate the cover of each species for the **entire stand**. Percent cover values are approximate guidelines, not strict rules.

Group A
Evergreen Riparian Forests and Woodlands

1a. Rocky Mountain juniper *(Juniperus scopulorum)* present and dominant, or if the only tree present, it has ≥10 % total canopy cover. Red-osier dogwood *(Cornus sericea)* may or may not be present. Stands are often old, relict stands on upper terraces of larger rivers. **Rocky Mountain juniper/Red-osier dogwood *(Juniperus scopulorum/Cornus sericea)* Woodland**, page 66.

1b. Stand dominated by pine, spruce, or fir ..... (2)

2a. Lodgepole pine *(Pinus contorta)* is the dominant tree in the canopy. The understory is wet and dominated by water sedge *(Carex aquatilis)* or bluejoint reedgrass *(Calamagrostis canadensis)*. *Sphagnum* moss carpets the ground. The variation of this community which includes lodgepole pine is known only from Gunnison County. **(Engelmann spruce)/Bog birch/Water sedge/Sphagnum moss *()Picea engelmannii)/Betula nana (=glandulosa)/Carex aquatilis/Sphagnum*) Iron Fen**, page 298.

2b. Lodgepole pine *(Pinus contorta)* not present or if so, then not the dominant tree ..... (3)

3a. Dominant tree is Douglas-fir *(Pseudotsuga menziesi)* ..... (8)

3b. Dominant tree is spruce (*Picea* spp.) or fir (*Abies* spp.) ..... (4)

4a. Stands dominated by blue spruce *(Picea pungens)* ..... (5)

4b. Engelmann spruce *(Picea engelmannii)* and/or subalpine fir *(Abies lasiocarpa)* dominate the canopy layer ..... (11)

5a. Field horsetail *(Equisetum arvense)* thickly covers the ground, at least in patches, and is the most abundant herbaceous species in the undergrowth. **Blue spruce/Field horsetail *(Picea pungens/Equisetum arvense)* Woodland**, page 74.

5b. Understory dominated by shrub species ..... (6)

6a. Woody, persistent catkins present on dominant understory shrub. Thinleaf alder (*Alnus incana* ssp. *tenuifolia)* or river birch *(Betula occidentalis)* is the dominant shrub ..... (7)

6b. Woody, persistent catkins not present on dominant understory shrubs. Red-osier dogwood *(Cornus sericea)* is present and dominates the shrub canopy layer. Other shrubs may be present (*Alnus incana* ssp. *tenuifolia, Salix* spp.) and may be equal to but do not exceed abundance of *Cornus.* **Blue spruce/Red-osier dogwood *(Picea pungens/Cornus sericea)* Woodland**, page 72.

7a. Understory dominated by thinleaf alder (*Alnus incana* ssp. *tenuifolia*) **Blue spruce/Thinleaf alder *(Picea pungens/Alnus incana* ssp. *tenuifolia)* Woodland**, page 68.

7b. Understory dominated by river birch *(Betula occidentalis).* **Blue spruce/ River birch (*Picea pungens/Betula occidentalis*) Woodland**, page 70.

8a. Stands of Douglas-fir *(Pseudotsuga menziesii)* on cool, shaded streams in narrow valleys at montane elevations, river birch *(Betula occidentalis)* or red-osier dogwood *(Cornus sericea)* present..... (9)

8b. Stands of Douglas-fir *(Pseudotsuga menziesii)* on warmer, less well-shaded streams of narrow or broader valleys, foothills to montane elevations, Gambel oak (*Quercus gambelii)* or snowberry *(Symphoricarpos* spp.*)* present in understory ..... (10)

9a. An open to thick band of river birch (*Betula occidentalis*) occurs along the stream bank (thinleaf alder and red-osier dogwood shrubs may be present, even abundant, but not more so than the birch). **Douglas-fir/River birch (*Pseudotsuga menziesii/Betula occidentalis*) Woodland**, page 76.

9b. A thick stand of red-osier dogwood (*Cornus sericea*) occurs along the bank, floodplain, or gully under the canopy of Douglas-fir (*Pseudotsuga menziesii*). **Douglas-fir/Red-osier dogwood (*Pseudotsuga menziesii/Cornus sericea*) Woodland**, page 78.

10a. Mountain snowberry *(Symphoricarpos oreophilus)* thickets present under or near the *Pseudotsuga menziesii* canopy. **Douglas-fir/Snowberry *(Pseudotsuga menziesii/Symphoricarpos* spp.*)* Forest,** page 80.

10b. Gambel oak *(Quercus gambelii)* forms thickets under or near the Douglas-fir *(Pseudotsuga menziesii)* canopy. Serviceberry (*Amelanchier* spp.) may be present but does not dominate the shrub canopy. **Douglas-fir/Gambel oak *(Pseudotsuga menziesii/Quercus gambelii)* Forest**, usually an upland type, but may be found in riparian zones. Not described in this guide.

11a. Sphagnum moss *(Sphagnum angustifolium)* carpets much of the ground layer. Water sedge *(Carex aquatilis)* is common. Bog birch *(Betula nana (=glandulosa))* may be present in the shrub layer. Soils are peat with iron deposits, appearing orange colored and possibly solidified. (**Engelmann spruce)/Bog birch/Water sedge/Sphagnum moss *((Picea engelmannii)/Betula nana (=glandulosa)/Carex aquatilis/Sphagnum*) Iron Fen**, page 298.

11b. Not as above. Either subalpine fir *(Abies lasiocarpa)* or Engelmann spruce *(Picea engelmannii)* is the dominant tree .....(12)

12a. Understory dominated by shrub species ..... (13)

12b. Understory dominated by herbaceous species ..... (16)

13a. A band of thinleaf alder *(Alnus incana* ssp. *tenuifolia)* and/or Drummond willow *(Salix drummondiana)* occurs along the stream bank ..... (14)

13b. Thinleaf alder *(Alnus incana* ssp. *tenuifolia)* and Drummond willow *(Salix drummondiana)* usually absent, but if present then in such small isolated pockets that they are not dominant (<10%) ..... (15)

14a. Thinleaf alder is the dominant shrub along the stream bank, Drummond willow may be present, but is less abundant than thinleaf alder. **Subalpine fir-Engelmann spruce/Thinleaf alder (*Abies lasiocarpa-Picea engelmannii/Alnus incana* ssp. *tenuifolia*) Forest**, page 52.

14b. Drummond willow *(Salix drummondiana)* is the dominant shrub along the stream bank. If thinleaf alder *(Alnus incana* ssp. *tenuifolia)* is present it is less abundant. If the two shrubs occur in equal abundance, the stand is probably an elevational transition between the *Abies lasiocarpa-Picea engelmannii/Alnus incana ssp. tenuifolia* and the *Abies lasiocarpa-Picea engelmannii/Salix drummondiana* types. **Subalpine fir-Engelmann spruce/Drummond willow *(Abies lasiocarpa-Picea engelmannii/Salix drummondiana)* Forest**, page 64.

15a. The shrub canopy is sparse to thick, and dominated by any one of several currant *(Ribes)* species. **Subalpine fir-Engelmann spruce/Currant spp. *(Abies lasiocarpa-Picea engelmannii/Ribes* spp.*)* Forest**, page 62.

15b. Understory dominated other shrub species. **Unclassified association**

16a. Stream banks lined with thick mosses and many forb species. Among the most prominent species are: tall fringed bluebells *(Mertensia ciliata)*, arrowleaf ragwort *(Senecio triangularis)*, or heartleaf bittercress *(Cardamine cordifolia)*. Only one of these three need be present to key to this type. The diagnostic characteristic is the lack of shrub cover and the abundance of forb cover. **Subalpine fir-Engelmann spruce/Tall fringed bluebells *(Abies lasiocarpa-Picea engelmannii/Mertensia ciliata)* Forest**, page 60.

16b. Stream banks lined with mosses and few to no forb species, herbaceous undergrowth dominated by graminoid species or field horsetail *(Equisetum arvense)* ..... (17)

17a. Field horsetail *(Equisetum arvense)* is the most important understory species. Bluejoint reedgrass *(Calamagrostis canadensis)* or water sedge *(Carex aquatilis)* may be present, but not as abundant as the *Equisetum.* **Subalpine fir-Engelmann spruce/Field horsetail *(Abies lasiocarpa-Picea engelmannii/Equisetum arvense)* Forest**, page 58.

17b. Bluejoint reedgrass *(Calamagrostis canadensis)* or Water sedge *(Carex aquatilis)* is the dominant graminoid species..... (18)

18a. Bluejoint reedgrass *(Calamagrostis canadensis)* is the dominant graminoid present. **Subalpine fir-Engelmann spruce/Bluejoint reedgrass *(Abies lasiocarpa-Picea engelmannii/Calamagrostis canadensis)* Forest**, page 54.

18b. Water sedge *(Carex aquatilis)* is the dominant graminoid present. **Subalpine fir-Engelmann spruce/Water sedge *(Abies lasiocarpa-Picea engelmannii/Carex aquatilis)* Forest**, page 56.

Group B
Mixed Coniferous and Deciduous Forests and Woodlands

1a. Narrowleaf cottonwood *(Populus angustifolia)* and Rocky Mountain juniper *(Juiperus scopulorum)* both present in approximately equal amounts. Shrubs may be completely absent, or several shrubs such as *Rhus trilobata* (skunkbush sumac), *Symphoricarpos oreophilus* (mountain snowberry), or currant spp. *(Ribes)* may be present. **Narrowleaf cottonwood-Rocky Mountain juniper *(Populus angustifolia-Juniperus scopulorum)* Woodland**, page 88.

1b. Rocky Mountain juniper *(Juiperus scopulorum)* is not present, or if so, then with < 10% cover ..... (2)

2a. Narrowleaf cottonwood *(Populus angustifolia)* is co-dominant with subalpine fir *(Abies lasiocarpa)* and/or Engelmann spruce *(Picea engelmannii)*.....(3)

2b. Subalpine fir *(Abies lasiocarpa)* not present. Engelmann spruce *(Picea engelmannii)* and blue spruce *(Picea pungens)* or Douglas-fir *(Pseudotsuga menziesii* codominant with narrowleaf cottonwood *(Populus angustifolia)* ..... (4)

3a. Honeysuckle *(Lonicera involucrata)* often occurs in the understory although it may not be abundant. **Subalpine fir-Engelmann spruce-Narrowleaf cottonwood/(Twinberry honeysuckle) *(Abies lasiocarpa-Picea engelmannii-Populus angustifolia/(Lonicera involucrata))* Forest**, page 86.

3b. Another shrub is more common in the understory. Unclassified or described in another section of the key. Try re-keying in Group A, Evergreen Riparian Forests and Woodlands, or Group C, Deciduous Dominated Forests and Woodlands.

4a. Narrowleaf cottonwood *(Populus angustifolia)* is co-dominant with blue spruce *(Picea pungens)* or Engelmann spruce *(Picea engelmannii)*. Thinleaf alder *(Alnus incana ssp. tenuifolia)* is the dominant shrub. **Narrowleaf cottonwood-Blue spruce/Thinleaf alder *(Populus angustifolia-Picea pungens/Alnus incana* ssp. *tenuifolia)* Woodland**, page 90.

4b. Blue spruce *(Picea pungens)* is not present, or if so, then providing less cover than other conifers ..... (5)

5a. Narrowleaf cottonwood *(Populus angustifolia)* is co-dominant with Douglas-fir *(Pseudotsuga menziesii)*. **Narrowleaf cottonwood-Douglas-fir *(Populus angustifolia-Pseudotsuga menziesii)* Woodland**, page 92.

5b. Douglas-fir *(Pseudotsuga menziesii)* not present, or if so, with < 10% cover, shrubs prominent in understory ..... (6)

6a. Narrowleaf cottonwood *(Populus angustifolia)* is co-dominant with white fir *(Abies concolor)*. Blue spruce *(Picea pungens)* may be present. Rocky Mountain maple *(Acer glabrum)* is common in the understory. **White fir-(Blue spruce)-Narrowleaf cottonwood/Rocky Mountain maple *(Abies concolor-(Picea pungens)-Populus angustifolia/Acer glabrum)* Forest**, page 84.

6b. Community is other than described. Unclassified or described in another section of the key. Try re-keying in Group A, Evergreen Riparian Forests and Woodlands, or Group C, Deciduous Dominated Forests and Woodlands.

Group C
Deciduous Dominated Forests and Woodlands

1a. Boxelder *(Acer negundo)* is the dominant tree, the only tree present, or is co-dominant with narrowleaf cottonwood *(Populus angustifolia)*. Boxelder sometimes appears as a subcanopy to the taller cottonwoods, or as separate patches within a surrounding narrowleaf cottonwood forest ..... (2)

1b. Boxelder *(Acer negundo)* is not present in the stand ..... (7)

2a. Narrowleaf cottonwood *(Populus angustifolia)* not present in the stand, it may be present along the reach, but not within the stand of boxelder *(Acer negundo)* ..... (3)

2b. Narrowleaf cottonwood *(Populus angustifolia)* present and co-dominant with boxelder *(Acer negundo)* ..... (6)

3a. Stands along perennial streams, in well-shaded, steep-walled canyons, red-osier dogwood (*Cornus sericea)* or river birch *(Betula occidentalis)* present and abundant..... (4)

3b. Stands on ephemeral or intermittent streams, less well-shaded stream banks in broad valley bottoms, often on high, drier stream banks. Red-osier dogwood *(Cornus sericea)* or river birch *(Betula occidentalis)* not present. Chokecherry *(Prunus virginiana)* may be present ..... (5)

4a. River birch *(Betula occidentalis)* present and abundant as a co-dominant tree/shrub or as an understory shrub canopy. Often the boxelder *(Acer negundo)* occurs on upper terraces and river birch on the lower, wetter stream banks, but they may occur together as well. **Boxelder/River birch *(Acer negundo/Betula occidentalis)* Woodland**, page 98.

4b. River birch not present, or if so, in trace amounts relative to other shrub species. Red-osier dogwood *(Cornus sericea)* present and abundant. Currants or gooseberries (*Ribes* spp.) often also present. **Boxelder/Red-osier dogwood *(Acer negundo/Cornus sericea)* Forest**, page 100.

5a. Chokecherry (*Prunus virginiana*) scattered about or in thick bands beneath the boxelder canopy. Chokecherry (*Prunus virginiana*) is an indicator for this type even if present with minimal cover. On streams of lower elevations or on the Western Slope. **Boxelder/Chokecherry *(Acer negundo/Prunus virginiana)* Forest**, page 106.

5b. Chokecherry not present. Only a few scattered shrubs (e.g., *Ribes* spp.), or no shrubs present. Undergrowth purely introduced weeds or simply bare ground. Unclassified stands: ***Acer negundo* Alliance**

6a. In stands of mixed boxelder *(Acer negundo)* and narrowleaf cottonwood *(Populus angustifolia)*, red-osier dogwood *(Cornus sericea)* is present and abundant. On broad floodplains, patches of boxelder can occur at some distance from narrowleaf cottonwood stands, but the floodplain as a whole is a mosaic of these two species. Other shrubs may be present, such as thinleaf alder *(Alnus incana* ssp. *tenuifolia)*, or willows (*Salix* spp.). These are more or less restricted to the stream edge, while the dogwood grows in the shade of the mixed overstory. **Boxelder-Narrowleaf cottonwood/Red-osier dogwood *(Acer negundo-Populus angustifolia/Cornus sericea)* Forest**, page 104.

6b. Red-osier dogwood *(Cornus sericea)* not present. Netleaf hackberry (*Celtis laevigata* var. *reticulata)* present. Only one stand known from Unaweep

Seep in Mesa County. **Boxelder-Narrowleaf cottonwood/Netleaf hackberry *(Acer negundo-Populus angustifolia/Celtis laevigata* var. *reticulata)* Forest**, page 102.

7a. Balsam poplar *(Populus balsamifera)* dominates the canopy along the reach. **Balsam poplar *(Populus balsamifera)* Forest**, page 136.

7b. Quaking aspen *(Populus tremuloides)*, cottonwoods *(Populus angustifolia, P. deltoides),* or peachleaf willow *(Salix amygdaloides)* dominant.....(8)

8a. Quaking aspen *(Populus tremuloides)* is the dominant tree although other trees may be present .....(9)

8b. Cottonwoods *(Populus deltoides* or *P .angustifolia)* or peachleaf willow *(Salix amygdaloides)* dominate the stand ..... (15)

9a. Quaking aspen *(Populus tremuloides)* is the dominant overstory canopy tree, the association occurs along mountain streams, shrubs are abundant in the understory..... (10)

9b. Quaking aspen *(Populus tremuloides)* dominates the canopy, few or no shrubs are present, tall wildflower species are abundant in the understory. **Quaking aspen/Tall forb *(Populus tremuloides/*Tall forb*)* Forest**, page 180.

10a. Thinleaf alder *(Alnus incana* ssp. *tenuifolia)* or river birch *(Betula occidentalis)* is the dominant shrub. ..... (11)

10b. Other shrubs dominant in the understory ..... (12)

11a. Thinleaf alder *(Alnus incana* ssp. *tenuifolia)* dominates the shrub layer, if river birch *(Betula occidentalis)* is present, it has less than half of the amount of thinleaf alder cover. **Quaking aspen/Thinleaf alder *(Populus tremuloides/Alnus incana* ssp. *tenuifolia)* Forest**, page 172.

11b. River birch *(Betula occidentalis)* provides the shrub cover. If thinleaf alder *(Alnus incana* ssp. *tenuifolia)* is present, it provides less cover than river birch. **Quaking aspen/River birch *(Populus tremuloides/Betula occidentalis)* Forest**, page 174.

12a. Drummond willow *(Salix drummondiana)* is the most abundant shrub along the stream banks, some thinleaf alder *(Alnus incana* ssp. *tenuifolia)* may be present but not dominant. **Quaking aspen/Drummond willow *(Populus tremuloides/Salix drummondiana)* Forest**, association not described here.

12b. Drummond willow *(Salix drummondiana)*, if present, provides less cover than other shrubs ..... (13)

13a. Rocky Mountain maple *(Acer glabrum)* is the dominant shrub, if thinleaf alder *(Alnus incana* ssp. *tenuifolia)* and river birch *(Betula occidentalis)* are present, they make up less than half the cover of the Rocky Mountain maple present. This community is very rare and is not restricted to stream sides; it is also found on moist north-facing slope. **Quaking aspen/Rocky Mountain maple *(Populus tremuloides/Acer glabrum)* Forest**, page 170.

13b. If Rocky Mountain maple *(Acer glabrum)* is present, it is not the dominant shrub. Communities of narrow canyons ..... (14)

14a. Red-osier dogwood *(Cornus sericea)* is the dominant shrub in the understory. **Quaking aspen/Red-osier dogwood *(Populus tremuloides/Cornus sericea)* Forest**, page 176.

14b. Beaked hazelnut *(Corylus cornuta)* is the dominant shrub. **Quaking**

aspen/Beaked hazelnut *(Populus tremuloides/Corylus cornuta)* Forest, page 178.

15a. Narrowleaf cottonwood *(Populus angustifolia)* is the dominant tree species, either as seedlings, saplings or mature trees. Stands of medium elevations. ..... (16)

15b. Plains cottonwood or Rio Grande cottonwood *(Populus deltoides* ssp. *monilifera* or *Populus deltoides* ssp. *wislizenii)* and/or peachleaf willow *(Salix amygdaloides)* are the dominant tree species. Stands of low elevations (generally below 6500 feet) ..... (32)

16a. Immature narrowleaf cottonwoods *(Populus angustifolia),* seedlings, saplings, and poles (less than 5 feet (1.5 m) tall, and if taller, no more than 5", 12.6 cm dbh), dominate the stand ..... (17)

16b. Mature narrowleaf cottonwood *(Populus angustifolia)* trees dominate the tree canopy (taller than 5 ft (1.5 m) and dbh greater than 5 in, 12.6 cm). (18)

17a. Narrowleaf cottonwood *(Populus angustifolia)* trees generally confined to gravel bars and immediate stream banks. Sandbar willow *(Salix exigua)* is often present as a dominant or co-dominant shrub. Stands consisting solely of *Populus angustifolia* seedlings, without sandbar willow *(Salix exigua)*, also key to this community. **Narrowleaf cottonwood/Sandbar willow *(Populus angustifolia/Salix exigua)* Woodland**, page 124.

17b. Narrowleaf cottonwood *(Populus angustifolia)* trees of stream banks, as well as point bars and gravel bars. Several willow species are present in relatively equal abundance (e.g., *Salix eriocephala*, *S. monticola*, *S. exigua,* and/or *S. lucida*), such that it is difficult to determine if any one species is the "dominant" willow. **Narrowleaf cottonwood/Mixed willow *(Populus angustifolia/Salix (monticola, drummondiana, lucida)* Woodland**, page 132.

18a. Shrubs create a subcanopy underneath mature cottonwoods, sometimes the shrubs are confined to a narrow strip along the stream bank ..... (19)

18b. No shrubs species are present, or if so, then <10% cover (never dominant) ..... (31)

19a. Stands of cool moist stream sides, dominant shrubs present are thinleaf alder *(Alnus incana* ssp. *tenuifolia),* river birch *(Betula occidentalis),* red-osier dogwood *(Cornus sericea),* and/or willows (*Salix* species) ..... (20)

19b. Streams of foothills and lower elevations (East or West Slope), warm exposures, drier, more elevated stream banks, one or more of several shrub species (willows never dominant) make up the understory ..... (27)

20a. Willows (*Salix* spp.) make up less than half the shrub cover ..... (21)

20b. Either several species of willow are present in similar abundance (*Salix eriocephala*, *S. monticola*, *S. exigua,* and/or *S. lucida*), or just *Salix exigua* is present ..... (23)

21a. Red-osier dogwood *(Cornus sericea)* is the dominant shrub present, although thinleaf alder *(Alnus incana* ssp. *tenuifolia)* may be present with as much cover as the dogwood. **Narrowleaf cottonwood/Red-osier dogwood *(Populus angustifolia/Cornus sericea)* Woodland**, page 114.

21b. River birch *(Betula occidentalis)* or thinleaf alder *(Alnus incana* ssp. *tenuifolia)* dominate the shrub layer ..... (22)

22a. River birch *(Betula occidentalis)* is present and is as abundant as any other shrub species. Often co-dominant with thinleaf alder *(Alnus incana* ssp. *tenuifolia)* or red-osier dogwood *(Cornus sericea)*. River birch is less common and more threatened than thinleaf alder, thus co-dominant stands fall into the birch type for conservation tracking. **Narrowleaf cottonwood/River birch *(Populus angustifolia/Betula occidentalis)* Woodland**, page 112.

22b. River birch *(Betula occidentalis)* is not present or present in very minor amounts. Thinleaf alder *(Alnus incana* ssp. *tenuifolia)* is abundant and dominant. Other shrubs may be present but usually make up less than half the thinleaf alder cover. **Narrowleaf cottonwood/Thinleaf alder *(Populus angustifolia/Alnus incana* ssp. *tenuifolia)* Woodland**, page 110.

23a. Several (at least 3) willow species are present in similar abundance such that it is difficult to determine if any one species is the "dominant" willow. **Narrowleaf cottonwood/Mixed willow *(Populus angustifolia/Salix* spp.*)* Woodland**, page 132.

23b. A single willow species can be said to dominate the shrub canopy, with or without other shrub species ..... (24)

24a. The dominant willow species has a waxy coating on the twigs (Drummond willow, *Salix drummondiana,* or bluestem willow*, S. irrorata*). Other shrub species may be present, including other willows..... (25)

24b. The dominant willow of the understory is not as above. Sandbar willow *(Salix exigua)* or shining willow *Salix lucida* usually the dominant willow ..... (26)

25a. Drummond willow *(Salix drummondiana)* is dominant, growing thickly along the stream channel edge and as scattered individuals on the floodplain. Rocky Mountain maple *(Acer glabrum)* is also present. Known from only one stand on the western flank of the Sangre de Cristo Mountains. **Narrowleaf cottonwood/Drummond willow-Rocky Mountain maple *(Populus angustifolia/Salix drummondiana-Acer glabrum)* Woodland**, page 122.

25b. Bluestem willow *(Salix irrorata)* is the dominant shrub. Some sandbar willow *(Salix exigua)* may be present. Stands restricted to a narrow band at the foothill-plains transition elevation along the Front Range. **Narrowleaf cottonwood/Bluestem willow *(Populus angustifolia/Salix irrorata)* Woodland**, page 126.

26a. Shining willow *(Salix lucida* ssp. *caudata* or ssp. *lasiandra)* forms a tall sub-canopy under the narrowleaf cottonwood *(Populus angustifolia);* few other shrubs are present. **Narrowleaf cottonwood/Shining willow *(Populus angustifolia/ Salix lucida* ssp. *caudata* or ssp. *lasiandra)* Woodland**, page 130.

26b. Sandbar willow *(Salix exigua)* very abundant, mixed in and often of equal height with the young cottonwoods. Other young shrubs may be present (thinleaf alder, etc), but sandbar willow is the dominant shrub canopy component. **Narrowleaf cottonwood/Sandbar willow *(Populus angustifolia/Salix exigua)* Woodland**, page 124.

27a. Stands restricted to broad floodplains of southwestern Colorado. Known from the lower Gunnison and Uncompahgre River drainages south to the San Juan River, including some low-elevation tributaries. Stands have

silver buffaloberry *(Shepherdia argentea)* present, not necessarily dominant; strapleaf willow (*Salix liguifolia =S. eriocephala* var. *ligulifolia)* may or may not by present. The presence of *Shepherdia argentea* is the diagnostic species for this narrowleaf cottonwood community. **Narrowleaf cottonwood/Strapleaf willow-Silver buffaloberry *(Populus angustifolia/Salix ligulifolia-Shepherdia argentea)* Woodland**, page 128.

27b. Stands not restricted to floodplains of southwestern Colorado, without silver buffaloberry *(Shepherdia argentea)* ..... (28)

28a. Stands with river hawthorn *(Crataegus rivularis)* a dominant component of an often diverse shrub layer, isolated stands of hawthorn without the cottonwood overstory often occur within the same floodplain mosaic. **Narrowleaf cottonwood/River hawthorn *(Populus angustifolia/ Crataegus rivularis)* Woodland**, page 116.

28b. Stands with no river hawthorn *(Crataegus rivularis)* present, or if present then not the dominant shrub component..... (29)

29a. Chokecherry *(Prunus virginiana)* is the dominant shrub present, often with few other shrubs present. **Narrowleaf cottonwood/ Chokecherry *(Populus angustifolia/Prunus virginiana)* Woodland**, page 118.

29b. Chokecherry *(Prunus virginiana)* may be present, but not dominant..... (30)

30a. Skunkbush sumac *(Rhus trilobata)* present and forming large, if patchy, clumps under and between the cottonwood canopy. Generally restricted to the western half of the state. **Narrowleaf cottonwood/Skunkbush sumac *(Populus angustifolia/Rhus trilobata)* Woodland**, page 120.

30b. Snowberry (*Symphoricarpos oreophilus, S. occidentalis,* or *S. albus*) present and forming large, patchy clumps under and between the cottonwood canopy. **Narrowleaf cottonwood/Common snowberry *(Populus angustifolia/ Symphoricarpos albus*) Woodland**, page 134.

31a. No shrubs or herbaceous layer present. Substrate is pure sand and often with a thick litter layer of cottonwood leaves, located in or near Great Sand Dunes National Monument. **Narrowleaf cottonwood *(Populus angustifolia)* Sand Dune Forest**, page 108.

31b. Few to no shrubs are present, the undergrowth is dominated by mostly introduced hay-meadow grasses such as Kentucky bluegrass (*Poa pratensis*) or creeping bentgrass *(Agrostis stolonifera).* **Narrowleaf cottonwood/Mesic graminoid *(Populus angustifolia/*Mesic graminoid) Woodland**, undescribed association needing further verification.

32a. Mature or immature cottonwoods *(Populus deltoides)* are the dominant trees in the stand ..... (33)

32b. Peachleaf willow *(Salix amygdaloides)* dominates the woodland canopy. Cottonwoods (*Populus deltoides* or *P. angustifolia*) may be present. **Peachleaf willow *(Salix amygdaloides)* Woodland**, page 182.

33a. Mature cottonwoods dominate the stand. On the eastern plains, peachleaf willow *(Salix amygdaloides)* is almost always present, but can be few in number, or very widely spaced. Stands dominated by Fremont cottonwood *(Populus fremontii)*, not yet reported to occur in Colorado, but similar to Rio Grande cottonwood (*Populus deltoides* ssp. *wislizenii*), may occur in stands along the southwestern border, key here as well ..... (34)

33b. Immature (seedlings and saplings) cottonwoods *(Populus deltoides)* make

up the stand. On the eastern plains, seedling and sapling peachleaf willow *(Salix amygdaloides)* may be present as well ..... (46)

34a. Stands co-occur with Gooding willow *(Salix gooddingii)*, known from arroyos of desert-steppe in the extreme southwestern part of the state. **Fremont Cottonwood/Goodding willow *(Populus fremontii/Salix gooddingii)* Woodland**. Association not described in this guide.

34b. Stand not as above..... (35)

35a. Stands have little to no shrub understory, with <10% for the entire stand, ignoring any tamarisk *(Tamarix ramosissima)* which may be present, even abundant. The ground is covered in herbaceous growth..... (36)

35b. Stands that have a shrub subcanopy (10% or greater) underneath or very near and associated with the trees (growing on the same fluvial surface, shrubs can be partly under, and partly out in the open) ..... (47)

36a. Mesic graminoid species such as switchgrass *(Panicum virgatum),* Indiangrass *(Sorghastrum nutans),* woolly sedge *(Carex pellita (=lanuginosa))*, and prairie cordgrass *(Spartina pectinata*) dominate the undergrowth ..... (37)

36b. Xeric graminoid species such as western wheatgrass *(Pascopyrum smithii),* vine mesquite *(Panicum obtusum),* sand dropseed *(Sporobolus cryptandrus),* composite dropseed *(Sporobolus compositus* var. *compositus),* alkali sacaton *(Sporobolus airoides)*, alkali muhly *(Muhlenbergia asperifolia),* slender wheatgrass *(Elymus trachycaulis),* smooth brome *(Bromus inermis),* and inland saltgrass *(Distichlis spicata)* dominate the undergrowth ..... (39)

37a. Known only from the eastern plains, on the Big Sandy and Arikaree Rivers. Tall-grass prairie species such as switchgrass *(Panicum virgatum)*, big bluestem *(Andropogon gerardii)*, and indiangrass *(Sorghastrum nutans)* occur underneath and between the cottonwood canopy and switchgrass dominates the undergrowth. **Plains cottonwood/Switchgrass-Little bluestem *(Populus deltoides/Panicum virgatum-Schizachyrium scoparium)* Woodland**, page 150.

37b. Woolly sedge *(Carex pellita, =lanuginosa)* or prairie cordgrass *(Spartina pectinata)* dominate the undergrowth and form a near monotypic carpet. Known primarily from the South Platte River, northeastern plains..... (38)

38a. Woolly sedge *(Carex pellita, =lanuginosa)* dominates the undergrowth (if mixed with prairie cordgrass *(Spartina pectinata)* and nearly equal in abundance, go to the next choice). **Plains cottonwood/Woolly sedge *(Populus deltoides/Carex pellita (=lanuginosa))* Woodland**, page 140.

38b. Prairie cordgrass *(Spartina pectinata)* dominates the undergrowth in near monotypic stands. **Plains cottonwood-(black willow)/Prairie cordgrass-sedge *(Populus deltoides-(Salix nigra)/Spartina pectinata-Carex* spp*.)* Woodland**, page 160.

39a. The non-native pasture grass smooth brome *(Bromus inermis)* is very abundant, forming a nearly monotypic lawn under the cottonwood canopy. Known from agricultural valleys, eastern plains, San Luis Valley and Western Slope. **Plains cottonwood/ Smooth brome *(Populus deltoides/Bromus inermis)* Woodland**, page 138.

39b. Other grasses dominate the understory..... (40)

40a. Inland saltgrass is the dominant grass, usually covering at least 30% of the

stand. **Plains cottonwood/Inland saltgrass *(Populus deltoides/Distichlis spicata)* Woodland**, page 142.

40b. Vine mesquite *(Panicum obtusum)* and western wheatgrass *(Pascopyrum smithii)* occur in alternating large patches underneath the tall overstory canopy of cottonwoods.....(41)

41a. Some alkali sacaton (*Sporobolus airoides*), sand dropseed (*S. cryptandrus*), and inland saltgrass (*Distichlis spicata*), may be present. Soils generally more clayey than sandy within the first 15cm or so. Known only from the Purgatory and Arkansas Rivers of the southeastern plain. **Plains cottonwood/Western wheatgrass-Vine mesquite *(Populus deltoides/Pascopyrum smithii-Panicum obtusum)* Woodland**, page 152

41b. Vine mesquite *(Panicum obtusum)* and western wheatgrass *(Pascopyrum smithii)* may be present, but not dominant in the undergrowth.....(42)

42a. Undergrowth dominated by isolated patches of alkali muhly *(Muhlenbergia asperifolia)*. Soils are moist (at least seasonally) and alkaline. The alkali muhly may be some distance from the cottonwoods, but both occur on the same active fluvial surface within the stream channel. Known from Chico Creek and the Apishapa River, western portion of the eastern plains. **Plains cottonwood/Alkali muhly *(Populus deltoides/Muhlenbergia asperifolia)* Forest**, page 148.

42b. Alkali muhly *(Muhlenbergia asperifolia)* may be present but other grasses are more abundant.....(43)

43a. Slender wheatgrass *(Elymus trachycaulus)* is the dominant understory grass. **Plains cottonwood/Slender wheatgrass *(Populus deltoides/Elymus trachycaulus)* Woodland**, page 144.

43b. Undergrowth dominated by alkali sacaton *(Sporobolus airoides),* composite dropseed *(Sporobolus compositus* var. *compositus, =Sporobolus asper)*, or sand dropseed *(S. cryptandrus)*. Soils dry and sandy, at least at the surface, may or may not be alkaline.....(44)

44a. Undergrowth dominated by alkali sacaton *(Sporobolus airoides)*. Other species present include sand dropseed *(S. cryptandrus)* and blue grama (*Bouteloua gracilis*). Soils are dry, sandy, and slightly alkaline. Stands of the southeastern plains. **Plains cottonwood/Alkali sacaton *(Populus deltoides/Sporobolus airoides)* Woodland**, page 162.

44b. Undergrowth dominated by composite dropseed *(Sporobolus compositus* var. *compositus)* or sand dropseed *(Sporobolus cryptandrus)*.....(45)

45a. Undergrowth dominated by composite dropseed *(Sporobolus compositus* var. *compositus)*. Cottonwood trees widely separated, stands on upper terraces of the Arkansas River. **Plains cottonwood/Composite dropseed *(Populus deltoides/Sporobolus compositus* var. *compositus)* Woodland**, page 164.

45b. Undergrowth dominated by sand dropseed *(Sporobolus cryptandrus)*. Other species that may be present include western wheatgrass *(Pascopyum smithii)* and Canada wildrye *(Elymus canadensis)*. Stands of southeastern plains, Big Sandy, Arkansas and Cimarron Rivers. **Plains cottonwood/Sand dropseed *(Populus deltoides/Sporobolus cryptandrus)* Woodland**, page 166.

46a. Cottonwood *(Populus deltoides)* trees are generally young seedling and

saplings. Sandbar willow *(Salix exigua)* is scattered to co-dominant within the stand, often both woody species are of the same height. Stands of the eastern plains may have young peachleaf willow *(Salix amygdaloides)* mixed in as well. Stands on the Western Slope usually do not have peachleaf willow. **Plains cottonwood-(Peachleaf willow)/Sandbar willow *(Populus deltoides (Salix amygdaloides)/Salix exigua)* Woodland**, page 158.

46b. Cottonwood *(Populus deltoides)* trees are generally older, mature individuals, forming closed canopy gallery forests to open woodlands with very old and widely spaced trees on upper terraces..... (47)

47a. Skunkbush sumac *(Rhus trilobata)* forms small to large patches underneath and between the cottonwood overstory canopy. Sumac generally confined to alluvial bottoms. Stands of river floodplains on the Western Slope. **Plains cottonwood/Skunkbush sumac *(Populus deltoides/Rhus trilobata)* Woodland**, page 156.

47b. Skunkbush sumac *(Rhus trilobata)* may be present on adjacent side slopes, especially in the foothills canyons and streams of the eastern plains. Other shrubs occur under the cottonwood canopy..... (48)

48a. Tall-medium height shrubs (>3 ft) dominate the shrub layer ..... (49)

48b. Short-stature shrubs dominate the shrub layer..... (50)

49a. Wild-privet *(Forestiera pubescens)* occurs in the understory and covers almost one-fourth to one-half of the plot. Russian olive *(Elaeagnus angustifolia)* may also be present and may be more abundant than wild-privet. Currently described only from the Animas River drainage, but expected to occur in far western Colorado. **Plains cottonwood/Wild-privet *(Populus deltoides/Forestiera pubescens)* Woodland**, page 146.

49b. Chokecherry *(Prunus virginiana)* occurs in small to large patches under the cottonwood canopy. **Plains cottonwood/Chokecherry *(Populus deltoides/Prunus virginiana)* Woodland**, page 154.

50a. *Symphoricarpos occidentalis* occurs in large and small patches under and among the canopy of cottonwoods. Known from the South Platte River and its tributaries. **Plains cottonwood/Western snowberry *(Populus deltoides /Symphoricarpos occidentalis)* Woodland**, page 168.

50b. Shrubs other than those mentioned observed. Unclassified association.

Group D
Tall Willow Shrublands

The **matrix willow** is the species that makes up the bulk of the structure and biomass of the willow shrubland. While several other willow species may be present, the matrix willow has the highest individual cover, even though the combined cover of all other willows present may exceed that value. Willow shrublands are named for their dominant or matrix willow, but almost always have several other willow species present as well. Throughout this key, we use the terms dominant and matrix willow interchangeably.

1a. Sandbar willow *(Salix exigua)* and/or strapleaf willow *(Salix ligulifolia =S. eriocephala* var. *ligulifolia)* are the dominant or co-dominant willows .... (2)

1b. Other willows are dominant, sandbar willow *(Salix exigua)* or strapleaf willow *(Salix ligulifolia)* may be present in the stand, but do not make up

the bulk of the biomass ..... (5)

2a. Sandbar willow *(Salix exigua)* is dominant, other willows, if present, have less than half the cover of sandbar willow ..... (3)

2b. Strapleaf willow *(Salix ligulifolia)* is co-dominant with sandbar or sandbar is not present or if so, only in small amounts ..... (4)

3a. Herbaceous growth under the sandbar willow *(Salix exigua)* canopy is low, the ground cover is mostly bare ground or alluvium (sand, cobbles, etc.), grasses and forbs may be present but have a combined cover of less than 30% or so. **Sandbar willow *(Salix exigua)*/Barren ground Shrubland**, page 204.

3b. Herbaceous growth under the sandbar willow *(Salix exigua)* canopy is at least 30%. Total bare ground (or alluvium) is less than 30% or so; grasses or other graminoids make up most of the ground cover. **Sandbar willow *(Salix exigua)*/Mesic graminoid Shrubland**, page 206.

4a. Strapleaf willow *(Salix ligulifolia)* is co-dominant with sandbar willow *(Salix exigua)*, few other willows are present. Known only from Costilla and Las Animas counties. **Sandbar willow-Strapleaf willow *(Salix exigua-Salix ligulifolia)* Shrubland**, page 208.

4b. Strapleaf willow *(Salix ligulifolia)* is the dominant or co-dominant willow with mountain willow (*Salix monticola*), or other willows, often found near stream edges, but can form floodplain thickets. Sandbar willow *(Salix exigua)* is not present or if so, only in small amounts. **Strapleaf willow *(Salix ligulifolia = S. eriocephala* var. *ligulifolia)* Shrubland**, page 222.

5a. Mountain willow *(Salix monticola)* or Geyer willow *(Salix geyeriana)* are the dominant, or matrix willow (other willow species cover when combined may be greater than *Salix monticola* or *Salix geyeriana* individually) ..... (6)

5b. Mountain willow *(Salix monticola)* or Geyer willow *(Salix geyeriana)* are not present, or if so, not dominant or the matrix willow, other willow species are dominant ..... (17)

6a. Either mountain willow *(Salix monticola)* or Geyer willow *(Salix geyeriana)* is the dominant and matrix willow, the two are not co-dominant ..... (7)

6b. Mountain willow *(Salix monticola)* and Geyer willow *(Salix geyeriana)* have nearly equal percent cover, and are evenly distributed throughout the stand; it is difficult to determine which is more abundant ..... (16)

7a. Mountain willow *(Salix monticola)* is the dominant, matrix willow, if Geyer willow *(Salix geyeriana)* is present, it is much less abundant than mountain willow ..... (8)

7b. Geyer willow *(Salix geyeriana)* is the dominant, matrix willow, if mountain willow *(Salix monticola)* is present, it is less abundant than Geyer willow ..... (13)

8a. Understory dominated by field horsetail *(Equisetum arvense)*. **Mountain willow/Field horsetail *(Salix monticola/Equisetum arvense)* Shrubland**, page 232.

8b. Understory dominated by other species, forbs or graminoids ..... (9)

9a. Herbaceous layer is dominated by a single graminoid species, or if the species is not dominant, it at least has the highest cover of any other herbaceous species present in the undergrowth ..... (10)

9b. Many grasses and/or forb species are present and it is impossible to assign dominance to any single herbaceous species in the undergrowth..... (12)

10a. Bluejoint reedgrass *(Calamagrostis canadensis)* is the dominant understory species, or has at least the highest percent cover of all herbaceous species present in the undergrowth. **Mountain willow/ Bluejoint reedgrass *(Salix monticola/Calamagrostis canadensis)* Shrubland**, page 226.

10b. Water sedge *(Carex aquatilis)* or beaked sedge *(Carex utriculata)* is the dominant or most abundant graminoid..... (11)

11a. Water sedge *(Carex aquatilis)* is dominant, if beaked sedge *(Carex utriculata)* is present it is confined to stream edge, and is generally not present throughout the undergrowth. Water sedge *(Carex aquatilis)* may not be a clear dominant, but has at least the highest percent cover of all herbaceous species present in the undergrowth, and is present throughout the stand. **Mountain willow/Water sedge *(Salix monticola/Carex aquatilis)* Shrubland**, page 228.

11b. Beaked sedge *(Carex utriculata)* is dominant. Beaked sedge may not be a clear dominant, but has at least the highest percent cover of all herbaceous species present in the undergrowth. **Mountain willow/Beaked sedge *(Salix monticola/Carex utriculata)* Shrubland**, page 230.

12a. Total cover of forb species is greater than the total graminoid cover, many species are present, no one forb species has dominance over others present, many non-native forb species may occur in the stand. **Mountain willow/Mesic forb *(Salix monticola*/Mesic forb) Shrubland**, page 234.

12b. Total cover of graminoid species is greater than the total forb cover, many species are present, no one graminoid species has dominance over others present, many non-native graminoids may occur in the stand. **Mountain willow/Mesic graminoid *(Salix monticola*/Mesic graminoid) Shrubland**, page 236.

13a. Total cover of forb species is greater than the total graminoid cover, many species are present, no one forb species has dominance over others present, many non-native forb species may occur in the stand. **Geyer willow/Mesic forb *(Salix geyeriana*/Mesic forb) Shrubland**, page 216.

13b. Herbaceous undergrowth is not dominated by forbs (total graminoid cover is greater than total forb cover)..... (14)

14a. Herbaceous undergrowth is dominated by sedges (*Carex* spp.); other graminoids do not exceed sedge in percent cover for the entire stand..... (15)

14b. Herbaceous undergrowth is dominated by bluejoint reedgrass *(Calamagrostis canadensis),* either as the only graminoid species present, or if not dominant then as the most abundant among several graminoid species, and most evenly distributed throughout the stand. **Geyer willow/Bluejoint reedgrass *(Salix geyeriana/Calamagrostis canadensis)* Shrubland**, page 210.

15a. Herbaceous undergrowth is dominated by beaked sedge *(Carex utriculata),* either as the only graminoid species present, or if not dominant, then as the most abundant among several graminoid species and most evenly distributed throughout the stand. **Geyer willow/Beaked sedge *(Salix geyeriana/Carex utriculata)* Shrubland**, page 214.

15b. Herbaceous undergrowth is dominated by water sedge *(Carex aquatilis),*

either as the only graminoid species present, or if not dominant, then as the most abundant among several graminoid species, and most evenly distributed throughout the stand. **Geyer willow/Water sedge *(Salix geyeriana/Carex aquatilis)* Shrubland**, page 212.

16a. Herbaceous undergrowth is dominated by bluejoint reedgrass *(Calamagrostis canadensis)*, often with several other graminoid species, but bluejoint reedgrass is the most abundant or most evenly distributed throughout the stand. **Geyer willow-Mountian willow/Bluejoint reedgrass *(Salix geyeriana-Salix monticola/Calamagrostis canadensis)* Shrubland**, page 218.

16b. Herbaceous undergrowth is dominated by mostly forb species, it is difficult to place one as the most abundant or dominant species, but total forb cover exceeds total graminoid cover. **Geyer willow-Mountain willow/Mesic forb *(Salix geyeriana-Salix monticola/*Mesic forb*)* Shrubland**, page 220.

17a. Stand is dominated by Drummond willow *(Salix drummondiana)*, or it is the matrix willow, found along steep, boulder-lined streams as well as low-gradient floodplains and streambanks..... (18)

17b. Stand is dominated by other willow species, or another willow species appears to be the matrix willow..... (21)

18a. Thinleaf alder *(Alnus incana* ssp. *tenuifolia)* is almost as abundant as Drummond willow *(Salix drummondiana)*. **Thinleaf alder-Drummond willow *(Alnus incana* ssp. *tenuifolia-Salix drummondiana)* Shrubland**, page 188.

18b. Thinleaf alder *(Alnus incana* ssp. *tenuifolia)* not present, or if so, then with much less cover than Drummond willow *(Salix drummondiana)*. Undergrowth is dominated by numerous forb and graminoid species..... (19)

19a. In general, the total forb cover exceeds the total graminoid cover, but it is difficult to assign dominance to any one species. **Drummond willow/Mesic forb *(Salix drummondiana*/Mesic forb) Shrubland**, page 202.

19b. Undergrowth is dominated by a single graminoid species..... (20)

20a. Undergrowth is dominated by water sedge *(Carex aquatilis),* or if not dominant then it has the highest cover of all graminoid species present, and is distributed most evenly throughout the stand. **Drummond willow/Water sedge *(Salix drummondiana*/*Carex aquatilis)* Shrubland**, page 200.

20b. Undergrowth is dominated by bluejoint reedgrass *(Calamagrostis canadensis),* or if not dominant then it has the highest cover of all graminoid species present, and is distributed most evenly throughout the stand. **Drummond willow/Bluejoint reedgrass *(Salix drummondiana*/*Calamagrostis canadensis)* Shrubland**, page 198.

21a. The matrix or dominant willow is Bebb willow *(Salix bebbiana)*. Any combination of herbaceous species in the undergrowth or other, associated willows keys to this type. **Bebb willow *(Salix bebbiana)* Shrubland**, page 190.

21b. The matrix or dominant willow is not Bebb willow *(Salix bebbiana)*..... (22)

22a. The matrix or dominant willow is shining willow *(Salix lucida* ssp. *caudata* or ssp. *lasiandra)* or Booth willow *(Salix boothii)* ..... (23)

22b. The matrix or dominant willow not one of the ones mentioned above. If

stand is dominated by planeleaf willow (*Salix planifolia*), a willow that may be tall or short, see Group E. Community not described.

23a. The matrix or dominant willow is shining willow (*Salix lucida* ssp. *caudata* or ssp. *lasiandra*). Any combination of herbaceous species in the undergrowth or other, associated willows keys to this type. **Shining willow *(Salix lucida* ssp. *caudata* or ssp. *lasiandra)* Shrubland**, page 224.

23b. The matrix or dominant willow is Booth willow *(Salix boothii)* ..... (24)

24a. Undergrowth dominated by beaked sedge *(Carex utriculata)*, or if not dominant then it has the highest cover of all graminoid species present, and is distributed most evenly throughout the stand. Stands occur on saturated soils, and are more or less restricted to the northern third of the state. **Booth willow/Beaked sedge *(Salix boothii/Carex utriculata)* Shrubland**, page 192.

24b. Undergrowth dominated by other herbaceous species..... (25)

25a. Undergrowth dominated by many herbaceous species, such that it is impossible to assign dominance to any one species. However, total forb cover exceeds that of graminoid cover. Stands are more or less restricted to the northern third of the state. **Booth willow/Mesic forb (*Salix boothii*/Mesic forb) Shrubland**, page 194.

25b. Undergrowth dominated by many herbaceous species, such that it is difficult to assign dominance to any one species. However, total graminoid cover exceeds that of forb cover. **Booth willow/Mesic graminoid (*Salix boothii*/Mesic graminoid) Shrubland**, page 196.

Group E
Short Willow Shrublands

The **matrix willow** is the species that makes up the bulk of the structure and biomass of the willow shrubland. While several other willow species may be present, the matrix willow has the highest individual cover, even though the combined cover of all other willows present may exceed that value. Willow shrublands are named for their dominant or matrix willow, but almost always have several other willow species present as well. Throughout this key, we use the terms dominant and matrix willow interchangeably.

1a. Stand dominated by planeleaf willow *(Salix planifolia)*. Other willows may be present, but with not more than half the cover of planeleaf willow..... (2)

1b. Stand dominated by other willows, leaves usually hairy and less shiny, twigs not shiny dark red to purple-black. Planeleaf willow *(Salix planifolia)* may be present, but with less than half the cover of the matrix willow.....(6)

2a. Herbaceous undergrowth is dominated by numerous forb species, their combined cover exceeds that of total graminoid species present .....(3)

2b. Herbaceous undergrowth is dominated by one or numerous graminoid species, their combined cover far exceeding that of the combined forb species.....(4)

3a. The ground is saturated to inundated for most of the growing season, marsh-marigold *(Caltha leptosepala)* is present and conspicuous throughout the stand. **Planeleaf willow/Marsh-marigold *(Salix planifolia/Caltha leptosepala)* Shrubland**, page 248.

3b. Herbaceous undergrowth is dominated by numerous forbs, marsh-marigold

is not present, or if so, then not throughout the stand, and not the dominant forb species, the ground is moist but not saturated to the surface for most of the growing season. **Planeleaf willow/ Mesic forb (*Salix planifolia*/Mesic forb) Shrubland**, page 254.

4a. Herbaceous undergrowth is dominated by graminoids with water sedge *(Carex aquatilis)* dominant or at least the most abundant single species. **Planeleaf willow/Water sedge *(Salix planifolia/Carex aquatilis)* Shrubland**, page 250.

4b. Water sedge *(Carex aquatilis)* is often present, but other graminoid species provide more cover.....(5)

5a. Herbaceous undergrowth is dominated by bluejoint reedgrass *(Calamagrostis canadensis)*, if not dominant then the most abundant single species in the stand, and the most evenly distributed. **Planeleaf willow/Bluejoint reedgrass *(Salix planifolia/Calamagrostis canadensis)* Shrubland**, page 246.

5b. Herbaceous undergrowth is dominated by beaked sedge *(Carex utriculata)*, if not dominant then the most abundant single species in the stand and the most evenly distributed. **Planeleaf willow/Beaked sedge *(Salix planifolia/Carex utriculata)* Shrubland**, page 252.

6a. Barrenground willow *(Salix brachycarpa)* is the dominant willow. Other willows may be present, but barrenground willow is the matrix willow (other willow species cover when combined may be greater) .....(7)

6b. Barrenground willow *(Salix brachycarpa)* is not the dominant willow..... (8)

7a. Undergrowth is dominated by water sedge *(Carex aquatilis)*, other graminoid and forb species may be present, but water sedge has the highest percent cover of all species present. **Barrenground willow/Water sedge *(Salix brachycarpa*/*Carex aquatilis)* Shrubland**, page 240.

7b. Undergrowth is dominated by a number of forb and graminoid species. Water sedge (*Carex aquatilis*) may be present but it is not dominant. In fact, it is difficult to assign dominance to any one species, and the total forb cover exceeds that of the total graminoid cover. **Barrenground willow/Mesic forb (*Salix brachycarpa*/Mesic forb) Shrubland**, page 242.

8a. Wolf willow *(Salix wolfii)* dominates the shrub layer. Other willows may be present, but Wolf willow is the matrix willow (cover of other willow species when combined may be greater than Wolf willow)..... (9)

8b. Hoary willow *(Salix candida)* dominates the shrub layer. Rare, on hummocks of nutrient-rich fens in South Park, may occur in other areas of the state. **Hoary willow/Seaside arrowgrass *(Salix candida/Triglochin maritimum)* Extreme Rich Fen**, page 244.

9a. Undergrowth dominated by forbs, no single forb species stands out as the most dominant, but total forb cover exceeds that of total graminoid cover. **Wolf willow/Mesic forb *(Salix wolfii*/Mesic forb*)* Shrubland**, page 262.

9b. The undergrowth is dominated by graminoid species. Forb species may be present, but are not as abundant as the graminoid species..... (10)

10a. Sedges (*Carex* spp). dominate the undergrowth, if not dominant, then are singly more abundant and evenly distributed throughout the stand than all other species ..... (11)

10b. Bluejoint reedgrass *(Calamagrostis canadensis)* dominates the undergrowth.

If not dominant, then is singly more abundant and evenly distributed throughout the stand than all other species. **Wolf willow/Bluejoint reedgrass *(Salix wolfii/Calamagrostis canadensis)* Shrubland**, page 256.

11a. Water sedge *(Carex aquatilis)* dominates the undergrowth. If not dominant, then is singly more abundant and evenly distributed throughout the stand than all other species. Soils are moist but not saturated throughout the growing season. **Wolf willow/Water sedge *(Salix wolfii/Carex aquatilis)* Shrubland**, page 258.

11b. Beaked sedge *(Carex utriculata)* dominates the undergrowth. If not dominant, then is singly more abundant and evenly distributed throughout the stand than all other species. Soils are saturated throughout the growing season. **Wolf willow/Beaked sedge *(Salix wolfii/Carex utriculata)* Shrubland**, page 260.

Group F
Non-willow Shrublands

1a. Stand dominated by the introduced species, saltcedar *(Tamarix ramosissima)*, large shrubs or small trees. **Saltcedar *(Tamarix ramosissima)* Shrubland**, page 312.

1b. Stand dominated by other, often shorter shrubs, all natives .....(2)

2a. Stands of dwarf shrubs in subalpine fens. Dominated by the subshrub alpine laurel *(Kalmia microphylla)* and/or the subshrub alpine spicywintergreen. **Alpine laurel-Alpine spicywintergreen *(Kalmia microphylla-Gaultheria humifusa)* Shrubland**, page 296.

2b. Stands of other habitats, dominated by taller shrubs .....(3)

3a. Stand dominated by shrubby cinquefoil *(Dasiphora (=Pentaphylloides) floribunda)* .....(4)

3b. Stand dominated by other non-willow shrubs (willows may be present) ...(5)

4a. An open low shrubland with thick cover of bunch grasses, mostly tufted hairgrass *(Deschampsia caespitosa)*. **Shrubby-cinquefoil/Tufted hairgrass *(Dasiphora (=Pentaphylloides) floribunda/Deschampsia caespitosa)* Shrubland**, page 290.

4b. Not as above. Mountain rush *(Juncus balticus* var. *montanus)* is common in the understory. **Shrubby cinquefoil/Mountain rush *(Dasiphora (=Pentaphylloides) floribunda/Juncus balticus* var. *montanus)* Shrubland**, page 292.

5a. Riparian shrublands dominated by the tall shrub, thinleaf alder *(Alnus incana* ssp. *tenuifolia)*. Other shrubs may be abundant, even co-dominant .....(6)

5b. Thinleaf alder *(Alnus incana* ssp. *tenuifolia)* is not present, or if so, then not dominant nor co-dominant ..... (11)

6a. One or several willows (*Salix* spp.) are co-dominant with thinleaf alder *(Alnus incana* ssp. *tenuifolia)* .....(7)

6b. Shrubs other than willows (*Salix* spp.) are co-dominant, present, or thinleaf alder is the only shrub present.....(8)

7a. Drummond willow *(Salix drummondiana)* is nearly as abundant as thinleaf

alder *(Alnus incana* ssp. *tenuifolia)*. **Thinleaf alder-Drummond willow *(Alnus incana* ssp. *tenuifolia-Salix drummondiana)* Shrubland**, page 188.

7b. Thinleaf alder *(Alnus incana* ssp. *tenuifolia)* is co-dominant with two or more willow species, such that the willow combined cover is equal or nearly equal to that of alder. Drummond willow *(Salix drummondiana)*, if present, is with several other willow species that have equal or greater cover. **Thinleaf alder-Mixed willow (Mountain willow, Shining willow, Strapleaf willow) *(Alnus incana* ssp. *tenuifolia-Salix (monticola, lucida, ligulifolia))* Shrubland**, page 276.

8a. Red-osier dogwood (*Cornus sericea*) is co-dominant with equal or near equal cover of thinleaf alder *(Alnus incana* ssp. *tenuifolia)*. **Thinleaf alder-Red-osier dogwood *(Alnus incana* ssp. *tenuifolia-Cornus sericea)* Shrubland**, page 268.

8b. Other shrubs, if present, have less than half the cover of thinleaf alder *(Alnus incana* ssp. *tenuifolia)* ..... (9)

9a. Herbaceous undergrowth is dominated by forb species (wildflowers), mostly natives, total graminoid cover (grasses and grass-like plants) is much less than total forb cover. **Thinleaf alder/Mesic forb *(Alnus incana* ssp. *tenuifolia*/Mesic forb) Shrubland**, page 272.

9b. Herbaceous undergrowth is dominated by many graminoid or horsetail *(Equisetum)* species, mostly native species or mostly introduced species, total forb cover is much less than total graminoid or horsetail cover ..... (10)

10a. Field horsetail (*Equisetum arvense*) is the dominant (or at least most abundant) herbaceous undergrowth component, exceeding that of any other graminoid or forb species present. **Thinleaf alder/Field horsetail *(Alnus incana* ssp. *tenuifolia*/*Equisetum arvense)* Shrubland**, page 270.

10b. No single graminoid species appears to be more dominant than any other graminoid present. Total graminoid cover exceeds that of total forb cover. **Thinleaf alder/Mesic graminoid *(Alnus incana* ssp. *tenuifolia*/Mesic graminoid*)* Shrubland**, page 274.

11a. Red-osier dogwood *(Cornus sericea)* or birch (*Betula* spp.) is the dominant shrub ..... (12)

11b. Other shrub species dominate the stand (no alder, birch, red-osier dogwood, or willows are present, or if so, clearly not dominant) ..... (16)

12a. Red-osier dogwood *(Cornus sericea)* is dominant, various currants or gooseberries (*Ribes* spp.) may be present, even co-dominant with the dogwood. Stands are often located at the base of cliffs, and generally form small narrow or isolated bands rather than broad shrublands along the stream banks and floodplains. **Red-osier dogwood *(Cornus sericea)* Shrubland**, page 286.

12b. Either river birch *(Betula occidentalis)* or bog birch *(B. nana (=glandulosa))* dominate or co-dominate the stand ..... (13)

13a. River birch *(Betula occidentalis)* is dominant or co-dominant with thinleaf alder *(Alnus incana* ssp. *tenuifolia)*. River birch *(Betula occidentalis)* is the diagnostic species, and it is weighted more than thinleaf alder *(Alnus incana* ssp. *tenuifolia)*, as it is somewhat less common. Even though evenly mixed stands of *Betula* and *Alnus incana* ssp. *tenuifolia* exist, they are named and tracked as *Betula* communities for conservation purposes ..... (15)

13b. Bog birch *(Betula nana (=glandulosa))* is the dominant or co-dominant shrub, often with willow species ..... (14)

14a. Generally restricted to subalpine elevations on saturated mineral and peat soils. Undergrowth components have not been differentiated into separate plant associations. **Bog birch/Mesic forb-Mesic graminoid (*Betula nana (=glandulosa)/*Mesic forb-Mesic graminoid*)* Shrubland**, page 278.

14b. Restricted to acidic fens where waters are enriched with iron. (**Engelmann spruce)/Bog birch/Water sedge/Sphagnum moss *((Picea engelmannii)/ Betula nana (=glandulosa)/Carex aquatilis/Sphagnum*) Iron Fen**, page 298.

15a. Herbaceous undergrowth is dominated by numerous forb species. It is difficult to assign one species dominance over the other forb species, but in any case total forb cover exceeds that of total graminoid cover. **River birch/Mesic forb *(Betula occidentalis/*Mesic forb*)* Shrubland**, page 280.

15b. Herbaceous undergrowth is dominated by numerous graminoid species. Many can be invasive, non-native grasses. It may be difficult to assign one species as the most abundant, but total graminoid cover exceeds total forb cover. **River birch/Mesic graminoid *(Betula occidentalis*/Mesic graminoid*)* Shrubland**, page 282.

16a. Shrublands of relatively dry riparian habitats. Located at the higher and outer fringe of the riparian zone, or the only riparian community present in a woody draw. In very hot and dry climates, these shrublands occur along ephemeral or intermittent streams. Elsewhere, they are more or less restricted to the lower elevations, on narrow, steep, or rocky perennial streams. Some of these types may not technically be wetlands, but they are frequently located in riparian zones along ephemeral or intermittent streams. They are included here to provide identification for these types that are geographically riparian, even though they may not fit the technical definition of wetlands. Dominated by hackberry *(Celtis),* hawthorn *(Crataegus),* privet *(Forestiera),* singleleaf ash *(Fraxinus),* chokecherry or plum *(Prunus)*, sumac *(Rhus),* buffaloberry *(Shepherdia),* or snowberry *(Symphoricarpos)* ..... (17)

16b. Shrublands of relatively moist riparian/wetland habitats. Located in deep, well-shaded, cool canyons in the mountains, within the annually flooded area of the stream channel, or on seasonally wet flats of valley bottoms. Dominated by greasewood *(Sarcobatus vermiculatus)* or beaked hazelnut *(Corylus cornuta)* ..... (24)

17a. Woodland (or an individual large tree) dominated by netleaf hackberry (*Celtis laevigata* var. *reticulata*), known only from the extreme western edge of the state at Hovenweep National Monument, and in the extreme southeastern corner, on Comanche National Grassland. **Netleaf hackberry *(Celtis laevigata* var. *reticulata)* Woodland**, page 284.

17b. Netleaf hackberry (*Celtis laevigata* var. *reticulata*) not present..... (18)

18a. River hawthorn *(Crataegus rivularis)* present, forming small pockets along foothill draws and broader river floodplains. **River hawthorn *(Crataegus rivularis)* Shrubland**, page 288.

18b. River hawthorn *(Crataegus rivularis)* not present, or if so, it is part of a cottonwood community, and not forming independent thickets..... (19)

19a. Chokecherry or plum (*Prunus* spp.), skunkbush sumac *(Rhus trilobata)* or

snowberry *(Symphoricarpos* spp.*)* present, forming thickets in woody draws in the foothills, or, as small pockets on the floodplains of larger rivers... (20)

19b. Silver buffaloberry *(Shepherdia argentea)*, wild-privet *(Forestiera pubescences)* or singleleaf ash *(Fraxinus anomala)* present, forming dense thickets or very open, sparsely vegetated areas, either the only species present or clearly dominating the shrubland, distinguishable from other communities along the reach ..... (22)

20a. Chokecherry *(Prunus virginiana)* forms small, near-pure pockets (with few other shrubby species present, maybe a few currants and roses) in narrow woody draws in foothill streams, and on the floodplains of larger rivers. American plum *(Prunus americana)* often, but not always, present. **Chokecherry-(American plum)** ***(Prunus virginiana (Prunus americana))*** **Shrubland**, page 298.

20b. Skunkbush sumac *(Rhus trilobata)* or western snowberry *(Symphoricarpos occidentalis)* is the dominant shrub ..... (21)

21a. Skunkbush sumac *(Rhus trilobata)* is present, forming thickets in woody draws in the foothills of the Eastern and Western Slopes, more commonly occupying riparian habitats on the Western Slope, either as isolated pockets in narrow tributaries or small patches within a mosaic of vegetation on the floodplains of larger rivers. A fairly common shrubland. On the Front Range, it forms woody draws in narrow, foothill streams, but it can also form shrublands on steep upland hillsides, far away from the riparian influence (where sandbar willow is never present). **Skunkbush sumac-(Sandbar willow)** ***(Rhus trilobata-(Salix exigua))*** **Shrubland**, page 302.

21b. Western snowberry *(Symphoricarpos occidentalis)* is present, forming thickets. **Western snowberry** ***(Symphoricarpos occidentalis)*** **Shrubland,** page 310.

22a. Silver buffaloberry *(Shepherdia argentea)* present and not associated with or immediately beneath a cottonwood canopy. It forms narrow bands along the stream banks and overflow channels of larger river floodplains on the Western Slope. **Silver buffaloberry** ***(Shepherdia argentea)*** **Shrubland**, page 306.

22b. Stands of extreme south and western part of the state, dominated by wild-privet *(Forestiera pubescens)* or singleleaf ash *(Fraxinus anomala)*. Either may be the only woody species present..... (23)

23a. Wild-privet *(Forestiera pubescens)* forms thickets on the highest part of the stream banks. Sandbar willow *(Salix exigua)* can occur immediately adjacent to it on the lower slopes of the stream bank. Known only from the Dolores River. **Wild-privet** ***(Forestiera pubescens)*** **Shrubland**, page 294.

23b. No wild-privet *(Forestiera pubescens)* present, or if so, not forming thickets. Singleleaf ash scattered sparsely up and down ephemeral washes and arroyos of the four-corners area. **Singleleaf ash-Gambel oak** ***(Fraxinus anomala- Quercus gambelii)*** **Shrubland**, undescribed association needing further verification.

24a. Black greasewood *(Sarcobatus vermiculatus)* is the dominant shrub in the stand ..... (25)

24b. Beaked hazelnut *(Corylus cornuta)* is the dominant shrub in the stand... (26)

25a. Alkaline, seasonally wet soils with an understory of inland saltgrass

(Distichlis spicata). **Black greasewood/Inland saltgrass *(Sarcobatus vermiculatus/Distichlis spicata)* Shrubland**, page 306.

25b. Alkaline, seasonally wet soils, dominated by black greasewood *(Sarcobatus vermiculatus)* with very sparse understory. **Black greasewood/Barren ground *(Sarcobatus vermiculatus/*Barren ground*)* Shrubland**, page 304.

26a. Narrow, heavily shaded (by Douglas-fir, blue spruce or aspen) canyons on the northern Front Range, understory dominated by beaked hazelnut *(Corylus cornuta)*, an eastern-relict species. **Quaking aspen/Beaked hazelnut *(Populus tremuloides/Corylus cornuta)* Shrubland**, page 178.

26b. Dominated by other shrub species. Unclassified associations.

Group G
Herbaceous Vegetation

1a. Scouringrush horsetail *(Equisetum hyemale)* is the most abundant herbaceous plant; there may be a few trees or shrubs, usually with < 5% cover. **Scouringrush horsetail *(Equisetum hyemale)* Herbaceous Vegetation**, page 384.

1b. Forbs or graminoids provide the dominant herbaceous vegetation ..... (2)

2a. Forbs (i.e., wildflowers or broadleaved herbaceous plants) dominate the wetland vegetation..... (3)

2b. Graminoids (i.e., grasses, sedges, spikerushes, rushes, bulrushes) dominate the wetland vegetation..... (20)

3a. Wetlands of rock walls or canyon alcoves ..... (4)

3b. Wetlands of other habitats..... (5)

4a. On near vertical cliffs, often dripping. Purpus' sullivantia (*Sullivantia purpusii*) is the dominant plant. Known from the Gunnison and White River basins. **Purpus' sullivantia *(Sullivantia hapemanii* var*. purpusii)* Hanging Garden**, undescribed association.

4b. On rockwalls or in canyon alcoves in the western counties. Dominated by Mancos columbine *(Aquilegia micrantha)*. Eastwood monkeyflower *(Mimulus eastwoodiae)* often present. **Mancos columbine-(Eastwood monkeyflower) *(Aquilegia micrantha-(Mimulus eastwoodiae))* Hanging Garden**, page 324.

5a. Riparian wetlands on floodplains or stream edges at any elevation .....(6)

5b. Wetlands of slopes, flats, or depressions (mountain meadows, intermountain basins, the eastern plains, or the western valleys) with ephemeral or permanent standing water..... (11)

6a. Usually above 8,000 feet..... (7)

6b. Usually below 6,500 feet..... (10)

7a. Brandegee fumewort *(Corydalis caseana* ssp*. brandegei)* present with at least 50% cover. Other forbs present and may be abundant, but with less cover. **Brandegee fumewort-Tall fringed bluebells *(Corydalis caseana* ssp*. brandegei-Mertensia ciliata)* Herbaceous Vegetation**, page 366.

7b. Riparian wetlands, usually near stream edges. Brandegee fumewort *(Corydalis caseana* ssp*. brandegei)* not present or, if so, then other species

are more abundant ..... (8)

8a. Dominated by heartleaf bittercress *(Cardamine cordifolia),* tall fringed bluebells *(Mertensia ciliata),* or arrowleaf ragwort *(Senecio triangularis).* One, two, or all three of the species may be present. Any of the three may be most abundant. If trees form a canopy above the forbs, the stand may belong to the *Abies lasiocarpa-Picea engelmannii/Mertensia ciliata* (subalpine fir-Engelmann spruce/tall fringed bluebells) association. **Heartleaf bittercress- Tall fringed bluebells-Arrowleaf ragwort *(Cardamine cordifolia-Mertensia ciliata-Senecio triangularis)* Herbaceous Vegetation**, page 332.

8b. The species from 8a may be present, but other species provide more cover ..... (9)

9a. Stands may also occur between 6,500 and 8,000 ft. Either fowl mannagrass *(Glyceria striata)* or seep monkeyflower *(Mimulus guttatus)* are present with at least 10% cover. Either may be almost a monoculture or may occur with other species. **Fowl mannagrass-Seep monkeyflower-Milkflower willowherb *(Glyceria striata-Mimulus guttatus-Epilobium lactiflorum)* Herbaceous Vegetation**, page 390.

9b. Brook saxifrage *(Saxifraga odontaloma)* is present, usually as the most abundant species. **Brook saxifrage *(Saxifraga odontoloma)* Herbaceous Vegetation**, page 414.

10a. On floodplains, usually below 6,500 feet in elevation. American licorice *(Glycyrrhiza lepidota)* is abundant. **American licorice-Scouringrush horsetail *(Glycyrrhiza lepidota-Equisetum hyemale)* Herbaceous Vegetation**, page 392.

10b. Dominated by other forb species. Unclassified association.

11a. Densely vegetated wet meadows in the mountains, with saturated soils or standing water. May occur along a stream but are not usually confined to the stream edge ..... (12)

11b. Wetlands of other habitats ..... (13)

12a. Marsh-marigold *(Caltha leptosepala)* is the most abundant plant. **Marsh marigold *(Caltha leptosepala)* Herbaceous Vegetation**, page 330.

12b. Wetlands of drier sites, marsh-marigold *(Caltha leptosepala)* is not present, hairlike sedge *(Carex capillaris)* and the small forb serpent-grass *(Polygonum viviparum)* are present. Either may be more abundant. There is typically a high diversity of species in the wetland. **Hairlike sedge-Serpent-grass *(Carex capillaris-Polygonum viviparum)* Herbaceous Vegetation**, page 338.

13a. Wetlands of alkaline flats or mountain fens, usually above 8,000 feet. Dominated by arrowgrass (*Triglochin)* species. **Seaside arrowgrass-Marsh arrowgrass *(Triglochin maritimum-Triglochin palustre)* Herbaceous Vegetation**, page 432.

13b. Wetlands of alkaline flats, ponds, playas, or drawdown zones, often below 8,000 feet ..... (14)

14a. Wetlands in or near permanent standing water ..... (15)

14b. Stands of reservoir drawdown zones, playas, or other sites that may not have permanent standing water ..... (16)

15a. Beggartick *(Bidens)*, a tall sunflower-like plant, is the most abundant plant. Nodding beggartick (*Bidens cernua*) is common on the East Slope, devil's beggartick *(Bidens frondosa)* on the West Slope. **Beggartick *(Bidens cernua-Bidens frondosa)* Herbaceous Vegetation**, page 326.

15b. Curlytop knotweed *(Polygonum lapathifolia)* or oval-leaf knotweed *(Polygonum arenastrum)* dominate the stand. **Knotweed spp. (*Polygonum* spp.)-Mesic Graminoid Herbaceous Vegetation**, page 410.

16a. Sea milkwort *(Glaux maritima)* present although other species, especially graminoids may be more abundant. **Sea milkwort *(Glaux maritima)* Herbaceous Vegetation**, page 386.

16b. Sea milkwort *(Glaux maritima)* not present, or if so, then not abundant. (17)

17a. Water speedwell *(Veronica anagallis-aquatica)* is present. Toad rush *(Juncus bufonius)* may also be present and may be more abundant than the speedwell. Described only from the Front Range, especially the Cherry Creek drainage, but is more widespread. **Water speedwell-(Toad rush) *(Veronica anagallis-aquatica-(Juncus bufonius))* Herbaceous Vegetation**, page 436.

17b. Water speedwell *(Veronica anagallis-aquatica)* and toad rush *(Juncus bufonius)* not present, or if so, then not abundant ..... (18)

18a. Dominated by Pursh seepweed *(Suaeda calceoliforms)*. **Pursh seepweed *(Suaeda calceoliformis)* Herbaceous Vegetation**, page 430.

18b. Pursh seepweed *(Suaeda calceoliforms)* not present, or if so, then not abundant..... (19)

19a. Rough cocklebur (*Xanthium strumarium*) present and usually the most abundant species. **Rough cocklebur *(Xanthium strumarium)* Herbaceous Vegetation**, page 438.

19b. Common mares-tail *(Hippurus vulgaris)* present and usually the most abundant species. **Common mares-tail *(Hippurus vulgaris)* Herbaceous Vegetation**, undescribed association, needing further verification.

20a. Wetland vegetation is predominantly sedges (*Carex* spp.) or bog sedges (*Kobresia* spp.), in small patches or large meadows ..... (21)

20b. Graminoids other than sedges (*Carex* spp.) and bog sedges (*Kobresia* spp.) are dominant..... (40)

21a. Known from nutrient rich fens in South Park. Bog sedges (*Kobresia* spp.) are the most abundant species, growing on hummocks. Bog sedges also grow in the alpine tundra, but the wetland communities described here occur below 10,000 ft in extreme rich fens. ..... (22)

21b. Found throughout the state. Herbaceous growth dominated by sedges (*Carex* spp.), in small patches or large meadows ..... (23)

22a. Simple bog sedge (*Kobresia simpliciuscula*) is the dominant plant. Rolland bulrush *(Trichophorum pumilum)* occurs almost exclusively in this association, but it is not present in every stand. **Simple bog sedge-(Rolland bulrush) (*Kobresia simpliciuscula-(Trichophorum pumilum))* Herbaceous Vegetation**, page 400.

22b. Bellardi bog sedge *(Kobresia myosuroides)* is the dominant plant. Alpine meadowrue *(Thalictrum alpinum)* is always present, although sometimes with low cover. **Bellardi bog sedge-Alpine meadowrue *(Kobresia***

myosuroides-Thalictrum alpinum) **Herbaceous Vegetation**, page 398.

23a. Sedge communities of seasonally wet to saturated mineral and organic soils, common wetlands of the mountains and plains: water sedge *(Carex aquatilis),* woolly sedge *(C. pellita),* smallwing sedge *(C. microptera),* Nebraska sedge *(C. nebrascensis),* clustered field sedge *(C. praegracilis)*, mountain sedge *(C. scopulorum),* beaked sedge *(C. utriculata)*, blackish sedge *(C. nigricans)*, Emory sedge *(C. emoryi)*, or sheep sedge *(C. illota)* .....(24)

23b. Sedges of rich fens, quaking fens, isolated wetlands of the mountains and high valleys, not common: rock sedge *(Carex saxatilis),* analogue sedge *(C. simulata),* native sedge *(C. vernacula),* blister sedge *(C. vesicaria)*, or hairlike sedge *(C. capillaris)* .....(35)

24a. Stands described from riparian areas in western valleys and the Front Range, but probably occurring in other parts of the state. Emory sedge *(Carex emoryi)* dominates the vegetation, usually covering at least 2/3 of the stand. Emory sedge drops its perigynia by mid-June, so may be difficult to identify later in the season. **Emory sedge *(Carex emoryi)* Herbaceous Vegetation**, page 340.

24b. Emory sedge *(Carex emoryi)* not present or not dominant .....(25)

25a. In shallow swales and first order tributaries on the eastern plains. Also known from North Park and probably occurs in others parts of the state. Dominated by clustered field sedge *(Carex praegracilis)*. **Clustered field sedge *(Carex praegracilis)* Herbaceous Vegetation**, page 352.

25b. Clustered field sedge *(Carex praegracilis)* not present or not dominant . (26)

26a. Stands dominated by Nebraska sedge *(Carex nebrascensis)*. **Nebraska sedge *(Carex nebrascensis)* Herbaceous Vegetation**, page 346.

26b. Stands not dominated by Nebraska sedge *(Carex nebrascensis).* Dominated by tall sedges, in fens, wet meadows, or along ditches.....(27)

27a. Woolly sedge *(Carex pellita (= lanuginosa))* is the only sedge species present, and often the only graminoid in the stand, forming thick bands along regulated rivers and streams, or with other species in meadows. **Woolly sedge *(Carex pellita (=lanuginosa))* Herbaceous Vegetation**, page 350.

27b. Woolly sedge *(Carex pellita(=lanuginosa))* not present, or if so, then not dominant.....(28)

28a. Water sedge *(Carex aquatilis)* and/or beaked sedge *(Carex utriculata)* dominate the stand (together or singly). These species also occur in many other associations. To key here they must be the dominant or codominant species ..... (29)

28b. Other species of sedge *(Carex)* dominate the stand..... (31)

29a. The two species occur in near equal abundance, and if not equal then one is not less than two-thirds cover of the other. **Water sedge-Beaked sedge *(Carex aquatilis-Carex utriculata)* Herbaceous Vegetation**, page 336.

29b. The two species may appear together, but one is more abundant than the other, by at least half as much .....(30)

30a. Water sedge *(Carex aquatilis)* individually has the highest cover, if beaked sedge *(Carex utriculata)* is present, it contributes not more than one third of

the total cover. **Water sedge *(Carex aquatilis)* Herbaceous Vegetation**, page 334.

30b. Beaked sedge *(Carex utriculata)* individually has the highest cover, if water sedge *(Carex aquatilis)* present, it contributes not more than one third of the total cover. **Beaked sedge *(Carex utriculata)* Herbaceous Vegetation**, page 360.

31a. Found in the subalpine in small meadows in wide low-gradient valleys, and near beaver dams or marshes. Smallwing sedge *(Carex microptera)* is the dominant species. **Smallwing sedge *(Carex microptera)* Herbaceous Vegetation**, page 344.

31b. Smallwing sedge *(Carex microptera)* is not the dominant species.....(32)

32a. Forbs are a significant component of the community, usually contributing at least 15% of the vegetative cover. Stands of marshy areas in the upper subalpine and alpine. Mountain sedge *(Carex scopulorum)* present and the most abundant graminoid in the stand. Water sedge *(Carex aquatilis)* may also be present. Marsh marigold *(Caltha leptosepala)* is nearly always present, but is not an indicator since it also occurs in other associations. **Mountain sedge-Marsh-marigold *(Carex scopulorum-Caltha leptosepala)* Herbaceous Vegetation**, page 356.

32b. Stands are clearly dominated by sedges (*Carex* spp.), with the dominant sedge usually contributing at least 25% of the vegetative cover ..... (34)

33a. The vegetation is dominated by near monocultures of black alpine sedge *(Carex nigricans)* which often forms dense mats. Neither forbs nor shrubs provide as much as 25% of the cover. **Black alpine sedge-Drummond rush *(Carex nigricans-Juncus drummondii)* Herbaceous Vegetation**, page 348.

33b. Black alpine sedge *(Carex nigricans)* is not the dominant species.....(34)

34a. Stands of wet meadows or fens. Small-head sedge *(Carex illota)* is the dominant plant. **Small-head sedge *(Carex illota)* Herbaceous Vegetation**, page 342.

34b. Small-head sedge *(Carex illota)* is not the dominant species .....(35)

35a. Forbs are a significant component of the community although careful observation may be needed to detect the small forb, serpent-grass *(Polygonum viviparum)*. Hairlike sedge (*Carex capillaris*) or serpent-grass *(Polygonum viviparum)* dominate the stand. Small stands occur in alpine areas on marsh margins, around frost heaves, and in hummocky and drainage areas on high elevation saddles. Close to half the ground surface is often bare (or lichen-covered) soil or rock. **Hairlike sedge-Serpent-grass *(Carex capillaris-Polygonum viviparum)* Herbaceous Vegetation**, page 338.

35b. Stands clearly dominated by sedges .....(36)

36a. Stands of alpine snowmelt basins above 12,000 ft. Native sedge (*Carex vernacula*), the dominant sedge, has a dense terminal ball-like head, the individual spikes are not visible without dissection. **Native sedge *(Carex vernacula)* Herbaceous Vegetation**, page 362.

36b. Stands of other habitats or elevations, or dominated by a different species of sedge (*Carex* spp.). The dominant sedge may have erect terminal spikes, but they are not arranged in a very dense ball-like cluster..... (37)

37a. Blister sedge *(Carex vesicaria)* present and the dominant graminoid. Often forms a near monoculture in areas with permanent standing water. Known from the Colorado West Slope and the San Luis Valley. **Blister sedge *(Carex vesicaria)* Herbaceous Vegetation**, page 364.

37b. Blister sedge *(Carex vesicaria)* not present or not the dominant species. (38)

38a. Rock sedge *(Carex saxatilis)* present and the dominant graminoid. Known from the upper Colorado River Basin on the West Slope and from the Routt National Forest. Soils often saturated during the growing season, but may dry during the latter part of the season. **Rock sedge *(Carex saxatilis)* Herbaceous Vegetation**, page 354.

38b. Rock sedge *(Carex saxatilis)* not present or not the dominant species .... (39)

39a. Analogue sedge *(Carex simulata)* is always present (10-30%) and is an indicator for this association. Other species may be more abundant and conspicuous than analogue sedge *(Carex simulata)*. Occurs on saturated, hummocky organic soils. **Analogue sedge *(Carex simulata)* Herbaceous Vegetation**, page 358.

39b. Not as above. Unclassified association.

40a. Wetlands in depressions (depressions may be in the riparian zone) with standing water for much of the year with cattails (*Typha* spp.), bulrushes (*Schoenoplectus* or *Scirpus* spp.), spikerushes (*Eleocharis* spp.), or mannagrass (*Glyceria* spp.) dominant in or near standing water ..... (41)

40b. Wetlands with saturated to well drained soils, if standing water is present, this recedes within a few weeks. Stand dominated by grasses (Poaceae) or rushes (*Juncus* spp.), in riparian areas, slope wetlands, or isolated wetlands such as playas ..... (52)

41a. Stands dominated by spikerushes (*Eleocharis* spp.) in wet places from low to high elevations..... (42)

41b. Stands not dominated by spikerushes (*Eleocharis* spp.). Large or small wetlands where water collects (swales of floodplains of larger rivers, in or below ponds and ditches) ..... (46)

42a. Stands along the margins of ponds and slow moving reaches (pools) of streams, on peat soils in the subalpine, or drying ponds at lower elevations. Common spikerush *(Eleocharis palustris)* dominant, some scattered bulrushes may occur, but with not much more than 10% cover. **Common spikerush *(Eleocharis palustris)* Herbaceous Vegetation**, page 376.

42b. Other species of spikerush are more abundant than common spikerush.. (43)

43a. Few-flower spikerush *(Eleocharis quinqueflora)* dominates the stand.... (44)

43b. Other species of spikerush are more abundant than few-flower spikerush *(Eleocharis quinqueflora)*..... (45)

44a. Stands of peat bogs, above 10,000 feet, dominated by few-flower spikerush *(Eleocharis quinqueflora)*. Water sedge *(Carex aquatilis)* is often present. Total cover is typically low (<30%) for this type. **Few-flower spikerush *(Eleocharis quinqueflora)* Herbaceous Vegetation**, page 380.

44b. Stands found in water tracks of extreme rich fens in South Park. Seaside arrowgrass *(Triglochin maritima)* or marsh arrowgrass *(Triglochin palustre)* often present. Vegetation may be sparse. Often occurs on a floating mat of peat. Variation of **Few-flower spikerush *(Eleocharis quinqueflora)***

Herbaceous Vegetation, page 380.

45a. Stands of lowlands to subalpine elevations dominated by dense stands of very small (< 10cm tall), slender spikerushes. Often on margins of ephemeral ponds. One or both of two species of spikerush (*Eleocharis acicularis* or *E. parvula*) may be present. **Needle spikerush *(Eleocharis acicularis)* Herbaceous Vegetation**, page 374 and **Dwarf spikerush *(Eleocharis parvula)* Herbaceous Vegetation**, page 378.

45b. Stands below 6,000 ft dominated by the taller (15-40 in, 4-10 dm), stouter beaked spikerush *(Eleocharis rostellata)*. May have stolons. **Beaked spikerush *(Eleocharis rostellata)* Herbaceous Vegetation**, page 382.

46a. Tall near monotypic stands of one or more cattail species *(Typha angustifolia, T. latifolia,* and or *T. domingensis),* or mixed stands of emergent wetland species with cattail the dominant plant. **Cattail *(Typha angustifolia-Typha latifolia-(Typha domingensis))* Herbaceous Vegetation**, page 434.

46b. Little to no cattail *(Typha)* present, grasses, bulrushes (*Schoenoplectus* spp. = *Scirpus* or *Bolboschoenus*), or bur-reed *(Sparganium)* dominant, either singly or in combination with other species ..... (47)

47a. Stand consists mostly of broadfruit bur-reed *(Sparganium eurycarpum)*. **Broadfruit bur-reed *(Sparganium eurycarpum)* Herbaceous Vegetation**, undescribed association, needing further verification.

47b. Stand consists mostly of bulrushes (*Schoenoplectus* and *Scirpus* spp.)... (48)

48a. Stand consists mostly of tall (>3 feet), round-stemmed bulrushes (*Schoenoplectus acutus* and *Schoenoplectus tabernaemontani, = Scirpus acutus* and *Scirpus tabernaemontani,* or *Schoenoplectus lacustris* ssp. *acutus* and *S.* ssp. *creber*, respectively), either in monotypic or mixed stands. **Hardstem bulrush-Softstem bulrush *(Schoenoplectus acutus* var. *acutus-Schoenoplectus tabernaemontani)* Herbaceous Vegetation**, page 416.

48b. Stand dominated by shorter stature bulrushes, or if greater than 3 feet, then with triangular stems ..... (49)

49a. Stand dominated by Nevada bulrush *(Scirpus nevadensis)*. **Nevada bulrush (*Scirpus nevadensis (=Amphiscirpus nevadensis))* Herbaceous Vegetation**, page 422.

49b. Stand dominated by other bulrush species, with sharply-edged triangular stems ..... (50)

50a. Cosmopolitan bulrush *(Schoenoplectus maritimus =Scirpus maritimus = Bolboschoenus maritimus)* is the dominant wetland species. **Cosmopolitan bulrush *(Schoenoplectus maritimus (=Bolboschoenus maritimus))* Herbaceous Vegetation**, page 418.

50b. Stand dominated by other bulrush species..... (51)

51a. Stand dominated by common threesquare (*Schoenoplectus pungens = Scirpus pungens)*. **Common threesquare (*Schoenoplectus pungens)* Herbaceous Vegetation**, page 420.

51b. Stand dominated by cloaked bulrush *(Scirpus pallidus)*. **Cloaked bulrush *(Scirpus pallidus)* Herbaceous Vegetation**, undescribed association, needing further verification.

52a. Tall grass species, averaging over 3 feet tall (2-8 ft) dominate wetland. Rice cutgrass *(Leersia oryzoides)* and fowl mannagrass *(Glyceria striata)*, although often shorter than 3 feet, may be taller and key here ..... (53)

52b. Grasses or other dominant graminoids not over 3 feet tall ..... (59)

53a. Stands of moist floodplain benches on the eastern plains or on mud flats of larger rivers, or in small swales where there are pockets of clay soils..... (54)

53b. Stands in or near standing or running water ..... (55)

54a. Stands of moist floodplain benches, dominated by big bluestem *(Andropogon gerardii)*, yellow indiangrass *(Sorghastrum nutans)*, and prairie cordgrass *(Spartina pectinata)*. Restricted to Eastern Plains. **Big bluestem/Yellow indiangrass-(Prairie cordgrass) *(Andropogon gerardii-Sorghastrum nutans-(Spartina pectinata))* Herbaceous Vegetation**, page 322.

54b. Stand dominated by prairie cordgrass *(Spartina pectinata)* in nearly monotypic stands, often large areas on mud flats of larger rivers, or in small swales where there are pockets of clay. Soils not necessarily alkaline. **Prairie cordgrass *(Spartina pectinata)* Herbaceous Vegetation**, page 426.

55a. Common reed *(Phragmites australis)* is the dominant grass, often reaching over 6 feet in height, occurs in small pockets on large floodplains (Colorado, Arkansas). Few other species are present in the stand. **Common reed *(Phragmites australis)* Western North America Temperate Semi-natural Herbaceous Vegetation**, page 408.

55b. Stand dominated by other grass species..... (56)

56a. Reed canarygrass (*Phalaris arundinacea*) is the most abundant graminoid in the stand. **Reed canarygrass *(Phalaris arundinacea)* Herbaceous Vegetation**, page 406.

56b. Mannagrass *(Glyceria* spp.*)* or rice cutgrass *(Leersia oryzoides)* are the dominant plants ..... (57)

57a. Rice cutgrass *(Leersia oryzoides)* is the dominant grass. **Rice cutgrass *(Leersia oryzoides)* Herbaceous Vegetation**, page 402.

57b. Mannagrass (*Glyceria striata* or *G. grandis*) is the most abundant graminoid in the stand ..... (58)

58a. American mannagrass *(Glyceria grandis)* is present and is usually the most abundant plant in the stand, sometimes with equal cover with another species. Usually below 8,000 feet, occasionally higher. **American mannagrass *(Glyceria grandis)* Herbaceous Vegetation**, page 388.

58b. American mannagrass *(Glyceria grandis)* is not present. Fowl mannagrass *(Glyceria striata)* or seep monkeyflower *(Mimulus guttatus)* present and usually the most abundant species in the stand. Usually above 8,000 feet. **Fowl mannagrass-Seep monkeyflower *(Glyceria striata-Mimulus guttatus)* Herbaceous Vegetation**, page 390.

59a. Stands occupying alkaline flats. Nuttall alkaligrass *(Puccinellia nuttalliana, =airoides)* always present, although forb species may sometimes provide more cover. **Nuttall alkaligrass *(Puccinellia nuttalliana)* Herbaceous Vegetation**, page 412.

59b. Stands may occur in a variety of habitats, including mud flats and sand bars within the active channel of the river; riparian habitat on more stable

surfaces, such as terraces, floodplains and stream banks; or depressions in these habitats or lake/pond margins or slopes ..... (60)

60a. Stands on mud flats or sand bars within the active channel of the river .. (61)

60b. Stands not in the active channel of a river or stream ..... (62)

61a. Stand dominated by alkali cordgrass *(Spartina gracilis)*, sandy and alkaline soils in stream channels and mud flats. **Alkali cordgrass *(Spartina gracilis)* Herbaceous Vegetation**, page 424.

61b. Stand dominated by other species. Unclassified or described in another section of the key.

62a. Stands of wet and disturbed sites, in gardens, farmyards, watering holes frequented by livestock, banks of irrigation ditches or moist waste places. Barnyard grass *(Echinochloa crus-galli)* is the dominant plant. **Barnyard grass *(Echinochloa crus-galli)* Herbaceous Vegetation**, page 372.

62b. Stands in depressions, on slopes, along streams, or on slightly raised terraces, sometimes forming larger meadows..... (63)

63a. Stand dominated by mountain rush *(Juncus balticus* var. *montanus),* several species of grass are usually present as well. A common type known throughout the state at many elevations. A dark, sinuous band following the stream channel through a grassy meadow or around a pond is a good diagnostic clue for this type. **Mountain rush *(Juncus balticus* var. *montanus)* Herbaceous Vegetation**, page 396.

63b. Stand dominated by grasses, not rushes (*Juncus* spp.). ..... (64)

64a. Stands of grassland playas, small depressions that are only occasionally flooded. Potential playa association types, not described. See page 11 for types needing further investigation.

64b. Stands of other habitats ..... (65)

65a. Stands of mud flats, often around beaver ponds or other drying ponds, dominated by shortawn foxtail *(Alopecurus aequalis)*. May also occur in narrow strips or larger meadows along streams. **Shortawn foxtail *(Alopecurus aequalis)* Herbaceous Vegetation**, page 320.

65b. Bluejoint reedgrass *(Calamagrostis canadensis)*, tufted hairgrass *(Deschampsia caespitosa),* inland saltgrass *(Distichlis spicata)*, alkali muhly *(Muhlenbergia asperifolia)*, redtop *(Agrostis gigantea)* pullup muhly *(Muhlenbergia filiformis)*, or foxtail barley *(Hordeum jubatum)* are dominant. These may form large meadows on the plains or in the middle elevations of the mountains. ..... (66)

66a. Stands dominated by bluejoint reedgrass *(Calamagrostis canadensis)* or tufted hairgrass *(Deschampsia caespitosa)*. May occur from the foothills zone into the subalpine *(Calamagrostis canadensis)* or the lower alpine *(Deschampsia caespitosa)* ..... (67)

66b. Stands dominated by other grasses, usually below 9,500 ft..... (68)

67a. Dense stand of grasses with bluejoint reedgrass (*Calamagrostis canadensis*) providing most of the cover. **Bluejoint reedgrass *(Calamagrostis canadensis)* Herbaceous Vegetation**, page 328.

67b. Tufted hairgrass *(Deschampsia caespitosa)* always present, in bunches. Forbs and other graminoids common and often abundant as well. On moist floodplains or drier slopes, subalpine and alpine elevations. **Tufted**

hairgrass *(Deschampsia caespitosa)* Herbaceous Vegetation, page 368.

68a. Stands restricted to sites with low salinity and alkalilnity, dominated by redtop *(Agrostis gigantea)*, often on streambanks, sometimes forming larger meadows. **Redtop *(Agrostis gigantea)* Herbaceous Vegetation**, page 318.

68b. Stands tolerant of saline and alkaline conditions, dominated by alkali muhly *(Muhlenbergia asperifolia)*, dropseed *(Sporobolus* spp.*),* inland saltgrass *(Distichlis spicata)*, or foxtail barley *(Hordeum jubatum)*..... (69)

69a. Stands usually below 6,000 ft, dominated by alkali muhly *(Muhlenbergia asperifolia)*, known only from the lower Purgatory, Apishapa, and Arkansas Rivers. **Alkali muhly *(Muhlenbergia asperifolia)* Herbaceous Vegetation**, page 404.

69b. Stand dominated by other grasses, may be higher or lower than 6,000 ft (70)

70a. Stand dominated by inland saltgrass *(Distichlis spicata)*, forming low, near monotypic stands on alkaline flats in high montane valleys (e.g., San Luis Valley) or on the eastern plains. In spring, stands may be in standing water. **Inland saltgrass *(Distichlis spicata)* Herbaceous Vegetation**, page 370.

70b. Stand not dominated by inland saltgrass *(Distichlis spicata)*..... (71)

71a. Stands of pure alkali sacaton *(Sporobolus airoides)*, occupying small, alkaline flats of larger rivers. Observed on the San Miguel and Arkansas Rivers, and in South Park. **Alkali sacaton *(Sporobolus airoides)* Herbaceous Vegetation**, page 428.

71b. Stand not dominated by alkali sacaton *(Sporobolus airoides)* ..... (72)

72a. Stand dominated by foxtail barley *(Hordeum jubatum)* in moist to wet meadows. **Foxtail barley *(Hordeum (=Critesion) jubatum)* Herbaceous Vegetation**, page 394.

72b. Not as above. Unidentified association.

WETLAND AND RIPARIAN PLANT ASSOCIATIONS OF COLORADO

The following pages contain photos, descriptions and stand data summary tables for 184 plant associations. Associations are arranged in seven groups:

Group	Page
A: Evergreen Riparian Forests	51
B: Mixed Coniferous and Deciduous Forests and Woodlands	83
C: Deciduous Dominated Forests and Woodlands	95
D: Tall Willow Shrublands	185
E: Short Willow Shrublands	239
F: Non-Willow Shrublands	265
G: Herbaceous Vegetation	315

Descriptions are ordered alphabetically by scientific name within group. In a few cases where an association occurs in more than one group, the description is included only in the first group. Many of these descriptions have been adapted from previous work by Kittel et al. (1999), and for brevity, citations in the original work have been omitted. Complete citation information can be found in the Community Characterization Abstracts in Carsey et al. (2003).

Summary tables show species occurring in aproximately 10% or more of plots. Species with average cover greater than or equal to 5% are listed first, in descending order of average percent cover. The number of plots these species were found in is shown on the right hand side of the table. Other species which were present with average cover less than 5% in at least 10% of plots are listed below in descending order of average percent cover, and their range of cover is shown in parentheses. In some instances, plots were assigned to an association when the dominant species occurred in the stand but did not actually appear in the plot sampled.

Global and State ranks are subject to change as more information is collected.

Maps show locations of plots used in this classification, and may not include all known occurrences of an association. In some instances, plots are close enough together to appear as a single dot.

A list of **undescribed associations**, which lack sufficient data for validation and/or description at this time, follows on page 440.

GROUP A:
EVERGREEN RIPARIAN FORESTS

Association	Page
Abies lasiocarpa-Picea engelmannii/Alnus incana ssp. *tenuifolia* Subalpine fir-Engelmann spruce/Thinleaf alder Forest	52
Abies lasiocarpa-Picea engelmannii/Calamagrostis canadensis Subalpine fir-Engelmann spruce/Bluejoint reedgrass Forest	54
Abies lasiocarpa-Picea engelmannii/Carex aquatilis Subalpine fir-Engelmann spruce/Water sedge Forest	56
Abies lasiocarpa-Picea engelmannii/Equisetum arvense Subalpine fir-Engelmann spruce/Field horsetail Forest	58
Abies lasiocarpa-Picea engelmannii/Mertensia ciliata Subalpine fir-Engelmann spruce/Tall fringed bluebells Forest	60
Abies lasiocarpa-Picea engelmannii/Ribes spp. Subalpine fir-Engelmann spruce/Currant spp. Forest	62
Abies lasiocarpa-Picea engelmannii/Salix drummondiana Subalpine fir-Engelmann spruce/Drummond willow Forest	64
Juniperus scopulorum/Cornus sericea Rocky Mountain juniper/Red-osier dogwood Woodland	66
Picea pungens/Alnus incana ssp. *tenuifolia* Blue spruce/Thinleaf alder Woodland	68
Picea pungens/Betula occidentalis Blue spruce/River birch Woodland	70
Picea pungens/Cornus sericea Blue spruce/Red-osier dogwood Woodland	72
Picea pungens/Equisetum arvense Blue spruce/Field horsetail Woodland	74
Pseudotsuga menziesii/Betula occidentalis Douglas-fir/River birch Woodland	76
Pseudotsuga menziesii/Cornus sericea Douglas-fir/Red-osier dogwood Woodland	78
Pseudotsuga menziesii/Symphoricarpos spp. Douglas-fir/Snowberry Forest	80

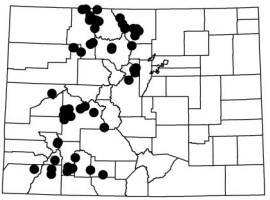
Subalpine fir - Engelmann spruce / Thinleaf alder Forest

Abies lasiocarpa - Picea engelmannii / Alnus incana ssp. *tenuifolia*

Global rank/State rank
G5 / S5

HGM subclass: R2, R3/4

Colorado elevation range:
7,200-10,300 ft (2,200-3,100 m)



General Description

Occurs on heavily forested stream reaches where *Abies lasiocarpa-Picea engelmannii* (subalpine fir-Engelmann spruce) forests also occur on adjacent hillslopes. Tall *Alnus incana* ssp. *tenuifolia* (thinleaf alder) and *Salix drummondiana* (Drummond willow) grow in a thick band along the edge of the stream. At lower elevations, *Alnus incana* is more abundant than *Salix drummondiana*. At mid-elevations, the two shrubs can be codominant. At higher elevations, *Salix drummondiana* becomes dominant and *Alnus incana* drops out, forming the *Abies lasiocarpa-Picea engelmannii/Salix drummondiana* plant association.

This is a common community on first- and second-order streams above 8,000 ft in elevation. It is generally found on stream benches and banks in narrow, 150-800 ft (40-250 m) wide, V-shaped valleys. Most commonly occurs within 15-20 ft (5-6 m) of the channel edge and is rarely more than 2 ft (0.5 m) above the stream bank. Stream channels are narrow and steep, moderately wide with a moderate gradient or wide and very sinuous.

Soils are shallow, dark-colored, thin layers of loamy sands, silty loams, and sandy clay loams over cobbly alluvium. There is generally a high organic matter content in the top 20 inches (50 cm) and mottles at 40 inches (100 cm), becoming skeletal at 60 inches (150 cm).

Vegetation Description

Picea engelmannii (Engelmann spruce) and/or *Abies lasiocarpa* (subalpine fir) dominates the upper canopy, with *Picea engelmannii* present more often that *Abies lasiocarpa.* Other tree species such as *Picea pungens* (blue spruce), *Pinus contorta* (lodgepole pine), and *Populus tremuloides* (quaking aspen) are occasionally present. *Alnus incana* ssp. *tenuifolia* (thinleaf alder) is always present in the shrub canopy layer, and other shrubs are often present as well. The herbaceous undergrowth is usually rich in forb species, with an overall herbaceous cover of 20-70%.

Ecological processes

This association appears to be a late-seral, or at least a long-lived, riparian community that may represent a successional change from deciduous-dominated overstory to a conifer-dominated overstory at lower elevations, a shift which may be attributed to a lack of flooding or other frequent disturbance. The successional process of the spruce-fir forest is slow (200 + years); factors such as fire frequency, wind-throw and insect attack can affect the composition and age structure of *Abies lasiocarpa* and *Picea engelmannii* stands.

Avg. Cover %	(Range)	Species Name	# Plots (N=56)
34	(1-80%)	Alnus incana ssp. tenuifolia	56
31	(1-82%)	Picea engelmannii	51
22	(1-53%)	Cornus sericea ssp. sericea	8
21	(1-77%)	Abies lasiocarpa	43
17	(3-30%)	Salix geyeriana	8
14	(2-48%)	Pinus contorta	9
12	(1-32%)	Acer glabrum	9
12	(1-43%)	Corydalis caseana ssp. brandegeei	7
9	(0.1-95%)	Calamagrostis canadensis	32
9	(1-43%)	Equisetum arvense	29
7	(1-20%)	Salix drummondiana	25
7	(1-10%)	Picea pungens	9
6	(1-30%)	Lonicera involucrata	40
5	(0.1-15%)	Carex aquatilis	9
5	(1-21%)	Populus tremuloides	15
5	(1-20%)	Salix monticola	6

Other species with < 5% average cover present in at least 10% of plots:
Heracleum maximum (0.1-25%), Oxypolis fendleri (1-34%), Mertensia ciliata (0.1-11%), Mertensia franciscana (1-7%), Amelanchier alnifolia (1-10%), Maianthemum racemosum ssp. amplexicaule (1-18%), Rubus parviflorus (1-10%), Streptopus amplexifolius var. chalazatus (1-8%), Pyrola asarifolia ssp. asarifolia (1-10%), Cardamine cordifolia (1-11%), Glyceria striata (1-14%), Ribes inerme (1-10%), Saxifraga odontoloma (1-10%), Symphyotrichum foliaceum (1-10%), Hydrophyllum fendleri (1-10%), Vaccinium scoparium (1-8%), Ribes lacustre (1-7%), Viola canadensis var. scopulorum (0.1-20%), Galium trifidum ssp. subbiflorum (1-10%), Equisetum pratense (1-6%), Osmorhiza depauperata (1-10%), Aconitum columbianum (1-10%), Actaea rubra ssp. arguta (1-8%), Senecio triangularis (1-9%), Arnica cordifolia (1-7%), Thalictrum fendleri (1-10%), Mitella pentandra (1-10%), Geranium richardsonii (1-8%), Rosa woodsii (1-7%), Chamerion angustifolium ssp. circumvagum (1-6%), Maianthemum stellatum (1-8%), Osmorhiza berteroi (1-3%), Dodecatheon pulchellum (1-5%), Galium triflorum (1-8%), Chaenactis douglasii (1-4%), Elymus glaucus (1-5%), Carex disperma (0.1-5%), Orthilia secunda (1-3%), Conioselinum scopulorum (0.1-5%), Rubus idaeus ssp. strigosus (1-3%), Luzula parviflora (0.1-4%), Taraxacum officinale (1-3%), Achillea millefolium var. occidentalis (1-5%), Poa pratensis (1-4%), Pyrola minor (1-3%), Geum macrophyllum var. perincisum (0.1-3%), Fragaria virginiana ssp. glauca (1-3%), Pseudocymopterus montanus (1-2%), Galium boreale (1-3%), Carex microptera (1-2%), Bromus ciliatus var. ciliatus (1%).

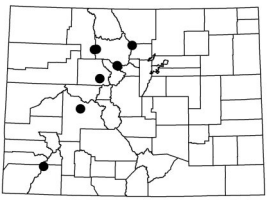
Subalpine fir - Engelmann spruce / Bluejoint reedgrass Forest

Abies lasiocarpa - Picea engelmannii / Calamagrostis canadensis

Global rank/State rank:
G5 / S3

HGM subclass: R2

Colorado elevation range:
8,600-9,800 ft (2,600-3,000 m)



General Description

This association forms a heavily shaded forest with few shrubs and a thick carpet of grass. It is a minor plant association that occurs sporadically throughout the middle and northern Rocky Mountains and occasionally in the southern San Juan Mountains in southwest Colorado. The ground is wet and spongy and covered with moss and grasses.

Typical habitats for this association are narrow to wide valleys with moderate (5%) stream gradients. It occurs on moist toeslopes bordering streams and wet meadows about 1.5 ft (0.5 m) above the bankfull level of the channel. Water tables are usually high with standing water present in the growing season. Soils are typically poorly drained with fine sandy clay over a gravel or cobble layer.

Vegetation Description

Picea engelmannii (Engelmann spruce) is usually the dominant overstory species. *Abies lasiocarpa* (subalpine fir) can occur with up to 50% cover. Shrub cover is generally low, shrubs may or may not be present. Shrub species occasionally present include *Alnus incana* ssp. *tenuifolia* (thinleaf alder) *Lonicera involucrata* (twinberry honeysuckle) *Salix drummondiana* (Drummond willow), and *Vaccinium myrtillus* (whortleberry).

Calamagrostis canadensis (bluejoint reedgrass) dominates the herbaceous understory and is always present with 20-95% cover. *Equisetum arvense* (field horsetail) is also usually present, with 3-20% cover. Other mesic graminoids present less often include *Glyceria striata* (fowl mannagrass), *Carex utriculata* (beaked sedge), *Carex aquatilis* (water sedge), and *Carex microptera* (small-wing sedge). Forb cover can be high or

low depending on site conditions. Common forb species include *Senecio triangularis* (arrowleaf ragwort), *Heracleum maximum* (common cowparsnip) and *Ligusticum* (licorice-root) spp.

Ecological processes

Many first- and second-order streams run through subalpine spruce-fir forests providing habitats for obligate riparian shrubs, forbs, and grasses, forming a number of riparian *Abies lasiocarpa-Picea engelmannii* (subalpine fir-Engelmann spruce) plant associations. Although *Abies lasiocarpa* and *Picea engelmannii* are not obligate riparian species, the two species strongly influence subalpine riparian ecosystems.

Sites supporting this forest type are fairly wet. As hydrologic conditions change, the understory will change to reflect wetter or drier conditions.

Avg. Cover %	(Range)	Species Name	# Plots (N=8)
39	(20-95%)	Calamagrostis canadensis	8
36	(14-60%)	Picea engelmannii	7
21	(10-50%)	Abies lasiocarpa	6
15	(10-20%)	Carex utriculata	2
13	(5-20%)	Pinus contorta	2
12	(3-20%)	Equisetum arvense	7
11	(1-20%)	Glyceria striata	2
9	(3-20%)	Senecio triangularis	4
7	(1-20%)	Heracleum maximum	4
7	(3-10%)	Alnus incana ssp. tenuifolia	2
7	(3-10%)	Ligusticum porteri	2
6	(1-11%)	Ligusticum tenuifolium	2
5	(1-10%)	Saxifraga odontoloma	3

Other species with < 5% average cover present in at least 10% of plots:
Streptopus amplexifolius var. chalazatus (1-10%), Lonicera involucrata (1-10%), Geranium richardsonii (1-10%), Ribes lacustre (3-5%), Mertensia ciliata (1-10%), Cardamine cordifolia (1-5%), Carex aquatilis (1-5%), Geum macrophyllum var. perincisum (1-10%), Oxypolis fendleri (1-5%), Rosa woodsii (1-5%), Aconitum columbianum (1-3%), Arnica cordifolia (1-3%), Carex disperma (0.1-5%), Fragaria virginiana ssp. glauca (1-3%), Carex microptera (1-3%), Chamerion angustifolium ssp. circumvagum (1-2%), Galium triflorum (1%), Orthilia secunda (1%), Vicia americana (1%), Bromus ciliatus var. ciliatus (1%), Mitella pentandra (1%), Carex canescens (1%), Poa pratensis (1%), Veronica americana (1%), Pyrola minor (1%), Senecio serra var. serra (1%), Moneses uniflora (0.1-1%), Luzula parviflora (0.1-1%), Conioselinum scopulorum (0.1-1%).

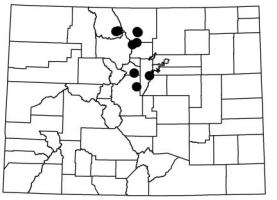
Subalpine fir - Engelmann spruce / Water sedge Forest

Abies lasiocarpa - Picea engelmannii / Carex aquatilis

Global rank/State rank:
G4 / S3

HGM subclass: S1/2, R2, R3/4?

Colorado elevation range:
7,600-10,100 ft (2,300-3,080 m)



General Description

This association is a shaded forest with few to no shrubs and a thick to open carpet of *Carex aquatilis* (water sedge) along the stream banks. It occurs below 10,000 ft (3,000 m) on saturated soils along narrow streams and adjacent to willow carrs and sedge fens. The undergrowth of this association is dominated by *Carex aquatilis* (water sedge) with *Calamagrostis canadensis* (bluejoint reedgrass) as an occasional a co-dominant.

In Colorado, this association occurs on the margins of subalpine willow carrs and sedge fens and adjacent to moderate gradient, narrow streams. Soils are organic or sandy clay loams.

Vegetation Description

Picea engelmannii (Engelmann spruce) is usually the dominant overstory species in this plant association with 13-35% cover. *Abies lasiocarpa* (subalpine fir) can also be present with 7-70% cover. At lower elevations, *Populus angustifolia* (narrowleaf cottonwood), *Populus tremuloides* (quaking aspen) and even *Populus* x *acuminata* (lanceleaf cottonwood) may be present and mixed with the conifer overstory. The shrub cover is minor but diverse, with *Lonicera involucrata* (twinberry honeysuckle), *Juniperus communis* (common juniper), *Salix bebbiana* (Bebb willow), *Salix monticola* (mountain willow), *Salix planifolia* (planeleaf willow), and *Betula occidentalis* (river birch).

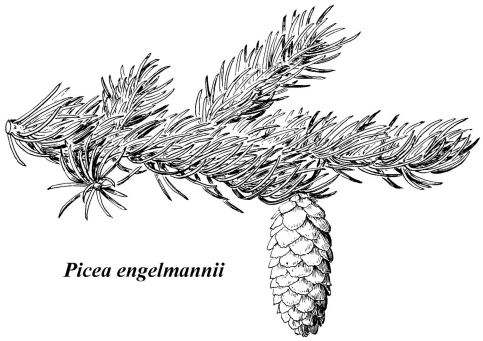
The herbaceous understory dominated by 10-80% cover of *Carex aquatilis* (water sedge) is the diagnostic indicator vegetation layer for this association. No other single herbaceous species exceeds it in abundance. Forbs can be abundant or sparse.

Ecological Processes

The *Abies lasiocarpa-Picea engelmannii/Carex aquatilis* plant association is considered to be a climax community when it occurs along the edges of wet willow carrs and sedge fens. One theory of succession suggests that as ponds begin to dry, a fibrous mat forms, allowing terrestrial species such as sedges to become established. As ponds continue to fill in and the water level lowers, *Carex aquatilis* becomes the dominant sedge. As the area dries more and the water table lowers, conifers such as *Abies lasiocarpa* and *Picea engelmannii* become established.

Avg. Cover %	(Range)	Species Name	# Plots (N=6)
34	(3-80%)	Carex aquatilis	6
28	(7-70%)	Abies lasiocarpa	3
25	(13-35%)	Picea engelmannii	5
18	(10-25%)	Pinus contorta	2
8	(3-16%)	Calamagrostis canadensis	4
7	(3-10%)	Carex norvegica	2
6	(1-10%)	Salix planifolia	3
6	(1-13%)	Saxifraga odontoloma	3
5	(1-10%)	Equisetum arvense	3

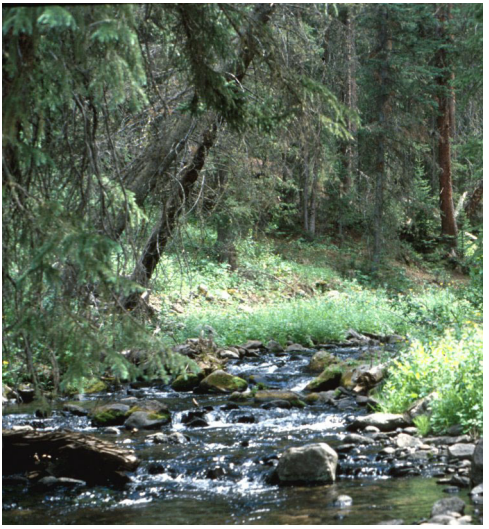
Other species with < 5% average cover present in at least 10% of plots:
Caltha leptosepala (1-9%), Streptopus amplexifolius var. chalazatus (1-6%), Chamerion angustifolium ssp. circumvagum (1-5%), Mertensia ciliata (1-5%), Senecio triangularis (1-6%), Carex disperma (1-4%), Salix monticola (1-4%), Cardamine cordifolia (1-3%), Lonicera involucrata (1-5%), Luzula parviflora (0.1-4%), Rosa woodsii (1-3%), Rhodiola rhodantha (1-2%), Fragaria virginiana ssp. glauca (1%), Salix bebbiana (1%), Mitella pentandra (1%), Taraxacum officinale (1%), Vaccinium scoparium (0.1-1%).



Picea engelmannii

Subalpine fir - Engelmann spruce / Field horsetail Forest

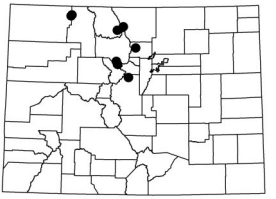
Abies lasiocarpa - Picea engelmanni / Equisetum arvense



Global rank/State rank:
G4 / S2

HGM subclass: R2, R3/4

Colorado elevation range:
8,400-9,500 ft (2,600-2,900 m)



General Description

The *Abies lasiocarpa-Picea engelmannii/Equisetum arvense* (subalpine fir-Engelmann spruce/field horsetail) plant association is a shaded, moist forest with few to almost no shrubs present and an open carpet of *Equisetum arvense* (field horsetail) along the stream bank. It occurs below 10,000 ft (3,000 m) and is often a disturbance (flooding) dependent community. However, in some situations this association may persist for long periods in the absense of disturbance.

Although this is a widespread community extending from British Columbia through the U.S. to northern Colorado, it is relatively rare in Colorado, where it occurs in the northern and central mountains. In the Routt National Forest, this plant association occurs on low terraces along low to moderate gradient streams. Soils are sandy with a gravel layer near the surface.

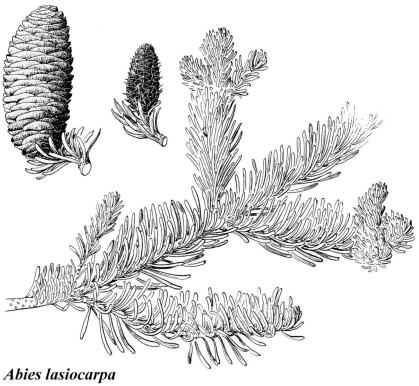
Vegetation Description

Picea engelmannii (Engelmann spruce) is the dominant overstory species and is present in all stands. *Abies lasiocarpa* (subalpine fir) is often present with a lower average cover. Total shrub canopy is low, and includes species such as *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Salix geyeriana* (Geyer willow) and *Lonicera involucrata* (twinberry honeysuckle). *Equisetum arvense* (field horsetail) is the characteristic and always dominant herbaceous species. Other herbaceous species typically present include *Calamagrostis canadensis* (Bluejoint reedgrass), *Senecio triangularis* (arrowleaf ragwort), *Oxypolis fendleri* (Fendler cowbane), *Mertensia ciliata* (tall fringed bluebells), *Saxifraga odontoloma* (brook saxifrage), *Geranium richardsonii* (Richardson geranium), and *Carex aquatilis* (water sedge).

Adjacent riparian areas include *Abies lasiocarpa-Picea engelmannii* (subalpine fir-Engelmann spruce) forests and *Salix drummondiana* (Drummond willow) shrublands.

Ecological processes

In Utah, Idaho, and western Wyoming, the *Abies lasiocarpa-Picea engelmannii/ Equisetum arvense* (subalpine fir-Engelmann spruce/field horsetail) plant association is considered a late-seral to climax stage community. In Colorado, this association is considered an early-seral type. The association is dependent on flood disturbance (deposition of sand and silt) to maintain the understory dominance of *Equisetum arvense* (field horsetail). With larger disturbances, *Populus tremuloides* (quaking aspen) and *Populus angustifolia* (narrowleaf cottonwood) will become established. Without flood disturbance, the site will remain dominated by *Abies lasiocarpa* and *Picea engelmannii*.



Abies lasiocarpa

Avg. Cover %	(Range)	Species Name	# Plots (N=8)
39	(19-70%)	Equisetum arvense	8
28	(9-50%)	Picea engelmannii	8
11	(1-20%)	Vaccinium scoparium	2
10	(3-27%)	Abies lasiocarpa	6
10	(5-16%)	Geranium richardsonii	3
10	(1-30%)	Heracleum maximum	6
9	(1-15%)	Alnus incana ssp. tenuifolia	6
8	(1-20%)	Calamagrostis canadensis	7
8	(3-13%)	Salix drummondiana	2
6	(1-10%)	Carex aquatilis	2
5	(3-10%)	Chamerion angustifolium ssp. circumvagum	3
5	(1-15%)	Cardamine cordifolia	4
5	(1-10%)	Senecio triangularis	6

Other species with < 5% average cover present in at least 10% of plots:
Oxypolis fendleri (1-11%), Mertensia ciliata (1-11%), Salix monticola (1-7%), Orthilia secunda (2-6%), Saxifraga odontoloma (1-10%), Aconitum columbianum (1-10%), Lonicera involucrata (1-8%), Ribes lacustre (1-5%), Osmorhiza depauperata (1-4%), Caltha leptosepala (1-5%), Streptopus amplexifolius var. chalazatus (0.1-5%), Mitella pentandra (1-5%), Carex microptera (1-2%), Salix planifolia (1-2%), Fragaria virginiana ssp. glauca (1-3%), Taraxacum officinale (1-2%), Geum macrophyllum var. perincisum (0.1-2%), Arnica cordifolia (1-1%), Moneses uniflora (1%), Juncus balticus var. montanus (1%), Juncus drummondii (1%), Conioselinum scopulorum (1%), Viola canadensis var. scopulorum (1%), Galium triflorum (1%), Pyrola minor (1%), Platanthera hyperborea var. hyperborea (1%), Luzula parviflora (0.1-1%), Rosa woodsii (0.1-1%), Glyceria striata (0.1-1%), Fragaria vesca ssp. bracteata (0.1%).

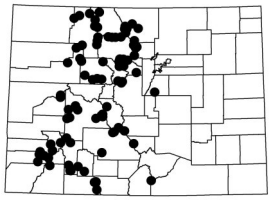
Subalpine fir - Engelmann spruce / Tall fringed bluebells Forest

Abies lasiocarpa - Picea engelmannii / Mertensia ciliata

Global rank/State rank:
G5 / S5

HGM subclass: S1/2?, R2, R3/4

Colorado elevation range:
8,200-11,500 ft (2,500-3,500 m)



General Description

This association is a heavily shaded forest with no shrubs and a thick line of wildflowers lining the stream edge. It is a common community in the subalpine zone along first- and second-order streams. *Mertensia ciliata* (tall fringed bluebells) is nearly always present but can be absent. Other forbs consistently present include *Cardamine cordifolia* (heartleaf bittercress), *Saxifraga odontoloma* (brook saxifrage) and *Senecio triangularis* (arrowleaf ragwort). *Salix drummondiana* (Drummond willow), *Lonicera involucrata* (twinberry honeysuckle), and *Ribes* (currant) species can be present, but with less than 10% cover. At high elevations, *Vaccinium myrtillus* (whortleberry), typically an upland species, can intergrade with this riparian plant association on the stream banks. This is a common plant association throughout the southern Rocky Mountains of Colorado and occurs in all mountain ranges and National Forests in Colorado, comprising approximately 2,000+ miles of stream habitat in Colorado alone.

This association occurs in narrow to wide valleys, 35-350 feet (10-100 m) wide, and is limited to the immediate stream channel edge and overflow areas. It usually establishes within 15 feet (5 m) of the channel and within 2 feet (0.5 m) of channel bankfull height. Typically this association occurs along steep (2-15% gradient), narrow streams, but can also be found along moderate gradient stretches. Soils range from a thin layer of skeletal sandy loams to somewhat deep, mottled loamy sands over colluvial boulders. Total soil depth is never more than 7 feet (2 m), and is typically less than 3 feet (1 m). Consistent to all profiles is a deep, dark brown color and high organic content.

Vegetation Description

Either *Picea engelmannii* (Engelmann spruce) or *Abies lasiocarpa* (subalpine fir) is present, although they are not always present together. The tree canopy can be very

thick, completely overhanging the stream, or it can be quite open, with a wide gap over the stream. There is generally very little shrub cover. *Vaccinium myrtillus* (whortleberry), can be abundant, but it was present in only a third of the stands sampled. Other shrub species that may be present include *Salix drummondiana* (Drummond willow), *S. planifolia* (planeleaf willow), *S. monticola* (mountain willow), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Lonicera involucrata* (twinberry honeysuckle), and several *Ribes* (currant) species.

The dense, mossy forb layer is the diagnostic part of this vegetation type. The forb layer is usually very narrow, often well under 3 ft (1 m) wide, clinging to and undulating with the side of the narrow stream channel. It is species-rich with 20-80% total combined forb cover. No single forb species is consistently present in every stand, however, a distinct suite of species is present in varying combinations.

Ecological Processes

Many first- and second-order streams run through subalpine spruce-fir forests providing habitats for obligate riparian shrubs, forbs, and grasses, forming a number of riparian *Abies lasiocarpa - Picea engelmannii* (subalpine fir-Engelmann spruce) plant associations. Although *Abies lasiocarpa* and *Picea engelmannii* are not obligate riparian species, the two species strongly influence subalpine riparian ecosystems.

Avg. Cover %	(Range)	Species Name	# Plots (N=92)
33	(1-100%)	Picea engelmannii	89
17	(1-90%)	Abies lasiocarpa	79
13	(2-24%)	Alnus incana ssp. tenuifolia	12
10	(1-50%)	Senecio triangularis	70
10	(1-50%)	Vaccinium myrtillus var. oreophilum	31
10	(1-50%)	Cardamine cordifolia	82
9	(1-20%)	Ribes lacustre	14
9	(1-53%)	Mertensia ciliata	80
7	(1-56%)	Saxifraga odontoloma	66
7	(1-21%)	Vaccinium scoparium	17
7	(1-20%)	Oxypolis fendleri	72
6	(1-20%)	Trollius laxus ssp. albiflorus	15
5	(1-27%)	Ribes montigenum	18
5	(1-37%)	Carex aquatilis	26

Other species with < 5% average cover present in at least 10% of plots:
Calamagrostis canadensis (1-40%), Caltha leptosepala (1-20%), Salix planifolia (1-20%), Salix drummondiana (1-10%), Streptopus amplexifolius var. chalazatus (1-18%), Erigeron peregrinus ssp. callianthemus (1-10%), Equisetum arvense (1-20%), Salix monticola (1-20%), Arnica mollis (1-16%), Arnica cordifolia (1-29%), Lonicera involucrata (1-20%), Heracleum maximum (1-20%), Mitella pentandra (1-15%), Ligusticum porteri (1-10%), Aconitum columbianum (1-10%), Geranium richardsonii (1-15%), Conioselinum scopulorum (1-16%), Deschampsia caespitosa (1-11%), Bromus ciliatus var. ciliatus (1-10%), Juncus balticus var. montanus (1-5%), Maianthemum stellatum (1-3%), Chamerion angustifolium ssp. circumvagum (1-10%), Orthilia secunda (1-7%), Osmorhiza depauperata (1-6%), Polygonum bistortoides (1-3%), Achillea millefolium var. occidentalis (1-5%), Fragaria virginiana ssp. glauca (1-5%), Luzula parviflora (1-10%), Juncus drummondii (1-5%), Poa pratensis (1-4%), Rhodiola rhodantha (1-4%), Taraxacum officinale (1-6%), Viola canadensis var. scopulorum (1-4%), Pyrola minor (1-3%), Listera cordata (1-2%), Veronica wormskjoldii (1-2%), Platanthera dilatata var. albiflora (1%).

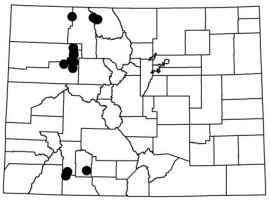
Subalpine fir - Engelmann spruce / Currant spp. Forest

Abies lasiocarpa - Picea engelmannii / Ribes spp.

Global rank/State rank:
G5 / S3

HGM subclass: R2, R3/4?

Colorado elevation range:
8,300-12,200 ft (2,500-3,700 m)



General Description

The *Abies lasiocarpa-Picea engelmannii/Ribes* spp. (subalpine fir-Engelmann spruce/Currant spp.) association forms a heavily shaded forest with a very open shrub layer of just a few individual shrubs. This association has a wide elevational range, and is a common and facultative riparian community. It occurs along steep or moderate gradient streams where the riparian area is narrow and dominated by species of the surrounding forest. *Abies lasiocarpa* (subalpine fir) and *Picea engelmannii* (Engelmann spruce) dominate the tree canopy, while *Ribes* (currant) species dominate the shrub layer.

This is a small community in Colorado, occuring throughout mountainous regions of the state. It has been documented from the Flat Tops Plateau in the White and Colorado River Basins and in the San Juan, Rio Grande, Gunnison, White River, Routt, San Isabel and Pike National Forests. In Colorado, this plant association occurs along narrow to moderately wide streams in steep ravines and valleys. Stream channels are narrow and steep or moderately wide and sinuous with a moderate gradient. Soils are sands or loam over sand, gravel, and cobbles.

Vegetation Description

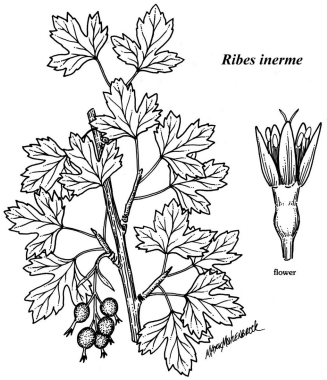
This community is very similar to the *Abies lasiocarpa-Picea engelmannii/Mertensia ciliata* plant association, with a similar overstory and herbaceous characteristics. The difference lies in the consistent presence of a shrub layer with *Ribes* spp. often as the dominant species. *Abies lasiocarpa* (subalpine fir) and *Picea engelmannii* (Engelmann spruce) dominate the tree canopy.

The shrub layer is dominated by 1-50% cover of usually one and occasionally a mix of any of the following *Ribes* (currant) species: *Ribes inerme* (whitestem gooseberry), *R. lacustre* (prickly currant), *R. montigenum* (gooseberry currant), or *R. wolfii* (Wolf

currant). Other shrubs that may be present include *Lonicera involucrata* (twinberry honeysuckle) and *Sorbus scopulina* (mountain ash). Willows may be present along the stream edge (usually less abundant than the *Ribes)*, and can include *Salix drummondiana* (Drummond willow), *S. monticola*, (mountain willow) *S. bebbiana* (Bebb willow), or *S. boothii* (Booth willow). A variable forb layer is present.

Ecological Processes

Many first- and second-order streams run through subalpine spruce-fir forests providing habitats for obligate riparian shrubs, forbs, and grasses, forming a number of riparian *Abies lasiocarpa-Picea engelmannii* (subalpine fir-Engelmann spruce) plant associations. Although *Abies lasiocarpa* and *Picea engelmannii* are not obligate riparian species, the two species strongly influence subalpine riparian ecosystems.

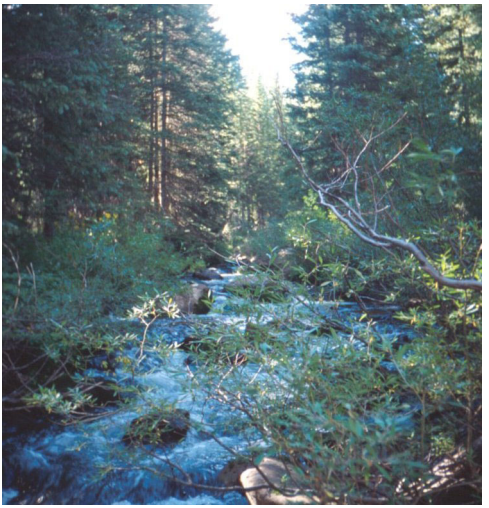


Avg. Cover %	(Range)	Species Name	# Plots (N=14)
21	(1-50%)	Picea engelmannii	14
18	(5-38%)	Abies lasiocarpa	13
12	(1-20%)	Ribes wolfii	3
12	(1-30%)	Lonicera involucrata	13
12	(3-22%)	Ribes inerme	6
12	(1-20%)	Ribes lacustre	4
11	(4-20%)	Ribes montigenum	4
10	(1-40%)	Ribes laxiflorum	5
7	(1-17%)	Sorbus scopulina	4
6	(3-10%)	Salix drummondiana	5
6	(1-13%)	Actaea rubra ssp. arguta	3
5	(2-10%)	Mertensia franciscana	3
5	(1-12%)	Oxypolis fendleri	3
5	(1-14%)	Geranium richardsonii	12
5	(1-10%)	Chamerion angustifolium ssp. circumvagum	6
5	(1-20%)	Senecio triangularis	11

Other species with < 5% average cover present in at least 10% of plots:
Cardamine cordifolia (1-10%), Heracleum maximum (1-10%), Erigeron coulteri (1-7%), Mertensia ciliata (1-10%), Aconitum columbianum (1-10%), Mitella pentandra (1-5%), Carex microptera (1-5%), Conioselinum scopulorum (1-5%), Arnica cordifolia (1-5%), Rubus idaeus ssp. strigosus (1-5%), Alnus incana ssp. tenuifolia (1-5%), Saxifraga odontoloma (1-9%), Streptopus amplexifolius var. chalazatus (1-10%), Vaccinium myrtillus var. oreophilum (1-6%), Sambucus racemosa var. racemosa (1-5%), Vaccinium scoparium (1-6%), Equisetum arvense (1-5%), Calamagrostis canadensis (1-5%), Hydrophyllum fendleri (1-3%), Achillea millefolium var. occidentalis (1-5%), Mimulus guttatus (1-5%), Polemonium pulcherrimum ssp. delicatum (1-5%), Maianthemum stellatum (1-7%), Fragaria virginiana ssp. glauca (1-6%), Bromus ciliatus var. ciliatus (1-5%), Deschampsia caespitosa (1-5%), Urtica dioica ssp. gracilis (1-3%), Galium triflorum (1-3%), Orthilia secunda (1-3%), Thalictrum fendleri (1-3%), Viola canadensis var. scopulorum (1-2%), Osmorhiza depauperata (1-2%), Luzula parviflora (1%), Geum macrophyllum var. perincisum (1%), Taraxacum officinale (1%), Erigeron elatior (1%), Elymus glaucus (1-%), Angelica grayi (1%), Galium boreale (1%), Poa reflexa (1%), Poa pratensis (1%).

Subalpine fir - Engelmann spruce / Drummond willow Forest

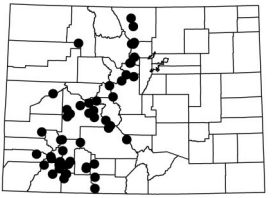
Abies lasiocarpa - Picea engelmannii / Salix drummondiana



Global rank/State rank:
G5 / S4

HGM subclass: R2, R3/4

Colorado elevation range:
8,400-10,900 ft (2,600-3,300 m)



General Description

This association is a heavily forested type found along second and third-order streams above 8,400 ft (2,600 m) where *Abies lasiocarpa-Picea engelmannii* (subalpine fir-Engelmann spruce) forests also occur on adjacent hillslopes. Tall *Alnus incana* ssp. *tenuifolia* (thinleaf alder) and *Salix drummondiana* (Drummond willow) grow in a thick band along the edge of the stream. At lower elevations, *Alnus incana* is more abundant than *Salix drummondiana*. At mid-elevations, the two shrubs can be co-dominant. At higher elevations, *Salix drummondiana* becomes dominant and *Alnus incana* drops out, forming the *Abies lasiocarpa-Picea engelmannii/Salix drummondiana* plant association. *Picea pungens* (blue spruce) is occasionally present at the stream edge and represents a variation of this type.

This common and well-documented plant association occurs in the San Juan Mountains and the Colorado, Gunnison, Arkansas, and South Platte River Basins. It is commonly found on steep (2-25% gradient), narrow (<35 ft, 10 m), first-order streams in moderate to deep V-shaped valleys. The thick shrub canopy is restricted to a narrow band along the rocky stream bank. It can also occur in wider valleys along moderate gradient reaches with channel bottoms that range from bedrock to gravel and one site in the Gunnison River Basin occurs along a braided stream channel. Soils are typically shallow (<3 ft, 1 m) sandy loams to sandy clay loams packed between large angular boulders and cobbles with a thin layer of partially decomposed organic matter under the litter layer.

Vegetation Description

This association does not generally form a mosaic and is often the only riparian association along a stream reach. It typically has a dense canopy of 20-90% cover of *Abies lasiocarpa* (subalpine fir) and/or *Picea engelmannii* (Engelmann spruce). *Picea*

pungens (blue spruce) is occasionally present in lower elevation, wet stands, and *Pinus contorta* (lodgepole pine) may be present in drier, early-seral stands. *Salix drummondiana* (Drummond willow) is always present as part of a narrow but dense strip of shrubs. Other shrubs that occur with less frequency include *Salix monticola* (mountain willow), *Salix brachycarpa* (barrenground willow), *Salix planifolia* (planeleaf willow), *Lonicera involucrata* (twinberry honeysuckle), *Alnus incana* ssp. *tenuifolia* (thinleaf alder) and *Cornus sericea* (red-osier dogwood). The dense herbaceous undergrowth is formed by a variety of species.

Ecological Processes

The dense overstory, thick shrub canopy, and thick forb undergrowth of this association indicate that it is late-seral. High forb cover suggests that with time, further upper canopy closure, and a continued high water table, this association may shift to an *Abies lasiocarpa-Picea engelmannii/Mertensia ciliata* (subalpine fir/bluebells) plant association. With a more open forest canopy, shrubs such as *Alnus incana* ssp. *tenuifolia* (thinleaf alder) or *Salix drummondiana* (Drummond willow) may have higher abundance. Stands with high cover of both *Salix drummondiana* and *Alnus incana* in the understory may be transitional as *Salix drummondiana* replaces *Alnus incana* at higher elevations.

Avg. Cover %	(Range)	Species Name	# Plots (N=55)
36	(1-90%)	Salix drummondiana	53*
32	(3-100%)	Picea engelmannii	52
15	(1-40%)	Alnus incana ssp. tenuifolia	15
13	(3-21%)	Pinus contorta	11
12	(1-40%)	Populus tremuloides	11
10	(1-40%)	Salix monticola	29
10	(1-36%)	Abies lasiocarpa	37
9	(1-34%)	Vaccinium myrtillus var. oreophilum	7
7	(1-20%)	Heracleum maximum	34
7	(1-30%)	Ribes inerme	8
7	(1-12%)	Picea pungens	8
6	(1-44%)	Streptopus amplexifolius var. chalazatus	14
6	(1-30%)	Calamagrostis canadensis	31
6	(1-31%)	Lonicera involucrata	38
6	(1-19%)	Equisetum arvense	22
6	(1-30%)	Mertensia ciliata	41
6	(1-12%)	Salix bebbiana	7
5	(1-13%)	Carex aquatilis	11
5	(1-27%)	Salix brachycarpa	8
5	(1-30%)	Senecio triangularis	29

Other species with < 5% average cover present in at least 10% of plots:

Oxypolis fendleri (1-16%), Orthilia secunda (1-12%), Cardamine cordifolia (1-15%), Mertensia franciscana (1-12%), Symphoricarpos oreophilus (1-10%), Arnica cordifolia (1-13%), Equisetum pratense (1-14%), Rosa woodsii (1-10%), Geranium richardsonii (1-12%), Ligusticum porteri (1-10%), Saxifraga odontoloma (1-17%), Chamerion latifolium (1-6%), Viola canadensis var. scopulorum (1-17%), Carex disperma (1-13%), Chamerion angustifolium ssp. circumvagum (1-9%), Conioselinum scopulorum (1-12%), Maianthemum stellatum (1-20%), Actaea rubra ssp. arguta (1-8%), Galium triflorum (1-8%), Taraxacum officinale (1-10%), Juncus compressus (1-3%), Aconitum columbianum (1-10%), Osmorhiza depauperata (1-10%), Fragaria virginiana ssp. glauca (1-5%), Poa pratensis (1-7%), Thalictrum fendleri (1-10%), Rubus idaeus ssp. strigosus (1-5%), Pseudocymopterus montanus (1-8%), Pyrola minor (1-3%), Deschampsia caespitosa (1-3%), Mitella pentandra (1-3%), Geum macrophyllum var. perincisum (1-3%), Galium boreale (1-3%), Achillea millefolium var. occidentalis (1-10%), Luzula parviflora (1-3%), Polygonum viviparum (1-3%), Mimulus guttatus (1-2%), Polygonum bistortoides (1-2%).

* Salix drummondiana occurred in all stands, but was not captured in every sample plot.

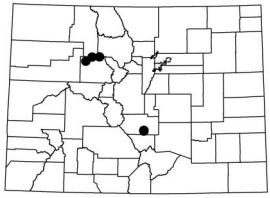
Rocky Mountain juniper / Red-osier dogwood Woodland

Juniperus scopulorum / Cornus sericea

Global rank/State rank:
G4 / S2

HGM subclass: R3/4

Colorado elevation range:
6,400-6,900 ft (2,000-2,100 m)



General Description

This association has an open canopy of *Juniperus scopulorum* (Rocky Mountain juniper) and an occasional upland species, such as *Juniperus osteosperma* or *J. monosperma* (Utah or one-seed juniper). The understory contains few shrubs and little herbaceous growth. This plant association is common along desert streams and arroyos and can occur on upper terraces with *Populus angustifolia-Juniperus scopulorum* (narrowleaf cottonwood-Rocky Mountain juniper) on the lower floodplain. Although *Cornus sericea* (red-osier dogwood) was present in fewer than half of the plots sampled, the overall species composition closely matches the *Juniperus scopulorum*/*Cornus sericea* (Rocky Mountain juniper/red-osier dogwood) type described from Montana.

This plant association appears to be limited to a distinct band at the high water mark of gently meandering, moderate-gradient stream channels having little to moderate floodplain development. Stands sampled along the Colorado River appeared to be mature, relic stands surviving only on upper stream banks and terraces approximately 7 ft (2 meters) above the active stream channel. Only a few stands of this community have been documented in Colorado.

The shallow soils are derived from coarse alluvial substrates. Soil textures are sandy clay loams to sandy loams with a high percentage of coarse fragments.

Vegetation Description

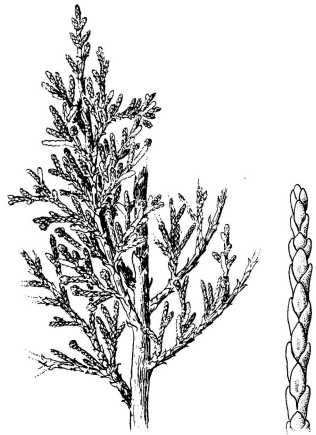
The upper canopy is dominated by *Juniperus scopulorum* (Rocky Mountain juniper) (30-80% cover) with a few scattered *Populus angustifolia* (narrowleaf cottonwood) (<10%) individuals. The shrub layer is very patchy along the streambank. *Cornus sericea* (red-osier dogwood) is the most frequently present shrub species (40% constancy). Other infrequently encountered shrubs, with an average of about 1%

cover, include *Quercus gambelii* (Gambel oak), *Rhus trilobata* (skunkbush sumac), *Rosa woodsii* (Woods rose), *Salix exigua* (sandbar willow), *S. monticola* (mountain willow), and *Symphoricarpos oreophilus* (mountain snowberry).

The herbaceous undergrowth occurs within the shade of the tree canopy as well as on exposed point bars. No species were consistently present, but commonly encountered native species ranging from 1-8% cover include *Panicum virgatum* (switchgrass), *Equisetum hyemale* (scouringrush horsetail), and *Equisetum arvense* (field horsetail). Commonly present non-native grasses include *Agrostis stolonifera* (creeping bentgrass), *Poa pratensis* (Kentucky bluegrass), and *Elytrigia repens* (quackgrass). Forb cover is sparse and consists of only a few scattered individuals.

Ecological Processes

In riparian areas, *Juniperus scopulorum* (Rocky Mountain juniper) generally occurs with *Populus angustifolia* (narrowleaf cottonwood). However, in narrow, V-shaped canyons and at the margins of older terraces in wider valleys, *Juniperus scopulorum* can occur as the single dominant tree species. The *Populus angustifolia-Juniperus scopulorum* (narrowleaf cottonwood-Rocky Mountain juniper) plant association may convert to *Juniperus scopulorum* as *Populus angustifolia* dies and does not regenerate. Therefore, the dominance of *Juniperus scopulorum* indicates a late seral stage of a riparian community.



Juniperus scopulorum

Avg. Cover %	(Range)	Species Name	# Plots (N=5)
52	(34-81%)	Juniperus scopulorum	5
16	(1-30%)	Cornus sericea	2
15	(14-15%)	Agrostis stolonifera	2
7	(1-10%)	Poa pratensis	3
6	—	Elymus repens	1
5	—	Pinus edulis	1
5	(2-7%)	Medicago lupulina	2

Other species with < 5% average cover present in at least 10% of plots:
Panicum virgatum (1-8%), Melilotus officinalis (4%), Equisetum arvense (1-7%), Elymus elymoides (3%), Maianthemum stellatum (3%), Phalaris arundinacea (3%), Equisetum hyemale var. affine (1-8%), Trifolium repens (2-3%), Juncus balticus var. montanus (1-3%), Eleocharis palustris (1-3%), Pseudotsuga menziesii (1-3%), Antennaria rosulata (2%), Pascopyrum smithii (2%), Leymus cinereus (1-3%), Lepidium virginicum (1-2%), Achillea millefolium var. occidentalis (1%), Salix exigua (1%), Taraxacum officinale (1%), Rhus trilobata var. trilobata (1%), Thlaspi montanum (1%), Allium cernuum (1%), Artemisia frigida (1%), Campanula rotundifolia (1%), Carex utriculata (1%), Descurainia incana (1%), Symphoricarpos oreophilus (1%), Salix monticola (1%), Heterotheca villosa (1%), Physaria floribunda (1%), Rosa woodsii (1%), Juniperus monosperma (1%), Ribes inerme (1%), Quercus gambelii (1%), Populus angustifolia (1%), Mertensia ciliata (1%), Hesperostipa comata (1%).

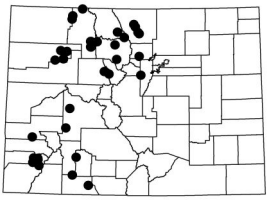
Blue spruce / Thinleaf alder Woodland

Picea pungens / Alnus incana ssp. *tenuifolia*

Global rank/State rank:
G3 / S3

HGM subclass:
R2, R3/4

Colorado elevation range:
6,100-10,650 ft (1,900-3,200 m)



General Description

The *Picea pungens/Alnus incana* ssp. *tenuifolia* (blue spruce/thinleaf alder) plant association occurs in montane riparian areas in Colorado. It occurs in deep, shaded canyons and narrow valleys along relatively straight stream reaches. It generally forms small patches, but can be continuous for several river miles.

This plant association occurs along narrow to moderately wide floodplains and stream benches in canyons subject to cold air drainage and limited sunlight. Stream channels are steep and narrow, moderately broad and slightly sinuous, or broad and highly sinuous. Soils are generally shallow and range from loamy sand to silty clay loams with heavy organic matter content over gravel, cobbles, and boulders.

Vegetation Description

Picea pungens (blue spruce) dominates the overstory with 1-70% cover. There are typically many seedling and saplings as well as mature trees. *Abies lasiocarpa* (subalpine fir) is usually present with up to 50% cover. Other tree species that occurred in half or fewer of the stands sampled include *Picea engelmannii* (Engelmann spruce), *Populus tremuloides* (quaking aspen), *Pinus contorta* (lodgepole pine) and *Pinus ponderosa* (ponderosa pine).

The thick shrub understory is confined to a narrow band lining the stream channel. *Alnus incana* ssp. *tenuifolia* (thinleaf alder) was present in all stands sampled, and ranged in cover from 1 to 80%. Other shrub species present were highly variable, with constancy of less then 40%, but often appearing with abundant cover when present. These shrubs include *Salix drummondiana* (Drummond willow), *Cornus sericea* (red-osier dogwood), *Ribes lacustre* (current), *Acer glabrum* (Rocky Mountain maple),

Vaccinium spp. (whortleberry), *Salix boothii* (Booth willow), and *Salix wolfii* (Wolf willow).

The forb canopy layer is thick, up to 50% total cover and species-rich, often with more than 40 species represented in one stand. Species include *Actaea rubra* (red baneberry), *Conioselinum scopulorum* (Rocky Mountain hemlockparsley), *Oxypolis fendleri* (cowbane), *Geranium richardsonii* (Richardson geranium), *Heracleum maximum* (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), *Mertensia ciliata* (tall fringed bluebells), *Rudbeckia laciniata* var. *ampla* (cutleaf cornflower), and *Equisetum arvense* (field horsetail).

Ecological Processes

In deep, narrow canyons with swift-moving streams and narrow floodplains and benches, *Picea pungens* (blue spruce) appears to be a climax riparian species, and will remain until removed or damaged by a catastrophic flood. In Colorado, the closely related *Picea pungens/Equisetum arvense* (blue spruce/field horsetail) plant association is considered an indicator of frequent flooding. With less frequent flooding, this association may gradually change to a *Picea pungens/Alnus incana* ssp. *tenuifolia* (blue spruce/thinleaf alder) plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=35)
32	(1-70%)	Picea pungens	35
28	(1-80%)	Alnus incana ssp. tenuifolia	34*
12	(1-85%)	Calamagrostis canadensis	13
12	(1-55%)	Salix exigua	5
12	(1-50%)	Abies lasiocarpa	15
9	(1-28%)	Acer glabrum	6
9	(1-32%)	Salix bebbiana	7
9	(1-28%)	Salix monticola	7
9	(1-18%)	Populus tremuloides	8
8	(1-45%)	Equisetum arvense	27
8	(1-40%)	Salix drummondiana	16
8	(1-20%)	Ribes lacustre	7
7	(1-32%)	Ribes inerme	10
7	(1-18%)	Pinus contorta	6
5	(1-25%)	Poa pratensis	20
5	(1-30%)	Lonicera involucrata	26
5	(0.1-20%)	Rudbeckia laciniata var. ampla	14
5	(1-10%)	Cornus sericea	8
5	(0.1-20%)	Trifolium repens	8

Other species with < 5% average cover present in at least 10% of plots:
Saxifraga odontoloma (1-10%), Symphoricarpos oreophilus (1-20%), Heracleum maximum (1-15%), Rubus idaeus ssp. strigosus (0.1-20%), Mertensia ciliata (1-10%), Thalictrum fendleri (1-10%), Streptopus amplexifolius var. chalazatus (1-10%), Senecio triangularis (1-10%), Erigeron speciosus var. speciosus (1-9%), Maianthemum stellatum (0.1-13%), Geranium richardsonii (0.1-10%), Bromus ciliatus var. ciliatus (1-11%), Actaea rubra ssp. arguta (1-10%), Salix ligulifolia (1-5%), Rosa woodsii (1-10%), Aconitum columbianum (1-10%), Taraxacum officinale (0.1-15%), Poa palustris (1-5%), Amelanchier alnifolia (1-10%), Phleum pratense (1-10%), Cardamine cordifolia (1-10%), Urtica dioica ssp. gracilis (1-10%), Elymus glaucus (1-10%), Galium triflorum (1-10%), Luzula parviflora (0.1-8%), Conioselinum scopulorum (0.1-5%), Dasiphora floribunda (1-7%), Chamerion angustifolium ssp. circumvagum (1-10%), Osmorhiza depauperata (0.1-10%), Fragaria virginiana ssp. glauca (1-5%), Glyceria striata (0.1-5%), Achillea millefolium var. occidentalis (1-5%), Galium boreale (1-5%), Orthilia secunda (1-3%), Viola canadensis var. scopulorum (0.1-3%), Carex microptera (1-3%), Vicia americana (1-5%), Oxypolis fendleri (1-3%), Osmorhiza berteroi (1-3%), Geum macrophyllum var. perincisum (0.1-5%), Prunella vulgaris (1%), Ranunculus macounii (1%).

*Alnus incana ssp. tenuifolia occurred in all stands, but was not captured in every sample plot.

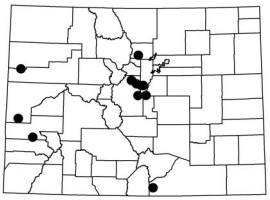
Blue spruce / River birch Woodland

Picea pungens / Betula occidentalis

Global rank/State rank:
G2 / S2

HGM subclass: R2

Colorado elevation range:
6,160-8,860 ft (1,870-2,700 m)



General Description

The *Picea pungens/Betula occidentalis* (blue spruce/river birch) plant association is a cool, moist riparian woodland occurring in deep, narrow canyons in the foothills and at lower montane elevations. *Betula occidentalis* (river birch) forms a thick band along the stream banks with branches overhanging the stream. Mature *Picea pungens* (blue spruce) shade the *Betula occidentalis* along narrow floodplains.

This association is limited to deep, 100-600 ft (30-180 m), narrow canyons where it occurs on terraces, stream banks, and narrow floodplains. Stream channels are steep (6-10% gradient) and narrow or moderately wide with a moderate gradient (1-2%). Soils are generally sandy loams to clay loams with mottling 15-45 inches (35-110 cm) deep.

Vegetation Description

Picea pungens (blue spruce) dominates the canopy. *Populus tremuloides* (quaking aspen) may also be present. The shrub canopy is dominated by *Betula occidentalis* (river birch). Other shrubs that may be present include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Salix exigua* (sandbar willow), *Salix bebbiana* (Bebb willow), and *Cornus sericea* (red-osier dogwood). The herbaceous undergrowth can be dense to open. Forb species that may be present include *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Heracleum maximum* (common cowparsnip), *Fragaria virginiana* (strawberry), and *Mertensia ciliata* (tall fringed bluebells). Graminoid species that may be present include *Calamagrostis canadensis* (bluejoint reedgrass)

and *Agrostis stolonifera* (creeping bentgrass). *Equisetum arvense* (field horsetail) may be sparse to dense.

Ecological Processes

This association appears to be stable and late-seral. In deep, narrow canyons with swift-moving streams and narrow floodplains and benches, *Picea pungens* (blue spruce) appears to be a climax riparian species and will remain until removed or damaged by a catastrophic flood.

Picea pungens (blue spruce) is a slow-growing, long-lived tree which regenerates from seed. Seedlings are shallow rooted and require perennially moist soils for establishment and optimal growth. *P. pungens* (blue spruce) is intermediate in shade tolerance, being somewhat more tolerant than *Pinus ponderosa* (ponderosa pine) or *Pseudotsuga menziesii* (Douglas-fir), and less tolerant than *Abies lasiocarpa* (subalpine fir) or *Picea engelmannii* (Engelmann spruce). *Betula occidentalis* (river birch) can tolerate flooding but not permanent inundation. Fire disturbance results in *Betula occidentalis* (river birch) resprouting and the replacement of this type with an early-seral plant association such as *Populus tremuloides/Betula occidentalis* (quaking aspen/river birch).

Avg. Cover %	(Range)	Species Name	# Plots (N=13)
37	(10-70%)	Picea pungens	13
27	(10-50%)	Betula occidentalis	12*
25	(20-30%)	Carex pellita	2
16	(1-30%)	Salix monticola	2
14	(2-41%)	Calamagrostis canadensis	5
13	(1-34%)	Alnus incana ssp. tenuifolia	7
11	(1-20%)	Symphoricarpos oreophilus	2
9	(2-28%)	Agrostis stolonifera	5
9	(1-30%)	Populus tremuloides	7
8	(1-30%)	Equisetum arvense	8
8	(1-20%)	Juncus balticus var. montanus	3
8	(1-30%)	Poa pratensis	9
7	(1-22%)	Salix bebbiana	7
6	(1-40%)	Rosa woodsii	11
6	(3-10%)	Cornus sericea ssp. sericea	4
6	(1-11%)	Heracleum maximum	8
6	(1-15%)	Lonicera involucrata	4
5	(1-10%)	Equisetum hyemale var. affine	3

Other species with < 5% average cover present in at least 10% of plots:
Rudbeckia laciniata var. ampla (1-15%), Poa compressa (1-10%), Juniperus scopulorum (2-6%), Glyceria striata (0.1-5%), Symphyotrichum foliaceum (1-5%), Leucanthemum vulgare (1-5%), Aconitum columbianum (1-5%), Geranium richardsonii (0.1-5%), Taraxacum officinale (1-7%), Equisetum pratense (1-7%), Vicia americana (1-5%), Trifolium repens (1-5%), Mentha arvensis (0.1-6%), Fragaria virginiana ssp. glauca (1-4%), Cardamine cordifolia (1-3%), Achillea millefolium var. occidentalis (1-5%), Dodecatheon pulchellum (1-3%), Maianthemum stellatum (1-5%), Mertensia ciliata (0.1-4%), Galium boreale (1-2%), Ranunculus macounii (0.1-2%), Geum macrophyllum var. perincisum (1%), Chamerion angustifolium ssp. circumvagum (1%), Thalictrum fendleri (1%), Poa palustris (1%), Prunella vulgaris (1%), Ribes inerme (1%), Ribes cereum (1%), Phleum pratense (1%), Symphoricarpos albus (1%), Luzula parviflora (0.1-1%), Conioselinum scopulorum (0.1%).

*Betula occidentalis occurred in all stands but was not captured in every sample plot.

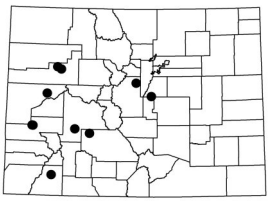
Blue spruce / Red-osier dogwood Woodland

Picea pungens / Cornus sericea

Global rank/State rank:
G4 / S2

HGM subclass: R2?, R3/4

Colorado elevation range:
7,000-8,500 ft (2,100-2,600 m)



General Description

The *Picea pungens/Cornus sericea* (blue spruce/red-osier dogwood) plant association is a cool, moist riparian woodland occurring in deep narrow canyons. It was once a more common type and represents slightly more stable habitats than those of the *Picea pungens/Alnus incana* ssp. *tenuifolia* (blue spruce/thinleaf alder) plant association. The *Picea pungens/Cornus sericea* association is characterized by an open to thick understory of *Cornus sericea* (red-osier dogwood), deeply shaded by *Picea pungens* (blue spruce).

This plant association occurs on floodplains and benches in narrow valleys, 20-100 ft (7-30 m) wide, with variable stream gradients (1-10%). It occurs along broad, slightly meandering channel reaches and occasionally along steep and narrow reaches. Soils are deep, dark-colored clay loams to sandy loams, often with signs of mottling. There may be high organic matter in the top layers.

Vegetation Description

The upper canopy of this plant association is dominated by *Picea pungens* (blue spruce), which is present in all stands. Other tree species present with less than 40% frequency include *Populus tremuloides* (quaking aspen), *Populus angustifolia* (narrowleaf cottonwood), *Abies lasiocarpa* (subalpine fir) and *Picea engelmannii* (Engelmann spruce). The shrub canopy is dominated by *Cornus sericea* (red-osier dogwood), which is present in all stands and forms an open to dense thicket with 5-

80% cover. *Symphoricarpos oreophilus* (mountain snowberry) and *Lonicera involucrata* (twinberry honeysuckle) are present in >60% of sampled stands. Other shrubs with lower frequency but noticeably high abundance include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Betula occidentalis* (river birch), *Salix monticola* (mountain willow), *Salix drummondiana* (Drummond willow), *Acer glabrum* (Rocky Mountain maple), *Prunus virginiana* (chokecherry), and *Amelanchier utahensis* (Utah serviceberry).

The herbaceous understory is highly variable, depending on the site conditions and the amount of past disturbance. No one forb or graminoid species is present in all stands. Frequently encountered (>50% frequency) herbaceous species include *Equisetum arvense* (field horsetail), *Maianthemum stellatum* (starry false Solomon seal), and *Geranium richardsonii* (Richardson geranium).

Ecological Processes

In deep, narrow canyons with swift-moving streams and narrow floodplains and benches, *Picea pungens* (blue spruce) appears to be a climax riparian species, and will remain until removed or damaged by a catastrophic flood. *Cornus sericea* (red-osier dogwood) is more abundant on level sites where water tables are periodically high. *Picea pungens* (blue spruce) is a slow-growing, long-lived tree which regenerates from seed. Seedlings are shallow rooted and require perennially moist soils for establishment and optimal growth. *P. pungens* (blue spruce) is intermediate in shade tolerance, being somewhat more tolerant than *Pinus ponderosa* (ponderosa pine) or *Pseudotsuga menziesii* (Douglas-fir), and less tolerant than *Abies lasiocarpa* (subalpine fir) or *Picea engelmannii* (Engelmann spruce).

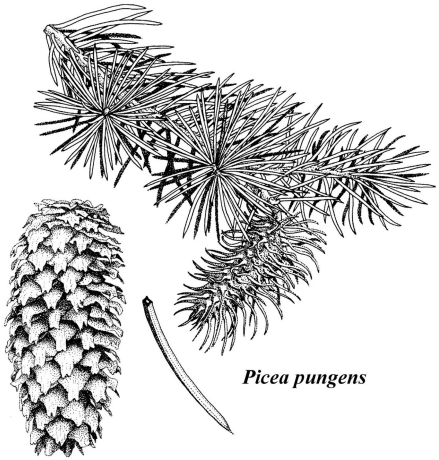
Avg. Cover %	(Range)	Species Name	# Plots (N=10)
36	(19-63%)	Picea pungens	9*
28	(3-78%)	Cornus sericea ssp. sericea	10
18	(1-50%)	Populus tremuloides	3
16	(1-40%)	Populus angustifolia	4
16	(1-30%)	Picea engelmannii	2
13	(5-20%)	Acer glabrum	3
10	(10-10%)	Betula occidentalis	2
9	(3-20%)	Salix drummondiana	4
7	(1-19%)	Alnus incana ssp. tenuifolia	8
7	(3-10%)	Abies lasiocarpa	2
6	(3-10%)	Geranium richardsonii	3
6	(1-25%)	Rosa woodsii	6
5	(1-10%)	Ribes inerme	3
5	(1-20%)	Salix bebbiana	5
5	(1-10%)	Amelanchier utahensis	3

Other species with < 5% average cover present in at least 10% of plots:
Salix ligulifolia (1-10%), Lonicera involucrata (1-10%), Rudbeckia laciniata var. ampla (1-10%), Salix exigua (3-5%), Symphoricarpos oreophilus (1-10%), Heracleum maximum (1-7%), Calamagrostis canadensis (1-5%), Amelanchier alnifolia (1-5%), Actaea rubra ssp. arguta (1-5%), Mahonia repens (1-5%), Paxistima myrsinites (1-5%), Rubus parviflorus (1-5%), Maianthemum stellatum (1-10%), Poa pratensis (1-5%), Osmorhiza depauperata (1-3%), Equisetum arvense (1-3%), Taraxacum officinale (1-3%), Maianthemum racemosum ssp. amplexicaule (1%), Fragaria virginiana ssp. glauca (1%), Achillea millefolium var. occidentalis (1%), Conioselinum scopulorum (1%), Quercus gambelii (1%), Viola canadensis var. scopulorum (1%), Juncus compressus (1%), Geum macrophyllum var. perincisum (1%), Galium triflorum (1%), Bromus inermis (1%), Galium boreale (1%).

* Picea pungens occurred in all stands, but was not captured in every sample plot.

Blue spruce / Field horsetail Woodland

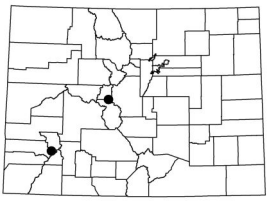
Picea pungens / Equisetum arvense



Global rank/State rank:
G3? / S2?

HGM subclass: R3/4

Colorado elevation range:
8,400-9,400 ft (2,560-2,900 m)



General Description

The *Picea pungens/Equisetum arvense* (blue spruce/field horsetail) plant association is restricted to narrow canyons and cool ravines. Dense stands of *Picea pungens* with a thick carpet of *Equisetum arvense* and few shrubs characterize the vegetation. Occurrences tend to be limited to narrow stream benches and banks that are frequently flooded.

This plant association occurs in narrow, V-shaped valleys with cold-air drainage, forming small bands along narrow benches and floodplains. Stream channels dominated by *Picea pungens* (blue spruce) are generally wide with narrow, developed floodplains. Streambed material is coarse (boulders and cobbles). Soils are relatively heavy and somewhat poorly drained. Soil textures are clay loams and silty clay loams with alternating layers of sandy loams.

Vegetation Description

The overstory is a dense canopy of *Picea pungens* (blue spruce), *Pseudotsuga menziesii* (Douglas-fir), and *Pinus contorta* (lodgepole pine). Shrub cover is minor, yet diverse. Shrub species with at least 1% cover each include *Betula nana (=glandulosa)* (bog birch), *Salix geyeriana* (Geyer willow), *Salix monticola* (Rocky Mountain willow), and *Rosa woodsii* (Woods rose). The herbaceous undergrowth consists of a few species including *Equisetum arvense* (field horsetail), *Carex aquatilis* (water sedge), and *Juncus balticus* var. *montanus* (mountain rush).

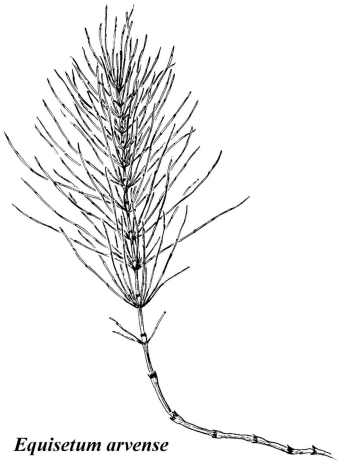
Ecological Processes

In deep, narrow canyons with swift-moving streams and narrow floodplains and benches, *Picea pungens* (blue spruce) appears to be a climax riparian species. *Picea pungens* will remain until removed or damaged by a catastrophic flood.

A closely related community, the *Picea*/*Equisetum arvense* (spruce/field horsetail), reported from Montana, Wyoming, Idaho, and Utah, is considered a late-seral to near climax riparian type. In Colorado, the *Picea pungens*/*Equisetum arvense* (blue spruce/field horsetail) plant association is considered an indicator of frequent flooding. While many of the trees are fairly large, the understory of *Equisetum arvense* (field horsetail) indicates frequent flooding. Some stands remain undisturbed and occur in persistently wet areas of the floodplain. With less frequent flooding, this association may gradually change to a *Picea pungens*/*Alnus incana* ssp. *tenuifolia* (blue spruce/thinleaf alder) plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=2)
29	—	Pseudotsuga menziesii	1
25	(5-44%)	Picea pungens	2
24	—	Pinus contorta	1
18	(11-25%)	Equisetum arvense	2
8	(1-15%)	Salix monticola	2
8	(1-15%)	Salix geyeriana	2
8	—	Carex aquatilis	1
6	—	Rosa woodsii	1
5	(4-5%)	Juncus balticus var. montanus	2

Other species with < 5% average cover present in at least 10% of plots:
Juniperus scopulorum (3%), Pseudocymopterus montanus (3%), Betula nana (2%), Thlaspi montanum (2%), Poa alpina (2%), Salix ligulifolia (2%), Salix planifolia (2%), Antennaria parvifolia (1%), Chamerion angustifolium ssp. circumvagum (1%), Deschampsia caespitosa (1%), Fragaria virginiana ssp. glauca (1%), Geum macrophyllum var. perincisum (1%), Lonicera involucrata (1%), Maianthemum stellatum (1%), Agrostis stolonifera (1%), Poa compressa (1%), Populus tremuloides (1%), Sedum lanceolatum ssp. lanceolatum (1%), Taraxacum officinale (1%), Mimulus tilingii (1%).



Equisetum arvense

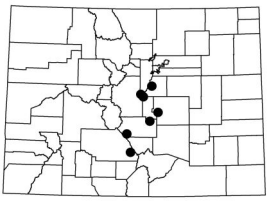
Douglas-fir / River birch Woodland

Pseudotsuga menziesii / Betula occidentalis

Global rank/State rank:
G3? / S3

HGM subclass: R3/4

Colorado elevation range:
6,600-8,400 ft (2,000-2,560 m)



General Description

The *Pseudotsuga menziesii/Betula occidentalis* (Douglas-fir/river birch) association occurs in narrow foothill canyons of the Colorado Front Range in the upper Arkansas and South Platte River Basins and in the Rio Grande National Forest. This plant association occurs in narrow canyons with small streams and is limited to a narrow band along stream banks. Stream channels are steep and narrow with mostly rocky beds.

The soils, derived from alluvial and colluvial deposits, are fairly shallow (60-135 in, 25-55 cm) and become skeletal with depth. Surface layers are sandy loams, clay loams, and loams. Subsurface layers are sandy loams with 10-30% cobbles and gravels. Organic matter from accumulated litter appears to be concentrated in the upper layers.

Vegetation Description

This association is characterized by a dominance of *Pseudotsuga menziesii* (Douglas-fir) and *Betula occidentalis* (river birch), which are key indicators for this type, even if other tree and shrub species present are abundant. The overstory canopy of this plant association is dominated by 25-50% cover of *Pseudotsuga menziesii* (Douglas-fir). Other tree species that may be present include *Populus angustifolia* (narrowleaf cottonwood), *Juniperus scopulorum* (Rocky Mountain juniper), *Pinus ponderosa*

(ponderosa pine), *Abies concolor* (white fir), *Abies lasiocarpa* (subalpine fir), *Picea pungens* (blue spruce), and *Populus tremuloides* (quaking aspen).

The shrub canopy is fairly thick and diverse with 20-80% cover of *Betula occidentalis* (river birch). Other shrubs that may be present include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Acer glabrum* (Rocky Mountain maple), *Rosa woodsii* (Woods rose), *Jamesia americana* (wax flower), *Cornus sericea* (red-osier dogwood), *Quercus gambelii* (Gambel oak), *Salix bebbiana* (Bebb willow), *Salix ligulifolia* (strapleaf willow), *Salix monticola* (mountain willow), and *Salix irrorata* (bluestem willow).

The herbaceous undergrowth is sparse and limited by heavy shade. Some of the more abundant species that may be present include *Maianthemum stellatum* (starry false Solomon seal), *Equisetum arvense* (field horsetail), *Carex disperma* (softleaf sedge), and *Melilotus officinalis* (yellow sweetclover).

Ecological Processes

The *Pseudotsuga menziesii/Betula occidentalis* (Douglas-fir/river birch) plant association appears to be in a late-seral stage since *Pseudotsuga menziesii* is successfully reproducing. It also appears that this association is limited to perennial streams where the cold-air drainage and perennial stream flow provide a cool and moist environment to support a diverse shrub canopy.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
36	(26-50%)	Pseudotsuga menziesii	7
34	(16-86%)	Betula occidentalis	7
31	(5-52%)	Alnus incana ssp. tenuifolia	5
24	(9-38%)	Populus tremuloides	2
22	(8-36%)	Abies concolor	2
18	(10-25%)	Quercus gambelii	2
16	(5-26%)	Cornus sericea	2
11	(2-19%)	Salix bebbiana	2
10	(4-20%)	Populus angustifolia	4
7	(3-20%)	Rosa woodsii	5
7	(1-23%)	Juniperus scopulorum	4
7	(6-8%)	Carex disperma	2
7	(1-13%)	Acer glabrum	5
6	(1-15%)	Equisetum arvense	3
6	(2-10%)	Pinus ponderosa var. scopulorum	4
5	(1-9%)	Salix irrorata	2
5	(3-7%)	Poa pratensis	2
5	(1-13%)	Jamesia americana	4

Other species with < 5% average cover present in at least 10% of plots:
Juncus compressus (3-5%), Mertensia ciliata (2-3%), Prunus virginiana var. melanocarpa (1-3%), Heracleum maximum (1-3%), Rubus idaeus ssp. strigosus (1-3%), Symphoricarpos oreophilus (1-3%), Galium trifidum ssp. subbiflorum (1-3%), Taraxacum officinale (1-3%), Toxicodendron rydbergii (1-2%), Maianthemum stellatum (1-3%), Fragaria virginiana ssp. glauca (1%), Chamerion angustifolium ssp. circumvagum (1%), Mentha arvensis (1%), Conioselinum scopulorum (1%), Agrostis stolonifera (1%).

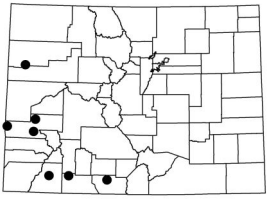
Douglas-fir / Red-osier dogwood Woodland

Pseudotsuga menziesii / Cornus sericea

Global rank/State rank:
G4 / S2

HGM subclass: R3/4

Colorado elevation range:
5,600-8,500 ft (1,700-2,400 m)



General Description

In Colorado, this is an uncommon association that naturally occurs in small patches. It occurs in the San Juan and Rio Grande National Forests, the San Miguel and Dolores River Basins, Gunnison River Basin, and White River Basin.

This plant association occurs in narrow valleys with variable stream gradients (5-25%) on narrow floodplains and elevated benches. Stands occur well above the stream channel bankfull height, 1-10 ft (0.16-3 m). Stream channels are steep and narrow. The soils are generally well-drained, well-developed colluvial clay loams to sandy loams. Coarse fragments range from 0 to 25%. The water table is at least one meter below the surface.

Vegetation Description

Pseudotsuga menziesii (Douglas-fir) dominates the overstory with 10-60% cover. Other tree species that may be present include *Populus angustifolia* (narrowleaf cottonwood), *Populus tremuloides* (quaking aspen), *Abies concolor* (white fir), *Acer negundo* (boxelder), and *Picea pungens* (blue spruce). *Cornus sericea* (red-osier dogwood) forms a dense shrub layer with 20-75% cover. Other shrub species that may be present include *Acer glabrum* (mountain maple), *Quercus gambelii* (Gambel oak), *Alnus incana* (thinleaf alder), *Ribes* (currant), and *Prunus virginiana* (chokecherry). The ground is covered with a thick layer of duff and few herbaceous plants. This association is often the only type within a narrow valley profile. Adjacent

riparian areas may have *Cornus sericea* (red-osier dogwood) and *Acer glabrum* (Rocky Mountain maple) shrubland communities.

Ecological Processes

Pseudotsuga menziesii (Douglas-fir) is a non-obligate riparian species. This plant association is limited to narrow canyon bottoms where upland *Pseudotsuga menziesii* forests on north-facing slopes grade into riparian corridors. Narrow canyons with steep slopes create pockets of moist, cool air by funneling cold-air drainage and providing a microsite for *Pseudotsuga menziesii*. *Cornus sericea* (red-osier dogwood) is more abundant on level sites where water tables are periodically high. At lower elevations, *Pseudotsuga menziesi* can occur in cool valley bottoms where it cannot survive on warmer and drier valley slopes. Well drained colluvial soils also favor *Pseudotsuga menziesii* establishment.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
35	(20-74%)	Cornus sericea	7
34	(10-66%)	Pseudotsuga menziesii	7
30	(3-70%)	Acer glabrum	4
14	(5-32%)	Alnus incana ssp. tenuifolia	4
12	(5-19%)	Populus tremuloides	2
11	(1-30%)	Rosa woodsii	4
11	(4-18%)	Picea pungens	2
10	(10-10%)	Rhus trilobata var. trilobata	2
9	(5-13%)	Ribes inerme	2
7	(1-20%)	Populus angustifolia	4
7	(3-10%)	Salix exigua	2
6	(1-16%)	Prunus virginiana var. melanocarpa	3
6	(3-10%)	Amelanchier utahensis	3
5	(1-10%)	Equisetum hyemale var. affine	3
5	(2-11%)	Abies concolor	3
5	(1-10%)	Paxistima myrsinites	3

Other species with < 5% average cover present in at least 10% of plots:
Actaea rubra ssp. arguta (2-5%), Geranium richardsonii (1-5%), Fragaria vesca ssp. bracteata (1-4%), Equisetum arvense (1-5%), Maianthemum racemosum ssp. amplexicaule (1-5%), Quercus gambelii (1-6%), Heracleum maximum (1-3%), Rubus parviflorus (1-2%), Maianthemum stellatum (1-2%), Osmorhiza depauperata (1-2%), Symphoricarpos oreophilus (1-2%), Poa pratensis (1%), Vicia americana (1%), Galium triflorum (1%).

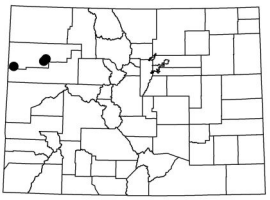
Douglas-fir / Snowberry Forest

Pseudotsuga menziesii / Symphoricarpos spp.

Global rank/State rank:
G5 / S4

HGM subclass: R3/4

Colorado elevation range:
6,500-8,400 ft (2,000-2,500 m)



General Description

Pseudotsuga menziesii (Douglas-fir) is not an obligate riparian species. It often occurs in ravines, canyons, and along narrow riparian areas and on the uplands as well. The *Pseudotsuga menziesii/Symphoricarpos* spp. (Douglas-fir/snowberry) plant association occurs on north-facing slopes in moist, cool, narrow canyons where *Pseudotsuga menziesii* occurs on the uplands and continues down into the riparian area. The steep slopes and dense shade limit the shrub or herbaceous understory.

In the eastern half of the White River Basin, this plant association appears to be restricted to steep north facing draws and ravines. It occurs along steep, mostly first-order, often ephemeral streams with steep side slopes. Stream channels are very steep (up to 16%) and narrow. The soil textures are coarse sandy loams with a high percentage of coarse rock fragments.

Vegetation Description

The overstory is 10-30% cover of *Pseudotsuga menziesii* (Douglas-fir) with 5-20% cover of *Symphoricarpos* spp. (snowberry) in the understory. Other shrub species include *Rosa woodsii* (Woods rose), *Amelanchier utahensis* (Utah serviceberry), and *Quercus gambelii* (Gambel oak). The herbaceous undergrowth is minor. This is usually the only riparian community along the river reach.

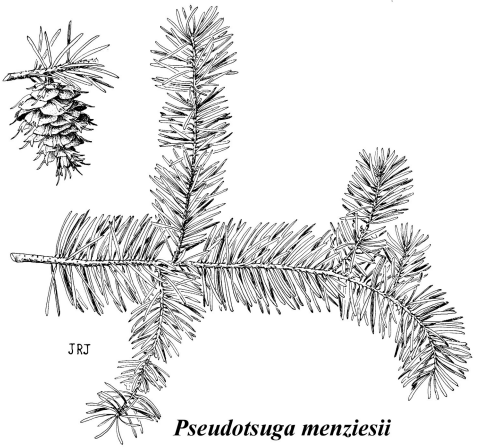
Ecological Processes

Because *Pseudotsuga menziesii* (Douglas-fir) is not an obligate riparian species, this association can also occur in large stands on the uplands where rainfall is adequate to maintain the community. The *Pseudotsuga menziesii/Symphoricarpos* spp. (Douglas-fir/snowberry) riparian association appears to be limited to very narrow canyon bottoms where upland *Pseudotsuga menziesii* forests on north facing slopes grade into riparian corridors. Narrow canyons with steep slopes create pockets of moist, cool air which create microsites for *Pseudotsuga menziesii*. Well-drained colluvial soils also aid in establishing *Pseudotsuga menziesii*. Steep slopes and coarse substrates also make this association highly susceptible to soil erosion.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
20	(10-30%)	Pseudotsuga menziesii	3
20	—	Populus tremuloides	1
15	(5-20%)	Symphoricarpos oreophilus	3
12	(5-20%)	Rosa woodsii	3
10	(1-20%)	Poa pratensis	3
6	(1-10%)	Juncus balticus var. montanus	2
5	(1-10%)	Juniperus scopulorum	3
5	(5%)	Achillea millefolium var. occidentalis	2
5	—	Amelanchier alnifolia	1
5	—	Galium triflorum	1
5	—	Galium mexicanum ssp. asperrimum	1
5	—	Veronica anagallis-aquatica	1
5	—	Thermopsis montana	1
5	—	Ranunculus cymbalaria	1
2	(1-5%)	Prunus virginiana var. melanocarpa	3

Other species with < 5% average cover present in at least 10% of plots:

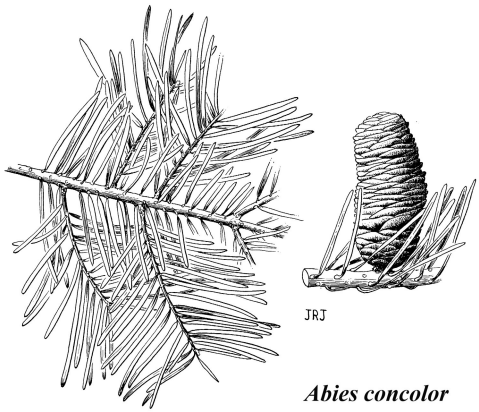
Taraxacum officinale (1%), Ipomopsis aggregata (1%), Maianthemum stellatum (1%), Geranium richardsonii (1%), Ericameria nauseosa ssp. nauseosa var. glabrata (1%), Hydrophyllum fendleri (1%), Vicia americana (1%), Urtica dioica ssp. gracilis (1%), Bromus inermis (1%), Erigeron subtrinervis (1%), Artemisia tridentata (1%), Heterotheca villosa (1%), Heracleum maximum (1%), Hedysarum boreale (1%), Glyceria striata (1%), Geum macrophyllum var. perincisum (1%), Elymus trachycaulus ssp. trachycaulus (1%), Galium boreale (1%), Alyssum desertorum (1%), Erigeron flagellaris (1%), Corydalis aurea (1%), Bromus tectorum (1%), Artemisia ludoviciana (1%), Carex geyeri (1%), Carex microptera (1%), Achnatherum hymenoides (1%), Comandra umbellata ssp. pallida (1%), Chenopodium fremontii (1%), Chenopodium foliosum (1%), Viola adunca (1%), Verbascum thapsus (1%), Vaccinium myrtillus var. oreophilum (1%), Thlaspi montanum (1%), Sium suave (1%), Sisymbrium loeselii (1%), Rumex crispus (1%), Rudbeckia laciniata var. ampla (1%), Ribes inerme (1%), Koeleria macrantha (1%), Pseudostellaria jamesiana (1%), Heuchera parvifolia var. parvifolia (1%), Penstemon barbatus (1%), Paxistima myrsinites (1%), Packera multilobata (1%), Osmorhiza depauperata (1%), Oenothera caespitosa (1%), Mentha arvensis (1%), Melilotus officinalis (1%), Lolium arundinaceum (1%), Viola canadensis var. scopulorum (1%), Ligusticum porteri (1%), Acer glabrum (1%), Juncus compressus (1%), Quercus gambelii (1%).



Pseudotsuga menziesii

GROUP B:
MIXED CONIFEROUS AND DECIDUOUS FORESTS AND WOODLANDS

Association	Page
Abies concolor-(Picea pungens)-Populus angustifolia/Acer glabrum White fir-(Blue spruce)-Narrowleaf cottonwood/Rocky Mountain maple Forest	84
Abies lasiocarpa-Picea engelmannii-Populus angustifolia/(Lonicera) involucrata Subalpine fir-Engelmann spruce-Narrowleaf cottonwood/(Twinberry honeysuckle) Forest	86
Populus angustifolia-Juniperus scopulorum Narrowleaf cottonwood-Rocky Mountain juniper Woodland	88
Populus angustifolia-Picea pungens/Alnus incana ssp. *tenuifolia* Narrowleaf cottonwood-Blue spruce/Thinleaf alder Woodland	90
Populus angustifolia-Pseudotsuga menziesii Narrowleaf cottonwood-Douglas-fir Woodland	92



Abies concolor

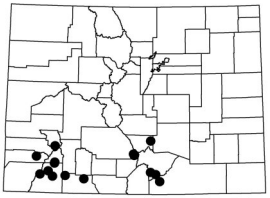
White fir - (Blue spruce) - Narrowleaf cottonwood / Rocky Mountain maple Forest

Abies concolor - (Picea pungens) - Populus angustifolia / Acer glabrum

Global rank/State rank:
G2 / S2

HGM subclass: R3/4

Colorado elevation range:
7,200-9,100 ft (2,200-2,770 m)



General Description

The *Abies concolor-(Picea pungens)-Populus angustifolia/Acer glabrum* (white fir-blue spruce-narrowleaf cottonwood/Rocky Mountain maple) plant association is a diverse, mixed conifer-deciduous forest occurring on active floodplains and stream banks of montane valley floors. The presence of *Abies concolor* distinguishes this community from the more common *Populus angustifolia-Picea pungens/Alnus incana* (narrowleaf cottonwood-blue spruce/thinleaf alder) plant association, and is indicative of the southern-most mountains in Colorado. *Picea pungens* (blue spruce) is often an upper canopy component but is not present in all stands. This is reflected in the association name by placing *Picea pungens* in parentheses.

This community is located in narrow to moderately wide valleys, 50-300 ft (17-100 m) on immediate stream banks, floodplains and upper terraces, 1-6.5 ft, 1.5 ft avg. (0.3-2.0 m, 0.35 avg. m), above the channel high-water level. Streams are steep to moderately steep, straight to moderately sinuous (2-6%, average 4% gradient). The soils are well drained and poorly developed mineral soils with shallow sandy loams over coarse alluvial materials.

Vegetation Description

The upper canopy is diverse, dominated by *Populus angustifolia* (narrowleaf cottonwood) and *Abies concolor* (white fir) and usually including several other tree species such as *Picea pungens* (blue spruce), *Abies lasiocarpa* (subalpine fir), and *Pseudotsuga menziesii* (Douglas-fir). Shrubs are thickest near the stream channel with *Acer glabrum* (Rocky Mountain maple) being the most commonly encountered and

abundant species. Other shrubs often present include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Betula occidentalis* (river birch), *Cornus sericea* (red-osier dogwood), *Amelanchier utahensis* (Utah serviceberry), *Jamesia americana* (wax flower), *Lonicera involucrata* (twinberry honeysuckle), *Mahonia repens* (Oregon grape), *Salix bebbiana* (Bebb willow), *S. drummondiana* (Drummond willow), *S. monticola* (mountain willow), *Symphoricarpos* spp. (snowberry), *Ribes* spp. (current), and *Rosa woodsii* (Woods rose).

The herbaceous undergrowth is variable, depending on site conditions, but is generally sparse, with less than 20% total cover. No one species is present in all stands. Common forb species include *Heracleum maximum* (common cowparsnip), *Geranium richardsonii* (Richardson geranium), *Vicia americana* (American vetch), *Viola* spp. (violet), *Osmorhiza berteroi* (sweet cicely), *Maianthemum stellatum* (starry false Solomon seal), *Mertensia ciliata* (tall fringed bluebells). Graminoid species include *Elymus glaucus* (blue wildrye), *Bromus inermis* (smooth brome), and *Poa pratensis* (Kentucky bluegrass).

Ecological Processes

This plant association is a mid- to late-seral community. High elevations and cool, shaded canyon bottoms create an environment for *Abies concolor* (white fir) and *Picea pungens* (blue spruce). The active channel flooding and sediment deposition along the reach allows *Populus angustifolia* (narrowleaf cottonwood) to persist. On higher terraces that no longer experience flooding, *Abies* and *Picea* may become the climax tree species.

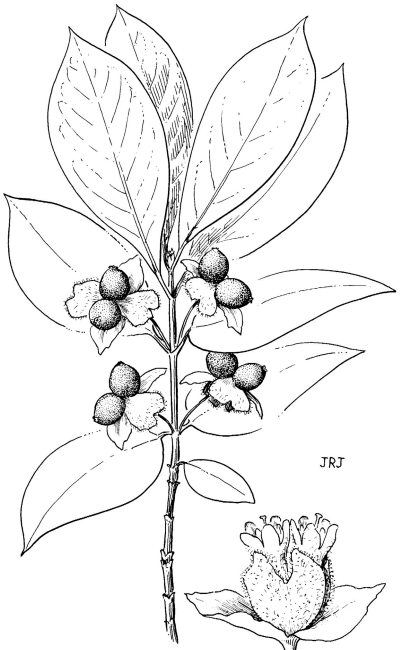
Avg. Cover %	(Range)	Species Name	# Plots (N=15)
45	(20-100%)	Populus angustifolia	14
33	(5-60%)	Picea pungens	6
29	(5-66%)	Abies concolor	13*
20	(1-62%)	Acer glabrum	12
15	(1-50%)	Alnus incana ssp. tenuifolia	10
13	(1-36%)	Pseudotsuga menziesii	10
12	(1-27%)	Salix drummondiana	5
8	(1-30%)	Heracleum maximum	5
7	(1-30%)	Amelanchier alnifolia	7
7	(1-30%)	Elymus glaucus	5
6	(1-20%)	Lonicera involucrata	8
5	(1-10%)	Symphoricarpos oreophilus	5

Other species with < 5% average cover present in at least 10% of plots:
Rudbeckia laciniata var. ampla (1-10%), Taraxacum officinale (1-7%), Rosa woodsii (1-10%), Geranium richardsonii (1-7%), Poa pratensis (1-11%), Maianthemum stellatum (1-4%), Thalictrum fendleri (1-3%), Chamerion angustifolium ssp. circumvagum (1-4%), Actaea rubra ssp. arguta (1-3%), Equisetum arvense (1-3%), Galium triflorum (1-3%), Mertensia ciliata (1-3%), Oxypolis fendleri (1%), Achillea millefolium var. occidentalis (1%).

*Abies concolor occurred in all stands, but was not captured in every sample plot.

Subalpine fir - Engelmann spruce - Narrowleaf cottonwood / (Twinberry honeysuckle) Forest

Abies lasiocarpa - Picea engelmannii - Populus angustifolia / (Lonicera involucrata)

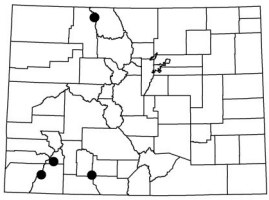


Lonicera involucrata

Global rank/State rank:
G4 / S3

HGM subclass: R2**,** R3/4

Colorado elevation range:
8,300-9,500 ft (2,500-2,800 m)



General Description

The *Abies lasiocarpa-Picea engelmannii-Populus angustifolia/(Lonicera involucrata)* (subalpine fir-Engelmann spruce-narrowleaf cottonwood/(twinberry honeysuckle)) plant association is an unusual combination occurring at the upper elevational limits of *Populus angustifolia* (narrowleaf cottonwood) and is generally restricted to the southern parts of the Colorado Rockies. One plot from Routt County is tentatively plassed in this association as well.

The community occurs on active floodplains of larger rivers in the upper montane valleys, on terraces or elevated stream benches between 1.5-7 ft (0.5-1.2 m) above the active channel elevation. The rivers are wide and slightly sinuous. Soils are fairly shallow (6-15 in, 10-40 cm) sandy loam and sand over deep, coarse alluvial materials.

Vegetation Description

The overstory is a mix of *Picea engelmannii* (Engelmann spruce) and *Populus angustifolia* (narrowleaf cottonwood). Other tree species that may be present include

Abies lasiocarpa (subalpine fir), *Abies concolor* (white fir) seedling and saplings, and *Pseudotsuga menziesii* (Douglas-fir). Overall, shrubs are not abundant and provide less than 50% cover. *Lonicera involucrata* (twinberry honeysuckle) is the most constant shrub species, but may not be abundant. Other species include *Acer glabrum* (Rocky Mountain maple), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Salix geyeriana* (Geyer willow), and *Symphoricarpos oreophilus* (mountain snowberry). Herbaceous cover is sparse and no species is consistently present. The most typical species include *Bromus canadensis* (Canadian brome), *Festuca rubra* (red fescue), *Fragaria virginiana* (strawberry), *Heracleum maximum* (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), and *Geranium richardsonii* (Richardson geranium).

Ecological Processes

The *Abies lasiocarpa-Picea engelmannii-Populus angustifolia/(Lonicera involucrata)* (subalpine fir-Engelmann spruce-narrowleaf cottonwood/(twinberry honeysuckle)) plant association is a mid- to late-seral community. *Populus angustifolia* (narrowleaf cottonwood) will continue to co-occur with conifer species where fluvial activity (e.g., flooding, channel migration, sediment deposition, and scouring) persists. Higher elevations and cool, shaded canyon bottoms create an environment for *Abies lasiocarpa* (subalpine fir) and *Picea engelmannii* (Engelmann spruce). The active channel flooding and sediment deposition allows *Populus angustifolia* (narrowleaf cottonwood) to persist or regenerate. On higher terraces that no longer experience flooding, *Abies* and *Picea* may become the climax tree species.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
49	(20-93%)	Populus angustifolia	6*
21	(4-55%)	Abies lasiocarpa	5
20	(10-30%)	Picea engelmannii	7
19	(2-44%)	Pseudotsuga menziesii	3
10	(3-20%)	Alnus incana ssp. tenuifolia	4
8	(1-20%)	Lonicera involucrata	6*
7	(3-10%)	Ribes lacustre	2
6	(1-10%)	Salix monticola	2
6	(1-10%)	Heterotheca villosa	2
5	(1-10%)	Geranium richardsonii	5
4	(3-5%)	Senecio atratus	2

Other species with < 5% average cover present in at least 10% of plots:
Thalictrum fendleri (1-10%), Picea pungens (2-5%), Heracleum maximum (1-5%), Taraxacum officinale (1-7%), Populus tremuloides (1-4%), Acer glabrum (1-3%), Osmorhiza depauperata (1-5%), Cornus sericea ssp. sericea (1-3%), Solidago simplex ssp. simplex var. simplex (1-3%), Erigeron glabellus (1-3%), Pedicularis procera (1-3%), Maianthemum stellatum (1-5%), Fragaria virginiana ssp. glauca (1-3%), Symphoricarpos oreophilus (1-3%), Ligusticum porteri (1-3%), Actaea rubra ssp. arguta (1-3%), Achillea millefolium var. occidentalis (1-3%), Bromus inermis (1-2%), Bromus ciliatus var. ciliatus (1-2%), Mertensia ciliata (1-1%), Paxistima myrsinites (1-1%), Chamerion angustifolium ssp. circumvagum (1-1%), Galium triflorum (1-1%), Senecio triangularis (1-1%), Amelanchier alnifolia (1-1%), Ribes montigenum (1-1%), Vicia americana (1-1%), (-%),

* Populus angustifolia occurred in all stands, but was not captured in every sample plot.

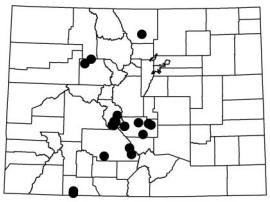
Narrowleaf cottonwood - Rocky Mountain juniper Woodland

Populus angustifolia - Juniperus scopulorum

Global rank/State rank:
G2G3 / S3

HGM subclass: R3/4

Colorado elevation range:
6,000-8,600 ft (1,800-2,600 m)



General Description

Populus angustifolia (narrowleaf cottonwood) and *Juniperus scopulorum* (Rocky Mountain juniper) dominated riparian areas are uncommon. The community occurs along lower foothill streams with perennial to intermittent stream flows. Total biomass and canopy cover are often low. The association is characterized by an open canopy of *Populus angustifolia* (narrowleaf cottonwood) and *Juniperus scopulorum* (Rocky Mountain juniper), often with little else growing in the understory. The species composition and percent cover is variable and depends on aspect, elevation, and stream flow, in addition to the degree of disturbance by recreational use and livestock grazing.

Stream channels are steep and narrow with rocky to sandy bottoms. This association can also occur on upper terraces and elevated islands of wide, meandering river reaches such as those found along the Arkansas and Colorado Rivers. Valley widths are typically 700 ft (200 m) or less and stream gradients are generally low to moderate (0.5-2.5%). *Juniperus scopulorum* (Rocky Mountain juniper) is situated at the high water line and above, while the *Populus angustifolia* (narrowleaf cottonwood) grades into the active floodplain area. Soils of this plant association are derived from alluvial deposits. The surface soils consist of loamy sand, clay loams, silty clays or organic matter. Subsurface layers range from sandy loams and loamy sands to clay loams and sandy clay loams with 20-50% gravel and cobbles. Soil depth ranges from 15-25 inches (40 to 65 cm).

Vegetation Description

This plant association is characterized by an open to closed canopy of 20-100% cover of *Populus angustifolia* (narrowleaf cottonwood) and scattered to abundant *Juniperus*

scopulorum (Rocky Mountain juniper) with 5-85% cover. Stands with northern aspects may include *Pseudotsuga menziesii* (Douglas-fir) or *Populus tremuloides* (quaking aspen). Two stands in the lower San Juan watershed with *Juniperus osteosperma* (Utah juniper), rather than *J. scopulorum* (Rocky Mountain juniper), are included in this type.

There is very little shrub canopy and little to no herbaceous undergrowth due to dry conditions. If present, the shrub canopy may include a wide variety of species, although none is present in every stand. Shrub species may include *Clematis ligusticifolia* (western white clematis), *Acer glabrum* (Rocky Mountain maple), *Rhus trilobata* (skunkbush sumac), *Symphoricarpos oreophilus* (mountain snowberry), *Quercus gambelii* (Gamble oak), and *Berberis fendleri* (Colorado barberry).

Non-native species are some of the more commonly encountered herbaceous components of this association, and generally occur in disturbed stands. Species include *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (dandelion), *Agrostis stolonifera* (creeping bentgrass), and *Melilotus officinalis* (sweet clover).

Ecological Processes

As with all cottonwood woodlands, this association is found within a continually changing alluvial environment where riparian vegetation is constantly being "re-set" by flooding disturbance. Mature cottonwood stands do not regenerate in place, but regenerate by "moving" up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities. The process of cottonwood regeneration is dependent on flooding disturbance. Periodic flooding allows cottonwood seedlings to germinate and become established on newly deposited, moist sandbars. Natural river processes of bank erosion, deposition and channel migration result in a dynamic patchwork of different age classes, plant associations and habitats.

Avg. Cover %	(Range)	Species Name	# Plots (N=20)
51	(12-97%)	Populus angustifolia	20
29	(3-86%)	Juniperus scopulorum	18
12	(6-22%)	Quercus gambelii	3
11	(3-24%)	Carex utriculata	3
10	(1-29%)	Poa pratensis	13
9	(0.1-30%)	Maianthemum stellatum	6
9	(6-12%)	Pseudotsuga menziesii	3
9	(1-23%)	Alnus incana ssp. tenuifolia	3
8	(1-18%)	Acer glabrum	4
7	(1-17%)	Agrostis stolonifera	6
6	(1-27%)	Clematis ligusticifolia	10
6	(1-12%)	Melilotus officinalis	6

Other species with < 5% average cover present in at least 10% of plots:
Leymus cinereus (1-10%), Medicago lupulina (1-8%), Equisetum arvense (1-8%), Thermopsis divaricarpa (2-7%), Trifolium repens (1-7%), Thalictrum fendleri (1-4%), Juncus balticus var. montanus (1-6%), Rhus trilobata var. trilobata (1-6%), Equisetum hyemale var. affine (1-6%), Rosa woodsii (0.1-5%), Salix exigua (1-3%), Achillea millefolium var. occidentalis (1-3%), Symphoricarpos oreophilus (1-2%), Taraxacum officinale (1-3%), Artemisia ludoviciana (1-2%), Bromus tectorum (1%), Pascopyrum smithii (1%), Tragopogon dubius (1%).

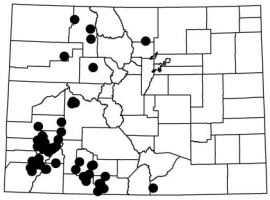
Narrowleaf cottonwood - Blue spruce / Thinleaf alder Woodland

Populus angustifolia - Picea pungens / Alnus incana ssp. *tenuifolia*

Global rank/State rank:
G4 / S4

HGM subclass: R2?, R3/4

Colorado elevation range:
6,800-9,600 ft (2,070-2,925 m)



General Description

This is a common mixed deciduous-evergreen community of montane valleys, where *Populus angustifolia* (narrowleaf cottonwood) and *Picea pungens* (blue spruce) are co-dominant along a stream reach. Frequently, other conifer trees are present, but not as abundant as *Picea pungens* (blue spruce). The shrub understory is typically dense and diverse. *Alnus incana* ssp. *tenuifolia* (thinleaf alder) is almost always present. Only a handful of good condition stands are known, and the community is highly threatened by improper livestock grazing, heavy recreational use, and stream flow alterations.

This association occurs in valleys with narrow to moderately wide floodplains, 30-600 ft (10-200 m), and in deep canyons. This association is commonly found on slightly meandering to meandering floodplains of broad reaches. Occasionally, stands occur along steep reaches. Soils range from shallow sandy loams to silty clay loams and clays over cobbles and boulders. Profiles are generally highly stratified, with layers of fine soils over layers of coarser sediments.

Vegetation Description

The upper canopy is dominated by *Populus angustifolia* (narrowleaf cottonwood) and either *Picea pungens* (blue spruce) or *Picea engelmannii* (Engelmann spruce). Other less frequently encountered tree species may also be present and include *Pseudotsuga menziesii* (Douglas-fir), *Abies concolor* (white fir), *Populus tremuloides* (quaking aspen), and *Abies lasiocarpa* (subalpine fir). *Alnus incana* ssp. *tenuifolia* (thinleaf alder) is almost always present in the shrub canopy layer, although cover amounts vary and other shrub species may be more abundant. *Lonicera involucrata* (twinberry honeysuckle) is the most frequently encountered species after *Alnus*. Many other shrub species can occur within this association, including *Amelanchier alnifolia*

(Saskatoon serviceberry), *Acer glabrum* (Rocky Mountain maple), *Salix drummondiana* (Drummond willow), *S. exigua* (sandbar willow), *S. lucida* ssp. *caudata* (shining willow), *S. geyeriana* (Geyer willow), *S. boothii* (Booth willow), *Prunus virginiana* (chokecherry), and *Symphoricarpos oreophilus* (mountain snowberry).

The undergrowth is diverse and can be sparse or dense, depending on local conditions. Total herbaceous cover rarely exceeds 40%. *Maianthemum stellatum* (starry false Solomon seal) and *Geranium richardsonii* (Richardson geranium) are frequently found. Graminoid cover is less diverse than forb cover.

Ecological Processes

This mixed deciduous-evergreen plant association is a mid-seral community. With continued fluvial activity, such as flooding, channel migration, sediment deposition, and scouring, narrowleaf cottonwood and blue spruce will continue to co-occur along the reach. Gradual and slightly sinuous stream channels that have overbank flow and sediment deposition favor establishment of *Populus angustifolia*. *Picea pungens* is favored along reaches in deep valleys with steep canyon walls that provide conditions for strong cold-air drainage. If the floodplain is no longer active, i.e., is no longer flooded because the stream channel has become lower (surface becomes a terrace) or upstream dams control floods, then cottonwoods will eventually die and the conifers may persist.

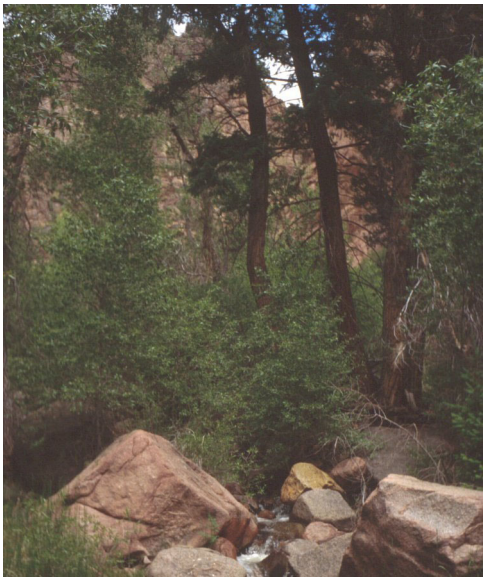
Avg. Cover %	(Range)	Species Name	# Plots (N=51)
34	(2-90%)	Populus angustifolia	51*
28	(1-60%)	Betula occidentalis	8
27	(0.1-90%)	Alnus incana ssp. tenuifolia	41
25	(1-80%)	Picea pungens	51
17	(1-50%)	Picea engelmannii	9
17	(1-96%)	Cornus sericea ssp. sericea	31
11	(1-50%)	Salix ligulifolia	15
11	(1-25%)	Pseudotsuga menziesii	17
9	(1-50%)	Acer glabrum	12
7	(1-40%)	Lonicera involucrata	33
7	(1-28%)	Populus tremuloides	8
7	(1-23%)	Abies concolor	9
7	(1-15%)	Salix drummondiana	11
6	(2-20%)	Salix exigua	8
6	(1-30%)	Calamagrostis canadensis	8
5	(1-30%)	Salix monticola	15
5	(1-20%)	Prunus virginiana var. melanocarpa	8
5	(1-15%)	Amelanchier alnifolia	17

Other species with < 5% average cover present in at least 10% of plots:
Rudbeckia laciniata var. ampla (1-16%), Symphoricarpos rotundifolius (1-30%), Salix bebbiana (0.1-15%), Equisetum arvense (1-10%), Maianthemum stellatum (0.1-30%), Elymus glaucus (1-20%), Equisetum hyemale var. affine (1-20%), Geranium richardsonii (1-10%), Heracleum maximum (1-11%), Osmorhiza depauperata (1-30%), Poa pratensis (1-16%), Actaea rubra ssp. arguta (1-10%), Taraxacum officinale (0.1-16%), Mertensia franciscana (1-9%), Ligusticum porteri (1-10%), Fragaria virginiana ssp. glauca (1-9%), Rosa woodsii (0.1-9%), Thalictrum fendleri (1-10%), Pseudocymopterus montanus (1-10%), Ribes inerme (1-5%), Viola canadensis var. scopulorum (1-10%), Amelanchier utahensis (0.1-3%), Paxistima myrsinites (1-4%), Galium triflorum (1-10%), Chamerion angustifolium ssp. circumvagum (1-3%), Equisetum pratense (1-4%), Rubus idaeus ssp. strigosus (1-5%), Geum macrophyllum var. perincisum (0.1-4%), Cardamine cordifolia (1-4%), Achillea millefolium var. occidentalis (1-5%), Vicia americana (1-5%), Galium boreale (0.1-5%), Oxypolis fendleri (1-4%), Mertensia ciliata (0.1-5%).

*Populus angustifolia occurred in all stands, but was not captured in every sample plot.

Narrowleaf cottonwood - Douglas-fir Woodland

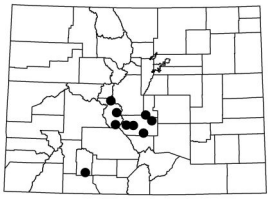
Populus angustifolia - Pseudotsuga menziesii



Global rank/State rank:
G3 / S2

HGM subclass: R3/4

Colorado elevation range:
7,100-8,700 ft (2,150-2,700 m)



General Description

This plant association occurs in the San Juan National Forest and in parts of the upper Arkansas River Basin. It is also expected to occur in narrow foothill canyons of the Colorado Front Range. The *Populus angustifolia-Pseudotsuga menziesii* (narrowleaf cottonwood-Douglas-fir) plant association is limited to narrow canyon bottoms and V-shaped valleys where a northern or protected aspect creates cool micro-environments. This association represents a transition from lower montane to upper montane habitats. Nearly all stands observed have an adjacent north-facing slope with *Pseudotsuga menziesii* (Douglas-fir) forests.

The association grows in wash bottoms and on immediate stream banks, cobble bars, and terraces. Stream channels are steep and narrow with streambeds of bedrock, sand, or silt. This association also occurs on slightly meandering floodplains of broad reaches with coarse channel bed material. The soils are derived from alluvial and colluvial deposits and are fairly shallow, 10-30 inches (25-75 cm) thick. The soils become skeletal with depth. Surface layers are sandy loams, clay loams, and loams. Subsurface layers are sandy loams with 10-30% cobbles and gravels. Organic matter from accumulated litter is concentrated in the upper layers.

Vegetation Description

The upper canopy of this plant association is dominated by *Pseudotsuga menziesii* (Douglas-fir) and *Populus angustifolia* (narrowleaf cottonwood). The mix of these two species as mature trees in the overstory canopy is the diagnostic characteristic for

this plant association. *Juniperus scopulorum* (Rocky Mountain juniper) or *Abies concolor* (white fir) may also be present. Several other conifer tree species may be present, but with less than 1% cover. Shrub cover is typically low, but is highly variable and diverse. No single species was present in all stands sampled. Shrub species include *Acer glabrum* (Rocky Mountain maple), *Salix exigua* (sandbar willow), *Betula occidentalis* (river birch), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Quercus gambelii* (Gambel oak), *Salix lucida* ssp. *caudata* (shining willow), *Clematis ligusticifolia* (western white clematis), and *Ribes cereum* (wax currant).

The herbaceous undergrowth can be sparse and is usually limited by heavy shade and dry soil conditions. Herbaceous species include *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (dandelion), *Achillea millefolium* var. *occidentalis* (western yarrow), *Trifolium repens* (white clover), and *Agrostis stolonifera* (creeping bentgrass).

Ecological Processes

Pseudotsuga menziesii (Douglas-fir) is a non-obligate riparian species and in Colorado riparian communities dominated by this species are uncommon. Observed stands of the *Populus angustifolia-Pseudotsuga menziesii* plant association were composed of mature trees, appear to be late-seral, and were limited to narrow canyon bottoms where upland *Pseudotsuga menziesii* forests grade into the riparian corridor or invade late successional terraces. Narrow canyons with steep slopes create pockets of moist, cool air by funneling cold-air downwards and providing a microsite for *Pseudotsuga menziesii*. Well-drained colluvial soils favor *Pseudotsuga menziesii* establishment.

Along broader, meandering rivers, *Pseudotsuga menziesii* can occur on upper terraces with stands of *Populus angustifolia*. These stands likely represent a drier occurrence of a *Populus angustifolia* community where *Pseudotsuga menziesii* is not an indicator of riparian condition. However, at lower elevations and in narrow valleys with cold air drainage, *Pseudotsuga menziesii*, co-dominating with *Populus angustifolia* on stream banks and floodplains, represents a perpetual riparian community.

Avg. Cover %	(Range)	Species Name	# Plots (N=9)
39	(26-59%)	Populus angustifolia	9
24	(8-45%)	Pseudotsuga menziesii	9
11	(5-17%)	Clematis ligusticifolia	2
10	(5-15%)	Trifolium repens	3
8	(1-18%)	Acer glabrum	5
7	(4-13%)	Alnus incana ssp. tenuifolia	3
6	(1-14%)	Ribes cereum	3
6	(2-8%)	Juniperus scopulorum	6
6	(1-10%)	Melilotus officinalis	2
5	(2-11%)	Salix exigua	3
4	(1-13%)	Poa pratensis	8

Other species with < 5% average cover present in at least 10% of plots:
Geranium richardsonii (1-15%), Abies concolor (2-5%), Achnatherum hymenoides (1-6%), Agrostis stolonifera (1-6%), Elymus repens (2-3%), Bromus inermis (2-3%), Taraxacum officinale (1-4%), Holodiscus dumosus (1-2%), Rosa woodsii (1-2%), Thalictrum fendleri (1-2%), Symphoricarpos oreophilus (1-2%), Achillea millefolium var. occidentalis (1%), Bromus tectorum (1%), Medicago lupulina (1%), Heterotheca villosa (1%), Heracleum maximum (1%), Elymus trachycaulus ssp. trachycaulus (1%), Ribes inerme (1%).

GROUP C:
DECIDUOUS DOMINATED FORESTS AND WOODLANDS

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Quaking aspen/Tall forb Forest
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Peachleaf willow Woodland

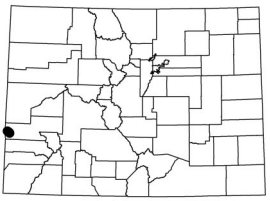
Boxelder / River birch Woodland

Acer negundo / Betula occidentalis

Global rank/State rank:
G1G2 / S1

HGM subclass: R3/4

Colorado elevation range:
5,000-6,100 ft (1,500-1,900 m)



General Description

The *Acer negundo/Betula occidentalis* (boxelder/river birch) plant association is a medium-tall (8-15 ft, 2.5-5.5 m) deciduous woodland. It grows in narrow, sandstone box canyons of western Colorado where it is known from only three locations on the extreme western edge of the state. It appears to be a very unusual combination, and is considered a rare plant association.

The association occurs on immediate stream banks within 10 ft (2 m) of the channel. The stream channel is highly sinuous with well developed sandy point bars. The soils are shallow to deep sand or loam over cobbles.

Vegetation Description

Acer negundo (boxelder) dominates the overstory, typically with 40-70% cover. The shrub layer is dominated by 20-80% cover of *Betula occidentalis* (river birch). Other shrub species include *Salix exigua* (sandbar willow), *Forestiera pubescens* (wild privet), and *Clematis ligusticifolia* (western white clematis). Herbaceous undergrowth is sparse, with *Poa pratensis* (Kentucky bluegrass), *Equisetum hyemale* (scouringrush horsetail), and *Elymus repens* (quackgrass).

Ecological Processes

Stands dominated by *Acer negundo* (boxelder) may be a riparian climax type until the site becomes drier from channel migrating or downcutting. This association appears to flourish in narrow canyons with natural flood regimes or altered flows (e.g., Black Canyon of the Gunnison). With scouring floods, *Acer negundo* may survive only if it

grows on upper colluvial slopes. This may provide a seed source for regeneration after flooding and deposition.

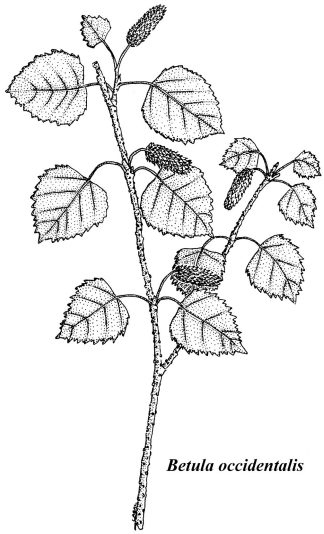
The age-class distribution of *Acer negundo* along riparian corridors is distinct. Juvenile trees obtain water directly from the stream channel or from the upper soil horizons that have been recharged by stream water. Mature trees, however, tap into the deeper groundwater. The use of groundwater by adult trees may provide a constant source of water as stream flows drop in the late summer, thus reducing their chance of mortality during summer droughts.

Avg. Cover %	(Range)	Species Name	# Plots (N=4)
53	(20-80%)	Betula occidentalis	3*
41	(5-70%)	Acer negundo var. interius	4
16	(1-30%)	Forestiera pubescens	2
12	(1-30%)	Salix exigua	3
10	—	Elymus repens	1
6	(1-10%)	Equisetum hyemale var. affine	2
6	(1-10%)	Rosa woodsii	2
5	(1-10%)	Poa pratensis	3
5	(1-10%)	Clematis ligusticifolia	3
5	(5%)	Elymus trachycaulus ssp. trachycaulus	2
5	—	Glycyrrhiza lepidota	1

Other species with < 5% average cover present in at least 10% of plots:
Artemisia ludoviciana (1-5%), Bromus tectorum (1-5%), Equisetum laevigatum (1%), Phalaris arundinacea (1%), Agrostis stolonifera (1%), Salix monticola (1%), Artemisia tridentata (1%), Brickellia grandiflora (1%), Ericameria nauseosa ssp. nauseosa var. glabrata (1%), Elymus elymoides (1%), Lolium pratense (1%), Juncus balticus var. montanus (1%), Verbascum thapsus (1%), Eurybia glauca (1%), Poa fendleriana (1%).

*Betula occidantalis occurred in all stands, but was not captured in every sample plot.

Acer negundo



Betula occidentalis

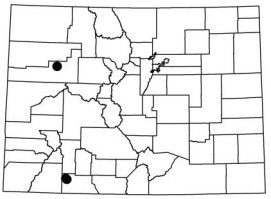
Boxelder / Red-osier dogwood Forest

Acer negundo / Cornus sericea

Global rank/State rank:
G3? / S2

HGM subclass: R3/4

Colorado elevation range:
6,800-7,700 ft (2,070-2,300 m)



General Description

The *Acer negundo/Cornus sericea* (boxelder/red-osier dogwood) plant association is a medium-tall (5-15 ft, 1.5-4.5 m) deciduous forest. It flourishes in narrow, shady canyons, often with a controlled stream flow and is known from lower montane canyons in Utah and western Colorado.

This plant association occurs within narrow, 40 ft (12 m) wide, box canyons about 10 ft (2-3 m) above the channel bankfull level. Stream channels are steep and narrow or moderately wide and sinuous. The soil textures are sandy loams to clay loams.

Vegetation Description

Acer negundo (boxelder) dominates the overstory with 15-70% cover. The shrub layer is dense and diverse with *Cornus sericea* (red-osier dogwood) (40-60% cover) as the dominant shrub. Other shrub species (present with 50% or less frequency) include *Ribes inerme* (whitestem gooseberry), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Acer glabrum* (Rocky Mountain maple), *Salix exigua* (sandbar willow), *Quercus gambelii* (Gambel oak), *Rubus idaeus* (American red raspberry), and *Salix irrorata* (bluestem willow). Forb and graminoid species include *Heracleum maximum* (common cowparsnip), *Geranium richardsonii* (Richardson geranium), *Actaea rubra* (red baneberry), and *Mertensia franciscana* (Franciscan bluebells).

Ecological Processes

Acer negundo (boxelder) may be a riparian climax type, unless the site becomes too dry due to channel migration and downcutting. This association appears to flourish in narrow canyons with natural flood regimes or altered flows (e.g., Black Canyon of the Gunnison). With scouring floods, *Acer negundo* may survive only if it grows on upper colluvial slopes. This may provide a seed source for regeneration after flooding and deposition.

Avg. Cover %	(Range)	Species Name	# Plots (N=4)
47	(40-60%)	Cornus sericea	3*
33	(15-70%)	Acer negundo var. interius	4
33	(5-60%)	Ribes inerme	2
19	(12-26%)	Alnus incana ssp. tenuifolia	2
11	(7-14%)	Picea pungens	2
8	(1-15%)	Heracleum maximum	2
8	(5-10%)	Rubus idaeus ssp. strigosus	2
7	(5-10%)	Actaea rubra ssp. arguta	3
6	(4-8%)	Carex geyeri	2
6	(1-10%)	Geranium richardsonii	4
5	(4-5%)	Rosa woodsii	3

Other species with < 5% average cover present in at least 10% of plots:

Abies concolor (4-5%), Viola canadensis var. scopulorum (1-5%), Poa pratensis (1-5%), Aconitum columbianum (1-5%), Rudbeckia laciniata var. ampla (1-5%), Dactylis glomerata (1-5%), Elymus glaucus (1-5%), Angelica ampla (1-5%), Equisetum pratense (1-4%), Ligusticum porteri (1-5%), Galium triflorum (1-5%), Lonicera involucrata (1-3%), Vicia americana (1-3%), Fragaria vesca ssp. bracteata (1-2%), Taraxacum officinale (1-2%), Agrostis gigantea (1-2%), Maianthemum stellatum (1%), Galium boreale (1%), Maianthemum racemosum ssp. amplexicaule (1%), Achillea millefolium var. occidentalis (1%).

*Cornus sericea occurred in all stands, but was not captured in every sample plot.

Cornus sericea

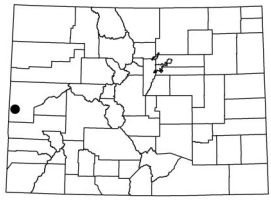
Boxelder - Narrowleaf cottonwood / Netleaf hackberry Forest

Acer negundo - Populus angustifolia / Celtis laevigata var. *reticulata*

Global rank/State rank:
G1Q / S1Q

HGM subclass: R3/4

Colorado elevation range:
5,900 ft (1,800 m)



General Description

The *Acer negundo-Populus angustifolia/Celtis laevigata* var. *reticulata* (boxelder-narrowleaf cottonwood/netleaf hackberry) plant association is a tall (12-25 ft, 4-8 m), multi-layered deciduous forest. It is a provisionally described community known from only one location on a seep in Unaweep Canyon in Mesa County. This forest occurs in a complex wetland with several other provisionally described woody and herbaceous plant associations. The forest occurs in dense patches around several small channels fed by the seep. Along these rivulets are wet meadow communities dominated by *Eleocharis palustris* (common spikerush) with *Schoenoplectus tabernaemontani* (softstem bulrush) and *Phragmites australis* (common reed). The hillside seep drains into a fast moving creek with *Alnus incana* ssp. *tenuifolia* with abundant *Eupatorium maculatum* (spotted joepyeweed) in the undergrowth and *Salix exigua* (sandbar willow) riparian shrublands.

This plant association occurs on a hillside seep above a moderately wide valley. Stream channels are tiny rivulets draining the hillside seep. Soils are shallow silty clay loam and sandy loam.

Vegetation Description

This plant association is characterized by a deciduous tree canopy of *Celtis laevigata* var. *reticulata* (netleaf hackberry), *Populus angustifolia* (narrowleaf cottonwood) and scattered cover of *Acer negundo* (boxelder). The shrub understory includes *Clematis ligusticifolia* (western white clematis), *Rhus trilobata* (skunkbush sumac), *Betula occidentalis* (river birch) and the non-native *Rubus discolor* (Himalayan blackberry). The herbaceous undergrowth is dense, but dominated by non-native weedy species, such as *Melilotus officinalis* (yellow sweetclover), *Taraxacum officinale* (dandelion), and *Nepeta cataria* (catnip).

Ecological Processes

This plant association appears similar to the *Acer negundo-Populus angustifolia/ Cornus sericea* association, but does not occur on an alluvial floodplain. Seed deposition and establishment of the dominant canopy species in the *Acer negundo-Populus angustifolia/Celtis laevigata* var. *reticulata* association is not dependent on alluvial processes, but bare ground for seedling establishment is created by ground slumping.

Avg. Cover %	(Range)	Species Name	# Plots (N=1)
70	—	Clematis ligusticifolia	1
50	—	Celtis laevigata var. reticulata	1
20	—	Bidens frondosa	1
20	—	Phalaris arundinacea	1
20	—	Rhus trilobata var. trilobata	1
20	—	Rubus discolor	1
20	—	Holcus lanatus	1
10	—	Betula occidentalis	1
10	—	Glyceria striata	1
10	—	Melilotus officinalis	1
10	—	Toxicodendron rydbergii	1
10	—	Nepeta cataria	1
10	—	Phleum pratense	1
10	—	Populus angustifolia	1
10	—	Taraxacum officinale	1
5	—	Equisetum arvense	1
5	—	Eupatorium maculatum	1
5	—	Arctium minus	1

Other species with < 5% average cover present in at least 10% of plots:
Mentha arvensis (1%), Bromus tectorum (1%), Crataegus rivularis (1%), Plantago major (1%), Quercus gambelii (1%), Sisymbrium altissimum (1%).

Celtis laevigata var. *reticulata*

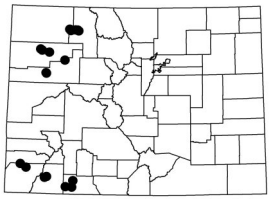
Boxelder - Narrowleaf cottonwood / Red-osier dogwood Forest

Acer negundo - Populus angustifolia / Cornus sericea

Global rank/State rank:
G2 / S2

HGM subclass: R3/4

Colorado elevation range:
5,700-7,700 ft (1,730-2,350 m)



General Description

The *Acer negundo-Populus angustifolia/Cornus sericea* (box elder-narrowleaf/red-osier dogwood) plant association is a tall (12-25 ft, 4-8 m), multi-layered, deciduous riparian forest. It is grows on broad alluvial floodplains with strongly meandering stream channels, where it can form extensive riparian forests. It can also occur as small stands on narrow streams at high elevations.

This plant association occurs along moderately sinuous stream reaches within narrow valleys or broad alluvial floodplains. It occurs at 2-10 ft (0.5-2 m) above the bankfull channel level. Stream channels are slightly meandering to strongly meandering. Soil textures range from loamy sand to silty clay loam with minimal skeletal fraction. Mottling may occur at about 20-25 inches (50-60 cm).

Vegetation Description

This community is characterized by a tall gallery forest of *Populus angustifolia* (narrowleaf cottonwood) and a subcanopy of *Acer negundo* (boxelder). In most of the stands sampled, *Acer negundo* (boxelder) formed a subcanopy underneath the taller canopy of narrowleaf cottonwoods. However, patches of *Acer negundo* (boxelder) do occur on the floodplain without the cottonwood overstory as part of the overall mosaic of different aged stands. These are thought to be older stands where the cottonwood has died. *Juniperus scopulorum* (Rocky Mountain juniper), *Pseudotsuga menziesii* (Douglas-fir), and *Picea pungens* (blue spruce) are occasionally present in small amounts.

Mesic shrubs form a dense and diverse mid-canopy layer. *Cornus sericea* (red-osier dogwood) is the most abundant and dominant shrub. Other shrub species which may be present include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Rosa woodsii* (Woods rose), *Acer glabrum* (Rocky Mountain maple), *Rhus trilobata* (skunkbush sumac), *Salix ligulifolia* (strapleaf willow), *Salix monticola* (mountain willow), *Salix boothii*

(Booth willow), and *Salix lucida* ssp. *caudata* (shining willow). Forb and graminoid cover vary from low to abundant. Species include *Maianthemum racemosum* (feathery false Solomon seal), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), and *Solidago gigantea* (giant goldenrod). In disturbed stands *Cirsium arvense* (Canada thistle), *Agrostis gigantea* (redtop), and *Taraxacum officinale* (dandelion) can occur.

Ecological Processes

The *Acer negundo-Populus angustifolia/Cornus sericea* (boxelder-narrowleaf cottonwood/red-osier dogwood) plant association appears to be late-seral. This is evident from the mature *Populus angustifolia* trees and dense stands of *Cornus sericea* within the closed forest canopy. Young, early-seral stands of regenerating cottonwoods may be found on the inside bends of the channel and on point bars and lower terraces. Channel migration and meander movement may cut into the mature forest on the outside of meander bends, leaving the stands immediately adjacent to, yet potentially several meters above, the channel. Over time, the riparian communities can convert to upland plant associations.

Avg. Cover %	(Range)	Species Name	# Plots (N=21)
41	(3-90%)	Populus angustifolia	19*
33	(1-90%)	Cornus sericea ssp. sericea	21
27	(1-80%)	Acer negundo var. interius	20*
19	(5-80%)	Solidago gigantea	6
19	(1-50%)	Prunus virginiana var. melanocarpa	5
18	(1-80%)	Bromus inermis	7
11	(1-30%)	Clematis ligusticifolia	5
10	(1-40%)	Poa pratensis	15
10	(1-30%)	Crataegus rivularis	9
10	(1-30%)	Agrostis gigantea	4
8	(1-27%)	Pseudotsuga menziesii	5
8	(1-15%)	Alnus incana ssp. tenuifolia	4
7	(1-20%)	Ribes inerme	6
7	(5-10%)	Osmorhiza depauperata	4
7	(1-20%)	Maianthemum racemosum ssp. amplexicaule	5
7	(1-20%)	Rosa woodsii	17
7	(1-23%)	Geranium richardsonii	6
6	(1-30%)	Dactylis glomerata	9
6	(1-20%)	Phalaris arundinacea	7
6	(1-20%)	Rudbeckia laciniata var. ampla	11
6	(1-20%)	Elymus glaucus	6
5	(1-30%)	Maianthemum stellatum	11
5	(1-20%)	Taraxacum officinale	14
5	(1-11%)	Quercus gambelii	5

Other species with < 5% average cover present in at least 10% of plots:
Rhus trilobata var. trilobata (1-10%), Amelanchier alnifolia (1-10%), Juniperus scopulorum (1-10%), Rubus idaeus ssp. strigosus (1-7%), Elymus repens (1-10%), Amelanchier utahensis (1-5%), Phleum pratense (1-10%), Mahonia repens (1-5%), Galium triflorum (1-5%), Symphoricarpos oreophilus (1-5%), Geum macrophyllum var. perincisum (1-5%), Lonicera involucrata (1-5%), Urtica dioica ssp. gracilis (1-5%), Vicia americana (1-3%), Melilotus officinalis (1-3%), Achillea millefolium var. occidentalis (1-2%), Galium boreale (1%), Mentha arvensis (1%)

*Populus angustifolia and Acer negungo were present in all stands, but were not captured in every sample plot.

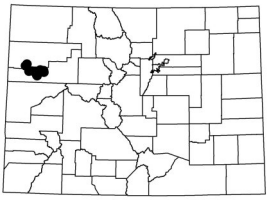
Boxelder / Chokecherry Forest

Acer negundo / Prunus virginiana

Global rank/State rank:
G3 / S2

HGM subclass: R3/4

Colorado elevation range:
6,000-7,500 ft (1,800-2,290 m)



General Description

The *Acer negundo/Prunus virginiana* (box elder/chokecherry) plant association is characterized by dense to scattered cover of *Acer negundo* (boxelder) and a dense thicket of *Prunus virginiana* (chokecherry). It grows on broad alluvial floodplains at low elevations. When left undisturbed, the shrub canopy can be very thick and nearly impenetrable. However, many stands in Colorado are in severely degraded states with very sparse shrub canopies.

This association occurs on moderately wide, flat valley bottoms. It can also occur on colluvial deposits and narrow, confined terraces where the stream channel has been downcut. Stream channels are mostly straight, narrow and steep. Some channels are wider and slightly sinuous; occasionally a channel may be very steep and entrenched.

Vegetation Description

The overstory of this plant association is dominated by 10-100% cover of different age classes of *Acer negundo* (boxelder). Other tree species that may be present include *Populus angustifolia* (narrowleaf cottonwood) and *Pseudotsuga menziesii* (Douglas-fir). The shrub diversity can be high in less disturbed stands, with *Prunus virginiana* (chokecherry), *Amelanchier utahensis* (Utah serviceberry), *Symphoricarpos oreophilus* (mountain snowberry), *Ribes inerme* (whitestem gooseberry), *Acer glabrum* (Rocky Mountain maple), *Cornus sericea* (red-osier dogwood), *Holodiscus dumosus* (rockspirea), and *Rhamnus smithii* (Smith buckthorn).

The understory can be dense with forb species including up to 50% cover of *Geranium richardsonii* (Richardson geranium) and up to 40% cover of *Urtica dioica* (stinging nettle). Graminoid cover is minor.

Ecological Processes

Acer negundo (boxelder) appears to flourish in narrow canyons with natural flood regimes or altered flows (e.g., Black Canyon of the Gunnison). With scouring floods, *Acer negundo* may survive only if it grows on upper colluvial slopes. This may provide a seed source for regeneration after flooding and deposition.

In Montana, an *Acer negundo/Prunus virginiana* (boxelder/chokecherry) habitat type occurs in the Great Plains region of the state. It establishes along alluvial fans, narrow streams or woody draws. In Colorado, many stands of this association appear to be in advanced stages of degradation. They are open with little to no regeneration of boxelder, little shrub cover, and compacted soils. With time, the boxelder trees will die and topple.

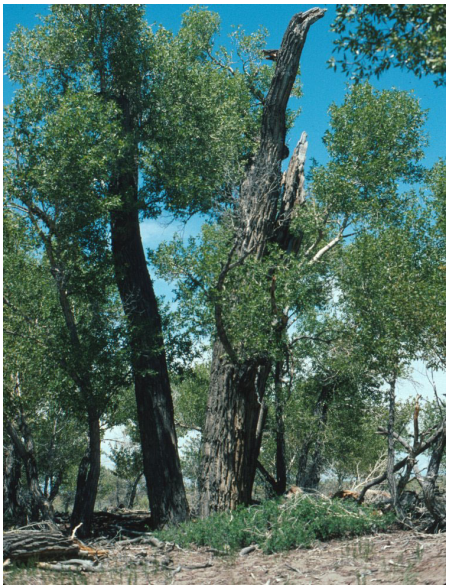
Avg. Cover %	(Range)	Species Name	# Plots (N=15)
57	(10-100%)	Acer negundo var. interius	15
26	(1-50%)	Geranium richardsonii	2
16	(1-60%)	Osmorhiza depauperata	4
15	(1-34%)	Populus angustifolia	6
13	(1-60%)	Prunus virginiana var. melanocarpa	11*
13	(5-20%)	Hackelia floribunda	2
8	(1-30%)	Symphoricarpos oreophilus	13
7	(1-20%)	Cornus sericea	5
7	(1-20%)	Mertensia ciliata	3
7	(1-40%)	Mahonia repens	7
6	(1-40%)	Urtica dioica ssp. gracilis	11
6	(1-20%)	Ribes inerme	7
6	(1-20%)	Amelanchier utahensis	10
6	(1-10%)	Acer glabrum	4
6	(1-10%)	Rhamnus smithii	2
6	(1-10%)	Elymus glaucus	2
5	(1-20%)	Poa pratensis	11

Other species with < 5% average cover present in at least 10% of plots:
Rhus trilobata var. trilobata (1-10%), Holodiscus dumosus (1-10%), Pseudotsuga menziesii (1-10%), Descurainia incana (1-10%), Senecio eremophilus var. kingii (1-5%), Cynoglossum officinale (1-5%), Lonicera involucrata (1-3%), Rosa woodsii (1-5%), Clematis ligusticifolia (1-3%), Maianthemum stellatum (1-3%), Quercus gambelii (1-3%), Rubus idaeus ssp. strigosus (1-3%), Heracleum maximum (1%), Viola adunca (1%), Rorippa teres (1%).

*Prunus virginiana was present in all stands, but was not captured in every sample plot.

Narrowleaf cottonwood Sand Dune Forest

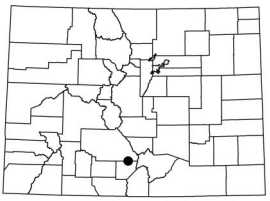
Populus angustifolia Sand Dune Forest



Global rank/State rank:
G1 / S1

HGM subclass: R3/4

Colorado elevation range:
7,600 ft (2,300 m)



General Description

The *Populus angustifolia* (narrowleaf cottonwood) Sand Dune Forest is an extremely rare association which occurs in an unusual environmental setting on braided, sandy streams adjacent to wind-driven, actively moving sand dunes. It is known only from the east side of the San Luis Valley, at the base of the Sangre de Cristo Mountains, just northwest of Great Sand Dunes National Monument.

The *Populus angustifolia* Sand Dune Forest community occurs on a series of sand dunes stabilized by vegetation. The cottonwoods occur on the ridges of the sand dunes and increase in age with distance from the active stream channel. The cottonwood stands may have created the sand dunes by trapping wind-borne sand. The stream channel is braided with additional dry channels on either side of the active channel, giving the impression of an alluvial fan. The soil is deep (30 inches, 73 cm) loamy sand with little horizon development.

Vegetation Description

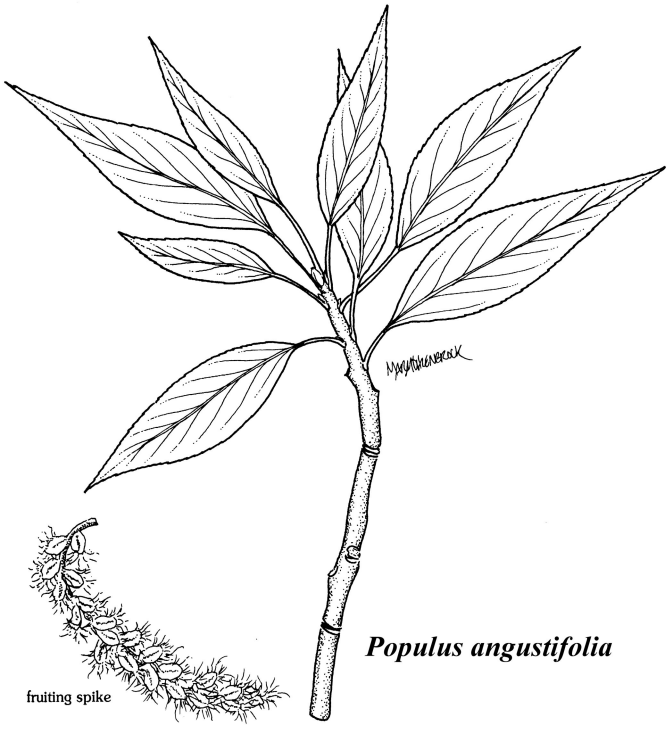
This community is a mature stand of up to 90% *Populus angustifolia* (narrowleaf cottonwood) with no shrubs or herbaceous species under the canopy. The ground is covered with a thick layer of cottonwood leaves (65%), wood (cottonwood branches) (15%), and bare sand (20%).

Ecological Processes

The *Populus angustifolia* Sand Dune Forest appears to be a product of a unique environment in Colorado. As the cottonwoods increase in age and distance from the

active stream channel, trees trap wind-borne sand and create ridges of sand, or sand dunes. As trees are buried, the cottonwoods send out aerial roots and grow taller, much in the same way that the species responds to burial by flooding and fluvial deposition. Several large old trees, up to 8 ft (2 m) in diameter were found near the center of the sand dune forest. Younger trees (2 inch, 4.5 cm) occur in thick bands on slightly lower sand dune ridges. These sapling and pole-sized trees produced sucker shoots, creating another band of seedling-sized cottonwoods.

Avg. Cover %	(Range)	Species Name	# Plots (N=1)
92	n/a	Populus angustifolia	1



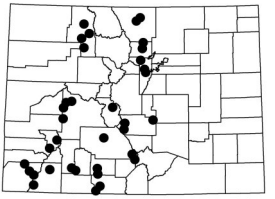
Narrowleaf cottonwood / Thinleaf alder Woodland

Populus angustifolia / Alnus incana ssp. *tenuifolia*

Global rank/State rank:
G3 / S3

HGM subclass: R3/4

Colorado elevation range:
6,000-9,600 ft (1,830-2,930 m)



General Description

The *Populus angustifolia/Alnus incana* ssp. *tenuifolia* (narrowleaf cottonwood/thinleaf alder) plant association is characterized by a dense stand of *Alnus incana* lining the stream bank and an open to nearly closed canopy of *Populus angustifolia*. Other shrubs may occur but *Alnus incana* ssp. *tenuifolia* (thinleaf alder) usually has at least 10-20% cover and is the most abundant of all other shrubs within the stand. It occurs along narrow, fast-moving stream reaches in montane areas.

This plant association occurs on active floodplains in narrow to broad valleys. It forms a narrow, dense band along stream banks and benches. Some of the stands have signs of recent flooding. Stream gradient and channel width are highly variable. Some sites occur along steep, narrow reaches with little sinuosity. Other sites occur along low gradient, moderately sinuous, broad channel reaches, low gradient, highly sinuous reaches, or very narrow and highly sinuous stream sections. Soils are mostly coarse textured ranging from deep sands to shallow sandy loams. Some profiles show stratification with loams to clay loams alternating with sands. Most profiles become skeletal at an average depth of 12 inches (30 cm).

Vegetation Description

The dominance of *Populus angustifolia* (narrowleaf cottonwood) and *Alnus incana* ssp. *tenuifolia* (thinleaf alder) are the key diagnostic characteristics of this association. Several other tree and shrub species may be present, but they rarely equal the abundance of the diagnostic species. The overstory is an open to dense canopy of *Populus angustifolia*, which is always present, if sometimes only as sapling-sized individuals. Other tree species that may be present include *Pseudotsuga menziesii* (Douglas-fir), *Juniperus scopulorum* (Rocky Mountain juniper), *Populus tremuloides* (quaking aspen), *Pinus ponderosa* (ponderosa pine), *Populus* x *acuminata* (lanceleaf cottonwood), *Abies concolor* (white fir), or *Picea pungens* (blue spruce). The shrub understory is dominated by a dense band of *Alnus incana* ssp. *tenuifolia* (thinleaf alder) lining the stream bank. A variety of other shrubs may be present, intermingling

with the alder but usually providing less than the total alder cover. Other shrub species include *Salix bebbiana* (Bebb willow), *Salix monticola* (mountain willow), *Salix drummondiana* (Drummond willow), *Salix ligulifolia* (strapleaf willow), *Salix lucida* ssp. *caudata* (shining willow), *Salix exigua* (sandbar willow), *Cornus sericea* (red-osier dogwood), *Rosa woodsii* (Woods rose), *Acer glabrum* (Rocky Mountain maple), and *Betula occidentalis* (river birch).

The herbaceous undergrowth is generally sparse. Herbaceous species include *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (dandelion), *Equisetum arvense* (field horsetail), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Heracleum maximum* (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), *Trifolium repens* (white clover), *Calamagrostis canadensis* (bluejoint reedgrass), *Oxypolis fendleri* (Fendler cowbane), and *Cardamine cordifolia* (heartleaf bittercress).

Ecological Processes

The *Populus angustifolia/Alnus incana* ssp. *tenuifolia* (narrowleaf cottonwood/thinleaf alder) plant association is considered a mid-seral community (not the youngest and not the oldest stands of cottonwoods within a reach). With time and without flooding disturbance, stands may become dominated by invading conifers from adjacent upland communities such as *Pseudotsuga menziesii* (Douglas-fir), *Juniperus* spp. (juniper), or *Picea engelmannii* (Engelmann spruce).

Avg. Cover %	(Range)	Species Name	# Plots (N=37)
37	(3-84%)	Populus angustifolia	37
35	(1-80%)	Alnus incana ssp. tenuifolia	37
18	(1-40%)	Agrostis gigantea	5
13	(1-30%)	Salix lucida ssp. caudata, lasiandra	14
13	(3-28%)	Betula occidentalis	5
12	(1-48%)	Trifolium repens	7
11	(3-35%)	Salix drummondiana	10
10	(1-30%)	Poa pratensis	26
10	(1-30%)	Cornus sericea ssp. sericea	12
10	(1-34%)	Populus tremuloides	5
8	(1-32%)	Salix exigua	8
7	(1-15%)	Agrostis stolonifera	6
7	(1-14%)	Salix monticola	9
6	(1-22%)	Cardamine cordifolia	5
6	(0.1-40%)	Dactylis glomerata	9
6	(1-20%)	Rubus idaeus ssp. strigosus	6
6	(1-17%)	Calamagrostis canadensis	8
6	(1-14%)	Pseudotsuga menziesii	7
5	(1-14%)	Salix bebbiana	8
5	(1-11%)	Ribes inerme	5
5	(1-20%)	Rudbeckia laciniata var. ampla	12

Other species with < 5% average cover present in at least 10% of plots:
Acer glabrum (1-10%), Rosa woodsii (1-30%), Heracleum maximum (0.1-15%), Pyrola asarifolia ssp. asarifolia (1-10%), Poa palustris (1-10%), Taraxacum officinale (1-20%), Juniperus scopulorum (1-11%), Salix ligulifolia (1-10%), Lonicera involucrata (0.1-10%), Equisetum arvense (0.1-18%), Oxypolis fendleri (1-11%), Urtica dioica ssp. gracilis (1-10%), Prunus virginiana var. melanocarpa (1-7%), Maianthemum stellatum (0.1-10%), Osmorhiza depauperata (1-4%), Achillea millefolium var. occidentalis (0.1-12%), Clematis ligusticifolia (1-3%), Juncus balticus var. montanus (1-6%), Vicia americana (1-5%), Mertensia ciliata (1-5%), Galium triflorum (1-4%), Thalictrum fendleri (1-5%), Geum macrophyllum var. perincisum (1-6%), Geranium richardsonii (1-5%), Fragaria virginiana ssp. glauca (1-5%), Chamerion angustifolium ssp. circumvagum (1-3%), Galium boreale (1-3%), Mentha arvensis (1-4%), Symphoricarpos oreophilus (1-3%), Galium trifidum ssp. subbiflorum (1-3%), Actaea rubra ssp. arguta (0.1-3%), Phleum pratense (1%), Equisetum laevigatum (0.1-1%).

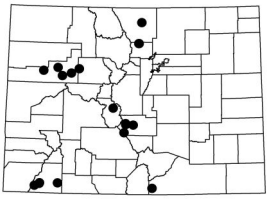
Narrowleaf cottonwood / River birch Woodland

Populus angustifolia / Betula occidentalis

Global rank/State rank:
G3 / S2

HGM subclass: R3/4

Colorado elevation range:
6,000-8,400 ft (1,830-2,600 m)



General Description

This plant association is a lush deciduous community of *Populus angustifolia* (narrowleaf cottonwood) and *Betula occidentalis* (river birch) growing in a thick band along the stream banks. The community is one of the wetter *Populus angustifolia* plant associations, which indicates a perennial source of water and possibly lateral seepage to the channel. Some stands occur on hillside seeps.

This plant association occurs on stream banks and benches along narrow, somewhat steep streams with little to moderate floodplain development. It also occurs on immediate stream banks or steep-sided overflow channel areas along larger streams with well-developed floodplains. Stream channels are steep and narrow with rocky beds or broad and meandering. Soils have a surface layer of partially decomposed organic matter 2-4 inches (5-10 cm) thick. Subsurface layers are very coarse with 10-60% gravel or cobbles. Subsurface textures range from clay loams to loamy sands.

Vegetation Description

This plant association is characterized by an overstory of 5-80% cover of *Populus angustifolia* (narrowleaf cottonwood) and a thick shrub understory of *Betula occidentalis* (river birch). Other tree species that can be present include *Pseudotsuga menziesii* (Douglas-fir) and *Juniperus scopulorum* (Rocky Mountain juniper). Other shrubs that can be abundant, but never more than birch include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Acer glabrum* (mountain maple), *Cornus sericea* (red-osier dogwood), *Salix bebbiana* (Bebb willow), *Crataegus rivularis* (river hawthorn), *Ribes*

inerme (whitestem gooseberry), *Salix ligulifolia* (strapleaf willow), *Rhus trilobata* (skunkbush sumac), *Salix irrorata* (bluestem willow), *Rubus parviflorus* (thimbleberry), and *Prunus virginiana* (chokecherry).

Graminoid and forb cover is minor, except in degraded stands, where introduced, non-native species can be abundant. These include *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (dandelion), *Melilotus* spp. (sweetclover). Native herbaceous species include *Maianthemum stellatum* (starry false Solomon seal), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Carex utriculata* (beaked sedge), and *Angelica ampla* (giant angelica).

Ecological Processes

The *Populus angustifolia/Betula occidentalis* (narrowleaf cottonwood/river birch) plant association is considered to be early- to mid-seral. *Betula occidentalis* becomes abundant along stream banks with perennial stream flow and well-aerated soils. With continued aggradation of the alluvial surface and shading from a thick shrub canopy, successful *Populus angustifolia* reproduction may cease and the stand may become a *Betula occidentalis* dominated shrubland with a graminoid understory. *Populus angustifolia* appears to be reproducing in two of the stands sampled, however, the individuals may be sprouting from roots rather than developing from seeds.

Avg. Cover %	(Range)	Species Name	# Plots (N=24)
41	(4-80%)	Populus angustifolia	24
35	(8-67%)	Betula occidentalis	24
19	(1-59%)	Alnus incana ssp. tenuifolia	10
16	(1-63%)	Agrostis gigantea	5
11	(1-20%)	Cornus sericea	7
10	(2-18%)	Poa compressa	5
9	(1-24%)	Pseudotsuga menziesii	8
9	(1-22%)	Acer glabrum	5
8	(0.1-23%)	Salix lucida ssp. caudata, lasiandra	3
8	(0.1-28%)	Melilotus officinalis	5
8	(1-20%)	Poa pratensis	12
7	(1-20%)	Glyceria striata	3
6	(1-14%)	Trifolium repens	8
6	(0.1-20%)	Dactylis glomerata	4
6	(0.1-30%)	Rudbeckia laciniata var. ampla	8
6	(1-10%)	Clematis ligusticifolia	5
6	(1-18%)	Salix bebbiana	7

Other species with < 5% average cover present in at least 10% of plots:
Calamagrostis canadensis (1-10%), Salix exigua (1-7%), Salix ligulifolia (1-10%), Geranium richardsonii (1-7%), Juniperus scopulorum (1-15%), Equisetum arvense (0.1-15%), Medicago lupulina (1-5%), Ribes inerme (0.1-10%), Prunus virginiana var. melanocarpa (1-11%), Carex microptera (1-5%), Taraxacum officinale (1-11%), Conioselinum scopulorum (1-7%), Heracleum maximum (1-5%), Cirsium arvense (1-5%), Rosa woodsii (1-7%), Populus tremuloides (1-5%), Urtica dioica ssp. gracilis (1-4%), Deschampsia caespitosa (1-3%), Quercus gambelii (0.1-5%), Bromus inermis (0.1-5%), Osmorhiza depauperata (1-3%), Maianthemum stellatum (0.1-5%), Amelanchier utahensis (1-3%), Thalictrum fendleri (0.1-5%), Achillea millefolium var. occidentalis (0.1-2%), Oxypolis fendleri (1%), Bromus ciliatus var. ciliatus (1%), Equisetum hyemale var. affine (1%), Senecio triangularis (1%), Cynoglossum officinale (0.1-1%), Veronica americana (0.1-1%), Equisetum laevigatum (0.1-1%).

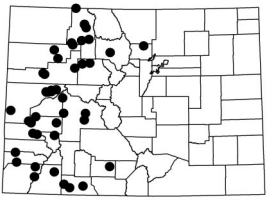
Narrowleaf cottonwood / Red-osier dogwood Woodland

Populus angustifolia / Cornus sericea

Global rank/State rank:
G4 / S3

HGM subclass: R3/4

Colorado elevation range:
5,400-8,700 ft (1,800-2700 m)



General Description

The *Populus angustifolia/Cornus sericea* (narrowleaf cottonwood/red-osier dogwood) plant association is found along moderate-size rivers in the montane zone. It is highly variable in the number of conifer and shrub species present along the reach. However, it is generally recognized by a clear dominance of *Populus angustifolia* (narrowleaf cottonwood), which is often twice the abundance of other tree species, and a thick understory of *Cornus sericea* (red-osier dogwood).

This association occurs in two distinct settings - one in narrow valleys (30 ft, 10 m) with swift, steep streams (4% gradient) where it occurs on narrow benches, and the other in wide valleys (500 ft, 150 m) on broad floodplains along, moderately steep, meandering rivers (2% gradient). This association usually occurs 2-6 ft (0.5-2 m) above the stream channel. Stream channels vary widely in slope and width and are either broad, moderately sinuous with moderate gradients or broad, highly sinuous with low gradients. Occasionally, stream channels are steep and narrow. Soils are highly variable and stratified. Soil textures include silty clays, silty clay loams, clay loams, sandy clays, sandy clay loam, and loamy sands.

Vegetation Description

This is one of the most diverse cottonwood-dominated riparian plant associations. The upper canopy can consist of several species, but *Populus angustifolia* (narrowleaf cottonwood) is almost always dominant with 5-85% cover. Other tree species that may be present include *Picea pungens* (blue spruce), *Populus tremuloides* (quaking aspen), *Pseudotsuga menziesii* (Douglas-fir), *Pinus ponderosa* (ponderosa pine), and *Abies lasiocarpa* (subalpine fir).

The shrub layer is dense and diverse with 1-98% cover of *Cornus sericea* (red-osier dogwood). Other shrub species may be as abundant, but not exceeding *Cornus*. Shrub species include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Amelanchier* spp. (serviceberry), *Rosa woodsii* (Woods rose), *Symphoricarpos oreophilus* (mountain

snowberry), *Acer glabrum* (Rocky Mountain maple), *Prunus virginiana* (chokecherry), *Quercus gambelii* (Gambel oak), *Salix ligulifolia* (strapleaf willow), *Crataegus rivularis* (river hawthorn), *Lonicera involucrata* (twinberry honeysuckle), *Salix exigua* (sandbar willow), *Betula occidentalis* (river birch), *Salix drummondiana* (Drummond willow), *Salix lucida* ssp. *caudata* (shining willow), and *Salix monticola* (mountain willow). Stands vary in aspect and shade provided, some are relatively moist and shady, others are relatively dry and open. In the moister environments, the herbaceous cover can be high (>50%).

Ecological Processes

In Colorado, some stands of this association appear to be mid- to late-seral mature cottonwood forests that are isolated from frequent flooding and sediment deposition. A seasonally high water table is required to maintain a vigorous *Cornus sericea* layer. Stands of this association growing at lower elevations and on high, drier terraces have greater cover of *Amelanchier utahensis* (Utah serviceberry), *Amelanchier alnifolia* (Saskatoon serviceberry) and *Crataegus rivularis* (river hawthorn) and may have undergone over-grazing in the past.

Avg. Cover %	(Range)	Species Name	# Plots (N=46)
44	(5-85%)	Populus angustifolia	46
36	(1-98%)	Cornus sericea ssp. sericea	46
18	(3-50%)	Alnus incana ssp. tenuifolia	25
14	(1-30%)	Crataegus rivularis	7
14	(1-30%)	Salix lucida ssp. caudata, lasiandra	6
12	(1-50%)	Picea pungens	10
12	(1-30%)	Amelanchier utahensis	9
10	(1-22%)	Salix ligulifolia	13
8	(1-40%)	Rosa woodsii	41
8	(0.1-30%)	Populus tremuloides	8
8	(1-30%)	Acer glabrum	13
8	(1-30%)	Solidago gigantea	7
8	(1-30%)	Lonicera involucrata	16
7	(1-30%)	Rudbeckia laciniata var. ampla	19
7	(1-20%)	Salix drummondiana	10
7	(1-30%)	Clematis ligusticifolia	6
7	(1-20%)	Pseudotsuga menziesii	8
7	(1-70%)	Poa pratensis	31
7	(1-44%)	Ribes inerme	17
7	(1-29%)	Quercus gambelii	14
7	(1-30%)	Prunus virginiana var. melanocarpa	19
6	(1-25%)	Actaea rubra ssp. arguta	9
6	(1-31%)	Salix exigua	11
5	(1-20%)	Heracleum maximum	16
5	(1-20%)	Maianthemum stellatum	37
5	(1-10%)	Salix monticola	6
5	(1-12%)	Symphoricarpos oreophilus	23

Other species with < 5% average cover present in at least 10% of plots:
Dactylis glomerata (1-20%), Amelanchier alnifolia (1-10%), Juniperus scopulorum (1-20%), Agrostis gigantea (1-10%), Rubus idaeus ssp. strigosus (1-20%), Taraxacum officinale (1-20%), Geranium richardsonii (1-30%), Fragaria virginiana ssp. glauca (1-20%), Mentha arvensis (1-10%), Osmorhiza depauperata (1-10%), Elymus glaucus (1-5%), Phleum pratense (1-10%), Equisetum arvense (0.1-10%), Calamagrostis canadensis (1-5%), Ligusticum porteri (1-10%), Viola canadensis var. scopulorum (1-5%), Vicia americana (1-10%), Paxistima myrsinites (1-5%), Galium boreale (1-5%), Geum macrophyllum var. perincisum (1-5%), Equisetum laevigatum (1-5%), Chamerion angustifolium ssp. circumvagum (1-8%), Mertensia ciliata (1-5%), Galium triflorum (1-3%), Thalictrum fendleri (1-5%), Equisetum hyemale var. affine (1-5%), Glyceria striata (1-3%), Achillea millefolium var. occidentalis (1-3%), Conioselinum scopulorum (1-2%), Solidago canadensis (1%).

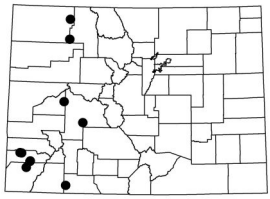
Narrowleaf cottonwood / River hawthorn Woodland

Populus angustifolia / Crataegus rivularis

Global rank/State rank:
G2? / S2

HGM subclass: R3/4

Colorado elevation range:
6,900-8,000 ft (2,100-2,400 m)



General Description

The *Populus angustifolia/Crataegus rivularis* (narrowleaf cottonwood/river hawthorn) plant association is characterized by having dense to sparse canopy cover of mature *Populus angustifolia* (narrowleaf cottonwood) trees. The understory is typically very dense and consists of *Crataegus rivularis* (river hawthorn) and other shrub species including *Cornus sericea* (red-osier dogwood) and various tall *Salix* (willow) species. Graminoid and forb cover is minimal. This association generally occurs away from the immediate stream bank in moderately wide valleys. It also occurs along dry backchannels or ephemeral streams.

Stream channels are wide and moderately to highly sinuous. The soils are sandy clays and highly stratified alluvium.

Vegetation Description

Populus angustifolia (narrowleaf cottonwood) forms an open to dense overstory canopy with 4-63% cover. *Crataegus rivularis* (river hawthorn) forms a dense shrub canopy with 10-70% cover, and *Rosa woodsii* (Woods rose) forms a sub-shrub canopy. These three species were present in every stand sampled. Other tree species may be present, including *Pinus ponderosa* (ponderosa pine) and *Pseudotsuga menziesii* (Douglas-fir). Shrub species may include *Symphoricarpos oreophilus* (mountain snowberry), *Quercus gambelii* (Gambel oak), *Dasiphora floribunda* (shrubby cinqefoil), *Cornus sericea* (red-osier dogwood), *Salix bebbiana* (Bebb willow), *Salix ligulifolia* (strapleaf willow), and *Salix monticola* (mountain willow).

Graminoid and forb cover is typically low due to dry soil conditions. *Taraxacum officinale* (dandelion) and *Iris missouriensis* (wild iris) are present in nearly all sampled stands. Other herbaceous species present include *Maianthemum stellatum* (starry false Solomon seal), *Poa pratensis* (Kentucky bluegrass), *Thermopsis montana*

(mountain goldenbanner), *Thalictrum fendleri* (Fendler meadowrue), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Carex praegracilis* (clustered field sedge), and *Delphinium nuttallianum* (Nuttal larkspur).

Ecological Processes

An abundance of *Crataegus rivularis* (river hawthorn) may indicate a late seral stage of the cottonwood stand. *Crataegus* occupies the driest part of the riparian habitat, and may indicate the surface is no longer flooded. In Montana, thickets of *Crataegus* are considered a grazing disclimax. Cattle will browse *Crataegus* and heavy pressure can cause thickets to become open and increaser species such as *Rosa woodsii* (Woods rose), *Symphoricarpos* (snowberry) and *Poa pratensis* (Kentucky bluegrass) become established and abundant.

Avg. Cover %	(Range)	Species Name	# Plots (N=10)
44	(4-63%)	Populus angustifolia	10
35	(1-100%)	Ribes inerme	3
25	(10-70%)	Crataegus rivularis	10
14	(1-30%)	Cornus sericea	5
14	(3-40%)	Symphoricarpos oreophilus	6
10	(1-20%)	Salix monticola	3
10	(1-30%)	Rosa woodsii	10
10	(3-20%)	Pinus ponderosa var. scopulorum	4
8	(1-50%)	Maianthemum stellatum	9
6	(1-15%)	Quercus gambelii	5
6	(1-20%)	Amelanchier alnifolia	6

Other species with < 5% average cover present in at least 10% of plots:
Rudbeckia laciniata var. ampla (1-10%), Dasiphora floribunda (1-10%), Poa pratensis (1-10%), Osmorhiza depauperata (1-6%), Melilotus officinalis (1-10%), Thalictrum fendleri (1-9%), Geranium richardsonii (1-6%), Thermopsis montana (1-3%), Juncus balticus var. montanus (1-3%), Phleum pratense (1-3%), Fragaria virginiana ssp. glauca (1-3%), Vicia americana (1-5%), Bromus inermis (1-3%), Taraxacum officinale (1-3%), Achillea millefolium var. occidentalis (1%), Iris missouriensis (1%), Galium triflorum (1%), Pseudocymopterus montanus (1%), Trifolium longipes (1%).

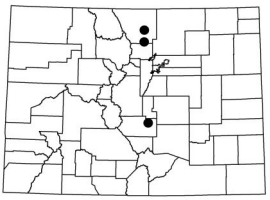
Narrowleaf cottonwood / Chokecherry Woodland

Populus angustifolia / Prunus virginiana

Global rank/State rank:
G2Q / S1

HGM subclass: R3/4, R5

Colorado elevation range:
5,950-7,000 ft (1,800-2,130 m)



General Description

The *Populus angustifolia/Prunus virginiana* (narrowleaf cottonwood/chokecherry) plant association occurs only along low elevation, foothill streams. It is characterized by a thick growth of *Prunus virginiana* with an open overstory of *Populus angustifolia* and occasionally *Populus* x *acuminata* (lanceleaf cottonwood) or *Populus deltoides* (plains cottonwood). *Prunus virginiana* is considered a non-obligate riparian species because it grows on the outer edge of the riparian area.

This plant association occurs on narrow, elevated, or steeply sloping stream banks and benches in narrow to moderately broad valleys, 100-400 ft (30-120 m) wide. Stream channels are broad, low gradient, and slightly sinuous. Soils are shallow sandy clay loams with many fine layers from fluvial deposition. Soils become skeletal at a depth of approximately 8 inches (20 cm).

Vegetation Description

This plant association is characteristic of ephemeral streams of the Front Range foothills and of lower elevation Western Slope streams. The overstory is dominated by *Populus angustifolia* (narrowleaf cottonwood) and *Populus* x *acuminata* (lanceleaf cottonwood). The shrub layer is thick with *Prunus virginiana* (chokecherry), *Symphoricarpos occidentalis* (snowberry), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), and *Clematis ligusticifolia* (western white clematis). The herbaceous undergrowth is diverse, depending on local site conditions and amount of past disturbance, and may include *Poa pratensis* (Kentucky bluegrass), *Bromus tectorum* (cheat grass), *Solidago canadensis* (Canada goldenrod), *Agrostis stolonifera* (creeping bentgrass), and *Carex pellita* (woolly sedge).

Ecological Processes

The *Populus angustifolia/Prunus virginiana* (narrowleaf cottonwood/ chokecherry) plant association is a late-seral community. With time, the *Populus angustifolia* die,

leaving patches of *Prunus virginiana*, which will persist as long as water reaches the tap roots.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
33	(8-52%)	Populus angustifolia	3
32	—	Bromus tectorum	1
31	—	Populus x acuminata	1
25	—	Solidago canadensis	1
25	—	Symphoricarpos occidentalis	1
19	(6-31%)	Salix amygdaloides	2
18	(1-39%)	Poa pratensis	3
16	(3-40%)	Prunus virginiana var. melanocarpa	3
13	—	Agrostis stolonifera	1
8	—	Carex pellita	1
7	—	Ambrosia artemisiifolia var. elatior	1
7	—	Alnus incana ssp. tenuifolia	1
7	—	Prunus americana	1
6	(4-8%)	Juniperus scopulorum	2
5	—	Melilotus officinalis	1
5	—	Ratibida columnifera	1

Other species with < 5% average cover present in at least 10% of plots:
Taraxacum officinale (1-7%), Thalictrum dasycarpum (4%), Arctium minus (4%), Elymus lanceolatus (4%), Rubus deliciosus (4%), Ranunculus sceleratus var. sceleratus (4%), Clematis ligusticifolia (3%), Holodiscus dumosus (3%), Symphyotrichum lanceolatum ssp. hesperium var. hesperium (3-3%), Acer negundo var. interius (1-4%), Rosa woodsii (1-3%), Thermopsis divaricarpa (2%), Epilobium ciliatum ssp. glandulosum (2%), Pinus ponderosa var. scopulorum (2%), Rumex crispus (2%), Verbascum thapsus (2%), Equisetum arvense (1-2%), Lolium pratense (1-2%), Plantago major (1-2%), Trifolium repens (1%), Dodecatheon pulchellum (1%), Thalictrum fendleri (1%), Geranium viscosissimum var. incisum (1%), Equisetum laevigatum (1%), Eleocharis palustris (1%), Cynoglossum officinale (1%), Toxicodendron rydbergii (1%), Brickellia californica (1%), Ptelea trifoliata (1%), Stellaria crassifolia (1%), Symphoricarpos oreophilus (1%), Ribes aureum (1%), Maianthemum stellatum (1%), Quercus gambelii (1%), Medicago lupulina (1%), Vitis riparia (1%), Tragopogon dubius (1%), Nepeta cataria (1%), Symphoricarpos albus (1%).

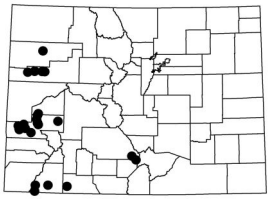
Narrowleaf cottonwood / Skunkbush sumac Woodland

Populus angustifolia / Rhus trilobata

Global rank/State rank:
G3 / S3

HGM subclass: R3/4

Colorado elevation range:
5,000-8,000 ft (1,500-2,440 m)



General Description

The *Populus angustifolia*/*Rhus trilobata* (narrowleaf cottonwood/skunkbush sumac) plant association is characterized by a scattered overstory of *Populus angustifolia* with an occasional *P.* x *acuminata* (lanceleaf cottonwood) or *P. deltoides* ssp. *wislizeni* (Rio Grande cottonwood). The shrub understory is a dense layer of *Rhus trilobata*. It occurs in sandstone canyons and on streams adjacent to sand dunes.

This plant association occurs on immediate river banks, floodplain meanders, and narrow benches in narrow to wide, 65-500 ft (20-150 m), sandstone canyons. Stands generally occur within 3 ft (1 m) of the high water mark, but can also occur on higher terraces, up to 10 ft (3 m) above the channel. In the western portion of the Colorado River drainage, this association occurs on small streams in shale canyon areas. Stream channels are wide and highly sinuous or wide and moderately sinuous. Occasionally, stream channels are narrow and steep. The soils associated with this plant association are often alkaline and of a calcareous parent material. The soil textures are fine sandy loams, clay loams, silty clay loams, and silty clay.

Vegetation Description

This plant association is characterized by the presence and abundance of *Rhus trilobata* (skunkbush sumac) with *Populus angustifolia* (narrowleaf cottonwood), or *P.* x *acuminata* (lanceleaf cottonwood). The cottonwoods may be young or mature trees. Other trees that may be present in the overstory include *Acer negundo* (boxelder), *Juniperus osteosperma* (Utah juniper), *Juniperus scopulorum* (Rocky Mountain juniper), *Pinus ponderosa* (ponderosa pine), *Pseudotsuga menziesii* (Douglas-fir), *Pinus edulis* (pinyon pine), and *Ulmus pumila* (Siberian elm), an introduced species found in a single plot.

The shrub layer is dominated by *Rhus trilobata* (skunkbush sumac). Other shrubs that may be present include *Clematis ligusticifolia* (western white clematis), *Rosa woodsii* (Woods rose), *Quercus gambelii* (Gambel oak), *Salix exigua* (sandbar willow), *Amelanchier utahensis* (Utah serviceberry), *Cornus sericea* (red-osier dogwood), *Forestiera pubescens* (wild privet), *Prunus virginiana* (chokecherry), *Berberis fendleri* (Colorado barberry), *Shepherdia argentea* (silver buffaloberry), and *Acer glabrum* (Rocky Mountain maple). The herbaceous undergrowth is usually sparse.

Ecological Processes

In southwestern Colorado, *Rhus trilobata* is present in both young and old cottonwood stands. As the stand matures, *Rhus trilobata* becomes denser and excludes other shrubs. On higher terraces that are less frequently flooded, *Populus angustifolia* does not reproduce. This indicates succession to an upland community. The presence of *Quercus gambelii* (Gambel oak) in some stands may indicate a trend toward an upland oak shrub community.

As with all cottonwood woodlands, this association is found within a continually changing alluvial environment where riparian vegetation is constantly being "re-set" by flooding disturbance. The process of cottonwood regeneration is dependent on flooding disturbance. Periodic flooding allows cottonwood seedlings to germinate and become established on newly deposited, moist sandbars. Natural river processes of bank erosion, deposition and channel migration result in a dynamic patchwork of different age classes, plant associations and habitats.

Avg. Cover %	(Range)	Species Name	# Plots (N=34)
37	(1-99%)	Rhus trilobata var. trilobata	32*
33	(1-80%)	Populus angustifolia	32*
20	(1-50%)	Mahonia repens	5
20	(1-60%)	Populus x acuminata	6
19	(3-40%)	Forestiera pubescens	6
18	(1-40%)	Acer negundo var. interius	8
17	(3-31%)	Prunus virginiana var. melanocarpa	5
16	(1-26%)	Berberis fendleri	5
11	(1-30%)	Shepherdia argentea	4
10	(1-21%)	Maianthemum stellatum	9
9	(1-30%)	Salix exigua	11
9	(1-20%)	Crataegus rivularis	4
8	(1-56%)	Clematis ligusticifolia	22
8	(1-20%)	Quercus gambelii	13
7	(1-30%)	Poa pratensis	19
7	(1-21%)	Pascopyrum smithii	5
6	(1-10%)	Cornus sericea	7
6	(0.1-30%)	Rosa woodsii	18
6	(1-10%)	Artemisia tridentata	8
5	(1-10%)	Juniperus scopulorum	6
5	(1-20%)	Symphoricarpos oreophilus	9
5	(1-10%)	Toxicodendron rydbergii	6

Other species with < 5% average cover present in at least 10% of plots:
Ericameria nauseosa ssp. nauseosa var. glabrata (0.1-10%), Amelanchier utahensis (1-10%), Melilotus officinalis (0.1-10%), Equisetum arvense (1-5%), Glycyrrhiza lepidota (1-5%), Taraxacum officinale (1-5%), Vicia americana (1-5%), Artemisia ludoviciana (1-3%), Bromus tectorum (1-3%), Heterotheca villosa (1%), Eleocharis palustris (1%), Achillea millefolium var. occidentalis (0.1-1%), Equisetum laevigatum (0.1-1%).

* Populus angustifolia and Rhus trilobata occurred in all stands, but were not captured in every sample plot.

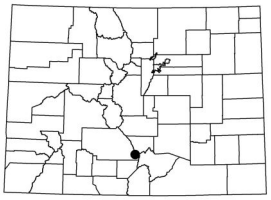
Narrowleaf cottonwood / Drummond willow - Rocky Mountain maple Woodland

Populus angustifolia / Salix drummondiana - Acer glabrum

Global rank/State rank:
G2? / S1

HGM subclass: R2?, R3/4

Colorado elevation range:
8,400-8,600 ft (2,560-2,620 m)



General Description

The *Populus angustifolia/Salix drummondiana-Acer glabrum* (narrowleaf cottonwood/Drummond willow-Rocky Mountain maple) community is a lush deciduous woodland known from one large, nearly pristine stand located on an active alluvial floodplain of Sand Creek in the Sangre de Cristo Mountains. It is characterized by a dense overstory of *Populus angustifolia* (narrowleaf cottonwood) and *Salix drummondiana* (Drummond willow) along the immediate stream bank and scattered *Acer glabrum* (Rocky Mountain maple) and *Salix lucida* ssp. *caudata* (shining willow) across the floodplain.

This plant association occurs on a fairly wide, 300 ft (100 m), and active floodplain in a deep, U-shaped valley. The floodplain shows signs of active flooding, mud and debris flows, as well as avalanches from the steep valley side slopes. The ground surface is relatively flat with trenches, scour holes, debris deposits and downed logs. The community occurs across the entire floodplain, from the immediate stream edge to the toeslopes of the valley walls. The stream channel gradient is moderately steep (3.5%), and wide (12-30 ft, 6-10 m) with pool-drop sequences in some sections. Surface horizon textures are sandy loams and loam sands grading to pure sand. Coarse alluvial cobbles appear at a depth of 15 inches (40 cm).

Vegetation Description

Populus angustifolia (narrowleaf cottonwood), which are mostly young trees, dominate the upper canopy. Other trees that may be present include *Abies concolor* (white fir), *Populus tremuloides* (quaking aspen), and *Pseudotsuga menziesii* (Douglas-fir).

Salix drummondiana (Drummond willow) occurs across the floodplain, but it is notably more concentrated at the stream edge; total canopy cover ranges from 20 to 80%. *Acer glabrum* (Rocky Mountain maple) also occurs along the stream edge and scattered across the floodplain. *Rosa woodsii* (Woods rose) was present in all sampled stands. Other shrubs that may be present include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Jamesia americana* (wax flower), *Salix lucida* ssp. *caudata* (shining willow), and *Prunus virginiana* (chokecherry).

Herbaceous cover is generally low. Species present include *Orthilia secunda* (sidebells wintergreen), *Maianthemum stellatum* (starry false Solomon seal), *Pyrola asarifolia* (liverleaf wintergreen), and *Oxypolis fendleri* (Fendler cowbane).

Ecological Processes

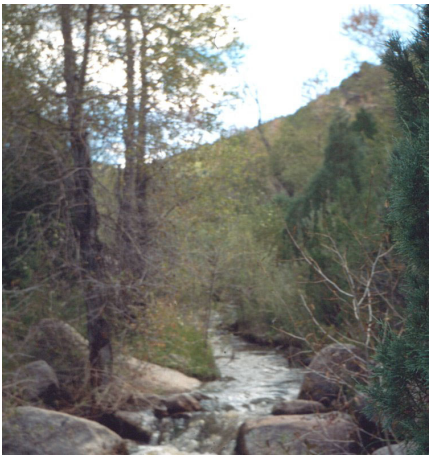
As with all cottonwood woodlands, this association is found within a continually changing alluvial environment where riparian vegetation is constantly being "re-set" by flooding disturbance. Mature cottonwood stands do not regenerate in place, but regenerate by "moving" up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities. The process of cottonwood regeneration is dependent on flooding disturbance. Periodic flooding allows cottonwood seedlings to germinate and become established on newly deposited, moist sandbars. Natural river processes of bank erosion, deposition and channel migration result in a dynamic patchwork of different age classes, plant associations and habitats.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
59	(32-86%)	Populus angustifolia	3
47	(19-62%)	Salix drummondiana	3
16	(8-23%)	Populus tremuloides	2
14	(6-20%)	Acer glabrum	3
14	(5-30%)	Maianthemum stellatum	3
13	(5-30%)	Rosa woodsii	3
10	—	Pyrola asarifolia ssp. asarifolia	1
10	(1-20%)	Orthilia secunda	3
8	(2-13%)	Pseudotsuga menziesii	2
6	—	Chamerion angustifolium ssp. circumvagum	1
6	(1-11%)	Abies concolor	3
5	—	Picea pungens	1

Other species with < 5% average cover present in at least 10% of plots:
Salix lucida ssp. caudata, lasiandra (1-7%), Juncus compressus (4%), Juniperus scopulorum (3%), Oxypolis fendleri (3%), Galium triflorum (1-4%), Alnus incana ssp. tenuifolia (1-4%), Jamesia americana (2%), Bromus hordeaceus (1-2%), Prunus virginiana var. melanocarpa (1-2%), Fragaria virginiana ssp. glauca (1%), Osmorhiza depauperata (1%), Heracleum maximum (1%), Achillea millefolium var. occidentalis (1%), Senecio triangularis (1%), Cinna latifolia (1%), Carex disperma (1%), Senecio integerrimus (1%), Taraxacum officinale (1%).

Narrowleaf cottonwood / Sandbar willow Woodland

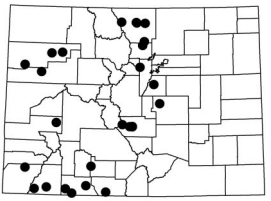
Populus angustifolia / Salix exigua



Global rank/State rank:
G4 / S4

HGM subclass: R3/4, R5

Colorado elevation range:
5,200-8,500 ft (1,580-2,600 m)



General Description

This is a very common plant association of young seedling and sapling *Populus angustifolia* (narrowleaf cottonwood) intermixed with *Salix exigua* (sandbar willow). The association occupies point bars, gravel bars, benches and low areas that are flooded annually.

This plant association occurs on recently flooded point bars, low terraces, and stream benches. It is usually well within the active channel and immediate floodplain of the stream and does not occur more than 3-6 ft (1-2 m) above the high-water mark. Stream channels are wide and slightly sinuous, or wide and moderately sinuous. Soils are skeletal (40% gravel and 10-20% cobbles) and shallow, 15 in (35 cm) deep, sands, sandy loams, sandy clay loams, or silty clays over coarse alluvial material.

Vegetation Description

This plant association represents the early, successional stage of nearly all *Populus angustifolia* (narrowleaf cottonwood) dominated plant associations, and is characterized by an open to dense stand of *Populus angustifolia* (narrowleaf cottonwood) young trees, seedlings and saplings with *Salix exigua* (sandbar willow). *Populus* x *acuminata* (lanceleaf cottonwood) may also be present in similar age classes. Other more widely scattered trees occurring in fewer than 20% of sampled stands include *Abies lasiocarpa* (subalpine fir), *Picea engelmannii* (Engelmann spruce), *Pinus ponderosa* (ponderosa pine), and *Picea pungens* (blue spruce).

The shrub canopy is typically at the same height of the seedling and sapling cottonwood trees, although older, transitional, stands will have taller, more mature trees with *Salix exigua* as an understory. Other shrubs that may be present include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Salix lucida* ssp. *caudata* or ssp. *lasiandra* (shining willow), *Salix ligulifolia* (strapleaf willow), *Salix drummondiana* (Drummond willow), and *Salix bebbiana* (Bebb willow).

The herbaceous undergrowth is generally invasive, non-native and sparse from frequent flooding disturbance. Non-native species include *Poa pratensis* (Kentucky bluegrass), *Trifolium repens* (white clover), *Agrostis stolonifera* (creeping bentgrass), *Linaria vulgaris* (butter and eggs), *Taraxacum officinale* (dandelion), *Medicago lupulina* (black medick), *Phleum pratense* (timothy), *Melilotus officinalis* (yellow sweetclover), *Dactylis glomerata* (orchardgrass), and *Elymus repens* (quackgrass). Native herbaceous species that can be present include *Equisetum arvense* (field horsetail), *Achillea millefolium* var. *occidentalis* (western yarrow), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Carex microptera* (big head sedge), *Carex pellita* (woolly sedge), and *Mentha arvensis* (wild mint).

Ecological Processes

Populus angustifolia/Salix exigua (narrowleaf cottonwood/sandbar willow) is one of the earliest successional stages of a cottonwood-dominated plant association. *Populus angustifolia* and *Salix exigua* seeds often germinate together on freshly deposited sandbars. If the site becomes more stable and less frequently flooded (i.e., the stream channel migrates away from the site), the *Populus angustifolia* saplings mature, but the *Salix exigua* population eventually declines. The association can become one of several mid- or late-seral floodplain types including *Populus angustifolia/Alnus incana* ssp. *tenuifolia* (narrowleaf cottonwood/thinleaf alder) and *Populus angustifolia/ Cornus sericea* (narrowleaf cottonwood/red-osier dogwood).

Avg. Cover %	(Range)	Species Name	# Plots (N=27)
38	(15-80%)	Populus angustifolia	27
22	(1-64%)	Salix exigua	24*
17	(0.1-40%)	Agrostis gigantea	5
13	(1-70%)	Poa pratensis	19
11	(1-40%)	Trifolium pratense	5
10	(1-88%)	Equisetum arvense	11
8	(1-20%)	Salix lucida ssp. caudata, lasiandra	6
6	(1-30%)	Melilotus officinalis	10
6	(1-38%)	Trifolium repens	12
6	(1-20%)	Medicago lupulina	9
5	(1-12%)	Salix ligulifolia	5
5	(1-19%)	Bromus inermis	6
5	(2-10%)	Alnus incana ssp. tenuifolia	7
5	(1-10%)	Dactylis glomerata	4

Other species with < 5% average cover present in at least 10% of plots:
Phleum pratense (1-10%), Poa compressa (1-15%), Heterotheca villosa (1-10%), Juncus balticus var. montanus (0.1-10%), Juniperus scopulorum (1-8%), Eleocharis palustris (1-5%), Taraxacum officinale (0.1-20%), Rudbeckia laciniata var. ampla (0.1-5%), Clematis ligusticifolia (0.1-6%), Mentha arvensis (1-5%), Rosa woodsii (0.1-5%), Achillea millefolium var. occidentalis (1-3%), Carex microptera (1%),.

*Salix exigua was present in all stands, but was not captured in every sample plot.

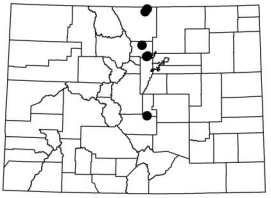
Narrowleaf cottonwood / Bluestem willow Woodland

Populus angustifolia / Salix irrorata

Global rank/State rank:
G2 / S2

HGM subclass: R3/4

Colorado elevation range:
5,600-7,300 ft (1,700-2,200 m)



General Description

The *Populus angustifolia/Salix irrorata* (narrowleaf cottonwood/bluestem willow) plant association is a provisional type representing young, early-seral stands of *Populus angustifolia*. Some stands of this association in the upper South Platte River Basin have significant cover of *Populus deltoides* ssp. *monilifera* (plains cottonwood). These stands are in the transition zone where *Populus deltoides*, typically a low elevation species, and *Populus angustifolia* occur together.

This plant association occupies immediate stream banks and point bars of meandering rivers. It is located very close to, or well within, the high-water line of a stream. Stream channels can be moderately steep (8-9% gradient) and sinuous with a narrow floodplain, or less steep (1-2% gradient) and highly sinuous, or braided. Soils are shallow and skeletal, 30-50% cobbles at 6 inches (15 cm) depth, sandy clay loams alternating with loamy sands and silty clay loams.

Vegetation Description

This plant association is characterized by 4-75% cover of all age classes of *Populus angustifolia* (narrowleaf cottonwood). Other trees that may be present include *Populus deltoides* ssp. *monilifera* (plains cottonwood), *Populus* x *acuminata* (lanceleaf cottonwood), and *Salix amygdaloides* (peachleaf willow).

The shrub canopy consists of *Salix irrorata* (bluestem willow) creating a thick band along the streambank. In fact, some stands would be dense *Salix irrorata* (bluestem willow) shrublands if it were not for the nearby *Populus angustifolia* (narrowleaf cottonwood) that overhang the bank. Other shrubs that may be present include *Salix exigua* (sandbar willow), *Salix monticola* (mountain willow), and *Alnus incana* ssp. *tenuifolia* (thinleaf alder).

Herbaceous undergrowth is sparse due to frequent flooding. However, non-native species can be abundant, including *Agrostis stolonifera* (creeping bentgrass), *Poa*

pratensis (Kentucky bluegrass), and *Bromus inermis* (smooth brome). Herbaceous natives can also be present, and include *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Carex nebrascensis* (Nebraska sedge), *Glyceria grandis* (American mannagrass), *Schoenoplectus acutus* (hardstem bulrush), and *Epilobium* spp. (willowherb).

Ecological Processes

The *Populus angustifolia/Salix irrorata* (narrowleaf cottonwood/bluestem willow) plant association is considered an early-seral community following the establishment of *Populus angustifolia*. A dense cover of *Salix irrorata* or *Salix exigua* (sandbar willow) indicates frequent flooding. With time, the vegetation traps sediment and the land surface aggrades. With continued flooding and sediment deposition, this plant association will shift to a more mature floodplain community.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
43	(7-90%)	Salix irrorata	7
29	(4-75%)	Populus angustifolia	7
26	(13-37%)	Agrostis stolonifera	3
14	(13-14%)	Populus deltoides	2
13	(1-22%)	Salix exigua	3
13	(1-25%)	Mertensia ciliata	2
11	(9-17%)	Poa pratensis	5
8	(1-15%)	Poa compressa	2
8	(1-15%)	Agrostis gigantea	2
7	(1-20%)	Clematis ligusticifolia	3
7	(2-11%)	Elymus lanceolatus	3
5	(0.1-10%)	Acer glabrum	2
5	(5-5%)	Alnus incana ssp. tenuifolia	2

Other species with < 5% average cover present in at least 10% of plots:
Rudbeckia laciniata var. ampla (2-6%), Trifolium repens (1-7%), Epilobium ciliatum ssp. glandulosum (2-6%), Salix amygdaloides (1-7%), Elymus trachycaulus ssp. trachycaulus (2-5%), Lolium pratense (2-5%), Cirsium arvense (1-5%), Betula occidentalis (1-3%), Rosa woodsii (1-2%), Stellaria crassifolia (1%), Taraxacum officinale (1%), Oxalis stricta (1%), Mentha arvensis (1%), Centaurea diffusa (1%), Arctium minus (1%).

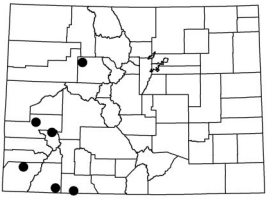
Narrowleaf cottonwood / Strapleaf willow - Silver buffaloberry Woodland

Populus angustifolia / Salix ligulifolia - Shepherdia argentea

Global rank/State rank:
G2 / S2

HGM subclass: R3/4

Colorado elevation range:
6,000-7,100 ft (1,800-2,200 m)



General Description

Populus angustifolia/Salix ligulifolia-Shepherdia argentea (narrowleaf cottonwood/ strapleaf willow-silver buffaloberry) is an extremely limited plant association in western Colorado. Historically, it was more widespread and common in broad river valleys. Intense, long-term use by livestock and alterations in the river flow regime have caused a decline in its distribution.

This plant association occurs in narrow to broad, 1,000 ft (300 m) wide, alluvial valleys. Mature stands occur on terraces up to 10 ft (2.5 m) above the active channel. Mature stands spread out across wide floodplains, but also occur on narrow floodplains of constricted reaches. Stream channels are wide and sinuous with low to moderate gradients (1-5%). The soils are deep, sandy loams.

Vegetation Description

This plant association is characterized by an overstory canopy of *Populus angustifolia* (narrowleaf cottonwood) and the presence of *Shepherdia argentea* (silver buffaloberry). The tree canopy consists of mature *Populus angustifolia* (narrowleaf cottonwood), with seeding and sapling sized *P. angustifolia* that can occur in bands close to the river's edge. Other trees that may be present include *Pinus edulis* (pinyon pine) and *Populus* x *acuminata* (lanceleaf cottonwood).

The shrub layer is diverse and widely spaced. *Shepherdia argentea* (silver buffaloberry) is the key characteristic shrub for this association. Low abundance may indicate a degraded occurrence. *Salix ligulifolia* (strapleaf willow) is so widely spaced that it may not be sampled. Other shrub species which may be present include *Rhus trilobata* (skunkbush sumac), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Cornus sericea* (red-osier dogwood), *Rosa woodsii* (Woods rose), *Crataegus rivularis* (river

hawthorne), *Quercus gambelii* (Gambel oak), *Salix exigua* (sandbar willow), *Salix irrorata* (bluestem willow), and *Betula occidentalis* (river birch).

The herbaceous undergrowth is typically dominated by introduced hay grasses including *Agrostis stolonifera* (creeping bentgrass), *Poa pratensis* (Kentucky bluegrass), and *Dactylis glomerata* (orchardgrass). A few native species also occur, including *Maianthemum stellatum* (starry false Solomon seal), *Equisetum arvense* (field horsetail), *Glycyrrhiza lepidota* (American licorice), *Thlaspi montanum* (alpine pennycress), and *Pascopyrum smithii* (western wheatgrass).

Ecological Processes

No undisturbed stands of the *Populus angustifolia/Salix ligulifolia-Shepherdia argentea* (narrowleaf cottonwood/strapleaf willow-silver buffaloberry) plant association are known in Colorado. The predominance of non-native grasses in the undergrowth and widely spaced shrubs indicate heavy utilization by cattle.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
34	(1-85%)	Populus angustifolia	7
33	(3-59%)	Shepherdia argentea	7
28	—	Salix irrorata	1
26	—	Salix lucida ssp. caudata, lasiandra	1
20	—	Agrostis stolonifera	1
18	(1-69%)	Poa pratensis	6
18	—	Populus x acuminata	1
16	(1-30%)	Clematis ligusticifolia	5
11	(1-28%)	Rosa woodsii	4
10	—	Crataegus rivularis	1
10	—	Thlaspi montanum	1
10	—	Quercus gambelii	1
10	—	Salix ligulifolia	1
10	—	Symphoricarpos oreophilus	1
9	(1-40%)	Rhus trilobata var. trilobata	5
9	(1-22%)	Alnus incana ssp. tenuifolia	4
9	—	Deschampsia caespitosa	1
9	(3-14%)	Betula occidentalis	2
8	(1-27%)	Salix exigua	4
4	(1-11%)	Trifolium repens	3

Other species with < 5% average cover present in at least 10% of plots:
Melilotus officinalis (3-5%), Poa compressa (4-4%), Dactylis glomerata (3-3%), Symphyotrichum laeve var. geyeri (3-3%), Thalictrum fendleri (3-3%), Chamerion angustifolium ssp. circumvagum (3-3%), Amelanchier alnifolia (3-3%), Salix monticola (3-3%), Pinus edulis (3-3%), Heterotheca villosa (3-3%), Prunella vulgaris (3-3%), Cornus sericea ssp. sericea (1-3%), Taraxacum officinale (1-3%), Pascopyrum smithii (1-3%), Glycyrrhiza lepidota (1-3%), Elymus lanceolatus (2%), Hedysarum boreale (2%), Equisetum arvense (1-3%), Maianthemum stellatum (1-3%), Cirsium arvense (1-2%), Phleum pratense (1%), Juncus balticus var. montanus (1%), Carduus nutans ssp. macrolepis (1%), Elymus trachycaulus ssp. trachycaulus (1%), Dasiphora floribunda (1%), Symphyotrichum spathulatum (1%), Mahonia repens (1%), Equisetum laevigatum (1%), Calamagrostis canadensis (1%), Toxicodendron rydbergii (1%), Asparagus officinalis (1%), Arctium minus (1%), Apocynum cannabinum (1%), Trifolium pratense (1%), Poa reflexa (1%), Ribes cereum (1%), Equisetum hyemale var. affine (1%), Achillea millefolium var. occidentalis (1%), Solidago canadensis (1%), Ipomopsis aggregata (1%), Streptopus amplexifolius var. chalazatus (1%), Galium triflorum (1%), Galium boreale (1%), Oxypolis fendleri (1%).

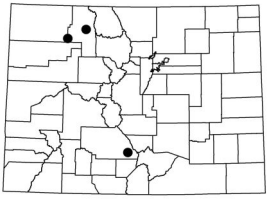
Narrowleaf cottonwood / Shining willow Woodland

Populus angustifolia / Salix lucida ssp. *caudata* or ssp. *lasiandra*

Global rank/State rank:
G1Q / S1

HGM subclass: R3/4

Colorado elevation range:
6,580-7,640 ft (2,000-2,330 m)



General Description

The *Populus angustifolia/Salix lucida* ssp. *caudata* or ssp. *lasiandra* (narrowleaf cottonwood/shining willow) plant association is a provisional association known from only a few locations in western and south central Colorado. It is a mature stand of *Populus angustifolia* (narrowleaf cottonwood) with a sub-canopy of *Salix lucida* var. *caudata* (shining willow).

The *Populus angustifolia/Salix lucida* ssp. *caudata* or ssp. *lasiandra* community occurs on low terraces and floodplains. The low terrace is a flat, nutrient-rich surface approximately 3 ft (1 m) above the active channel and may be an old beaver pond that was drained by the stream. The soil is a deep loamy sand with 10-25% organic matter that accumulated in the once-present beaver pond. Lower layers have no coarse fragments and little horizon development.

Vegetation Description

Tall (25-40 ft, 7-10 m), mature *Populus angustifolia* (narrowleaf cottonwood) with 20-35% cover create the upper canopy. The second canopy is made up of tall (10-15 ft, 3-4 m) *Salix lucida* (shining willow). *Alnus incana* ssp. *tenuifolia* (thinleaf alder) or *Salix exigua* (sandbar willow) may also be present in low amounts. The herbaceous undergrowth is sparse and includes *Poa pratensis* (Kentucky bluegrass), *Solidago canadensis* (Canada goldenrod), *Cirsium arvense* (Canada thistle), *Agrostis gigantea* (redtop), *Taraxacum officinale* (dandelion), and *Melilotus officinalis* (yellow sweetclover).

Ecological Processes

Salix lucida is often associated with abandoned beaver ponds or found along steep stream reaches below beaver ponds. It appears to colonize areas that have filled with

silt or are in the process of doing so. Eventually, this association will be replaced by slightly drier-site willow species. However, with disturbance such as overuse by livestock, willow cover may decline. With severe disturbance, the willows will completely disappear.

As with all cottonwood woodlands, this association is found within a continually changing alluvial environment where riparian vegetation is constantly being "re-set" by flooding disturbance. Mature cottonwood stands do not regenerate in place, but regenerate by "moving" up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities. The process of cottonwood regeneration is dependent on flooding disturbance. Periodic flooding allows cottonwood seedlings to germinate and become established on newly deposited, moist sandbars. Natural river processes of bank erosion, deposition and channel migration result in a dynamic patchwork of different age classes, plant associations and habitats.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
37	(10-80%)	Salix lucida ssp. caudata, lasiandra	3
28	(20-35%)	Populus angustifolia	3
18	(10-25%)	Poa pratensis	2
11	(1-20%)	Solidago canadensis	2
10	—	Carex nebrascensis	1
10	—	Pseudostellaria jamesiana	1
10	—	Salix exigua	1
5	(5-5%)	Agrostis gigantea	2
5	—	Juncus balticus var. montanus	1
5	—	Alnus incana ssp. tenuifolia	1
5	—	Phalaris arundinacea	1
5	—	Poa palustris	1
5	—	Trifolium hybridum	1

Other species with < 5% average cover present in at least 10% of plots:
Melilotus officinalis (1-5%), Cirsium arvense (1%), Taraxacum officinale (1%), Phleum pratense (1%), Maianthemum stellatum (1%), Geum macrophyllum var. perincisum (1%), Equisetum hyemale var. affine (1%), Elymus repens (1%), Cardamine cordifolia (1%), Bromus inermis (1%), Carex praegracilis (1%), Achillea millefolium var. occidentalis (1%), Vicia americana (1%), Potentilla gracilis (1%), Rudbeckia laciniata var. ampla (1%), Sidalcea candida (1%), Symphyotrichum foliaceum (1%), Trifolium pratense (1%), Mentha arvensis (1%).

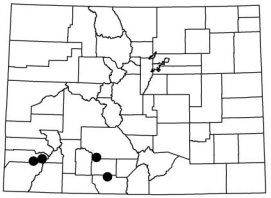
Narrowleaf cottonwood/Mixed willow Woodland

Populus angustifolia / Salix (monticola, drummondiana, lucida)

Global rank/State rank:
G3 / S3

HGM subclass: R3/4

Colorado elevation range:
7,900-8,900 ft (2,400-2,700 m)



General Description

The *Populus angustifolia*/*Salix (monticola, drummondiana, lucida)* (narrowleaf cottonwood/mixed willow) plant association is an early to mid-seral stage of more mature *Populus angustifolia* dominated plant associations. The cottonwoods are fairly young trees (5-15 in, 12-38 cm dbh), with a diverse mix of willows and other shrubs in the understory canopy.

This community occurs on active floodplains, stream benches and low terraces, generally within 1-4.5 ft (0.3-1.4 m) of the active channel elevation. Stream channels range from steep and narrow to broad, moderate gradient and more sinuous. Sites show signs of active flooding. One stand occurs on an overflow or back channel. Soils are somewhat deep (about 3 ft, 1 m), loamy to clay sands over very coarse alluvial layers with at least 25% gravel and other coarse fragments present in all layers.

Vegetation Description

The upper canopy is dominated by young (sapling, pole and medium-sized 5-15 in, 12-35 cm in diameter) *Populus angustifolia* (narrowleaf cottonwood) trees with 25-90% cover. The understory has a consistent mixture of two or more willow species, which can include *Salix exigua* (sandbar willow), *S. ligulifolia* (strapleaf willow), *S. monticola* (mountain willow), *S. lucida* ssp. *caudata* (shining willow), *S. drummondiana* (Drummond willow), and *S. geyeriana* (Geyer willow). Total cover of the shrub layer is between 15-70%. Other, non-willow shrubs are usually present as well, and include *Rosa woodsii* (Woods rose), *Ribes* spp. (gooseberry), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Crataegus rivularis* (river hawthorn), *Dasiphora floribunda* (shrubby cinquefoil), and *Symphoricarpos* spp. (snowberry).

The herbaceous undergrowth is generally low in total cover, with 10-40% forbs and 5-15% graminoids. Common species include *Maianthemum stellatum* (starry false

Solomon seal), *Trifolium* spp. (clover), *Erigeron* spp. (fleabane), *Poa pratensis* (Kentucky bluegrass), and *Bromus inermis* (smooth brome).

Ecological Processes

As with all cottonwood woodlands, this association is found within a continually changing alluvial environment where riparian vegetation is constantly being "re-set" by flooding disturbance. Mature cottonwood stands do not regenerate in place, but regenerate by "moving" up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities. The process of cottonwood regeneration is dependent on flooding disturbance. Periodic flooding allows cottonwood seedlings to germinate and become established on newly deposited, moist sandbars. Natural river processes of bank erosion, deposition and channel migration result in a dynamic patchwork of different age classes, plant associations and habitats.

Avg. Cover %	(Range)	Species Name	# Plots (N=4)
57	(23-89%)	Populus angustifolia	4
17	(6-36%)	Salix monticola	3
13	(10-16%)	Alnus incana ssp. tenuifolia	2
12	—	Salix drummondiana	1
11	—	Juniperus monosperma	1
7	—	Ribes cereum	1
6	(1-13%)	Poa pratensis	4
5	(1-9%)	Ribes inerme	2
5	(4-6%)	Salix exigua	2
5	(3-7%)	Salix lucida ssp. caudata, lasiandra	2
5	—	Maianthemum stellatum	1

Other species with < 5% average cover present in at least 10% of plots:
Symphyotrichum foliaceum (4%), Symphoricarpos albus (4%), Rosa woodsii (1-8%), Lonicera involucrata (3%), Equisetum arvense (3%), Heracleum maximum (3%), Bromus ciliatus var. ciliatus (3%), Galium triflorum (3%), Equisetum pratense (3%), Crataegus rivularis (3%), Cornus sericea ssp. sericea (3%), Trifolium pratense (3%), Thermopsis montana (3%), Symphoricarpos oreophilus (3%), Salix geyeriana (3%), Rudbeckia laciniata var. ampla (3%), Pseudocymopterus montanus (3%), Phleum pratense (3%), Pedicularis procera (3%), Medicago lupulina (3%), Salix ligulifolia (2-3%), Taraxacum officinale (2-3%), Achillea millefolium var. occidentalis (1-2%), Juncus balticus var. montanus (1%), Glyceria striata (1%), Fragaria virginiana ssp. glauca (1%), Dasiphora floribunda (1%), Iris missouriensis (1%), Thalictrum fendleri (1%), Dactylis glomerata (1%), Amelanchier alnifolia (1%), Angelica pinnata (1%), Geranium richardsonii (1%), Bromus inermis (1%), Chamerion angustifolium ssp. circumvagum (1%), Calamagrostis canadensis (1%), Carex pellita (1%), Cardamine cordifolia (1%), Carex microptera (1%), Mertensia ciliata (1%), Castilleja sulphurea (1%), Castilleja miniata (1%), Carex utriculata (1%), Elymus glaucus (1%), Vicia americana (1%), Trifolium repens (1%), Solidago canadensis (1%), Ribes lacustre (1%), Heterotheca villosa (1%), Platanthera sparsiflora var. ensifolia (1%), Pinus ponderosa var. scopulorum (1%), Oxypolis fendleri (1%), Mimulus guttatus (1%), Zigadenus elegans ssp. elegans (1%), Maianthemum racemosum ssp. amplexicaule (1%), Rubus idaeus ssp. strigosus (1%).

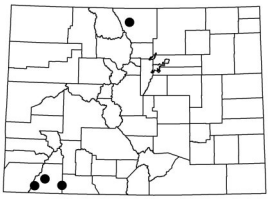
Narrowleaf cottonwood / Common snowberry Woodland

Populus angustifolia / Symphoricarpos albus

Global rank/State rank:
G2Q / S2Q

HGM subclass: R3/4

Colorado elevation range:
5,500-8,350 ft (1,700-2,550 m)



General Description

The *Populus angustifolia/Symphoricarpos albus* (narrowleaf cottonwood/common snowberry) plant association is limited to small patches in Front Range canyons, and along narrow streams on the Colorado Western Slope. In Colorado, we include stands dominated by a variety of *Symphoricarpos* species within this community. *Symphoricarpos albus* is used in the name of this association because most of the snowberry species encountered in stand data are identified as *Symphoricarpos albus.* However, since Weber does not recognize *Symphoricarpos albus* from the Western Slope, these may be a different species.

This plant association occurs on upper terraces and outer edges of floodplains in medium to wide valleys, 500-1,800 ft (150-550 m). This association generally occurs 5-30 ft (1.5-6 m) above the channel bankfull level. Stream channels are wide and shallow and slightly meandering. Soils are deep sandy loams and clay loams, highly stratified, and with little coarse material present.

Vegetation Description

The overstory of this plant association is characterized by 40-100% cover of mature *Populus angustifolia* (narrowleaf cottonwood). The shrub layer in mesic stands is dominated by *Symphoricarpos albus* (common snowberry) on the Eastern Slope, and by *Symphoricarpos oreophilus* (mountain snowberry) on the Western Slope. Other shrub species, which may or may not be present include *Prunus virginiana* (chokecherry), *Quercus gambelii* (Gambel oak), *Ribes lacustre* (prickly currant), *Ribes cereum* (wax currant), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Betula occidentalis* (river birch), and *Salix bebbiana* (Bebb willow). Xeric stands are less diverse and have a higher abundance of *Symphoricarpos* spp. and may represent older, more mature stands.

Graminoid cover is mostly non-native grasses including *Poa pratensis* (Kentucky bluegrass) and *Agrostis stolonifera* (creeping bentgrass). Forb cover is sparse but diverse, including *Thalictrum fendleri* (Fendler meadowrue), *Maianthemum stellatum* (starry false Solomon seal), *Osmorhiza depauperata* (bluntseed sweetroot) and *Achillea millefolium* var. *occidentalis* (western yarrow).

Ecological Processes

The *Populus angustifolia/Symphoricarpos albus* (narrowleaf cottonwood/common snowberry) plant association is a late-seral cottonwood community that will not regenerate in place as it occurs on elevated toeslopes away from the scoured, bare soils needed for cottonwood seedling establishment. *Symphoricarpos* will persist after the mature cottonwoods die and fall over.

Avg. Cover %	(Range)	Species Name	# Plots (N=4)
68	(40-100%)	Populus angustifolia	4
30	—	Actaea rubra ssp. arguta	1
25	(20-30%)	Amelanchier alnifolia	2
21	—	Symphoricarpos oreophilus	1
20	—	Juniperus scopulorum	1
16	(1-31%)	Pinus ponderosa	2
15	(1-27%)	Symphoricarpos albus	3
14	(13-15%)	Quercus gambelii	2
10	—	Galium triflorum	1
10	—	Elymus repens	1
10	—	Lonicera involucrata	1
10	—	Luzula spicata	1
6	(1-10%)	Maianthemum stellatum	3
6	(1-10%)	Rosa woodsii	3
6	(0.1-11%)	Paxistima myrsinites	2
5	—	Elymus lanceolatus	1
5	—	Dactylis glomerata	1
5	—	Poa palustris	1
5	—	Portulaca halimoides	1
5	(0.1-10%)	Achillea millefolium var. occidentalis	4

Other species with < 5% average cover present in at least 10% of plots:
Prunus virginiana var. melanocarpa (4-%), Poa pratensis (1-5%), Hedysarum boreale (3%), Berberis fendleri (3%), Melilotus officinalis (3%), Mahonia repens (1-3%), Thalictrum fendleri (0.1-4%), Vicia americana (0.1-2%), Galium boreale (1%), Iris missouriensis (1%), Deschampsia caespitosa (1%), Fragaria vesca ssp. bracteata (1%), Chamerion angustifolium ssp. circumvagum (1%), Carex geyeri (1%), Bromus tectorum (1%), Bromus inermis (1%), Bromus ciliatus var. ciliatus (1%), Bidens cernua (1%), Alnus incana ssp. tenuifolia (1%), Poa glauca ssp. rupicola (1%), Trifolium pratense (1%), Trifolium longipes (1%), Sium suave (1%), Pseudostellaria jamesiana (1%), Phleum pratense (1%), Mentha arvensis (1%), Ligusticum porteri (1%), Juniperus osteosperma (1%), Cynoglossum officinale (0.1%), Symphyotrichum lanceolatum ssp. hesperium var. hesperium (0.1%), Taraxacum officinale (0.1%), Geum rivale (0.1%), Osmorhiza depauperata (0.1%), Gentianella amarella ssp. heterosepala (0.1%), Artemisia ludoviciana (0.1%), Convolvulus arvensis (0.1%), Urtica dioica ssp. gracilis (0.1%), Tragopogon dubius (0.1%), Potentilla hippiana (0.1-0.1%), Helianthus annuus (0.1%), Pedicularis procera (0.1%), Medicago lupulina (0.1%), Linaria vulgaris (0.1%).

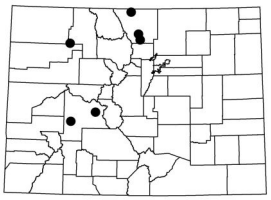
Balsam poplar Forest

Populus balsamifera

Global rank/State rank:
GU / S2

HGM subclass: R2, R3/4

Colorado elevation range:
7,300-8,900 ft (2,225-2,700 m)



General Description

The *Populus balsamifera* (balsam poplar) plant association is a minor type in Colorado. It occurs in the Routt National Forest, on tributaries of the Colorado River near Eagle, along the Cache la Poudre River, and within the Gunnison River Basin. Colorado appears to be the southern limit of the range of *Populus balsamifera,* which has a limited distribution and rarely forms stands larger than a few hundred yards long. *Populus balsamifera* is distinguished from *Populus angustifolia* (narrowleaf cottonwood) by its broad leaves with pale undersides and large, sticky-resinous buds.

This plant association occurs along a variety of streams (first through fourth order) in moderate to wide, 200-600 ft (60-180 m), glacial out-wash valleys. This association appears to be limited to immediate stream banks, overflow channels, and floodplains. Stream channels are broad and slightly meandering. Soils are fairly deep, fine sandy and silty loams over skeletal alluvial deposits.

Vegetation Description

Mature trees and saplings of *Populus balsamifera* (balsam poplar) create an overstory canopy. *Picea pungens* (blue spruce) may also be present. A thick band of shrubs can occur along the stream edge including *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Salix drummondiana* (Drummond willow), *Rosa woodsii* (Woods rose), *Lonicera involucrata* (twinberry honeysuckle), *Ribes inerme* (whitestem gooseberry), and *Sambucus racemosa* (red elderberry). The herbaceous undergrowth includes mesic species such as *Heracleum maximum* (common cowparsnip), *Geranium richardsonii* (Richardson geranium), *Osmorhiza depauperata* (bluntseed sweetroot), *Equisetum arvense* (field horsetail), *Poa pratensis* (Kentucky bluegrass), *Hydrophyllum fendleri* (Fendler waterleaf), and *Maianthemum stellatum* (starry false Solomon seal).

Ecological Processes

Populus balsamifera (balsam poplar) is a common horticultural addition to urban landscapes and may become established from cultivated areas. Careful observation is required to determine if stands in the wild are dominated by the native species.

Avg. Cover %	(Range)	Species Name	# Plots (N=6)
59	(23-91%)	Populus balsamifera	6
29	(5-60%)	Alnus incana ssp. tenuifolia	4
26	(1-70%)	Heracleum maximum	5
18	(3-33%)	Salix drummondiana	2
14	(10-20%)	Picea pungens	3
12	(1-30%)	Rudbeckia laciniata var. ampla	3
6	(1-20%)	Equisetum arvense	6
6	(1-10%)	Calamagrostis canadensis	2
5	(2-10%)	Mertensia ciliata	3
5	(1-10%)	Geranium richardsonii	5

Other species with < 5% average cover present in at least 10% of plots:
Osmorhiza depauperata (1-8%), Hydrophyllum fendleri (1-8%), Rosa woodsii (1-10%), Ribes inerme (0.1-10%), Maianthemum racemosum ssp. amplexicaule (1-5%), Cardamine cordifolia (3-3%), Populus tremuloides (1-5%), Poa pratensis (1-6%), Taraxacum officinale (0.1-7%), Cicuta douglasii (1-4%), Salix bebbiana (0.1-4%), Lonicera involucrata (1-3%), Geum macrophyllum var. perincisum (1-2%), Fragaria virginiana ssp. glauca (1-2%), Achillea millefolium var. occidentalis (1-2%), Galium boreale (0.1-3%), Oxypolis fendleri (1-1%), Phleum alpinum (1%), Viola canadensis var. scopulorum (1%), Conioselinum scopulorum (0.1-1%).

Populus balsamifera

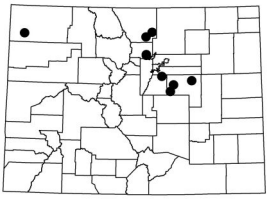
Plains cottonwood / Smooth brome Woodland

Populus deltoides / Bromus inermis

Global rank/State rank:
Not Applicable

HGM subclass: R3/4, R5

Colorado elevation range:
4,900-6,800 ft (1,500-2,070 m)



General Description

The *Populus deltoides/Bromus inermis* (plains cottonwood/smooth brome) plant association is a human-created and grazing-induced riparian woodland. It is the result of seeding *Bromus inermis*, an aggressive rhizomatous species, as a hay meadow grass. This association has an open to closed canopy of large *Populus deltoides* trees. There is little to no shrub understory and a near monotypic carpet of *Bromus inermis*. The native undergrowth has been almost completely replaced by introduced grasses.

This plant association occupies broad alluvial floodplains and upper terraces of narrow to broad meandering streams, as well as ephemeral washes. The soils of this plant association are deep and pale in color. Soil textures are mostly sandy loam to silty clay alternating with slightly coarser sands.

Vegetation Description

Mature *Populus deltoides* ssp. *monilifera* or ssp. *wislizenii* (plains or Rio Grande cottonwood) trees form an open to nearly closed canopy, typically with 30-80% cover. The understory is dominated by 10-85% cover of the non-native grass, *Bromus inermis* (smooth brome). Few other shrub and herbaceous species are present. When other shrubs and forbs are present in some abundance (>10% cover), the stand may be a degraded occurrence of a different *Populus deltoides* (plains cottonwood) plant association.

Ecological Processes

The undergrowth of the *Populus deltoides* /*Bromus inermis* (plains cottonwood/ smooth brome) plant association is a product of direct seeding. Altered hydrology (usually a lowered water table) combined with season-long livestock grazing within a

floodplain can allow *Bromus inermis* (smooth brome) to invade from adjacent pastures. With heavy grazing pressure, native grasses lose their competitive advantage in the presence of *Bromus inermis* and disappear entirely from the area. Therefore, with continual heavy grazing and no regeneration of *Populus deltoides* due to the altered hydrology, this plant association will eventually become a *Bromus inermis* meadow.

Avg. Cover %	(Range)	Species Name	# Plots (N=16)
47	(10-85%)	Bromus inermis	16
44	(2-85%)	Populus deltoides	16
43	(15-70%)	Anemone canadensis	2
27	(1-43%)	Poa pratensis	8
20	(2.5-37.5%)	Euphorbia esula var. esula	4
10	(0.1-25%)	Salix amygdaloides	8
9	(2.5-15%)	Elymus repens	4
7	(2-16%)	Taraxacum officinale	3
7	(2.5-15%)	Ambrosia psilostachya	3
6	(2.5-15%)	Salix exigua	5
6	(1-14.5%)	Pascopyrum smithii	4
5	(0.1-15%)	Agrostis gigantea	5

Other species with < 5% average cover present in at least 10% of plots:
Medicago sativa (2-7%), Juncus balticus var. montanus (1-15%), Achillea millefolium var. occidentalis (1-7%), Ambrosia artemisiifolia var. elatior (2-4%), Dactylis glomerata (1-5%), Artemisia ludoviciana (2-4%), Elymus canadensis (2.5%), Urtica dioica ssp. gracilis (2-2.5%), Melilotus officinalis (1.5-2.5%), Symphoricarpos occidentalis (1-2.5%), Juncus articulatus (1-3%), Tragopogon dubius (1-2.5%), Lactuca serriola (1-2.5%), Poa compressa (1-2.5%), Equisetum laevigatum (1-3%), Equisetum arvense (1-2%), Medicago lupulina (1-2%), Verbena hastata (1%).

Bromus inermis

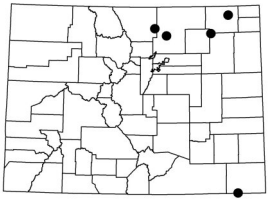
Plains cottonwood / Woolly sedge Woodland

Populus deltoides / Carex pellita (=lanuginosa)

Global rank/State rank:
G2 / S1

HGM subclass: R5

Colorado elevation range:
3,700-4,900 ft (1,100-1,500 m)



General Description

The *Populus deltoides/Carex pellita* (plains cottonwood/woolly sedge) plant association is an open to closed canopy woodland of large *Populus deltoides* trees with a dense layer of *Carex pellita* covering the ground. It occurs in swales and other depressions on the floodplain. This association occurs most commonly along the floodplain of the lower South Platte River from Greeley to Julesberg. One occurrence of the association is known form the extreme southeast corner of the state.

This plant association occurs along broad, braided channels in low-lying swales and overflow channels that are slightly less well drained than *Spartina pectinata* (prairie cordgrass) dominated areas. It occurs in small, easily overlooked patches but can form long bands in the bottoms of overflow troughs. Soils are predominately heavy clays with signs of mottling often present.

Vegetation Description

Mature *Populus deltoides* ssp. *monilifera* (plains cottonwood) trees form a nearly closed canopy. The undergrowth in undisturbed sites is predominately *Carex pellita* (woolly sedge). Other trees that can be present include *Salix amygdaloides* (peachleaf willow); often these are so widely spread they may be missed altogether. There is no consistent shrub canopy, but a few species may be present, including *Prunus virginiana* (chokecherry), *Celtis laevigata* var. *reticulata* (netleaf hackberry), *Vitis riparia* (riverbank grape), and *Parthenocissus quinquefolia* (Virginia creeper). The herbaceous undergrowth is dominated by *Carex pellita* (woolly sedge). Other species include *Elymus lanceolatus* (streambank wheatgrass), *Bromus inermis* (smooth brome), *Muhlenbergia asperifolia* (alkali muhly), and *Phalaris arundinacea* (reed canarygrass).

Ecological Processes

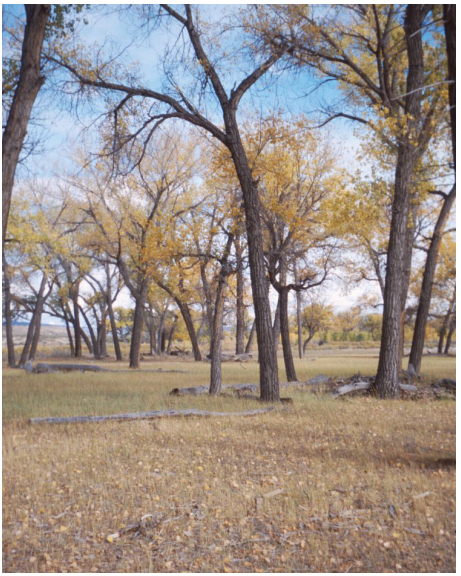
The *Populus deltoides*/*Carex pellita* (plains cottonwood/woolly sedge) association appears to be a mid- to late-seral stage that has experienced over-bank flooding deposition. Cottonwoods can tolerate burial by sending out new shoots just below the new substrate surface. *Carex pellita* (woolly sedge) occurs in the wetter swales beneath the cottonwood canopy and is stimulated by fluvial deposition. This plant association can therefore replace other cottonwood associations by only changing the understory. Without over-bank flooding, *Carex pellita* will give way to dry grasses and less mesic shrubs such as *Symphoricarpos occidentalis* (western snowberry) and *Prunus virginiana* (chokecherry).

Avg. Cover %	(Range)	Species Name	# Plots (N=6)
57	(1-86%)	Populus deltoides	6
52	(14-76%)	Carex pellita	6
34	(27-40%)	Salix amygdaloides	3
23	(5-40%)	Phalaris arundinacea	2
18	(3-42%)	Elymus lanceolatus	3
13	—	Bromus inermis	1
9	—	Celtis laevigata var. reticulata	1
8	—	Glycyrrhiza lepidota	1
6	—	Muhlenbergia asperifolia	1
5	—	Euphorbia esula var. esula	1
5	—	Parthenocissus quinquefolia	1

Other species with < 5% average cover present in at least 10% of plots:
Vitis riparia (2-8%), Asclepias speciosa (4%), Prunus virginiana var. melanocarpa (4%), Ratibida columnifera (4%), Poa pratensis (4%), Polygonum pensylvanicum (2-4%), Cirsium arvense (3%), Artemisia ludoviciana (2%), Apocynum androsaemifolium (2%), Schoenoplectus pungens (2%), Elymus canadensis (2%), Plantago major (2%), Rumex crispus (2%), Spartina pectinata (1-2%), Xanthium strumarium (1%), Ribes aureum (1%), Chenopodium glaucum (1%), Convolvulus arvensis (1%), Conyza canadensis (1%), Chenopodium album (1%), Bromus hordeaceus (1%), Juniperus scopulorum (1%), Bothriochloa laguroides ssp. toreyana (1%), Bidens tripartita (1%), Bidens frondosa (1%), Ambrosia artemisiifolia var. elatior (1%), Viola canadensis var. scopulorum (1%), Ulmus pumila (1%), Toxicodendron rydbergii (1%), Solidago canadensis (1%), Schoenoplectus acutus\tabernaemontani (1%), Acer negundo var. interius (1%), Euphorbia dentata (1%).

Plains cottonwood / Inland saltgrass Woodland

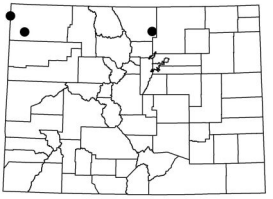
Populus deltoides / Distichlis spicata



Global rank/State rank:
G2 / S2

HGM subclass: R5

Colorado elevation range:
3,300-6,300 ft (1,005-1,920 m)



General Description

This plant association occurs on upper terraces of the floodplains of mature rivers. It is a transitional community in both the spatial and temporal sense. Spatially, it is transitional between the active floodplain with a more mesic understory and xeric upland shortgrass prairie communities. Temporally, it marks the abandonment of a terrace by a river; cottonwood does not regenerate in this community. The loss of mesic shrubs such as sandbar willow and its replacement by saltgrass marks the retreat of the water table. This association often has a park-like appearance and is characterized by an open canopy of scattered, mature cottonwood with an understory dominated by grasses, especially the low-growing saltgrass. *Pascopyrum smithii* (Western wheatgrass) may be co-dominant, and many other grasses and forbs are usually present with low cover. Shrub cover is also low.

Rivers that support this association occupy broad valleys filled with their own alluvium, deposited since the middle Pliocene. Elevations range from about 5,000 ft (1,525 m) on the Yampa and Green Rivers to 3,350 ft (1,020 m) on the South Platte and Arkansas Rivers near the Kansas and Nebraska borders. The highest river flows result from spring snowmelt (generally peaking in late-May through mid-June), and more rarely, from isolated heavy summer thunderstorms. The *Populus deltoides/ Distichlis spicata* association occurs on middle and upper terraces of floodplains of geologically mature rivers. The floodplains of these rivers are typically wide and flat and include depositional and erosional features typical of mature rivers, such as active channels, overflow channels, meander scrolls, oxbows, and terraces. This association occurs on higher terraces away from the active floodplain, where the water table is several feet below the surface, but mature trees are able to tap the deeper water table.

These terraces flood extremely rarely. Soils are derived primarily from fine-textured alluvium, secondarily from aeolian deposits. These soils are often poorly developed and typically consist of unaltered bands or lenses of sand, clay, silt and gravel. They are well drained, low in organic matter, and are often alkaline (pH > 7.0).

Vegetation Description

This association is characterized by a relatively open canopy of *Populus deltoides*, (plains cottonwood). In most stands the trees are large and uniformly sized, but density can vary greatly. Although not always recorded in stand data, other deciduous trees are occasionally present, including the natives *Salix amygdaloides* (peachleaf willow)*, Fraxinus pennsylvanica* (green ash) and *Acer negundo* (boxelder), and introduced species such as *Ulmus pumila* (Siberian elm)*, Tamarix ramosissima* (saltcedar), and *Elaeagnus angustifolia* (Russian olive). The shrub layer is often poorly developed, but patches of broad-leaved deciduous shrubs occasionally occur.

The herbaceous layer is dominated by the perennial grass *Distichlis spicata* (inland saltgrass), with highly variable cover (from 2% to more than 70%). This variation is apparently related to the degree of tree canopy closure, in that more open stands of *Populus* have denser graminoid cover in the understory. *Sporobolus cryptandrus* (sand dropseed) and *Pascopyrum smithii* (western wheatgrass) are other common perennial grasses, but usually with less cover than *Distichlis spicata*. The herbaceous layer generally also contains a mix of other graminoid and forb species. Most stands include weedy native species such as povertyweed (*Iva axillaris*) and exotic species such as *Bromus tectorum* (cheatgrass), *Melilotus officinalis* (yellow sweetclover), or *Poa pratensis* (Kentucky bluegrass). Total herbaceous cover is highly variable and cryptograms are very uncommon.

Ecological Processes

This plant association usually represents floodplain terraces that are rarely, if ever flooded. Regeneration of cottonwoods is dependent on floods that scour sand and gravel bars, preparing them for seed germination. If rivers do not experience flood events at appropriate times of the year, cottonwood stands will not regenerate.

Avg. Cover %	(Range)	Species Name	# Plots (N=6)
40	(2-70.5%)	Distichlis spicata	6
39	(20-62%)	Populus deltoides	6
18	(1.3-30%)	Pascopyrum smithii	5
16	(1-27.8%)	Bromus tectorum	3
15	—	Medicago sativa	1
14	(0.1-37%)	Chrysothamnus viscidiflorus	4
13	(1-37%)	Melilotus officinalis	3
12	—	Glycyrrhiza lepidota	1
12	(4.8-18%)	Iva axillaris	4
10	—	Elymus canadensis	1
9	(5.8-10.9%)	Elymus trachycaulus ssp. trachycaulus	4
7	—	Salsola tragus	1
7	(0.1-14.5%)	Poa compressa	2
5	(3.1-6.5%)	Kochia americana	2

Other species with < 5% average cover present in at least 10% of plots:
Descurainia pinnata (1.3-6.5%), Juncus balticus var. montanus (3.6%), Sporobolus airoides (0.1-7.4%), Poa pratensis (0.1-5%), Conyza canadensis (1%), Descurainia sophia (1%), Equisetum hyemale var. affine (1%), Artemisia ludoviciana (1%), Tragopogon dubius (0.1-1%), Taraxacum officinale (0.1%), Symphyotrichum lanceolatum ssp. hesperium var. hesperium (0.1%), Symphoricarpos occidentalis (0.1%), Medicago lupulina (0.1%), Erigeron pumilus (0.1%), Gratiola neglecta (0.1%).

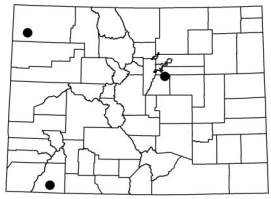
Plains cottonwood / Slender wheatgrass Woodland

Populus deltoides / Elymus trachycaulus

Global rank/State rank:
GU / S2

HGM subclass: R5

Colorado elevation range:
5,900-6,000 ft (1,798-1,829 m)



General Description

This plant association occurs on upper terraces of the floodplains of mature streams or rivers. Spatially, this community is transitional between the active floodplain with a more mesic understory and xeric upland communities. Temporally, this community marks the abandonment of a terrace by a river; cottonwood does not regenerate in this community. The loss of mesic shrubs such as sandbar willow and its replacement by slender wheatgrass marks the retreat of the water table. This association often has a park-like appearance and is characterized by an open canopy of scattered, mature *Populus deltoides* (plains cottonwood) with an understory dominated by grasses, especially *Elymus trachycaulus* (slender wheatgrass). Many other grasses and forbs may be present with low cover. Shrub cover is also low.

Rivers that support *Populus deltoides/Elymus trachycaulus* (plains cottonwood/ slender wheatgrass) communities occupy broad valleys filled with alluvium, deposited since the middle Pliocene. Described occurrences come from a narrow elevational range around 6,000 ft. *Populus deltoides/Elymus trachycaulus* occurs on middle and upper terraces of floodplains of geologically mature rivers. The floodplains of these rivers are typically wide and flat and include depositional and erosional features typical of mature rivers, such as active channels, overflow channels, meander scrolls, oxbows, and terraces. This association occurs on higher terraces away from the active floodplain, where the water table is several feet below the surface, but mature trees are able to tap the deeper water table. These terraces flood extremely rarely.

Streams supporting this association are broad, relatively shallow, low-gradient and sinuous. Soils are derived primarily from fine-textured alluvium, secondarily from aeolian deposits. These soils are often poorly developed and typically consist of

unaltered bands or lenses of sand, clay, silt and gravel. They are well drained and low in organic matter.

Vegetation Description

This association is characterized by relatively open to dense canopies of the broad-leaved deciduous tree *Populus deltoides*, (plains cottonwood). In most stands the trees are large and uniformly sized, but density can vary greatly. The shrub layer is often poorly developed, but may include small patches of *Salix exigua* (sandbar willow) at wetter sites. The herbaceous layer is dominated by the perennial grass *Elymus trachycaulus* (slender wheatgrass), with highly variable cover. The herbaceous layer generally also contains a mix of other graminoid and forb species. Introduced species are common in the shrub and herbaceous layers; exotics may include *Tamarix ramosissima* (saltcedar), *Elaeagnus angustifolia* (Russian olive), *Poa pratensis* (Kentucky bluegrass), *Cirsium arvense* (Canada thistle), *Elymus repens* (quackgrass), and others. Most stands also include weedy native species such as *Iva axillaris* (povertyweed). Total herbaceous cover is highly variable and cryptograms are very uncommon.

Ecological Processes

This plant association usually represents floodplain terraces that are rarely, if ever, flooded. Regeneration of cottonwoods typically occurs on lower bars and is dependent on floods that scour sands and gravels, preparing them for seed germination. If rivers do not experience flood events at appropriate times of the year, cottonwood stands will not regenerate. With extended grazing pressure the understory of this association is likely to be dominated by non-native species, especially *Poa pratensis* (Kentucky bluegrass).

Avg. Cover %	(Range)	Species Name	# Plots (N=5)
63	(37.5-88%)	Populus deltoides	5
44	(37-62%)	Elymus trachycaulus ssp. trachycaulus	4
38	—	Elymus lanceolatus	1
38	—	Clematis ligusticifolia	1
24	(20-28.5%)	Iva axillaris	2
15	(14.5-15%)	Cirsium arvense	3
10	(1-15%)	Poa pratensis	5
9	(2.5-15%)	Symphyotrichum lanceolatum ssp. hesperium var. hesperium	2

Other species with < 5% average cover present in at least 10% of plots:
Bromus inermis (3.5%), Elaeagnus angustifolia (0.1-5%), Asclepias speciosa (2.5%), Cardamine breweri (2.5%), Artemisia ludoviciana (2.5%), Ambrosia trifida (2.5%), Achillea millefolium var. occidentalis (2.5%), Tamarix ramosissima (2.5%), Symphyotrichum falcatum (2.5%), Potentilla norvegica (2.5%), Phleum pratense (2.5%), Elymus canadensis (1-2.5%), Symphoricarpos occidentalis (1-3%), Glycyrrhiza lepidota (1-2.5%), Salix exigua (1-2.5%), Pascopyrum smithii (1%), Elymus repens (1%), Ceratocephala testiculata (1%), Apocynum cannabinum (1%), Agrostis gigantea (1%), Toxicodendron rydbergii (1%), Rosa woodsii (1%), Forestiera pubescens (1%), Equisetum arvense (1%), Mentha spicata (1%), Melilotus officinalis (1%), Maianthemum stellatum (1%), Lepidium latifolium (1%), Vitis riparia (1%), Equisetum laevigatum (1%), Equisetum hyemale var. affine (0.1-1.5%), Poa compressa (0.1%), Dactylis glomerata (0.1%), Artemisia tripartita ssp. tripartita (0.1%), Bromus tectorum (0.1%), Muhlenbergia asperifolia (0.1%), Taraxacum officinale (0.1%), Plantago major (0.1%), Helianthus annuus (0.1-0.1%), Acer glabrum (0.1%), Plantago lanceolata (0.1%).

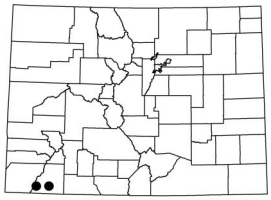
Plains cottonwood / Wild-privet Woodland

Populus deltoides / Forestiera pubescens

Global rank/State rank:
GU / S2

HGM subclass: R5

Colorado elevation range:
5,450-5,850 ft (1,661-1,783 m)



General Description

This plant association occurs on terraces along low-gradient rivers and is characterized by a fairly dense forest of *Populus deltoides* (plains cottonwood) with a shrub understory dominated by *Forestiera pubescens* (wild privet). This plant association occurs in the Animas River drainage in southwestern Colorado. Soils are generally coarse alluvium derived from igneous bedrock.

Vegetation Description

Populus deltoides (plains cottonwood) dominates this type forming a fairly dense canopy with 40-90% cover. *Forestiera pubescens* dominates the shrub layer. *Eleagnus angustifolia* (Russian olive) is often present. Other shrubs that may be present include *Salix exigua* (sandbar willow), *Rhus trilobata* (skunkbush sumac), *Chrysothamnus viscidiflorus* (yelllow rabbitbrush), and *Ericameria nauseosa* (=*Chrysothamnus nauseosos* - rubber rabbitbrush).

The herbaceous layer is often sparse, and usually includes some exotic species. *Agrostis gigantea* (redtop) and *Dactylis glomerata* (orchardgrass) had 15% cover each in one stand. Other graminoids usually have less than 5% cover and include *Muhlenbergia asperifolia* (alkali muhly), *Sporobolus airoides* (alkali sacaton), *Poa pratensis* (Kentucky bluegrass), *Elytrigia intermedia* (slender wheatgrass), and *Elymus lanceolatus* (streambank wheatgrass). Forbs usually provide less than 5% cover and may include *Glycyrrhiza lepidota* (American licorice), *Mentha spicata* (spearmint), and *Clematis ligusticifolia* (western white clematis). Forb cover may be much higher when exotic species such as *Cardaria pubescens* (hairy whitetop) and *Acroptilon repens* (Russian knapweed) are present.

Ecological Processes

As with all cottonwood woodlands, this association is found within a continually changing alluvial environment where riparian vegetation is constantly being “re-set”

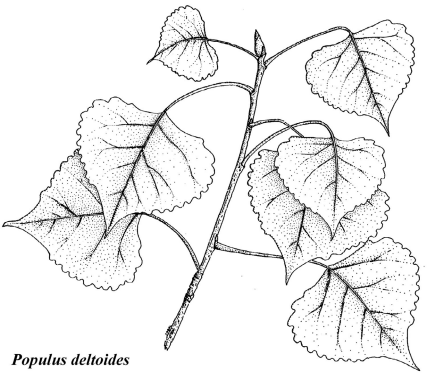
by flooding disturbance. Mature cottonwood stands do not regenerate in place, but regenerate by "moving" up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities. The process of cottonwood regeneration is dependent on flooding disturbance. Periodic flooding allows cottonwood seedlings to germinate and become established on newly deposited, moist sandbars. Natural river processes of dating, deposition and channel migration result in a dynamic patchwork of different age classes, plant associations and habitats.

Avg. Cover %	(Range)	Species Name	# Plots (N=6)
80	(38-88%)	Populus deltoides	6
43	(1-100%)	Elaeagnus angustifolia	6
38	—	Cardaria pubescens	1
31	(1-63%)	Forestiera pubescens	6
23	(1-63%)	Acroptilon repens	3
15	—	Chrysothamnus viscidiflorus	1
15	—	Salix exigua	1
8	(1-15%)	Dactylis glomerata	2
6	(1-15%)	Agrostis gigantea	3
5	(5-5%)	Muhlenbergia asperifolia	3
5	—	Elytrigia intermedia	1

Other species with < 5% average cover present in at least 10% of plots:
Elymus lanceolatus (0.1-5%), Rhus trilobata var. trilobata (0.1-5%), Xanthium strumarium (1%), Medicago sativa (1%), Pascopyrum smithii (1%), Plantago lanceolata (1%), Plantago major (1%), Tamarix ramosissima (1%), Sporobolus airoides (0.1-1%), Bromus inermis (0.1-1%), Poa pratensis (0.1-1%), Chenopodium album (0.1-1%), Clematis ligusticifolia (0.1-1%), Ericameria nauseosa ssp. nauseosa var. glabrata (0.1-1%), Mentha spicata (0.1-1%), Equisetum laevigatum (0.1%), Elymus canadensis (0.1%), Asclepias subverticillata (0.1%), Glycyrrhiza lepidota (0.1%), Gratiola neglecta (0.1%), Phleum pratense (0.1%), Toxicodendron rydbergii (0.1%), Euphorbia esula var. esula (0.1%).

Plains cottonwood / Alkali muhly Forest

Populus deltoides / Muhlenbergia asperifolia

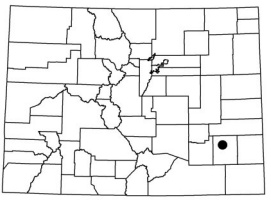


Populus deltoides

Global rank/State rank:
G3 / S1

HGM subclass: R5

Colorado elevation range:
3,850 ft (1,180 m)



General Description

The *Populus deltoides/Muhlenbergia asperifolia* (plains cottonwood/alkali muhly) association is a widely spaced, open riparian forest or woodland with very little shrub canopy, and thick layer of warm-season grasses covering the ground.

This association lies in an old overflow channel of the Arkansas River, that is now flooded more frequently and for a longer duration due to its upstream proximity to the John Martin Reservoir. Here the Arkansas River is a wide, slightly meandering river that is becoming entrenched. At this location the river is impounded by a dam and frequently inundated by John Martin Reservoir. Soils are deep silty clays, high in organic matter, and have mottles at 8 inches (21 cm) depth.

Vegetation Description

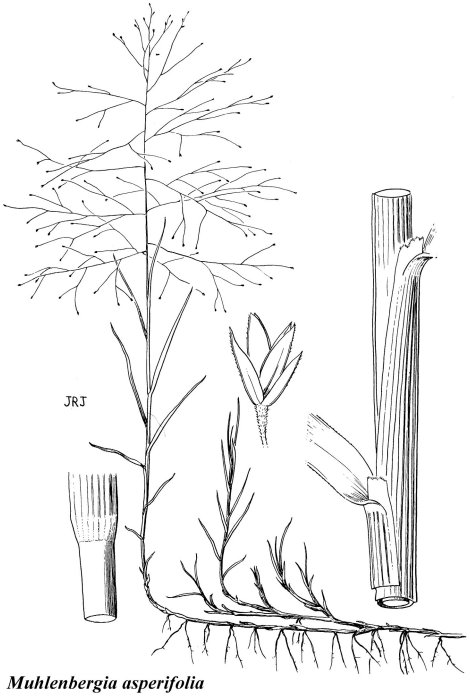
Tall, mature, and widely spaced *Populus deltoides* ssp. *monilifera* (plains cottonwood) and infrequent *Salix amygdaloides* (peachleaf willow) make up the overstory canopy of this association. The herbaceous undergrowth is dominated by graminoids, including *Muhlenbergia asperifolia* (alkali muhly), *Distichlis spicata* (inland saltgrass), *Scirpus microcarpus* (panicled bulrush), *Panicum virgatum* (switchgrass), and *Eleocharis palustris* (common spikerush). A few forbs include *Apocynum cannabinum* (Indianhemp) and *Ambrosia artemisiifolia* (annual ragweed).

Ecological Processes

Little is known about the *Populus deltoides/Muhlenbergia asperifolia* (plains cottonwood/alkali muhly) plant association. It appears to be mid-seral stage of cottonwood regeneration. Alkali muhly is known to prefer moist alkaline soils.

Avg. Cover %	(Range)	Species Name	# Plots (N=1)
31	n/a	Muhlenbergia asperifolia	1
24	n/a	Populus deltoides	1
20	n/a	Salix amygdaloides	1
20	n/a	Distichlis spicata	1
13	n/a	Scirpus microcarpus	1
6	n/a	Panicum virgatum	1
6	n/a	Eleocharis palustris	1
5	n/a	Elaeagnus angustifolia	1

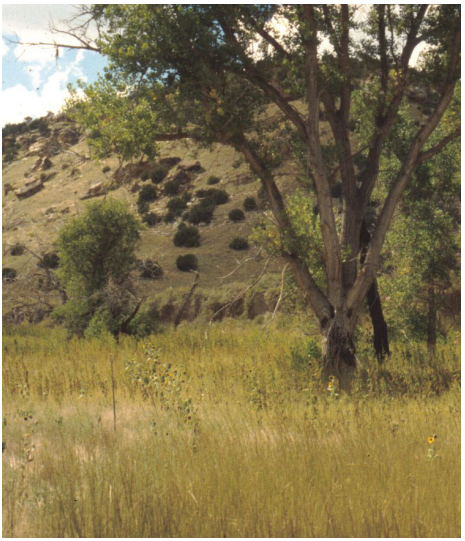
Other species with < 5% average cover present in at least 10% of plots:
Bassia hyssopifolia (4%), Tamarix ramosissima (2%), Schoenoplectus pungens (1%), Elymus canadensis (1%), Chenopodium album (1%), Apocynum cannabinum (1%), Ambrosia artemisiifolia var. elatior (1%).



Muhlenbergia asperifolia

Plains cottonwood / Switchgrass - Little bluestem Woodland

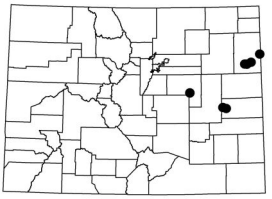
Populus deltoides / Panicum virgatum - Schizachyrium scoparium



Global rank/State rank:
G2 / S2

HGM subclass: R5

Colorado elevation range:
3,300-5,650 ft (1,000-1,720 m)



General Description

This is a mature *Populus deltoides* (plains cottonwood) woodland with an open to closed canopy and little to no shrub cover. The undergrowth is a thick prairie of several tall-grass species, especially *Panicum virgatum* (switchgrass) and *Spartina pectinata* (prairie cordgrass). *Schizachyrium scoparium* (little bluestem) is a more common element of this association in the Great Plains outside Colorado.

This plant association occurs on low floodplain ridges, slightly elevated point bars, and stream banks. It is found along strongly meandering rivers with moderate to low gradients. Channel substrates range from heavy clays to sand. Soil textures of this association range from fine, sandy loams to silty clay. Soils are deep and stratified by depositional layers with no coarse fragments.

Vegetation Description

The overstory canopy of this association is scattered *Populus deltoides* ssp. *monilifera* (plains cottonwood) (15-75% cover) growing individually or in small stands. *Salix amygdaloides* (peachleaf willow) is often present, but can be so widely spaced that it is missed in sampling. In other stands, the opposite is true and *Salix amygdaloides* (peachleaf willow) outnumbers the widely spaced *Populus deltoides* ssp. *monilifera* (plains cottonwood).

The most distinguishing feature of this association, however, is the lush herbaceous undergrowth of graminoid species including *Panicum virgatum* (switchgrass), *Spartina pectinata* (prairie cordgrass), *Bouteloua gracilis* (blue grama), *Calamovilfa longifolia* (prairie sandreed), *Sporobolus cryptandrus* (sand dropseed), *Sporobolus*

airoides (alkali sacaton), *Carex pellita* (woolly sedge), *Carex nebrascensis* (Nebraska sedge), *Schizachyrium scoparium* (little bluestem), and *Bouteloua curtipendula* (sideoats grama). Kansas and Nebraska ecologists report that *Schizachyrium scoparium* (little bluestem) is more common in this plant association farther east. Other herbaceous species present include *Medicago sativa* (alfalfa), *Psoralidium tenuiflorum* (slimflower scurfpea), and *Melilotus officinalis* (yellow sweetclover).

Ecological Processes

Because the regeneration and establishment of new stands of cottonwood is dependent upon flooding events, any alterations to the natural flow regime of a river can affect the cottonwood ecosystem. Upstream dams stabilize stream flows and reduce flooding frequency and magnitude. This results in fewer flood events that would allow for cottonwood stand regeneration. Without periodic disturbance by flooding, riparian areas become dominated by late-seral communities dominated by upland species.

Avg. Cover %	(Range)	Species Name	# Plots (N=9)
54	(14-77%)	Populus deltoides	9
46	(1-87%)	Salix amygdaloides	6
23	(11-34%)	Carex pellita	2
19	(2-47%)	Panicum virgatum	8
15	(1-33%)	Eleocharis palustris	3
13	(7-18%)	Spartina gracilis	2
12	(4-25%)	Spartina pectinata	3
10	(1-43%)	Poa pratensis	8
10	(1-19%)	Elymus lanceolatus	3
10	(1-18%)	Schoenoplectus pungens	2
8	(2-20%)	Medicago sativa	3
8	(5-11%)	Sporobolus airoides	2
7	(1-11%)	Sporobolus cryptandrus	3
7	(3-10%)	Bouteloua gracilis	4
5	(1-10%)	Pascopyrum smithii	4
5	(2-8%)	Poa palustris	2
4	(1-10%)	Glycyrrhiza lepidota	3

Other species with < 5% average cover present in at least 10% of plots:
Toxicodendron rydbergii (1-7%), Bromus japonicus (1-8%), Salix exigua (1-7%), Juncus articulatus (1-5%), Muhlenbergia asperifolia (2-4%), Bromus tectorum (1-3%), Calamovilfa longifolia (1-3%), Euphorbia dentata (1-4%), Ambrosia artemisiifolia var. elatior (1-5%), Elymus canadensis (1-2%), Taraxacum officinale (1-2%), Artemisia ludoviciana (1-2%), Mirabilis linearis (1%), Buchloe dactyloides (1%), Rumex crispus (1%), Lactuca serriola (1%).

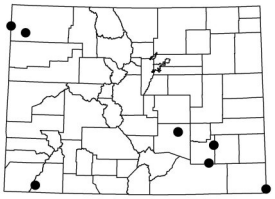
Cottonwood / Western wheatgrass - Vine mesquite Woodland

Populus deltoides / Pascopyrum smithii - Panicum obtusum

Global rank/State rank:
G2 / S2

HGM subclass: R3/4?, R5

Colorado elevation range:
3,500-5,900 ft (1,060-1,800 m)



General Description

The *Populus deltoides/Pascopyrum smithii-Panicum obtusum* (cottonwood/ western wheatgrass-vine mesquite) riparian woodland occurs on silty clay soils along rivers and streams of the southeastern Colorado plains and along large rivers on the Western Slope. Mature *Populus deltoides* (cottonwood) provide a nearly continuous overhead canopy. High-quality stands have few shrubs, creating an open, park-like structure. Many stands in Colorado along the lower Arkansas and Purgatory Rivers have a thick subcanopy of *Tamarix ramosissima* (saltcedar), an invasive non-native shrub.

This association occurs in wide valleys on floodplains and terraces. Stands are located 61-533 ft (20-175 m) lateral distance from the active channel, although one plot occurred right at the channel edge. Stands are 2-3 ft (0.65-1 m) above the height of the average annual high water mark, with the exception of one stand, that occurred right at the active channel average high water level. Stream channels are wide and meandering with sand and gravel beds, or wide and braided with sand beds. Soils are deep silty clay and silty clay loams to over 30 inches (60 cm) deep. Some profiles have loamy sands and sands at depth.

Vegetation Description

Populus deltoides ssp. *monilifera* or ssp. *wislizenii* (plains or Rio Grande cottonwood) dominates the overstory canopy. *Salix amygdaloides* (peachleaf willow) may be present in small amounts. *Ericameria nauseosa* ssp. *nauseosa* var. *glabrata* (rubber rabbitbrush), when present, is the only native shrub. *Tamarix ramosissima* (saltcedar) was frequently abundant although plot selection attempted to avoid it. The herbaceous undergrowth is dominated by a mix of *Pascopyrum smithii* (western wheatgrass) and *Panicum obtusum* (vine mesquite). Other grass species that may be present include *Distichlis spicata* (inland saltgrass), *Panicum virgatum* (switchgrass), *Muhlenbergia asperifolia* (alkali muhly), *Sporobolus airoides* (alkali sacaton), *Sporobolus*

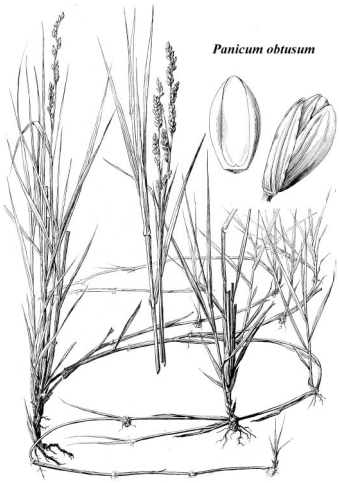
cryptandrus (sand dropseed), *Elymus canadensis* (Canada wildrye), *Bouteloua gracilis* (blue grama), and *Bothriochloa laguroides* ssp. *torreyana* (silver beardgrass).

Ecological Processes

The *Populus deltoides/Pascopyrum smithii-Panicum obtusum* (cottonwood/western wheatgrass-vine mesquite) riparian woodland is a late-seral community of active floodplains. This association occurs only on fine-textured soils in very subtle topographic swales on the floodplain. Large patches of *Sporobolus cryptandrus* (sand dropseed) occur underneath the same cottonwood stand, on the same terrace or floodplain, where pockets of very dry and sandy soils occur on subtle topographic ridges, forming the *Populus deltoides/Sporobolus cryptandrus* (cottonwood/sand dropseed) plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=13)
33	(7-84.5%)	Pascopyrum smithii	13
33	(1-83%)	Populus deltoides	13
30	(2-79%)	Panicum obtusum	6
28	(1-76%)	Tamarix ramosissima	5
17	(0.1-62%)	Melilotus officinalis	4
16	(2.5-25%)	Poa compressa	3
14	(2.5-24.5%)	Iva axillaris	3
11	(0.1-38%)	Bromus tectorum	4
11	(0.1-23%)	Sporobolus airoides	7
9	(0.1-20.5%)	Poa pratensis	4
9	(1-15%)	Distichlis spicata	4
8	(1-15%)	Artemisia tripartita ssp. tripartita	2
6	(1-15%)	Ericameria nauseosa ssp. nauseosa var. glabrata	3
5	(1-10%)	Ambrosia artemisiifolia var. elatior	4

Other species with < 5% average cover present in at least 10% of plots:
Medicago sativa (1-5%), Sporobolus cryptandrus (1-5%), Elymus canadensis (1-8%), Glycyrrhiza lepidota (0.1-5%), Chenopodium album (1-4%), Ambrosia trifida (1-4%), Muhlenbergia asperifolia (1-4%), Conyza canadensis (1-3%), Equisetum hyemale var. affine (1-3%), Gratiola neglecta (1-2.5%), Symphyotrichum lanceolatum ssp. hesperium var. hesperium (0.1-2.5%), Bouteloua gracilis (1%), Ratibida columnifera (1%), Opuntia polyacantha (1%), Lactuca serriola (0.1-1%), Tragopogon dubius (0.1-1%).



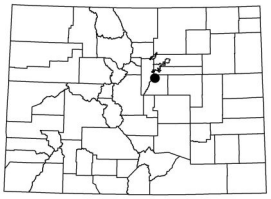
Plains cottonwood / Chokecherry Woodland

Populus deltoides / Prunus virginiana

Global rank/State rank:
G1Q / S1

HGM subclass: R3/4, R5

Colorado elevation range:
5,600 ft (1,700 m)



General Description

This is a mature plains cottonwood (*Populus deltoides* ssp. *monilifera*) association with large trees that form an open to closed canopy. Open meadows dotted with small, thick pockets of *Prunus virginiana* (chokecherry) shrubs characterize the understory. This association is known from only one degraded occurrence on a foothill tributary to the South Platte River in Colorado.

The *Populus deltoides/Prunus virginiana* (plains cottonwood/chokecherry) plant association occurs on upper terraces and elevated stream banks. The stream channel is narrow and braided with shifting islands and point bars. The soils consist of deep 28-32+ inches (70-80 cm) loamy sands alternating with layers of coarse sands and silty clays having high organic content.

Vegetation Description

This association is characterized by an open to closed canopy of 20-80% cover of tall, mature *Populus deltoides* (plains cottonwood). The shrub canopy includes *Prunus virginiana* (chokecherry), *Symphoricarpos occidentalis* (western snowberry), and *Celtis laevigata* var. *reticulata* (netleaf hackberry). A low-stature shrub canopy about 1.5 ft (0.3 m) high consisting of *Symphoricarpos occidentalis* (western snowberry) can occur underneath the taller shrubs. The shrub canopy is discontinuous and occurs in patches that are interspersed with meadows of mostly non-native grasses including *Elymus canadensis* (Canada wildrye), *Bromus inermis* (smooth brome), and *Elytrigia intermedia* (intermediate wheatgrass).

Ecological Processes

In Montana, other plant associations such as *Fraxinus pennsylvanica/Prunus virginiana* (green ash/chokecherry) and *Acer negundo/Prunus virginiana* (box-elder/chokecherry), indicate that the *Populus deltoides/Prunus virginiana* (plains cottonwood/chokecherry) plant association in Colorado may be a southern extension of one of the *Prunus virginiana* associations. The location of this association on terraces above the current stream channel and the large size of the trees indicate that it is a late-seral association.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
70	—	Populus x acuminata	1
58	(19-78%)	Populus deltoides	3
53	—	Elytrigia intermedia	1
31	(27-36%)	Prunus virginiana var. melanocarpa	3
30	(6-53%)	Salix fragilis	2
23	—	Pascopyrum smithii	1
20	(4-44%)	Symphoricarpos occidentalis	3
18	—	Rosa woodsii	1
16	—	Elymus lanceolatus	1
14	(8-21%)	Cynoglossum officinale	3
14	(3-26%)	Bromus inermis	3
11	—	Celtis laevigata var. reticulata	1
11	(2-19%)	Galium triflorum	2
8	—	Carex pellita	1
7	(3-10%)	Poa pratensis	2
4	(1-7%)	Prunus americana	2

Other species with < 5% average cover present in at least 10% of plots:
Clematis ligusticifolia (3%), Cirsium arvense (3%), Agropyron cristatum (3%), Parthenocissus quinquefolia (1-3%), Maianthemum stellatum (2%), Glycyrrhiza lepidota (2%), Rhus trilobata var. trilobata (1%), Mirabilis nyctaginea (1%), Dactylis glomerata (1%), Conium maculatum (1%), Convolvulus arvensis (1%), Apocynum androsaemifolium (1%), Ribes aureum (1%), Ribes cereum (1%), Salix amygdaloides (1%).

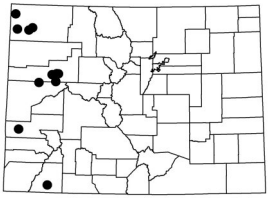
Plains cottonwood / Skunkbush sumac Woodland

Populus deltoides / Rhus trilobata

Global rank/State rank:
G2 / S2

HGM subclass: R3/4, R5

Colorado elevation range:
4,800-6,000 ft (1,450-1,830 m)



General Description

The *Populus deltoides/Rhus trilobata* (cottonwood/skunkbush sumac) woodland is documented from western Colorado in the Colorado, Yampa, and San Miguel/Dolores River Basins below 6,000 ft in elevation and represents a late-seral stage of maturing cottonwoods. The trees are usually large and widely-spaced with thick patches of *Rhus trilobata* (skunkbush sumac) between and underneath the overstory trees.

The *Populus deltoides*/*Rhus trilobata* (cottonwood/skunkbush sumac) plant association is found on immediate stream banks and the upper terraces of wide alluvial floodplains. The stream channels are highly sinuous, low gradient, and less sinuous, slightly steeper gradient streams. Soils are deep, stratified clay loams to sandy loams with fresh, alluvial sand and gravels on point bars.

Vegetation Description

This association has large, spreading *Populus deltoides* ssp. *wislizeni* (Rio Grande cottonwood) trees, and an open shrub canopy of *Rhus trilobata* (skunkbush sumac). Other trees that may be present include *Populus* x *acuminata* (lanceleaf cottonwood), *Picea pungens* (blue spruce), and *Acer negundo* (boxelder). Other shrubs that may be present include *Shepherdia argentea* (silver buffaloberry), *Tamarix ramosissima* (saltcedar), *Betula occidentalis* (river birch), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Lonicera involucrata* (twinberry honeysuckle), *Symphoricarpos occidentalis* (western snowberry), *Berberis fendleri* (Colorado barberry), *Salix lucida* ssp. *lasiandra* (shining willow), and *Salix exigua* (sandbar willow).

The herbaceous understory is usually sparse and consists mainly of *Elytrigia repens* (creeping quackgrass), *Solidago canadensis* (Canada goldenrod), *Maianthemum stellatum* (starry false Solomon seal), *Bromus tectorum* (cheatgrass), *Carex aquatilis* (water sedge), *Cirsium arvense* (Canadian thistle), *Asclepias speciosa* (showy

milkweed), *Melilotus alba* (white sweetclover), *Poa pratensis* (Kentucky bluegrass), and *Bromus inermis* (smooth brome).

Ecological Processes

As *Populus deltoides* individuals mature and grow large, *Rhus trilobata* shrubs first become more abundant and then more widely spaced. The presence of *Artemisia tridentata* (sagebrush) indicates that *Populus deltoides/Rhus trilobata* (cottonwood/skunkbush sumac) on higher terraces may be a successional stage to an upland shrub or woodland community dominated by *Artemisia tridentata*.

Avg. Cover %	(Range)	Species Name	# Plots (N=15)
41	(2.5-88%)	Populus deltoides	15
19	(1-50%)	Elymus repens	5
19	(1-50%)	Rhus trilobata var. trilobata	14*
16	(1-40%)	Populus angustifolia	9
11	(1-30%)	Poa pratensis	11
10	(0.1-38%)	Agrostis gigantea	10
10	(5-15.1%)	Elaeagnus angustifolia	4
10	(10-10%)	Cirsium arvense	2
9	(1-30%)	Elymus trachycaulus ssp. trachycaulus	5
9	(0.1-30%)	Forestiera pubescens	4
8	(1-30%)	Bromus tectorum	5
8	(5-10%)	Sporobolus airoides	2
7	(1-20%)	Shepherdia argentea	5
7	(1-20%)	Clematis ligusticifolia	6
6	(1-10%)	Iva axillaris	2
6	(1-10%)	Maianthemum stellatum	2
5	(0.1-20%)	Bromus inermis	9

Other species with < 5% average cover present in at least 10% of plots:
Solidago canadensis (1-10%), Asclepias speciosa (1-5%), Juncus balticus var. montanus (1-5%), Muhlenbergia asperifolia (0.1-5%), Elymus lanceolatus (0.1-5%), Dactylis glomerata (0.1-5%), Acroptilon repens (1-5%), Conyza canadensis (1-5%), Equisetum laevigatum (0.1-5%), Tamarix ramosissima (1-5%), Rosa woodsii (0.1-5%), Ericameria nauseosa ssp. nauseosa var. glabrata (0.1-5%), Melilotus officinalis (1-2.5%), Glycyrrhiza lepidota (0.1-2.5%), Asparagus officinalis (1%), Verbascum thapsus (1%), Cynoglossum officinale (1%), Artemisia biennis (1%), Elymus canadensis (0.1-1%), Hordeum jubatum ssp. jubatum (0.1-1%), Mentha spicata (0.1-1%), Apocynum cannabinum (0.1%), Asclepias subverticillata (0.1%).

*Rhus trilobata occurred in all stands, but was not captured in every sample plot.

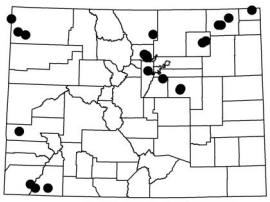
Plains cottonwood - (Peachleaf willow) / Sandbar willow Woodland

Populus deltoides - (Salix amygdaloides) / Salix exigua

Global rank/State rank:
G3G4 / S3

HGM subclass: R3/4, R5

Colorado elevation range:
3,450-6,500 ft (1,050-2,000 m)



General Description

This is an early-seral association with a mix of sapling and pole sized *Populus deltoides*, either ssp. *monilifera* or ssp. *wislizeni* (plains or Rio Grande cottonwood) intermixed with *Salix exigua* (sandbar willow). It is the younger stage of plains cottonwood associations that when older have more widely spaced trees. This association is often located on low streambanks and islands, but can also occur on overflow channels away from the main stream channel. It typically has a fairly dense tree canopy with little herbaceous ground cover.

This plant association occurs on young, alluvial surfaces such as point bars, low stream banks, and overflow areas. It occurs on immediate stream banks and low overflow areas near the main river channel, and on the floodplain of meandering, low to moderate gradient (0.5-3%) streams with silt and sand stream beds. Channels are broad and braided. Along smaller washes and incised reaches (e.g., Kiowa and West Bijou Creeks), the plant association occurs on higher terraces, where periodic summer flash floods disturb the entire floodplain. The washes have flat-bottomed, sandy beds. Soils are typically fresh alluvial material with little soil development. Textures are predominately loose, friable sands interspersed with narrow bands of clay loams and sandy clays.

Vegetation Description

This association is characterized by seedling, sapling, and pole-sized *Populus deltoides*, either ssp. *monilifera* or ssp. *wislizeni* (plains or Rio Grande cottonwood), mixed with *Salix exigua* (sandbar willow) on sandbars, point bars, and other low, frequently flooded areas. Canopy cover of *Populus deltoides* ranges from 1-70%; cover of *Salix exigua* (sandbar willow) ranges from 2-85%. The total height of this association is often under 4 ft (1.5 m), but a few stands have near-mature sized cottonwood trees, and represent the

last transition to older cottonwood types as the *Salix exigua* (sandbar willow) is shaded out by the overstory canopy of cottonwoods. Other sapling and seedling tree species may be present, including *Salix amygdaloides* (peachleaf willow), *Fraxinus pennsylvanica* (green ash), and *Ulmus pumila* (Siberian elm). Other shrubs that may be present include *Salix ligulifolia* (strapleaf willow) and *Vitis riparia* (riverbank grape).

The herbaceous understory is relatively sparse with *Xanthium strumarium* (rough cocklebur), *Melilotus officinalis* (yellow sweetclover), *Poa pratensis* (Kentucky bluegrass), *Bromus inermis* (smooth brome), and *Bromus tectorum* (cheatgrass). If the stand is very moist, up to 22% cover may be *Carex* spp. (sedge) with some *Scirpus* spp. (bulrush) and *Eleocharis palustris* (common spikerush) present.

Ecological Processes

The *Populus deltoides/Salix exigua* (broad-leaf cottonwood/sandbar willow) plant association is an early to mid-seral stage. With time and tree growth, *Salix exigua* (sandbar willow) is shaded by taller cottonwoods, and becomes less important. This vegetation type may be transitional between a *Salix exigua* (sandbar willow) dominated association and a *Populus deltoides* (cottonwood) dominated association. However, this plant association is thought to be a response to intermediate environmental conditions, especially intermediate soil moisture where *Salix exigua* dominates the wettest soils and *Populus deltoides* dominates the driest. *Salix amygdaloides* (peachleaf willow), commonly present in Eastern Slope occurrences of this association, also requires stream flooding for regeneration. This and similar associations are located throughout the western Great Plains, and on larger, low elevation rivers on the Western Slope. It was once a patchy type scattered along the South Platte and Platte Rivers. Presently it may be more abundant than it was historically due to the altered hydrologic character of the river. It may decline as the South Platte River becomes more narrow and entrenched.

Avg. Cover %	(Range)	Species Name	# Plots (N=33)
33	(1-70%)	Populus deltoides	33
29	(2-85 %)	Salix exigua	33
17	(1-42%)	Equisetum arvense	4
17	(2-50%)	Salix amygdaloides	13
14	(2-40%)	Bromus inermis	8
12	(1-38%)	Juncus balticus var. montanus	6
11	(1-63%)	Tamarix ramosissima	9
10	(1-38%)	Poa pratensis	9
9	(1-20%)	Phalaris arundinacea	5
9	(3-15%)	Conyza canadensis	4
9	(0.1-19%)	Bromus tectorum	4
8	(0.1-24%)	Hordeum jubatum ssp. jubatum	7
8	(1-33%)	Pascopyrum smithii	6
8	(0.1-30%)	Schoenoplectus pungens	5
6	(1-21%)	Fraxinus pennsylvanica	6
6	(0.1-26%)	Melilotus officinalis	10
5	(0.1-13%)	Poa compressa	4

Other species with < 5% average cover present in at least 10% of plots:
Plantago major (1-18%), Iva axillaris (0.1-16%), Xanthium strumarium (1-10%), Eleocharis palustris (1-7%), Panicum capillare (1-6.4%), Mentha arvensis (0.1-5%), Elymus canadensis (0.1-3%), Equisetum laevigatum (1-3%), Echinochloa crus-galli (0.1-2%), Verbascum thapsus (0.1-2%), Gratiola neglecta (0.1-1%).

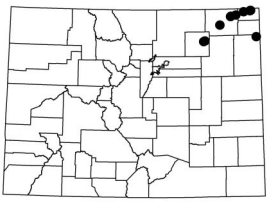
Plains cottonwood - (Black willow) / Prairie cordgrass - Sedge spp. Woodland

Populus deltoides - (Salix nigra) / Spartina pectinata - Carex spp.

Global rank/State rank:
G1G2 / S1

HGM subclass: R5

Colorado elevation range:
3,500-4,200 ft (1,000-1,300 m)



General Description

In Colorado, where it is known only from the South Platte and Republican Rivers, this association is equivalent to the *Populus deltoides-(Salix amygdaloides)/Spartina pectinata* association. This plant association has mature, widely spaced *Populus deltoides* (plains cottonwood) and occasional *Salix amygdaloides* (peachleaf willow) trees. There is little to no shrub cover and the herbaceous undergrowth is a luxuriant layer of tall *Spartina pectinata* (prairie cordgrass). This association is largely confined to swales and low areas on the floodplain where soils are fine textured and water accumulates in early summer.

This plant association occurs on wet, but well drained low-lying areas, such as swales and depressions, within overflow channels on broad floodplains. The low-lying areas are often separated by higher ridges. The stream channels are broad, shallow, and braided. Soils of this plant association show signs of continual flooding and fine-sediment deposition. Soils are stratified with alternating layers of fine and coarse particles. There are signs of faint to moderate mottling with moderate soil development.

Vegetation Description

The overstory canopy can be very open (20-30% cover) to nearly closed (up to 80% cover) of mature *Populus deltoides* ssp. *monilifera* (plains cottonwood) and 1-55% cover of *Salix amygdaloides* (peachleaf willow). In some stands, the *Populus deltoides* (plains cottonwood) or *Salix amygdaloides* (peachleaf willow) are far enough apart that they can be missed by the sampling technique used. The herbaceous undergrowth is dominated by *Spartina pectinata* (prairie cordgrass) and sometimes *Carex pellita* (woolly sedge). A few scattered shrubs may also be present, including

Salix exigua (sandbar willow), *Vitis riparia* (riverbank grape), and *Symphoricarpos occidentalis* (western snowberry). A few scattered forbs may be present, including *Polygonum pennsylvanicum* (Pennsylvania smartweed), *Glycyrrhiza lepidota* (American licorice), and *Asclepias* spp. (milkweed).

Ecological Processes

The *Populus deltoides - (Salix amygdaloides)*/*Spartina pectinata*-*Carex* spp. (plains cottonwood-(peachleaf willow)/prairie cordgrass-sedge) plant association appears to be a mid- to late-seral stage that has experienced over-bank flooding deposition. Cottonwoods can tolerate burial by sending out new shoots just below the new substrate surface. *Spartina pectinata* (prairie cordgrass) occurs in the wetter swales beneath the cottonwood canopy and is stimulated by fluvial deposition. This plant association can therefore replace other cottonwood associations by only changing the understory. Without over-bank flooding, *Spartina pectinata* will give way to dry grasses and less mesic shrubs such as *Symphoricarpos occidentalis* (western snowberry) and *Prunus virginiana* (chokecherry).

Avg. Cover %	(Range)	Species Name	# Plots (N=14)
50	(1-78%)	Populus deltoides	14
44	(25-97.5%)	Spartina pectinata	13*
30	(1-88%)	Chenopodium album	3
16	(1-42%)	Elymus lanceolatus	5
14	(3-36%)	Carex pellita	6
10	(5-15%)	Celtis laevigata var. reticulata	2
9	(1-53%)	Salix amygdaloides	14
9	(1-26%)	Glycyrrhiza lepidota	4
7	(1-20%)	Vitis riparia	7
7	(1-12%)	Pascopyrum smithii	2
6	(1-12%)	Fraxinus pennsylvanica	4
5	(1-10%)	Salix exigua	8

Other species with < 5% average cover present in at least 10% of plots:
Poa pratensis (0.1-9%), Xanthium strumarium (1-7%), Toxicodendron rydbergii (2-2.5%), Symphoricarpos occidentalis (1-4%), Cirsium arvense (0.1-3%), Echinochloa crus-galli (1-2%), Polanisia dodecandra (1-2%), Convolvulus arvensis (1-2%), Apocynum androsaemifolium (1-2%), Polygonum pensylvanicum (1%).

*Spartina pectinata occurred in all stands, but was not captured in every sample plot.

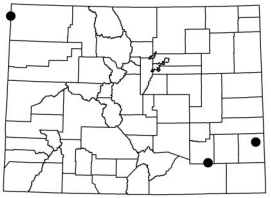
Plains cottonwood / Alkali sacaton Woodland

Populus deltoides / Sporobolus airoides

Global rank/State rank:
G2Q / S2

HGM subclass: R5

Colorado elevation range:
3,400-6,300 ft (1,000-1,340 m)



General Description

The *Populus deltoides/Sporobolus airoides* (plains cottonwood/alkali sacaton) riparian woodland is a late-seral, mature cottonwood woodland on upper terraces. The woodland is very open with widely spaced trees. The distance between trees may be more than twice their canopy widths. Shrubs are few and far between. The ground is covered with thick grasses. Although originally described from the eastern plains, a similar association from the Western Slope is included here.

This association occurs on upper terraces. It is located 120-1,000 ft (37-300 m) lateral distance from the active channel, and 3.6-4.1 ft (1.1-1.25 m) above the channel high water mark. Stream channels are wide and meandering with distinct point-bars and cut-banks at curves. The stream gradient is < 1%. Predominant bed material is gravel and sand. Soils are deep loamy sands with silt loam and silty clay textures in the upper layers 2-6 inches (5-15 cm). One profile had distinct mottles starting at 2 inches (5 cm) depth.

Vegetation Description

Large, widely spaced *Populus deltoides* (plains cottonwood) characterize this association. Shrubs form a minor component of this type. The introduced *Tamarix ramosissima* (saltcedar) occurs at all sampled sites. *Chrysothamnus viscidiflorus* (yellow rabbitbrush) is fairly abundant at the Green River site.

The herbaceous undergrowth is dominated by *Sporobolus airoides* (alkali sacaton). Other herbaceous species that may be present include *Kochia scoparia* (kochia), *Panicum obtusum* (vine mesquite), *Bouteloua gracilis* (blue grama), *Aristida purpurea* (purple threeawn), *Helianthus annuus* (common sunflower), and *Ambrosia artemisiifolia* (annual ragweed).

Ecological Processes

The *Populus deltoides/Sporobolus airoides* (plains cottonwood/alkali sacaton) riparian woodland is a late-seral community of active floodplains. *Sporobolus airoides* (alkali sacaton) is a salt tolerant plant and is commonly found in low-lying alkaline bottoms and wash banks.

Pockets of *Panicum obtusum* (vine mesquite), *Pascopyrum smithii* (western wheatgrass), and *Distichlis spicata* (saltgrass) can also occur on the same terrace, under the same stand of cottonwood trees, but on finer textured soils in very subtle topographic swales. Pockets of *Sporobolus cryptandrus* (sand dropseed) can also occur on drier, sandy soils on minor ridges on the same floodplain surface. It would appear that the graminoid species in the undergrowth of these cottonwood communities are responding to soil texture, moisture holding capacities and degree of soil salinity, while the cottonwoods are well established with much deeper, phreatophytic roots. Subsequent to cottonwood establishment, successive flooding events have unevenly deposited different sediments on the floodplain surface, creating a micro-mosaic of different habitats underneath the cottonwood canopy.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
49	(30-61%)	Sporobolus airoides	3
24	—	Equisetum hyemale var. affine	1
23	—	Bassia hyssopifolia	1
15	(9-19%)	Populus deltoides	3
15	—	Chrysothamnus viscidiflorus	1
10	—	Erigeron pumilus	1
7	—	Tragopogon dubius	1
5	—	Distichlis spicata	1
5	—	Bromus tectorum	1
5	—	Panicum obtusum	1
5	(1-8%)	Helianthus annuus	2

Other species with < 5% average cover present in at least 10% of plots:
Melilotus officinalis (4%), Bouteloua gracilis (3%), Solidago gigantea (3%), Gratiola neglecta (1-3%), Aristida purpurea (2%), Ambrosia artemisiifolia var. elatior (2%), Lepidium latifolium (2%), Sporobolus cryptandrus (2%), Tamarix ramosissima (1%), Bromus hordeaceus (1%), Bothriochloa laguroides ssp. toreyana (1%), Juniperus monosperma (1%), Triglochin maritimum (1%), Pascopyrum smithii (1%), Poa pratensis (1%), Solanum rostratum (1%), Heterotheca villosa (1%), Elymus canadensis (0.1-1%).

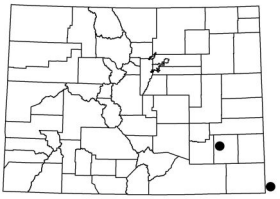
Plains cottonwood / Composite dropseed Woodland

Populus deltoides / Sporobolus compositus var. *compositus*

Global rank/State rank:
G1Q / S1

HGM subclass: R5

Colorado elevation range:
3,400-3,900 ft (1,040-1,200 m)



General Description

In Colorado, the *Populus deltoides*/*Sporobolus compositus* (plains cottonwood/ composite dropseed) riparian woodland is a late-seral, mature *Populus deltoides* ssp. *monilifera* (plains cottonwood) woodland on upper terraces. The woodland is very open with widely spaced trees. The distance between trees may be more than twice their canopy widths. Shrubs are few and far between. The ground is sparsely covered with grasses (30% cover) and patches of sand (70%). This association is known only from the southeastern corner of Colorado.

This association occurs on wide valley floodplains. It is located 1,835-2,100 ft (560-640 m) lateral distance from the active channel, and 1-3 ft (0.32-1.0 m) above the high water mark in the channel. Stream channels are broad and slightly sinuous, becoming entrenched in places, with stream gradients of 0.5-3%. Soils are deep, sandy clays to silt clays, with no coarse fragments and mottles at 6 inches (15 cm).

Vegetation Description

This association is dominated by an open canopy of large *Populus deltoides* ssp. *monilifera* (plains cottonwood) trees. *Salix amygdaloides* (peachleaf willow) is usually present on the floodplain in scattered amounts. Other trees that may be present include *Elaeagnus angustifolia* (Russian olive). There are very few shrubs, but *Artemisia filifolia* (sand sagebrush) and *Tamarix ramosissima* (saltcedar) can be present.

The herbaceous undergrowth is dominated by *Sporobolus compositus* var. *compositus (=Sporobolos asper)* (composite dropseed). Other graminoid species that may be present include *Sporobolus cryptandrus* (sand dropseed), *Sporobolus airoides* (alkali sacaton), *Panicum obtusum* (vine mesquite), *Elymus canadensis* (Canada wildrye),

and *Distichlis spicata* (inland saltgrass). Other herbaceous species include *Ambrosia artemisiifolia* (annual ragweed), *Helianthus annuus* (common sunflower), and *Senecio* spp. (ragwort).

Sporobolus compositus var. compositus (=Sporobolus asper)

Ecological Processes

The *Populus deltoides/ Sporobolus compositus* var. *compositus* (plains cottonwood/composite dropseed) riparian woodland is a late-seral community of active floodplains. *Sporobolus compositus* var. *compositus* occurs on very dry, often sandy soils and is common east of the Rocky Mountains.

It would appear that the graminoid species in the understory of these cottonwood communities are responding to soil texture, moisture holding capacity, and salinity, while the cottonwoods are well established with much deeper, phreatophytic roots. Subsequent to cottonwood establishment, successive flooding events have unevenly deposited different sediments on the floodplain surface, creating a micro-mosaic of different habitats underneath the cottonwood canopy.

Avg. Cover %	(Range)	Species Name	# Plots (N=2)
68	(61-75%)	Populus deltoides	2
26	(12-39%)	Sporobolus compositus var. compositus	2
12	—	Panicum obtusum	1
9	—	Sporobolus cryptandrus	1
8	—	Sporobolus airoides	1
7	(6-7%)	Ambrosia artemisiifolia var. elatior	2
5	—	Convolvulus arvensis	1
5	—	Pascopyrum smithii	1
4	(1-7%)	Elymus canadensis	2

Other species with < 5% average cover present in at least 10% of plots:
Bromus hordeaceus (4%), Salix amygdaloides (4%), Distichlis spicata (2-3%), Artemisia filifolia (2%), Elaeagnus angustifolia (2%), Muhlenbergia asperifolia (2%), Mentzelia chrysantha (1%), Bothriochloa laguroides ssp. toreyana (1%), Eragrostis trichodes (1%), Euphorbia dentata (1%), Medicago sativa (1%), Tamarix ramosissima (1%), Panicum virgatum (1%), Helianthus annuus (1%).

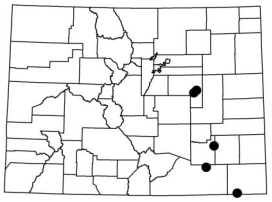
Plains cottonwood / Sand dropseed Woodland

Populus deltoides / Sporobolus cryptandrus

Global rank/State rank:
G1G2Q / S1S2

HGM subclass: R5

Colorado elevation range:
3,900-5,800 ft (1,200-1,770 m)



General Description

In Colorado, the *Populus deltoides*/*Sporobolus cryptandrus* (plains cottonwood/sand dropseed) woodland occurs on sandy floodplain soils within the Arkansas River basin. A nearly continuous overhead canopy is provided by mature *Populus deltoides* ssp. *monilifera* (plains cottonwood). There are few native shrubs, which often leads to an open, park-like structure; however, *Tamarix ramosissima* (saltcedar), a non-native, introduced invasive shrub has become a thick subcanopy in many stands along the lower Arkansas River in Colorado.

Stands occur in wide valley bottoms on active floodplains, located 144-570 ft (44-173 m) laterally away from the active stream channel, and 2-5 ft (0.6-2.15 m) above the annual high water mark. Streams ranged from wide, meandering cobble or sand-bed channels to broad, braided sand-bed ephemeral washes. Soils are deep ranging from 19-31 inches (49-80+ cm). Textures ranged from silty and sandy clay loams over sand on the larger, perennial river floodplains, to loamy sands over sand on the dry wash floodplains.

Vegetation Description

Populus deltoides ssp. *monilifera* (plains cottonwood) creates a distinct overstory gallery canopy. *Salix amygdaloides* (peach leaf willow) may be present in small amounts. Native shrubs are not present or are very scattered, and include *Artemisia filifolia* (sand sage). The introduced *Tamarix ramosissima* (saltcedar) is thick on the floodplains of perennial rivers.

The herbaceous understory is dominated by *Sporobolus cryptandrus* (sand dropseed). Other grass species that may be present include *Pascopyrum smithii* (western

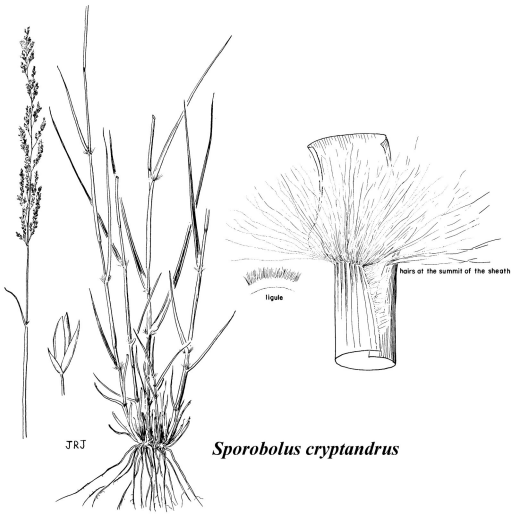
wheatgrass), *Sporobolus airoides* (alkali sacaton), *Panicum obtusum* (vine mesquite), *Elymus canadensis* (Canada wildrye), *Andropogon hallii* (sand bluestem), and *Hesperostipa comata* ssp. *comata* (needle and thread grass).

Ecological Processes

The *Populus deltoides/Sporobolus cryptandrus* (plains cottonwood/sand dropseed) riparian woodland is a late-seral community of active floodplains. It appears to develop only on very dry and sandy soils, on higher terraces that are less frequently flooded. *Sporobolus cryptandrus* (sand dropseed) is limited to sandy soils, but can be an indicator of disturbed sites.

Avg. Cover %	(Range)	Species Name	# Plots (N=5)
30	(21-40%)	Populus deltoides	5
18	(3-40%)	Sporobolus cryptandrus	5
13	—	Psoralidium tenuiflorum	1
9	(1-16%)	Panicum obtusum	2
8	—	Juniperus scopulorum	1
6	—	Paspalum setaceum	1
6	(3-8%)	Andropogon gerardii	2
5	(1-11%)	Elymus canadensis	3

Other species with < 5% average cover present in at least 10% of plots:
Psoralidium lanceolatum (4%), Panicum virgatum (4%), Lactuca serriola (4%), Sporobolus airoides (1-5%), Calamovilfa longifolia (3%), Buchloe dactyloides (3%), Tamarix ramosissima (3%), Bromus tectorum (1-4%), Ambrosia artemisiifolia var. elatior (1-4%), Pascopyrum smithii (1-6%), Helianthus annuus (1-4%), Euphorbia hexagona (1-3%), Hesperostipa comata (1-3%), Artemisia ludoviciana (2%), Bromus inermis (2%), Bromus hordeaceus (2%), Achnatherum hymenoides (2%), Medicago sativa (1-2%), Bassia hyssopifolia (1%), Euphorbia dentata (1%), Gratiola neglecta (1%), Schizachyrium scoparium (1%), Conyza canadensis (1%), Artemisia filifolia (1%), Artemisia dracunculus ssp. glauca (1%), Aristida purpurea (1%), Bothriochloa laguroides ssp. toreyana (1%), Chenopodium album (1%), Mirabilis linearis (1%), Poa pratensis (1%), Taraxacum officinale (1%), Heterotheca villosa (1%), Juniperus monosperma (1%), Melilotus officinalis (1%), Mentzelia chrysantha (1%), Cenchrus longispinus (1%).



Sporobolus cryptandrus

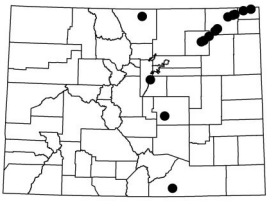
Plains cottonwood / Western snowberry Woodland

Populus deltoides / Symphoricarpos occidentalis

Global rank/State rank:
G2G3 / S2

HGM subclass: R3/4?, R5

Colorado elevation range:
3,400-6,250 ft (1,030-1,900 m)



General Description

This is a mature *Populus deltoides* (plains cottonwood) plant association with widely-spaced, large trees and low-stature thickets 2-3 ft (0.5-1 m) high of *Symphoricarpos occidentalis* (western snowberry) underneath the cottonwood canopy. Open areas of dry, weedy grasses occur between clumps of shrubs. Dips and swales of the floodplain may hold other wet plant associations such as stands of *Salix exigua* (sandbar willow) or *Carex pellita* (woolly sedge).

This plant association occupies elevated ridges and flat areas of the floodplain that are well-drained and slightly higher than most of the other surfaces. These sites tend to be further from the main channel. This association can also occur close to the active channel, but is always on an elevated surface. The stream channel is broad and braided. Soils of this plant association show the most development of all the low elevation floodplain vegetation types. Typically, the profile is highly stratified, but with distinct soil development (B) layers. Soil textures range from silty clays to loamy sands. Following flooding in this plant association, there may be fresh sediment on the surface and mottling down to 15 inches (40 cm) in depth. A thin clay lens in each layer indicates that floods can reach heights up to 7 ft (2 m) above the active channel.

Vegetation Description

This plant association has mature, widely spaced *Populus deltoides* ssp. *monilifera* (plains cottonwood) (19-90% cover). *Salix amygdaloides* (peachleaf willow) is usually present, although sometimes so widely spaced it can easily be missed. Other trees that may be present include *Fraxinus pennsylvanica* (green ash), *Ulmus pumila* (Siberian elm), *Salix fragilis* (crack willow), and *Acer negundo* (box elder). The low-stature (1-3 ft, 0.3-1 m) shrub canopy contains *Symphoricarpos occidentalis* (western snowberry). Other shrubs species that may be present include *Toxicodendron rydbergii* (western poison ivy). The herbaceous cover is low in undisturbed stands

and thick with introduced species in disturbed stands. Herbaceous species include *Spartina pectinata* (prairie cordgrass), *Elymus lanceolatus* (streambank wheatgrass), *Poa pratensis* (Kentucky bluegrass), *Bromus inermis* (smooth brome) and *Agrostis stolonifera* (creeping bentgrass).

Ecological Processes

The *Populus deltoides/Symphoricarpos occidentalis* (plains cottonwood/western snowberry) plant association appears to be one of the last stages of cottonwood dominance on the floodplain. The trees are large and widely spaced. As they topple and die, *Symphoricarpos occidentalis* (western snowberry) becomes the remaining dominant woody species. This late-seral plant association is located on the highest surfaces within the floodplain. Its lateral position varies greatly. Presumably, as islands throughout the wide braided channel become more stable and vegetated, thereby aggregating more sediments and experiencing fewer floods, succession advances to this late stage.

Avg. Cover %	(Range)	Species Name	# Plots (N=16)
51	(19-90%)	Populus deltoides	16
26	(3-66%)	Symphoricarpos occidentalis	16
15	(1-38%)	Elymus lanceolatus	9
13	(2-41%)	Spartina pectinata	10
12	(1-37%)	Poa pratensis	10
12	(1-22%)	Bromus inermis	6
11	(4-16%)	Fraxinus pennsylvanica	6
10	(2-35%)	Vitis riparia	5
9	(1-20%)	Pascopyrum smithii	7
9	(1-23%)	Ulmus pumila	3
7	(2-13%)	Toxicodendron rydbergii	4
7	(4-11%)	Euphorbia esula var. esula	3
7	(1-12%)	Cirsium arvense	6
6	(1-16%)	Salix exigua	7
5	(1-8%)	Bidens frondosa	3
5	(1-14%)	Salix amygdaloides	6

Other species with < 5% average cover present in at least 10% of plots:
Glycyrrhiza lepidota (1-9%), Bromus japonicus (1-5%), Xanthium strumarium (1-4%), Rosa woodsii (1-7%), Rumex crispus (1-3%), Ambrosia artemisiifolia var. elatior (1-4%), Elymus canadensis (1-3%), Chamaesyce serpyllifolia (1%).

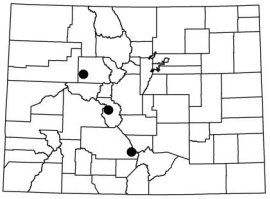
Quaking aspen / Rocky Mountain maple Forest

Populus tremuloides / Acer glabrum

Global rank/State rank:
G1G2 / S1S2

HGM subclass: R2, R3/4

Colorado elevation range:
8,200-9,600 ft (2,500-2,930 m)



General Description

The *Populus tremuloides/Acer glabrum* (quaking aspen/Rocky Mountain maple) forest occurs along narrow streams and gulches and in broader valleys where shading, aspect, or hillslope springs create moist soil conditions away from the stream channel. This forest is not restricted to riparian habitats, and will occur on steep, moist hillsides as well as following stream courses. This association is known from fewer than 10 locations in the central and south-central mountain regions of Colorado.

This association occurs on north to north-east facing slopes on alluvial terraces in narrow and medium valleys, on stream banks, floodplains and moist steep hillslopes. It is located 1-15 ft (0.3-5.0 m) lateral distance from the channel, and 0.25-6 ft (0.1-1.7 m) above the annual high water mark in the channel. Streams are often quite steep (5-7%), and very rocky. Soils are shallow sandy loams and silty clay loams, highly skeletal, with high organic matter in the top 4 inches (10 cm).

Vegetation Description

This association is dominated by an overhead canopy of *Populus tremuloides* (quaking aspen). Other trees that may be present include *Populus angustifolia* (narrowleaf cottonwood), *P. balsamifera* (balsam poplar), *Abies lasiocarpa* (subalpine fir), and *Picea engelmannii* (Englemann spruce). The shrub canopy is dominated by *Acer glabrum* (Rocky Mountain maple). Other shrubs that may be present include *Cornus sericea* (red-osier dogwood), *Ribes* spp. (currant), *Sambucus racemosa* (scarlet elderberry), *Amelanchier alnifolia* (Saskatoon serviceberry), *Mahonia repens* (Oregon grape), and *Prunus virginiana* (chokecherry).

The herbaceous undergrowth is often rich in forbs, their combined total cover sometimes reaching as much as 60%. Forb species that may be present include *Thalictrum fendleri* (Fendler meadowrue), *Epilobium angustifolium* ssp. *circumvagum*

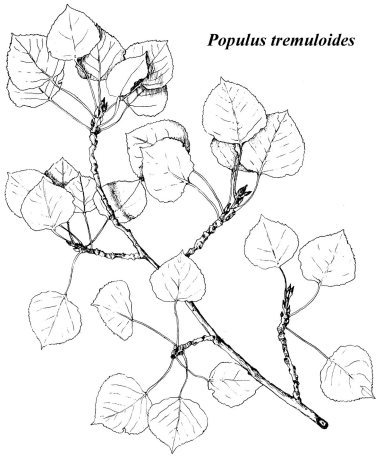
(fireweed), *Maianthemum stellatum* (starry false Solomon seal), and *Actaea rubra* (red baneberry). Graminoids, including *Calamagrostis canadensis* (bluejoint reedgrass) and *Elymus* spp. (wildrye), are less abundant.

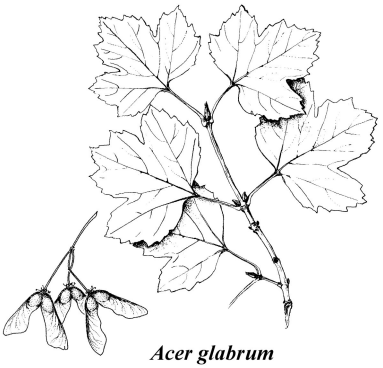
Ecological Processes

In the San Juan National Forest, this association may be seral to the *Abies lasiocarpa/ Cornus sericea* (subalpine fir/red-osier dogwood) or *Abies concolor/Cornus sericea* (white fir/red-osier dogwood) plant associations.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
52	(3-87%)	Populus tremuloides	3
35	(20-61%)	Acer glabrum	3
16	(8-23%)	Rosa woodsii	2
14	(1-26%)	Chamerion angustifolium ssp. circumvagum	2
10	—	Ribes wolfii	1
6	—	Juncus compressus	1
6	—	Pyrola asarifolia ssp. asarifolia	1
6	(4-7%)	Maianthemum stellatum	2
5	—	Amelanchier alnifolia	1
5	—	Populus angustifolia	1
5	—	Mahonia repens	1
5	(1-8%)	Calamagrostis canadensis	2

Other species with < 5% average cover present in at least 10% of plots:
Cornus sericea (1-8%), Thalictrum fendleri (4%), Amelanchier utahensis (3%), Lonicera involucrata (3%), Rubus parviflorus (3%), Abies lasiocarpa (3%), Actaea rubra ssp. arguta (2%), Heracleum maximum (1%), Aquilegia caerulea (1%), Ambrosia artemisiifolia var. elatior (1%), Corallorrhiza maculata (1%), Fragaria virginiana ssp. glauca (1%), Galium triflorum (1%), Aconitum columbianum (1%), Arnica cordifolia (1%), Symphoricarpos oreophilus (1%), Streptopus amplexifolius var. chalazatus (1%), Solidago canadensis (1%), Shepherdia canadensis (1%), Sambucus racemosa var. racemosa (1%), Picea engelmannii (1%), Osmorhiza depauperata (1%), Orthilia secunda (1%), Urtica dioica ssp. gracilis (1%), Salix bebbiana (1%).





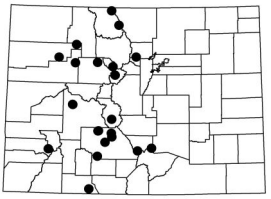
Quaking aspen / Thinleaf alder Forest

Populus tremuloides / Alnus incana ssp. *tenuifolia*

Global rank/State rank:
G3 / S3

HGM subclass: R3/4

Colorado elevation range:
7,850-9,700 ft (2,400-2,950 m)



General Description

The *Populus tremuloides/Alnus incana* ssp. *tenuifolia* (quaking aspen/thinleaf alder) plant association is located in narrow ravines and along first- and second-order streams where upland *Populus tremuloides* forests intermix with riparian shrub vegetation and at lower elevations where *Populus tremuloides* persists only in the riparian zone. The presence of obligate riparian species distinguish this association from upland *Populus tremuloides* communities. This plant association is known from throughout the Western Slope.

This plant association occurs in narrow, 25-225 ft (10-70 m) wide, valleys along stream banks of first- and second-order streams. Stream channels are steep and narrow and occasionally, of moderate gradient and width. Stream gradients range from 1-30%. Soils are generally skeletal, shallow, sandy and sandy clay loams or deeper sandy clay loams.

Vegetation Description

This plant association has a tall, 20-40 ft (6-12 m), overstory of *Populus tremuloides* (quaking aspen). Several conifer species can occur, but aspen is clearly the dominant canopy tree, at least along the streambanks. Other tree species that may be present include *Pinus contorta* (lodgepole pine), *Abies lasiocarpa* (subalpine fir), *Picea pungens* (blue spruce), and *Pseudotsuga menziesii* (Douglas-fir).

The shrub and forb canopy along the immediate stream bank distinguish this riparian plant association from the adjacent forests. The shrub layer is dominated by *Alnus incana* ssp. *tenuifolia* (thinleaf alder). Other shrubs that may be present in this association include *Salix drummondiana* (Drummond willow), *Lonicera involucrata* (twinberry honeysuckle), *Rosa woodsii* (Woods rose), *Salix bebbiana* (Bebb willow), and *Cornus sericea* (red-osier dogwood). The forb undergrowth can be dense and includes *Cardamine cordifolia* (heartleaf bittercress), *Mertensia ciliata* (tall fringed

bluebells), *Osmorhiza depauperata* (bluntseed sweetroot) and *Senecio triangularis* (arrowleaf ragwort). Graminoid cover includes *Calamagrostis canadensis* (bluejoint reedgrass), *Equisetum arvense* (field horsetail) and *Carex disperma* (softleaf sedge).

Ecological Processes

Populus tremuloides (quaking aspen) forests and woodlands can be self-perpetuating climax plant associations or early-seral stages of coniferous types. *Populus tremuloides* (quaking aspen) is a non-obligate riparian species and often occurs in upland communities. Where valley bottoms are moist and stable, *Populus tremuloides* can dominate the riparian area, while also occurring on adjacent mesic hillslopes. *Alnus incana* ssp. *tenuifolia* (thinleaf alder) is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining. After establishment, young stands of *Alnus incana* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils begin to develop.

Avg. Cover %	(Range)	Species Name	# Plots (N=22)
44	(3-100%)	Populus tremuloides	22
37	(5-89%)	Alnus incana ssp. tenuifolia	22
14	(3-22%)	Salix drummondiana	3
13	(3-20%)	Picea pungens	4
11	(1-20%)	Picea engelmannii	6
10	(1-52%)	Abies lasiocarpa	9
8	(1-40%)	Mertensia ciliata	18
8	(3-10%)	Rudbeckia laciniata var. ampla	5
8	(1-30%)	Heracleum maximum	14
8	(3-10%)	Pseudotsuga menziesii	3
7	(1-20%)	Carex utriculata	3
7	(1-10%)	Corydalis caseana ssp. brandegeei	3
6	(3-12%)	Actaea rubra ssp. arguta	3
6	(1-11%)	Ribes montigenum	3
6	(1-20%)	Calamagrostis canadensis	13
6	(1-20%)	Equisetum arvense	11
6	(1-25%)	Bromus inermis	5
6	(1-15%)	Arnica cordifolia	5
6	(1-20%)	Salix bebbiana	4
6	(1-13%)	Acer glabrum	4
5	(1-30%)	Cardamine cordifolia	16

Other species with < 5% average cover present in at least 10% of plots:
Senecio triangularis (1-16%), Poa compressa (1-9%), Geranium richardsonii (1-25%), Taraxacum officinale (1-15%), Lonicera involucrata (1-10%), Ribes inerme (1-13%), Orthilia secunda (1-10%), Oxypolis fendleri (1-8%), Aconitum columbianum (1-15%), Galium triflorum (1-8%), Osmorhiza depauperata (1-10%), Rosa woodsii (1-10%), Streptopus amplexifolius var. chalazatus (1-9%), Chamerion angustifolium ssp. circumvagum (1-9%), Fragaria virginiana ssp. glauca (1-7%), Carex microptera (1-5%), Poa pratensis (1-5%), Hydrophyllum fendleri (1-4%), Glyceria striata (1-5%), Geum macrophyllum var. perincisum (1-5%), Bromus ciliatus var. ciliatus (1-3%), Conioselinum scopulorum (1-9%), Maianthemum stellatum (1-4%), Saxifraga odontoloma (1-4%), Trifolium repens (1-3%), Viola canadensis var. scopulorum (1-3%), Achillea millefolium var. occidentalis (1-3%), Urtica dioica ssp. gracilis (1-3%), Galium boreale (1-3%), Rubus parviflorus (1-2%), Poa palustris (1%), Mahonia repens (1%), Sambucus racemosa var. racemosa (1%), Veronica americana (0.1-1%).

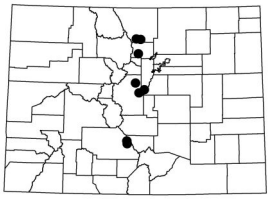
Quaking aspen / River birch Forest

Populus tremuloides / Betula occidentalis

Global rank/State rank:
G3 / S2

HGM subclass: R3/4

Colorado elevation range:
7,540-10,400 ft (2,300-3,100 m)



General Description

The *Populus tremuloides/Betula occidentalis* (quaking aspen/river birch) plant association is a lush, deciduous riparian woodland with a diverse canopy of aspen and conifer trees. The understory has a high structural diversity of shrubs and an herbaceous undergrowth ranging from a thick carpet of grasses and forbs to a very sparse ground cover in heavily shaded areas. The presence of obligate riparian shrub species distinguish this association from upland *Populus tremuloides* communities. This plant association is known only from foothill streams of the west side of the Sangre de Cristo Mountains and along the Colorado Front Range.

This plant association occurs along stream banks, benches and narrow floodplains in narrow valleys, 40-200 ft (130-660 m) wide, and steep, first-order gulches. Stream channels are steep and narrow or moderately steep and slightly meandering. The soils are uniformly sandy loams becoming skeletal at a 3 ft (1 m) depth. A sandy clay layer consistently appears at an average depth of 5 inches.

Vegetation Description

This plant association is characterized by an open to dense canopy of *Populus tremuloides* (quaking aspen). *Betula occidentalis* (river birch) forms a thick band along the stream banks. Associated tree species vary with elevation. *Pinus ponderosa* (ponderosa pine) and *Populus* x *acuminata* (lanceleaf cottonwood) occur at lower elevations, while *Abies lasiocarpa* (subalpine fir) and *Pseudotsuga menziesii* (Douglas-fir) occur at higher elevations. Other shrub species that may be present include *Rosa woodsii* (Woods rose), *Salix bebbiana* (Bebb willow), *S. monticola* (mountain willow), *S. planifolia* (planeleaf willow), *Acer glabrum* (Rocky Mountain maple), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), and *Cornus sericea* (red-osier dogwood).

The herbaceous undergrowth is sparse to thick, depending on local site conditions. Species include *Maianthemum stellatum* (starry false Solomon seal), *Equisetum arvense* (field horsetail), *Heracleum maximum* (common cowparsnip), *Aconitum columbianum* (Columbian monkshood), and *Dactylis glomerata* (orchardgrass).

Ecological Processes

Populus tremuloides (quaking aspen) forests and woodlands can be self perpetuating climax plant associations or early-seral stages of coniferous types. *Populus tremuloides* is a non-obligate riparian species and often occurs in upland communities. Where valley bottoms are moist and stable, *Populus tremuloides* can dominate the riparian area, while also occurring on adjacent mesic hillslopes.

Betula occidentalis (river birch) becomes abundant along stream banks with perennial stream flow and well-aerated soils. The presence of seedling and sapling conifers in some stands of this plant association indicates the potential to become a conifer/*Betula occidentalis* type. The suppression of fire in this plant association may allow conifer species to gain dominance since *Populus tremuloides* and *Betula occidentalis* sprout following fires.

Avg. Cover %	(Range)	Species Name	# Plots (N=8)
47	(24-77%)	Betula occidentalis	8
45	(20-85%)	Populus tremuloides	8
28	(5-50%)	Pinus ponderosa	2
13	(1-30%)	Heracleum maximum	4
13	(1-34%)	Juncus compressus	3
12	(1-30%)	Salix monticola	3
11	(1-21%)	Pseudotsuga menziesii	3
11	(1-30%)	Equisetum arvense	3
9	(1-30%)	Thalictrum fendleri	4
8	(1-14%)	Abies lasiocarpa	2
8	(5-10%)	Acer glabrum	2
7	(6-8%)	Carex disperma	2
7	(1-18%)	Maianthemum stellatum	4
6	(1-15%)	Salix bebbiana	6
6	(1-11%)	Poa pratensis	3
5	(1-14%)	Rosa woodsii	8
5	(1-8%)	Phleum pratense	2

Other species with < 5% average cover present in at least 10% of plots:
Aconitum columbianum (0.1-12%), Chamerion angustifolium ssp. circumvagum (1-8%), Agrostis stolonifera (3-4%), Mertensia ciliata (1-5%), Calamagrostis canadensis (1-7%), Lonicera involucrata (1-5%), Galium boreale (0.1-7%), Fragaria virginiana ssp. glauca (1-7%), Alnus incana ssp. tenuifolia (2%), Arnica cordifolia (2%), Achillea millefolium var. occidentalis (1-4%), Ribes inerme (1-2%), Taraxacum officinale (1-2%), Orthilia secunda (1%), Stellaria crassifolia (1%), Geranium richardsonii (0.1-1%).

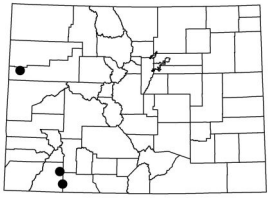
Quaking aspen / Red-osier dogwood Forest

Populus tremuloides / Cornus sericea

Global rank/State rank:
G4 / S2S3

HGM subclass: R3/4

Colorado elevation range:
6,600-8,200 ft (2,000-2,500)



General Description

The *Populus tremuloides/Cornus sericea* (quaking aspen/red-osier dogwood) plant association is located in narrow ravines where upland *Populus tremuloides* (quaking aspen) forests intermix with the riparian shrub vegetation. Obligate riparian shrub species distinguish this association from upland *Populus tremuloides* communities. This association occurs in the Colorado River Basin and the San Juan National Forest.

This plant association occurs in deep, narrow (6-20 m) valleys along banks of first-order streams. Stands are located 1-3 ft (0.25-1 m) above the channel bankfull level. Stream channels are narrow and have relatively steep gradients (5-40%). Occasionally stream channels are somewhat wider and more gradual. Soils range from skeletal, shallow, sandy and sandy clay loams to deeper sandy and silty clay loams.

Vegetation Description

This association is characterized by an overstory canopy of *Populus tremuloides* (quaking aspen), with an abundance of *Cornus sericea* (red-osier dogwood) in the shrub canopy. Several other tree species may be present, but none as consistently or in as high abundance as *Populus tremuloides* (quaking aspen). Other tree species include *Abies concolor* (white fir) and *Pseudotsuga menziesii* (Douglas-fir). Other shrub species include *Lonicera involucrata* (twinberry honeysuckle), *Salix drummondiana* (Drummond willow), *Salix boothii* (Booth willow), *Salix ligulifolia* (strapleaf willow), *Symphoricarpos oreophilus* (mountain snowberry), and *Alnus incana* ssp. *tenuifolia* (thinleaf alder).

The herbaceous undergrowth is relatively sparse, but diverse, with *Osmorhiza depauperata* (bluntseed sweetroot), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Heracleum maximum* (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), *Aconitum columbianum* (Columbian monkshood), *Mertensia franciscana* (Franciscan bluebells), and *Equisetum arvense* (field horsetail).

Ecological Processes

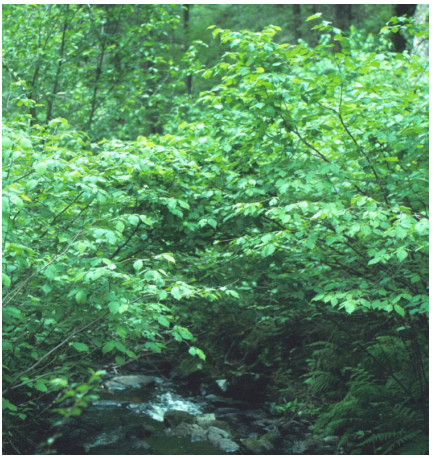
Populus tremuloides (quaking aspen) forests and woodlands can be self-perpetuating climax plant associations or early-seral stages of coniferous types. *Populus tremuloides* is a non-obligate riparian species and often occurs in upland settings. Where valley bottoms are moist and stable, *Populus tremuloides* can dominate the riparian area, while also occurring on adjacent mesic hillslopes. Mesic shrub understories composed of *Alnus incana* ssp. *tenuifolia* (thinleaf alder) or *Cornus sericea* (red-osier dogwood) can become dominated by *Symphoricarpos* spp. (snowberry) with heavy grazing. This is likely to occur in valley bottom stands where grazing has dried the soil and dropped the water table.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
49	(23-90%)	Cornus sericea	3
37	(20-59%)	Populus tremuloides	3
29	(25-32%)	Lonicera involucrata	2
22	(12-31%)	Rudbeckia laciniata var. ampla	2
18	(5-30%)	Maianthemum stellatum	2
14	—	Salix drummondiana	1
14	—	Abies concolor	1
13	—	Heracleum maximum	1
11	—	Salix boothii	1
10	(2-18%)	Pseudotsuga menziesii	2
10	—	Salix ligulifolia	1
10	—	Mertensia franciscana	1
9	—	Equisetum arvense	1
6	(5-7%)	Aconitum columbianum	2
6	—	Elymus glaucus	1
5	—	Geranium richardsonii	1

Other species with < 5% average cover present in at least 10% of plots:
Chamerion angustifolium ssp. circumvagum (4%), Alnus incana ssp. tenuifolia (4%), Equisetum pratense (1-6%), Sorbus scopulina (3%), Salix geyeriana (3%), Oxypolis fendleri (3%), Ligusticum porteri (3%), Quercus gambelii (3%), Carex geyeri (2%), Carex capillaris (2%), Osmorhiza depauperata (1-3%), Viola canadensis var. scopulorum (1-2%), Taraxacum officinale (1%), Galium trifidum ssp. subbiflorum (1%), Galium boreale (1%), Abies lasiocarpa (1%), Acer glabrum (1%), Actaea rubra ssp. arguta (1%), Amelanchier utahensis (1%), Angelica grayi (1%), Poa pratensis (1%), Symphoricarpos oreophilus (1%), Rubus idaeus ssp. strigosus (1%), Juncus balticus var. montanus (1%), Pseudostellaria jamesiana (1%), Glyceria striata (1%), Paxistima myrsinites (1%), Mertensia brevistyla (1%).

Quaking aspen / Beaked hazelnut Forest

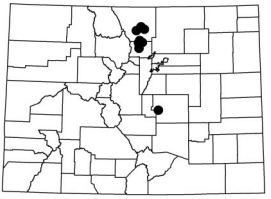
Populus tremuloides / Corylus cornuta



Global rank/State rank:
G3 / S1

HGM subclass: R3/4

Colorado elevation range:
6,500-7,500 ft (2,000-2,300 m)



General Description

In Colorado this association is also know as the *Corylus cornuta* (beaked hazelnut) association. The association is a thicket of medium-tall (4-6 ft, 1.5-2 m) shrubs, especially *Corylus cornuta* (beaked hazelnut). Stands usually have an overstory canopy of *Populus tremuloides* (quaking aspen), but may have a canopy of other trees, such as *Pseudotsuga menziesii* (Douglas-fir). In Colorado, this plant association occurs only in narrow, cool, foothill canyon ravines of the Front Range.

This plant association occurs on steep, well-defined stream banks in very narrow (less than 160 ft, (50 m) wide) valley bottoms. Stream channels are generally quite rocky and steep (5% gradient) with little sinuosity. Some soils have a top layer of organic matter, covered with a thick litter layer, and subsurface horizons of loamy sands with many thick roots and gravel. Other soils are moist, dark-colored, sandy loam over cobbles.

Vegetation Description

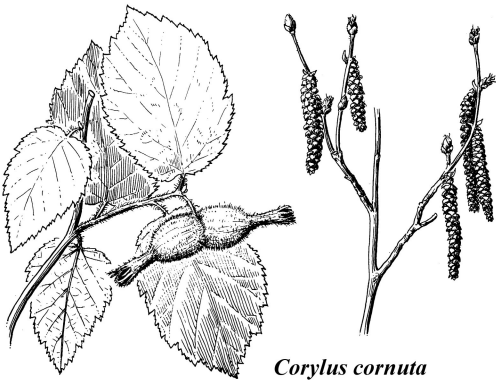
This plant association occurs in small stands with an overstory of *Populus tremuloides* (quaking aspen), *Pseudotsuga menziesii* (Douglas-fir), or *Picea pungens* (blue spruce). One atypical stand has 25% cover of *Populus deltoides* ssp. *monilifera* (plains cottonwood) at 7,500 ft (2,300 m). The dense shrub layer is dominated by *Corylus cornuta* (beaked hazelnut). Stands may include a wide variety of shrubs, ranging from merely present to co-dominant in abundance, but no one species is consistently present with *Corylus cornuta* (beaked hazelnut). Shrub species include *Betula occidentalis* (river birch), *Prunus americana* (American plum), *Acer glabrum* (Rocky Mountain maple), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Physocarpus monogynus* (mountain ninebark), *Cornus sericea* (red-osier dogwood), *Rubus idaeus* (American red raspberry), and *Prunus virginiana* (chokecherry), ranging in cover from 5 to 30%. Few herbaceous species occur in the undergrowth due to the dense shrub cover, thick coniferous litter, and rocky soils.

Ecological Processes

In the northwestern U.S., *Corylus cornuta* (beaked hazelnut) is widespread and grows in large thickets on well-drained soils at lower elevations. In Wyoming, it occurs in woods and thickets in the northeastern corner of the state. In the Great Plains (North Dakota, southeast South Dakota, Minnesota, and the Black Hills), *Corylus cornuta* occurs in upland forests and thickets. In Colorado, *Corylus cornuta* is limited to riparian areas in deep, cool canyons that receive more moisture and have a high humidity. These stands appear to be long-lived and stable and increase in size under the right growing conditions and lack of disturbance.

Avg. Cover %	(Range)	Species Name	# Plots (N=10)
72	(17-100%)	Corylus cornuta	10
19	(10-32%)	Picea pungens	3
17	(0.1-50%)	Carex deweyana	3
16	(1-44%)	Populus tremuloides	5
13	(3-26%)	Acer glabrum	4
13	(3-37%)	Alnus incana ssp. tenuifolia	7
10	(4-15%)	Betula occidentalis	3
10	(1-19%)	Salix bebbiana	2
9	(1-19%)	Pseudotsuga menziesii	5
7	(3-14%)	Cornus sericea	3
7	(1-17%)	Aralia nudicaulis	4
6	(1-10%)	Juniperus scopulorum	2
5	(2-11%)	Rosa woodsii	4
5	(1-8%)	Rudbeckia laciniata var. ampla	4
5	(1-9%)	Poa pratensis	2
5	(0.1-11%)	Prunus virginiana var. melanocarpa	5

Other species with < 5% average cover present in at least 10% of plots:
Equisetum arvense (1-6%), Prunus pensylvanica var. pensylvanica (1-5%), Actaea rubra ssp. arguta (0.1-10%), Rubus idaeus ssp. strigosus (0.1-7%), Galium boreale (1-6%), Lonicera involucrata (1-4%), Fragaria virginiana ssp. glauca (1-4%), Calamagrostis canadensis (2-3%), Maianthemum stellatum (0.1-5%), Viola canadensis var. scopulorum (0.1-3%), Osmorhiza depauperata (0.1-3%), Heracleum maximum (1-2%), Symphoricarpos occidentalis (1-2%), Hydrophyllum fendleri (0.1-2%), Ligusticum porteri (0.1-2%), Taraxacum officinale (0.1-2%), Geranium richardsonii (1-1%), Apocynum cannabinum (1%), Ribes inerme (1%), Stellaria crassifolia (1%), Maianthemum racemosum ssp. amplexicaule (0.1-2%), Mahonia repens (0.1-1%), Achillea millefolium var. occidentalis (0.1-1%), Unidentified (0.1-1%).



Corylus cornuta

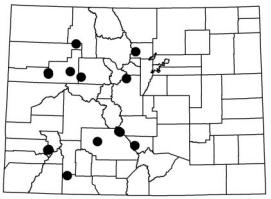
Quaking aspen / Tall forb Forest

Populus tremuloides / Tall forb

Global rank/State rank:
G5 / S5

HGM subclass: R2, R3/4

Colorado elevation range:
7,000-10,200 ft (2,100-3,100 m)



General Description

This community is common on the uplands and in riparian areas of the Colorado Western Slope. *Populus tremuloides* (quaking aspen) forests are abundant in the Rocky Mountains. The *Populus tremuloides*/Tall forb plant association is found on steep hill sides and often along narrow riparian areas. The undergrowth is characterized by a thick carpet of 1-3 foot (<1 m) tall forbs with no one species dominant. Forb species along stream bank stands can be different from hillside stands.

This plant association occurs on broad, gently sloping hillsides and valley bottoms. Stream channels are high-gradient and very narrow, moderately wide and moderately sinuous, or wide and sinuous. The soils are derived from alluvial deposition of a variety of parent materials. The soils are deep, well-drained loams, sandy loams to clay loams.

Vegetation Description

The *Populus tremuloides* /Tall forb (quaking aspen/tall forb) association is not restricted to riparian habitats. It is often found on very steep slopes on mesic hillsides throughout the Southern Rocky Mountains. *Populus tremuloides* (quaking aspen) is the dominant tree species in this plant association. Other tree species, usually coming in from the upland, include *Abies concolor* (white fir), *Pinus ponderosa* (ponderosa pine), *Picea pungens* (blue spruce), and *Abies lasiocarpa* (subalpine fir).

Shrub cover is typically minor. A few low-stature shrubs that may be present include *Juniperus communis* (common juniper), *Symphoricarpos oreophilus* (mountain snowberry), *Lonicera involucrata* (twinberry honeysuckle), *Ribes inerme* (whitestem gooseberry), *Sambucus racemosa* (scarlet elderberry), and *Vaccinium* spp. (blueberry).

Taller shrubs, typically lining the stream channel, include *Salix bebbiana* (Bebb willow), *S. monticola* (mountain willow), and *Ribes montigenum* (gooseberry currant).

The undergrowth is characterized by the presence of many species of mesic forbs, some of which can be quite tall. Forb species include *Mertensia ciliata* (tall fringed bluebells), *Geranium richardsonii* (Richardson geranium), *Heracleum maximum* (common cowparsnip), *Osmorhiza occidentalis* (western sweetroot), *Hydrophyllum fendleri* (Fendler waterleaf) *Delphinium barbeyi* (tall larkspur), *Senecio triangularis* (arrowleaf ragwort), *Aconitum columbianum* (Columbian monkshood), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Achillea millefolium* var. *occidentalis* (western yarrow), *Galium boreale* (northern bedstraw), *Galium triflorum* (fragrant bedstraw), *Maianthemum stellatum* (starry false Solomon seal), *Thalictrum fendleri* (Fendler meadowrue), and *Viola* spp. (violet). Graminoid species include *Equisetum arvense* (field horsetail), *Calamagrostis canadensis* (bluejoint reedgrass), *Carex* spp. (sedge), *Elymus glaucus* (blue wildrye), and the ever present *Poa pratensis* (Kentucky bluegrass).

Ecological Processes

Populus tremuloides (quaking aspen) forests and woodlands can be self-perpetuating climax plant associations or early-seral stages of coniferous types. *Populus tremuloides* is a non-obligate riparian species and often occurs in upland communities. Where valley bottoms are moist and stable, *Populus tremuloides* can dominate the riparian area, while also occurring on adjacent mesic hillslopes.

Avg. Cover %	(Range)	Species Name	# Plots (N=20)*
44	(10-80%)	Populus tremuloides	19*
22	(1-50%)	Hydrophyllum fendleri	4
18	(1-50%)	Heracleum maximum	12
14	(4-30%)	Thalictrum fendleri	5
12	(1-30%)	Bromus ciliatus var. ciliatus	5
11	(2-32%)	Equisetum arvense	6
9	(2-20%)	Senecio triangularis	4
9	(1-27%)	Rosa woodsii	8
8	(3-14%)	Juncus compressus	5
8	(3-20%)	Elymus glaucus	6
8	(3-10%)	Mertensia franciscana	4
8	(1-18%)	Conioselinum scopulorum	5
8	(0.1-24%)	Picea pungens	4
7	(1-20%)	Poa pratensis	12
7	(3-10%)	Salix monticola	4
7	(1-15%)	Poa palustris	5
6	(1-14%)	Fragaria virginiana ssp. glauca	7
6	(1-15%)	Senecio serra var. serra	5
5	(0.1-19%)	Chamerion angustifolium ssp. circumvagum	4
5	(0.1-10%)	Lonicera involucrata	6

Other species with < 5% average cover present in at least 10% of plots:
Ribes inerme (2-10%), Galium boreale (1-7%), Mertensia ciliata (1-15%), Oxypolis fendleri (1-14%), Aconitum columbianum (1-10%), Glyceria striata (1-6%), Geranium richardsonii (0.1-15%), Vicia americana (1-9%), Geum macrophyllum var. perincisum (1-5%), Prunus virginiana var. melanocarpa (1-6%), Taraxacum officinale (1-7%), Calamagrostis canadensis (1-4%), Achillea millefolium var. occidentalis (1-5%), Maianthemum stellatum (1-5%), Symphoricarpos oreophilus (1-3%), Urtica dioica ssp. gracilis (1-3%), Cardamine cordifolia (1%).

*Populus tremuloides occurred in all stands, but was not captured in every sample plot.

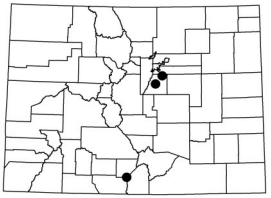
Peachleaf willow Woodland

Salix amygdaloides

Global rank/State rank:
G3 / S1

HGM subclass: R3/4, R5

Colorado elevation range:
6,000-7,500 ft (1,828-2,286 m)



General Description

This is an uncommon community in Colorado, although it was probably more common in the past. Stands are located in backwater areas and overflow channels of large rivers, on narrow floodplains of small creeks, and on the edges of ponds and lakes. Often it occurs in small isolated clumps adjacent to streams and rivers. The water table is usually within three ft (1 m) of the soil surface during the growing season and the vegetation is tolerant of flooding.

Salix amygdaloides associations may occur on a range of soil types, except heavy clays. It is most common on silty to sandy soils. It is tolerant of flooding and weakly saline or alkali soils. Soils may be saturated to within three ft (1 m) of the surface during much of the growing season.

Vegetation Description

Salix amygdaloides (peachleaf willow) provides a low, multi-stemmed canopy that may vary in cover from 25% to 85%. The understory varies considerably depending on the hydrologic regime and past disturbance of the site. There was little constancy of understory vegetation species in the four plots used to describe this type. *Populus angustifolia* (narrowleaf cottonwood) or *Populus deltoides* (plains cottonwood) can occur in very small amounts. The distinguishing characteristic of this association is the dominance of *Salix amygdaloides* and the near lack of cottonwoods. The shrub layer may include *Ribes aureum* (golden currant), *Salix exigua* (sandbar willow), or *Symphoricarpos occidentalis* (western snowberry).

The herbaceous layer composition varies from very wet emergent species such as *Schoenoplectus pungens* (common threesquare), *Scirpus pallidus* (cloaked bulrush), and *Eleocharis palustris* (common spikerush) to indicators of drier and disturbed

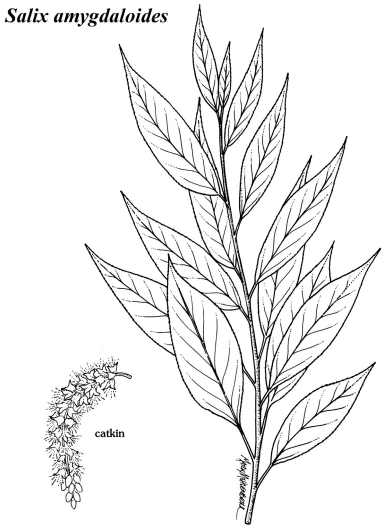
conditions, such as *Bromus inermis* (smooth brome), *Chenopodium album* (lambsquarters), and *Elymus repens* (quackgrass).

Ecological Processes

Increased disturbance results in a non-native herbaceous understory. If the disturbance includes livestock grazing, the weak, multi-stemmed *Salix amygdaloides* (peachleaf willow) may easily break, producing a great deal of downed wood. Drying conditions and grazing may reduce reproduction of the willows.

Avg. Cover %	(Range)	Species Name	# Plots (N=4)
53	(26-85%)	Salix amygdaloides	4
35	—	Lepidium latifolium	1
35	(32-37.5%)	Bromus inermis	2
20	(1-38%)	Carex pellita	2
18	—	Ribes aureum	1
14	—	Populus angustifolia	1
12	(11-13%)	Cirsium arvense	2
5	(4-5%)	Pascopyrum smithii	2

Other species with < 5% average cover present in at least 10% of plots:
Juncus articulatus (4%), Juncus balticus var. montanus (4%), Chamerion angustifolium ssp. circumvagum (3%), Phragmites australis (3%), Poa pratensis (3%), Epilobium ciliatum ssp. glandulosum (2.5%), Elymus repens (2.5%), Eleocharis palustris (2.5%), Conium maculatum (2.5%), Ambrosia trifida (2.5%), Urtica dioica ssp. gracilis (2.5%), Schoenoplectus pungens (2.5%), Scirpus pallidus (2.5%), Solidago canadensis (2.5-2.5%), Symphoricarpos occidentalis (2-2.5%), Taraxacum officinale (2%), Glycyrrhiza lepidota (1%), Chenopodium album (1%), Crataegus succulenta (1%), Ribes inerme (1%), Rosa woodsii (1%), Salix exigua (1%), Lactuca serriola (0.1%).



GROUP D:
TALL WILLOW SHRUBLANDS

Association	Page
Alnus incana ssp. *tenuifolia-Salix drummondiana* Thinleaf alder-Drummond willow Shrubland	188
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Salix boothii/Carex utriculata Booth willow/Beaked sedge Shrubland	192
Salix boothii/Mesic forb Booth willow/Mesic forb Shrubland	194
Salix boothii/Mesic graminoid Booth willow/Mesic graminoid Shrubland	196
Salix drummondiana/*Calamagrostis canadensis* Drummond willow/Bluejoint reedgrass Shrubland	198
Salix drummondiana/*Carex aquatilis* Drummond willow/Water sedge Shrubland	200
Salix drummondiana/Mesic forb Drummond willow/Mesic forb Shrubland	202
Salix exigua/Barren ground Sandbar willow/Barren ground Shrubland	204
Salix exigua/Mesic graminoid Sandbar willow/Mesic graminoid Shrubland	206
Salix exigua-Salix liguifolia (=S. eriocephala var. *ligulifolia)* Sandbar willow-Strapleaf willow Shrubland	208
Salix geyeriana/Calamagrostis canadensis Geyer willow/Bluejoint reedgrass Shrubland	210
Salix geyeriana/Carex aquatilis Geyer willow/Water sedge Shrubland	212
Salix geyeriana/Carex utriculata Geyer willow/Beaked sedge Shrubland	214
Salix geyeriana/Mesic forb Geyer willow/Mesic forb Shrubland	216
Salix geyeriana-Salix monticola/Calamagrostis canadensis Geyer willow-Mountian willow/Bluejoint reedgrass Shrubland	218
Salix geyeriana-Salix monticola/Mesic forb Geyer willow-Mountain willow/Mesic forb Shrubland	220
Salix liguifolia (=S. eriocephala var. *ligulifolia)* Strapleaf willow Shrubland	222
Salix lucida ssp. *lasiandra* or ssp. *caudata* Shining willow Shrubland	224

Salix monticola/Calamagrostis canadensis 226
Mountain willow/Bluejoint reedgrass Shrubland
Salix monticola/Carex aquatilis 228
Mountain willow/Water sedge Shrubland
Salix monticola/Carex utriculata 230
Mountain willow/Beaked sedge Shrubland
Salix monticola/Equisetum arvense 232
Mountain willow/Field horsetail Shrubland
Salix monticola/Mesic forb 234
Mountain willow/Mesic forb Shrubland
Salix monticola/Mesic graminoid 236
Mountain willow/Mesic graminoid Shrubland

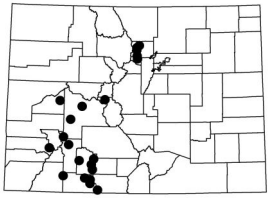
Thinleaf alder-Drummond willow Shrubland

Alnus incana ssp. *tenuifolia - Salix drummondiana*

Global rank/State rank:
G3 / S3

HGM subclass: R2, R3/4

Colorado elevation range:
7,300-9,700 ft (2,200-3,000m)



General Description

Alnus incana ssp. *tenuifolia-Salix drummondiana* (thinleaf alder-Drummond willow) is a relatively common plant association on the Western Slope. The association is generally found along steep-gradient streams with stable, shaded stream banks. This association occurs in the Gunnison, Arkansas, and St. Vrain River Basins and the San Juan and Rio Grande National Forests.

This association occurs along very steep, fast-moving streams in sheer-walled, confined canyons. It also occurs along or within the active channel of moderately to slightly entrenched channels in wider valleys. Stream channels are steep and rocky, less steep with limited floodplains and gravel and cobble bottoms, or wide and sinuous. Soils of this association are highly variable, but most are stratified alluvium with buried A horizons. Stands with a rich, herbaceous undergrowth have a thick layer, 5-10 inches (10-30 cm), of fine sandy loam and sandy clay loam over a coarse alluvial deposit. Stands with little shrub cover and herbaceous growth have coarse, skeletal soils without an accumulated fine layer at the surface.

Vegetation Description

This plant association is characterized by a dense, closed canopy of *Alnus incana* ssp. *tenuifolia* (thinleaf alder) and *Salix drummondiana* (Drummond willow) bordering the stream. Other willows that may be present include *Salix monticola* (mountain willow), *S. boothii* (Booth willow), *S. exigua* (sandbar willow), *S. lucida* (ssp. *caudata* or ssp. *lasiandra*) (shining willow), and *S. geyeriana* (Geyer willow). Other shrubs occasionally present include *Lonicera involucrata* (twinberry honeysuckle), *Ribes inerme* (whitestem gooseberry), *Cornus sericea* (red-osier dogwood), *Rosa woodsii* (Woods rose), *Amelanchier utahensis* (Utah serviceberry), *Acer glabrum* (Rocky Mountain maple), *Symphoricarpos oreophilus* (mountain snowberry), and *Ribes montigenum* (gooseberry currant).

Some stands have a rich herbaceous understory that includes *Oxypolis fendleri* (Fendler cowbane), *Heracleum maximum* (common cowparsnip), *Equisetum pratense* (field horsetail), *Mertensia ciliata* (tall fringed bluebells) *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), and *Angelica ampla* (giant angelica). In some stands, the herbaceous undergrowth is sparse (less than 10% cover) due to shading and flood-scouring.

Ecological Processes

The *Alnus incana* ssp. *tenuifolia-Salix drummondiana* (thinleaf alder-Drummond willow) plant association is an early to midseral community restricted to stream margins, rarely forming large, extensive stands. Both species are prolific seed producers and are the first to colonize coarse-textured cobble bars and recently scoured alluvial surfaces. When young, these shrubs are flexible, can tolerate most flood events, and readily resprout. With time, *Salix drummondiana* may become more abundant by taking advantage of the nitrogen-rich soils associated with *Alnus incana* ssp. *tenuifolia.*

Avg. Cover %	(Range)	Species Name	# Plots (N=22)
46	(14-98%)	Alnus incana ssp. tenuifolia	22
27	(7-60%)	Salix drummondiana	22
13	(2-70%)	Heracleum maximum	13
11	(2-30%)	Carex utriculata	4
10	(1-43%)	Salix monticola	12
9	(1-30%)	Calamagrostis canadensis	13
8	(1-30%)	Equisetum arvense	10
7	(1-23%)	Picea pungens	7
6	(1-25%)	Salix lucida ssp. caudata, lasiandra	6
6	(1-20%)	Lonicera involucrata	11
6	(1-16%)	Equisetum pratense	5
6	(1-10%)	Geranium richardsonii	9
5	(1-15%)	Mertensia ciliata	14
5	(1-11%)	Abies lasiocarpa	4
5	(1-10%)	Poa pratensis	10

Other species with < 5% average cover present in at least 10% of plots:
Cardamine cordifolia (1-11%), Rudbeckia laciniata var. ampla (1-10%), Taraxacum officinale (1-13%), Salix bebbiana (3-7%), Picea engelmannii (0.1-10%), Cornus sericea (1-10%), Ribes inerme (1-6%), Oxypolis fendleri (0.1-14%), Carex microptera (1-9%), Fragaria vesca ssp. bracteata (1-8%), Thalictrum fendleri (1-5%), Rubus idaeus ssp. strigosus (1-5%), Mertensia franciscana (1-6%), Achillea millefolium var. occidentalis (1-8%), Fragaria virginiana ssp. glauca (1-10%), Viola canadensis var. scopulorum (1-4%), Osmorhiza depauperata (1-3%), Galium triflorum (1-3%), Senecio triangularis (1-5%), Geum macrophyllum var. perincisum (0.1-4%), Galium boreale (1-5%), Conioselinum scopulorum (0.1-4%), Chamerion angustifolium ssp. circumvagum (1-2%), Luzula parviflora (0.1-4%), Maianthemum stellatum (1-2%), Rosa woodsii (1%).

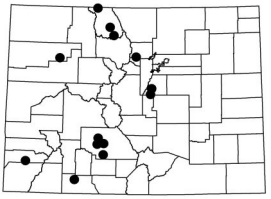
Bebb willow Shrubland

Salix bebbiana

Global rank/State rank:
G3? / S2

HGM subclass: R2, R3/4

Colorado elevation range:
7,300-9,400 ft (2,225-2,870 m)



General Description

This association occurs in canyon country at lower elevations in the San Juan National Forest, the Rio Grande River Basin and in foothill canyons of the South Platte River Basin. The *Salix bebbiana* (Bebb willow) plant association is a minor type in Colorado. It is a tall (5-15 ft, 1.5-3 m), deciduous, shrubland with an open to closed canopy, generally forming small thickets within larger riparian mosaics or long and thin continuous thickets in narrow tributary canyons.

This plant association occurs on briefly flooded, low-gradient streams or along narrow alluvial terraces of canyons. It can also occur on broad, seep-fed meadows. Stream channels are steep and narrow, wider, less steep, and moderately sinuous, or moderately wide and sinuous.

Soils are highly stratified layers of sandy loams, clay loams, and silty clay with mottling near the surface. Soils can also be deep, dark-colored silty clay loams with high organic content and mottling or they can be shallow, becoming skeletal at about 10 inches (25 cm) depth. In the spring and early summer, soils are saturated for several days to weeks and then slowly dry out over the rest of the growing season.

Vegetation Description

Salix bebbiana (Bebb willow) rarely forms large willow shrublands in Colorado and commonly appears in small patches within other plant associations. On occasion, however, it will form a small and dense shrubland with an overstory. Other shrubs that may be present include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Cornus sericea* (red-osier dogwood), *Dasiphora floribunda* (shrubby cinqfoil), *Ribes montigenum* (gooseberry currant), and *Salix ligulifolia* (strapleaf willow).

The herbaceous undergrowth is characterized by a sparse to moderately dense forb layer on raised, better-drained hummocks and ridges beneath the willow canopy.

Herbaceous species include *Achillea millefolium* var. *occidentalis* (western yarrow), *Poa pratensis* (Kentucky bluegrass), *Calamagrostis canadensis* (bluejoint reedgrass), *Geranium richardsonii* (Richardson geranium), *Juncus balticus* var. *montanus* (mountain rush), and *Heracleum maximum* (common cowparsnip).

Ecological Processes

In Colorado, stands of *Salix bebbiana* (Bebb willow) do not frequently occur. *Salix bebbiana* appears to be very sensitive to grazing, and forms the classic "mushroom" shape with overgrazing. *Salix bebbiana* rarely forms large willow carrs and is limited to small patches within larger riparian mosaics or in protected, narrow canyon bottoms that preclude livestock grazing.

Salix bebbiana

Avg. Cover %	(Range)	Species Name	# Plots (N=14)
35	(10-69%)	Salix bebbiana	14
27	(1-80%)	Poa compressa	3
22	(6-36%)	Ribes montigenum	3
16	(1-70%)	Calamagrostis canadensis	8
13	(10-18%)	Salix monticola	3
11	(2-36%)	Dasiphora floribunda	6
11	(1-30%)	Juncus balticus var. montanus	5
10	(1-22%)	Populus tremuloides	3
10	(2-21%)	Carex utriculata	6
8	(3-17%)	Ribes inerme	4
8	(1-20%)	Poa pratensis	9
6	(2-13%)	Carex aquatilis	3
6	(2-10%)	Agrostis gigantea	3
5	(1-10%)	Geum macrophyllum var. perincisum	3

Other species with < 5% average cover present in at least 10% of plots:
Rudbeckia laciniata var. ampla (2-6%), Geranium richardsonii (1-7%), Conioselinum scopulorum (1-10%), Thermopsis divaricarpa (1-8%), Lonicera involucrata (2-5%), Fragaria virginiana ssp. glauca (1-8%), Mertensia ciliata (1-5%), Chamerion angustifolium ssp. circumvagum (1-5%), Equisetum arvense (1-5%), Galium boreale (1-7%), Glyceria striata (1-5%), Taraxacum officinale (1-5%), Pedicularis groenlandica (1-5%), Potentilla pulcherrima X hippiana (1-3%), Thalictrum fendleri (1-5%), Trifolium repens (1-5%), Maianthemum stellatum (1-4%), Equisetum pratense (1-3%), Achillea millefolium var. occidentalis (0.1-3%), Rubus idaeus ssp. strigosus (1-2%), Mentha arvensis (1-2%), Dodecatheon pulchellum (1-2%), Phleum pratense (1%).

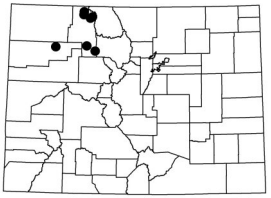
Booth willow / Beaked sedge Shrubland

Salix boothii / Carex utriculata

Global rank/State rank:
G4 / S3

HGM subclass: R2

Colorado elevation range:
7,100-8,600 ft (2,160-2,620 m)



General Description

This association is generally restricted to northern Colorado. It occurs in the Routt National Forest, and in the Yampa and White River Basins. The *Salix boothii*/*Carex utriculata* (Booth willow/beaked sedge) plant association is a tall, 4-12 ft (1-4 m) closed canopy shrubland. It commonly occurs in the wettest micro-habitats of the floodplain including low floodplains adjacent to beaver ponds and low areas between beaver dams. The ground is very wet and the water table is at or near the soil surface all season long.

This plant association is generally found along wide riparian corridors in areas adjacent to beaver ponds with saturated soils. In the Yampa River Basin, this association occurs on gently sloping floodplains in soils saturated from irrigation runoff and hillside seepage. Stream channels are wide and meandering, or narrow and steep. The upper soil layers generally contain a deep organic layer with some minerals, fine sands, loams, and clays. Some mottling is evident. The lower layers are gravel or cobble.

Vegetation Description

Salix boothii (Booth willow) dominates the canopy of this association. Other shrub species that may be present include *Salix geyeriana* (Geyer willow), *Salix wolfii* (Wolf willow), *Salix lucida* (ssp. *caudata* or ssp. *lasiandra*) (shining willow), *Salix monticola* (mountain willow), and *Salix planifolia* (planeleaf willow). *Salix serissima* (autumn willow), a rare disjunct species in Colorado, occurred at one site in the Yampa River Basin.

The saturated soils support a dense graminoid layer dominated by *Carex utriculata* (beaked sedge). Other graminoid species that may be present include *Carex aquatilis* (water sedge), *Carex pellita* (woolly sedge), *Calamagrostis canadensis* (bluejoint reedgrass), *Glyceria grandis* (American mannagrass), and *Juncus balticus* var. *montanus* (mountain rush). Forb cover is minimal.

Ecological Processes

This plant association commonly becomes established following beaver pond siltation. When an area is flooded by beaver activity, *Carex utriculata* (beaked sedge) becomes established and grows successfully even as the site begins to dry. With further drying of the site, *Salix boothii* (Booth willow) will become established. *Salix boothii* appears to establish on relatively mesic sites with soils that become neither completely saturated nor dry during the growing season. With continued drying, the undergrowth will be replaced with less hydrophytic species. With disturbance, such as excessive grazing, this plant association may be replaced with a *Salix boothii/Poa pratensis* (Booth willow/Kentucky bluegrass) plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=9)
58	(30-91%)	Salix boothii	8*
29	(3-90%)	Carex utriculata	9
16	(1-30%)	Carex pellita	2
12	(5-25%)	Salix geyeriana	6
11	(1-30%)	Salix lucida ssp. caudata, lasiandra	3
10	(10-10%)	Glyceria grandis	2
9	(2-30%)	Carex aquatilis	8
8	(3-16%)	Salix wolfii	3
8	(5-10%)	Lonicera involucrata	2
8	(5-10%)	Calamagrostis stricta	2
7	(5-10%)	Salix planifolia	3
7	(1-13%)	Calamagrostis canadensis	6
5	(1-10%)	Rosa woodsii	3
5	(4-6%)	Salix drummondiana	3

Other species with < 5% average cover present in at least 10% of plots:
Ribes inerme (1-5%), Poa pratensis (1-10%), Mertensia ciliata (1-5%), Heracleum maximum (1-5%), Pedicularis groenlandica (1-3%), Ligusticum porteri (1-3%), Equisetum arvense (1-3%), Maianthemum stellatum (1-4%), Thalictrum fendleri (1-2%), Mentha arvensis (1%), Geum macrophyllum var. perincisum (1%), Achillea millefolium var. occidentalis (1%), Carex microptera (1%), Galium trifidum ssp. subbiflorum (1%), Galium boreale (1%), Fragaria virginiana ssp. glauca (1%), Cardamine cordifolia (1%), Alopecurus aequalis (1%), Galium triflorum (1%), Polygonum bistortoides (1%), Senecio bigelovii var. hallii (1%).

*Salix boothii occurred in all stands, but was not captured in every sample plot.

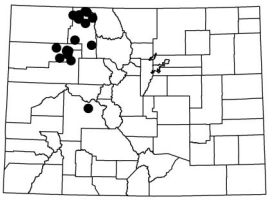
Booth willow / Mesic forb Shrubland

Salix boothii / Mesic forb

Global rank/State rank:
G3 / S3

HGM subclass: S1/2, R2

Colorado elevation range:
7,000-9,500 ft (2,130-2,900 m)



General Description

The *Salix boothii*/mesic forb (Booth willow/mesic forb) plant association is a tall (4-5 ft, 1-2 m) shrubland that often forms extensive thickets (willow carrs) on broad montane floodplains. This association is common in the northern half of Colorado.

This association occurs on wetter sites within the floodplain environment. It is usually found within 2.5 ft (0.75 m) of the water table, but is occasionally located above the channel on low terraces of straighter sections of river. The ground surface is often uneven and hummocky due to past flooding and beaver activity. A narrow to broad, low-gradient floodplain is common along all of the river reaches. Stream channels are steep and narrow, broad and sinuous, narrow and meandering, or recently eroding. Soils are highly stratified with alternating layers of sandy loams and clay loams and mottled within the top 4 inches (10 cm). Others are finely textured, dark-colored, highly organic soils with silty clay loam mottling. Lower profiles contain a gravel or cobble layer which may indicate that the soil section is a silted-in beaver pond.

Vegetation Description

Salix boothii (Booth willow) forms large stands with a canopy ranging from 20-80% cover. Other shrub species can be as abundant but do not exceed that of *Salix boothii* nor are they consistently present. Other shrub species include *Salix drummondiana* (Drummond willow), *Salix geyeriana* (Geyer willow), *Salix monticola* (mountain willow), *Dasiphora floribunda* (shrubby cinquefoil), *Betula nana (=glandulosa)* (bog birch), and *Alnus incana* ssp. *tenuifolia* (thinleaf alder).

The undergrowth is characterized by a sparse to lush forb layer growing on raised hummocks. No one forb species is dominant, instead several abundant species have a

combined cover of 40-60%. Forb species include *Swertia perennis* (star gentian), *Pedicularis groenlandica* (elephanthead lousewort), *Polygonum bistortoides* (American bistort), *Heracleum maximum* (common cowparsnip), and *Achillea millefolium* var. *occidentalis* (western yarrow). Graminoid cover is typically low (< 20%), but it can be as high as 80%. Graminoid species include *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), and *Calamagrostis canadensis* (bluejoint reedgrass).

Ecological Processes

The *Salix boothii* (Booth willow)/mesic forb plant association appears to be a stable and long-lived community on sites that are neither completely saturated nor dry throughout the growing season. The undergrowth of *Salix boothii* dominated associations varies according to the substrate and water regime. Wetter stands have an understory of *Carex utriculata* (beaked sedge), while drier stands may have *Calamagrostis canadensis* (bluejoint reedgrass) and various forb species. It is unclear whether grazing increases the dominance of either mesic forbs or graminoids or if there are subtle environmental differences between sites that contribute to this. With excessive grazing, this community may be replaced by a *Salix boothii/Poa pratensis* (Booth willow/Kentucky bluegrass) type with native forbs once dominant in the *Salix boothii*/mesic forb plant association growing under the protection of shrub bases.

Avg. Cover %	(Range)	Species Name	# Plots (N=20)
58	(20-80%)	Salix boothii	20
31	(1-80%)	Salix drummondiana	7
13	(1-34%)	Salix geyeriana	8
11	(1-80%)	Calamagrostis canadensis	11
10	(1-20%)	Salix wolfii	6
9	(1-40%)	Heracleum maximum	13
9	(1-40%)	Poa pratensis	11
9	(1-20%)	Agrostis gigantea	4
9	(1-50%)	Fragaria virginiana ssp. glauca	16
7	(1-30%)	Alnus incana ssp. tenuifolia	6
6	(1-20%)	Rudbeckia laciniata var. ampla	8
5	(1-30%)	Sidalcea candida	7
5	(1-20%)	Phleum pratense	11
5	(1-20%)	Carex utriculata	8

Other species with < 5% average cover present in at least 10% of plots:
Urtica dioica ssp. gracilis (1-10%), Taraxacum officinale (1-50%), Maianthemum stellatum (1-30%), Elymus repens (1-10%), Symphyotrichum foliaceum (1-10%), Lonicera involucrata (1-5%), Galium boreale (1-20%), Poa palustris (1-10%), Elymus glaucus (1-7%), Cardamine cordifolia (1-10%), Geranium richardsonii (1-10%), Ribes inerme (1-10%), Mertensia ciliata (1-5%), Equisetum arvense (1-6%), Achillea millefolium var. occidentalis (1-10%), Thalictrum fendleri (1-5%), Solidago canadensis (1-5%), Symphyotrichum lanceolatum ssp. hesperium var. hesperium (1-5%), Rubus idaeus ssp. strigosus (1-5%), Dactylis glomerata (1-5%), Geum macrophyllum var. perincisum (1-5%), Hymenoxys hoopesii (1-5%), Senecio bigelovii var. hallii (1-4%), Vicia americana (1-5%), Aconitum columbianum (1-2%), Carex microptera (1%), Conioselinum scopulorum (1%), Senecio triangularis (1%), Glyceria striata (1%), Chamerion angustifolium ssp. circumvagum (1%).

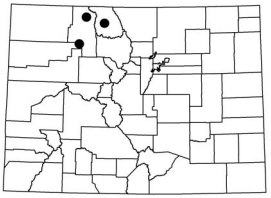
Booth willow / Mesic graminoid Shrubland

Salix boothii / Mesic graminoid

Global rank/State rank:
G3? / S3

HGM subclass: R2

Colorado elevation range:
7,800-8,900 ft (2,370-2,700 m)



General Description

Salix boothii (Booth willow) is a medium to tall shrub that often forms dense thickets on moist stream terraces and drier alluvial terraces. This plant association is generally found along wide riparian corridors, often surrounding beaver ponds.

In the Yampa River Basin, this association occurs on gently sloping floodplains in soils saturated from irrigation runoff and hillside seepage. Stream channels are wide and meandering. The upper soil layers are generally mineral soils that may be fine sands, loams, and clays. Some mottling is evident. Lower layers are gravel or cobble.

Vegetation Description

Salix boothii (Booth willow) provides a fairly dense canopy in this association, usually with about 70% cover. Other shrub species that may be present include *Salix geyeriana* (Geyer willow) and *Salix wolfii* (Wolf willow).

Wetter sites support a dense graminoid layer dominated by *Calamagrostis canadensis* (bluejoint reedgrass), with smaller amounts of *Carex utriculata* (beaked sedge) and *Carex pellita* (woolly sedge). In drier sites, the graminoid component often includes *Agrostis gigantea* (redtop), *Agrostis stolonifera* (creeping bentgrass), or *Poa pratensis* (Kentucky bluegrass). Forb cover is often minor but may include *Vicia americana* (American vetch) or *Fragaria virginiana* (strawberry).

Ecological Processes

This plant association commonly becomes established following beaver pond siltation and some drying. *Salix boothii* appears to establish on relatively mesic sites with soils that become neither completely saturated nor dry during the growing season. With continued drying, the undergrowth will be replaced with less hydrophytic species. With disturbance, such as excessive grazing, this plant association may be replaced

with a *Salix boothii/Poa pratensis* (Booth willow/Kentucky bluegrass) plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
54	(22-70%)	Salix boothii	3
20	—	Agrostis gigantea	1
20	—	Salix exigua	1
20	—	Poa palustris	1
19	—	Salix lucida ssp. caudata, lasiandra	1
16	—	Potentilla pulcherrima X hippiana	1
10	(5-15%)	Phleum pratense	2
10	—	Carex hoodii	1
10	—	Carex pellita	1
10	—	Symphyotrichum foliaceum	1
10	—	Salix wolfii	1
10	—	Salix monticola	1
10	—	Salix geyeriana	1
9	—	Calamagrostis canadensis	1
9	(1-16%)	Mentha arvensis	2
8	(5-10%)	Vicia americana	2
8	(5-10%)	Poa pratensis	2
5	—	Carex norvegica ssp. stevenii	1
5	—	Solidago canadensis	1
5	—	Ribes inerme	1

Other species with < 5% average cover present in at least 10% of plots:
Equisetum arvense (1-10%), Carex aquatilis (4%), Iris missouriensis (4%), Thalictrum fendleri (1-9%), Taraxacum officinale (1-9%), Fragaria virginiana ssp. glauca (1-5%), Deschampsia caespitosa (3%), Maianthemum stellatum (1-4%), Salix bebbiana (2%), Carex utriculata (1-2%), Galium boreale (1%), Geum macrophyllum var. perincisum (1%), Achillea millefolium var. occidentalis (1%), Fragaria vesca ssp. bracteata (1%), Aconitum columbianum (1%), Bromus tectorum (1%), Chamerion angustifolium ssp. circumvagum (1%), Sidalcea candida (1%), Geranium richardsonii (1%), Mertensia ciliata (1%).

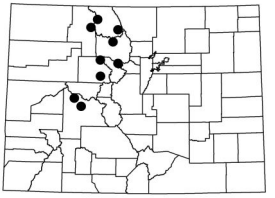
Drummond willow / Bluejoint reedgrass Shrubland

Salix drummondiana / Calamagrostis canadensis

Global rank/State rank:
G3 / S3

HGM subclass: S1/2, R2

Colorado elevation range:
8,000-9,800 ft (2,400-3,000 m)



General Description

The *Salix drummondiana*/*Calamagrostis canadensis* (Drummond willow/bluejoint reedgrass) plant association is characterized by a dense canopy of *Salix drummondiana* and a thick undergrowth of *Calamagrostis canadensis*. This association is often associated with beaver activity along streams and can also occur within the riparian mosaic with *Abies lasiocarpa-Picea engelmannii* (subalpine fir-Engelmann spruce) forests. This plant association occurs in scattered locations on the West Slope in the Yampa, Colorado and Gunnison River Basins and in the Routt National Forest.

This plant association occurs as small, isolated patches in forest and shrubland openings along channels in narrow valley bottoms. *Salix drummondiana* (Drummond willow) usually occurs along steep, narrow stream margins. It is often associated with beaver activity and can occasionally occur along low-gradient streams.

Vegetation Description

Salix drummondiana (Drummond willow) dominates the shrub overstory. Other shrubs can be present and abundant, such as *Salix planifolia* (planeleaf willow) and *Alnus incana* ssp. *tenuifolia* (thinleaf alder). The graminoid layer is dominated by *Calamagrostis canadensis* (bluejoint reedgrass). Other abundant graminoids include *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), and *Glyceria striata* (fowl mannagrass). Forb cover is typically low and includes *Galium boreale* (northern bedstraw), *Geranium richardsonii* (Richardson geranium), and *Mertensia ciliata* (tall fringed bluebells).

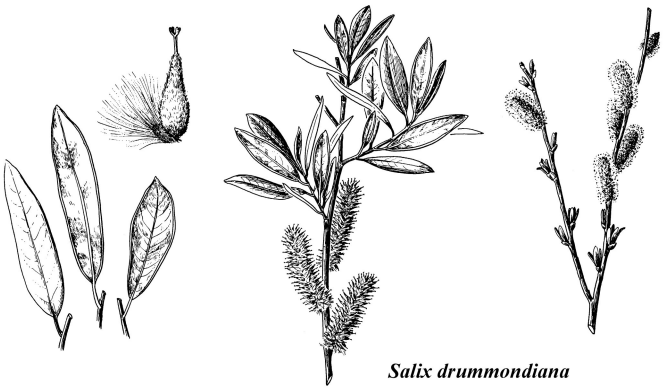
Ecological Processes

The *Salix drummondiana*/*Calamagrostis canadensis* (Drummond willow/bluejoint reedgrass) plant association is often an early colonizer of first-order, boulder-strewn, steep streams. Only a few stands representing the *Salix drummondiana*/*Calamagrostis canadensis* (Drummond willow/bluejoint reedgrass) plant association have been found

in Colorado, and livestock grazing has probably altered the species composition of these stands. This association appears to be limited to saturated wetland environments and therefore may be dependent on beaver populations that maintain a high water table. In addition, near beaver activity, this association may be a mid-successional community that will eventually become a *Salix planifolia* (planeleaf willow) or *Salix monticola* (mountain willow) type as the area dries slightly and accumulates sediment.

Avg. Cover %	(Range)	Species Name	# Plots (N=12)
54	(20-95%)	Salix drummondiana	12
34	(3-80%)	Calamagrostis canadensis	11
15	(5-30%)	Carex utriculata	3
14	(5-30%)	Carex aquatilis	4
13	(5-20%)	Salix geyeriana	2
11	(1-20%)	Salix planifolia	2
10	(1-20%)	Salix monticola	3
9	(5-11%)	Glyceria striata	3
8	(0.1-30%)	Heracleum maximum	8
4	(1-7%)	Equisetum arvense	6

Other species with < 5% average cover present in at least 10% of plots:
Chamerion angustifolium ssp. circumvagum (1-5%), Galium triflorum (1-5%), Veronica americana (1-4%), Deschampsia caespitosa (2-3%), Geranium richardsonii (1-5%), Alnus incana ssp. tenuifolia (2-3%), Mertensia ciliata (1-5%), Taraxacum officinale (1-3%), Poa pratensis (1-3%), Fragaria virginiana ssp. glauca (1-3%), Cardamine cordifolia (1-3%), Veratrum tenuipetalum (1-2%), Thalictrum sparsiflorum (1-2%), Geum macrophyllum var. perincisum (1-3%), Senecio triangularis (1-3%), Conioselinum scopulorum (0.1-2%), Achillea millefolium var. occidentalis (1%), Galium boreale (1%), Rubus idaeus ssp. strigosus (1%), Lonicera involucrata (1%), Bromus ciliatus var. ciliatus (1%), Epilobium lactiflorum (0.1-1%).



Salix drummondiana

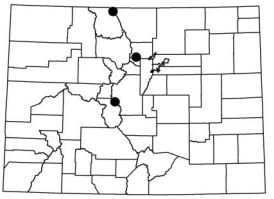
Drummond willow / Water sedge Shrubland

Salix drummondiana / Carex aquatilis

Global rank/State rank:
G2G3 / S2S3

HGM subclass: S1/2?, R2

Colorado elevation range:
8,430-10,460 ft (2,570-3,190 m)



General Description

The *Salix drummondiana/Carex aquatilis* (Drummond willow/water sedge) plant association forms a narrow band of tall (5-8 ft, 1.5-2.5 m) willows lining steep to moderately steep streams in the montane zone of the Rocky Mountains. The dominance of *Carex aquatilis* (water sedge) in the undergrowth is an indication of a wet, stable site. This association represents one of the wettest types within the *Salix drummondiana* Alliance.

Salix drummondiana (Drummond willow) typically becomes the dominant willow on floodplains of high-gradient streams in narrow, V-shaped valleys. Stream channels are steep and incised. Soils are deep sandy clays with high organic content in the top layers. Mottling is infrequent (10%) 6-20 inches (15-50 cm) below the surface and the soil profile becomes skeletal at a depth of 13 inches (33 cm).

Vegetation Description

Salix drummondiana (Drummond willow) forms a thick band of tall, 5-8 ft (1.5-2.5 m), shrubs overhanging the stream channel. Other shrubs that may be present include *Salix monticola* (mountain willow), *Dasiphora floribunda* (shrubby cinquefoil), and *Cornus sericea* (red-osier dogwood). The undergrowth is a thick carpet of grasses, grass-like plants and forbs including *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), *Carex microptera* (smallwing sedge), *Conioselinum scopulorum* (Rocky Mountain hemlockparsley), *Equisetum arvense* (field horsetail), *Fragaria virginiana* (strawberry), and *Senecio triangularis* (arrowleaf ragwort).

Ecological Processes

The *Salix drummondiana*/*Carex aquatilis* (Drummond willow/water sedge) plant association is early- to mid-seral. *Salix drummondiana* is a prolific seed producer and one of the first to colonize coarse-textured cobble bars and recently scoured alluvial

surfaces. *Salix drummondiana* is flexible and can tolerate most flood events. With time, fine-textured particles are deposited on the alluvial surface, raising the ground level above the annual flood stage. These fine-textured particles along with litter develop into more nutrient-rich soils. If the site remains close to the water table, but is not heavily disturbed by flooding (no scouring), grasses and grass-like plants will become established. The presence of *Carex aquatilis* and other sedge species is a good indication of a wet-mesic and stable site. With time, this association may become dominated by conifer trees.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
36	(30-42%)	Salix drummondiana	3
28	(20-45%)	Carex aquatilis	3
21	(11-30%)	Calamagrostis canadensis	2
15	—	Juncus tracyi	1
11	(5-16%)	Salix monticola	3
10	—	Equisetum pratense	1
10	—	Dodecatheon pulchellum	1
10	—	Dasiphora floribunda	1
9	(3-15%)	Picea engelmannii	2
9	—	Pinus contorta	1
6	—	Fragaria virginiana ssp. glauca	1
6	—	Juncus compressus	1
6	(1-10%)	Conioselinum scopulorum	2
5	—	Cornus sericea	1
5	—	Alnus incana ssp. tenuifolia	1
5	—	Carex simulata	1
5	—	Erigeron eximius	1
5	—	Caltha leptosepala	1
5	—	Salix lucida ssp. caudata, lasiandra	1
5	—	Ribes montigenum	1

Other species with < 5% average cover present in at least 10% of plots:
Arnica cordifolia (4%), Fragaria vesca ssp. bracteata (4%), Salix planifolia (2-5%), Arnica mollis (3%), Vaccinium scoparium (3%), Senecio triangularis (3%), Saxifraga odontoloma (3%), Festuca thurberi (3%), Pinus aristata (3%), Pedicularis groenlandica (3%), Oxypolis fendleri (0.1-5%), Taraxacum officinale (0.1-6%), Poa compressa (1-3%), Carex utriculata (2%), Equisetum arvense (2%), Aconitum columbianum (2%), Carex interior (2%), Carex occidentalis (2%), Chamerion angustifolium ssp. circumvagum (1%), Carex microptera (1%), Epilobium hornemannii (1%), Clematis ligusticifolia (1%), Angelica grayi (1%), Carex albonigra (1%), Cardamine cordifolia (1%), Cerastium arvense ssp. strictum (1%), Streptopus amplexifolius var. chalazatus (1%), Salix brachycarpa (1%), Pyrola asarifolia ssp. asarifolia (1%), Potentilla pulcherrima (1%), Polygonum viviparum (1%), Orthilia secunda (1%), Mitella pentandra (1%), Maianthemum stellatum (1%), Lupinus argenteus (1%), Vahlodea atropurpurea (1%), Juncus balticus var. montanus (1%), Abies lasiocarpa (1%), Poa pratensis (1%), Geum macrophyllum var. perincisum (0.1%), Achillea millefolium var. occidentalis (0.1%), Trifolium pratense (0.1%), Platanthera hyperborea var. hyperborea (0.1%).

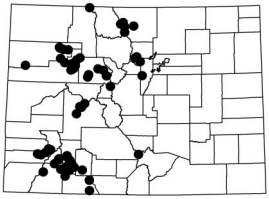
Drummond willow / Mesic forb Shrubland

Salix drummondiana / Mesic forb

Global rank/State rank:
G4 / S4

HGM subclass: S3/4, R2, R3/4

Colorado elevation range:
7,500-11,300 ft (2,400-3,500 m)



General Description

The *Salix drummondiana*/mesic forb (Drummond willow/mesic forb) plant association most commonly occurs on relatively steep streams and rarely forms more than a narrow, 5-25 ft (1.5-7.5 m) wide, band along streambanks. The closed to partially open canopy of *Salix drummondiana* and a thick carpet of many forb species characterize this plant association. This plant association occurs throughout the Western Slope and in montane regions along the Colorado Front Range.

The association occurs as a narrow band along high gradient streams in narrow, V-shaped valleys and as large willow carrs in the broad valleys of low gradient (1-3%), moderately sinuous streams. It is also located along broad, highly sinuous streams and broad, actively downcutting channels. This association also occurs near seeps. Soils range from deep sandy loams and sandy clay loams with no coarse fragments to shallow silty clay loams and sandy clay loams over coarse, angular cobbles.

Vegetation Description

Salix drummondiana (Drummond willow) forms an open to closed, narrow canopy of tall shrubs lining the stream bank. Other shrub species may be present with cover equal to but not exceeding that of *Salix drummondiana*. Mature trees may be present as a few individuals scattered through the shrubland or as canopy from an adjacent forested association. Stands with an overstory canopy of aspen are currently included in this association, although a *Populus tremuloides/Salix drummondiana* type may be separated at a later date. The herbaceous undergrowth may be sparse or richly diverse.

In general, total forb cover exceeds that of graminoid cover, and no single species is dominant.

Ecological processes

The *Salix drummondiana*/mesic forb (Drummond willow/mesic forb) association is often an early colonizer of first-order, boulder-strewn, steep streams. This association could be an early-seral stage of the *Abies lasiocarpa-Picea engelmannii* (subalpine fir-Engelmann spruce) plant association which also occurs along steep streams and alternates with the willow carrs. In wider valleys, this association occurs as a broad willow carr on well-developed soils near seeps or downstream from beaver dams. It appears to be a stable community in these environments.

Avg. Cover %	(Range)	Species Name	# Plots (N=60)
55	(20-98%)	Salix drummondiana	60
15	(2-37%)	Salix planifolia	7
13	(1-75%)	Populus tremuloides	10
12	(1-21%)	Alnus incana ssp. tenuifolia	17
11	(0.1-40%)	Salix monticola	33
10	(0.1-44%)	Mertensia ciliata	41
9	(1-29%)	Carex utriculata	12
8	(1-40%)	Heracleum maximum	39
8	(1-26%)	Mertensia franciscana	9
8	(1-34%)	Picea engelmannii	21
8	(1-30%)	Delphinium barbeyi	8
8	(1-60%)	Equisetum arvense	30
7	(1-20%)	Carex aquatilis	7
6	(0.1-30%)	Lonicera involucrata	36
6	(1-40%)	Cardamine cordifolia	44
6	(1-24%)	Ligusticum porteri	12
6	(0.1-30%)	Calamagrostis canadensis	31
6	(1-30%)	Oxypolis fendleri	24
5	(1-20%)	Ribes inerme	14
5	(1-20%)	Agrostis gigantea	7
5	(1-21%)	Arnica cordifolia	8
5	(1-13%)	Picea pungens	10
5	(1-34%)	Saxifraga odontoloma	19

Other species with < 5% average cover present in at least 10% of plots:
Hydrophyllum fendleri (1-17%), Rudbeckia laciniata var. ampla (1-14%), Dasiphora floribunda (1-19%), Senecio triangularis (1-24%), Abies lasiocarpa (1-12%), Geranium richardsonii (1-20%), Aconitum columbianum (1-20%), Elymus glaucus (1-10%), Osmorhiza depauperata (1-10%), Sambucus racemosa var. racemosa (1-10%), Chamerion angustifolium ssp. circumvagum (1-12%), Maianthemum stellatum (1-10%), Poa pratensis (1-20%), Conioselinum scopulorum (1-8%), Bromus ciliatus var. ciliatus (1-5%), Carex microptera (1-10%), Deschampsia caespitosa (1-7%), Thalictrum fendleri (1-5%), Veratrum tenuipetalum (1-5%), Viola canadensis var. scopulorum (1-10%), Geum macrophyllum var. perincisum (1-10%), Taraxacum officinale (0.1-8%), Galium triflorum (1-5%), Fragaria virginiana ssp. glauca (1-6%), Phleum pratense (1-5%), Urtica dioica ssp. gracilis (1-5%), Achillea millefolium var. occidentalis (0.1-5%), Streptopus amplexifolius var. chalazatus (1-5%), Rubus idaeus ssp. strigosus (1-5%), Mitella pentandra (1-4%), Symphoricarpos oreophilus (1-5%), Mimulus guttatus (1-3%), Glyceria striata (1-4%), Thlaspi montanum (1%), Pedicularis groenlandica (1%), Descurainia incana (1%).

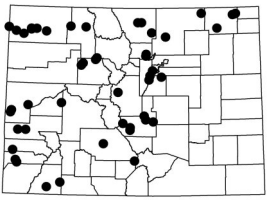
Sandbar willow / Barren Ground Shrubland

Salix exigua / Barren Ground

Global rank/State rank:
G5 / S5

HGM subclass: D4/5, R3/4, R5

Colorado elevation range:
3,600-9,900 ft (1,100-3,000 m)



General Description

This association occurs throughout Colorado, in every major watershed without exception. *Salix exigua* (sandbar willow) is one of the most common willow species in Colorado and occurs as a dominant in two associations, the *Salix exigua*/mesic graminoid and the *Salix exigua*/barren ground. These are easy to recognize as they are nearly pure stands of the willow, with few other species present. An undergrowth of a few, widely scattered forbs and grasses, where exposed cobbles or sand characterizes the ground cover, constitutes the *Salix exigua*/barren ground association, while an undergrowth of dense grasses and forbs covering at least 30% of the ground falls into the mesic graminoid type. *Salix exigua*/barren ground association occurs within the annual flood zone of a river on point bars, islands, sand or cobble bars and stream banks, while the *Salix exigua*/mesic graminoid association generally occurs along backwater channels and other perennially wet, but less scoured sites, such as floodplain swales and irrigation ditches.

This early seral plant association occurs primarily on sand and cobble bars of larger (second order and up) rivers. It is associated with annual flooding and inundation and will grow well into the channel, where it is flooded, even in drier years. It can form large, wide stands on mid-channel islands on larger rivers such as the Gunnison, Colorado and South Platte, or narrow stringer bands on small, rocky tributaries. This plant association occurs along a wide variety of stream reaches from moderately sinuous and moderate gradient reaches, to broad, meandering rivers with wide floodplains or broad, braided channels. Many stands also occur within highly entrenched or eroding gullies.

Soils of this association are typically coarse alluvial deposits of sand, silt and cobbles that are highly stratified with depth from flooding scour and deposition. Highly stratified profiles consist of alternating layers of clay loam and organic material with coarser sand or thin layers of sandy loam over very coarse alluvium. Occasionally, this association occurs on deep pockets of sand.

Vegetation Description

This association is characterized by an almost exclusive canopy of *Salix exigua* (sandbar willow) (1-98% cover) with very little herbaceous cover. Other shrubs and tree species may be present, but these rarely have greater cover than *Salix exigua*. Because this is such a widespread and common association, many other species can be present. A variety of other woody species may include *Populus angustifolia* (narrowleaf cottonwood), *P. deltoides* (plains cottonwood), *Abies lasiocarpa* (subalpine fir), *Salix ligulifolia* (strapleaf willow), *S. lucida* ssp. *caudata* (shining willow), *S. monticola* (mountain willow), *Acer negundo* (boxelder), and *Alnus incana* ssp. *tenuifolia* (thinleaf alder).

The herbaceous cover is typically very low, but can be as high as 30%. No single key herbaceous species is an indicator for this association, rather is it the combined amount of bare soil (dirt), gravel, cobble, or boulders that make up the ground cover that is the diagnostic indicator for this association. Common herbaceous species include *Poa pratensis* (Kentucky bluegrass), *Carex* spp. (sedge), *Melilotus officinalis* (yellow sweetclover), and *Cirsium* spp. (thistle). Although some species may appear high in cover, it is usually not representative of the whole stand, or it occurs between cobbles and boulders. Another key indicator for this association is the lack of soil development, and high ground cover of coarse alluvial material.

Ecological Processes

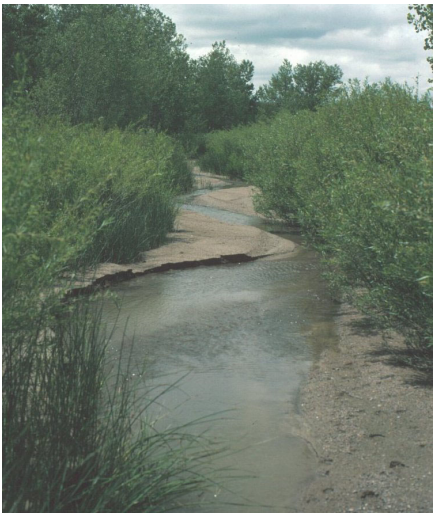
The *Salix exigua*/barren ground (sandbar willow/barren ground) plant association is considered an early seral community, capable of colonizing freshly deposited sand and gravel bars. *Salix exigua* is an excellent soil stabilizer with a deep root system and flexible stems that can withstand flooding. *Salix exigua* reduces erosion potential by increasing the friction of stream flow, trapping sediments and building a protected seed bed for a number of tree and shrub species. Succession without disturbance may lead to a greater understory cover, which, in turn, facilitates the establishment of shrub and tree seedlings. The presence of cottonwood seedlings within this association indicates succession to a cottonwood stand, if seedlings survive subsequent flooding events.

Avg. Cover %	(Range)	Species Name	# Plots (N=73)
61	(0.1-98%)	Salix exigua	73
10	(0.1-60%)	Clematis ligusticifolia	9
8	(1-40%)	Melilotus officinalis	10
6	(1-15%)	Cirsium arvense	10
6	(1-22%)	Trifolium repens	7
5	(1-20%)	Rosa woodsii	13
5	(0.1-30%)	Cornus sericea	13

Other species with < 5% average cover present in at least 10% of plots:
Agrostis gigantea (0.1-10%), Poa pratensis (1-15%), Populus deltoides (0.1-10%), Glycyrrhiza lepidota (0.1-10%), Equisetum hyemale var. affine (0.1-7%), Xanthium strumarium (0.1-5%), Apocynum cannabinum (0.1-10%), Bromus inermis (1-5%), Eleocharis palustris (0.1-10%), Medicago lupulina (1-5%), Echinochloa crus-galli (0.1-5%), Equisetum arvense (1-3%), Mentha arvensis (0.1-3%), Taraxacum officinale (0.1-1%).

Sandbar willow / Mesic graminoid Shrubland

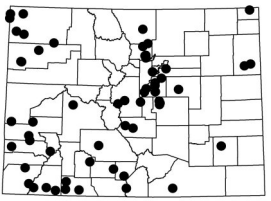
Salix exigua / Mesic graminoid



Global rank/State rank:
G5 / S5

HGM subclass: R3/4, R5

Colorado elevation range:
3,400-9,600 ft (1,040-2,930 m)



General Description

Salix exigua (sandbar willow) is one of the most common willow species in Colorado. and is characteristic of two associations, the *Salix exigua*/mesic graminoid and the *Salix exigua*/barren ground. Both may be nearly pure stands of the willow, with few other species present. An undergrowth of dense grasses and forbs covering at least 30% of the ground falls into the mesic graminoid type, while an undergrowth of a few, widely scattered forbs and grasses, where exposed cobbles or sand characterizes the ground cover, constitutes the *Salix exigua*/barren ground association. The *Salix exigua*/mesic graminoid association generally occurs along backwater channels and other perennially wet, but less scoured sites, such as floodplain swales and irrigation ditches while the *Salix exigua*/barren ground association occurs within the annual flood zone of a river on point bars, islands, sand or cobble bars and stream banks.

This plant association usually occurs within 3 feet (1 m) vertical distance of the stream channel on point bars, low floodplains, terraces and along overflow channels. It can also occur away from the stream channel in mesic swales or along the margins of beaver ponds. Stream channels are broad to narrow and meandering with sand or cobble beds. Soils are typically somewhat more developed than the *Salix exigua*/barren ground plant association due to a slightly more stable environment and greater input of organic matter. Textures are typically loamy sands interspersed with layers of silty clays and alternating with coarse sands. Upper layers (10-30 cm) often have 25-30% organic matter.

Vegetation Description

Salix exigua (sandbar willow) dominates the canopy of this association, giving the association its characteristic grayish-green color. Other shrub species can also be

present including *Rosa woodsii* (Woods rose), *Salix bebbiana* (Bebb willow), *Salix ligulifolia* (strapleaf willow), *Salix monticola* (mountain willow), *Salix lucida* (ssp. *caudata* or ssp. *lasiandra*) (shining willow), *Salix planifolia* (planeleaf willow), *Salix geyeriana* (Geyer willow), and *Alnus incana* ssp. *tenuifolia* (thinleaf alder). The undergrowth has at least 20-35% cover of various graminoid (and sometimes forb) species, although no single species is consistently present. Species include *Poa pratensis* (Kentucky bluegrass), *Juncus balticus* var. *montanus* (mountain rush), *Cirsium* spp. (thistle), *Carex pellita* (woolly sedge), and *Eleocharis palustris* (common spikerush). Forb cover is generally low, but can include a high percentage of non-native species such as *Medicago lupulina* (black medick) and *Melilotus officinalis* (yellow sweetclover).

Ecological Processes

This plant association is typical of recent floodplains and highly disturbed, low, wet areas and is considered early-seral. The amount of herbaceous growth in the understory is an indication of the amount of time since the last scouring (or depositional) flood event. *Salix exigua* (sandbar willow) is an excellent soil stabilizer with a deep root system and flexible stems that can withstand flooding. *Salix exigua* reduces erosion potential by increasing the friction of stream flow, trapping sediments and building a protected seed bed for a number of tree and shrub species. The presence of cottonwood seedlings within this association indicates succession to a cottonwood stand (and may represent the *Populus angustifolia* or *Populus deltoides/Salix exigua* plant associations), if seedlings survive subsequent flooding events.

Avg. Cover %	(Range)	Species Name	# Plots (N=118)
64	(5-100%)	Salix exigua	118
22	(1-88%)	Agrostis gigantea	48
21	(0.1-63%)	Elymus lanceolatus	16
17	(2-38%)	Agrostis stolonifera	14
16	(0.1-100%)	Poa pratensis	58
16	(0.1-60%)	Carex pellita	28
14	(0.1-63%)	Juncus balticus var. montanus	33
12	(0.1-85%)	Bromus inermis	22
12	(0.1-38%)	Tamarix ramosissima	12
10	(0.1-38%)	Schoenoplectus pungens	23
10	(1-80%)	Rosa woodsii	22
9	(0.1-31%)	Melilotus officinalis	27
8	(0.1-40%)	Eleocharis palustris	29
7	(1-20%)	Salix monticola	14
7	(1-38%)	Equisetum arvense	34
7	(1-15%)	Symphyotrichum lanceolatum ssp. hesperium var. hesperium	17
7	(1-38%)	Glycyrrhiza lepidota	16
6	(0.1-38%)	Cirsium arvense	28
6	(0.1-23%)	Salix ligulifolia	15
5	(1-18%)	Trifolium repens	13
5	(0.1-38%)	Populus deltoides	22

Other species with < 5% average cover present in at least 10% of plots:
Plantago major (0.1-24%), Hordeum jubatum ssp. jubatum (1-22%), Achillea millefolium var. occidentalis (0.1-38%), Mentha arvensis (0.1-30%), Taraxacum officinale (0.1-10%), Epilobium ciliatum ssp. glandulosum (0.1-5%), Elymus canadensis (0.1-10%), Verbascum thapsus (0.1-16%), Equisetum laevigatum (0.1-5%).

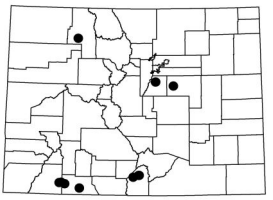
Sandbar willow - Strapleaf willow Shrubland

Salix exigua - Salix liguifolia (=S. eriocephala var. *ligulifolia)*

Global rank/State rank:
G2G3 / S2S3

HGM subclass: R3/4, R5

Colorado elevation range:
5,700-8,000 ft (1,700-2,450 m)



General Description

The *Salix exigua-Salix ligulifolia* (sandbar willow-strapleaf willow) plant association is a medium- to tall-willow shrubland occurring on saturated pointbars and active stream channels of foothill tributary streams. In the mountains, *Salix ligulifolia* mixes with *Salix monticola* (mountain willow) and *Salix drummondiana* (Drummond willow), forming the *Salix ligulifolia* (strapleaf willow) plant association. In the foothills, *Salix ligulifolia* mixes with *Salix exigua* (sandbar willow) and *Salix lucida* (shining willow), forming the *Salix exigua-Salix ligulifolia* (sandbar willow-strapleaf willow) plant association.

This plant association occurs in the wettest part of the riparian area, usually adjacent to the channel on low point bars, islands, low stream banks and overflow channels. The streams are broad and meandering with sandy beds or braided channels. Soils of foothill sites are shallow sandy clay loams and sands over unconsolidated alluvial material with thin buried layers of organic material.

Vegetation Description

This plant association is predominantly tall stands of *Salix ligulifolia* (strapleaf willow) mixed with *Salix exigua* (sandbar willow). Other shrubs that may be present include *Salix lucida* ssp. *caudata* (shining willow), *Rosa woodsii* (Woods rose), *Quercus gambelii* (Gambel oak), *Symphoricarpos* spp. (snowberry), *Prunus virginiana* (chokecherry), *Crataegus rivularis* (river hawthorn), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), and *Betula occidentalis* (river birch). The herbaceous undergrowth is dominated by any number of species, including *Carex pellita* (woolly sedge), *Carex nebrascensis* (Nebraska sedge), *Eleocharis palustris* (common spikerush), *Lactuca serriola* (prickly lettuce), *Juncus balticus* var. *montanus* (mountain rush), *Muhlenbergia asperifolia* (alkali muhly), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Calamagrostis stricta* (slimstem reedgrass), *Cirsium arvense* (Canadian thistle), *Bromus tectorum* (cheatgrass), and *Bromus inermis* (smooth brome).

Ecological Processes

This plant association appears to be an early- to mid-seral community. It occupies point bars and low stream banks that are flooded annually in the spring. It may be a transition zone between the common low elevation *Salix exigua* (sandbar willow) plant association and the less common montane elevation *Salix ligulifolia* (strapleaf willow) dominated associations.

Avg. Cover %	(Range)	Species Name	# Plots (N=12)
38	(15-70%)	Salix ligulifolia	12
31	(8-85%)	Salix exigua	11
21	(1-40%)	Bromus inermis	2
18	(10-25%)	Alnus incana ssp. tenuifolia	2
16	(1-46%)	Carex pellita	6
16	(10-21%)	Cornus sericea	2
12	(1-37%)	Maianthemum stellatum	4
12	(8-15%)	Rudbeckia laciniata var. ampla	2
10	(7-13%)	Muhlenbergia asperifolia	2
10	(1-26%)	Populus deltoides	3
8	(1-20%)	Cirsium arvense	4
8	(1-20%)	Lactuca serriola	3
7	(1-12%)	Salix lucida ssp. caudata, lasiandra	3
7	(1-12%)	Betula occidentalis	2
6	(1-9%)	Dactylis glomerata	3
6	(2-10%)	Equisetum hyemale var. affine	2
6	(1-10%)	Bromus tectorum	2
5	(1-10%)	Juncus balticus var. montanus	4
5	(5-5%)	Geranium richardsonii	2
5	(1-9%)	Agrostis stolonifera	2
5	(1-12%)	Poa pratensis	9

Other species with < 5% average cover present in at least 10% of plots:
Symphyotrichum lanceolatum ssp. hesperium var. hesperium (4-5%), Galium boreale (1-6%), Symphoricarpos oreophilus (1-6%), Populus angustifolia (2-5%), Equisetum laevigatum (1-7%), Taraxacum officinale (1-5%), Iris missouriensis (2-3%), Clematis ligusticifolia (1-4%), Rosa woodsii (1-6%), Carex microptera (1-3%), Medicago lupulina (1-3%), Alopecurus aequalis (1-3%), Apocynum androsaemifolium (1-3%), Mentha arvensis (1-3%), Eleocharis palustris (1-3%), Vicia americana (1-4%), Glycyrrhiza lepidota (1-3%), Achillea millefolium var. occidentalis (1-2%), Equisetum arvense (1-3%), Elymus trachycaulus ssp. trachycaulus (1%), Plantago major (1%), Medicago sativa (1%), Trifolium repens (1%), Verbascum thapsus (1%), Schoenoplectus acutus\tabernaemontani (1%), Rhus trilobata var. trilobata (1%).

Salix exigua

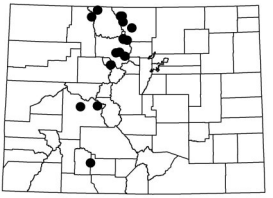
Geyer willow / Bluejoint reedgrass Shrubland

Salix geyeriana / Calamagrostis canadensis

Global rank/State rank:
G5 / S3

HGM subclass: R2

Colorado elevation range:
7,700-10,000 ft (2,350-3,050 m)



General Description

The *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) plant association is a tall (6-10 ft, 2-3 m), deciduous shrubland, often forming large expanses of willows on broad montane valley floors. The ground is usually hummocky with a thick carpet of grasses and grass-like plants. These shrublands are often associated with beaver-created wetlands. Although this association has been reported from several states, it is relatively uncommon in Colorado where it occurs in the Colorado River Basin, the upper South Platte River Basin, and on the Routt, Arapaho, Roosevelt, Rio Grande, and Gunnison National Forests.

This plant association occurs along sinuous, moderate to low gradient (0.1-8%) rivers and adjacent to beaver ponds on hummocky land surfaces. Stream channels are wide and strongly meandering. Soil textures are fine silty clay loams with high organic content.

Vegetation Description

Salix geyeriana (Geyer willow) dominates the tall-shrub overstory. Other shrubs that may be present include *Salix monticola* (mountain willow), *Salix planifolia* (planeleaf willow), *Salix drummondiana* (Drummond willow), and *Alnus incana* ssp. *tenuifolia* (thinleaf alder). The undergrowth is always dominated by *Calamagrostis canadensis* (bluejoint reedgrass). Other graminoids that may be present include *Carex aquatilis* (water sedge) and *Carex utriculata* (beaked sedge). Forb cover is relatively low.

Ecological Processes

The *Salix geyeriana* (Geyer willow) dominated associations appear to be long-lived and late-seral, remaining in areas where a shallow water table saturates soils, not dropping below 3 ft (1 m) for much of the growing season. Stands are limited to cold, wet environments of broad valley bottoms at high elevations. Due to the colder environments, organic matter builds up in the soils and succession to other

associations is likely to be slow. Beaver activity is also important in maintaining this association since it may be the last successional community to establish on naturally silted-in beaver ponds.

Carex utriculata (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) are common dominant undergrowth of several *Salix* plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain.

Carex utriculata (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channels with the shallowest water tables. *Carex aquatilis* (water sedge) occurs on intermediate sites that have saturated but not inundated soils. *Calamagrostis canadensis* (bluejoint reedgrass) dominates the drier sites with lower water tables.

Avg. Cover %	(Range)	Species Name	# Plots (N=21)
53	(20-100%)	Salix geyeriana	21
33	(1-80%)	Calamagrostis canadensis	21
15	(5-25%)	Thalictrum fendleri	2
13	(1-20%)	Salix boothii	3
13	(3-25%)	Ribes lacustre	3
11	(3-20%)	Salix planifolia	3
10	(1-16%)	Alnus incana ssp. tenuifolia	3
9	(3-16%)	Salix wolfii	5
9	(1-15%)	Fragaria virginiana ssp. glauca	6
9	(1-30%)	Carex aquatilis	6
8	(1-30%)	Poa pratensis	13
8	(0.1-20%)	Salix monticola	10
7	(1-15%)	Phleum pratense	4
7	(1-20%)	Carex utriculata	10
6	(1-10%)	Carex microptera	2
5	(1-10%)	Ribes inerme	4
5	(1-30%)	Heracleum maximum	8

Other species with < 5% average cover present in at least 10% of plots:
Lonicera involucrata (1-15%), Agrostis scabra (1-20%), Geum macrophyllum var. perincisum (1-10%), Dasiphora floribunda (1-10%), Taraxacum officinale (1-10%), Juncus balticus var. montanus (1-5%), Mertensia ciliata (1-7%), Achillea millefolium var. occidentalis (1-5%), Deschampsia caespitosa (1-3%), Trisetum wolfii (1-3%), Scirpus microcarpus (1-3%), Conioselinum scopulorum (1-5%), Galium boreale (0.1-3%), Equisetum arvense (0.1-4%), Glyceria striata (1-2%), Betula nana (1-2%), Cardamine cordifolia (1-2%), Polemonium occidentale ssp. occidentale (0.1-2%), Geranium richardsonii (1%), Pedicularis groenlandica (1%), Oxypolis fendleri (1%), Aconitum columbianum (1%), Solidago canadensis (1%), Senecio triangularis (1%), Castilleja sulphurea (1%), Eleocharis palustris (1%), Caltha leptosepala (1%), Symphyotrichum foliaceum (0.1-1%).

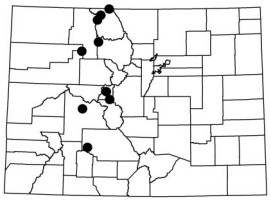
Geyer willow / Water sedge Shrubland

Salix geyeriana / Carex aquatilis

Global rank/State rank:
G3 / S3

HGM subclass: S1/2, R2

Colorado elevation range:
8,400-10,500 ft (2,500-3,200 m)



General Description

Salix geyeriana (Geyer willow) forms a tall willow shrubland with smaller shrubs often occurring under the canopy. The canopy is nearly closed and a thick carpet of mesic grasses and forbs blanket the ground. The ground surface is often hummocky with willows establishing on the raised mounds and grasses dominating in the swales. The association also occurs on hillside seeps. This association is relatively uncommon in Colorado. Few stands are in pristine condition. It may be less common than it was historically due to heavy grazing at the turn of the century.

This association occurs on floodplains that have an undulating topography with hummocks, ridges and swales that create a microenvironment for its heterogeneous understory. The floodplains tend to be broad, are usually flooded in early spring/summer, and have saturated soils throughout the growing season. This plant association occurs on narrow, flat benches along steep stream reaches. It also occurs on floodplains of narrow, subalpine, low gradient, braided or highly sinuous steams. Stream channels can also be broad and sinuous. Soils are shallow to deep with mottling often occurring near the surface. Soil textures are fine sandy clay loams, clay loams and silty loams often alternating with layers of coarse sand.

Vegetation Description

This plant association is characterized by a tall willow canopy dominated by *Salix geyeriana* (Geyer willow). Other shrubs may include *Betula nana (=glandulosa)* (bog birch), *Salix brachycarpa* (barrenground willow), *S. boothii* (Booth willow), *S. monticola* (mountain willow), and *S. planifolia* (planeleaf willow).

Graminoid cover is greater than forb cover and is dominated by *Carex aquatilis* (water sedge). Other graminoids that may be present include *Carex utriculata* (beaked sedge), *Deschampsia caespitosa* (tufted hairgrass), and *Calamagrostis canadensis* (bluejoint reedgrass). Forb cover is concentrated on elevated micro-ridges and higher areas where shrubs are rooted. Forb species that may be present include *Senecio*

triangularis (arrowleaf ragwort), *Achillea millefolium* var. *occidentalis* (western yarrow), *Conioselinum scopulorum* (Rocky Mountain hemlockparsley), and *Geum macrophyllum* (largeleaf avens).

Ecological Processes

Salix geyeriana dominated associations appear to be long-lived and late-seral, remaining in areas where a shallow water table saturates soils, not dropping below 3 ft (1 m) for much of the growing season. Stands are limited to cold, wet environments of broad valley bottoms at high elevations. Due to the colder environments, organic matter builds up in the soils and succession to other associations is likely to be slow. Beaver activity is also important in maintaining this association since it may be the last successional community to establish on naturally silted-in beaver ponds.

Carex utriculata (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) are common dominant undergrowth of several *Salix* plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain.

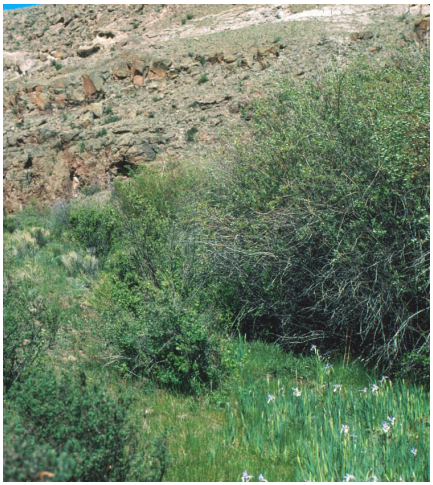
Carex utriculata (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channel with the shallowest water tables. *Carex aquatilis* (water sedge) occurs on intermediate sites that have saturated but not inundated soils. *Calamagrostis canadensis* (bluejoint reedgrass) dominates the drier sites with lower water tables.

Avg. Cover %	(Range)	Species Name	# Plots (N=9)
37	(12-80%)	Salix geyeriana	9
29	(10-60%)	Carex aquatilis	9
16	(1-30%)	Salix brachycarpa	2
14	(1-30%)	Salix boothii	3
11	(1-25%)	Equisetum arvense	4
10	(5-16%)	Salix monticola	3
10	(3-20%)	Calamagrostis canadensis	6
10	(5-14%)	Carex utriculata	4
8	(1-19%)	Juncus balticus var. montanus	3
7	(1-20%)	Salix planifolia	6
6	(2-14%)	Senecio triangularis	3
6	(1-15%)	Thalictrum fendleri	3
6	(1-20%)	Poa pratensis	5
5	(1-9%)	Agrostis stolonifera	2
5	(1-9%)	Stellaria longifolia	2

Other species with < 5% average cover present in at least 10% of plots:
Conioselinum scopulorum (1-10%), Fragaria virginiana ssp. glauca (1-11%), Dasiphora floribunda (1-10%), Deschampsia caespitosa (1-10%), Lonicera involucrata (3-4%), Geum macrophyllum var. perincisum (1-10%), Phleum pratense (1-5%), Cardamine cordifolia (1-6%), Luzula parviflora (1-4%), Achillea millefolium var. occidentalis (1-4%), Aconitum columbianum (1-3%), Mertensia ciliata (1-4%), Vicia americana (1-3%), Pedicularis groenlandica (1-3%), Taraxacum officinale (1-3%), Oxypolis fendleri (1-2%), Galeopsis bifida (1-2%), Heracleum maximum (1%), Geranium richardsonii (1%), Glyceria striata (1%), Chamerion angustifolium ssp. circumvagum (1%), Thlaspi montanum (1%).

Geyer willow / Beaked sedge Shrubland

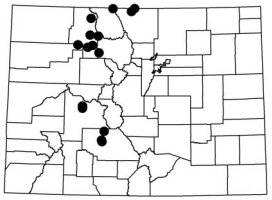
Salix geyeriana / Carex utriculata



Global rank/State rank:
G5 / S3

HGM subclass: R2

Colorado elevation range:
6,800-9,000 ft (2,100-2,800 m)



General Description

The *Salix geyeriana/Carex utriculata* (Geyer willow/beaked sedge) plant association is a tall (5-15 ft, 1.5-2.5 m), deciduous shrubland with a nearly closed canopy of willows and thick carpet of sedges in the undergrowth. It is often wet, with saturated soils throughout much of the growing season. This association is well documented from many western states, but is relatively uncommon in Colorado.

This association occurs in moderately wide to wide valley bottoms in swales and overflow channels of active floodplains adjacent to wide stream channels. This association often occurs near beaver activity. Stream channels are slightly meandering or braided from beaver activity. Soils textures are silty clay loam, clay, and sandy clay, usually forming thick, cohesive layers interspersed with layers of gravel or sand. Mottling or gleying is often present.

Vegetation Description

Salix geyeriana (Geyer willow) dominates the shrub overstory with 20-70% cover. Other willow species that may be present include *Salix monticola* (mountain willow), *Salix drummondiana* (Drummond willow), *Salix wolfii* (Wolf willow), and *Salix planifolia* (planeleaf willow). Other shrubs that may be present include *Alnus incana* spp. *tenuifolia* (thinleaf alder) and *Lonicera involucrata* (twinberry honeysuckle). The graminoid layer is dominated by 20-80% cover of *Carex utriculata* (beaked sedge). Other graminoids that may be present include *Carex aquatilis* (water sedge), *Calamagrostis canadensis* (bluejoint reedgrass), and *Carex praegracilis* (clustered field sedge). Forb cover is generally minor.

Ecological Processes

Salix geyeriana dominated associations appear to be long-lived and late-seral, remaining in areas where a shallow water table saturates soils, not dropping below 3 ft (1 m) for much of the growing season. Stands are limited to cold, wet environments of broad valley bottoms at high elevations. Due to the colder environments, organic matter builds up in the soils and succession to other associations is likely to be slow. Beaver activity is also important in maintaining this association since it may be the last successional community to establish on naturally silted-in beaver ponds.

Carex utriculata (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) are common dominant undergrowth of several *Salix* plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain.

Carex utriculata (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channel with the shallowest water tables. *Carex aquatilis* (water sedge) occurs on intermediate sites that have saturated but not inundated soils. *Calamagrostis canadensis* (bluejoint reedgrass) dominates the drier sites with lower water tables.

Avg. Cover %	(Range)	Species Name	# Plots (N=16)
47	(20-70%)	Salix geyeriana	15*
36	(5-80%)	Carex utriculata	16
18	(1-70%)	Poa pratensis	6
15	(9-20%)	Salix monticola	5
13	(1-31%)	Equisetum arvense	4
12	(1-30%)	Calamagrostis canadensis	7
11	(2-27%)	Carex aquatilis	11
10	(2-30%)	Salix planifolia	7
9	(1-24%)	Aconitum columbianum	3
9	(1-16%)	Bromus ciliatus var. ciliatus	2
8	(1-20%)	Ribes inerme	3
8	(1-20%)	Deschampsia caespitosa	3
8	(5-10%)	Salix wolfii	2
8	(5-10%)	Salix boothii	2
7	(1-16%)	Phleum pratense	4
6	(1-10%)	Poa palustris	2
5	(1-16%)	Cardamine cordifolia	4
5	(3-7%)	Potentilla pulcherrima X hippiana	2
5	(3-7%)	Conioselinum scopulorum	2
5	(1-20%)	Fragaria virginiana ssp. glauca	5

Other species with < 5% average cover present in at least 10% of plots:
Saxifraga odontoloma (1-10%), Alnus incana ssp. tenuifolia (1-10%), Taraxacum officinale (1-11%), Senecio triangularis (1-12%), Geranium richardsonii (1-10%), Juncus balticus var. montanus (1-5%), Heracleum maximum (1-5%), Galium triflorum (1-5%), Agrostis stolonifera (1-5%), Geum macrophyllum var. perincisum (1-10%), Pedicularis groenlandica (1-7%), Trifolium repens (1-7%), Achillea millefolium var. occidentalis (1-10%), Lonicera involucrata (1-5%), Dasiphora floribunda (1-3%), Thalictrum fendleri (1-3%), Mentha arvensis (1-4%), Carex microptera (1-3%), Maianthemum stellatum (1-3%), Cicuta douglasii (1-2%), Rumex crispus (1-2%), Mertensia ciliata (1-2%), Oxypolis fendleri (1%), Vicia americana (1%), Pinus contorta (1%), Cirsium tioganum var. coloradense (1%), Rosa woodsii (1%), Galium boreale (1%).

***** Salix geyeriana occurred in all stands, but was not captured in every sample plot.

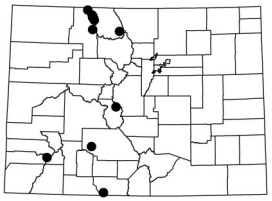
Geyer willow / Mesic forb Shrubland

Salix geyeriana / Mesic forb

Global rank/State rank:
G3 / S3

HGM subclass: R2, R3/4

Colorado elevation range:
8,100-9,900 ft (2,460-3,000 m)



General Description

The *Salix geyeriana*/mesic forb (Geyer willow/mesic forb) plant association is a tall (5-15 ft, 1.5-2.5 m), deciduous shrubland confined to a narrow band along stream banks. The herbaceous undergrowth is dominated by mosses and forbs. This association is well documented in several western states. However, large, pristine stands without introduced species in the undergrowth are extremely rare.

This plant association generally occurs along moderately wide, low-gradient valley bottoms with sinuous stream channels. It can also occur in narrow valley bottoms (65-165 ft, 20-50 m), and on flood benches of moderately sinuous stream channels. Soils are coarse skeletal sandy loams and sandy clay loams overlying gravel and cobble horizons. Soils of this plant association tend to have more coarse fragments than other more moist *Salix geyeriana* associations.

Vegetation Description

Salix geyeriana (Geyer willow) dominates the tall shrub canopy. Other willow species that may be present include *Salix monticola* (mountain willow), *Salix drummondiana* (Drummond willow), *Salix planifolia* (planeleaf willow), *Salix wolfii* (Wolf willow), and *Salix brachycarpa* (barrenground willow). *Alnus incana* ssp. *tenuifolia* (thinleaf alder) can also be present. Forb cover is low to fairly dense and includes *Mertensia ciliata* (tall fringed bluebells), *Heracleum maximum* (common cowparsnip), *Senecio triangularis* (arrowleaf ragwort), *Oxypolis fendleri* (Fendler cowbane), and *Fragaria virginiana* (strawberry). Graminoid cover is sparse.

Ecological Processes

The *Salix geyeriana*/mesic forb (Geyer willow/mesic forb) plant association appears to be a long-lived, late-seral community that will remain dominant where a high water table saturates soils for much of the growing season. However, if the stand has predominantly non-native species in the undergrowth, such as *Trifolium repens* (white

clover) and *Taraxacum officinale* (dandelion), it is likely a grazing-induced community. With appropriate grazing management, the stand can revert back to the *Salix geyeriana*/mesic forb (Geyer willow/mesic forb) or the *Salix geyeriana* /mesic graminoid (Geyer willow/mesic graminoid) plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=10)
54	(30-75%)	Salix geyeriana	10
28	(15-50%)	Alnus incana ssp. tenuifolia	4
20	(6-32%)	Salix monticola	4
14	(7-20%)	Salix boothii	2
12	(3-20%)	Salix wolfii	2
11	(1-28%)	Heracleum maximum	6
9	(1-17%)	Juncus balticus var. montanus	2
9	(1-34%)	Mertensia ciliata	6
8	(6-10%)	Trifolium repens	2
8	(1-16%)	Picea engelmannii	3
7	(1-18%)	Cardamine cordifolia	4
7	(3-11%)	Carex utriculata	2
6	(1-20%)	Poa pratensis	4
6	(1-11%)	Trifolium longipes	2
6	(2-9%)	Senecio triangularis	5
6	(1-10%)	Castilleja sulphurea	2
5	(1-13%)	Taraxacum officinale	7
5	(2-8%)	Erigeron speciosus var. speciosus	2
5	(1-9%)	Pinus contorta	2
5	(1-18%)	Carex aquatilis	5

Other species with < 5% average cover present in at least 10% of plots:
Prunella vulgaris (4-5%), Veratrum tenuipetalum (3-7%), Geranium richardsonii (2-10%), Aconitum columbianum (1-9%), Thalictrum fendleri (1-6%), Carex microptera (1-10%), Achillea millefolium var. occidentalis (1-23%), Dasiphora floribunda (1-9%), Calamagrostis canadensis (2-6%), Salix planifolia (1-10%), Ligusticum tenuifolium (2-5%), Viola macloskeyi ssp. pallens (1-6%), Oxypolis fendleri (1-10%), Conioselinum scopulorum (1-5%), Erigeron peregrinus ssp. callianthemus (3-3%), Galium boreale (1-5%), Fragaria virginiana ssp. glauca (1-5%), Lonicera involucrata (2-3%), Equisetum arvense (1-5%), Aster alpinus var. vierhapperi (1-3%), Osmorhiza depauperata (1-3%), Carex foenea (1-3%), Carex norvegica (1-3%), Trisetum spicatum (1-3%), Vicia americana (1-4%), Pedicularis groenlandica (1-3%), Luzula parviflora (1-3%), Phleum alpinum (1-3%), Maianthemum stellatum (1-2%), Galium triflorum (1-2%), Castilleja miniata (1-2%), Ribes montigenum (1-2%), Mitella pentandra (1-2%), Saxifraga odontoloma (1-2%), Geum macrophyllum var. perincisum (1%), Deschampsia caespitosa (1%), Caltha leptosepala (1%), Bromus ciliatus var. ciliatus (1%), Bromus lanatipes (1%), Chamerion angustifolium ssp. circumvagum (1%), Elymus glaucus (1%), Stellaria longifolia (1%), Streptopus amplexifolius var. chalazatus (1%).

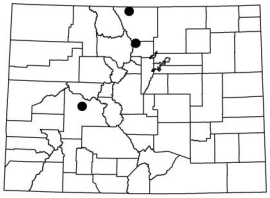
Geyer willow - Mountain willow / Bluejoint reedgrass Shrubland

Salix geyeriana - Salix monticola / Calamagrostis canadensis

Global rank/State rank:
G3 /S3

HGM subclass: R2

Colorado elevation range:
8,200-9,200 ft (2,500-2,800 m)



General Description

The *Salix geyeriana-Salix monticola/Calamagrostis canadensis* (Geyer willow-mountain willow/bluejoint reedgrass) plant association is a tall (4-8 ft, 1.5-2.5 m), deciduous shrubland that occurs in small and large stands interspersed with wet meadows, open stream channels, and beaver ponds. The willow canopy is nearly a homogeneous mix of the two willow species.

This plant association occurs on wide floodplains that are flat or hummocky and occurs within 2 ft (0.5 m) of the channel high water mark. Stream channels are narrow and highly sinuous or braided by beaver activity. Soil textures range from sandy loam to silty clay, with up to 50% organic matter in the upper layers. Water table depths range from 8-25 inches (20-60 cm).

Vegetation Description

The shrub canopy is dominated by 22-40% cover of *Salix geyeriana* (Geyer willow) and 15-50% cover of *Salix monticola* (mountain willow). Other shrubs that may be present include *Salix planifolia* (planeleaf willow), *Salix drummondiana* (Drummond willow), *Lonicera involucrata* (twinberry honeysuckle), and *Ribes inerme* (whitestem gooseberry). The undergrowth can be patchy, but generally dominated by *Calamagrostis canadensis* (bluejoint reedgrass). Other herbaceous species that may be present include *Carex aquatilis* (water sedge), *Geum macrophyllum* (largeleaf avens), and *Heracleum maximum* (common cowparsnip).

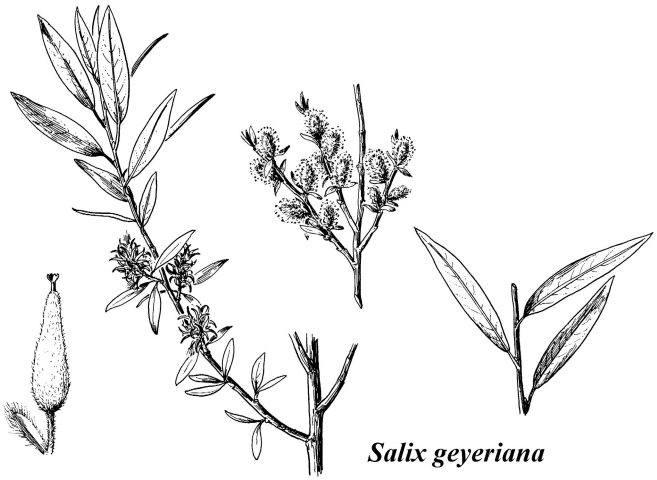
Ecological Processes

Stands dominated by *Salix geyeriana* (Geyer willow) appear to be stable, long-lived communities. *Salix geyeriana* is most stable where the water table does not drop below 3 ft (1 m) of the surface. It appears to be limited to cold, wet environments of broad valley bottoms at high elevations. Due to the colder environments, organic matter builds up in the soils and succession to other associations is likely to be slow.

Beaver activity is also important in maintaining this association since it may be the last successional community to establish on naturally silted-in beaver ponds.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
31	(16-50%)	Salix monticola	3
31	(20-47%)	Calamagrostis canadensis	3
28	(22-40%)	Salix geyeriana	3
21	—	Heracleum maximum	1
15	—	Carex disperma	1
15	—	Urtica dioica ssp. gracilis	1
13	—	Carex aquatilis	1
11	—	Lonicera involucrata	1
9	(4-13%)	Salix planifolia	2
7	—	Rubus idaeus ssp. strigosus	1
7	(1-12%)	Geum macrophyllum var. perincisum	2
5	—	Cardamine cordifolia	1
5	—	Fragaria virginiana ssp. glauca	1
5	—	Rudbeckia laciniata var. ampla	1
5	—	Salix drummondiana	1

Other species with < 5% average cover present in at least 10% of plots:
Carex utriculata (4%), Viola canadensis var. scopulorum (4%), Rosa woodsii (4%), Cicuta douglasii (3%), Rhodiola rhodantha (2%), Cirsium arvense (2%), Pinus ponderosa var. scopulorum (2%), Trifolium repens (2%), Chamerion angustifolium ssp. circumvagum (1-2%), Equisetum arvense (1%), Ribes inerme (1%), Stellaria crassifolia (1%), Taraxacum officinale (1%), Thalictrum alpinum (1%), Mertensia ciliata (1%).



Salix geyeriana

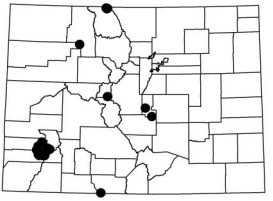
Geyer willow - Mountain willow / Mesic forb Shrubland

Salix geyeriana - Salix monticola / Mesic forb

Global rank/State rank:
G3 / S3

HGM subclass: R2

Colorado elevation range:
7,700-9,800 ft (2,300-3,000 m)



General Description

The *Salix geyeriana-Salix monticola*/mesic forb plant association is a tall, mixed-willow shrubland with an undergrowth species composition that is grazing-induced. The undergrowth is a carpet of grasses and forbs on a hummocky ground surface. Season-long grazing has increased the non-native grass cover and reduced the native forbs in most occurrences.

This plant association occurs on broad alluvial floodplains with steep side slopes. Stream channels are broad and moderately sinuous to highly sinuous or narrow, entrenched, ephemeral gullies. Soils are silt, silty loams, silty clay loams, sandy clay loams and deep sands. Several stands in the San Miguel River Basin occur on deep clay loams of old beaver ponds. Some soil profiles have considerable coarse materials while others are relatively fine textured. Mottling is evident near the surface indicating elevated water tables during part of the year.

Vegetation Description

This plant association is characterized by a tall, nearly closed canopy of *Salix monticola* (mountain willow) and *Salix geyeriana* (Geyer willow), with a combined cover between 10-90% and usually so near in abundance, one cannot determine which is the dominant willow in the stand. Other shrubs that may be present include *Ribes inerme* (whitestem gooseberry), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Salix drummondiana* (Drummond willow), and *Dasiphora floribunda* (shrubby cinquefoil).

The undergrowth in undisturbed stands is a thick carpet of forbs including *Mertensia ciliata* (tall fringed bluebells), *Achillea millefolium* var. *occidentalis* (western yarrow), *Heracleum maximum* (common cowparsnip), *Conioselinum scopulorum* (Rocky Mountain hemlockparsley), *Senecio triangularis* (arrowleaf ragwort), and *Cardamine cordifolia* (heartleaf bittercress). The graminoid layer is usually sparse, but includes *Carex utriculata* (beaked sedge) and *Carex aquatilis* (water sedge). Disturbed stands

have a high cover of non-native grasses including *Agrostis stolonifera* (creeping bentgrass) and *Poa pratensis* (Kentucky bluegrass).

Ecological Processes

The *Salix geyeriana-Salix monticola*/mesic forb plant association differs from the *Salix geyeriana*/mesic forb plant association because *Salix monticola* is always present with a significant cover and sometimes in a greater abundance than *Salix geyeriana*. The presence of *Salix monticola* may be due to differences in environmental factors or may represent a different successional stage of the *Salix geyeriana*/mesic forb association. This plant association may be a grazing-induced type due to the abundance of non-native grasses in some stands. With removal of season-long grazing, this association may return to a native forb dominated undergrowth or a dominance of *Calamagrostis canadensis* (bluejoint reedgrass), becoming a *Salix geyeriana-Salix monticola/Calamagrostis canadensis* plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=19)
45	(8-86%)	Salix monticola	18*
38	(10-80%)	Salix geyeriana	18*
20	(1-52%)	Agrostis stolonifera	6
13	(10-20%)	Alnus incana ssp. tenuifolia	3
10	(1-35%)	Ribes inerme	11
10	(1-20%)	Poa pratensis	12
8	(1-15%)	Poa palustris	3
7	(1-30%)	Carex aquatilis	5
7	(1-30%)	Trifolium repens	5
7	(1-20%)	Lonicera involucrata	8
7	(5-10%)	Rudbeckia laciniata var. ampla	3
6	(1-30%)	Fragaria virginiana ssp. glauca	7
6	(1-20%)	Juncus balticus var. montanus	7
5	(1-20%)	Taraxacum officinale	14
5	(1-10%)	Carex utriculata	3
5	(1-9%)	Senecio triangularis	3
5	(1-14%)	Heracleum maximum	10

Other species with < 5% average cover present in at least 10% of plots:
Dasiphora floribunda (1-22%), Cirsium tioganum var. coloradense (1-10%), Mertensia ciliata (1-14%), Geranium richardsonii (1-20%), Maianthemum stellatum (1-10%), Equisetum arvense (1-20%), Phleum pratense (1-10%), Rubus idaeus ssp. strigosus (3-5%), Urtica dioica ssp. gracilis (1-10%), Thalictrum fendleri (1-5%), Aconitum columbianum (1-5%), Achillea millefolium var. occidentalis (1-14%), Bromus ciliatus var. ciliatus (1-5%), Vicia americana (1-5%), Conioselinum scopulorum (1-4%), Ligusticum porteri (1-5%), Potentilla pulcherrima (1-5%), Geum macrophyllum var. perincisum (1-10%), Chamerion angustifolium ssp. circumvagum (1-5%), Hymenoxys hoopesii (1-3%), Rosa woodsii (1-3%), Carex microptera (1-2%), Cardamine cordifolia (1-3%), Deschampsia caespitosa (1-2%), Oxypolis fendleri (1%), Moehringia lateriflora (1%), Mentha arvensis (1%), Erigeron coulteri (1%), Galium boreale (1%), Cirsium parryi (1%), Senecio bigelovii var. hallii (1%).

*Salix geyeriana and Salix monticola occurred in all stands, but were not captured in every sample plot.

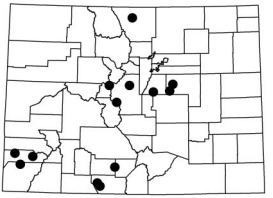
Strapleaf willow Shrubland

Salix liguifolia (=S. eriocephala var. *ligulifolia)*

Global rank/State rank:
G2G3 / S2S3

HGM subclass: S1/2, R2, R3/4

Colorado elevation range:
6,350-10,200 ft (1,900-3,100 m)



General Description

The *Salix ligulifolia* (strapleaf willow) plant association is a medium- to tall-willow shrubland occurring on saturated floodplains and stream banks of montane and lower subalpine elevations. *Salix ligulifolia* often mixes with *Salix exigua* (sandbar willow) and *Salix lucida* (shining willow) in the foothills, forming the *Salix exigua-Salix ligulifolia* (sandbar willow-strapleaf willow) plant association. In the mountains, *Salix ligulifolia* mixes with *Salix monticola* (mountain willow) and *Salix drummondiana* (Drummond willow) where it grows in relatively broad valley bottoms.

This association occurs in moderately wide valleys along low terraces and floodplains, and stream banks of narrower reaches. The plant association occurs along reaches with vegetated islands between multiple channels below an active beaver pond, along slightly sinuous broad channels, along more sinuous channels with well developed floodplains, and along steep narrow gullies. Soils are saturated sandy loams and clay loams with a high organic matter content in the upper layers.

Vegetation Description

This association has a canopy dominated by *Salix ligulifolia* (strapleaf willow), usually mixed with several other willow species. *Salix ligulifolia* (strapleaf willow) is the key diagnostic species, other willows may have equal cover, but in general do not exceed that of *Salix ligulifolia*. Other willows that may be present include *Salix monticola* (mountain willow), *Salix geyeriana* (Geyer willow), *Salix bebbiana* (Bebb willow), *Salix lucida (*ssp. *caudata* or ssp. *lasiandra)* (shining willow), *Salix wolfii* (Wolf willow), and *Salix planifolia* (planeleaf willow). Additional shrubs that may be present include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Cornus sericea* (red-osier dogwood), and *Dasiphora floribunda* (shrubby cinquefoil).

The herbaceous undergrowth can be dense in undisturbed stands with *Carex utriculata* (beaked sedge), *Carex nebrascensis* (Nebraska sedge), *Carex pellita* (woolly sedge), *Juncus balticus* var. *montanus* (mountain rush), and *Calamagrostis canadensis*

(bluejoint reedgrass). Forb cover is generally low, but some species are abundant, including *Taraxacum officinale* (dandelion), *Achillea millefolium* var. *occidentalis* (western yarrow), *Thalictrum fendleri* (Fendler meadowrue), and *Fragaria virginiana* (strawberry). No herbaceous species was consistantly present with high abundance, so none was chosen as diagnostic.

Ecological Processes

This association appears to be a long-lived mid to late-seral type since it is associated with beaver activity and saturated soils throughout the growing season.

Avg. Cover %	(Range)	Species Name	# Plots (N=13)
34	(18-66%)	Salix ligulifolia	13
26	(15-36%)	Carex nebrascensis	2
20	(3-41%)	Carex utriculata	5
17	(1-35%)	Salix lucida ssp. caudata, lasiandra	7
15	(3-43%)	Salix monticola	9
13	(1-25%)	Salix exigua	6
12	(2-27%)	Calamagrostis canadensis	6
12	(6-21%)	Salix planifolia	3
11	(2-26%)	Carex aquatilis	3
10	(1-19%)	Thalictrum fendleri	2
10	(1-28%)	Poa pratensis	10
9	(1-25%)	Juncus balticus var. montanus	6
8	(3-13%)	Typha latifolia	2
8	(1-34%)	Trifolium repens	6
7	(5-8%)	Scirpus microcarpus	2
6	(3-10%)	Alnus incana ssp. tenuifolia	3
6	(5-7%)	Betula nana	2
5	(1-10%)	Taraxacum officinale	8
5	(2-8%)	Chamerion angustifolium ssp. circumvagum	2
5	(3-6%)	Poa palustris	2

Other species with < 5% average cover present in at least 10% of plots:
Dasiphora floribunda (1-10%), Salix geyeriana (1-12%), Carex pellita (1-8%), Mentha arvensis (1-9%), Fragaria virginiana ssp. glauca (1-12%), Eleocharis palustris (1-7%), Cirsium arvense (2-4%), Salix bebbiana (3%), Equisetum arvense (1-6%), Mertensia ciliata (1-4%), Achillea millefolium var. occidentalis (1-7%), Conioselinum scopulorum (2-3%), Geranium viscosissimum var. incisum (1-4%), Agrostis stolonifera (2-3%), Geum macrophyllum var. perincisum (1-4%), Deschampsia caespitosa (1-4%), Trifolium pratense (1-3%), Carex microptera (1-3%), Phleum pratense (1-3%), Heracleum maximum (1-2%), Iris missouriensis (1-2%), Juncus articulatus (1-2%), Picea pungens (1-2%), Bromus inermis (1-2%), Potentilla pulcherrima (1-2%), Cicuta douglasii (1-2%), Oxypolis fendleri (1%), Platanthera dilatata var. albiflora (1%), Plantago major (1%), Populus angustifolia (1%), Galium triflorum (1%), Medicago lupulina (1%), Ambrosia artemisiifolia var. elatior (1%), Maianthemum stellatum (1%), Rumex crispus (1%), Carex hassei (1%).

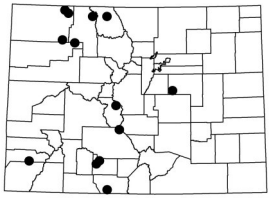
Shining willow Shrubland

Salix lucida ssp. *lasiandra* or ssp. *caudata*

Global rank/State rank:
G3Q / S2S3

HGM subclass: R2, R3/4

Colorado elevation range:
6,500-9,500 ft (1,980-2,900 m)



General Description

The *Salix lucida* ssp. *caudata* or ssp. *lasiandra* (shining willow) plant association is a tall willow community often found within a mosaic of several other riparian communities. It is generally a small patch type on large floodplain ecosystems and is more or less confined to the montane to lower subalpine belt (5,000-8,000 ft) in Colorado.

This plant association occurs in saturated areas, usually adjacent to the channel flow. It is found on low point bars and islands, as well as on low stream banks and overflow channels of larger rivers. It also occurs in steep foothill tributary streams. Soils have high organic matter content with reduced conditions.

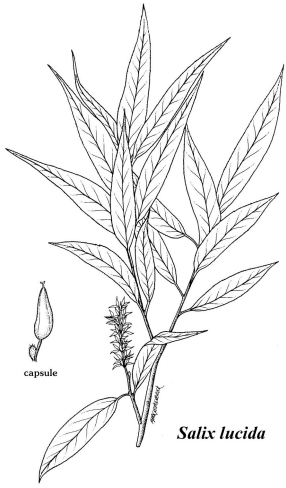
Vegetation Description

This association is dominated by *Salix lucida*, either ssp. *caudata* or ssp. *lasiandra* (shining willow). Stands may consist of one or several willow species. The particular composition of willows is highly variable, depending on the stand's elevation and location. Other willows that may be present include *Salix ligulifolia* (strapleaf willow), *Salix boothii* (Booth willow), and *Salix geyeriana* (Geyer willow). Other shrub species that may be present included: *Ribes montigenum* (gooseberry currant), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), and *Betula occidentalis* (river birch). One higher elevation stand had *Pinus contorta* (lodgepole pine).

The undergrowth is dominated by mesic grasses and sedges including *Calamagrostis canadensis* (bluejoint reedgrass), and several *Carex* (sedge) species. Forb cover is insignificant. In degraded stands, the undergrowth includes non-native grasses such as *Agrostis gigantea* (redtop), *Phleum pratense* (timothy), and *Poa pratensis* (Kentucky bluegrass).

Ecological Processes

The *Salix lucida* (shining willow) plant association establishes on deep alluvial materials and is considered to be early-seral. It is often associated with abandoned beaver ponds or occurs along steeper reaches below beaver ponds. It appears to colonize areas that have been or are currently filling in with silt. This association will eventually be replaced by slightly drier-site willow species. However, with disturbance such as overuse by livestock, willow cover may decline. With severe disturbance, the willows will disappear. This association will then become dominated by *Rosa woodsii* (Woods rose) and eventually *Poa pratensis* (Kentucky bluegrass).



Salix lucida

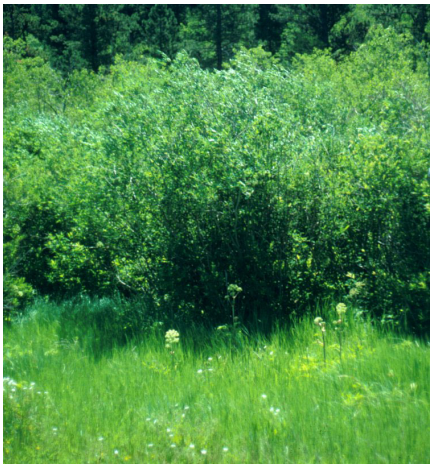
Avg. Cover %	(Range)	Species Name	# Plots (N=13)
44	(8-82%)	Salix lucida ssp. caudata, lasiandra	12*
35	(1-80%)	Salix ligulifolia	4
21	(12-30%)	Salix boothii	2
18	(10-30%)	Agrostis gigantea	4
16	(8-23%)	Calamagrostis canadensis	2
14	(1-30%)	Poa pratensis	7
13	(4-25%)	Alnus incana ssp. tenuifolia	7
13	(1-40%)	Salix monticola	4
10	(1-42%)	Phleum pratense	6
9	(3-14%)	Carex pellita	2
8	(6-10%)	Salix geyeriana	3
8	(3-21%)	Juncus balticus var. montanus	5
8	(2-13%)	Equisetum pratense	2
7	(1-15%)	Trifolium repens	5
5	(1-12%)	Mertensia ciliata	3
5	(1-9%)	Thermopsis montana	2
5	(3-7%)	Bromus inermis	2
5	(1-9%)	Taraxacum officinale	8

Other species with < 5% average cover present in at least 10% of plots:
Geranium richardsonii (1-15%), Rosa woodsii (1-12%), Salix exigua (1-10%), Eleocharis palustris (1-5%), Ribes montigenum (1-7%), Prunella vulgaris (1-5%), Carex aquatilis (1-6%), Rudbeckia laciniata var. ampla (1-5%), Carex utriculata (1-4%), Mentha arvensis (1-5%), Dasiphora floribunda (1-4%), Equisetum arvense (1-4%), Fragaria virginiana ssp. glauca (1-2%), Maianthemum stellatum (1-3%), Deschampsia caespitosa (1-2%), Galium boreale (1-2%), Achillea millefolium var. occidentalis (1-5%), Heracleum maximum (1-2%), Conioselinum scopulorum (1-1%), Ribes aureum (1-1%), Geum macrophyllum var. perincisum (1-1%), Dactylis glomerata (1-1%), Melilotus officinalis (1-1%), Glyceria striata (1-1%), Castilleja sulphurea (1-1%), Epilobium ciliatum ssp. glandulosum (1-1%), Potentilla diversifolia (1-1%), Thalictrum fendleri (1-1%), Amelanchier alnifolia (1-1%), Vicia americana (1-1%), (-%),

*Salix lucida occurred in all stands, but was not captured in every sample plot.

Mountain willow / Bluejoint reedgrass Shrubland

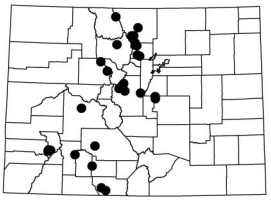
Salix monticola / Calamagrostis canadensis



Global rank/State rank:
G3 / S3

HGM subclass: R2

Colorado elevation range:
7,500-10,000 ft (2,280-3,050 m)



General Description

The *Salix monticola/Calamagrostis canadensis* (mountain willow/bluejoint reedgrass) plant association is a tall (4-5 ft, 1.5-2 m) shrubland with an open to closed canopy of willows and a lush carpet of grasses. It occurs along broad floodplains and narrow streams in the montane and upper montane elevations.

This plant association occurs on narrow to wide, (100-1,000 ft; 30-300 m), low-gradient (2-3.5%) valley bottoms and floodplains. In wider valleys, large stands of this association occur between meanders and at the edges of beaver ponds. Stream channels are steep and narrow, moderately steep and wide, wide and sinuous, or braided from beaver activity. Soils are finely textured sandy clays to silty clay loams, often saturated to within 10 inches (30 cm) of the surface. Soils can also be silty loams over sand and coarse sand. Mottling often occurs at 5-15 inches (20-40 cm) depth.

Vegetation Description

This plant association has a closed, mixed canopy of willows with *Salix monticola* (mountain willow) being the dominant or matrix willow. The matrix species is the willow with the highest abundance, even though other willow species combined may have greater canopy cover. Other willows that may be present include *Salix drummondiana* (Drummond willow), *S. boothii* (Booth willow), *S. geyeriana* (Geyer willow), and *S. wolfii* (Wolf willow).

Calamagrostis canadensis (bluejoint reedgrass) forms an open to dense graminoid layer. Other graminoids that may be present include *Carex aquatilis* (water sedge), *C. utriculata* (beaked sedge), *C. microptera* (small-wing sedge), *Deschampsia caespitosa* (tufted hairgrass), and *Glyceria grandis* (American mannagrass). Total forb cover ranges from 20-50% cover and may include *Cardamine cordifolia* (heartleaf

bittercress), *Geranium richardsonii* (Richardson geranium), *Mertensia ciliata* (tall fringed bluebells), *Oxypolis fendleri* (Fendler cowbane), *Geum macrophyllum* (largeleaf avens), *Solidago canadensis* (Canada goldenrod), *Senecio bigelovii* var. *hallii* (Hall ragwort), and *Galium boreale* (northern bedstraw).

Ecological Processes

Salix monticola (mountain willow) dominated plant associations appear to be long-lived and stable. They occur on mesic sites that support a diversity of graminoids and forbs. *Salix monticola* appears to grow only where the water table does not drop below 3 ft (1 m) of the surface. It appears to be limited to cold, wet environments in broad valley bottoms at high elevations. The presence of dying conifer trees in these associations may indicate a rise in the water table. A higher water table allows for the increase in cover of *Calamagrostis canadensis* (bluejoint reedgrass) and the conversion from a conifer/*Calamagrostis canadensis* type to a *Salix* spp./ *Calamagrostis canadensis* type.

Carex utriculata (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) are common dominant undergrowth of several *Salix* plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain. *Carex utriculata* (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channels with the shallowest water tables. *Carex aquatilis* (water sedge) occurs on intermediate sites that have saturated but not inundated soils. *Calamagrostis canadensis* (bluejoint reedgrass) dominates the drier sites with lower water tables.

Avg. Cover %	(Range)	Species Name	# Plots (N=37)
57	(17-99%)	Salix monticola	37
39	(1-95%)	Calamagrostis canadensis	37
12	(2-40%)	Salix drummondiana	15
12	(1-25%)	Salix geyeriana	10
11	(1-18%)	Alnus incana ssp. tenuifolia	8
10	(0.1-33%)	Angelica ampla	5
10	(3-15%)	Ribes lacustre	5
8	(1-20%)	Carex aquatilis	6
7	(1-19%)	Carex microptera	5
7	(0.1-30%)	Heracleum maximum	19
7	(1-25%)	Salix planifolia	10
6	(1-17%)	Salix bebbiana	10
6	(0.1-20%)	Equisetum arvense	18
6	(3-10%)	Salix ligulifolia	5
6	(0.1-20%)	Cirsium arvense	4
6	(1-20%)	Poa pratensis	16
5	(0.1-15%)	Mertensia ciliata	15
5	(1-20%)	Fragaria virginiana ssp. glauca	10

Other species with < 5% average cover present in at least 10% of plots:
Ribes montigenum (1-12%), Lonicera involucrata (0.1-15%), Betula nana (1-11%), Taraxacum officinale (0.1-17%), Rudbeckia laciniata var. ampla (0.1-7%), Carex utriculata (1-8%), Conioselinum scopulorum (0.1-15%), Chamerion angustifolium ssp. circumvagum (1-8%), Equisetum pratense (1-5%), Dasiphora floribunda (1-5%), Achillea millefolium var. occidentalis (1-8%), Geranium richardsonii (0.1-12%), Montia chamissoi (1-4%), Maianthemum stellatum (0.1-5%), Phleum pratense (1-5%), Viola canadensis var. scopulorum (1-6%), Geum macrophyllum var. perincisum (0.1-5%), Rosa woodsii (1-3%), Picea pungens (0.1-4%), Cardamine cordifolia (1-4%), Picea engelmannii (1-3%), Mentha arvensis (1-2%), Ribes inerme (0.1-3%), Oxypolis fendleri (1%), Stellaria crassifolia (1-1%), Galium boreale (0.1-2%), Aconitum columbianum (0.1-2%)

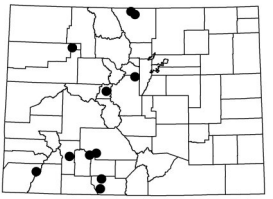
Mountain willow / Water sedge Shrubland

Salix monticola / Carex aquatilis

Global rank/State rank:
G3 / S3

HGM subclass: R2

Colorado elevation range:
7,700-10,800 ft (2,350-3,300 m)



General Description

The *Salix monticola*/*Carex aquatilis* (mountain willow/water sedge) plant association is a tall (5-8 ft, 1.5-2.5 m), deciduous shrubland with a fairly open willow canopy and a thick carpet of grasses and sedges in the undergrowth. It occurs on open floodplains, often occuping the entire valley floor. The undergrowth is dominated by patches of *Carex aquatilis* (water sedge). This association often includes *Carex utriculata* (beaked sedge) and *Calamagrostis canadensis* (bluejoint reedgrass), but is distinguished from the *Salix monticola*/*Carex utriculata* (mountain willow/beaked sedge) and *Salix monticola* / *Calamagrostis canadensis* (mountain willow/bluejoint reedgrass) associations because *Carex aquatilis* (water sedge) is either the clear dominant or most consistently present of the three throughout the stand.

This plant association occurs in narrow valleys on coarse-textured stream banks. Stream channels are narrow and highly sinuous or braided by beaver activity. Soils are sandy clay loams to sandy loams with layers of gravel and organic matter. Mottles appear at 8 inches (20 cm) depth.

Vegetation Description

This plant association forms a tall willow carr dominated by *Salix monticola* (mountain willow) as the matrix species. The matrix species is the willow with the highest abundance, even though other willow species combined may have greater canopy cover. Other shrubs that may be present include *Salix bebbiana* (Bebb willow), *Salix drummondiana* (Drummond willow), *Cornus sericea* (red-osier dogwood), and *Lonicera involucrata* (twinberry honeysuckle).

The herbaceous undergrowth is dominated by *Carex aquatilis* (water sedge). Cover of other graminoid and forb species is low due to shading and flood disturbance. Stands with abundant *Carex utriculata* (beaked sedge) or *Calamagrostis canadensis*

(bluejoint reedgrass) may indicate a transitional stage to another *Salix monticola* (mountain willow) association.

Ecological Processes

Salix monticola (mountain willow) dominated plant associations appear to be long-lived and stable. They occur on mesic sites that support a diversity of graminoids and forbs. *Salix monticola* appears to grow only where the water table does not drop below 3 ft (1 m) of the surface. It appears to be limited to cold, wet environments in broad valley bottoms at high elevations. The presence of dying conifer trees in these associations may indicate a rise in the water table.

Carex utriculata (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) are common dominant undergrowth of several *Salix* plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain. *Carex utriculata* (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channel with the shallowest water tables. *Carex aquatilis* (water sedge) occurs on intermediate sites that have saturated but not inundated soils. *Calamagrostis canadensis* (bluejoint reedgrass) dominates the drier sites with lower water tables.

Avg. Cover %	(Range)	Species Name	# Plots (N=11)
48	(10-88%)	Salix monticola	11
24	(9-51%)	Carex aquatilis	10
19	(1-70%)	Salix geyeriana	5
18	(1-90%)	Calamagrostis canadensis	7
16	(1-30%)	Salix drummondiana	2
14	(7-20%)	Alnus incana ssp. tenuifolia	2
12	(7-17%)	Salix bebbiana	2
9	(2-16%)	Salix boothii	2
7	(6-10%)	Salix planifolia	3
7	(4-10%)	Picea engelmannii	3
6	(1-16%)	Carex utriculata	4
5	(1-12%)	Poa pratensis	5
5	(1-11%)	Cardamine cordifolia	7
5	(1-12%)	Deschampsia caespitosa	6
5	(4-6%)	Ribes montigenum	2
5	(1-13%)	Dasiphora floribunda	8

Other species with < 5% average cover present in at least 10% of plots:
Mertensia ciliata (1-10%), Salix lucida ssp. caudata, lasiandra (1-7%), Equisetum arvense (1-10%), Carex microptera (1-6%), Mentha arvensis (1-6%), Salix brachycarpa (1-8%), Conioselinum scopulorum (1-6%), Caltha leptosepala (1-5%), Achillea millefolium var. occidentalis (1-8%), Trifolium repens (1-7%), Pedicularis groenlandica (2-3%), Taraxacum officinale (1-5%), Fragaria virginiana ssp. glauca (1-5%), Juncus balticus var. montanus (1-4%), Salix ligulifolia (1-3%), Ligusticum porteri (1-3%), Geranium richardsonii (1-5%), Aconitum columbianum (1-3%), Chamerion angustifolium ssp. circumvagum (1-3%), Oxypolis fendleri (1-3%), Agrostis stolonifera (1-2%), Luzula parviflora (1-2%), Maianthemum stellatum (1-2%), Ribes inerme (1-2%), Trifolium longipes (1-2%), Geum macrophyllum var. perincisum (1-2%), Phleum alpinum (1%), Veronica wormskjoldii (1%), Thalictrum fendleri (1%), Abies lasiocarpa (1%), Vicia americana (1%), Phleum pratense (1%), Equisetum pratense (1%), Dodecatheon pulchellum (1%), Galium boreale (1%).

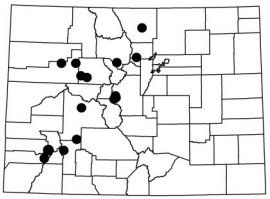
Mountain willow / Beaked sedge Shrubland

Salix monticola / Carex utriculata

Global rank/State rank:
G3 / S3

HGM subclass: S1/2, R2

Colorado elevation range:
6,600-10,300 ft (2,000-3,100 m)



General Description

The *Salix monticola*/*Carex utriculata* (mountain willow/beaked sedge) plant association is a tall (5-8 ft, or 1.5-2.5 m), deciduous shrubland with an open canopy of willows and a thick understory of grasses and sedges. It occurs on open floodplains and often occupies the entire valley floor. The undergrowth is dominated by patches of *Carex utriculata* (beaked sedge). This association often includes *Carex aquatilis* (water sedge) and *Calamagrostis canadensis* (bluejoint reedgrass), but is distinguished from the *Salix monticola*/*Carex aquatilis* (mountain willow/water sedge) and *Salix monticola*/*Calamagrostis canadensis* (mountain willow/bluejoint reedgrass) associations because *Carex utriculata* is either the clear dominant or most consistently present of the three throughout the stand.

This plant association commonly occurs near beaver ponds. Willows establish on hummocks of higher ground and *Carex utriculata* (beaked sedge) establishes at the pond margins. This association also occurs along wet stream banks and terraces of low gradient (<3%), broad valley bottoms. Stream reaches can be moderately wide with a gentle gradient, wide and meandering, or altered by beaver activity, creating multiple channels. Soils are clay loam, sandy clay loam and heavy silty clay textures with occasional mottling. Some profiles have a buried organic layer. Others have up to 40% organic matter in the top 20 inches (50 cm).

Vegetation Description

This association is characterized by a thick canopy dominated by *Salix monticola* (mountain willow) as the matrix species. The matrix species is the willow with the highest abundance, even though other willow species combined may have greater canopy cover. Other shrub species that may be present include *Salix geyeriana* (Geyer

willow), *Salix brachycarpa* (barrenground willow), *Salix drummondiana* (Drummond willow), *Salix. ligulifolia* (strapleaf willow), and *Salix boothii* (Booth willow).

Carex utriculata (beaked sedge) is the most abundant graminoid. Other graminoid cover is minor and includes *Carex aquatilis* (water sedge), *Poa pratensis* (Kentucky bluegrass), and *Deschampsia caespitosa* (tufted hairgrass). Total forb cover is generally less than 10%. Forb species include *Cardamine cordifolia* (heartleaf bittercress), *Mertensia ciliata* (tall fringed bluebells), and *Heracleum maximum* (common cowparsnip).

Ecological Processes

This plant association requires a high water table and saturated soils for much of the growing season and may be an early successional stage of the *Salix monticola/Carex aquatilis* and the *Salix monticola/Calamagrostis canadensis* associations.

Carex utriculata (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) are common dominant undergrowth of several *Salix* plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain. *Carex utriculata* (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channel with the shallowest water tables. *Carex aquatilis* (water sedge) occurs on intermediate sites that have saturated but not inundated soils. *Calamagrostis canadensis* (bluejoint reedgrass) dominates the drier sites with lower water tables.

Avg. Cover %	(Range)	Species Name	# Plots (N=30)
52	(10-95%)	Salix monticola	30
39	(1-80%)	Carex utriculata	30
18	(1-60%)	Carex aquatilis	9
16	(7-30%)	Cirsium arvense	3
15	(4-40%)	Salix geyeriana	9
11	(1-25%)	Salix wolfii	7
9	(1-28%)	Salix brachycarpa	8
7	(2-10%)	Ribes lacustre	4
7	(1-20%)	Salix drummondiana	9
6	(1-20%)	Salix planifolia	4
6	(1-11%)	Salix ligulifolia	5
6	(1-20%)	Cardamine cordifolia	12
6	(3-9%)	Equisetum pratense	3
5	(1-15%)	Betula nana	5
5	(1-15%)	Equisetum arvense	17
5	(1-25%)	Calamagrostis canadensis	9

Other species with < 5% average cover present in at least 10% of plots:
Poa pratensis (1-24%), Phleum pratense (1-10%), Juncus balticus var. montanus (2-8%), Conioselinum scopulorum (1-10%), Glyceria striata (0.1-15%), Swertia perennis (0.1-10%), Juncus tracyi (1-9%), Fragaria virginiana ssp. glauca (1-9%), Heracleum maximum (1-10%), Mertensia ciliata (1-20%), Oxypolis fendleri (1-7%), Trifolium repens (0.1-8%), Geum macrophyllum var. perincisum (0.1-15%), Alnus incana ssp. tenuifolia (1-5%), Lonicera involucrata (1-7%), Dasiphora floribunda (1-5%), Picea pungens (1-6%), Pedicularis groenlandica (1-6%), Taraxacum officinale (1-5%), Achillea millefolium var. occidentalis (0.1-5%), Deschampsia caespitosa (1-4%), Senecio triangularis (1-3%), Angelica ampla (1-3%), Chamerion angustifolium ssp. circumvagum (1-3%), Aconitum columbianum (1-3%), Geranium richardsonii (0.1-3%), Ribes inerme (1%), Rosa woodsii (1%), Castilleja miniata (1%).

Mountain willow / Field horsetail Shrubland

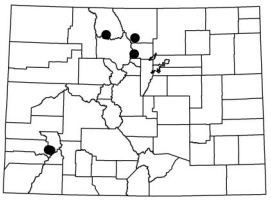
Salix monticola / Equisetum arvense

Salix monticola

Global rank/State rank:
G2? / S2

HGM subclass: R2

Colorado elevation range:
7,600-9,400 ft (2,300-2,865 m)



General Description

The *Salix monticola/Equisetum arvense* (mountain willow/field horsetail) plant association is a tall (5-8 ft, 1.5-2.5 m), deciduous shrubland with a dense canopy and an herbaceous layer dominated by *Equisetum arvense* (field horsetail) and a variety of forbs and grasses.

The *Salix monticola*/*Equisetum arvense* (mountain willow/field horsetail) plant association occurs in areas with low to medium channel gradients. The water sources documented in plots are groundwater and streamflow. Soils are peat, fine and organic; they range in moisture from dry to permanently wet.

Vegetation Description

Salix monticola (mountain willow) forms a fairly dense canopy and is the dominant willow. Other willow species are less common in this association than in some *Salix monticola* associations. Other willow species which may be present include *Salix bebbiana* (Bebb willow) and *Salix drummondiana* (Drummond willow). Other shrubs that may be present in low numbers include *Ribes* (currant) spp. and *Lonicera involucrata* (twinberry honeysuckle).

Total herbaceous cover ranges from 50-100%. *Equisetum arvense* (field horsetail) is the dominant understory species. Most other herbaceous species make up less than 10% cover and no species is consistently present in all stands. Forb species that may be present include *Angelica ampla* (giant angelica), *Heracleum maximum* (common cowparsnip) and *Conioselinum scopulorum* (Rocky Mountain hemlockparsley). Graminoid cover is minor, and in general never exceeds the total forb cover. Graminoid species that may be present include *Calamagrostis canadensis* (bluejoint reedgrass) *Carex utriculata* (beaked sedge), and *Poa palustris* (fowl bluegrass).

Exotic graminoid and forb species indicating grazing pressure in the past include *Poa pratensis* (Kentucky bluegrass) and *Taraxacum officinale* (dandelion).

Ecological Processes

Salix monticola (mountain willow) dominated plant associations appear to be long-lived and stable. They occur on mesic sites that support a diversity of graminoids and forbs. *Salix monticola* appears to grow only where the water table does not drop below 3 ft (1 m) of the surface. It appears to be limited to cold, wet environments in broad valley bottoms at high elevations. Due to the colder environments, organic matter builds up in the soils, and it is likely that succession to other associations is slow. The presence of dying conifer trees in these associations may indicate an increase in the water table.

The *Salix monticola/Equisetum arvense* (mountain willow/field horsetail) plant association occurs on mesic sites and supports a rich diversity of forbs. On broad, hummocky floodplains stands can form extensive willow carrs. At higher elevations, this association grades into the *Salix planifolia*/mesic forb (planeleaf willow/mesic forb) association. Stands with abundant *Salix planifolia* present may indicate a transition between higher sites dominated by *Salix planifolia* and the wider, lower montane areas where *Salix monticola* becomes more abundant.

Avg. Cover %	(Range)	Species Name	# Plots (N=6)
75	(60-95%)	Salix monticola	6
48	(30-70%)	Equisetum arvense	6
20	(15-25%)	Angelica ampla	2
16	(1-30%)	Alnus incana ssp. tenuifolia	2
9	(3-14%)	Carex utriculata	2
7	(1-19%)	Calamagrostis canadensis	3
7	(1-10%)	Heracleum maximum	3
7	(3-10%)	Lonicera involucrata	4
6	(2-10%)	Conioselinum scopulorum	3
5	(0.1-16%)	Taraxacum officinale	5

Other species with < 5% average cover present in at least 10% of plots:
Poa pratensis (3-5%), Poa palustris (1-5%), Glyceria striata (0.1-8%), Chamerion angustifolium ssp. circumvagum (1-5%), Achillea millefolium var. occidentalis (1-5%), Geranium richardsonii (0.1-5%), Aconitum columbianum (2%), Galium boreale (1%), Geum macrophyllum var. perincisum (0.1-2%).

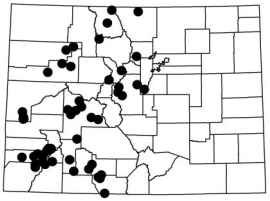
Mountain willow / Mesic forb Shrubland

Salix monticola / Mesic forb

Global rank/State rank:
G4 / S3

HGM subclass: S1/2, R2, R3/4

Colorado elevation range:
6,800-10,700 ft (2,070-3,260 m)



General Description

The *Salix monticola/*mesic forb (mountain willow/mesic forb) plant association is a tall (5-8 ft, 1.5-2.5 m), deciduous shrubland with a dense or open canopy and an herbaceous layer dominated by a variety of forbs and grasses. While no single herbaceous species is a clear dominant, total forb cover is generally greater than 30% and exceeds total graminoid cover.

This association occurs along broad, swift-moving streams and active floodplains in narrow to moderately wide valleys. The ground surface is usually undulating, from past flooding or beaver activity. Stands form narrow bands at the stream edge, ranging from 1-6 ft (0.1-2 m) above the channel elevation. In wider valley bottoms, stands occur further from the bank, but never more than 2.5 ft (0.75 m) above the annual high water mark. Most stands occur adjacent to straight, wide, and shallow channels ranging from bedrock to silty-bottomed reaches. A few stands occur on meandering, cobble-bottomed reaches or streams braided by beaver activity. Soils are fine textured sandy clays to silty and sandy clay loams.

Vegetation Description

Salix monticola (mountain willow) forms a dense to open canopy, and if not the clear dominant, then it is the matrix willow. The matrix species is the willow with the highest abundance, even though other willow species combined may have greater canopy cover. Other shrub species that may be present include *Ribes inerme* (whitestem gooseberry), *Salix drummondiana* (Drummond willow), *S. planifolia* (planeleaf willow), *S. bebbiana* (Bebb willow), *S. geyeriana* (Geyer willow), *S. brachycarpa* (barrenground willow), *S. wolfii* (Wolf willow), *S. lucida* ssp. *caudata* or *lasiandra* (shining willow), *Alnus incana* ssp. *tenuifolia* (thinleaf alder) and *Lonicera involucrata* (twinberry honeysuckle).

Total forb cover ranges from 10-70%. No one forb species is noticeably more abundant than any other, nor is any species consistently present in all stands. Forb species that may be present include *Heracleum maximum* (common cowparsnip), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Mertensia ciliata* (tall fringed bluebells), and *Fragaria virginiana* (strawberry). Graminoid cover may be absent or up to 50% cover; in general it does not exceed the total forb cover. Graminoid species that may be present include *Calamagrostis canadensis* (bluejoint reedgrass) and *Carex utriculata* (beaked sedge). Generally, forbs are dominant under shrubs on hummocks and ridges while graminoids dominate the undergrowth in low-lying, wetter swales. Exotic graminoid and forb species include *Poa pratensis* (Kentucky bluegrass), *Trifolium repens* (white clover), and *Taraxacum officinale* (dandelion).

Ecological Processes

Salix monticola (mountain willow) dominated plant associations appear to be long-lived and stable. They occur on mesic sites that support a diversity of graminoids and forbs. *Salix monticola* appears to grow only where the water table does not drop below 3 ft (1 m) of the surface. It appears to be limited to cold, wet environments in broad valley bottoms at high elevations. Due to the colder environments, organic matter builds up in the soils, and it is likely that succession to other associations is slow. This plant association occurs on mesic sites and supports a rich diversity of forbs. On broad, hummocky floodplains stands can form extensive willow carrs. Sites with a higher abundance of exotic forbs and graminoids may be grazing-induced. At higher elevations, this association grades into the *Salix planifolia*/mesic forb (planeleaf willow/mesic forb) association.

Avg. Cover %	(Range)	Species Name	# Plots (N=93)
58	(1-100%)	Salix monticola	93
17	(1-40%)	Ribes lacustre	26
16	(0.1-60%)	Salix drummondiana	31
16	(1-75%)	Heracleum maximum	49
12	(1-70%)	Ribes inerme	23
11	(1-40%)	Alnus incana ssp. tenuifolia	16
10	(1-30%)	Salix geyeriana	15
9	(1-50%)	Poa pratensis	42
9	(0.1-30%)	Salix bebbiana	15
9	(1-20%)	Salix brachycarpa	11
9	(0.1-60%)	Mertensia ciliata	55
9	(1-30%)	Salix planifolia	18
8	(1-28%)	Rudbeckia laciniata var. ampla	13
8	(0.1-30%)	Calamagrostis canadensis	31
7	(1-60%)	Juncus balticus var. montanus	10
7	(1-22%)	Trifolium repens	10
6	(1-14%)	Picea pungens	14
6	(0.1-30%)	Cardamine cordifolia	22
6	(1-20%)	Lonicera involucrata	43
6	(1-25%)	Urtica dioica ssp. gracilis	21
5	(0.1-20%)	Equisetum arvense	44
5	(1-16%)	Aconitum columbianum	18
5	(1-20%)	Carex utriculata	13

Other species with < 5% average cover present in at least 10% of plots:
Picea engelmannii (1-13%), Bromus ciliatus var. ciliatus (0.1-20%), Conioselinum scopulorum (0.1-15%), Hydrophyllum fendleri (1-10%), Carex aquatilis (1-10%), Dasiphora floribunda (0.1-13%), Fragaria virginiana ssp. glauca (0.1-10%), Geranium richardsonii (0.1-10%), Senecio triangularis (1-10%), Taraxacum officinale (0.1-12%), Maianthemum stellatum (0.1-12%), Achillea millefolium var. occidentalis (1-10%), Chamerion angustifolium ssp. circumvagum (0.1-11%), Thalictrum fendleri (0.1-9%), Ligusticum porteri (0.1-10%), Geum macrophyllum var. perincisum (1-5%), Rosa woodsii (0.1-5%), Oxypolis fendleri (1-5%), Vicia americana (0.1-5%).

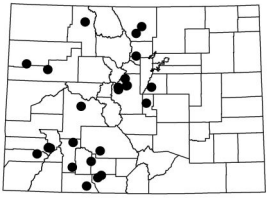
Mountain willow / Mesic graminoid Shrubland

Salix monticola / Mesic graminoid

Global rank/State rank:
G3 / S3

HGM subclass: S1/2, S3/4, R2

Colorado elevation range:
6,600-11,000 ft (2,000-3,350 m)



General Description

The *Salix monticola*/mesic graminoid (mountain willow/mesic graminoid) plant association is a tall (5-8 ft, 1.5-2.5 m), deciduous shrubland, with an open to closed canopy of willows on broad, gentle floodplains, or in narrow canyon bottoms. The herbaceous undergrowth is diverse, with a variety of graminoid and forb species. This association is distinguished from the *Salix monticola*/mesic forb association by having a higher cover of graminoid species. Stands with predominantly non-native graminoid species in the undergrowth are considered grazing-induced. Stands are considered high quality when their undergrowth is predominantly native graminoid species.

The *Salix monticola*/mesic graminoid (mountain willow/mesic graminoid) plant association dominates stream reaches in narrow to wide valleys, 65-400 ft (20-120 m) wide, with active floodplains and broad, swift-moving streams. Stands usually occur > 2 ft (0.5 m) above the bankfull channel along the stream edge or away from the channel up to 50 ft (15 m). The ground surface is usually undulating due to past flooding or beaver activity. Stream channels can be fairly steep and narrow with cobble beds, moderately wide and sinuous with cobble beds or broad, meandering rivers with a developed floodplain. Some stands also occur along channels that are braided due to beaver activity. Soils are fine textured clay loams and sandy clay loams of varying depths, 4-18 inches (10-45 cm). Mottling and gleyed layers often occur within 5 inches (12 cm) of the ground surface.

Vegetation Description

Salix monticola (mountain willow) forms a dense to open canopy. If it is not the clear dominant, then it is the matrix willow. The matrix species is the willow with the highest abundance, even though other willow species combined may have greater canopy cover. Other shrubs that may be present at higher elevations include *Salix planifolia* (planeleaf willow), *S. geyeriana* (Geyer willow), and *S. brachycarpa*

(barrenground willow). At lower elevations, other shrubs that may be present include *Salix irrorata* (bluestem willow), *S. lucida* ssp. *caudata* (shining willow), *Alnus incana* ssp. *tenuifolia* (thinleaf alder) and *Dasiphora floribunda* (shrubby cinquefoil).

Total graminoid cover ranges from 10-55% and exceeds that of total forb cover. No single species is particularly dominant over the others, and no one species is present in every stand. Graminoid species that may be present include *Poa pratensis* (Kentucky bluegrass), *Juncus balticus* var. *montanus* (mountain rush), *Carex aquatilis* (water sedge), and *Equisetum arvense* (field horsetail). Forb cover ranges from 5-20% and forbs generally are not as abundant as graminoids. Forb species that may be present include *Heracleum maximum* (common cowparsnip), *Fragaria virginiana* (strawberry) and *Achillea millefolium* var. *occidentalis* (western yarrow). In stands with pronounced hummock micro-topography underneath the willow canopy, graminoids will typically dominate the low-lying swales, while forbs will dominate the better drained hummocks and ridge tops.

Ecological Processes

The *Salix monticola/*mesic graminoid (mountain willow/mesic graminoid) plant association appears to be a stable, long-lived community. Stands with an abundance of *Poa pratensis* (Kentucky bluegrass) or *Agrostis stolonifera* (creeping bentgrass) may be a grazing-induced disclimax. Stands with abundant *Salix planifolia* (planeleaf willow) may indicate a transition between higher elevational sites dominated by *Salix planifolia* and lower elevational sites where *Salix monticola* is more abundant.

Avg. Cover %	(Range)	Species Name	# Plots (N=31)
52	(7-90%)	Salix monticola	31
25	(5-48%)	Salix drummondiana	5
22	(2-40%)	Salix planifolia	6
18	(0.1-60%)	Juncus balticus var. montanus	13
17	(1-50%)	Carex aquatilis	11
15	(4-20%)	Alnus incana ssp. tenuifolia	4
14	(1-40%)	Poa pratensis	18
12	(0.1-40%)	Carex utriculata	13
11	(1-30%)	Salix geyeriana	8
8	(1-20%)	Calamagrostis canadensis	10
7	(0.1-21%)	Dasiphora floribunda	11
7	(1-30%)	Deschampsia caespitosa	6
6	(0.1-25%)	Salix lucida ssp. caudata, lasiandra	7
6	(1-15%)	Phleum pratense	4
5	(0.1-22%)	Taraxacum officinale	19
5	(1-15%)	Picea pungens	5
5	(0.1-16%)	Salix bebbiana	7

Other species with < 5% average cover present in at least 10% of plots:
Equisetum arvense (0.1-20%), Lonicera involucrata (1-10%), Carex microptera (1-10%), Trifolium repens (0.1-6%), Dodecatheon pulchellum (0.1-10%), Achillea millefolium var. occidentalis (0.1-8%), Mertensia ciliata (0.1-10%), Ribes inerme (1-5%), Salix brachycarpa (1-5%), Geranium richardsonii (1-4%), Conioselinum scopulorum (1-5%), Fragaria virginiana ssp. glauca (1-3%), Heracleum maximum (1-3%), Geum macrophyllum var. perincisum (0.1-3%), Equisetum pratense (1-3%), Cardamine cordifolia (0.1-3%).

GROUP E:
SHORT WILLOW SHRUBLANDS

Association	Page
Salix brachycarpa/*Carex aquatilis* Barrenground willow/Water sedge Shrubland	240
Salix brachycarpa/Mesic forb Barrenground willow/Mesic forb Shrubland	242
Salix candida/Triglochin maritimum Hoary willow/Seaside arrowgrass Extreme Rich Fen	244
Salix planifolia/Calamagrostis canadensis Planeleaf willow/Bluejoint reedgrass Shrubland	246
Salix planifolia/Caltha leptosepala Planeleaf willow/Marsh-marigold Shrubland	248
Salix planifolia/Carex aquatilis Planeleaf willow/Water sedge Shrubland	250
Salix planifolia/Carex utriculata Planeleaf willow/Beaked sedge Shrubland	252
Salix planifolia/Mesic forb Planeleaf willow/Mesic forb Shrubland	254
Salix wolfii/Calamagrostis canadensis Wolf willow/Bluejoint reedgrass Shrubland	256
Salix wolfii/Carex aquatilis Wolf willow/Water sedge Shrubland	258
Salix wolfii/Carex utriculata Wolf willow/Beaked sedge Shrubland	260
Salix wolfii/Mesic forb Wolf willow/Mesic forb Shrubland	262

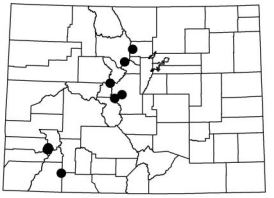
Barrenground willow / Water sedge Shrubland

Salix brachycarpa / Carex aquatilis

Global rank/State rank:
G2? / S2

HGM subclass: S1/2, S3/4

Colorado elevation range:
8,300-11,000 ft (2,530-3,350 m)



General Description

The *Salix brachycarpa/Carex aquatilis* (barrenground willow/water sedge) plant association is a short-stature (2-3 ft; 0.4-1 m) willow shrubland with an open canopy. It grows along narrow, sinuous floodplains in the upper montane or subalpine zones of the Rocky Mountains. Since *Salix brachycarpa* (barrenground willow) is typically not associated with the hydric sedge, *Carex aquatilis*, this plant association may indicate that the site was once wetter and is now becoming drier allowing *Salix brachycarpa* to become established. This plant association occurs in the South Platte and Arkansas River Basins on the Eastern Slope and on San Juan National Forest in the San Juan Mountains on the Western Slope.

This plant association occurs on low floodplains immediately adjacent to the stream channel. Stream gradients are low with channels either broad and meandering or braided. Soils include deep, 24 inches (60 cm), organic soils or loam, sandy clay loam, and silty clay loam. The water table can be within the first 8 inches (20 cm) of soil early in the season. Mottles may also be present in the first layer of the profile.

Vegetation Description

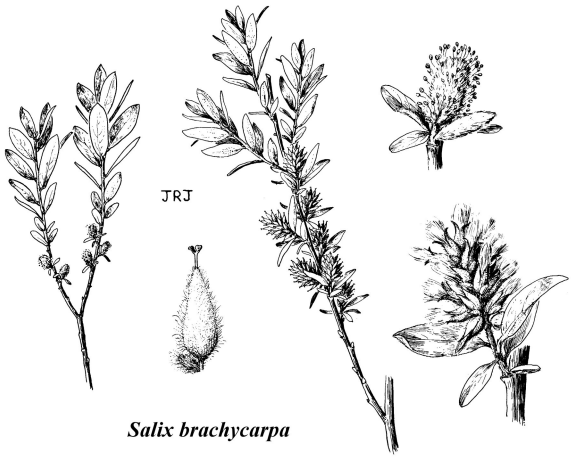
Salix brachycarpa (barrenground willow) is the dominant shrub in this plant association. Other shrubs that may be present include *Dasiphora floribunda* (shrubby cinquefoil), *Salix wolfii* (Wolf willow), and *S. monticola* (mountain willow). The herbaceous undergrowth is a thick carpet of graminoids dominated by *Carex aquatilis* (water sedge). Other graminoids that may be present include *Carex utriculata* (beaked sedge), *Carex scopulorum* (mountain sedge), *Carex interior* (inland sedge), *Juncus balticus* var. *montanus* (mountain rush), and *Deschampsia caespitosa* (tufted hairgrass). Forbs are diverse and include *Thermopsis divaricarpa* (spreadfruit goldenbanner), *Maianthemum stellatum* (starry false Solomon seal), and *Potentilla* spp. (cinquefoil).

Ecological Processes

Salix brachycarpa (barrenground willow) typically grows on sites that are drier than those occupied by *Carex aquatilis* (water sedge) and it is unusual for them to occur together. Soil data indicate that occurrences of this plant association are perennially wet or have been in the past. It may be that with a drop in the water table, possibly due to heavy grazing and recreational use, these sites have begun to dry out and *Salix brachycarpa* is becoming established. In the South Platte River Basin, occurrences of this plant association also have abundant *Dasiphora floribunda* (shrubby cinquefoil) and *Juncus balticus* var. *montanus* (mountain rush) which are increaser species under long-term livestock grazing. These sites may be shifting from wetter *Salix monticola* (mountain willow) or *S. planifolia* (planeleaf willow) associations to drier *S. brachycarpa* or *Dasiphora floribunda* associations.

Avg. Cover %	(Range)	Species Name	# Plots (N=8)
29	(6-80%)	Salix brachycarpa	8
23	(6-40%)	Carex aquatilis	8
14	(1-22%)	Juncus balticus var. montanus	4
11	(4-25%)	Carex utriculata	5
11	(0.1-21%)	Carex scopulorum	2
10	(1-15%)	Thalictrum alpinum	3
10	(5-15%)	Kobresia simpliciuscula	2
7	(4-10%)	Carex interior	2
6	(2-11%)	Picea pungens	3
6	(3-9%)	Dasiphora floribunda	4
6	(3-10%)	Deschampsia caespitosa	3
5	(2-7%)	Salix wolfii	2

Other species with < 5% average cover present in at least 10% of plots:
Salix monticola (3-5%), Poa pratensis (1-8%), Swertia perennis (0.1-5%), Cardamine cordifolia (1-6%), Triglochin palustre (1-5%), Betula nana (1-5%), Calamagrostis canadensis (2-2.9%), Equisetum arvense (1-4%), Senecio triangularis (1-3%), Pedicularis groenlandica (0.1-5%), Fragaria virginiana ssp. glauca (1-2%), Trifolium repens (1-2%), Mertensia ciliata (1%), Taraxacum officinale (1%), Achillea millefolium var. occidentalis (1%), Geum macrophyllum var. perincisum (1%), Carex aurea (1%), Aconitum columbianum (1%).



Salix brachycarpa

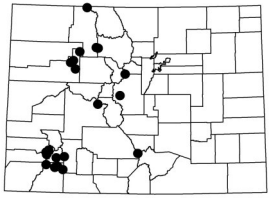
Barrenground willow / Mesic forb Shrubland

Salix brachycarpa / Mesic forb

Global rank/State rank:
G4 / S4

HGM subclass: S1/2, R1, R2

Colorado elevation range:
8,500-11,500 ft (2,600-3,500 m)



General Description

Typically, the *Salix brachycarpa*/mesic forb (barrenground willow/mesic forb) plant association occurs on well-drained slopes in subalpine valleys. This association may be considered part of a *Salix planifolia-Salix brachycarpa* (planeleaf willow-barrenground willow) mixed type. However, *Salix brachycarpa* occurs on slightly drier sites and is often adjacent to wetter, pure stands of *Salix planifolia*. The two species intermix at the ecotone between the wetter and drier sites. This plant association occurs in subalpine areas of the San Juan Mountains, the San Miguel/Dolores, Gunnison, Colorado and White River Basins, the Routt National Forest, and Rio Grande/Closed Basin.

The *Salix brachycarpa*/mesic forb (barrenground willow/mesic forb) plant association occurs along the drier fringes of broad, glaciated basins and along broad, straight streams in the subalpine zone. This association occupies elevated hummocks and drier side slopes, often surrounding wetter, low areas vegetated with *Salix planifolia* (planeleaf willow) associations. Stream channels are wide and shallow, or narrow, deep and sinuous. Soil textures range from silty clay loams to fine sandy loams with some mottling.

Vegetation Description

Salix brachycarpa (barrenground willow) occurs in almost pure stands on hummocks and well-drained slopes adjacent to the valley floor. *Salix planifolia* (planeleaf willow) dominated associations occur within the same riparian/wetland mosaic in lower, poorly-drained areas and intermix with the *Salix brachycarpa* (barrenground willow) association at their ecotone. Within the *Salix brachycarpa* (barrenground willow) association, *Salix planifolia* (planeleaf willow) may occur with 2-30% cover. Other shrubs may include *Salix wolfii* (Wolf willow) and *Betula nana (=glandulosa)* (bog birch) in high, subalpine stands; and *Salix monticola* (mountain willow), and *S. drummondiana* (Drummond willow).

The herbaceous undergrowth is dominated by forb cover, which exceeds total graminoid cover, although no one forb species is dominant nor present in every stand. Forb species include *Senecio triangularis* (arrowleaf ragwort), *Mertensia ciliata* (tall fringed bluebells), *Cardamine cordifolia* (heartleaf bittercress), *Caltha leptosepala* (marsh marigold), *Thalictrum* spp. (meadowrue), *Pseudocymopterus montanus* (alpine false springparsley), *Fragaria virginiana* (strawberry), *Oxypolis fendleri* (Fendler cowbane) and *Ligusticum* spp. (licoriceroot). Graminoid species may include *Deschampsia caespitosa* (tufted hairgrass), *Carex aquatilis* (water sedge) and *Calamagrostis canadensis* (bluejoint reedgrass). Lichen and moss-covered boulders are often present.

Ecological Processes

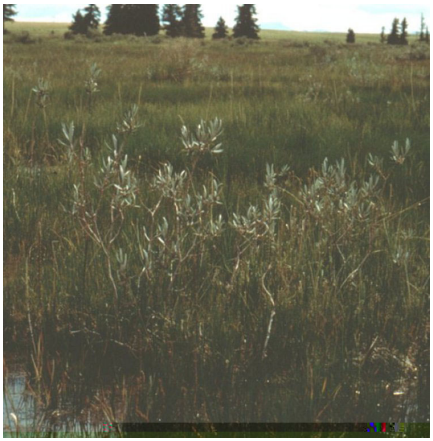
Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (Wolf willow) are abundant low-stature (1-3 ft, 0.3-1 m) willows of first- and second-order streams of subalpine elevations of Colorado. *Salix planifolia* and *Salix brachycarpa* can form extensive stands, often creating intricate mosaics in broad, subalpine valleys. In general, *Salix planifolia* occupies the wettest micro-habitats on peat soils, although it can grow well on mineral soils. *Salix brachycarpa* is more often found on slightly drier and more well-drained micro-habitats than *Salix planifolia*. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils. *Salix brachycarpa* grows on lateral moraines, coarse-textured stream banks, ridge tops and on small hummocks. This plant association appears to be stable, but little is known about its successional trends. It is sometimes intensely grazed by sheep, which may alter the species composition.

Avg. Cover %	(Range)	Species Name	# Plots (N=20)
48	(10-98%)	Salix brachycarpa	20
20	(3-70%)	Salix wolfii	5
16	(10-22%)	Carex aquatilis	6
15	(3-50%)	Salix monticola	8
14	(2-30%)	Salix planifolia	10
12	(2-30%)	Caltha leptosepala	6
10	(1-25%)	Picea engelmannii	7
8	(1-20%)	Fragaria virginiana ssp. glauca	9
7	(1-20%)	Thalictrum alpinum	5
6	(1-10%)	Dasiphora floribunda	9
6	(1-20%)	Senecio triangularis	11
6	(1-20%)	Carex utriculata	5
6	(1-20%)	Ligusticum porteri	7
6	(1-26%)	Deschampsia caespitosa	11
5	(1-16%)	Taraxacum officinale	12
5	(1-13%)	Hymenoxys hoopesii	7
5	(1-13%)	Calamagrostis canadensis	8

Other species with < 5% average cover present in at least 10% of plots:
Geranium richardsonii (1-11%), Mertensia ciliata (1-16%), Oxypolis fendleri (1-13%), Bromus ciliatus var. ciliatus (1-10%), Aconitum columbianum (3-5%), Carex microptera (1-10%), Cardamine cordifolia (1-14%), Valeriana edulis (1-6%), Equisetum arvense (1-6%), Poa pratensis (1-10%), Achillea millefolium var. occidentalis (1-8%), Geum macrophyllum var. perincisum (1-5%), Erigeron coulteri (1-7%), Phleum alpinum (1-5%), Rhodiola rhodantha (1-9%), Pedicularis groenlandica (1-3%), Stellaria longifolia (1%), Luzula parviflora (1%), Veronica wormskjoldii (1%).

Hoary willow / Seaside arrowgrass Extreme Rich Fen

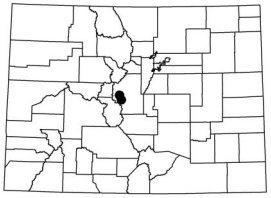
Salix candida / Triglochin maritimum



Global rank/State rank:
G1? / S1?

HGM subclass: S1/2

Colorado elevation range:
8,500-10,000 ft (2,590-3,050 m)



General Description

Salix candida/Triglochin maritimum (hoary willow/seaside arrowgrass) is a rare association that occurs between 8,500 and 10,000 ft elevation in the extreme rich fens of South Park in Colorado. Levels of calcium, magnesium, and other plant nutrients in the groundwater that feeds these fens are very high. This association is restricted to continuously wet, anaerobic histosolic soils of peatlands. The association is characterized by widely scattered clumps of 3-5 ft (1-1.5 m) tall *Salix candida* (hoary willow), with lesser amounts of other low willow species such as *Salix planifolia* (planeleaf willow) or *Salix brachycarpa* (barrenground willow) and/or *Dasiphora floribunda* (shrubby cinquefoil).

This association occurs in one of the large intermountain basins in the Southern Rocky Mountains. The floor of the park is covered with glacial debris washed from the limestone and dolomite peaks of the Mosquito Range at the western boundary of the park. The minerals in these glacial deposits create the unusual water chemistry of the extreme rich fens. Within the fens a complex of drier hummocks above water-filled rills has developed. The *Salix candida/Triglochin maritimum* association occurs on the raised hummocks.

Soils are characterized by organic horizons greater than one meter. Water tables normally remain at or near the soil surface throughout the growing season. Because of the cold dry climate of South Park, peat accumumlates at the rate of approximately four inches per one thousand years, a rate slower than that of intermediate and rich fens. For that reason, peat depth in extreme rich fens tends to be shallower than in other types of fens.

Vegetation Description

Communities within this alliance are defined as seasonally flooded cold-deciduous shrublands. They are dominated by *Salix candida* (hoary willow) which is a short

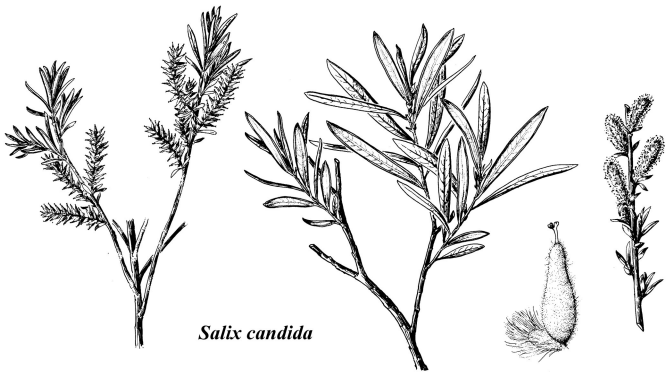
shrub that can reach heights of 10 ft (3 m), but usually is less than 3 ft (1 m) tall. The short shrub layer is characterized by scattered clumps of *Salix candida*, making up approximately 15% of the vegetation cover. Other willow species and *Dasiphora floribunda* may be present in lesser amounts. *Triglochin maritimum* (seaside arrowgrass) is often present and may contribute more cover than *Salix candida*. Graminoids that may be present include *Kobresia simpliciuscula* (simple bog sedge), *Carex simulata* (analogue sedge), *Carex microptera* (smallwing sedge) and *Juncus balticus* var. *montanus* (mountain rush). In addition to *Salix candida* (hoary willow, ranked G5S2), two other state rare plant species, *Salix myrtillifolia* (blueberry willow, G5S1) and *Primula egaliksensis* (Greenland primrose, G4S2) have been documented in this association; other rare plants of extreme rich fens may also occur.

Ecological Processes

The *Salix candida/Triglochin maritimum* (hoary willow/seaside arrowgrass) association is stable as long as the water regime is constant. *Salix candida* is a low vigor sprouting species after browsing, thus, heavy browsing can eliminate *Salix candida* from the community. Water diversion and groundwater pumping may lower the water table and dessicate the peatland soils necessary for this association to persist. Because of its restriction to very wet organic soils, if the hydrologic conditions reach a certain threshold of dryness, the loss of this association would probably be rapid.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
60	—	Campylium stellatum	1
40	—	Kobresia simpliciuscula	1
26	(5-60%)	Triglochin maritimum	4
15	—	Carex simulata	1
12	(3-20%)	Salix candida	7
5	—	Salix myrtillifolia	1
4	(2-5%)	Carex microptera	2

Other species with < 5% average cover present in at least 10% of plots:
Juncus balticus var. montanus (2%), Polygonum viviparum (1-2%), Primula egaliksensis (1%), Triglochin palustre (1%), Deschampsia caespitosa (1%), Kobresia myosuroides (1%), Carex aquatilis (1%), Carex hassei (1%), Dasiphora floribunda (1%), Equisetum variegatum var. variegatum (1%), Juncus saximontanus (1%), Parnassia palustris var. parviflora (1%), Thalictrum alpinum (1%).



Salix candida

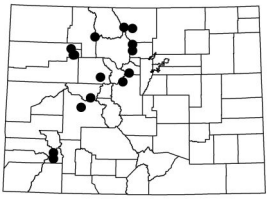
Planeleaf willow / Bluejoint reedgrass Shrubland

Salix planifolia / Calamagrostis canadensis

Global rank/State rank:
G4 / S3

HGM subclass: S1/2, R1

Colorado elevation range:
8,900-11,800 ft (2,700-3,600 m)



General Description

The *Salix planifolia/Calamagrostis canadensis* (planeleaf willow/bluejoint reedgrass) plant association is the least common of the *Salix planifolia* plant associations. It is frequently grazed to the point of shifting the dominant undergrowth grasses. It may have been more abundant historically.

This is a high elevation wetland plant association, usually occurring in broad, glacial valleys and swales where direct snow melt is the primary moisture source throughout the growing season. Stream channels are wide and moderately sinuous, often associated with beaver ponds. This association also occurs in narrow valleys with sinuous streams and wet floodplains. *Salix planifolia* shrublands occur on peat or mineral soils, deep clay loams and sandy clay loams, derived from glacial till. The mineral soils can have a high organic content.

Vegetation Description

Salix planifolia (planeleaf willow) forms a dense shrub layer with 30-100% cover. Other willow species that may be present include *Salix brachycarpa* (barrenground willow), and *Salix wolfii* (Wolf willow). *Calamagrostis canadensis* (bluejoint reedgrass) dominates the dense and sometimes rich herbaceous layer. Several *Carex* (sedge) species can also be present including *Carex utriculata* (beaked sedge), *Carex microptera* (smallwing sedge), and *Carex aquatilis* (water sedge). The forb layer can be diverse, but often has less than 20% total cover. Forb species can include *Caltha leptosepala* (marsh marigold), *Cardamine cordifolia* (heartleaf bittercress), *Pedicularis groenlandica* (elephanthead lousewort), and *Mertensia ciliata* (tall fringed bluebells).

Ecological Processes

Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. *Salix planifolia* and *Salix brachycarpa* can form extensive stands, often creating intricate mosaics in broad, subalpine valleys. In general, *Salix planifolia* occupies the wettest micro-habitats on peat soils, although it can grow well on mineral soils. *Salix brachycarpa* is more often found on slightly drier and more well-drained micro-habitats than *Salix planifolia*. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils. *Salix planifolia* also grows at elevations below the subalpine and becomes a much taller willow due to a longer growing season. In montane elevations, *Salix planifolia* is often a co-dominant in *Salix monticola* plant associations.

Salix planifolia

The *Salix planifolia/Calamagrostis canadensis* association may represent an ecotonal community to the conifer/*Calamagrostis canadensis* community type. In Colorado, *Salix planifolia/Calamagrostis canadensis* stands have been observed at the ecotone to the conifer/*Calamagrostis canadensis* plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=19)
72	(30-100%)	Salix planifolia	19
39	(5-90%)	Calamagrostis canadensis	19
18	(1-51%)	Betula nana	4
16	(2-30%)	Salix brachycarpa	2
9	(1-30%)	Mertensia ciliata	13
8	(1-25%)	Senecio triangularis	11
8	(5-10%)	Carex microptera	2
7	(1-20%)	Cardamine cordifolia	7
7	(3-10%)	Salix monticola	2
6	(5-7%)	Swertia perennis	2
5	(1-10%)	Carex utriculata	7
5	(5-5%)	Deschampsia caespitosa	2
5	(1-10%)	Caltha leptosepala	6

Other species with < 5% average cover present in at least 10% of plots:
Dasiphora floribunda (3-5%), Equisetum arvense (1-5%), Trisetum wolfii (2-5%), Conioselinum scopulorum (1-5%), Aconitum columbianum (1-7%), Saxifraga odontoloma (1-7%), Salix wolfii (1-5%), Carex aquatilis (0.1-5%), Stellaria calycantha (0.1-10%), Oxypolis fendleri (1-5%), Veronica wormskjoldii (1-6%), Chamerion latifolium (1-3%), Chamerion angustifolium ssp. circumvagum (1-2%), Viola macloskeyi ssp. pallens (1-2%), Phleum alpinum (1%), Achillea millefolium var. occidentalis (1%), Stellaria longifolia (1%), Thalictrum sparsiflorum (1%), Galium trifidum ssp. subbiflorum (1%), Taraxacum officinale (1%), Erigeron coulteri (1%), Pedicularis groenlandica (0.1-1%), Geum macrophyllum var. perincisum (0.1-1%), Picea engelmannii (0.1-1%), Agrostis scabra (0.1-1%), Rhodiola rhodantha (0.1-1%), Lonicera involucrata (0.1-1%), Poa reflexa (0.1-1%).

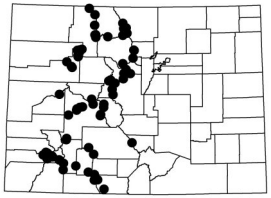
Planeleaf willow / Marsh-marigold Shrubland

Salix planifolia / Caltha leptosepala

Global rank/State rank:
G4 / S4

HGM subclass: S1/2, R1

Colorado elevation range:
8,900-11,800 ft (2,700-3,600 m)



General Description

The *Salix planifolia/Caltha leptosepala* (planeleaf willow/marsh marigold) plant association is a common and abundant upper montane and subalpine community occurring on very wet to saturated soils. This association is characterized by low-stature shrubs, less than 2 ft (0.5 m) tall, and a thick carpet of forbs in the undergrowth. There may be scattered patches of other willows present. This is a major subalpine wetland plant association that occurs throughout the Rocky Mountains of Colorado.

This plant association typically occurs in wide, glaciated valleys adjacent to streams. It occurs in swales, depressions, and on slopes where snowmelt runoff saturates soils for much of the growing season. The ground may be flat or uneven with raised hummocks. Stream gradients range from <1% in broad floodplains to 14% in steep snowmelt basins. Stream channels vary. Channels may be steep and narrow, first-order streams in snow melt basins, relatively wide and straight, narrow, relatively deep, and meandering in broad, glaciated valleys or braided, multiple channels below beaver dams. Soil textures are highly variable. Mineral soils vary along a moisture gradient. Wet sites have soil textures of silty clays and silt loams, while slightly drier sites have loamy sands and sandy loams overlying gravelly alluvium. Some stands occur on well-drained, mineral soils with well-oxygenated water and no mottled or gleyed layers. Other sites have a shallow organic layer overlying a gravel or cobble layer within 10-20 inches (20-50 cm) of the surface. The water table at these sites is usually near the surface throughout the growing season and may be perched by a clay horizon. Still other stands occur on deep, dark clay loams with high organic content or a fibrous layer on top.

Vegetation Description

Salix planifolia (planeleaf willow) may form nearly pure stands with 10-100% cover. Other willows that may be present at lower elevations include *Salix geyeriana* (Geyer willow) and *S. monticola* (mountain willow). At higher elevations, other shrubs that

may be present include *Salix brachycarpa* (barrenground willow) on drier sites, or *Betula nana (=glandulosa)* (bog birch) and *Salix wolfii* (Wolf willow) on wetter sites. *Picea engelmannii* (Engelmann spruce) is occasionally scattered throughout the stand.

Typically, the willow canopy is nearly closed and an herbaceous undergrowth occurs only in openings between willow patches. The undergrowth is characterized by an abundance of forbs with few graminoids. *Caltha leptosepala* (marsh marigold) is usually present. Other wet species such as *Trollius laxus* (American globeflower), *Cardamine cordifolia* (heartleaf bittercress), *Senecio triangularis* (arrowleaf ragwort), *Mertensia ciliata* (tall fringed bluebells), *Pedicularis groenlandica* (elephanthead lousewort) and *Rhodiola rhodantha* (redpod stonecrop) are also indicators of this type. Graminoid species that may be present include *Calamagrostis canadensis* (bluejoint reedgrass) and *Carex aquatilis* (water sedge).

Ecological Processes

Salix planifolia (planeleaf willow), *S. brachycarpa* (barrenground willow) and *S. wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. *Salix planifolia* and *Salix brachycarpa* can form extensive stands, often creating intricate mosaics in broad, subalpine valleys. In general, *Salix planifolia* occupies the wettest micro-habitats on peat soils, although it can grow well on mineral soils. *Salix brachycarpa* is more often found on slightly drier and more well-drained micro-habitats than *Salix planifolia*. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils. *Salix planifolia* also grows at elevations below the subalpine, and becomes a much taller willow due to a longer growing season. In montane elevations, *Salix planifolia* is often a co-dominant in *Salix monticola* plant associations. This association occurs in wet swales that are saturated throughout most or all of the growing season. It is a long-lived, stable association that changes with fluctuations in the water table and degree of soil saturation.

Avg. Cover %	(Range)	Species Name	# Plots (N=73)
65	(12.4-100%)	Salix planifolia	73
19	(1-64%)	Caltha leptosepala	69
11	(0.1-30%)	Salix brachycarpa	15
9	(1-48%)	Salix wolfii	14
9	(1-40%)	Salix monticola	13
9	(0.1-40%)	Carex aquatilis	46
7	(1-30%)	Senecio triangularis	51
7	(1-58%)	Cardamine cordifolia	43
7	(0.1-36%)	Calamagrostis canadensis	34
6	(1-18%)	Picea engelmannii	21
5	(1-20%)	Erigeron peregrinus ssp. callianthemus	13
5	(1-20%)	Geranium richardsonii	15
5	(0.1-20%)	Mertensia ciliata	46
5	(1-11%)	Carex utriculata	13

Other species with < 5% average cover present in at least 10% of plots:
Aconitum columbianum (1-20%), Saxifraga odontoloma (1-16%), Oxypolis fendleri (1-14%), Conioselinum scopulorum (0.1-10%), Pedicularis groenlandica (0.1-19%), Fragaria virginiana ssp. glauca (1-10%), Deschampsia caespitosa (1-11%), Rhodiola rhodantha (0.1-11%), Swertia perennis (0.1-10%), Chamerion angustifolium ssp. circumvagum (1-6%), Achillea millefolium var. occidentalis (1-5%), Polygonum bistortoides (1-10%), Phleum alpinum (1-10%), Veronica wormskjoldii (0.1-8%), Polygonum viviparum (1-6%), Taraxacum officinale (1-5%), Luzula parviflora (1-4%).

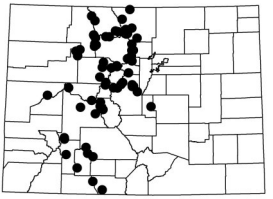
Planeleaf willow / Water sedge Shrubland

Salix planifolia / Carex aquatilis

Global rank/State rank:
G5 / S4

HGM subclass: S1/2

Colorado elevation range:
8,300-11,700 ft (2,530-3,560 m)



General Description

The *Salix planifolia/Carex aquatilis* (planeleaf willow/water sedge) plant association is a low-stature willow shrubland that grows in wet to saturated soils, ususally above 9,000 ft (2,800 m). It is a common plant association of subalpine glacial valleys. *Salix planifolia* occasionally mixes with *Salix brachycarpa* (barrenground willow) or *Salix wolfii* (Wolf willow) at higher elevations and grades into taller willow carrs with *Salix monticola* (mountain willow) at lower elevations. This plant association is a common type and occurs throughout the Rocky Mountains of Colorado.

This plant association occurs in wide, wet valleys on snow-melt fed swales. It also occurs in narrow valleys with sinuous streams and wet floodplains associated with beaver ponds. Stream channels are wide and moderately sinuous, narrow and sinuous, or highly braided by beaver activity. Soils have an organic peat top layer over mineral silty clays, heavy silty clay loams, silty loams, sandy loams, or loamy sands. Mottling is often evident.

Vegetation Description

This plant association is characterized by low-stature (1.5-5 ft; 0.5-1.5 m) *Salix planifolia* (planeleaf willow). Other willows that may be present include *Salix monticola* (mountain willow), *Salix wolfii* (Wolf willow), *Salix boothii* (Booth willow), *Salix geyeriana* (Geyer willow), and *Salix drummondiana* (Drummond willow)

The herbaceous undergrowth is dominated by *Carex aquatilis* (water sedge). Other graminoid species that may be present include *Carex utriculata* (beaked sedge), *Calamagrostis canadensis* (bluejoint reedgrass), and *Deschampsia caespitosa* (tufted hairgrass). Total forb cover is often less than 30%. Species that may be present include *Caltha leptosepala* (marsh marigold), *Cardamine cordifolia* (heartleaf

bittercress), *Pedicularis groenlandica* (elephanthead lousewort), and *Conioselinum scopulorum* (Rocky Mountain hemlockparsley).

Ecological Processes

Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. *Salix planifolia* and *Salix brachycarpa* can form extensive stands, often creating intricate mosaics in broad, subalpine valleys. In general, *Salix planifolia* occupies the wettest micro-habitats on peat soils, although it can grow well on mineral soils. *Salix brachycarpa* is often found on slightly drier and more well-drained micro-habitats than *Salix planifolia*. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils. *Salix planifolia* also grows at elevations below the subalpine, and becomes a much taller willow due to a longer growing season. At montane elevations, *Salix planifolia* is often a co-dominant in *Salix monticola* plant associations.

The *Salix planifolia/Carex aquatilis* (planeleaf willow/water sedge) plant association occurs in wet swales that are saturated throughout the growing season. The dense canopy layers and thick undergrowth indicate stable conditions. Both *Carex aquatilis* (water sedge) and *Caltha leptosepala* (marsh marigold) can tolerate saturated soils, and occasionally they co-dominate the undergrowth.

Avg. Cover %	(Range)	Species Name	# Plots (N=69)
51	(6.4-96%)	Salix planifolia	69
32	(1-90%)	Carex aquatilis	69
15	(1-40%)	Salix wolfii	20
13	(1-70%)	Caltha leptosepala	31
13	(1-30%)	Carex utriculata	23
13	(0.1-24%)	Salix drummondiana	8
10	(1-38%)	Salix monticola	12
9	(1-33%)	Salix brachycarpa	9
8	(0.1-40%)	Calamagrostis canadensis	40
8	(1-53%)	Picea engelmannii	19
7	(0.1-27%)	Betula nana	19
6	(1-20%)	Ligusticum tenuifolium	7
6	(1-20%)	Saxifraga odontoloma	14
5	(1-20%)	Salix geyeriana	7
5	(1-20%)	Senecio triangularis	29
5	(1-20%)	Trisetum wolfii	7

Other species with < 5% average cover present in at least 10% of plots:
Deschampsia caespitosa (1-20%), Carex canescens (0.1-12%), Viola canadensis var. scopulorum (1-8%), Conioselinum scopulorum (1-13%), Cardamine cordifolia (1-13%), Pedicularis groenlandica (0.1-20%), Dasiphora floribunda (1-8%), Polygonum bistortoides (1-10%), Veronica wormskjoldii (1-12%), Rhodiola rhodantha (0.1-9%), Mertensia ciliata (1-9%), Equisetum arvense (1-4%), Chamerion angustifolium ssp. circumvagum (1-7%), Fragaria virginiana ssp. glauca (1-13%), Carex microptera (1-10%), Polygonum viviparum (1-9%), Luzula parviflora (1-6%), Aconitum columbianum (1-7%), Achillea millefolium var. occidentalis (1-6%), Oxypolis fendleri (1-9%), Swertia perennis (0.1-6%), Taraxacum officinale (1-4%), Phleum alpinum (1-4%), Poa pratensis (1-4%), Geum macrophyllum var. perincisum (1-5%).

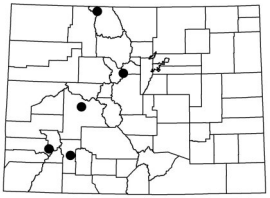
Planeleaf willow / Beaked sedge Shrubland

Salix planifolia / Carex utriculata

Global rank/State rank:
G3G4 / S2

HGM subclass: S1/2

Colorado elevation range:
8,900-10,760 ft (2,700-3,280 m)



General Description

The *Salix planifolia/Carex utriculata* (planeleaf willow/beaked sedge) plant association is a low-stature willow shrubland that grows in wet to saturated soils above 8,900 ft (2,700 m). It appears to be much less common than the related *Salix planifolia/Carex aquatilis* (planeleaf willow/water sedge) association, and is probably indicative of wetter sites.

This plant association occurs in wide, wet valleys on snowmelt fed swales. It also occurs in narrow valleys with sinuous streams and wet floodplains associated with beaver ponds. Soils have an organic peat top layer over mineral silty clays, heavy silty clay loams, silty loams, sandy loams, or loamy sands.

Vegetation Description

This plant association is characterized by 30-90% cover of low-stature (1-5 ft, 0.5-1.5 m) *Salix planifolia* (planeleaf willow). Other willows that may be present include *Salix monticola* (mountain willow), *Salix wolfii* (Wolf willow) and *Salix geyeriana* (Geyer willow). *Betula nana (=glandulosa)* (bog birch) and *Dasiphora floribunda* (shrubby cinquefoil) may also be components of the shrub layer.

Diversity of associated forb and graminoid species is typically low, although one plot from North Park had 22 herbaceous species present with cover values <5%. The herbaceous undergrowth is dominated by 11-80% cover of *Carex utriculata* (beaked sedge). Other graminoid species that may be present include *Carex aquatilis* (water sedge), *Calamagrostis canadensis* (bluejoint reedgrass), and *Bromus ciliatus* var. *ciliatus* (fringed brome). Total forb cover is typically less than 20%. Species that were most frequently present include *Conioselinum scopulorum* (Rocky Mountain hemlockparsley), *Geum macrophyllum* var. *perincisum* (largeleaf avens) and *Swertia perennis* (star gentian).

Ecological Processes

Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. *Salix planifolia* and *Salix brachycarpa* can form extensive stands, often creating intricate mosaics in broad, subalpine valleys. In general, *Salix planifolia* occupies the wettest micro-habitats on peat soils, although it can grow well on mineral soils. *Salix brachycarpa* is more often found on slightly drier and more well-drained micro-habitats than *Salix planifolia*. *Salix planifolia* also grows at elevations below the subalpine, and becomes a much taller willow due to a longer growing season. At montane elevations, *Salix planifolia* is often a co-dominant in *Salix monticola* plant associations.

Carex utriculata (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) are common dominant undergrowth of several *Salix* plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain.

Carex utriculata (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channel with the shallowest water tables. *Carex aquatilis* (water sedge) occurs on intermediate sites that have saturated but not inundated soils. *Calamagrostis canadensis* (bluejoint reedgrass) dominates the drier sites with lower water tables. As wetter sites become drier, it can colonize stands of *Carex utriculata* (beaked sedge) and *Carex aquatilis* (water sedge).

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
65	(30-89%)	Salix planifolia	7
48	(11-80%)	Carex utriculata	7
10	—	Salix wolfii	1
10	—	Salix monticola	1
7	(1-20%)	Carex aquatilis	3
6	(2-10%)	Betula nana	2
5	—	Dasiphora floribunda	1

Other species with < 5% average cover present in at least 10% of plots:
Conioselinum scopulorum (1-6%), Swertia perennis (2-5%), Calamagrostis canadensis (1-5%), Campylium stellatum (3%), Luzula parviflora (3%), Geum macrophyllum var. perincisum (1-3%), Bromus ciliatus var. ciliatus (2%), Climacium dendroides (2%), Stellaria umbellata (2%), Agrostis scabra (1%), Mertensia ciliata (1%), Pedicularis groenlandica (1%), Cardamine cordifolia (1%), Caltha leptosepala (1%), Dodecatheon pulchellum (1%), Fragaria virginiana ssp. glauca (1%), Galium trifidum ssp. subbiflorum (1%), Galium triflorum (1%), Rhodiola rhodantha (1%), Viola canadensis var. scopulorum (1%), Veronica wormskjoldii (1%), Symphyotrichum foliaceum (1%), Senecio triangularis (1%), Geranium richardsonii (1%), Salix geyeriana (1%), Gentianopsis thermalis (1%), Poa pratensis (1%), Phleum alpinum (1%), Lonicera involucrata (1%), Viola macloskeyi ssp. pallens (1%), Juncus drummondii (1%).

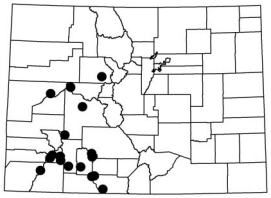
Planeleaf willow / Mesic forb Shrubland

Salix planifolia / Mesic forb

Global rank/State rank:
G4 / S4

HGM subclass: S1/2, R2

Colorado elevation range:
8,900-12,100 ft (2,700-3,700 m)



General Description

The *Salix planifolia*/mesic forb (planeleaf willow/mesic forb) plant association is a low stature (<2 ft, 0.5 m) shrubland with abundant and diverse forbs under the willow canopy. It is a common community of the sublapine and lower alpine areas. It occurs on mesic soils. This plant association typically occurs in wide, glaciated valleys adjacent to streams. It occurs in swales, depressions and on slopes where snow melt runoff saturates soils for much of the growing season. The ground may be flat or uneven with raised hummocks. Stream gradients range from <1% in broad floodplains to 14% in steep snowmelt basins. Stream channels vary. Channels may be steep and narrow, first-order streams in snow melt basins, relatively wide and straight, narrow, relatively deep, and meandering in broad, glaciated valleys or braided, multiple channels below beaver dams.

Soil textures are highly variable. Mineral soils vary along a moisture gradient. Wet sites have soil textures of silty clays and silt loams, while slightly drier sites have loamy sands and sandy loams overlying gravelly alluvium. Some stands occur on well-drained, mineral soils with well-oxygenated water and no mottled or gleyed layers. Other sites have a shallow organic layer overlying a gravel or cobble layer within 10-20 inches (20-50 cm) of the surface. The water table at these sites is usually near the surface throughout the growing season and may be perched by a clay horizon. Still other stands occur on deep, dark clay loams with high organic content or a fibric or hemic layer on top.

Vegetation Description

Salix planifolia (planeleaf willow) often forms nearly pure stands. Other willows that may be present include *Salix monticola* (mountain willow), *S. brachycarpa* (barrenground willow), *S. boothii* (Booth willow), *S. drummondiana* (Drummond willow), and *S. wolfii* (Wolf willow). *Picea engelmannii* (Engelmann spruce) can occur along the outer edges of the stand.

Typically, the willow canopy is nearly closed and an herbaceous undergrowth occurs only in openings between willow patches. The undergrowth is characterized by an abundance of forbs with few graminoids. Forb species include *Achillea millefolium* var. *occidentalis* (western yarrow), *Mertensia ciliata* (tall fringed bluebells), and *Senecio triangularis* (arrowleaf ragwort).

Ecological Processes

Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. In general, *Salix planifolia* occupies the wettest micro-habitats on peat soils, although it can grow well on mineral soils. *Salix brachycarpa* is more often found on slightly drier and more well-drained micro-habitats than *Salix planifolia*. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils. *Salix planifolia* also grows at elevations below the subalpine, and becomes a much taller willow due to a longer growing season. In montane elevations, *Salix planifolia* is often a co-dominant in *Salix monticola* plant associations.

The *Salix planifolia*/mesic forb (planeleaf willow/mesic forb) plant association occurs in wet swales that are saturated throughout most or all of the growing season. It is a long-lived, stable association that changes with fluctuations in the water table and degree of soil saturation. The *Salix planifolia/*mesic forb association may be a grazing-induced phase of the *Salix planifolia/Caltha leptosepala* (planeleaf willow/marsh marigold) association. Many stands in the Routt National Forest are heavily grazed and contain a high number of exotic and increaser species such as *Taraxacum officinale* (dandelion) and *Fragaria virginiana* (strawberry). Other stands in Colorado, however, do not show an increase in non-native species.

Avg. Cover %	(Range)	Species Name	# Plots (N=17)
59	(14-90%)	Salix planifolia	17
17	(9-28%)	Salix brachycarpa	7
16	(1-34%)	Picea engelmannii	6
14	(1-35%)	Mertensia ciliata	11
8	(1-12%)	Caltha leptosepala	6
8	(1-18%)	Oxypolis fendleri	8
8	(1-30%)	Salix monticola	5
6	(0.1-22%)	Senecio triangularis	10
5	(1-13%)	Conioselinum scopulorum	5
5	(1-16%)	Deschampsia caespitosa	8
5	(1-10%)	Pseudocymopterus montanus	4

Other species with < 5% average cover present in at least 10% of plots:
Carex aquatilis (1-9%), Primula parryi (1-10%), Calamagrostis canadensis (1-10%), Saxifraga odontoloma (1-9%), Hymenoxys hoopesii (1-9%), Achillea millefolium var. occidentalis (1-13%), Cardamine cordifolia (1-9%), Dasiphora floribunda (1-7%), Pedicularis groenlandica (1-11%), Geranium richardsonii (1-7%), Rhodiola integrifolia (1-7%), Aconitum columbianum (1-5%), Geum macrophyllum var. perincisum (1-5%), Bromus ciliatus var. ciliatus (1-4%), Polygonum viviparum (1-4%), Rhodiola rhodantha (1-4%), Taraxacum officinale (1-4%), Veronica wormskjoldii (1-2%), Phleum alpinum (1-2%), Polygonum bistortoides (1-2%), Castilleja rhexiifolia (1%), Luzula parviflora (1%), Potentilla pulcherrima (1%).

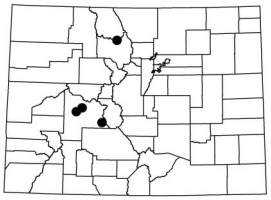
Wolf willow / Bluejoint reedgrass Shrubland

Salix wolfii / Calamagrostis canadensis

Global rank/State rank:
G3 / S3

HGM subclass: S1/2, R1

Colorado elevation range:
8,700-9,800 ft (2,650-3,000 m)



General Description

In Colorado, *Salix wolfii* (Wolf willow) grows in small patches and does not form large, expansive willow carrs like *Salix planifolia* (planeleaf willow). *Salix wolfii* often forms a mosaic with stands of *Salix planifolia*, *Salix brachycarpa* (barrenground willow) and open *Carex* spp. (sedge) meadows.

This plant association occurs in moderately wide to wide valleys along flat to rolling floodplains. Stream channels are wide and sinuous or sinuous and braided from beaver activity. Soil textures are silty loam, clay, sandy clay loam, and loamy sand with mottling.

Vegetation Description

The shrub layer is a mix of 30-80% cover of *Salix wolfii* (Wolf willow) and 10-30% cover of *Salix planifolia* (planeleaf willow). *Salix monticola* (mountain willow) and *Salix geyeriana* (Geyer willow) may also be present. A dense and rich graminoid undergrowth is dominated by *Calamagrostis canadensis* (bluejoint reedgrass). *Carex utriculata* (beaked sedge), *Carex aquatilis* (water sedge), and *Deschampsia caespitosa* (tufted hairgrass) are also present. Forb cover may be sparse but is diverse.

Ecological Processes

Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow), and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. Stands of *Salix wolfii* are less frequently encountered, and are usually limited in size. *Salix wolfii* dominated stands are more common on the Western Slope. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils.

Avg. Cover %	(Range)	Species Name	# Plots (N=5)
52	(30-80%)	Salix wolfii	5
36	(20-50%)	Calamagrostis canadensis	5
24	(10-30%)	Salix planifolia	4
20	—	Cardamine cordifolia	1
10	—	Vicia americana	1
8	(5-10%)	Senecio triangularis	2
7	(3-10%)	Carex utriculata	2
6	(3-10%)	Carex aquatilis	3
6	(1-15%)	Mertensia ciliata	4
5	—	Valeriana edulis	1

Other species with < 5% average cover present in at least 10% of plots:
Poa pratensis (1-10%), Dasiphora floribunda (1-5%), Alopecurus aequalis (3%), Veronica americana (3%), Conioselinum scopulorum (1-5%), Deschampsia caespitosa (1-3%), Salix geyeriana (1-3%), Salix monticola (1-3%), Phleum pratense (2%), Geum macrophyllum var. perincisum (1-2%), Pedicularis groenlandica (1%), Taraxacum officinale (1%), Carex pellita (1%), Trisetum spicatum (1%), Castilleja sulphurea (1%), Chamerion angustifolium ssp. circumvagum (1%), Trifolium repens (1%), Descurainia incana (1%), Elymus glaucus (1%), Fragaria virginiana ssp. glauca (1%), Achillea millefolium var. occidentalis (1%), Senecio bigelovii var. hallii (1%), Scirpus microcarpus (1%), Rhodiola integrifolia (1%), Salix boothii (1%), Thalictrum alpinum (1%).

Wolf willow / Water sedge Shrubland

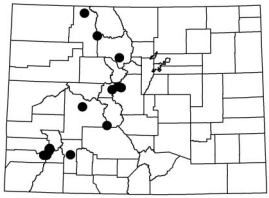
Salix wolfii / Carex aquatilis

Salix wolfii

Global rank/State rank:
G4 / S3

HGM subclass: S1/2, R1

Colorado elevation range:
8,400-11,400 ft (2,600-3,500 m)



General Description

The *Salix wolfii/Carex aquatilis* (Wolf willow/water sedge) plant association is an uncommon community of very wet subalpine sites in western Colorado. In Colorado, *Salix wolfii* grows in small patches and does not form as large, expansive willow carrs as *Salix planifolia* (planeleaf willow). *Salix wolfii* often forms a mosaic with stands of *Salix planifolia*, *Salix brachycarpa* (barrenground willow) and open *Carex* spp. (sedge) meadows.

The *Salix wolfii/Carex aquatilis* (Wolf willow/water sedge) plant association occurs in moderately narrow to wide valleys and glacial basins. It occurs on saturated peat wetlands and floodplains with lateral seepage of groundwater. Stream reaches can be moderately steep (gradient of 3-7%). Stream channels are deep, narrow, and sinuous, shallow, broad, and gently meandering, and highly divided by beaver activity. Soils vary from highly organic or peat to mineral-based. Soil textures include heavy silty clay loams, silty loams, and sandy clay loams with mottling. Some stands occur on deep sandy clays, often with a high organic content, and others occur on shallow silty clays over gravels and rocks.

Vegetation Description

The shrub layer is dominated by 20-70% cover of *Salix wolfii* (Wolf willow). Other willow species that may be present include *Salix planifolia* (planeleaf willow), *Salix boothii* (Booth willow), *Salix monticola* (mountain willow) and *Salix brachycarpa*

(barrenground willow). *Betula nana (=glandulosa)* (bog birch) may also be present. The herbaceous graminoid cover is generally dense and rich, dominated by *Carex aquatilis* (water sedge). Other graminoid species that may be present include *Carex utriculata* (beaked sedge) and *Deschampsia caespitosa* (tufted hairgrass). Forb cover varies from sparse (< 10% cover) to very dense (70%) and species are generally diverse. Forb species that may be present include *Caltha leptosepala* (marsh marigold), *Ligusticum tenuifolium* (Idaho licoriceroot) and *Thalictrum alpinum* (alpine meadowrue).

Ecological Processes

The dense shrub canopy and thick undergrowth of the *Salix wolfii/Carex aquatilis* (Wolf willow/water sedge) plant association indicate stable conditions. *Carex utriculata* (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) separate out along a moisture gradient related to the depth of the water table at a particular site. *Carex utriculata* occurs on the wettest sites, such as low-lying swales, with the highest water tables. *Carex aquatilis* occurs on intermediate sites. *Calamagrostis canadensis* dominates the driest sites with the lowest water tables and often colonizes clumps of *Carex utriculata* and *Carex aquatilis*. *Carex aquatilis* is well-suited to wet, organic soils and succession will occur slowly under these conditions. If the water table is lowered, other herbaceous species may become dominant in the undergrowth and eventually give way to non-native graminoid species.

Avg. Cover %	(Range)	Species Name	# Plots (N=19)
42	(10-80%)	Carex aquatilis	18*
40	(20-70%)	Salix wolfii	19
13	(1-30%)	Salix planifolia	9
12	(1-30%)	Betula nana	7
9	(2-20%)	Salix brachycarpa	4
8	(1-20%)	Caltha leptosepala	10
8	(5-13%)	Salix monticola	4
8	(1-20%)	Polygonum bistortoides	3
8	(1-20%)	Aconitum columbianum	3
6	(1-19%)	Carex utriculata	5
6	(2-20%)	Dasiphora floribunda	13
6	(1-25%)	Mertensia ciliata	6
5	(1-20%)	Fragaria virginiana ssp. glauca	5
5	(1-20%)	Geum macrophyllum var. perincisum	7
5	(1-7%)	Swertia perennis	3
5	(1-13%)	Thalictrum alpinum	6

Other species with < 5% average cover present in at least 10% of plots:
Juncus balticus var. montanus (1-10%), Conioselinum scopulorum (0.1-8%), Deschampsia caespitosa (1-7%), Achillea millefolium var. occidentalis (1-5%), Cardamine cordifolia (1-6%), Taraxacum officinale (1-5%), Carex microptera (1-5%), Antennaria corymbosa (1-3%), Pedicularis groenlandica (1-7%), Poa pratensis (1-3%), Calamagrostis canadensis (1-2%), Veronica wormskjoldii (1-2%), Polygonum viviparum (1-2%), Castilleja sulphurea (1-2%), Equisetum arvense (1%), Carex aurea (1%), Luzula parviflora (1%).

* Carex aquatilis occurred in all stands, but was not captured in every sample plot.

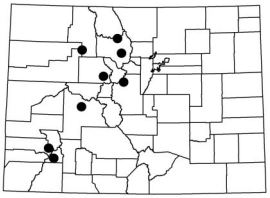
Wolf willow / Beaked sedge Shrubland

Salix wolfii / Carex utriculata

Global rank/State rank:
G4 / S3

HGM subclass: S1/2, R1

Colorado elevation range:
8,500-10, 700 ft (2,600-3,260 m)



General Description

The *Salix wolfii/Carex utriculata* (Wolf willow/beaked sedge) plant association is a community of very wet subalpine sites in western Colorado. In Colorado, *Salix wolfii* grows in small patches and does not form as large, expansive willow carrs (i.e., shrubland thickets) as *Salix planifolia* (planeleaf willow). *Salix wolfii* often forms a mosaic with stands of *Salix planifolia*, *Salix brachycarpa* (barrenground willow) and open *Carex* spp. (sedge) meadows.

This plant association occurs on saturated floodplains in broad to narrow valleys. It is often associated with beaver pond wetlands. Soil textures are silty loams to silty clay loams.

Vegetation Description

This plant association is characterized by a low, dense shrub layer dominated by 15-60% cover of *Salix wolfii* (Wolf willow). Other shrubs that may be present include *Salix planifolia* (planeleaf willow) and *Dasiphora floribunda* (shrubby cinqefoil). *Carex utriculata* (beaked sedge) dominates the lush graminoid undergrowth. Other graminoid species that may be present include *Calamagrostis canadensis* (bluejoint reedgrass) and *Carex aquatilis* (water sedge).

Ecological Processes

Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. Stands of *Salix wolfii* are less frequently encountered, and are usually limited in size. *Salix wolfii* dominated stands are more common on the Western Slope. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils.

Carex utriculata (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) separate out along a moisture gradient related to the depth of the water table at a particular site. *Carex utriculata* occurs on the wettest sites, such as low-lying swales, with the highest water tables. *Carex aquatilis* occurs on intermediate sites. *Calamagrostis canadensis* dominates the driest sites with the lowest water tables and often colonizes drier microsites in clumps of *Carex utriculata* and *Carex aquatilis.*

The *Salix wolfii/Carex utriculata* plant association occurs on saturated floodplains and wetlands. If the water table is lowered and the site begins to dry out, the *Salix wolfii/Carex utriculata* association may become a *Salix wolfii/Deschampsia caespitosa* (Wolf willow/tufted hairgrass) or *Salix wolfii*/mesic forb type.

Avg. Cover %	(Range)	Species Name	# Plots (N=9)
44	(15-60%)	Salix wolfii	9
34	(10-80%)	Carex utriculata	9
23	(10-40%)	Salix planifolia	3
11	(1-20%)	Salix boothii	2
10	(1-25%)	Carex aquatilis	6
10	(3-20%)	Calamagrostis canadensis	4
7	(3-10%)	Deschampsia caespitosa	5
7	(3-10%)	Salix geyeriana	2
6	(1-15%)	Phleum pratense	3
4	(1-7%)	Caltha leptosepala	4

Other species with < 5% average cover present in at least 10% of plots:
Betula nana (3-5%), Geum macrophyllum var. perincisum (1-5%), Conioselinum scopulorum (1-6%), Salix brachycarpa (2-3%), Dasiphora floribunda (1-5%), Heracleum maximum (1-5%), Pedicularis groenlandica (1-2%), Fragaria virginiana ssp. glauca (1%), Polygonum viviparum (1%), Cardamine cordifolia (1%), Glyceria striata (1%), Trisetum wolfii (1%).

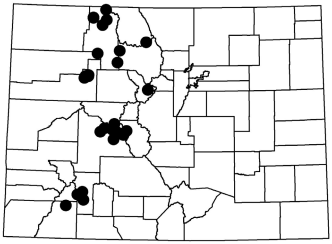
Wolf willow / Mesic forb Shrubland

Salix wolfii / Mesic forb

Global rank/State rank:
G3 / S3

HGM subclass: S1/2, R1

Colorado elevation range:
7,900-11,000 ft (2,400-3,400 m)



General Description

The *Salix wolfii*/mesic forb (Wolf willow/mesic forb) plant association occurs at mid to upper montane and lower subalpine elevations. It frequently covers wide, open, gently sloping areas near first- and second-order streams. It can be recognized by the generally dense layer of low-growing, silvery *Salix wolfii* (Wolf willow) dominating the overstory with a variety of mesic forbs and some graminoids in the undergrowth. In Colorado, *Salix wolfii* (Wolf willow) grows in small patches and does not form aslarge, expansive willow carrs (i.e., shrubland thickets) like *Salix planifolia* (planeleaf willow). *Salix wolfii* often forms a mosaic with stands of *S. planifolia*, *S. brachycarpa* (barrenground willow) and open *Carex* spp. (sedge) meadows.

This association occurs in wide mountain valleys, along first- or second-order streams on well-drained slopes and hummocks on the valley floor. The water table is usually within the top 3 ft (1 m) of soil and groundwater slowly seeps to the surface. Stream channels are narrow, relatively deep and sinuous. The soils may be saturated in the spring and early summer, but dry somewhat during the summer as the water table drops. Soil textures often have a high organic content and are silty clays, silty clay loams, silty loams, or deep sandy clays, clay loams, and sandy clay loams over gravels and rocks. Some stands have a loamy horizon underlain by a clay horizon.

Vegetation Description

Salix wolfii (Wolf willow) dominates the shrub layer with 10-90% cover. Other willow species that may be present include *Salix planifolia* (planeleaf willow), *Salix boothii* (Booth willow), and *Salix geyeriana* (Geyer willow). Total forb cover exceeds that of total graminoid cover. No single forb species is particularly more abundant than any other, and no one species is present in every stand. Forb species that may be present include *Caltha leptosepala* (marsh marigold), *Mertensia ciliata* (tall fringed

bluebells), *Senecio triangularis* (arrowleaf ragwort), *Ligusticum porteri* (Porter licoriceroot), *Fragaria virginiana* (strawberry), *Cardamine cordifolia* (heartleaf bittercress), *Geum macrophyllum* (large-leaved avens), and *Heracleum maximum* (common cowparsnip). Graminoid species present are diverse, yet generally have a low cover relative to the amount of total forb cover. Graminoid species may include *Deschampsia caespitosa* (tufted hairgrass), *Calamagrostis canadensis* (bluejoint reedgrass), and various *Carex* (sedge) species.

Ecological Processes

Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. Stands of *Salix wolfii* are less frequently encountered, and are usually limited in size. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils.

When non-native and increaser species are abundant, the *Salix wolfii*/mesic forb association may be a grazing-induced phase of the *Salix wolfii/Carex aquatilis* (Wolf willow/water sedge) association. Many stands in the Routt National Forest are heavily grazed and contain a high number of exotic and increaser species such as *Taraxacum officinale* (dandelion) and *Fragaria virginiana* (strawberry). However, other stands in Colorado without abundant increaser or non-native species do not appear to be grazing induced.

Avg. Cover %	(Range)	Species Name	# Plots (N=36)
58	(10-98%)	Salix wolfii	36
25	(1-80%)	Salix planifolia	15
21	(3-40%)	Salix boothii	9
12	(1-40%)	Carex aquatilis	20
10	(1-60%)	Caltha leptosepala	18
10	(1-70%)	Carex utriculata	12
10	(3-20%)	Betula nana	12
8	(1-20%)	Calamagrostis canadensis	13
7	(1-40%)	Deschampsia caespitosa	20
6	(1-22%)	Mertensia ciliata	16
5	(1-15%)	Fragaria virginiana ssp. glauca	22
5	(1-20%)	Thalictrum alpinum	10
5	(1-10%)	Juncus balticus var. montanus	6
5	(1-15%)	Dasiphora floribunda	23

Other species with < 5% average cover present in at least 10% of plots:
Conioselinum scopulorum (1-15%), Maianthemum stellatum (1-16%), Carex microptera (1-15%), Swertia perennis (0.1-10%), Symphyotrichum foliaceum (1-8%), Poa pratensis (1-10%), Taraxacum officinale (1-10%), Rhodiola rhodantha (1-5%), Aconitum columbianum (1-9%), Geranium richardsonii (1-10%), Senecio triangularis (1-8%), Cardamine cordifolia (1-10%), Geum macrophyllum var. perincisum (1-10%), Pedicularis groenlandica (1-10%), Phleum alpinum (1-10%), Achillea millefolium var. occidentalis (1-6%), Gentianopsis thermalis (0.1-5%), Galium boreale (1-6%), Saxifraga odontoloma (1-5%), Equisetum arvense (1-3%), Trisetum wolfii (1-5%), Vicia americana (1-3%), Thalictrum fendleri (1-3%), Luzula parviflora (1-2%), Castilleja sulphurea (0.1-2%), Oxypolis fendleri (1%), Veronica wormskjoldii (1%), Polygonum viviparum (0.1-1%).

GROUP F:
NON-WILLOW SHRUBLANDS

Association	Page
Alnus incana ssp. *tenuifolia-Cornus sericea* Thinleaf alder-Red-osier dogwood Shrubland	268
Alnus incana ssp. *tenuifolia*/*Equisetum arvense* Thinleaf alder/Field horsetail Shrubland	270
Alnus incana ssp. *tenuifolia*/Mesic forb Thinleaf alder/Mesic forb Shrubland	272
Alnus incana ssp. *tenuifolia*/Mesic graminoid Thinleaf alder/Mesic graminoid Shrubland	274
Alnus incana ssp. *tenuifolia-Salix drummondiana* Thinleaf alder-Drummond willow Shrubland	188
Alnus incana ssp. *tenuifolia-Salix (monticola, lucida, ligulifolia)* Thinleaf alder-Willow (Rocky Mountain, Shining, Strapleaf Shrubland	276
*Betula nana (=glandulosa)/*Mesic forb-Mesic graminoid Bog birch/Mesic forb-Mesic graminoid Shrubland	278
*Betula occidentalis/*Mesic forb River birch/Mesic forb Shrubland	280
*Betula occidentalis/*Mesic graminoid River birch/Mesic graminoid Shrubland	282
Celtis laevigata var. *reticulata* Netleaf hackberry Woodland	284
Cornus sericea Red-osier dogwood Shrubland	286
Crataegus rivularis River Hawthorn Shrubland	288
Dasiphora (=Pentaphylloides) floribunda/Deschampsia caespitosa Shrubby-Cinquefoil/Tufted hairgrass Shrubland	290
Dasiphora (=Pentaphylloides) floribunda/Juncus balticus var. *montanus* Shrubby Cinquefoil/Mountain rush Shrubland	292
Forestiera pubescens Wild-privet Shrubland	294
Kalmia microphylla-Gaultheria humifusa Bog Laurel-Alpine Spicywintergreen Shrubland	296
(Picea engelmannii)/Betula nana (=glandulosa)/Carex aquatilis/ Sphagnum (Engelmann spruce)/Bog birch/Water sedge/Sphagnum moss Iron Fen	298
Prunus virginiana-(Prunus americana) Chokecherry-(American plum) Shrubland	298

Rhus trilobata-(Salix exigua) 302
Skunkbush sumac-(Sandbar willow) Shrubland
*Sarcobatus vermiculatus/*Barren ground 304
Black greasewood/Barren ground Shrubland
Sarcobatus vermiculatus/Distichlis spicata 306
Black greasewood/Inland saltgrass Shrubland
Shepherdia argentea 306
Silver buffaloberry Shrubland
Symphoricarpos occidentalis 310
Western snowberry Shrubland
Tamarix ramosissima 312
Saltcedar Shrubland

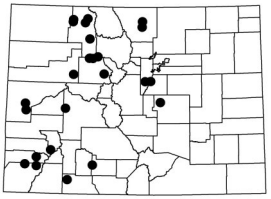
Thinleaf alder - Red-osier dogwood Shrubland

Alnus incana ssp. *tenuifolia - Cornus sericea*

Global rank/State rank:
G3Q/ S3

HGM subclass: R3/4

Colorado elevation range:
5600-9,000 ft (1,700-2,750 m)



General Description

The *Alnus incana* ssp. *tenuifolia-Cornus sericea* (thinleaf alder-red-osier dogwood) plant association is a narrow thicket of medium to tall shrubs lining the stream bank. Due to heavy shading, there is usually a limited herbaceous understory.

This plant association occurs on narrow, rocky banks and benches of small channels as well as narrow, constricted reaches of larger rivers. It can also occur along overflow channels and narrow tributaries. Stream channels are steep and narrow, wider and moderately sinuous, or wider and highly sinuous. Soils range from loamy sand to sandy clay loam. Mottling is evident at approximately 12 inches (30 cm) and gravel or cobble layers appear at 20-40 inches (50-100 cm) beneath the surface.

Vegetation Description

This plant association is characterized by a dense thicket of shrubs dominated by *Alnus incana* ssp. *tenuifolia* (thinleaf alder) and *Cornus sericea* (red-osier dogwood). *Salix exigua* (sandbar willow) is often present. A wide variety of other shrub species may be present, including *Salix bebbiana* (Bebb willow), *Salix ligulifolia* (strapleaf willow), *Salix lucida* (ssp. *caudata* or ssp. *lasiandra*) (shining willow), *Salix monticola* (mountain willow), *Lonicera involucrata* (twinberry honeysuckle), *Rosa woodsii* (Woods rose), *Betula occidentalis* (river birch), and *Rubus idaeus* (American red raspberry). Tree species are scattered and only occasionally present.
Forb cover is highly variable depending on the amount of light that penetrates the canopy. Forb species include *Rudbeckia laciniata* (cutleaf coneflower), *Heracleum*

maximum (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), *Osmorhiza depauperata* (bluntseed sweetroot) and *Ligusticum porteri* (Porter licoriceroot). Graminoid cover is usually low, but can include *Poa pratensis* (Kentucky bluegrass). *Equisetum arvense* (field horsetail) is sometimes present.

Ecological Processes

Alnus incana ssp. *tenuifolia* (thinleaf alder) is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining. After establishment, young stands of *Alnus* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils begin to develop. *Alnus incana* ssp. *tenuifolia* is shade-intolerant, and many mature stands in Colorado are restricted to stream bank edges, possibly because these are the only sites where light can penetrate the neighboring overstory canopy.

In Colorado, the *Alnus incana* ssp. *tenuifolia*-*Cornus sericea* (thinleaf alder-red-osier dogwood) plant association is tolerant of flooding and requires a high water table each spring. It appears to be a stable, long-lived association where succession to other types can be very slow.

Avg. Cover %	(Range)	Species Name	# Plots (N=25)
47	(1-100%)	Alnus incana ssp. tenuifolia	25
35	(5-83%)	Cornus sericea ssp. sericea	25
31	(8-70%)	Salix bebbiana	3
11	(3-20%)	Betula occidentalis	6
10	(1-20%)	Salix drummondiana	4
10	(1-33%)	Juniperus scopulorum	4
10	(3-30%)	Salix ligulifolia	7
9	(1-30%)	Rudbeckia laciniata var. ampla	14
8	(1-20%)	Lonicera involucrata	10
8	(0.1-30%)	Heracleum maximum	15
7	(1-20%)	Salix monticola	7
7	(1-45%)	Poa pratensis	11
6	(1-25%)	Calamagrostis canadensis	8
6	(1-20%)	Rubus idaeus ssp. strigosus	8
5	(1-20%)	Rosa woodsii	18

Other species with < 5% average cover present in at least 10% of plots:
Carex pellita (1-10%), Ribes inerme (1-10%), Populus angustifolia (1-13%), Salix exigua (1-10%), Agrostis gigantea (0.1-10%), Equisetum pratense (2-7%), Osmorhiza depauperata (1-10%), Poa palustris (1-5%), Urtica dioica ssp. gracilis (1-5%), Equisetum arvense (0.1-10%), Solidago gigantea (1-9%), Symphoricarpos oreophilus (1-5%), Maianthemum stellatum (1-10%), Aconitum columbianum (1-5%), Actaea rubra ssp. arguta (1-5%), Streptopus amplexifolius var. chalazatus (1-3%), Glyceria striata (1-5%), Rhus trilobata var. trilobata (1-3%), Geranium richardsonii (1-3%), Amelanchier alnifolia (1-3%), Ligusticum porteri (1-3%), Prunus virginiana var. melanocarpa (1-3%), Amelanchier utahensis (1-3%), Geum macrophyllum var. perincisum (0.1-5%), Elymus glaucus (1-3%), Mentha arvensis (1-2%), Mertensia ciliata (1-2%), Taraxacum officinale (1-2%), Achillea millefolium var. occidentalis (1%), Fragaria virginiana ssp. glauca (1%), Cardamine cordifolia (1%), Chamerion angustifolium ssp. circumvagum (1%), Phleum pratense (1%).

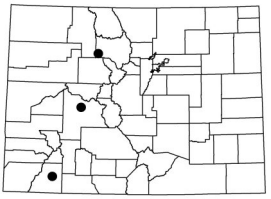
Thinleaf alder / Field horsetail Shrubland

Alnus incana ssp. *tenuifolia / Equisetum arvense*

Global rank/State rank:
G3 / S3

HGM subclass: R3/4

Colorado elevation range:
7,800-8,900 ft (2,370-2,700 m)



General Description

The *Alnus incana* ssp. *tenuifolia*/*Equisetum arvense* (thinleaf alder/field horsetail) plant association is a frequently flooded tall shrubland community. It occurs on stream banks and swales. *Equisetum arvense* (field horsetail) forms a thick carpet beneath young to mature alder shrubs. Few grasses or forbs occur with *Equisetum arvense* in the understory.

This plant association occurs on stream banks and in meadows adjacent to streams. Soils are shallow 25 inches (60 cm). Textures range from sandy to silty clay loam. Water tables appear to be shallow with mottling near the soil surface.

Vegetation Description

Alnus incana ssp. *tenuifolia* (thinleaf alder) dominates the overstory of this plant association with 30-70% cover. Other shrubs include *Lonicera involucrata* (twinberry honeysuckle), *Ribes inerme* (whitestem gooseberry), *Salix ligulifolia* (strapleaf willow), *Salix geyeriana* (Geyer willow), *Salix lucida* ssp. *caudata* (shining willow), and *Salix monticola* (mountain willow). The herbaceous understory is dominated by *Equisetum arvense* (field horsetail). Additional herbs include *Epilobium angustifolium* ssp. *circumvagum* (fireweed), *Heracleum maximum* (common cowparsnip), and *Taraxacum officinale* (dandelion) but each with less than 10% cover.

Ecological Processes

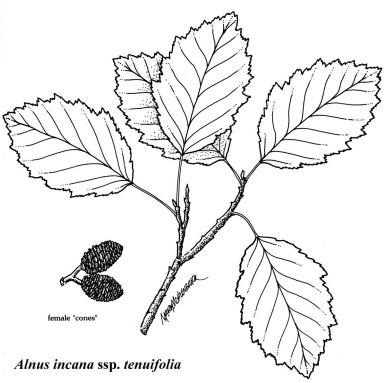
Alnus incana ssp. *tenuifolia* (thinleaf alder) is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining. After establishment, young stands of *Alnus* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils

begin to develop. *Alnus incana* ssp. *tenuifolia* is shade-intolerant, and many mature stands in Colorado are restricted to stream bank edges, possibly because these are the only sites where light can penetrate the neighboring overstory canopy.

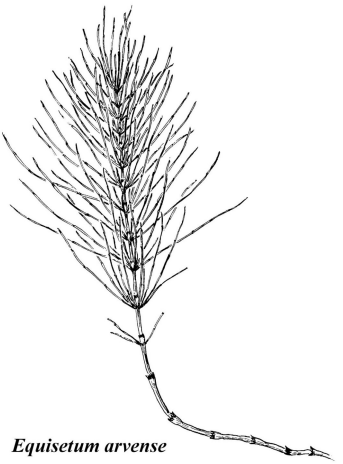
The dominance of *Equisetum arvense* in the understory of this plant association is an indication of recent scouring by floods.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
53	(30-70%)	Alnus incana ssp. tenuifolia	3
50	—	Carex disperma	1
32	(15-50%)	Equisetum arvense	3
15	—	Pyrola chlorantha	1
10	—	Cardamine cordifolia	1
10	—	Poa pratensis	1
10	—	Picea engelmannii	1
7	(3-10%)	Chamerion angustifolium ssp. circumvagum	2
6	(1-10%)	Heracleum maximum	2
6	(1-10%)	Taraxacum officinale	2
5	—	Swertia perennis	1

Other species with < 5% average cover present in at least 10% of plots:
Carex hassei (3-3%), Thalictrum sparsiflorum (3-3%), Agrostis stolonifera (3-3%), Actaea rubra ssp. arguta (3-3%), Salix lucida ssp. caudata, lasiandra (3-3%), Rudbeckia laciniata var. ampla (3-3%), Salix ligulifolia (3-3%), Ribes inerme (3-3%), Populus angustifolia (3-3%), Picea pungens (3-3%), Salix geyeriana (3-3%), Salix monticola (3-3%), Lonicera involucrata (3-3%), Geum macrophyllum var. perincisum (1-5%), Rosa woodsii (1-3%), Ligusticum porteri (1%), Geranium richardsonii (1%), Mertensia ciliata (1%), Oxypolis fendleri (1%), Vicia americana (1%), Hydrophyllum fendleri (1%), Galium boreale (1%), Fragaria virginiana ssp. glauca (1%), Erigeron speciosus var. speciosus (1%), Elymus repens (1%), Dactylis glomerata (1%), Cirsium eatonii (1%), Carex microptera (1%), Geranium viscosissimum var. incisum (1%), Carex aquatilis (1%), Betula nana (1%), Arnica cordifolia (1%), Arctostaphylos uva-ursi (1%), Carex utriculata (1%), Rubus idaeus ssp. strigosus (1%), Galium triflorum (1%), Phleum alpinum (1%), Nassella viridula (1%), Mentha arvensis (1%), Viola adunca (1%), Solidago simplex ssp. simplex var. simplex (1%), Aconitum columbianum (1%), Glyceria striata (1%), Streptopus amplexifolius var. chalazatus (1%), Phleum pratense (1%).



Alnus incana* ssp. *tenuifolia


Equisetum arvense

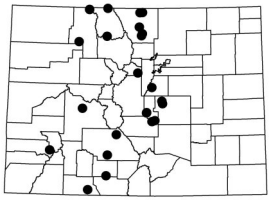
Thinleaf alder / Mesic forb Shrubland

Alnus incana ssp. *tenuifolia* / Mesic forb

Global rank/State rank:
G3 / S3

HGM subclass: R2, R3/4

Colorado elevation range:
5,800-9,600 ft (1,750-2,930 m)



General Description

This association is characterized by stands of medium-tall, deciduous shrubs and a thick, herbaceous undergrowth of forbs and wetland grasses. A low canopy of shorter shrubs may also be present with *Ribes* (currant) and *Salix* (willow) species and *Cornus sericea* (red-osier dogwood). Undisturbed stands have abundant forbs and native grasses. Stands disturbed by season-long livestock grazing have reduced forb cover and an increase in non-native grasses including *Poa pratensis* (Kentucky bluegrass) and *Agrostis stolonifera* (creeping bentgrass). Large stands (>0.5 acre, 0.2 ha) with the native herbaceous undergrowth intact are uncommon.

This plant association occurs along narrow, 130-230 ft (40-70 m) wide, alluvial benches and terraces of canyons and valleys. It also occurs as narrow bands in wider valleys and occasionally forms a wide band on the floodplain. Stream channels are highly variable. They can be steep (3-12%) gradient and narrow or wider, rocky, and moderately sinuous. Occasionally, stream channels are low gradient and highly sinuous, narrow and highly sinuous, or braided. Soils are well drained silt loams, loams, sandy clay loams, sandy loams, or just sand. Some profiles have a high percentage of organic matter and are either skeletal or stratified with skeletal layers. Some profiles have significant silt fractions in the upper layers.

Vegetation Description

Alnus incana ssp. *tenuifolia* (thinleaf alder) creates a dense, tall shrub canopy. Other shrubs occasionally present include *Lonicera involucrata* (twinberry honeysuckle), *Ribes inerme* (whitestem gooseberry), *R. montigenum* (gooseberry currant) *Rosa woodsii* (Woods rose), *Salix bebbiana* (Bebb willow), *S. drummondiana* (Drummond willow), *S. geyeriana* (Geyer willow), *S. lucida* ssp. *caudata* (shining willow) and *S. monticola* (mountain willow). A few trees, including *Picea engelmannii* (Engelmann

spruce), *Populus tremuloides* (quaking aspen), and *Populus angustifolia* (narrowleaf cottonwood) may be present along the edges of the stand.

The ground is generally very wet and covered with tall, 3-7 ft (1-2 m), forbs and graminoids. Forb cover is high in undisturbed stands, with total cover often exceeding 60%. Dominant forb species include *Heracleum maximum* (common cowparsnip), *Angelica ampla* (giant angelica), *Aconitum columbianum* (Columbian monkshood), *Mertensia ciliata* (tall fringed bluebells), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Viola canadensis* var. *scopulorum* (Canada white violet) and *Streptopus amplexifolius* (claspleaf twistedstalk). Graminoid species include *Glyceria striata* (fowl mannagrass), *Calamagrostis canadensis* (bluejoint reedgrass), *Carex microptera* (smallwing sedge), and *C. utriculata* (beaked sedge) A dense ground cover also includes *Equisetum arvense* (field horsetail), *Equisetum hyemale* (scouringrush horsetail) and *Equisetum pratense* (meadow horsetail).

Ecological Processes

Alnus incana ssp. *tenuifolia* (thinleaf alder) is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining. After establishment, young stands of *Alnus incana* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils begin to develop.

Avg. Cover %	(Range)	Species Name	# Plots (N=56)
56	(10-98%)	Alnus incana ssp. tenuifolia	56
14	(0.1-70%)	Heracleum maximum	42
12	(1-70%)	Aconitum columbianum	27
9	(0.1-18%)	Picea engelmannii	14
8	(1-62.5%)	Senecio triangularis	27
7	(1-40%)	Mertensia ciliata	40
7	(1-20%)	Salix drummondiana	15
7	(1-20%)	Rudbeckia laciniata var. ampla	13
7	(1-20%)	Populus tremuloides	14
7	(1-18%)	Salix geyeriana	8
7	(1-70%)	Rosa woodsii	14
6	(1-30%)	Ribes inerme	12
6	(1-32%)	Salix lucida ssp. caudata, lasiandra	11
6	(1-30%)	Lonicera involucrata	25
6	(1-16%)	Salix monticola	13
6	(1-30%)	Equisetum arvense	39
5	(1-25%)	Cardamine cordifolia	21
5	(1-13%)	Urtica dioica ssp. gracilis	13
5	(1-20%)	Calamagrostis canadensis	31
5	(1-11%)	Salix bebbiana	7

Other species with < 5% average cover present in at least 10% of plots:
Maianthemum stellatum (0.1-27%), Glyceria striata (0.1-15%), Geranium richardsonii (1-15%), Elymus glaucus (1-10%), Mentha arvensis (1-14%), Oxypolis fendleri (1-37.5%), Rubus idaeus ssp. strigosus (1-15%), Carex utriculata (1-6%), Poa pratensis (1-12%), Streptopus amplexifolius var. chalazatus (0.1-10%), Saxifraga odontoloma (1-5%), Taraxacum officinale (1-13%), Conioselinum scopulorum (1-10%), Abies lasiocarpa (1-6%), Arnica cordifolia (1-11%), Mitella pentandra (1-6%), Galium boreale (1-10%), Carex aquatilis (1-5%), Galium triflorum (1-5%), Osmorhiza depauperata (1-5%), Thalictrum fendleri (1-5%), Achillea millefolium var. occidentalis (1-8%), Actaea rubra ssp. arguta (1-5%), Phleum pratense (0.1-10%), Bromus inermis (1-5%), Fragaria virginiana ssp. glauca (1-3%), Geum macrophyllum var. perincisum (0.1-3%), Carex microptera (1-3%), Chamerion angustifolium ssp. circumvagum (1%).

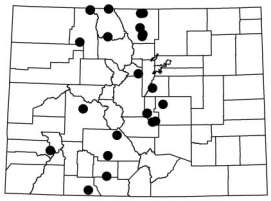
Thinleaf alder / Mesic graminoid Shrubland

Alnus incana ssp. *tenuifolia* / Mesic graminoid

Global rank/State rank:
G3/ S3

HGM subclass: S3/4, R2, R3/4

Colorado elevation range:
6,400-9,800 ft (2,000-3,000 m)



General Description

The *Alnus incana* ssp. *tenuifolia*/mesic graminoid plant association is a stand of medium-tall deciduous shrubs with a thick herbaceous cover of mostly native forb and grass species and little to no overstory tree canopy. Heavily disturbed stands have abundant non-native grasses. While many stands in Colorado fit the latter description, there are also several stands that remain undisturbed where the undergrowth is dominated by native graminoid cover.

This plant association occurs on narrow to moderately wide floodplains, stream benches, frequently flooded pointbars, recently deposited islands, and dredged stream banks. It also occurs on isolated hillside seeps. Stream channels can be steep and straight to highly sinuous or moderately steep and sinuous. Where this association occurs on point bars, stream channels are low gradient (<1%) and highly sinuous. Soils are mostly coarse alluvium, but characteristically have silt loams or sandy clay loams at the surface with a high percentage of organic matter. Soils are shallow to moderately deep, 15-30 inches (35-62 cm), and become increasingly skeletal with depth. Most profiles have 10-50% mottles at 7-10 inches (18-25 cm) depth.

Vegetation Description

Alnus incana ssp. *tenuifolia* (thinleaf alder) dominates the upper canopy. Other shrubs occasionally present include *Rosa woodsii* (Woods rose), *Rubus deliciosus* (Boulder raspberry), *Salix bebbiana* (Bebb willow), *S. drummondiana* (Drummond willow), *S. exigua* (sandbar willow), and *S. monticola* (mountain willow). Trees are infrequent and may be scattered throughout the shrubland or they may occur along one edge. Tree species include *Pinus ponderosa* (ponderosa pine), *Populus tremuloides* (quaking aspen), and *Picea engelmannii* (Engelmann spruce).

The undergrowth is a thick carpet of grasses. Native graminoids include *Calamagrostis canadensis* (bluejoint reedgrass), *Carex utriculata* (beaked sedge), *Glyceria striata* (fowl mannagrass), *Carex aquatilis* (water sedge), *Carex pellita* (woolly sedge) and *Festuca rubra* (red fescue). Some stands are dominated by introduced, non-native grasses, including *Poa pratensis* (Kentucky bluegrass), *Agrostis stolonifera* (creeping bentgrass), and *Bromus inermis* (smooth brome). Forb cover is usually low relative to the amount of graminoid cover in both disturbed and undisturbed stands, but can include a high variety of species, including *Mertensia ciliata* (tall fringed bluebells), *Mentha arvensis* (wild mint), *Cardamine cordifolia* (heartleaf bittercress) and *Caltha leptosepala* (marsh marigold).

Ecological Processes

Alnus incana ssp. *tenuifolia* (thinleaf alder) is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining. After establishment, young stands of *Alnus* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils begin to develop. *Alnus incana* ssp. *tenuifolia* is shade-intolerant, and many mature stands in Colorado are restricted to stream bank edges, possibly because these are the only sites where light can penetrate the neighboring overstory canopy.

Avg. Cover %	(Range)	Species Name	# Plots (N=25)
56	(8-95%)	Alnus incana ssp. tenuifolia	25
27	(1-65%)	Calamagrostis canadensis	14
15	(1-41%)	Poa pratensis	16
12	(2-26%)	Salix exigua	8
11	(2-26%)	Glyceria striata	6
10	(1-19%)	Carex disperma	4
10	(1-29%)	Salix bebbiana	4
10	(3-19%)	Betula occidentalis	4
9	(1-48%)	Rosa woodsii	8
9	(1-25%)	Agrostis stolonifera	6
9	(1-32%)	Carex utriculata	7
7	(1-23%)	Bromus inermis	5
6	(1-10%)	Pinus ponderosa var. scopulorum	5
6	(1-14%)	Salix ligulifolia	5
6	(1-20%)	Carex aquatilis	8
6	(1-15%)	Mertensia ciliata	12
5	(3-7%)	Carex microptera	5

Other species with < 5% average cover present in at least 10% of plots:
Heracleum maximum (1-11%), Salix monticola (1-16%), Juncus balticus var. montanus (1-10%), Mentha arvensis (0.1-14%), Equisetum arvense (1-14%), Cardamine cordifolia (1-8%), Ribes inerme (1-8%), Taraxacum officinale (1-14%), Trifolium repens (1-7%), Achillea millefolium var. occidentalis (1-13%), Geum macrophyllum var. perincisum (1-5%), Urtica dioica ssp. gracilis (1-5%), Galium boreale (1-3%), Rubus idaeus ssp. strigosus (1-5%), Geranium richardsonii (1-4%), Phleum pratense (1-2%), Fragaria virginiana ssp. glauca (1-2%), Oxypolis fendleri (1-2%), Maianthemum stellatum (0.1-2%).

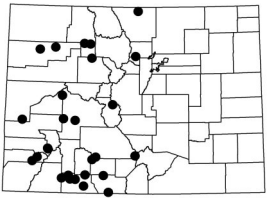
Thinleaf alder - Mixed willow (Mountain willow, Shining willow, Strapleaf willow) Shrubland

Alnus incana ssp. *tenuifolia - Salix (monticola, lucida, ligulifolia)*

Global rank/State rank:
G3 / S3

HGM subclass: R3/4

Colorado elevation range:
5,600-9,600 ft (1,700-2,930 m)



General Description

The *Alnus incana* ssp. *tenuifolia*/*Salix (monticola, lucida, ligulifolia)* (thinleaf alder/mixed willow species) plant association is a more general type than other *Alnus incana* ssp. *tenuifolia* types. It has a high diversity of associated shrub species, unlike the nearly pure stands of alder found in other *Alnus incana* ssp. *tenuifolia* dominated plant associations. The abundance of other shrubs may represent a transition in the physical setting, for example, from a broad floodplain dominated by *Salix* to a narrow valley bottom and channel lined with only *Alnus incana* ssp. *tenuifolia* (thinleaf alder).

This association occurs along narrow, moderately steep streams (30-65 ft (10-20 m) wide with a gradient of 3-10%) and in moderately wide to wide river valleys on cobble point bars, islands, flat alluvial benches, and large alluvial floodplains. Stream channels are steep and narrow, moderately steep and wide, or wide and sinuous. Soils are poorly developed with loamy sands, sand, sandy loams, and silt loams over coarse alluvium.

Vegetation Description

This plant association is characterized by the dominance of *Alnus incana* ssp. *tenuifolia* (thinleaf alder). There is considerable variation of associated shrub species in the stands. Several willow species are often present, but no single willow species consistently occurred in all stands. Other shrubs frequently present include *Salix lucida* (ssp. *caudata* or ssp. *lasiandra*) (shining willow), *S. monticola* (mountain willow), *S. drummondiana* (Drummond willow), *S. bebbiana* (Bebb willow), *S. exigua* (sandbar willow), *S. geyeriana* (Geyer willow), *S. ligulifolia* (strapleaf willow), *Acer glabrum* (Rocky Mountain maple), and *Amelanchier utahensis* (Utah serviceberry). Tree cover is sparse, but can include *Picea pungens* (blue spruce), *Populus tremuloides* (quaking aspen), *P. angustifolia* (narrowleaf cottonwood) and *Picea engelmannii* (Engelmann spruce).

The herbaceous undergrowth is varied with 10-90% total cover. Native herbaceous species include *Equisetum arvense* (field horsetail), *Heracleum maximum* (common cowparsnip), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Mertensia ciliata* (tall fringed bluebells) , *Calamagrostis canadensis* (bluejoint reedgrass) *Cardamine cordifolia* (heartleaf bittercress) and *Carex utriculata* (beaked sedge). Introduced species include *Trifolium repens* (white clover), *Taraxacum officinale* (dandelion) and *Poa pratensis* (Kentucky bluegrass)

Ecological Processes

In Colorado, the *Alnus incana* ssp. *tenuifolia* -mixed *Salix* species plant association may represent response to recent changes in the environment. Several stands occur on abandoned beaver dams, for example. This shift in the physical environment may explain the diverse mix of shrub species in the canopy. If the water table lowers, this plant association may succeed to a more stable, drier community dominated by *Salix geyeriana* (Geyer willow) or *Populus tremuloides* (quaking aspen). Other stands appear to be disturbed by livestock grazing and may represent a grazing-induced stage of the *Alnus incana* ssp. *tenuifolia/*mesic forb plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=28)
44	(5-100%)	Alnus incana ssp. tenuifolia	28
20	(3-50%)	Salix lucida ssp. caudata, lasiandra	17
19	(1-40%)	Salix ligulifolia	11
17	(1-57%)	Salix monticola	16
15	(3-39%)	Salix bebbiana	8
13	(1-70%)	Poa pratensis	20
12	(3-30%)	Salix geyeriana	6
12	(1-39%)	Salix exigua	13
10	(1-38%)	Calamagrostis canadensis	10
9	(1-27%)	Ribes inerme	11
9	(1-40%)	Salix drummondiana	10
8	(1-27%)	Trifolium repens	8
8	(1-30%)	Equisetum arvense	17
7	(3-13%)	Populus angustifolia	9
7	(1-21%)	Heracleum maximum	18
7	(1-15%)	Aconitum columbianum	5
7	(1-25%)	Mertensia ciliata	12
7	(1-22%)	Rudbeckia laciniata var. ampla	11
6	(1-30%)	Rosa woodsii	15
6	(1-20%)	Phleum pratense	10
6	(1-20%)	Picea pungens	6
6	(1-22%)	Mertensia franciscana	5
6	(1-18%)	Poa palustris	5
6	(1-15%)	Agrostis gigantea	5
5	(1-20%)	Dactylis glomerata	5
5	(1-20%)	Taraxacum officinale	21

Other species with < 5% average cover present in at least 10% of plots:
Glyceria striata (1-15%), Rubus idaeus ssp. strigosus (1-11%), Geranium richardsonii (1-17%), Cardamine cordifolia (1-19%), Lonicera involucrata (1-15%), Oxypolis fendleri (1-15%), Mentha arvensis (1-10%), Carex utriculata (1-10%), Achillea millefolium var. occidentalis (1-10%), Geum macrophyllum var. perincisum (0.1-10%), Juncus balticus var. montanus (1-8%), Urtica dioica ssp. gracilis (1-4%), Carex microptera (1-5%), Maianthemum stellatum (0.1-5%), Vicia americana (1-3%), Osmorhiza depauperata (1-3%), Galium boreale (1-2%).

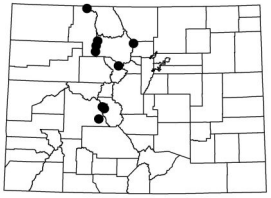
Bog birch / Mesic forb - Mesic graminoid Shrubland

Betula nana (=glandulosa) / Mesic forb - Mesic graminoid

Global rank/State rank:
G3G4 / S3

HGM subclass: S1/2, R1, R2

Colorado elevation range:
8,200-11,000 ft (2,500-3,350 m)



General Description

The *Betula nana (=glandulosa)*/mesic forb-mesic graminoid (bog birch/mesic forb-mesic graminoid) plant association is a low stature (2-3 ft, 0.3-1 m) open shrubland of subalpine and lower alpine elevations. It occurs intermixed with *Salix* (willow) shrublands and *Carex* (sedge) meadows, forming complex wetland mosaics. It typically grows in very wet peat fens. This association is documented throughout high mountain ranges of Colorado, although typically occurring only in small stands.

Most stands of this association occur within a mosaic of subalpine meadows or willow communities. It grows in areas where soils are saturated from snowmelt runoff for a significant part of the growing season, often in fens, where the vegetation receives water from seeps and springs. Stream channels may be wide and slightly sinuous. Soils are deep peats and moderately deep (9-12 in, 23-30 cm) silty clay loams over gravels with a water table 10-48 inches (25-120 cm) deep.

Vegetation Description

Betula nana (=glandulosa) (bog birch) is the dominant shrub in the canopy. Several other shrubs may be present; however, none are as abundant as *Betula.* Shrub species occasionally present include *Dasiphora floribunda* (shrubby cinquefoil), *Salix wolfii* (Wolf willow), *S. planifolia* (planeleaf willow), *S. brachycarpa* (barrenground willow), *S. monticola* (mountain willow), and *Lonicera involucrata* (twinberry honeysuckle).

The herbaceous undergrowth grows on small hummocks and is usually dominated by a dense mixture of mesic forbs and graminoids. Mesic graminoid species include

Calamagrostis canadensis (bluejoint reedgrass), *Carex aquatilis* (water sedge), *C. utriculata* (beaked sedge), *C. norvegica* (Norway sedge), *Deschampsia caespitosa* (tufted hairgrass), and *Phleum alpinum* (alpine timothy). Forb species include *Achillea millefolium* var. *occidentalis* (western yarrow), *Fragaria virginiana* (strawberry), *Galium boreale* (northern bedstraw), *Epilobium angustifolium* (fireweed), *Caltha leptosepala* (marsh marigold), *Ligusticum tenuifolium* (Idaho licoriceroot), *Angelica pinnata* (small-leaf angelica), *Mertensia ciliata* (tall fringed bluebells), *Thalictrum alpinum* (alpine meadowrue), and *Conioselinum scopulorum* (Rocky Mountain hemlockparsley).

Due to their small size, *Betula nana (=glandulosa)* (bog birch) communities often inter-grade with surrounding communities.

Ecological Processes

This plant association appears to be a long-lived mid- to late-seral community. As peatland hummocks develop or become more pronounced, they may become more heavily dominated by *Salix* (willow) species. Due to cold temperatures and a short growing season, this process may take several decades to occur.

Avg. Cover %	(Range)	Species Name	# Plots (N=10)
44	(20-80%)	Betula nana	10
21	(3-80%)	Carex aquatilis	5
17	(3-50%)	Picea engelmannii	4
16	(10-25%)	Salix planifolia	5
13	(3-30%)	Poa pratensis	3
12	(3-20%)	Salix monticola	4
12	(3-30%)	Salix brachycarpa	5
11	(3-20%)	Pinus contorta	3
9	(1-30%)	Calamagrostis canadensis	4
9	(1-21%)	Salix wolfii	7
9	(1-20%)	Dasiphora floribunda	8
9	(3-11%)	Ligusticum tenuifolium	4
8	(1-10%)	Chamerion angustifolium ssp. circumvagum	4
6	(1-11%)	Lonicera involucrata	4
6	(1-25%)	Fragaria virginiana ssp. glauca	7
6	(1-10%)	Caltha leptosepala	4
6	(1-20%)	Trisetum wolfii	4
6	(1-10%)	Carex utriculata	2
5	(1-10%)	Deschampsia caespitosa	5

Other species with < 5% average cover present in at least 10% of plots:
Bromus ciliatus var. ciliatus (1-8%), Galium boreale (1-13%), Poa reflexa (1-10%), Taraxacum officinale (1-12%), Conioselinum scopulorum (1-10%), Salix boothii (3-3%), Mertensia ciliata (1-10%), Geum macrophyllum var. perincisum (1-4%), Polygonum bistortoides (1-7%), Geum triflorum var. triflorum (1-4%), Thalictrum alpinum (2-3%), Arnica cordifolia (1-3%), Geranium richardsonii (1-3%), Juncus drummondii (1-3%), Trollius laxus ssp. albiflorus (1-3%), Symphyotrichum foliaceum (1-3%), Maianthemum stellatum (1-3%), Castilleja sulphurea (1-3%), Valeriana edulis (1-2%), Phleum alpinum (1-3%), Achillea millefolium var. occidentalis (1-3%), Luzula parviflora (1-2%), Polygonum viviparum (1%), Aconitum columbianum (1%), Veronica wormskjoldii (1%), Stellaria umbellata (1%), Pedicularis groenlandica (1%), Luzula comosa (1%), Trisetum spicatum (1%), Carex norvegica (1%), Equisetum arvense (1%), Rhodiola rhodantha (0.1%).

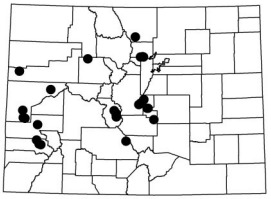
River birch / Mesic forb Shrubland

Betula occidentalis / Mesic forb

Global rank/State rank:
G3 / S2

HGM subclass: R3/4

Colorado elevation range:
6,300-8,800 ft (1,900-2,700 m)



General Description

This association is characterized by a tall, narrow band of shrubs lining the stream channel. The undergrowth can be sparse or a thick carpet of grasses and forbs. In undisturbed stands, forb species richness can be high.

This association occupies moderately wide stream benches and floodplains in narrow to moderately wide valleys and on hillside seeps. At lower elevations along sunny valley bottoms, well-developed, large occurrences occupy relatively flat stream benches and often extend away from the channel edge. Stream channels are wide, rocky/cobble-bottomed, moderately steep, and sinuous, wide, cobble-bottomed, less steep, and highly sinuous, or braided from beaver activity. This association also occurs along small floodplains of steep-gradient, narrow streams where the valley side slope meets the stream edge. In such settings *Betula occidentalis* (river birch) is squeezed between large boulders and herbaceous growth is limited to small pockets, or is found around seeps adjacent to the stream channel and along isolated springs on hillslopes away from the valley bottom (these may be in different HGM subclasses). Soils are fairly shallow, ranging from 12 to 25+ inches (30-60+ cm). and have a surface layer of 50-90% organic matter. Subsurface layers are clay loams, sandy clays, and sandy loams. Stands along narrow, steep stream channels occur between large alluvial and colluvial boulders and have almost no soil development.

Vegetation Description

Betula occidentalis (river birch) forms a nearly continuous tall-shrub to small-tree canopy along the stream bank. Other shrubs may include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Cornus sericea* (red-osier dogwood), *Salix exigua* (sandbar willow), *Jamesia americana* (cliffbush), *Amelanchier utahensis* (Utah serviceberry), *Prunus*

virginiana (chokecherry), and *Salix monticola* (mountain willow). Along narrow valleys at higher elevations, conifers may overhang the stream edge. Conifer species include *Pseudotsuga menziesii* (Douglas-fir), *Abies lasiocarpa* (subalpine fir), *Picea pungens* (blue spruce), and *Pinus ponderosa* (ponderosa pine).

Although some stands have considerable herbaceous cover, herbaceous undergrowth is usually limited due to the dense shrub canopy. Forb cover can include *Maianthemum stellatum* (starry false Solomon seal), *Heracleum maximum* (common cowparsnip), *Thalictrum fendleri* (Fendler meadowrue) and *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower). Graminoid cover is usually low, but can include *Poa pratensis* (Kentucky bluegrass), *Carex utriculata* (beaked sedge), *Juncus balticus* var. *montanus* (mountain rush), *Calamagrostis canadensis* (bluejoint reedgrass), and *Agrostis stolonifera* (creeping bentgrass). *Equisetum arvense* (field horsetail) may also be present.

Ecological Processes

This association is considered a mid-seral type. With prolonged heavy grazing, it may succeed to a *Salix* (willow) dominated association. It may also be an early successional stage for conifer-dominated associations. *Betula occidentalis* can tolerate flooding, but not permanent inundation. *Betula occidentalis* occurs at slightly lower elevations and on lower- gradient stream reaches than *Alnus incana* ssp. *tenuifolia* (thinleaf alder). Because *Betula occidentalis* communities occupy low elevation, foothill habitats in Colorado, they are more threatened by development and stream impoundments than *Alnus incana* ssp. *tenuifolia* or *Cornus sericea* (red-osier dogwood) riparian communities.

Avg. Cover %	(Range)	Species Name	# Plots (N=26)
55	(14-98%)	Betula occidentalis	26
18	(1-53%)	Cornus sericea ssp. sericea	11
16	(1-66%)	Pseudotsuga menziesii	7
16	(1-60%)	Angelica ampla	5
12	(8-21%)	Picea pungens	5
11	(1-38%)	Salix monticola	8
10	(1-40%)	Alnus incana ssp. tenuifolia	16
10	(1-30%)	Lonicera involucrata	5
10	(1-40%)	Maianthemum stellatum	19
9	(1-34%)	Poa pratensis	16
8	(1-34%)	Heracleum maximum	11
7	(1-16%)	Calamagrostis canadensis	5
7	(1-25%)	Salix exigua	8
7	(1-23%)	Carex utriculata	5
7	(4-13%)	Agrostis stolonifera	5
6	(1-17%)	Juniperus scopulorum	9
6	(1-36%)	Equisetum arvense	15
6	(1-17%)	Juncus balticus var. montanus	12
5	(1-18%)	Rosa woodsii	19
5	(1-17%)	Prunus virginiana var. melanocarpa	6

Other species with < 5% average cover present in at least 10% of plots:
Thalictrum fendleri (1-21%), Equisetum hyemale var. affine (1-10%), Geranium richardsonii (1-10%), Rubus idaeus ssp. strigosus (1-10%), Rudbeckia laciniata var. ampla (1-10%), Ribes inerme (0.1-10%), Cirsium arvense (0.1-5%), Mertensia ciliata (1-2%), Achillea millefolium var. occidentalis (1-3%), Vicia americana (1-2%), Galium boreale (0.1-2%), Taraxacum officinale (0.1-2%).

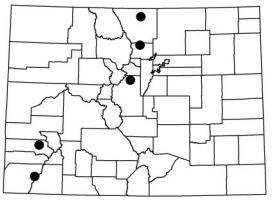
River birch / Mesic graminoid Shrubland

Betula occidentalis / Mesic graminoid

Global rank/State rank:
G3 / S2

HGM subclass: R3/4

Colorado elevation range:
6,900-9,300 ft (2,100-2840 m)



General Description

The *Betula occidentalis*/mesic graminoid (water birch/mesic graminoid) plant association is a tall (5-8 ft, 1.5-2.5 m), narrow band of shrubs lining a stream channel. When equally commingled with *Alnus incana* ssp. *tenuifolia* (thinleaf alder) or *Salix* spp. (willows), *Betula occidentalis* is the diagonistic species, and will key to a *Betula* (birch) type. The undergrowth is a sparse to thick carpet of grasses and grass-like plants with only a few forbs present. It occupies wetter sites than the *Betula occidentalis*/mesic forb (water birch/mesic forb) plant association. In Colorado, large, near-pristine stands are rare.

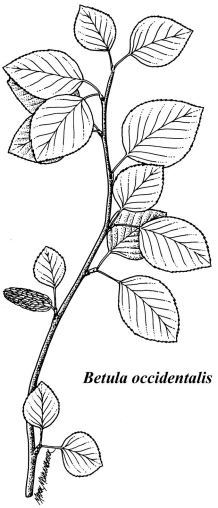
This plant association generally occurs on moderately wide to wide floodplains in bands up to 115 ft (35 m) wide, that often extend well away from the channel edge. This association also occurs in small patches at higher elevations and around seeps and isolated springs on hillslopes away from the valley bottom. Stream channels are wide, meandering, and cobble-bottomed. Soils are deep pockets of sandy loams with signs of mottling within the top 12 inches (30 cm).

Vegetation Description

Betula occidentalis (river birch) is the diagnostic species. It may be co-dominant with *Alnus incana* ssp. *tenuifolia* (thinleaf alder) or a variety of *Salix* spp. (willows). *Betula occidentalis* (river birch) forms a dense canopy of 40-75% cover. *Salix monticola* (mountain willow), *S. planifolia* (planeleaf willow), and *S. bebbiana* (Bebb willow) may be present. *Picea pungens* (blue spruce) and *Juniperus scopulorum* (Rocky Mountain juniper) may occur in the overstory, but with only about 1% cover each. Due to the dense shrub canopy, the herbaceous undergrowth may be limited in cover, but contains a diversity of species. Total graminoid cover generally exceeds that of total forb cover, but no single species is dominant. Graminoid species that may be present include *Carex pellita* (woolly sedge), *C. deweyana* (Dewey sedge), and *C. utriculata* (beaked sedge). Forb species that may be present include *Achillea*

millefolium var. *occidentalis* (western yarrow), *Cardamine cordifolia* (heartleaf bittercress), *Heracleum maximum* (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), and *Vicia americana* (American vetch).

Ecological Processes


Betula occidentalis

The *Betula occidentalis*/mesic graminoid (river birch/mesic graminoid) plant association occupies wetter habitats than the *Betula occidentalis*/mesic forb plant association. Stands dominated by *Carex pellita* (woolly sedge) or *Carex deweyana* (Dewey sedge) indicate undisturbed sites. Grazing pressure can eliminate native sedges, which are then replaced by non-native grasses, including *Agrostis stolonifera* (creeping bentgrass) and *Poa pratensis* (Kentucky bluegrass).

Betula occidentalis (river birch) can tolerate flooding, but not a permanent inundation of water. *Betula occidentalis* occurs at slightly lower elevations and on lower- gradient stream reaches than *Alnus incana* ssp. *tenuifolia* (thinleaf alder). Because *Betula occidentalis* communities occupy low elevation, foothill habitats in Colorado, they are more threatened by development and stream impoundments than *Alnus incana* ssp. *tenuifolia* or *Cornus sericea* (red-osier dogwood) riparian communities. Consequently, few undisturbed and unaltered stands exist today.

Avg. Cover %	(Range)	Species Name	# Plots (N=5)
57	(40-75%)	Betula occidentalis	5
22	(3-40%)	Carex pellita	2
16	(1-41%)	Poa pratensis	4
16	(1-30%)	Picea pungens	2
13	(1-25%)	Heracleum maximum	2
12	(3-20%)	Alnus incana ssp. tenuifolia	2
7	(3-10%)	Carex utriculata	2
7	(3-10%)	Phleum pratense	2
6	(2-10%)	Ribes inerme	2
6	(1-10%)	Calamagrostis canadensis	2
5	(1-9%)	Glyceria striata	2

Other species with < 5% average cover present in at least 10% of plots:
Rosa woodsii (1-7%), Juniperus scopulorum (2-5%), Achillea millefolium var. occidentalis (1%), Galium boreale (1%), Populus angustifolia (1%), Rubus idaeus ssp. strigosus (1%), Vicia americana (1%), Taraxacum officinale (1%), Maianthemum stellatum (0.1-1%).

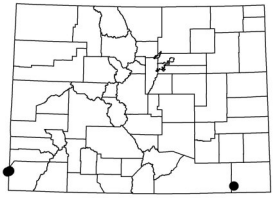
Netleaf hackberry Woodland

Celtis laevigata var. *reticulata*

Global rank/State rank:
G1G2Q / S1S2

HGM subclass: R3/4

Colorado elevation range:
4,700-5,500 ft (1,400-1,700 m)



General Description

In southwestern Colorado, the *Celtis laevigata* var. *reticulata* (netleaf hackberry) riparian shrubland occurs as small pockets or groves of netleaf hackberry trees at the base of sandstone cliffs at the head of box canyons where permanent springs feed an ephemeral stream. In southeastern Colorado, it occurs in small stands along elevated streambanks and terraces of perennial, spring-fed streams. The trees are of small stature, so from a distance it looks like a shrubland. However, in southwestern Colorado, individual trees growing right out of a spring can be quite large, more than 30 ft (9 m) tall and 2 ft (0.6 m) dbh, and exceed the height of the canyon rim by several feet.

In southwest Colorado, streams are first order, steep for the first 100 feet or so, sandy-bottom ephemeral channels originating from springs. In southeast Colorado, streams are second and third order, have gravel or bedrock beds, and are spring-fed perennial channels. Deep pools 30-65 ft (10-20 m) long and up to 6 ft (2 m) deep form at some bedrock constrictions. Soils are shallow sands to pure rock in southwestern Colorado. In southeastern Colorado, soils are deep silty loams over cobble-sized alluvium.

Vegetation Description

This association is characterized by small pockets or groves of *Celtis laevigata* var. *reticulata* (netleaf hackberry). *Celtis* (hackberry) is typically a small or stunted tree, but individuals growing right in springs at Hovenweep National Monument are large, straight trees, more than 30 ft (9 m) tall and 2 ft (0.6 m) dbh. The stand in the Arkansas River drainage may have been dominated by *Celtis occidentalis* (common hackberry), as the soil type might suggest. However, specimens were not collected, so the stand will be tracked as *Celtis laevigata* var. *reticulata* (netleaf hackberry) until more information is gathered to suggest otherwise.

Other woody species that may be present include *Salix gooddingii* (Goodding willow), *Fraxinus anomala* (single-leaf ash), *Rhus trilobata* (skunkbush sumac), and *Artemisia*

tridentata (big sagebrush). The herbaceous undergrowth is dry and weedy with *Bromus tectorum* (cheatgrass), *Arctium minus* (lesser burdock), *Chrysothamnus* spp. seedlings (rabbitbrush), *Heterotheca villosa* (hairy goldenaster) and *Ambrosia artemisiifolia* (annual ragweed). One stand had 20% cover of *Typha angustifolia* (narrowleaf cattail) growing in a pool underneath the *Celtis* canopy.

Ecological Processes

The successional status of *Celtis* shrublands is not known. Although *Celtis laevigata* var. *reticulata* (netleaf hackberry) is now found along watercourses in the western United States and northern Mexico, this plant has not always been restricted to intermittent and perennial streams. Several million years ago, the regional climate was much wetter and many tree species now found only along many steams thrived on slopes and plains. This deciduous forest included hackberry, cottonwood, willow, sycamore and many other sizable trees. Today, in a more arid climate, these species have retreated to the riparian zone, where they can find adequate and a more consistent source of water.

Avg. Cover %	(Range)	Species Name	# Plots (N=4)
77	—	Salix gooddingii	1
44	(32-54%)	Celtis laevigata var. reticulata	4
23	(2-46%)	Bromus tectorum	4
20	—	Typha angustifolia	1
11	—	Juniperus osteosperma	1
10	(3-17%)	Rhus trilobata var. trilobata	2
8	—	Deschampsia caespitosa	1
8	—	Elymus canadensis	1
7	—	Ambrosia artemisiifolia var. elatior	1
7	—	Verbascum thapsus	1
5	—	Carduus nutans ssp. macrolepis	1

Other species with < 5% average cover present in at least 10% of plots:
Cercocarpus montanus (4%), Chrysothamnus linifolius (4%), Sporobolus cryptandrus (4%), Artemisia tridentata (3%), Ambrosia trifida (2%), Heterotheca villosa (2%), Ericameria nauseosa ssp. nauseosa var. glabrata (1%), Artemisia filifolia (1%), Equisetum arvense (1%), Fraxinus anomala (1%), Opuntia polyacantha (1%), Pascopyrum smithii (1%), Salsola tragus (1%).

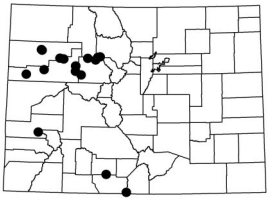
Red-osier dogwood Shrubland

Cornus sericea

Global rank/State rank:
G4Q / S3

HGM subclass: R3/4, R5

Colorado elevation range:
5,800-8,800 ft (1,760-2,680 m)



General Description

The *Cornus sericea* (red-osier dogwood) plant association is a medium-height (3-6 ft, 1-2 m), shrubland that often forms continuous, narrow bands along stream banks, benches, and bars. It can form very dense, small stands with limited disturbance, often at the base of a cliff.

This plant association occurs adjacent to stream channels and near seeps on moist toeslopes of canyon walls. It also occurs on narrow benches in ravines and on narrow terraces of wider valleys. Stream channels are narrow and moderately steep with gravel streambeds. The soils are relatively deep silty to sandy clay loams with stratified layers.

Vegetation Description

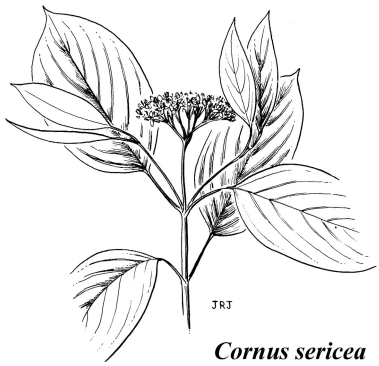
This plant association is characterized by a dense stand of *Cornus sericea* (red-osier dogwood). Other abundant shrub species, which may be present include *Rosa woodsii* (Woods rose), *Symphoricarpos oreophilus* (mountain snowberry), *Ribes inerme* (whitestem gooseberry), *Betula occidentalis* (river birch), *Acer glabrum* (Rocky Mountain maple), and *Alnus incana* ssp. *tenuifolia* (thinleaf alder). While trees occasionally occur in or adjacent to and overhang some stands, typically this shrubland has no overstory canopy. Scattered tree species may include mature *Populus angustifolia* (narrowleaf cottonwood), *Picea pungens* (blue spruce), *Pinus ponderosa* (ponderosa pine), or *Pseudotsuga menziesii* (Douglas-fir). The herbaceous undergrowth is highly variable and depends on the amount of sunlight reaching the ground. Commonly encountered forbs include *Maianthemum stellatum* (starry false Solomon seal), *Geranium richardsonii* (Richardson geranium), *Mertensia ciliata* (tall fringed bluebells), and *Urtica dioica* (stinging nettle). Some stands are without an herbaceous understory.

Ecological Processes

Cornus sericea (red-osier dogwood) forms a relatively stable community because of its ability to form dense thickets through vegetative reproduction. Subsequent succession takes place over a long period of time. In Montana, this plant association is considered to be early-seral since it colonizes stream bars and adjacent floodplains. With time, the association may eventually become dominated by conifer or deciduous tree species.

Avg. Cover %	(Range)	Species Name	# Plots (N=18)
50	(20-99%)	Cornus sericea ssp. sericea	18
22	(5-40%)	Equisetum hyemale var. affine	3
20	(1-50%)	Ribes aureum	3
18	(3-40%)	Betula occidentalis	7
12	(1-40%)	Salix exigua	8
11	(1-30%)	Clematis ligusticifolia	3
9	(1-20%)	Picea pungens	7
9	(1-20%)	Alnus incana ssp. tenuifolia	8
8	(1-21%)	Populus angustifolia	3
8	(1-16%)	Abies lasiocarpa	4
7	(1-20%)	Acer glabrum	7
6	(1-20%)	Salix drummondiana	8
5	(1-10%)	Phleum pratense	3
5	(1-10%)	Prunus virginiana var. melanocarpa	5
5	(1-10%)	Pseudotsuga menziesii	3

Other species with < 5% average cover present in at least 10% of plots:
Rudbeckia laciniata var. ampla (1-10%), Rosa woodsii (1-20%), Rhus trilobata var. trilobata (1-10%), Lonicera involucrata (1-10%), Poa pratensis (1-10%), Ribes inerme (1-10%), Humulus lupulus var. lupuloides (1-10%), Heracleum maximum (1-10%), Aconitum columbianum (1-5%), Juniperus scopulorum (2-5%), Maianthemum stellatum (1-19%), Symphoricarpos oreophilus (1-10%), Solidago canadensis (1-5%), Elymus glaucus (1-5%), Equisetum arvense (1-10%), Populus tremuloides (1-5%), Osmorhiza depauperata (1-5%), Amelanchier utahensis (1-10%), Juncus balticus var. montanus (1-5%), Bromus lanatipes (1-5%), Geum macrophyllum var. perincisum (1-5%), Angelica ampla (1-5%), Taraxacum officinale (1-5%), Geranium richardsonii (1-5%), Urtica dioica ssp. gracilis (1-10%), Viola canadensis var. scopulorum (1-5%), Thalictrum fendleri (1-5%), Galium triflorum (1-5%), Mertensia ciliata (1-5%), Actaea rubra ssp. arguta (1-5%), Carex utriculata (1-3%), Agrostis gigantea (1-2%), Cardamine cordifolia (1%), Maianthemum racemosum ssp. amplexicaule (1%), Rubus idaeus ssp. strigosus (1%), Sambucus racemosa var. racemosa (1%), Chamerion angustifolium ssp. circumvagum (1%), Paxistima myrsinites (1%), Symphyotrichum ascendens (1%), Salix ligulifolia (1%).



Cornus sericea

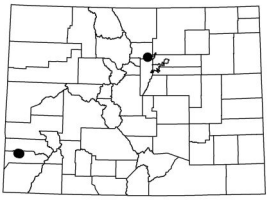
River hawthorn Shrubland

Crataegus rivularis

Global rank/State rank:
G2Q / S2

HGM subclass: R2, R3/4

Colorado elevation range:
5,500-8,000 ft (1,670-2,450 m)



General Description

The *Crataegus rivularis* (river hawthorn) plant association is a medium-tall (3-6 ft, 1-2 m) shrubland. It occurs on dry floodplains of ephemeral rivers and creeks, and is most often intermixed with cottonwood forests. This association is known from the San Juan National Forest. A closely related community dominated by *Crataegus succulenta* (fleshy hawthorn) is known from Boulder County and is is placed in this association until more information suggests otherwise.

This association occurs on narrow draws and valley floors that are approximately 65-100 ft (20-30 m) wide. One area had signs of beaver activity. Streams appeared to be mostly ephemeral streams with seeps along the sides of the valley, making for a complex wetland/riparian area. Stream channels are narrow, straight and steep or braided by beaver activity. Soils are sandy clay with 20-50% coarse material over highly stratified alluvial parent material.

Vegetation Description

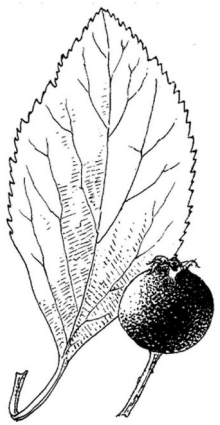
Crataegus rivularis (river hawthorn) forms a dense shrub canopy. One plot is dominated by *Crataegus succulenta* (fleshy hawthorn). *Salix bebbiana* (Bebb willow), *Salix ligulifolia* (strapleaf willow), and *Salix monticola* (mountain willow) may also be present. Other shrub species present include *Rosa woodsii* (Woods rose), *Dasiphora floribunda* (shrubby cinquefoil), *Symphoricarpos oreophilus* (mountain snowberry), and *Ribes* spp. (currant). *Populus angustifolia* (narrowleaf cottonwood) seedlings and saplings occurred in one stand with less than 10% total cover. Forb and graminoid cover is insignificant.

Ecological Processes

Crataegus occupies the driest part of the riparian habitat, and may indicate the surface is no longer flooded. In Montana, thickets of *Crataegus* are considered a grazing

disclimax. Cattle will browse *Crataegus* and heavy pressure can cause thickets to become open and increaser species such as *Rosa woodsii* (Woods rose), *Symphoricarpos* (snowberry) and *Poa pratensis* (Kentucky bluegrass) become established and abundant.

The presence of seedling and sapling *Populus angustifolia* (narrowleaf cottonwood) indicate the stand may mature into a *Populus angustifolia/Crataegus rivularis* (narrowleaf cottonwood/river hawthorn) plant association.



Crataegus rivularis

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
55	—	Crataegus succulenta	1
50	(30-70%)	Crataegus rivularis	2
31	(1-60%)	Salix monticola	2
21	—	Centaurea diffusa	1
20	(20-20%)	Salix bebbiana	2
17	—	Leersia oryzoides	1
15	(10-20%)	Salix ligulifolia	2
13	—	Prunus americana	1
12	—	Agrostis stolonifera	1
11	—	Eleocharis palustris	1
7	—	Populus deltoides	1
7	—	Equisetum laevigatum	1
7	(3-10%)	Rudbeckia laciniata var. ampla	2
6	—	Bromus inermis	1
6	—	Echinocystis lobata	1
6	—	Rorippa nasturtium-aquaticum	1
6	(1-10%)	Poa pratensis	2
5	—	Dactylis glomerata	1
5	—	Lolium pratense	1
4	—	Salix exigua	1

Other species with < 5% average cover present in at least 10% of plots:
Populus angustifolia (4%), Rosa woodsii (3%), Geranium richardsonii (3%), Cornus sericea (3%), Carex praegracilis (3%), Ribes inerme (3%), Mertensia ciliata (1-3%), Glyceria striata (1-3%), Symphoricarpos oreophilus (1-3%), Thermopsis montana (1-3%), Galium triflorum (1-3%), Clematis ligusticifolia (2%), Elymus lanceolatus (2%), Maianthemum stellatum (1%), Zigadenus elegans ssp. elegans (1%), Achillea millefolium var. occidentalis (1%), Thalictrum fendleri (1%), Allium brandegeei (1%), Vicia americana (1%), Carex hassei (1%), Asclepias speciosa (1%), Artemisia ludoviciana (1%), Arabis hirsuta var. pycnocarpa (1%), Angelica pinnata (1%), Amelanchier alnifolia (1%), Ambrosia artemisiifolia var. elatior (1%), Carex microptera (1%), Veronica americana (1%), Valeriana occidentalis (1%), Trifolium longipes (1%), Taraxacum officinale (1%), Senecio integerrimus (1%), Pseudocymopterus montanus (1%), Juncus balticus var. montanus (1%), Potentilla pulcherrima (1%), Epilobium ciliatum ssp. glandulosum (1%), Poa annua (1%), Pascopyrum smithii (1%), Moehringia lateriflora (1%), Juncus parryi (1%), Iris missouriensis (1%), Frasera speciosa (1%).

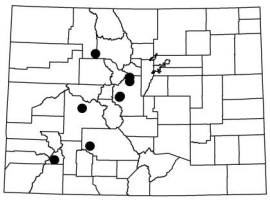
Shrubby cinquefoil / Tufted hairgrass Shrubland

Dasiphora (=Pentaphylloides) floribunda / Deschampsia caespitosa

Global rank/State rank:
G4 / S3S4

HGM subclass: S1/2?, S3/4

Colorado elevation range:
8,300-10,700 ft (2,500-3,300 m)



General Description

The *Dasiphora floribunda/Deschampsia caespitosa* (shrubby cinquefoil/tufted hairgrass) plant association is an open, low shrubland with thick cover of bunch grasses. Most stands of this association in Colorado appear to be grazing-induced. *Dasiphora floribunda* (shrubby cinquefoil) increases in abundance with continuous, season long grazing within a riparian area.

This association occurs on terraces above the stream channel and along the drier edges of isolated wetlands and rich fens. Stream channels are narrow and highly sinuous. The soils are sandy loams over sand and gravel layers.

Vegetation Description

The shrub layer of this association may be dense or open with individual shrubs widely and uniformly spaced with about 20-30% total canopy cover. *Dasiphora floribunda (=Pentaphylloides floribunda)* (shrubby cinquefoil) is the dominant, and often the only shrub species present. The graminoid layer is usually very thick. *Deschampsia caespitosa* (tufted hairgrass) is the grass most consistently present (i.e., occuring in all stands) and often in the highest relative abundance, even when its absolute abundance is not particularly high. Other graminoids that have high abundance but are not consistently present include *Poa secunda* (Sandberg bluegrass), *Festuca rubra* (red fescue), and *Juncus balticus* var. *montanus* (mountain rush).

Stands in excellent condition (i.e., neither grazing-induced nor in a degraded condition from over-grazing) have high cover of *Carex aquatilis* (water sedge) and *Trifolium longipes* (longstalk clover). Disturbed stands often have *Rumex aquaticus* (western dock), *Fragaria virginiana* (strawberry), and abundant *Taraxacum officinale* (dandelion).

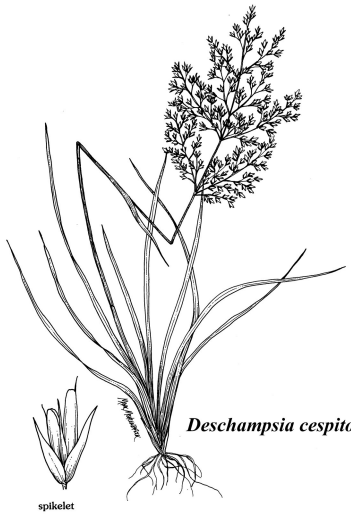
Ecological Processes

Grazing induced stands of this association are in mid-seral stages of secondary succession. Under longterm heavy grazing, *Dasiphora floribunda* will increase in abundance because it is unpalatable to livestock. Other species that increase with grazing in this association are *Poa pratensis* (Kentucky bluegrass), *Juncus balticus* var. *montanus* (mountain rush), and *Taraxacum officinale* (dandelion). Extended grazing may cause this plant association to convert to a *Dasiphora floribunda/Poa pratensis* (shrubby cinquefoil/Kentucky bluegrass) plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=10)
40	(15-80%)	Dasiphora floribunda	10
20	(1-60%)	Deschampsia caespitosa	10
16	(3-35%)	Carex microptera	5
16	(7-25%)	Fragaria virginiana ssp. glauca	4
12	(1-37%)	Juncus balticus var. montanus	5
10	(5-15%)	Antennaria microphylla	2
10	(1-30%)	Poa pratensis	6
7	(1-20%)	Potentilla gracilis	4
6	(1-10%)	Danthonia intermedia	3
5	(2-10%)	Taraxacum officinale	5
5	(5-5%)	Hordeum brachyantherum ssp. brachyantherum	2
5	(1-9%)	Carex aurea	2
5	(1-8%)	Trifolium longipes	2

Other species with < 5% average cover present in at least 10% of plots:
Caltha leptosepala (1-10%), Conioselinum scopulorum (1-7%), Achillea millefolium var. occidentalis (0.1-8%), Salix wolfii (1-5%), Geum macrophyllum var. perincisum (0.1-5%), Galium boreale (1-3%), Trifolium repens (1-2%), Geum triflorum var. triflorum (1-2%), Calamagrostis canadensis (1-2%), Agrostis scabra (1%), Iris missouriensis (1%), Phleum alpinum (1%), Agoseris glauca (1%), Symphyotrichum foliaceum (0.1-2%), Argentina anserina (0.1-1%).

Dasiphora floribunda



Deschampsia cespitosa

spikelet

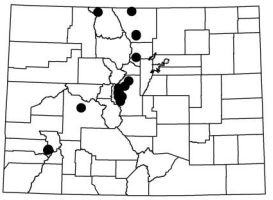
Shrubby cinquefoil / Mountain rush Shrubland

Dasiphora (=Pentaphylloides) floribunda / Juncus balticus var. *montanus*

Global rank/State rank:
G3 / S3

HGM subclass: S1/2?, S3/4

Colorado elevation range:
8,400-9,900 ft (2,560-3,018 m)



General Description

The *Dasiphora* (*=Pentaphylloides*) *floribunda/Juncus balticus* var. *montanus* (shrubby cinquefoil/mountain rush) plant association is an open, low shrubland with thick cover of mountain rush and various grasses. Most stands of this association in Colorado appear to be grazing-induced, and in at least some situations, it may be a degraded form of the *Dasiphora floribunda/Deschampsia caespitosa* (shrubby cinquefoil/tufted hairgrass) association. *Dasiphora floribunda* (shrubby cinquefoil) increases in abundance with continuous, season-long grazing within a riparian area; *Deschampsia caespitosa* (tufted hairgrass) is highly palatable to livestock and decreases with grazing. As *Deschampsia* decreases in abundance due to grazing or drying conditions, *Juncus balticus* var. *montanus* (mountain rush) may become more abundant. This association occurs along the drier margins of fens or wet meadows.

Vegetation Description

The shrub layer of this association is open to moderately dense, and is dominated by *Dasiphora floribunda* (shrubby cinquefoil) with about 10-60% total canopy cover. Although *Dasiphora floribunda* is often the only shrub species present, other woody species such as *Salix wolfii* (Wolf willow), *Salix brachycarpa* (barrenground willow), *Salix planifolia* (planeleaf willow) or *Betula nana (=glandulosa)* (bog birch) may be present in some stands with low cover amounts.

The herbaceous layer is usually very thick and varied. *Juncus balticus* var. *montanus* (mountain rush) is the most consistently present associated species. It often has the highest abundance relative to other graminoid species present, even when present with lower absolute cover percentage (range 10-85%). Other common graminoid species include *Deschampsia caespitosa* (tufted hairgrass), *Elymus trachycaulus* (slender wheatgrass), and *Poa pratensis* (Kentucky bluegrass). Forb species are variable; the

most common include *Achillea millefolium* var. *occidentalis* (western yarrow), *Argentina anserina* (silverweed cinquefoil), *Thalictrum alpinum* (alpine meadowrue), and *Cirsium scariosum* (meadow thistle).

Ecological Processes

Grazing induced stands of this association are in mid-seral stages of secondary succession. Under longterm heavy grazing, *Dasiphora floribunda* (shrubby cinquefoil) and *Juncus balticus* var. *montanus* (mountain rush) will increase in abundance because they are unpalatable to livestock. Other species that increase with grazing in this association are *Poa pratensis* (Kentucky bluegrass) and *Taraxacum officinale* (dandelion). Both *Dasiphora floribunda* and *Juncus balticus* var. *montanus* persist as soils dry out; the presence of this association does necessarily indicate true wetland conditions.

Avg. Cover %	(Range)	Species Name	# Plots (N=15)
41	(20-60%)	Dasiphora floribunda	15
39	(10-75%)	Juncus balticus var. montanus	15
25	(10-40%)	Antennaria corymbosa	3
17	(1-30%)	Muhlenbergia filiformis	3
12	(5-20%)	Poa pratensis	5
11	(1-20%)	Iris missouriensis	2
9	(0.1-40%)	Thalictrum alpinum	5
8	(1-15%)	Carex simulata	2
7	(1-15%)	Argentina anserina	6
7	(5-10%)	Salix wolfii	3
6	(1-25%)	Deschampsia caespitosa	7
6	(1-10%)	Symphyotrichum foliaceum	2
5	(0.1-15%)	Potentilla gracilis	4
5	(1-10%)	Carex aquatilis	4
5	(1-10%)	Taraxacum officinale	4

Other species with < 5% average cover present in at least 10% of plots:
Salix brachycarpa (2-5%), Carex praegracilis (1-5%), Elymus trachycaulus ssp. trachycaulus (1-5%), Achillea millefolium var. occidentalis (0.1-5%), Geum macrophyllum var. perincisum (0.1-5%), Polygonum viviparum (1-5%), Valeriana edulis (1-3%), Carex capillaris (0.1-3%), Agrostis scabra (1-2%), Kobresia myosuroides (1-2%), Trifolium longipes (1-2%), Cirsium scariosum (1-2%), Dodecatheon pulchellum (1%), Gentiana affinis (1%), Campanula parryi (1%), Juncus longistylis (1%), Pedicularis crenulata (1%), Sisyrinchium pallidum (1%), Primula incana (1%).

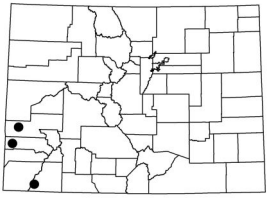
Wild-privet Shrubland

Forestiera pubescens

Global rank/State rank:
G1G2 / S1

HGM subclass: R3/4

Colorado elevation range:
5,120-6,500 ft (1,560-1,980 m)



General Description

The *Forestiera pubescens* (wild privet) plant association is a medium tall (3-5 ft, 1-1.5 m) shrubland that often occurs as dense thickets. It grows at the interface between the riparian area and the adjacent upland in desert areas of the southwest.

This plant association forms a narrow, but continuous, band about 10 ft (3 m) above the channel on streambanks and natural levees. It occurs on the outer edge of the active floodplain. The stream channel is wide and very sinuous. Soils are deep silty clays over clay loam and sandy loam.

Vegetation Description

This plant association is characterized by a shrub layer of *Forestiera pubescens* (wild privet) (15-90% cover) and *Rhus trilobata* (skunkbush) (15-40% cover). *Salix exigua* (sandbar willow) or *Tamarix ramosissima* (saltcedar) may overlap from adjacent stands and *Artemisia tridentata* (big sagebrush) may be present in the stands at the upland edge of the community. Forb and graminoid cover is low to moderate. *Clematis ligusticifolia* (western white clematis), *Rosa woodsii* (Woods rose), *Symphyotrichum lanceolatum* (white panicle aster) and *Glycyrrhiza lepidota* (American licorice) are the most common other non-graminoid species. Common graminoid species include *Elymus lanceolatus* (streambank wheatgrass), *Agrostis gigantea* (redtop), *Bromus tectorum* (cheatgrass), *Bromus japonicus* (Japanese brome) and *Bromus inermis* (smooth brome).

Ecological Processes

Forestiera pubescens (wild privet) appears to tolerate occasional flooding; it usually occupies slightly drier ground than *Salix exigua* (sandbar willow). More research is needed to determine the establishment conditions, long-term stability, and ecology of this unique plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=6)
67	(15-90%)	Forestiera pubescens	6
30	(15-38%)	Rosa woodsii	3
30	(15-38%)	Agrostis gigantea	3
26	(1-38%)	Salix exigua	3
23	(15-40%)	Rhus trilobata var. trilobata	4
18	(1-38%)	Elymus lanceolatus	3
15	(15-15%)	Xanthium strumarium	2
10	(5-15%)	Bromus tectorum	2
10	(5-15%)	Bromus inermis	2
10	(5-15%)	Equisetum arvense	2
10	(5-15%)	Cirsium arvense	2
10	(5-15%)	Schoenoplectus pungens	2
10	(5-15%)	Mentha arvensis	2
8	(5-15%)	Clematis ligusticifolia	3
8	(0.1-15%)	Equisetum laevigatum	2
5	(5-5%)	Tamarix ramosissima	2

Other species with < 5% average cover present in at least 10% of plots:
Symphyotrichum lanceolatum ssp. hesperium var. hesperium (1-5%), Glycyrrhiza lepidota (1-5%), Bromus japonicus (1%).

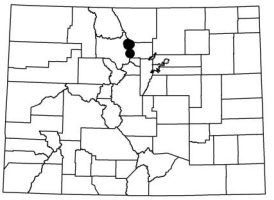
Alpine laurel - Alpine spicywintergreen Dwarf Shrubland

Kalmia microphylla - Gaultheria humifusa

Global rank/State rank:
G3G4 / S2

HGM subclass: S1/2

Colorado elevation range:
10,400-11,155 ft (3,170-3,400 m)



General Description

The *Kalmia microphylla-Gaultheria humifusa* (bog laurel-alpine spicywintergreen) association occurs on raised areas in hummocky topography or on peat plateaus at the edges of fens in the alpine and subalpine. Water tables are often at or near the surface for much of the growing season, but flooding is rare. Habitats are cold and snowy, with snowfields lingering into June or later.

This association occurs in moist subalpine and alpine meadows, snowbeds, lake margins, and other low gradient wet areas of the subalpine. Soils are frigid, derived from bedrock or aggraded alluvium, usually high in organic matter, and strongly acidic.

Vegetation Description

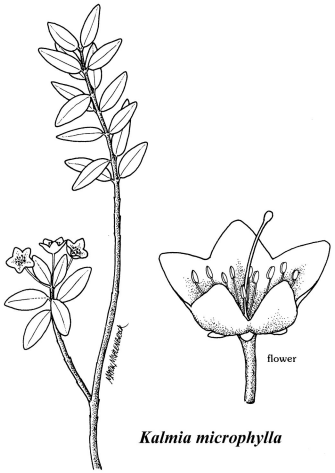
This association is characterized by a dwarf-shrub layer of *Kalmia microphylla* (bog laurel) and *Gautheria humifusa* (alpine spicywintergreen). Their combined cover varies between approximately 20% and 70%. A dense graminoid layer is often present, and may include *Carex aquatilis* (water sedge), *Juncus drummondiana* (Drummond rush), *Deschampsia caespitosa* (tufted hairgrass), and *Juncus mertensiana* (Mertens rush). *Carex nigricans* (black alpine sedge) may be abundant, but the shrub canopy is conspicuous and characteristic. Forb composition is variable but often includes *Erigeron peregrinus* (subalpine fleabane), *Caltha leptosepala* (marsh marigold), *Trollius laxus* ssp. *albiflorus* (American globeflower), and *Pedicularis groenlandica* (elephanthead lousewort). *Sphagnum russowii* (Russow sphagnum) is usually abundant in the ground layer.

Ecological Processes

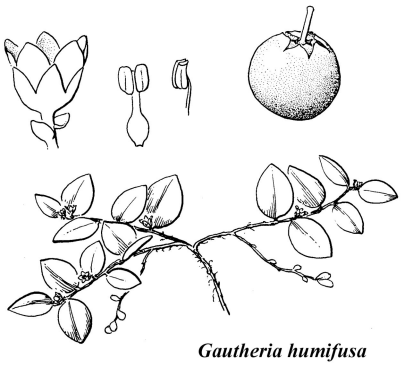
Habitats where this association occurs are usually saturated most of the year and typically develop acidic peat soils. Frost heaving may create changes in microtopography that allow coexistence of various wetland species.

Avg. Cover %	(Range)	Species Name	# Plots (N=5)
46	(3-90%)	Carex nigricans	4
20	(10-40%)	Gaultheria humifusa	5
17	(3-25%)	Kalmia microphylla	5
6	(3-10%)	Erigeron peregrinus ssp. callianthemus	4
5	(5-5%)	Ligusticum tenuifolium	2

Other species with < 5% average cover present in at least 10% of plots:
Carex aquatilis (1-7%), Juncus mertensianus (0.1-7%), Vaccinium caespitosum (0.1-5%), Trollius laxus ssp. albiflorus (1-3%), Juncus drummondii (0.1-3%), Deschampsia caespitosa (0.1-3%), Caltha leptosepala (0.1-5%), Agrostis humilis (1-2%), Arnica mollis (0.1-2%), Carex scopulorum (1%), Viola macloskeyi ssp. pallens (1%), Pedicularis groenlandica (0.1-1%), Gentiana parryi (0.1%).



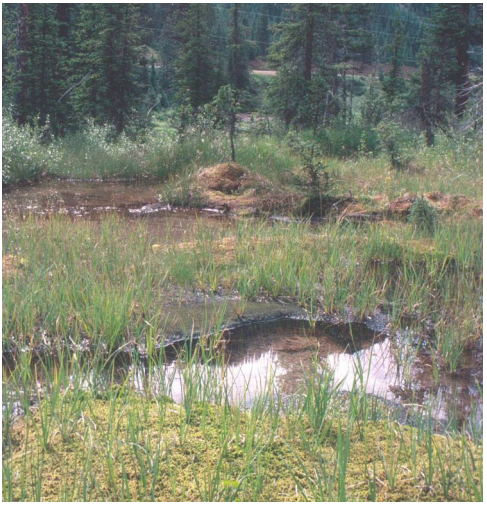
Kalmia microphylla



Gautheria humifusa

(Engelmann spruce) / Bog birch / Water sedge / Sphagnum moss Iron Fen

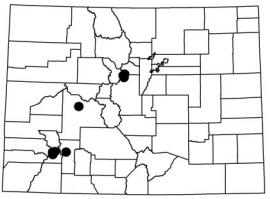
(Picea engelmannii) / Betula nana (=glandulosa) / Carex aquatilis / Sphagnum angustifolium



Global rank/State rank:
G2 / S2

HGM subclass: S1/2

Colorado elevation range:
9,800-11,300 ft (2,987-3,444 m)



General Description

This community occurs in habitats commonly referred to as iron fens. These are peatlands with acidic waters and high concentrations of dissolved ions. Two of the most striking features of iron fens are their limonite ledges and their characteristic suite of acid-tolerant plants. Limonite ledges form when iron precipitates into and solidifies the substrate (often thick layers of peat), forming hard rock ledges many meters thick. Springs often bubble up from the tops of the ledges continually depositing more iron. Iron fens often have networks of small pools and ponds.

Fens and bogs (peatlands) are generally classified according to pH and dissolved concentrations of mineral ions in the water supply. Peatlands fed primarily by rain contain low ion concentrations and have low pH values. This type of acid peatland does not occur in Colorado. Peatlands fed by calcareous groundwaters have high ion concentrations and high pH values. High Creek Fen in South Park is an example of this type, referred to as an extreme rich fen. In contrast, iron fens have a low pH (acidic waters) and high concentrations of dissolved ions. Consequently they look very different from other fens in Colorado.

This plant association usually occurs on very wet, gentle, lower slopes in fairly wide valleys in the subalpine zone. Water sources for these fens originate on hillsides of iron pyrite-rich fractured bedrock and talus. Soils are deep peats, often solidified by iron pyrite deposits.

Vegetation Description

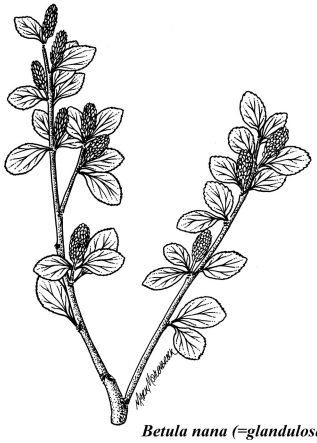
Only a few plant species can tolerate the acidic conditions in iron fens. This association is typically dominated by *Betula nana (=glandulosa)* (bog birch) shrubs, *Carex aquatilis* (water sedge), and the small shrubs *Vaccinium scoparium* (grouse whortleberry), *V. myritillus* (whortleberry)*, V. cespitosum* (dwarf bilberry), *Gaultheria humifusa* (alpine spicywintergreen), and/or *Kalmia microphylla* (alpine laurel). *Calamagrostis canadensis* (bluejoint reedgrass) is also common in the understory. Patches of *Picea engelmannii* (Engelmann spruce), *Abies lasiocarpa* (subalpine fir), or *Pinus contorta* (lodgepole pine) may occur in areas raised slightly above the level of standing water.

Thick *Sphagnum* groundcover is an indicator for this type. Sphagna and other mosses form a continuous carpet in all microsites except pools deeper than 4-8 inches (10-20 cm). Fens are the only Colorado ecosystems that support continuous *Sphagnum* carpets and hummock complexes. Dr. David Cooper found three disjunct boreal species in Colorado iron fens:

- *Sphagnum balticum* in shallow pools at one site, the first record for the coterminous U.S.
- The liverwort, *Gymnocolea inflata,* in springs and water tracks at sites where limonite was exposed at the surface.
- Reindeer lichen, *Cladina ragiferina,* on fen margins under spruce trees.

Ecological Processes

These communities are stable and long-lived. Iron-saturated peat layers may be up to 10 to 15 ft (3-5 m) deep. As long as iron-rich waters flow from springs in these sites, thicker layers of peat will continue to accumulate, acidic conditions will prevail, and the same suite of plants will persist. Drier conditions could lead, over time, to a reduction in the acidity of soils and to replacement of the iron fen community with the surrounding spruce-fir forest and subsequent loss of rare species habitat.



Betula nana (=glandulosa)

Avg. Cover %	(Range)	Species Name	# Plots (N=6)
32	(6-65%)	Sphagnum spp.	6
26	(5-70%)	Carex aquatilis	6
21	—	Carex utriculata	1
20	(10-30%)	Betula nana	5
12	(3-20%)	Calamagrostis canadensis	5
5	(0.3-15%)	Picea engelmannii	5
5	—	Vaccinium caespitosum	1
5	—	Pinus contorta	1
5	—	Deschampsia caespitosa	1

Other species with < 5% average cover present in at least 10% of plots:
Dasiphora floribunda (3%), Vaccinium myrtillus var. oreophilum (2%), Gaultheria humifusa (0.3-5%), Carex canescens (1%).

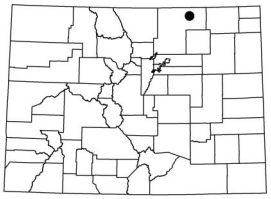
Chokecherry - (American plum) Shrubland

Prunus virginiana - (Prunus americana)

Global rank/State rank:
G4Q / S3

HGM subclass: R3/4

Colorado elevation range:
5,300-5,400 ft, (1,600-1,650 m)



General Description

The *Prunus virginiana-(Prunus americana)* (chokecherry-(American plum)) plant association is a medium-height (4-6 ft, 1.5-2 m) shrubland with dense vegetation. *Symphoricarpos occidentalis* (western snowberry) forms a low (1-2 ft, 0.3-0.75 m) shrub canopy layer, underneath the *Prunus*, further contributing to the stand's impenetrability. This association grows at the interface between the riparian areas and the adjacent upland. It usually occurs as small pockets on higher terraces or as narrow bands along the high water mark of steep banks and incised channels. It can also grow at the base of cliffs adjacent to rivers and streams where it forms impenetrable thickets.

On Colorado's Eastern Slope, this plant association occurs in steep gullies along rock outcrops and arroyos. Stream channels are steep-sided gullies. Soils are shallow to deep alluvial deposits that lie directly on bedrock. Textures are mostly silty loams, becoming skeletal at depth.

Vegetation Description

This association is characterized by a tall, dense layer of shrubs with 20-40% cover each of *Prunus virginiana* (chokecherry) and *Symphoricarpos occidentalis* (snowberry). In Nevada and Montana, *Prunus americana* (American plum) is occassionally a codominant in this association. Stands of mixed *Prunus virginiana* and *P. americana* have been observed in Colorado but these stands have yet to be sampled. Other shrub species present include *Ribes aureum* (golden currant) and *Toxicodendron rydbergii* (poison ivy). A few scattered *Juniperus scopulorum* (Rocky Mountain juniper) trees also occur within this association. The herbaceous

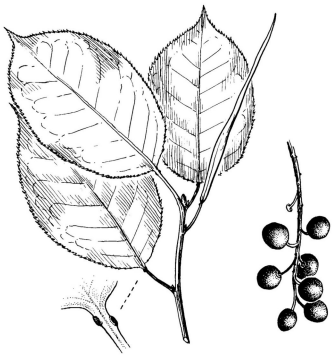
undergrowth is dominated by *Poa pratensis* (Kentucky bluegrass) and *Bromus tectorum* (smooth brome). Forb cover is scattered and includes *Maianthemum stellatum* (starry false Solomon seal), *Glycyrrhiza lepidota* (wild licorice), and *Descurainia sophia* (tansy mustard).

Ecological Processes

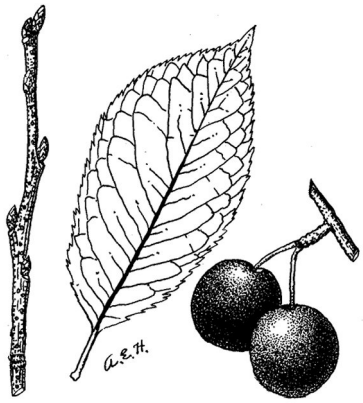
The *Prunus virginiana-(Prunus americana)* plant association appears to be limited to small, protected pockets within incised gullies and washes on the plains. These shrub species require more moisture than the surrounding uplands and occur in areas where runoff can quickly reach their roots, mainly at the bottom of rock outcrops and within the riparian zone. In Nevada, this association is considered a "marginal" riparian type and represents succession away from riparian conditions. In Montana, this association may be a grazing-induced successional stage of the *Fraxinus pennsylvanica*/*Prunus virginiana* (green ash/chokecherry) community type. In Colorado, this association appears to be a "marginal" riparian type and probably represents the site potential in ungrazed conditions.

Avg. Cover %	(Range)	Species Name	# Plots (N=2)
34	—	Rhus trilobata var. trilobata	1
31	(20-42%)	Prunus virginiana var. melanocarpa	2
30	(20-40%)	Symphoricarpos occidentalis	2
25	(20-30%)	Maianthemum stellatum	2
22	(3-40%)	Bromus tectorum	2
11	(1-20%)	Poa pratensis	2
11	(1-20%)	Ribes aureum	2
7	(1-13%)	Juniperus scopulorum	2
7	(3-10%)	Toxicodendron rydbergii	2

Other species with < 5% average cover present in at least 10% of plots:
Glycyrrhiza lepidota (3%), Hesperostipa comata (3%), Artemisia ludoviciana (3%), Thlaspi arvense (3%), Ribes cereum (1-2%), Descurainia sophia (1%), Convolvulus arvensis (1%), Eleocharis palustris (1%), Pascopyrum smithii (1%), Vicia americana (1%), Rosa woodsii (1%), Melilotus officinalis (1%).



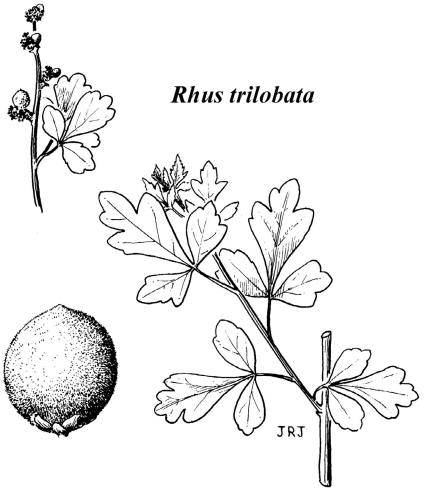
Prunus virginiana



Prunus americana

Skunkbush sumac - (Sandbar willow) Shrubland

Rhus trilobata - (Salix exigua)

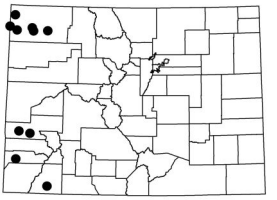


Rhus trilobata

Global rank/State rank:
G2 / S2

HGM subclass: R3/4

Colorado elevation range:
5,100-6,500 ft (1,600-2,000 m)



General Description

The *Rhus trilobata-(Salix exigua)* (skunkbush sumac-(sandbar willow)) plant association is a small shrubland that forms linear bands on rocky, well-drained benches and toeslopes. It is often confined between the high water mark of a river and adjacent cliff faces. On the West Slope *Rhus trilobata* is limited to riparian areas, but it occurs as an upland species in the Colorado Front Range foothills.

This plant association occurs at the bottom of cliffs and on toeslopes in very narrow, rocky river reaches having little floodplain development due to bedrock confinement. It often occurs as a narrow band on rocky, well-drained benches located between the high water line and the upland slopes in moderately wide valleys and along narrow reaches of larger rivers. Stream channels are wide and sinuous. Soil textures are shallow sandy loams or loamy sands over coarse alluvium or bedrock.

Vegetation Description

This plant association is characterized by a dense shrub layer dominated by 1-98% cover of *Rhus trilobata* (skunkbush). *Salix exigua* (sandbar willow) is present with moderate cover in about 30% of stands. In cooler, mesic sites *Cornus sericea* (red-osier dogwood) may be abundant. Other shrubs that may be present include *Salix. ligulifolia* (strapleaf willow), *Clematis ligusticifolia* (western white clematis), *Ribes aureum* (golden currant), *Chrysothamnus viscidiflorus* (green rabbitbrush), *Rosa woodsii* (Woods rose), and *Berberis fendleri* (Colorado barberry). The herbaceous undergrowth is sparse.

Ecological Processes

The *Rhus trilobata-(Salix exigua)* (skunkbush sumac-(sandbar willow)) plant association appears to be late-seral because it occurs at or above the high-water mark of the channel. *Rhus trilobata* can tolerate well-drained, rocky soils by remaining close to the river. This shrub species has roots that penetrate the water table through cracks in the bedrock or into areas where the roots can take advantage of summer rainfall events. This type appears to be a non-obligate riparian plant association because it occurs on the driest sites within a riparian zone and also occurs on Eastern Slope uplands in Colorado.

Avg. Cover %	(Range)	Species Name	# Plots (N=16)
31	(0.1-97.5%)	Rhus trilobata var. trilobata	16
21	(5-37.5%)	Toxicodendron rydbergii	2
21	(1-40%)	Ribes aureum	2
18	(15-20%)	Lepidium latifolium	2
15	(1-50%)	Clematis ligusticifolia	5
11	(10-11.9%)	Juniperus osteosperma	2
10	(1-20%)	Salix ligulifolia	3
10	(10-10%)	Cornus sericea ssp. sericea	3
9	(2.5-15%)	Tamarix ramosissima	2
9	(1-15%)	Bromus tectorum	4
7	(1-20%)	Salix exigua	5
7	(1-15%)	Melilotus officinalis	3
6	(0.1-15%)	Glycyrrhiza lepidota	5
6	(1-10%)	Elymus trachycaulus ssp. trachycaulus	2
4	(1-10%)	Maianthemum stellatum	4

Other species with < 5% average cover present in at least 10% of plots:
Chrysothamnus viscidiflorus (1-10%), Taraxacum officinale (1-10%), Rosa woodsii (0.1-10%), Elymus repens (2.5-5%), Bromus inermis (0.1-10%), Juncus balticus var. montanus (1-5%), Medicago lupulina (1-5%), Plantago major (1-5%), Berberis fendleri (1-5%), Artemisia tridentata (1-5%), Amelanchier alnifolia (0.1-5%), Sporobolus cryptandrus (2.5%), Poa pratensis (1-5%), Iva axillaris (1-2.5%), Artemisia tripartita ssp. tripartita (0.1-5%), Apocynum cannabinum (0.1-5%), Pinus edulis (0.1-2.5%), Pascopyrum smithii (0.1-2%), Trifolium repens (1%), Asclepias speciosa (1%), Plantago lanceolata (1%), Mentha arvensis (1%), Equisetum arvense (1-1%), Equisetum laevigatum (0.1-1%), Equisetum hyemale var. affine (0.1-2%), Achillea millefolium var. occidentalis (0.1-1%), Ambrosia tomentosa (0.05-0.1%).

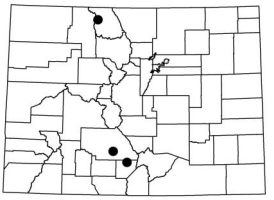
Black greasewood / Barren ground Shrubland

Sarcobatus vermiculatus / Barren ground

Global rank/State rank:
GU / S2

HGM subclass: F1

Colorado elevation range:
7,500-7,700 ft (2,280-2,350 m)



General Description

Sarcobatus vermiculatus (black geasewood) forms expansive shrublands on alkaline soils with a perennially high water table in southern and western Colorado. Stands of this long-lived deciduous shrub are patchy in western Colorado and are extensive in the San Luis Valley. This association of almost pure greasewood with very little understory has been documented only from the San Luis Valley and North Park. The community typically has an open canopy and extensive bare ground with a hard crusty surface and a deposit of salts during the dry season.

The *Sarcobatus vermiculatus* (black greasewood) plant association occurs where the water table is close to the surface of the soil for a large portion of the growing season and where the soil salinity is high. *Sarcobatus vermiculatus* is an indicator of saline-sodic or relatively moist soils, and grows on clay-loam, silt-loam, or deep, fine sandy loam soils with high salinity or alkalinity.

Vegetation Description

Sarcobatus vermiculatus (black greasewood) typically forms an open shrubland community with 20-60% cover. The understory is primarily bare ground, although sparse cover of *Suaeda calceoliformis* (Pursh seepweed) or *Spartina gracilis* (alkali cordgrass) may be present. One stand also had 3% cover of the rare *Cleome multicaulis* (slender spiderflower).

Ecological Processes

Sarcobatus vermiculatus (black greasewood) shrublands are long-lived and self perpetuating. Seedlings can survive under parent shrubs, despite high levels of salinity. Seeds germinate during spring runoff when surface moisture dilutes salinity.

Sarcobatus vermiculatus may occur as a band of vegetation around a salt flat or depression. This visible zonation is caused by the relative tolerances to soil salinity and depth to groundwater of the dominant species. Soil characteristics may also play a role in the mosaic of shrub species on the landscape.

In the San Luis Valley, the effects of groundwater pumping and surface water diversions have the potential to be detrimental to the persistence this association.

Avg. Cover %	(Range)	Species Name	# Plots (N=4)
36	(20-62.5%)	Sarcobatus vermiculatus	4
26	(15-37.5%)	Suaeda calceoliformis	2
Other species with < 5% average cover present in at least 10% of plots:			
Spartina gracilis (2-5%), Cleome multicaulis (3%).			

Sarcobatus vermiculatus

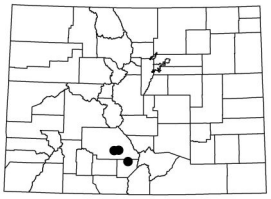
Black greasewood / Inland saltgrass Shrubland

Sarcobatus vermiculatus / Distichlis spicata

Global rank/State rank:
G4 / S2

HGM subclass: F1

Colorado elevation range:
5,500-7,650 ft (1,700-2,300 m)



General Description

Sarcobatus vermiculatus (black greasewood) forms expansive shrublands on alkaline soils with a perennial high water table in southern and western Colorado. In the San Luis valley, it grows between playa lakes on sandy hummocks. The shrubs are 2-4 ft (0.6-1.2 m) tall and usually have non-overlapping canopies. The understory is sparse, open herbaceous cover of *Distichlis spicata* (inland saltgrass) and other salt tolerant species.

This community occurs on the highest ground between salt flat depressions called playa lakes in the northern part of the San Luis Valley. The shrubs occur on hummocks, approximately 4 ft (1.2 m) above the lake bed. Soils are deep, fine-textured sandy loams to clay loams. The surface soil is very hard when dry, but the subsurface soils, below 12 in (30 cm), are of a friable loamy texture.

Vegetation Description

The shrub canopy is fairly open with 18-30% cover of *Sarcobatus vermiculatus* (black greasewood). *Ericameria nauseosa* ssp. *nauseosa* var. *glabrata* (rubber rabbitbrush) may also occur. The herbaceous understory is a dry carpet of *Distichlis spicata* (inland saltgrass) with up to 40% cover. Other graminoid species which may be present are *Juncus balticus* var. *montanus* (mountain rush) and *Spartina gracilis* (alkali cordgrass). Forb cover is minimal.

Ecological Processes

Sarcobatus vermiculatus (black greasewood) and other salt flat vegetation often occur as bands or rings of species around a salt flat or depression. This visible zonation is caused by the change in dominant species and their relative tolerances to soil salinity

and depth to groundwater. Soil characteristics may also play a role in the mosaic of shrub species on the landscape.

In the San Luis Valley, a large playa lake ecosystem supports the largest and most pristine example of *Sarcobatus vermiculatus* (black greasewood) shrublands in the state. The playas are ephemeral to perennial shallow lakes, depending on the variation in the annual precipitation.

Sarcobatus vermiculatus (black greasewood) shrublands are long-lived, self-perpetuating communities. Seedlings can survive under parent shrubs, where salinity is the highest. Seeds germinate in spring when surface soils are wet with spring runoff, and the salinity is most diluted. Although characteristic of desert climates, greasewood cannot tolerate droughts and grows only at the edges of lakes or arroyos or in sites with at high water table. Greasewood has salt glands adapted for excreting excess salts, often increasing the soil salinity over time.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
25	(18-30%)	Sarcobatus vermiculatus	7
25	(10-40%)	Distichlis spicata	7
11	(1-20%)	Spartina gracilis	2
8	(5-10%)	Ericameria nauseosa ssp. nauseosa var. glabrata	2
6	(3-8%)	Juncus balticus var. montanus	2

Other species with < 5% average cover present in at least 10% of plots:
Suaeda calceoliformis (2%), Lepidium latifolium (1%), Almutaster pauciflorus (1%), Lepidium alyssoides (0.1-2%).

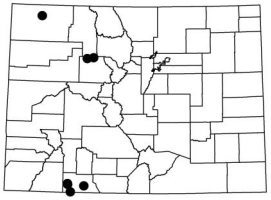
Silver buffaloberry Shrubland

Shepherdia argentea

Global rank/State rank:
G3G4 / S1

HGM subclass: R3/4

Colorado elevation range:
5,600-7,200 ft (1,700-2,200 m)



General Description

The *Shepherdia argentea* (silver buffaloberry) plant association is a medium-tall (4-6 ft, 1.2-2 m) shrubland. It occurs within a mosaic of deciduous tree and willow plant associations in the riparian corridor on broad floodplains of larger rivers on the Western Slope. Most stands in Colorado are severely degraded by improper grazing and stream flow alterations. Stands generally occur in wide valleys.

This plant association occurs on moderate to wide floodplains, 250-1000 ft (80-300 m) wide, with gravel and cobble streambed materials. Stream channels are low gradient, 0.3-4%, and moderately sinuous or highly sinuous. Some stream channels are heavily entrenched. Soils are deep, fine, silty and sandy clay loams over stratified alluvial material.

Vegetation Description

Shepherdia argentea (silver buffaloberry) dominates the dense, but patchy, tall-shrub layer of this plant association. Other shrubs that may be present include *Rosa woodsii* (woods rose), *Salix exigua* (sandbar willow) and *Rhus trilobata* (skunkbush sumac). *Artemisia tridentata* (big sagebrush), and *Chrysothamnus linifolius* (spearleaf rabbitbrush) may also be present.

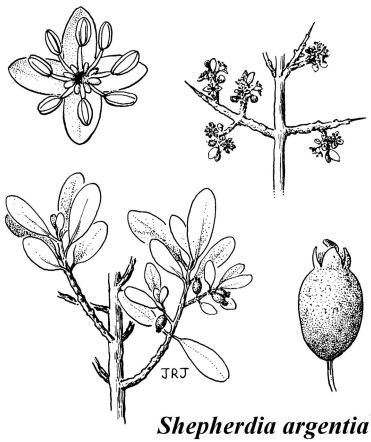
The herbaceous undergrowth varies from a sparse to dense cover. Forb species that may be present include *Solidago canadensis* (Canada goldenrod), *Maianthemum stellatum* (starry false Solomon seal), *Clematis ligusticifolia* (western white clematis), and *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower). Some stands have a thick litter layer between clumps of the native bunchgrass *Leymus cinereus* (basin wild-rye). Non-native grasses, including *Poa pratensis* (Kentucky bluegrass), *Bromus tectorum* (cheatgrass), and *Bromus inermis* (smooth brome) are present in disturbed stands.

Ecological Processes

In Colorado, *Shepherdia argentea* (silver buffaloberry) was probably once more widespread, but is on the decline with the loss of lower elevation riparian habitats. *Shepherdia argentea* is now an uncommon riparian shrub and is being replaced by *Elaeagnus angustifolia* (Russian olive). A few stands of the *Shepherdia argentea* association have *Populus angustifolia* (narrowleaf cottonwood) present. Historically, the *Shepherdia argentea* plant association may have been part of a riparian woodland dominated by *Populus angustifolia*. More information is needed about the historical range, regeneration requirements, and drought tolerance of *Shepherdia argentea*.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
56	(25-73%)	Shepherdia argentea	7
22	(1-47%)	Rosa woodsii	5
16	(1-31%)	Prunus virginiana var. melanocarpa	2
13	(1-24%)	Solidago canadensis	2
11	(1-20%)	Leymus cinereus	2
11	(1-20%)	Clematis ligusticifolia	2
10	(1-31%)	Salix exigua	5
10	(1-36%)	Poa pratensis	5
9	(1-22%)	Maianthemum stellatum	4
8	(1-22%)	Rhus trilobata var. trilobata	3
8	(1-14%)	Salix ligulifolia	2
6	(1-16%)	Elymus trachycaulus ssp. trachycaulus	3
6	(1-10%)	Rudbeckia laciniata var. ampla	2

Other species with < 5% average cover present in at least 10% of plots:
Cirsium arvense (1-7%), Berberis fendleri (1-5%), Symphoricarpos oreophilus (2-3%), Bromus inermis (1-5%), Taraxacum officinale (1-3%), Ribes inerme (1-2%), Juncus balticus var. montanus (1%), Equisetum arvense (1%), Erigeron flagellaris (1%), Equisetum laevigatum (1%).



Shepherdia argentia

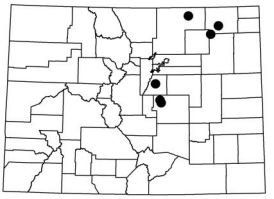
Western snowberry Shrubland

Symphoricarpos occidentalis

Global rank/State rank:
G4G5 / S3

HGM subclass: R5

Colorado elevation range:
3,900-6,600 ft (1,180-2,000 m)



General Description

The *Symphoricarpos occidentalis* (western snowberry) plant association occurs in small draws and on toeslopes within foothill canyons of the Colorado Front Range. Along the South Platte River floodplain, this association forms large, patchy stands of low to medium height on higher terraces and islands. Generally, few other shrub species are present.

Along the South Platte River, this plant association occurs on higher terraces and open rises of the broad floodplain. Along smaller tributaries, it occurs on draws and rocky ledges. *Symphoricarpos occidentalis* (western snowberry) can occur in narrow bands or as widely spaced individuals, but is most often found in large, thick patches. The streams have large braided channels and narrow, steep tributaries. Soils are silty clay loams and silty loams with moderately deep top layers (3-5 ft, 1-1.5 m).

Vegetation Description

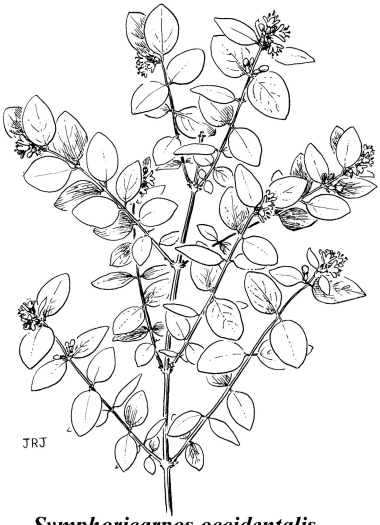
Symphoricarpos occidentalis (western snowberry) forms a moderately dense low stature (3 ft, 1.1 m) shrub layer with 30-90% cover. Other shrub species present in small amounts are *Ribes aureum* (golden currant) and *Salix exigua* (sandbar willow). The herbaceous undergrowth is sparse.

Ecological Processes

The *Symphoricarpos occidentalis* (western snowberry) plant association occupies the driest sites in the riparian area and may be a transitional community between riverine and upland habitats. This plant association is one of the last successional stages of the pioneering floodplain forest of the South Platte River in eastern Colorado. As the older *Populus deltoides* ssp. *monilifera* (plains cottonwood) die and fall over, they leave an open shrubland of *Symphoricarpos occidentalis*.

Avg. Cover %	(Range)	Species Name	# Plots (N=6)
57	(30-90%)	Symphoricarpos occidentalis	6
51	(5-96%)	Toxicodendron rydbergii	2
18	(6-29%)	Poa pratensis	6
12	(4-20%)	Bromus inermis	2
8	(1-27%)	Pascopyrum smithii	4
7	(1-13%)	Elymus lanceolatus	2
7	(1-15%)	Salix exigua	4

Other species with < 5% average cover present in at least 10% of plots:
Rosa woodsii (1-7%), Cirsium arvense (3-4%), Quercus gambelii (2-4%), Ambrosia artemisiifolia var. elatior (1-5%), Humulus lupulus var. lupuloides (1-4%), Ribes aureum (1-3%), Mentha arvensis (1-3%), Glycyrrhiza lepidota (1-3%), Taraxacum officinale (1-3%), Mirabilis nyctaginea (1-2%), Elymus canadensis (1-2%), Urtica dioica ssp. gracilis (1%).



Symphoricarpos occidentalis

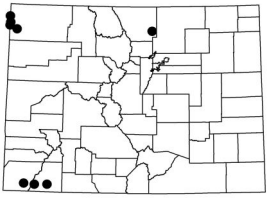
Saltcedar Shrubland

Tamarix ramosissima

Global rank/State rank:
Not Applicable

HGM subclass: R3/4, R5

Colorado elevation range:
5,289-6,490 ft (1,612-1,978 m)



General Description

Tamarix ramosissima (saltcedar) is a small deciduous shrub or tree that was introduced from Eurasia and is now naturalized in the southwestern United States where it is replacing native cottonwood and willow species. It is extremely adaptive, becomes established in disturbed areas, and often displaces native vegetation. It is tolerant of environmental extremes and is very long-lived.

Vegetation Description

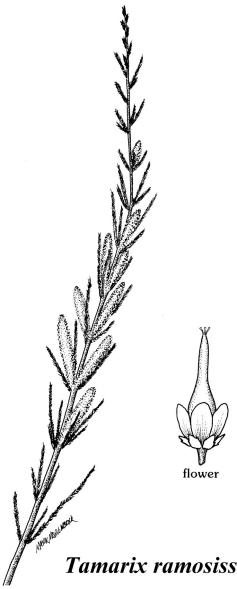
Tamarix ramosissima (saltcedar) often occurs as a near monoculture (5-100% cover). In some stands, however, understory species have as much or more cover than *Tamarix*. Abundant understory species include *Elymus lanceolatus* (wild rye), *Phalaris arundinacea* (reed canarygrass), *Bromus tectorum* (cheatgrass), and *Chrysothamnus viscidiflorus* (green rabbitbrush). Other species that may occur include *Hordeum jubatum* (foxtail barley), *Distichlis spicata* (inland saltgrass), and *Sporobolus airoides* (alkali sacaton).

Ecological Processes

Tamarix ramosissima (saltcedar) pioneers on newly exposed point bars and islands with little understory vegetation present. The species also invades grasslands dominated by *Distichlis spicata* (inland saltgrass) and *Sporobolus airoides* (alkali sacaton). Seedlings grow slowly and are susceptible to shading. The plant is considered to be a facultative phreatophyte that can draw from groundwater, but after establishment no longer needs groundwater to survive. *Tamarix* is extremely aggressive, tenacious, and persistent once established.

Avg. Cover %	(Range)	Species Name	# Plots (N=56)
47	(5-100%)	Tamarix ramosissima	56
20	(1-90%)	Bromus tectorum	12
20	(1-88%)	Juncus balticus var. montanus	6
16	(0.1-37.5%)	Lepidium latifolium	8
15	(1-50%)	Heterotheca villosa	9
14	(1-60%)	Elymus repens	5
12	(0.1-62%)	Chrysothamnus viscidiflorus	8
12	(0.1-50%)	Agrostis gigantea	18
12	(0.1-40%)	Lepidium montanum	9
9	(0.1-32.9%)	Iva axillaris	18
8	(0.1-20%)	Equisetum hyemale var. affine	14
7	(2-30.7%)	Sporobolus airoides	8
6	(1-15%)	Distichlis spicata	10
6	(0.1-15%)	Pascopyrum smithii	7
5	(1-10%)	Elymus trachycaulus ssp. trachycaulus	6
5	(0.1-30.2%)	Melilotus officinalis	24
4	(0.1-15%)	Acer negundo var. interius	5

Other species with < 5% average cover present in at least 10% of plots:
Sporobolus cryptandrus (0.1-10%), Poa pratensis (1-15%), Chrysothamnus linifolius (1-15%), Ericameria nauseosa ssp. nauseosa var. glabrata (1-10%), Elymus canadensis (0.1-10%), Muhlenbergia asperifolia (1-5%), Hordeum jubatum ssp. jubatum (0.1-5%), Cirsium arvense (0.1-7%), Asclepias speciosa (0.1-9%), Conyza canadensis (0.1-8%), Salix exigua (0.1-5%), Populus deltoides (0.1-8%), Xanthium strumarium (0.1-5%), Plantago major (0.1-3%), Apocynum cannabinum (0.1-3%), Mentha arvensis (0.1-2%), Machaeranthera canescens (0.1-1%), Gratiola neglecta (0.1-1%), Tragopogon dubius (0.1-1%).



Tamarix ramosissima

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Redtop Herbaceous Vegetation

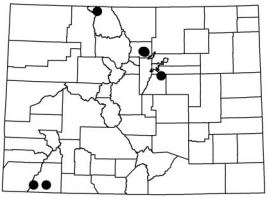
Agrostis gigantea

Agrostis gigantea

Global rank/State rank:
Not Applicable

HGM subclass: D4/5?, S3/4

Colorado elevation range:
5,200-8,760 ft (1,580-2,670 m)



General Description

Agrostis gigantea (redtop) is a pasture grass of Eurasian origin that is widely cultivated as hay. This species readily escapes cultivation and can be found in many wet meadows in the western U.S., including those that are no longer cultivated or have never been cultivated. *Agrostis gigantea* (redtop) is a facultative wetland species which grows in mesic to semi-hydric conditions and is tolerant of some flooding. The association is typically found in or near irrigated hay meadows or along streams and ditches.

Agrostis gigantea (redtop) grows on a wide variety of soil types and textures. It is tolerant of moderately acidic soils and soils low in calcium, phosphorus, and potassium. Soils in Colorado plots were fine to coarse alluvial and colluvial deposits over various substrates.

Vegetation Description

Agrostis gigantea (redtop) is typically the dominant species of this association, with an average cover of about 60% (range 15-90%). Other introduced pasture grassses are common associated species, and include *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (timothy), *Phalaris arundinacea* (reed canarygrass) and *Bromus inermis* (smooth brome). A variety of native and non-native graminoids and forbs also occur,

the most common species include *Carex pellita* (woolly sedge), *Epilobium ciliatum* ssp. *glandulosum* (fringed willowherb), *Rumex crispus* (curly dock), *Plantago lanceolata* (narrowleaf plantain) and *Juncus balticus* var. *montanus* (mountain rush).

Ecological Processes

Agrostis gigantea (redtop) colonizes disturbed sites. Older stands may be replaced by forbs.

Avg. Cover %	(Range)	Species Name	# Plots (N=12)
60	(15-90%)	Agrostis gigantea	12
26	(1-50%)	Trifolium pratense	2
20	(1-38%)	Rorippa nasturtium-aquaticum	2
18	(5-30%)	Bromus inermis	2
15	(10-20%)	Sporobolus compositus var. compositus	2
14	(1-38%)	Iris missouriensis	3
7	(1-15%)	Juncus balticus var. montanus	5
7	(1-15%)	Muhlenbergia asperifolia	3
6	(1-15%)	Poa pratensis	5
5	(1-15%)	Phleum pratense	5
5	(5-5%)	Crataegus rivularis	2
5	(5-5%)	Dactylis glomerata	2
5	(5-5%)	Festuca arizonica	2
5	(5-5%)	Hordeum jubatum ssp. jubatum	2

Other species with < 5% average cover present in at least 10% of plots:
Phalaris arundinacea (1-5%), Medicago lupulina (1-5%), Eleocharis palustris (1-5%), Plantago lanceolata (1-5%), Carex nebrascensis (0.1-5%), Melilotus officinalis (1-5%), Chenopodium incanum (0.1-5%), Plantago virginica (2%), Epilobium ciliatum ssp. glandulosum (1-5%), Symphyotrichum falcatum (1-2.5%), Oligoneuron rigidum (1-3%), Symphyotrichum laeve var. geyeri (1-2%), Carex pellita (1-2%), Taraxacum officinale (1%), Cirsium arvense (1%), Symphyotrichum lanceolatum ssp. hesperium var. hesperium (1%), Carduus nutans ssp. macrolepis (1%), Polypogon monspeliensis (1%), Rosa woodsii (1%), Rumex crispus (0.1-2%), Plantago major (0.1-1%), Cirsium vulgare (0.1-1%).

Shortawn foxtail Herbaceous Vegetation

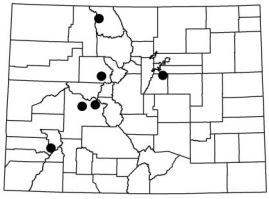
Alopecurus aequalis

Alopecurus aequalis

Global rank/State rank:
G3G4 / S2

HGM subclass: D2/3, D4/5

Colorado elevation range:
6,000-10,400 ft (1,830-3,170 m)



General Description

The *Alopecurus aequalis* (shortawn foxtail) association is an herbaceous association of lower to mid montane wet meadows and areas around beaver ponds, or other depressions. A perennial graminoid native to North America, *Alopecurus aequalis* under natural conditions is almost always found in wetlands. Although indigenous to North America, it is sometimes regarded as weedy here, and is considered a pest species in other countries.

Vegetation Description

Alopecurus aequalis (shortawn foxtail) is the characteristic species of this association, and is always present with cover ranging from low (2.5%) to high (85%). In some instances, one other herbaceous species may equal or exceed the percent cover of *Alopecurus aequalis*. Trees and shrubs are usually absent, although stems of *Salix exigua* (sandbar willow) may be sometimes be present. Herbaceous cover is usually sparse to moderate, and includes a variety of forb and graminoid species such as *Ranunulus repens* (creeping buttercup), *Hippuris vulgaris* (common mare's-tail), *Beckmannia syzigachne* (American sloughgrass), *Eleocharis palustris* (common spikerush), *Carex utriculata* (beaked sedge) and *Glyceria striata* (fowl mannagrass).

Weedy species such as *Echinochloa crus-galli* (barnyard grass) and *Xanthium strumarium* (rough cocklebur) may also be present.

Ecological Processes

Little information is available about the successional processes of this association.

Avg. Cover %	(Range)	Species Name	# Plots (N=12)
31	(3-85%)	Alopecurus aequalis	12
19	(0.1-38%)	Echinochloa crus-galli	2
16	(2-31%)	Ranunculus repens	4
8	(0.1-15%)	Hippuris vulgaris	2
8	(0.1-15%)	Rumex salicifolius var. mexicanus	2

Other species with < 5% average cover present in at least 10% of plots:
Beckmannia syzigachne (2.5-3%), Carex utriculata (0.1-3%), Glyceria striata (1-2%), Eleocharis palustris (0.1-2%).

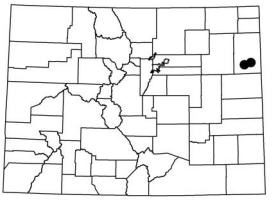
Big bluestem - Yellow indiangrass - (Prairie cordgrass) Herbaceous Vegetation

Andropogon gerardii - Sorghastrum nutans - (Spartina pectinata)

Global rank/State rank:
G2 / S1S2

HGM subclass: R5

Colorado elevation range:
3,700-5,700 ft (1,110-1,740m)



General Description

The *Andropogon gerardii-Sorghastrum nutans-(Spartina pectinata))* (big bluestem-Indiangrass-(prairie cordgrass)) plant association is a tall-grass, wet meadow. It occurs in riparian areas and low lying swales on the plains in eastern Colorado and in small patches along the Front Range foothills. Stands east of Colorado are less riparian dependent as the amount of annual rainfall increases. Eastern Colorado plains and foothills appear to be the westernmost extent of this plant association's range.

This plant association occupies low, flat floodplains and terraces. The sites are usually not more than 5 ft (1.5 m) from the water table and occur 300-1,200 ft (100-365 m) from the active stream channel. The channel is low gradient with a well developed floodplain and strong meander pattern. Soils are well-drained compared to the soils of the nearby floodplain environment. Soil textures range from fine sands to loamy sand.

Vegetation Description

This plant association is characterized by a thick stand of grasses dominated by *Panicum virgatum* (switchgrass), *Carex praegracilis* (clustered field sedge), *Sorghastrum nutans* (yellow Indiangrass), and *Andropogon gerardii* (big bluestem). Other graminoid species include *Schoenoplectus pungens* (common threesquare), *Spartina pectinata* (prairie cordgrass) and *Poa pratensis* (Kentucky bluegrass). Forb species are scattered and include *Glycyrrhiza lepidota* (American licorice), and *Cichorium intybus* (chicory). *Solidago* spp. (goldenrod) and *Equisetum laevigatum* (smooth horsetail) are also present. A few stems of shrubs, such as *Salix exigua* (sandbar willow), may grade in from adjacent plant associations.

Ecological Processes

This plant association occurs in an environment that is intermediate between palustrine and terrestrial. The water table is often near the surface and standing water may be

present in winter, spring, or after a heavy rainfall. Along the Arikaree River in northeastern Colorado, summer precipitation and spring run-off from neighboring sand hills keep the water table within 16 inches (40 cm) of the surface. This raised water table is conducive to the growth of *Andropogon gerardii* (big bluestem). This association may also be dependent on fire to keep shrubs and trees from becoming established.

Avg. Cover %	(Range)	Species Name	# Plots (N=2)
46	(23-68%)	Panicum virgatum	2
43	—	Poa pratensis	1
15	(9-21%)	Sorghastrum nutans	2
11	—	Hordeum jubatum ssp. jubatum	1
8	(7-9%)	Glycyrrhiza lepidota	2
7	(2-12%)	Schoenoplectus pungens	2
7	—	Elymus lanceolatus	1
6	—	Ambrosia artemisiifolia var. elatior	1
6	(3-8%)	Cichorium intybus	2

Other species with < 5% average cover present in at least 10% of plots:
Juncus articulatus (2-4%), Equisetum laevigatum (1-5%), Elytrigia intermedia (3%), Schizachyrium scoparium (2%), Juncus balticus var. montanus (2%), Poa compressa (2%), Geranium richardsonii (2%), Salix exigua (1%), Artemisia ludoviciana (1%), Bouteloua curtipendula (1%), Eleocharis palustris (1%), Elymus canadensis (1%), Rumex crispus (1%), Spartina pectinata (1%), Melilotus officinalis (1%).

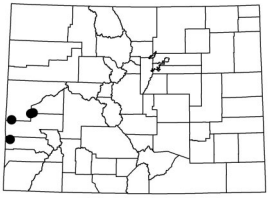
Mancos columbine - (Eastwood monkeyflower) Hanging Garden

Aquilegia micrantha - (Mimulus eastwoodiae)

Global rank/State rank:
G2G3 / S2S3

HGM subclass: S3/4

Colorado elevation range:
5,200-6,500 ft (1,585-1,980 m)



General Description

Hanging gardens flourish in the sandstone canyons of the Colorado River drainage. Three main garden types have been described: alcove, terrace, or windowblind. The type is determined by the nature of the geological formation and the presence or absence of joint systems. In general, the hanging gardens result from ancient swales or valleys in a sand dune-swale system that developed between the Cretaceous and Pennsylvanian periods (65-310 mya). The formations with greatest development are the Navajo and Entrada, both of them cross-bedded, massive formations composed of wind-blown sand and containing ancient pond bottoms that serve as impervious bedding planes. In Colorado, this plant association is often found in seeps at the base of the Wingate sandstone formation just above contact with the underlying Chinle formation.

The *Aquileiga micrantha-(Mimulus eastwoodiae)* (Mancos columbine-(Eastwood monkyflower)) plant association occurs on seeping sandstone walls and in alcoves. Known localities are in overhanging caverns cut into steep, sheer Wingate sandstone walls by springs and seeps. These tend to occur in small draws on the southeast-facing sides of canyons, but probably are not restricted to this exposure.

Vegetation Description

The seeps are often under overhanging cliffs or emerge from a vertical sandstone face. *Aquileiga micrantha* (Mancos columbine) is typically abundant while *Mimulus eastwoodiae* (Eastwood monkeyflower) is less so. A few shrubs, such as *Prunus virginiana* (chokecherry), *Ribes aureum* (golden currant), or *Betula occidentalis* (river birch) may occur nearby.

Other species found in these seeps include the fern *Adiantum capillus-veneris* (common maidenhair), *Epipactis gigantea* (giant helleborine or stream orchid), and occassionally the globally imperiled (G2) *Erigeron kachinensis* (Kachina daisy).

Species growing at the base of these seeps, where soil development can occur include *Cirsium calcareum* (Cainville thistle), *Calamagrostis scopulorum* (ditch reedgrass), *Phragmites australis* (common reed), *Aster laevis* (smooth blue aster), and *Muhlenbergia andina* (foxtail muhly).

Ecological Processes

Aquileiga micrantha-(Mimulus eastwoodiae) (Mancos columbine-(Eastwood monkyflower)) hanging gardens are often lush, stable and long-lived wetlands. Their physical location reduces the risk of disturbance, although disturbance of the water source can eliminate the association.

Avg. Cover %	(Range)	Species Name	# Plots
		No stand data available	

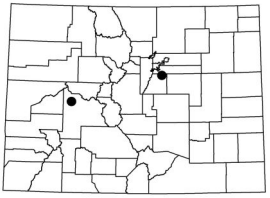
Beggartick Herbaceous Vegetation

Bidens cernua-Bidens frondosa

Global rank/State rank:
G3 / S3

HGM subclass: D2/3

Colorado elevation range:
6,000-7,500 ft (1,830-2,290 m)



General Description

The *Bidens cernua-Bidens frondosa* (nodding beggartick-devil's beggartick) association is an adventitious community that occurs on highly disturbed pond and lake margins and river backwaters. The two *Bidens* (beggartick) species are tall, rapid growing, annual forbs of wet soils and disturbed areas. In the Cherry Creek basin these two species are often found dominating a nitrophilous community on river bank edges.

This association is typically found on low gradient streams where seasonal inundation and hydrological disturbance are factors influencing community structure. In Colorado it is often found in muddy swales and on pond margins on the plains and in the intermountain basins. Stands typically occur on clayey or sandy wet loams. Soils are generally saturated seasonally or occasionally.

Vegetation Description

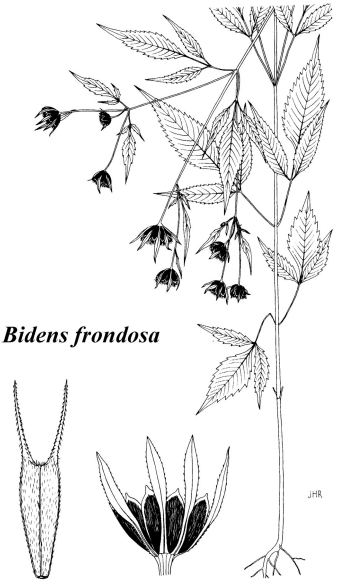
Bidens cernua (nodding beggartick) often occurs in a near monoculture, contributing 2-98% of the cover of documented stands. *Hordeum jubatum* (foxtail barley) makes up 63% of the cover in one plot. In all other stands associated species provide less than 15% of the cover. *Eleocharis palustris* (common spikerush) is one of the more common associates. Typically the vegetation varies widely from site to site, with the graminoids *Typha latifolia* (broadleaf cattail), *Schoenoplectus pungens* (common threesquare), *Scirpus lacustris* (hard/softstem bulrush), and *Glyceria grandis* (American mannagrass) being possible associates. Forbs other than *Bidens* generally makes up less than 5% of the vegetation cover. Aquatic plants such as *Sagittaria cuneata* (arumleaf arrowhead), *Myriophyllum sibiricum* (shortspike watermilfoil), and *Lemna* spp. (duckweed) may occur.

Ecological Processes

The *Bidens cernua-Bidens frondosa* (nodding beggartick-devil's beggartick) association is a nitrophilous community, which may indicate eutrophication of the habitat in which it is found. On wet soils other adventitious species may be found with *Bidens*; in standing water a variety of native aquatic plants may co-occur. The presence of this association may indicate excessive trampling of the shoreline where it occurs.

Avg. Cover %	(Range)	Species Name	# Plots (N=9)
65	(2-98%)	Bidens cernua	9
63	—	Bidens frondosa	1
63	—	Hordeum jubatum ssp. jubatum	1
17	(2-63%)	Eleocharis palustris	5
15	—	Alopecurus aequalis	1
15	—	Typha latifolia	1
9	—	Juncus ensifolius	1
8	(0.1-15%)	Polygonum lapathifolium	2
5	—	Spirodela polyrhiza	1
5	—	Phleum pratense	1

Other species with < 5% average cover present in at least 10% of plots:
Mentha arvensis (2.5-8%), Agrostis gigantea (2.5-4%), Carduus acanthoides (3%), Epilobium ciliatum ssp. ciliatum (3%), Rudbeckia laciniata var. ampla (3%), Lycopus americanus (2.5%), Veronica anagallis-aquatica (2.5%), Epilobium ciliatum ssp. glandulosum (2.5%), Equisetum laevigatum (2.5%), Glyceria grandis (2.5%), Schoenoplectus pungens (2.5%), Scirpus pallidus (2.5%), Polygonum persicaria (2.5%), Rorippa nasturtium-aquaticum (2.5%), Rorippa palustris ssp. hispida (2.5%), Salix exigua (2.5%), Schoenoplectus acutus\tabernaemontani (0.1-2.5%), Lolium pratense (0.1%), Carex nebrascensis (0.1%), Phalaris arundinacea (0.1%), Juncus torreyi (0.1%), Rumex crispus (0.1%), Sagittaria cuneata (0.1%).



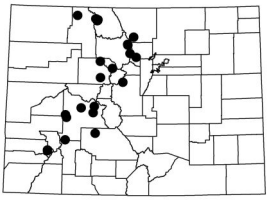
Bluejoint reedgrass Herbaceous Vegetation

Calamagrostis canadensis

Global rank/State rank:
G4 / S4

HGM subclass: R1, R2

Colorado elevation range:
7,700-11,200 ft (2,350-3,400 m)



General Description

The *Calamagrostis canadensis* (bluejoint reedgrass) plant association is a relatively small meadow association that occurs in broad glaciated valleys, openings in moist forests, silted-in beaver ponds, and narrow floodplains of lower montane canyons. It generally has few shrubs and fairly dense cover of grasses.

This plant association is found throughout the western and central mountains of Colorado. It is a common and well documented association throughout the western states. Channel types are narrow and sinuous to steeper, broad and somewhat sinuous. Soils are silty loams to skeletal loamy sands.

Vegetation Description

This plant association is characterized by a dense cover of *Calamagrostis canadensis* (bluejoint reedgrass). Other graminoids can be abundant, but never exceed the cover of *Calamagrostis canadensis* (bluejoint reedgrass). Other frequently occurring species include *Carex aquatilis* (water sedge) and *Equisetum arvense* (field horsetail). Other less frequently occurring species include *Carex microptera* (small winged sedge), *C. utriculata* (beaked sedge), *Luzula parviflora* (smallflowered woodrush), and *Glyceria striata* (fowl mannagrass).

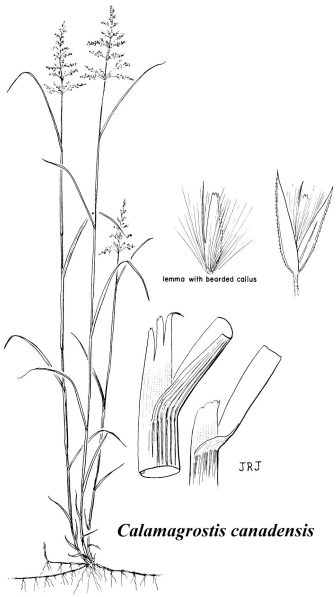
Forb cover is usually minor, but may include *Geum macrophyllum* (largeleaf avens), *Cardamine cordifolia* (heartleaf bittercress), *Senecio triangularis* (arrowleaf ragwort), and *Symphyotrichum foliaceum* var. *foliaceum* (alpine leafybract aster). A few shrubs and trees may occur in or near the stand, usually with less than 10% individual cover. Species present may include *Abies lasiocarpa* (subalpine fir). *Picea engelmannii* (Engelmann spruce), *Cornus sericea* (red-osier dogwood), *Ribes* spp. (currant), *Rosa woodsii* (Woods rose) and *Symphoricarpos* spp. (snowberry).

Ecological Processes

The *Calamagrostis canadensis* (bluejoint reedgrass) plant association appears to be a long-lived, mid-seral meadow association. At one site in the Routt National Forest *Calamagrostis canadensis* occurred on stable banks of an older channel and *Equisetum arvense* (field horsetail) and *Carex* (sedge) species were colonizing recently eroded banks. In Utah, this plant association often occurs adjacent to *Pinus contorta* (lodgepole pine) associations. When the pine trees die from pine bark beetle infestations, the water table rises as a result of reduced evapotranspiration. Increased available soil moisture allows for the expansion of the *Calamagrostis canadensis* plant association at the meadow/forest ecotone. This appears to be the case in Colorado as well. At subalpine elevations, *Calamagrostis canadensis* commonly occupies the outermost ring of vegetation around kettle ponds occurring within stands of *Pinus contorta*.

Avg. Cover %	(Range)	Species Name	# Plots (N=28)
66	(17-100%)	Calamagrostis canadensis	28
10	(1-15%)	Erigeron peregrinus ssp. callianthemus	3
5	(1-8%)	Glyceria striata	3
5	(1-18%)	Carex aquatilis	12
5	(2-10%)	Senecio triangularis	9

Other species with < 5% average cover present in at least 10% of plots:
Equisetum arvense (2-7%), Geum macrophyllum var. perincisum (1-10%), Carex utriculata (1-7%), Heracleum maximum (1-10%), Mertensia ciliata (1-13%), Conioselinum scopulorum (0.1-10%), Caltha leptosepala (1-5%), Galium triflorum (0.1-5%), Cardamine cordifolia (0.1-5%), Mentha arvensis (1-3%), Oxypolis fendleri (0.1-2%), Lonicera involucrata (1%), Achillea millefolium var. occidentalis (0.1-1%).



Calamagrostis canadensis

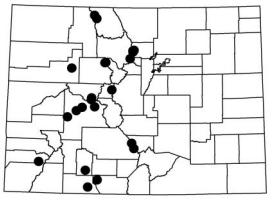
Marsh marigold Herbaceous Vegetation

Caltha leptosepala

Global rank/State rank:
G4 / S4

HGM subclass: S1/2

Colorado elevation range:
8,900-13,100 ft (2,700-3,990 m)



General Description

The frequently seen *Caltha leptosepala* (marsh marigold) plant association occurs in the subalpine and lower alpine on perennially saturated ground. This association is often associated with shallow seeps on hillslopes. It can be recognized by the prominence of *Caltha leptosepala*, a near absence of shrubs, and low cover of *Rhodiola rhodantha* (redpod stonecrop). This association occurs in mountainous regions throughout Colorado.

This association typically occupies seeps, streamsides, springs, and wet, sub-irrigated meadows on slopes up to 30%.

Vegetation Description

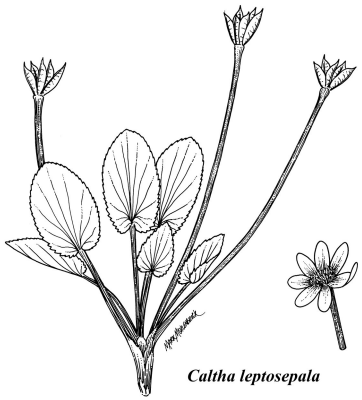
A dense, conspicuous layer of *Caltha leptosepala* (marsh marigold) dominates the plant association. Many graminoids and forbs that tolerate long-term soil saturation may also be present. *Carex aquatilis* (water sedge) is very common and is sometimes a co-dominant with *Caltha leptosepala*. *Deschampsia caespitosa* (tufted hairgrass) may be present, but in small amounts. Other forb species present may include *Pedicularis groenlandica* (elephant head), *Stellaria umbellata* (umbell starwort), *Swertia perennis* (star gentian), *Sedum rhodanthum* (pink stonecrop), and several others.

Ecological Processes

Caltha leptosepala is considered a stable community type. This association receives little use by livestock due to the wet conditions and the bitter, acrid taste of the foliage. Elk and deer may use this association heavily.

Avg. Cover %	(Range)	Species Name	# Plots (N=38)
42	(3-87%)	Caltha leptosepala	38
10	(0.1-40%)	Erigeron peregrinus ssp. callianthemus	10
9	(0.1-25%)	Ligusticum tenuifolium	4
9	(0.1-20%)	Calamagrostis canadensis	5
8	(1-20%)	Carex aquatilis	15
8	(3-15%)	Oxypolis fendleri	4
8	(0.1-20%)	Cardamine cordifolia	6
7	(0.1-17%)	Senecio triangularis	6
6	(0.1-15%)	Arnica mollis	6
5	(0.1-25%)	Carex scopulorum	10
5	(0.1-28%)	Deschampsia caespitosa	21
5	(0.1-10%)	Trollius laxus ssp. albiflorus	4

Other species with < 5% average cover present in at least 10% of plots:
Geum rossii var. turbinatum (0.1-17%), Swertia perennis (0.1-14%), Carex nigricans (0.1-25%), Saxifraga odontoloma (0.1-6%), Salix planifolia (0.1-10%), Veronica wormskjoldii (0.1-8%), Rhodiola rhodantha (0.1-15%), Pedicularis groenlandica (0.1-14%), Saxifraga oregana (0.1-7%), Polygonum bistortoides (0.1-5%), Juncus drummondii (0.1-7%), Primula parryi (0.1-6.8%), Potentilla diversifolia (0.1-4 %), Packera crocata (0.1-3%), Poa arctica (0.1-3%), Phleum alpinum (0.1-2%), Epilobium anagallidifolium (0.1-2%), Stellaria umbellata (0.1%).



Caltha leptosepala

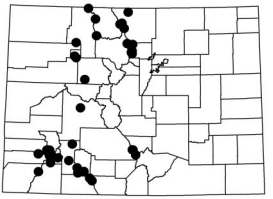
Heartleaf bittercress - Tall fringed bluebells - Arrowleaf ragwort Herbaceous Vegetation

Cardamine cordifolia - Mertensia ciliata - Senecio triangularis

Global rank/State rank:
G4 / S4

HGM subclass: S1/2, R1, R2

Colorado elevation range:
8,450-12,300 ft (2,570-3,800 m)



General Description

The generally small stands of the *Cardamine cordifolia-Mertensia ciliata-Senecio triangularis* (heartleaf bittercress-tall fringed bluebells-arrowleaf groundsel) plant association are found in and near running water of small streams, seeps, and springs. Associated taxa may vary greatly with this plant association, but the dominance of *Cardamine cordifolia*, *Mertensia ciliata* or *Senecio triangularis* is clear. All of these species, or only one of the three, may be present. If trees form a canopy above the forbs, the stand may belong to the *Abies lasiocarpa-Picea engelmannii/Mertensia ciliata* (subalpine fir-Engelmann spruce/tall fringed bluebells) association.

This association typically occurs on moderately steep to very steep first order streams, but can occur on less steep stream reaches as well. In many cases this habitat probably experiences a long period of snow cover. Soils can be moderately deep (15 in, 40 cm) sandy clay loam and sand, but in general are quite thin and skeletal.

Vegetation Description

This association is easy to recognize. It is a narrow band of forbs and mosses with one or more of the following three forb species being abundantly present: *Cardamine cordifolia* (heartleaf bittercress), *Mertensia ciliata* (tall fringed bluebells) and *Senecio triangularis* (arrowleaf ragwort). All of these species may be present or only one of them. In addition, this type is always rich in other forbs. Stands generally have at least fifteen species, and often have as many as 45 forb species present. This diversity is made up of a wide variety of forb species; some can be quite abundant. Other forb species include *Saxifraga odontoloma* (brook saxifrage), *Mitella pentandra* (fivestamen miterwort), *Oxypolis fendleri* (Fendler cowbane), *Delphinium barbeyi* (tall larkspur), *Epilobium* spp. (willowherb), *Caltha leptosepala* (marsh marigold), *Geranium richardsonii* (Richardson geranium), *Arnica cordifolia* (heartleaf arnica), *Conioselinum scopulorum* (Rocky Mountain hemlockparsley), *Rhodiola integrifolia* ssp. *integrifolia* (ledge stonecrop), *Primula parryi* (Parry primrose), *Corydalis*

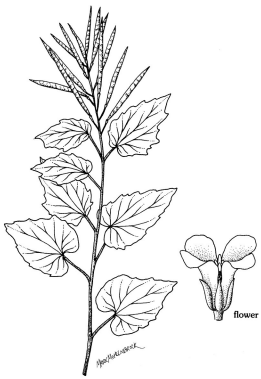
caseana ssp. *brandegei* (Brandegee fumewort), *Senecio taraxacoides* (dandelion ragwort), *Heracleum maximum* (common cowparsnip), and *Ligusticum porteri* (Porter licoriceroot), among others.

Ecological Processes

This association is found in a habitat which is early-seral and experiences frequent fluvial depositions, keeping any invading conifers from advancing beyond the sapling stage. Although it is an early-seral community, the *Cardamine cordifolia-Mertensia ciliata-Senecio triangularis* plant association is reasonably stable because it is maintained by frequent disturbance. However, with excessive grazing by sheep, it may be converted to communities dominated by various increaser species.

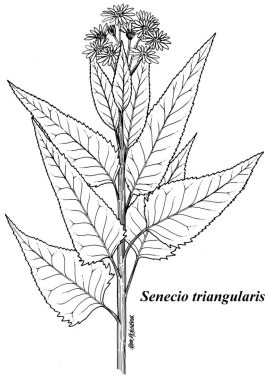
Avg. Cover %	(Range)	Species Name	# Plots (N=57)
33	(1-87%)	Cardamine cordifolia	51
27	(1-80%)	Mertensia ciliata	36
24	(0.1-90%)	Senecio triangularis	37
11	(1-30%)	Heracleum maximum	10
8	(0.1-30%)	Oxypolis fendleri	19
8	(0.1-30%)	Rhodiola integrifolia	5
8	(0.1-37%)	Saxifraga odontoloma	31
7	(2-20%)	Equisetum arvense	11
7	(1-25%)	Carex aquatilis	7
7	(0.1-20%)	Calamagrostis canadensis	10
6	(0.1-30%)	Caltha leptosepala	24
6	(0.1-15%)	Carex scopulorum	6
6	(1-18%)	Geranium richardsonii	8
5	(0.1-28%)	Picea engelmannii	10
5	(1-24%)	Arnica mollis	8

Other species with < 5% average cover present in at least 10% of plots:
Aconitum columbianum (1-15%), Juncus mertensianus (0.1-15%), Deschampsia caespitosa (0.1-20%), Carex utriculata (1-7%), Conioselinum scopulorum (1-5%), Rhodiola rhodantha (1-3.1%), Primula parryi (0.1-13%), Mitella pentandra (0.1-6%), Taraxacum officinale (1-9%), Mimulus guttatus (1-3%), Poa leptocoma (0.1-5%), Erigeron peregrinus ssp. callianthemus (0.1-7%), Castilleja rhexiifolia (0.1-3%), Phleum alpinum (0.1-3%), Trollius laxus ssp. albiflorus (0.1-3%), Achillea millefolium var. occidentalis (1-3%), Sibbaldia procumbens (0.1-3%), Luzula parviflora (1-3%), Juncus drummondii (0.1-3%), Polygonum bistortoides (0.1-3%), Epilobium anagallidifolium (0.1-4%), Stellaria umbellata (0.1-1%), Veronica wormskjoldii (0.1-1%), Poa reflexa (0.1-1%).



Cardamine cordifolia

Mertensia ciliata


Senecio triangularis

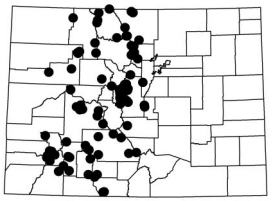
Water sedge Herbaceous Vegetation

Carex aquatilis

Global rank/State rank:
G5 / S4

HGM subclass: S1/2

Colorado elevation range:
7,600-11,800 ft (2,300-3,600 m)



General Description

Carex aquatilis (water sedge) is a common, widespread plant association that can occur as large meadows in high montane valleys or as narrow strips bordering ponds and streams at lower elevations. It occurs in a variety of environmental settings in the montane and subalpine zones. A clear dominance by *Carex aquatilis* and low cover of *C. utriculata* (beaked sedge) or *Pedicularis groenlandica* (elephanthead lousewort) set this plant association apart from closely related types.

This plant association occurs in a variety of valley types, but the largest expanses occur in broad, low-gradient valleys where large snow-melt fed swales and slopes dominate the landscape. It can also grow in fine sediments at the margins of lakes and beaver ponds. The largest occurrences are found adjacent to narrow, deep, sinuous streams. Some stands occur along steep streams, others along wide, shallow streams, as well as where beaver dams and ponds have altered the channel morphology. Soils are mostly deep, dark colored heavy clays, silts or organic layers over more skeletal layers. Soils are often saturated to the surface, and if not, mottling is commonly present within 10 cm of the surface.

Vegetation Description

This plant association is characterized by a dense rhizomatous meadow of *Carex aquatilis* (water sedge), usually accompanied by a few other graminoids species such as *Calamagrostis canadensis* (bluejoint reedgrass) or *Deschampsia caespitosa* (tufted hairgrass). *Eleocharis quinqueflora* (fewflower spikerush) can be abundant on organic substrates. *Carex utriculata* (beaked sedge) may be present. When present, *Carex utriculata* (beaked sedge) is usually not more than one third the cover of *C. aquatilis* (water sedge) cover. If it is more than that, the stand may be a *Carex aquatilis* - *Carex utriculata* (water sedge- beaked sedge) or *Carex utriculata* (beaked sedge) plant association. Forbs are often present, although sometimes inconspicuously. Species include *Epilobium* spp. (willowweed), *Pedicularis groenlandica* (elephanthead

lousewort), *Caltha leptosepala* (marsh marigold), *Cardamine cordifolia* (heartleaf bittercress), and *Mertensia ciliata* (tall fringed bluebells).

Ecological Processes

Presence of *Carex utriculata* (beaked sedge) may indicate the site has progressed from the more wet *Carex utriculata* community to the current less mesic conditions, and may become dominated by *Salix planifolia* (planeleaf willow) or *Salix wolfii* (Wolf willow). *Carex aquatilis* (water sedge) associations trap sediment from overbank flows which forms a clay pan, eventually raising the water table. This process drives retrogressive succession and a plant association dominated by *Carex utriculata* takes over on these sites.

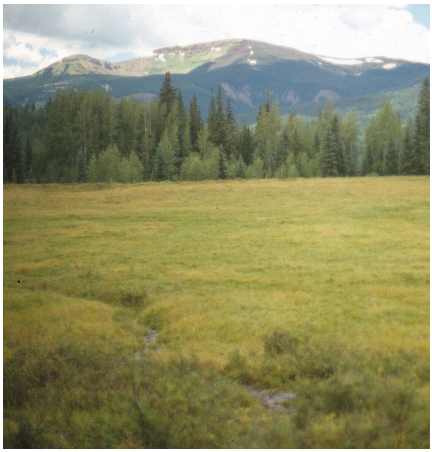
Avg. Cover %	(Range)	Species Name	# Plots (N=133)
60	(5-95%)	Carex aquatilis	133
13	(0.1-48%)	Caltha leptosepala	30
10	(1-30%)	Carex utriculata	35
9	(1-40%)	Calamagrostis canadensis	27
6	(0.1-31%)	Deschampsia caespitosa	40
6	(1-30%)	Juncus balticus var. montanus	19
5	(0.1-30%)	Salix planifolia	32

Other species with < 5% average cover present in at least 10% of plots:
Taraxacum officinale (0.1-20%), Cardamine cordifolia (1-15%), Achillea millefolium var. occidentalis (1-36%), Poa pratensis (1-7%), Geum macrophyllum var. perincisum (0.1-5%), Pedicularis groenlandica (0.1-10%), Rhodiola rhodantha (0.1-5%).

Carex aquatilis

Water sedge - Beaked sedge Herbaceous Vegetation

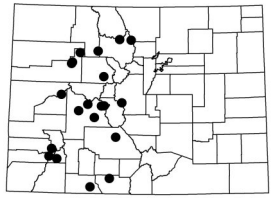
Carex aquatilis - Carex utriculata



Global rank/State rank:
G4 / S4

HGM subclass: D1, S1/2, S3/4

Colorado elevation range:
8,200-11,100 ft (2,500-3,400 m)



General Description

This plant association is recognized by the presence of both *Carex aquatilis* (water sedge) and *Carex utriculata* (beaked sedge) in roughly equal proportions. This is a common association that generally occurs in small to moderate size patches in very shallow, slow-moving to still water or on saturated soils near low-order streams, lakes, and backwater areas of larger rivers.

This plant association occurs in broad, glaciated, subalpine meadows that remain saturated with snowmelt runoff for most of the growing season. It is also often associated with beaver activity. Stream channels are narrow, deep, and sinuous, or wide and shallow. Soils are often organic, thick peat or sandy clays and sandy clay loams originating from glacial till.

Vegetation Description

This plant association has relatively low species diversity due to saturated soil conditions. *Carex aquatilis* (water sedge) and *Carex utriculata* (beaked sedge) co-dominate the association. Both species are present in equal or near equal amounts. For example, a stand with 10% cover of each *Carex* (sedge) species would classify as this type, however a stand with 10% *Carex aquatilis* (water sedge) and 80% *Carex utriculata* (beaked sedge) would classify as a *Carex utriculata* (beaked sedge) plant association. Other graminoid and forb species may also be present. Graminoid species include *Carex microptera* (smallwing sedge), *Deschampsia caespitosa* (tufted hairgrass), *Poa pratensis* (Kentucky bluegrass), *Juncus balticus* var. *montanus* (mountain rush), *Carex nebrascensis* (Nebraska sedge), and *Carex canescens* (pale sedge). Forb species include *Caltha leptosepala* (marsh marigold), *Rhodiola rhodantha* (redpod stonecrop), *Cardamine cordifolia* (heartleaf bittercress), *Senecio triangularis* (arrowleaf ragwort), *Pedicularis groenlandica* (elephanthead lousewort), and *Epilobium* spp. (willowweed).

Ecological Processes

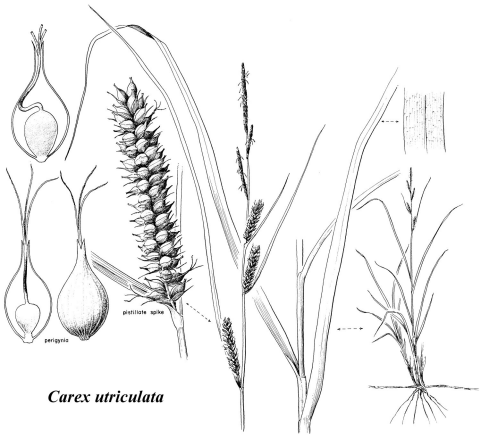
The difficulty in classifying mixed stands of *Carex aquatilis* (water sedge) and *Carex utriculata* (beaked sedge) has been discussed in the literature and attempts have been made to differentiate the types based on soil characteristics. In some cases a dominance of *Carex utriculata* on organic soils and *Carex aquatilis* on mineral soils has been noted, while in other cases the opposite trend where *Carex aquatilis* appears to occur more often on rich organic soils, while *Carex utriculata* occurs on less nutrient rich soils is observed.

In stands observed for this study, water availability appears to be a stronger factor in determining relative dominance of these two sedge species. *Carex utriculata* appears to tolerate standing water and may be a pioneering species since it readily establishes on exposed, saturated mineral soil. In Colorado, *Carex utriculata* occurs more often in standing water and often grades into a mesic terrestrial habitat where *Carex aquatilis* is commonly dominant. The *Carex aquatilis*-*Carex utriculata* plant association may, therefore, represent a spatial transition between a wet *Carex utriculata* association and a mesic *Carex aquatilis* association.

Avg. Cover %	(Range)	Species Name	# Plots (N=20)
32	(9-65%)	Carex utriculata	19*
30	(6-90%)	Carex aquatilis	20
18	(1-40%)	Deschampsia caespitosa	6
10	(3-20%)	Caltha leptosepala	4
7	(2-10%)	Carex canescens	3

Other species with < 5% average cover present in at least 10% of plots:
Carex microptera (1-10%), Poa pratensis (1-11%), Calamagrostis canadensis (1-13%), Juncus balticus var. montanus (1-7%), Pedicularis groenlandica (1-5%), Cardamine cordifolia (1-5%), Senecio triangularis (1-5%), Taraxacum officinale (1-3%), Achillea millefolium var. occidentalis (1-3%), Dasiphora floribunda (1-3%), Equisetum arvense (1-3%), Salix wolfii (1-3%).

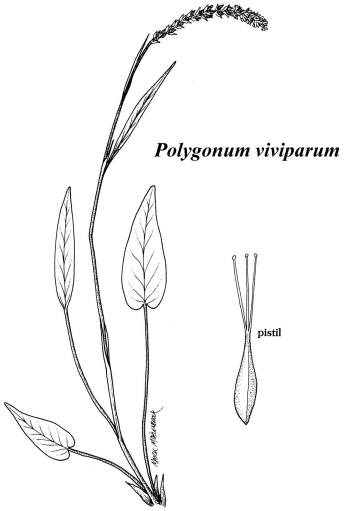
*Carex utriculata occurred in all stands, but was not captured in every sample plot.



Carex utriculata

Hairlike sedge - Serpent-grass Herbaceous Vegetation

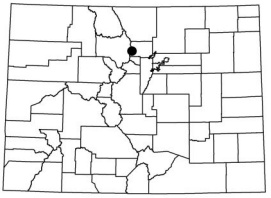
Carex capillaris - Polygonum viviparum



Global rank/State rank:
G2 / S2

HGM subclass: S1/2

Colorado elevation range:
10,700-13,200 ft (3,300-4,000 m)



General Description

This plant association occurs in alpine marshy areas adjacent to streams and melting snow fields, often at the headwaters of creeks. The association is characterized by a moderately dense cover of *Carex capillaris* (hairlike sedge) and or *Polygonum viviparum* (serpent-grass), together covering less than half the surface area. Numerous other herbaceous species are present but with very little cover. Close to half the ground surface is often bare soil or rock.

Vegetation Description

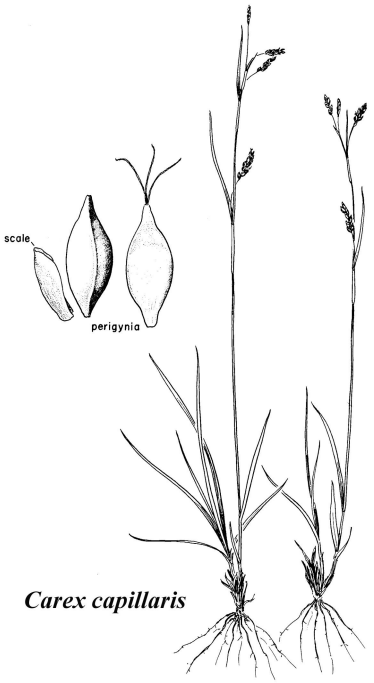
Carex capillaris (hairlike sedge) and/or *Polygonum viviparum* (serpent-grass) dominate the association. Either species may be absent from the stand; when present these species typically will have 15-37% cover. Numerous other forb and graminoid species may be present, but rarely contribute as much as 5% cover. The most frequently occurring species include *Gentiana algida* (whitish gentian), *Geum rossii* var. *turbinatum* (Ross' avens), *Lloydia serotina* (common alplily), *Juncus biglumis* (twoflowered rush), *Artemisia scopulorum* (alpine sagebrush), *Campanula uniflora* (arctic bellflower), *Kobresia myosuroides* (Bellardi bog sedge), *Rhodiola integrifolia* (ledge stonecrop) and *Pedicularis groenlandica* (elephanthead lousewort). The remainder of the stand is bare ground or rock.

Ecological Processes

Presence of this association in wet alpine areas indicates long-term stability and no disturbances of any kind. Moderate disturbance may convert this community to a mesic forb type while continued disturbance may result in bare ground.

Avg. Cover %	(Range)	Species Name	# Plots (N=9)
20	(15-37%)	Polygonum viviparum	9
9	(0.1-15%)	Carex capillaris	9

Other species with < 5% average cover present in at least 10% of plots:
Geum rossii var. turbinatum (0.1-3.1%), Rhodiola integrifolia (0.1-3.1%), Lloydia serotina (0.1-3.1%), Carex rupestris var. drummondiana (0.1-3.1%), Primula angustifolia (0.1-3.1%), Carex scopulorum (0.1-3.1%), Juncus triglumis (0.1-3.1%), Artemisia scopulorum (0.1-3.1%), Gentiana algida (0.1%), Juncus biglumis (0.1%), Campanula uniflora (0.1%), Kobresia myosuroides (0.1%), Pedicularis groenlandica (0.1%), Silene acaulis (0.1%), Festuca brachyphylla ssp. coloradensis (0.1%), Dasiphora floribunda (0.1%), Polygonum bistortoides (0.1%), Rhodiola rhodantha (0.1%), Trifolium parryi (0.1%), Carex nelsonii (0.1%), Carex misandra (0.1%), Potentilla diversifolia (0.1%), Juncus castaneus (0.1%), Eriogonum strictum ssp. proliferum var. proliferum (0.1%), Zigadenus elegans ssp. elegans (0.1%), Erigeron simplex (0.1%), Chionophila jamesii (0.1%), Deschampsia caespitosa (0.1%), Trisetum spicatum (0.1%), Minuartia obtusiloba (0.1%).



Carex capillaris

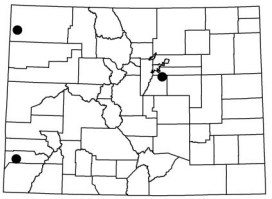
Emory sedge Herbaceous Vegetation

Carex emoryi

Global rank/State rank:
G2? / S2

HGM subclass: R5

Colorado elevation range:
5,800-6,400 ft (1,760-1,950 m)



General Description

Carex emoryi (Emory sedge) is a tall sedge that forms dense, near monocultures on the banks of streams and ditches at low elevations. Sites have seasonal to permanent soil moisture and seasonal to occasional inundation. Although not documented from other states, this association may occur throughout the midwestern and Rocky Mountain states.

Soils are generally coarse alluvium from sedimentary bedrock.

Vegetation Description

Carex emoryi (Emory sedge) propagates by rhizomes, and consequently, tends to form dense patches where it occurs. Cover values range from 40 to 98%. Other species in the association are highly variable, usually herbaceous, often weedy, and rarely abundant. The most commonly found species include *Apocynum cannabinum* (Indianhemp), *Equisetum arvens*e (field horsetail), *Mentha arvensis* (wild mint) and *Polygonum amphibium* var. *emersum* (longroot smartweed). Small amounts of shrubs from adjacent communities, such as *Salix exigua* (sandbar willow) or *Tamarix ramosissim*a (saltcedar) may occur in some plots.

Ecological Processes

Carex emoryi (Emory sedge) forms dense stands that are fairly stable but could be disturbed by heavy use. *Carex emoryi* is an obligate wetland plant in Colorado. Lowering of the water table or prolonged drought could threaten this community. This small patch community is not well documented, possibly because *Carex emoryi*

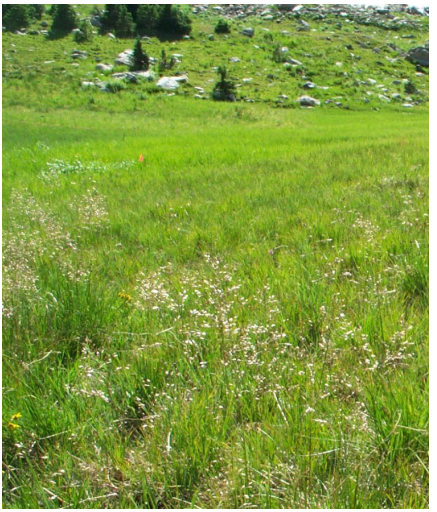
sets fruit early in the season and may be overlooked by scientists and managers identifying sedges later in the season.

Avg. Cover %	(Range)	Species Name	# Plots (N=8)
68	(40-97%)	Carex emoryi	8
9	(3-15%)	Xanthium strumarium	2

Other species with < 5% average cover present in at least 10% of plots:
Equisetum arvense (0.1-5%), Salix exigua (0.1-5%), Helenium autumnale var. montanum (0.1-2.5%), Apocynum cannabinum (0.1-2.5%), Polygonum amphibium var. emersum (0.1-2.5%), Mentha arvensis (0.1-1%), Equisetum hyemale var. affine (0.1%).

Small-head sedge Herbaceous Vegetation

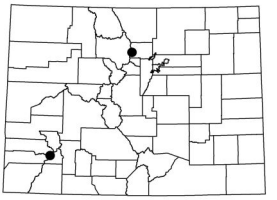
Carex illota



Global rank/State rank:
GUQ / S2

HGM subclass: S1/2

Colorado elevation range:
10,900-12,300 ft (3,320-3,750 m)



General Description

This association is found on lake shores, near springs, and below snow patches in a narrow altitudinal range in the lower alpine. It is characterized by a near monoculture of *Carex illota* (small-head sedge), low cover of other graminoids and forbs, and bare ground over at least one-third of the stand. Surface water is present for extended periods during the growing season, but is absent by the end of the growing season in most years.

Sites are flat to gently sloping, stable and snow-covered in winter. Soils from stands in Colorado are loess, with accumulations of organic matter. The average pH of the surface horizon is 5.2. The pH increases with depth; clay and organic matter, moisture retention capacity and available water decrease sharply with depth.

Vegetation Description

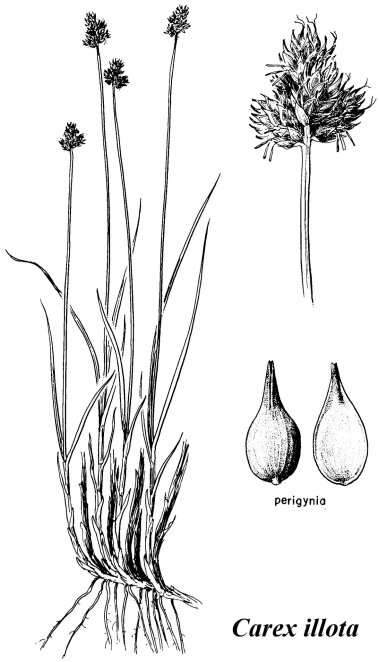
The *Carex illota* (small-head sedge) association is a seasonally flooded subpolar grassland. *Carex illota* (small-head sedge) often forms a near monoculture, usually with over 50% cover. Other forb and graminoid species that may be present, usually with less than 1% cover include *Carex scopulorum* (mountain sedge), *Juncus drummondii* (Drummond rush), *Carex nigricans* (black alpine sedge), *Caltha leptosepala* (marsh marigold), *Rhodiola rhodantha* (redpod stonecrop), and *Pedicularis groenlandica* (elephanthead lousewort). The shrub *Salix planifolia* (planeleaf willow) may also be present with less than 1% cover. The non-vascular layer is highly developed and almost equally as abundant as the vascular cover.

Ecological Processes

This plant association usually occurs under high quality undisturbed conditions with no introduced species, no advanced soil erosion or signs of trampling or soil compaction. Chronic disturbance from overgrazing or recreational use can result in plant trampling, damage or death, and increasing bare ground.

Avg. Cover %	(Range)	Species Name	# Plots (N=8)
57	(37-70%)	Carex illota	8
10	—	Deschampsia caespitosa	1
5	(0.1-20%)	Caltha leptosepala	4

Other species with < 5% average cover present in at least 10% of plots:
Juncus drummondii (0.1-10%), Pedicularis groenlandica (0.1-3%), Castilleja rhexiifolia (1%), Packera dimorphophylla (1%), Phleum alpinum (1%), Primula parryi (1%), Saxifraga odontoloma (1%), Carex nigricans (0.1-1%), Carex vernacula (0.1-1%), Carex scopulorum (0.1%), Rhodiola rhodantha (0.1%), Carex praegracilis (0.1%), Juncus biglumis (0.1%), Stellaria umbellata (0.1%), Salix planifolia (0.1%), Epilobium anagallidifolium (0.1%).



Carex illota

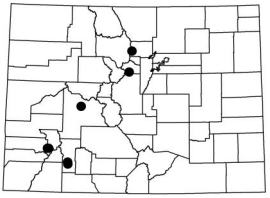
Smallwing sedge Herbaceous Vegetation

Carex microptera

Global rank/State rank:
G4 / S2?

HGM subclass: S1/2

Colorado elevation range:
8,900-11,700 ft (2,700-3,570 m)



General Description

The *Carex microptera* (smallwing sedge) association probably has a wide distribution throughout the state, but is overlooked due to its relatively small patch size. It has been documented from north-central Colorado and the San Juan National Forest in southwestern Colorado. This plant association typically forms small meadows on fine-textured, mesic soils. Its relationship with past heavy grazing may explain the relatively small occurrences. *Carex microptera* (smallwing sedge) typically dominates the association, but other graminoids are usually present and forb cover is minor.

This community is usually associated with meadows and stream terraces in wide, 350-500 ft (100-150 m), low-gradient valleys with narrow and sinuous stream channels. It also occurs near beaver dams and marshes. Soil textures range from fine, stratified alluvial material to clay with a thin organic layer on the surface.

Vegetation Description

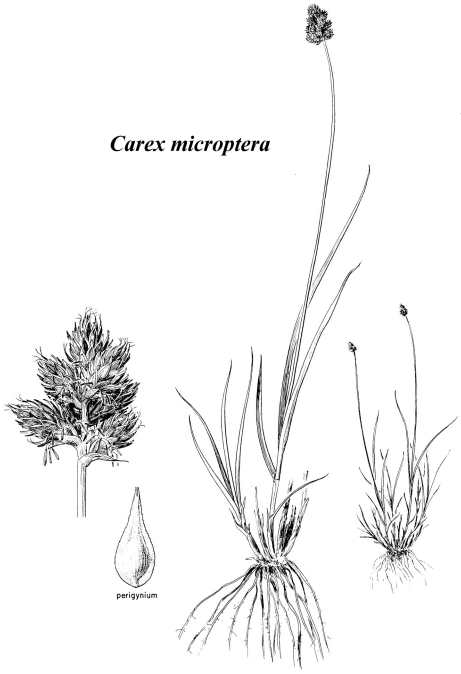
Carex microptera (smallwing sedge) forms a dense graminoid layer with 10-85% cover. Other graminoid species typically have less than 1% cover and include *Juncus triglumis* (threehulled rush), *Juncus castaneus* (chestnut rush), *Juncus longistylis* (longstyle rush), *Deschampsia caespitosa* (tufted hairgrass), *Carex capillaris* (hairlike sedge), *Carex saxatilis* (rock sedge) and other sedge species. Forb cover is usually not more than 20%, and is more commonly less than 5%. Common forb species include *Rhodiola integrifolia* (ledge stonecrop), *Polygonum viviparum* (alpine bistort), *Gentiana algida* (whitish gentian), *Artemisia scopulorum* (alpine sagebrush), *Pedicularis groenlandica* (elephanthead lousewort), *Achillea millefolium* var. *occidentalis* (western yarrow), *Epilobium hornemannii* (Hornemann willowherb), and *Potentilla diversifolia* (varileaf cinquefoil).

Ecological Processes

Little is known about the successional status of this plant association, but it appears to be a stable community on moist to wet sites along streams.

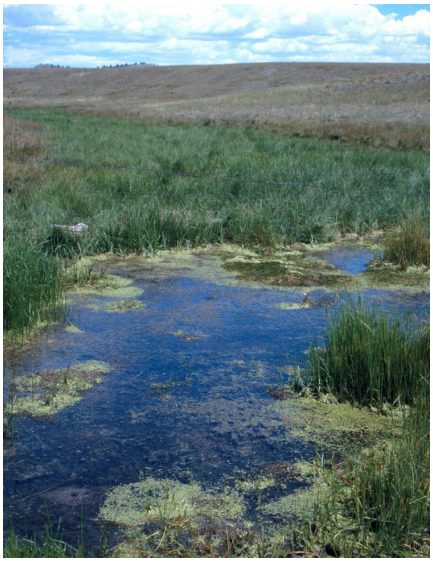
Avg. Cover %	(Range)	Species Name	# Plots (N=13)
61	(10-87%)	Carex microptera	13
20	(2-50%)	Juncus longistylis	3
18	(10-25%)	Carex aquatilis	2
13	(5-20%)	Poa pratensis	2
12	(8-15%)	Deschampsia caespitosa	2
6	(1-10%)	Phleum pratense	2
5	(5-5%)	Agrostis scabra	2
5	(1-10%)	Achillea millefolium var. occidentalis	3

Other species with < 5% average cover present in at least 10% of plots:
Taraxacum officinale (1-10%), Salix monticola (3-5%), Epilobium hornemannii (3-5%), Geum macrophyllum var. perincisum (2-5%), Pedicularis groenlandica (0.1-5%), Phleum alpinum (2-2%), Glyceria striata (1-2%), Veronica americana (1-2%), Polygonum viviparum (0.1-5%), Carex saxatilis (0.1-3.1%), Carex capillaris (0.1-2%), Potentilla diversifolia (0.1-1%), Salix planifolia (0.1-1%), Rhodiola rhodantha (0.1-1%), Juncus castaneus (0.1-1%), Gentiana algida (0.1%), Rhodiola integrifolia (0.1%), Juncus triglumis (0.1%), Artemisia scopulorum (0.1%), Pedicularis sudetica ssp. scopulorum (0.1%), Dasiphora floribunda (0.1%), Carex scopulorum (0.1%), Juncus biglumis (0.1%), Polygonum bistortoides (0.1%).



Nebraska sedge Herbaceous Vegetation

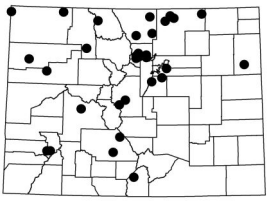
Carex nebrascensis



Global rank/State rank:
G4 / S3

HGM subclass: D2/3, S3/4

Colorado elevation range:
4,000-9,600 ft (1,220-2,930 m)



General Description

Carex nebrascensis (Nebraska sedge) is a widespread species and generally forms small- to medium-size meadows. It forms an open wetland meadow occurring along the margins of stream banks, lakes and seeps from the plains to the lower subalpine. The soils are generally saturated for much of the growing season and are subject to compaction by livestock.

This plant association appears to be restricted to saturated soils of flat floodplains bordering ponds or pools adjacent to stream channels. It can also occur along flat, marshy areas surrounding springs. Stream channels are low-gradient, moderately narrow, and sinuous or very narrow and sinuous. Soils are heavy clays and silty clay loams with high organic matter content. Anoxic conditions often occur within 8 inches (20 cm) of the surface either in the form of a gleyed layer or abundant mottling.

Vegetation Description

Carex nebrascensis (Nebraska sedge) forms the dominant cover and is the diagnostic species for this type. A wide variety of other graminoids and forbs may be present, depending on the elevation and moisture level of the site. Other graminoid species that can be abundant include *Eleocharis palustris* (common spikerush), *Carex praegracilis* (clustered field sedge), and *Schoenoplectus tabernaemontani* (softstem bulrush). Forb cover is generally low, but can be high in moist locations. Common forb species include *Ranunculus cymbalaria* (alkali buttercup), *Mentha arvensis* (wild mint), *Mimulus glabratus* (roundleaf monkeyflower), and *Melilotus officinalis* (yellow sweetclover).

Ecological Processes

In Montana, the *Carex nebrascensis* (Nebraska sedge) type is considered a grazing-disclimax. Under season-long grazing, *Carex nebrascensis* increases in abundance, replacing former dominant species. However, under extreme grazing conditions and a resulting drop in the water table, *Juncus balticus* var. *montanus* (mountain rush) or *Poa pratensis* (Kentucky bluegrass) can eventually replace *Carex nebrascensis*. In Nevada, sites dominated by *Carex nebrascensis* are considered the Potential Natural Community, which appears to be the case in undisturbed stands in Colorado.

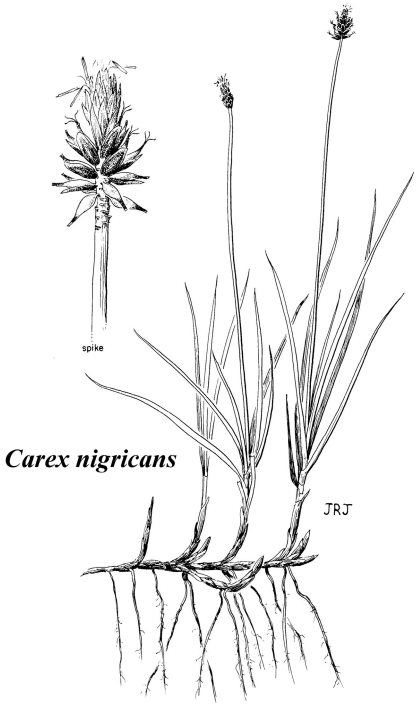
Avg. Cover %	(Range)	Species Name	# Plots (N=74)
69	(5-100%)	Carex nebrascensis	74
12	(0.1-43%)	Eleocharis palustris	23
7	(0.1-60%)	Juncus balticus var. montanus	26
6	(0.1-15%)	Epilobium leptophyllum	7
5	(0.1-20%)	Veronica anagallis-aquatica	9
5	(1-15%)	Carex pellita	7

Other species with < 5% average cover present in at least 10% of plots:
Epilobium ciliatum ssp. glandulosum (0.1-15%), Mentha arvensis (0.1-20%), Poa pratensis (0.1-15%), Agrostis gigantea (0.1-15%).

Carex nebrascensis

Black alpine sedge - Drummond rush Herbaceous Vegetation

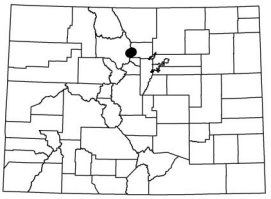
Carex nigricans - Juncus drummondii



Global rank/State rank:
GU / S2

HGM subclass: S1/2

Colorado elevation range:
10,400-11,800 ft (3,170-3,500 m)



General Description

The *Carex nigricans-Juncus drummondii* (black alpine sedge-Drummond rush) association is found in small depressions below late-melting snow patches and at the edges of wet sedge fens at high elevations, often at or above treeline. It has primarily been reported from the Indian Peaks area but may be common in other alpine areas of the state. It is not continually flooded, but has a high water table throughout the summer. The association often consists of hummocks of peat with *Carex nigricans* (black alpine sedge) above wetter areas with *Carex aquatilis* (water sedge).

This association occurs in meadows and on streambanks in alpine and subalpine areas. Soils are thin peats overlying gravels and other glacial deposits.

Vegetation Description

Carex nigricans (black alpine sedge) forms a low mat with high average cover and frequency. Cover is variable, but usually is greater than 50%. *Juncus drummondii* (Drummond rush) is usually present, but with less than 5% cover. Other graminoids, including *Deschampsia caespitosa* (tufted hairgrass), *Phleum alpinum* (alpine timothy), *Festuca brachyphylla* (Colorado fescue), and other *Carex* (sedge) spp. may be present with low cover. Forbs are typically more abundant than associated

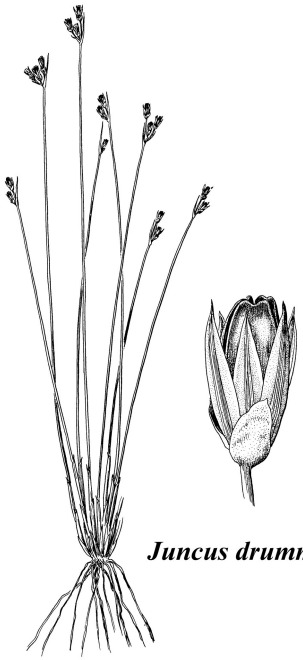
graminoids. Typical forbs include *Caltha leptosepala* (marsh marigold), *Pedicularis groenlandica* (elephanthead lousewort), *Antennaria media* (Rocky Mountain pussytoes), *Polygonum viviparum* (alpine bistort), *Ligusticum tenuifolium* (Idaho licoriceroot), *Stellaria umbellata* (umbrella starwort) and *Sibbaldia procumbens* (creeping sibbaldia).

Ecological Processes

This is a stable association. Soils are saturated during the entire growing season, but are not continually flooded.

Avg. Cover %	(Range)	Species Name	# Plots (N=9)
83	(63-87%)	Carex nigricans	9
0.5	(0.1-3%)	Juncus drummondii	8

Other species with < 5% average cover present in at least 10% of plots:
Caltha leptosepala (0.1-10%), Antennaria media (0.1-3%), Ligusticum tenuifolium (0.1-3%), Sibbaldia procumbens (0.1-3%), Deschampsia caespitosa (0.1-3%), Phleum alpinum (0.1%), Pedicularis groenlandica (0.1%), Stellaria umbellata (0.1%), Veronica wormskjoldii (0.1%), Erigeron simplex (0.1%), Erigeron melanocephalus (0.1%), Agrostis mertensii (0.1%), Carex phaeocephala (0.1%), Carex scopulorum (0.1%), Salix petrophila (0.1%), Epilobium anagallidifolium (0.1%), Polygonum douglasii (0.1%), Viola adunca (0.1%), Potentilla diversifolia (0.1%).



Juncus drummondii

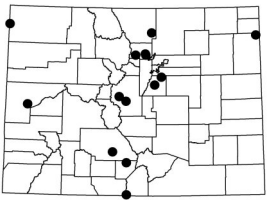
Woolly sedge Herbaceous Vegetation

Carex pellita (=lanuginosa)

Global rank/State rank:
G3 / S3

HGM subclass: D2/3, S3/4, R5

Colorado elevation range:
4,600-9,300 ft (1,400-2,830 m)



General Description

Carex pellita is the name currently used by the USDA Plants Database for both *Carex lanuginosa* and *Carex lasiocarpa*. These species are recognized separately in Colorado, where *C. lasiocarpa* is much less common than *C. lanuginosa*. The *Carex lasiocarpa* association is ranked as S1 in Colorado and is currently known only from the subalpine fens on the east side of the Park Range.

Carex pellita (=C. lanuginosa) (woolly sedge) is a distinctive wetland-indicator sedge that forms small- to medium sized meadows. It occurs in depressions and swales at the saturated edge of stream channels or in standing water. On the eastern plains of Colorado, it can occur under the canopy of cottonwood trees, forming the *Populus deltoides/Carex pellita* (plains cottonwood/wooly sedge) plant association.

This plant association occurs in very wet conditions, generally at the saturated edge of the stream channel or in standing water. Stream channels are sinuous with a moderate gradient. Soils are deep silt loams to clays. Mottling often occurs throughout the profile.

Vegetation Description

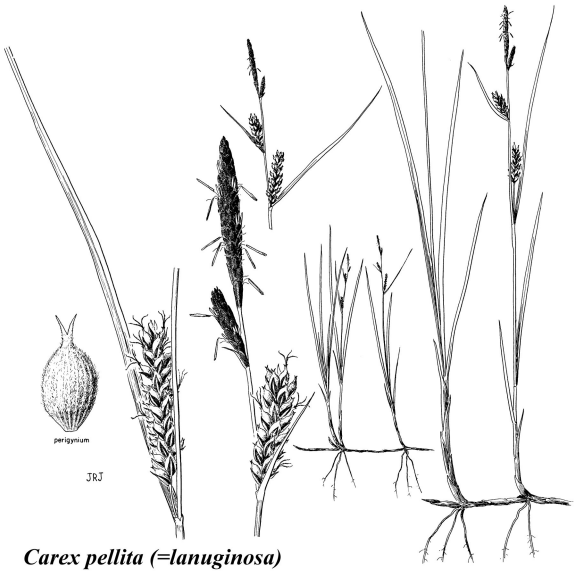
This plant association is characterized by a nearly monotypic stand of *Carex lanuginosa* (woolly sedge). Other graminoid cover is minor, but includes *Phalaris arundinacea* (reed canarygrass), *Carex nebrascensis* (Nebraska sedge), *Schoenoplectus pungens* (threesquare bulrush), and *Poa pratensis* (Kentucky bluegrass). Scattered forbs include *Mentha arvensis* (wild mint), and *Cirsium arvense* (Canada thistle). *Equisetum arvense* (field horsetail) and *Equisetum hyemale* (scouringrush horsetail) may also be present.

Ecological Processes

The *Carex pellita* (woolly sedge) plant association appears to be a fairly stable community because of its strongly rhizomatous roots and well developed soils. In Montana, the *Carex pellita* plant association can be associated with large amounts of *Carex lasiocarpa* (slender sedge). With season-long grazing, *Carex pellita* decreases in abundance, shifting dominance towards *Poa pratensis* (Kentucky bluegrass). In Colorado, stands of *Carex pellita* that occur on stream banks with a consistent water table depth and heavy, cohesive clay soils, appear stable and long-lived as long as the water table level remains consistent.

Avg. Cover %	(Range)	Species Name	# Plots (N=22)
73	(20 -98%)	Carex pellita	22
25	(10-40%)	Phalaris arundinacea	2
12	(3-20%)	Polygonum amphibium var. emersum	2
11	(0.1-40%)	Mentha arvensis	6
10	(0.1-20%)	Muhlenbergia asperifolia	2
10	(0.1-30%)	Poa pratensis	7
10	(1-20%)	Argentina anserina	7
9	(1-40%)	Eleocharis palustris	7
8	(5-10%)	Calamagrostis stricta	2
6	(5-7%)	Lycopus asper	2

Other species with < 5% average cover present in at least 10% of plots:
Deschampsia caespitosa (1-10%), Carex praegracilis (2-5%), Hordeum jubatum ssp. jubatum (0.1-10%), Carex nebrascensis (0.1-5%), Agrostis gigantea (2.5-3%), Schoenoplectus pungens (1-5%), Cirsium arvense (1-4%), Juncus balticus var. montanus (0.1-5%), Polygonum lapathifolium (0.1-2%), Rumex crispus (0.1-1%), Equisetum arvense (0.1-1%), Juncus torreyi (0.1-1%).



Carex pellita (=lanuginosa)

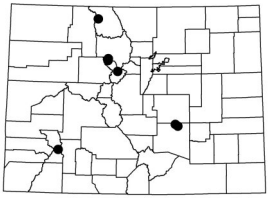
Clustered field sedge Herbaceous Vegetation

Carex praegracilis

Global rank/State rank:
G3G4 / S2

HGM subclass: S3/4

Colorado elevation range:
4,900-12,000 ft (1,500-3,650 m)



General Description

The *Carex praegracilis* (clustered sedge) plant association forms small meadows in swales and along stream channels from the shortgrass prairie in eastern Colorado to alpine areas throughout the state.

This plant association occurs along small, shallow drainages, usually no more than 7-17 ft (2-5 m) wide. The stream banks are gentle and flat. Stream channels are wide and flat, with little sinuosity, low gradient (0.5-1%), and little to no floodplain development. Soils are deep and range from heavy clays to sandy clay loams with mottling.

Vegetation Description

In this plant association the vegetation completely covers the ground in narrow bands following the stream bed and is dominated by *Carex praegracilis* (clustered sedge), with associated *Carex nebrascensis* (Nebraska sedge), *Eleocharis palustris* (common spikerush), and *Equisetum laevigatum* (smooth horsetail). Tree or shrub cover is minimal.

The *Carex praegracilis* (clustered field sedge) plant association often occurs as the only vegetation type along small streams. It can occur with patches of *Carex nebrascensis* (Nebraska sedge) and *Pascopyrum smithii* (western wheatgrass) or patches of *Schoenoplectus pungens* (threesquare bulrush) and *Schoenoplectus acutus* (hardstem bulrush) in adjacent pools within the channel.

Ecological Processes

Little is known about the successional pattern of *Carex praegracilis* (clustered sedge) dominated areas.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
55	(20-85%)	Carex praegracilis	7
30	(30-30%)	Spartina pectinata	2
15	(10-20%)	Carex utriculata	2
10	(10-10%)	Juncus longistylis	2
8	(5-11.9%)	Deschampsia caespitosa	4
8	(5-10%)	Cicuta douglasii	2
6	(1-15%)	Juncus balticus var. montanus	4
5	(1-10%)	Carex aquatilis	3
5	(5-5%)	Eleocharis palustris	2

Other species with < 5% average cover present in at least 10% of plots:
Schoenoplectus acutus\tabernaemontani (1-3%), Poa pratensis (0.1-1%), Senecio hydrophilus (0.1-1%).

Carex praegracilis

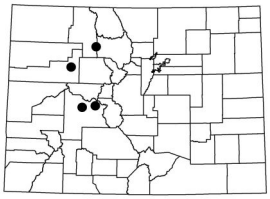
Rock sedge Herbaceous Vegetation

Carex saxatilis

Global rank/State rank:
G3 / S2

HGM subclass: S1/2, S3/4

Colorado elevation range:
8,900-10,700 ft (2,700-3,260 m)



General Description

The *Carex saxatilis* (rock sedge) plant association occurs on organic soils near streams and occurs as narrow meadows along shorelines of ponds and small lakes. The distinctive shiny, reddish color of the inflorescence of *Carex saxatilis* is the distinguishing characteristic of this sedge community.

In Colorado, this plant association occurs along shallow, partially peat-filled ponds and on seeps in wide meadows. The soil is highly organic and usually saturated to the surface, but may dry seasonally in the upper horizons. Seasonal drying may explain why some of the soils beneath this association exhibit a higher degree of decomposition than Histosols found under other *Carex* communities.

Vegetation Description

The total vegetative cover of this association is not high, due to saturated substrates and cold soil temperatures for much of the growing season. *Carex saxatilis* (rock sedge) dominates the graminoid cover with 25-70% cover. *Carex aquatilis* (water sedge), *Eleocharis quinqueflora* (fewflower spikerush), *Caltha leptosepala* (marsh marigold), and *Deschampsia caespitosa* (tufted hairgrass) are also associated with 10-

20% cover, but are not always present in every stand. Litter and peat cover much of the remaining area in some stands.

The *Carex saxatilis* (rock sedge) plant association occurs with *C. utriculata* (beaked sedge), *Eleocharis quinqueflora* (fewflower spikerush), or *Betula nana (=glandulosa)* (bog birch) communities on pond and lake margins and with various aquatic plant communities in adjacent standing water. On adjacent drier habitats, this association occurs with the *Salix planifolia*/*Carex aquatilis* (planeleaf willow/water sedge) association.

Ecological Processes

Little is known about the successional processes of this plant association. The environment of the *Carex saxatilis* community is similar to that of *Carex aquatilis* (water sedge). The two communities are closely allied and grade into each other. The *Carex saxatilis* type appears to be a stable community.

Avg. Cover %	(Range)	Species Name	# Plots (N=4)
42	(25-70%)	Carex saxatilis	4
20	—	Eleocharis quinqueflora	1
20	—	Carex aquatilis	1
10	—	Deschampsia caespitosa	1
10	—	Caltha leptosepala	1
5	—	Argentina anserina	1

Other species with < 5% average cover present in at least 10% of plots:
Rhodiola rhodantha (3%), Mentha arvensis (3%), Eriophorum angustifolium (3%), Carex utriculata (1%), Pedicularis groenlandica (1%), Packera dimorphophylla (1%), Epilobium saximontanum (1%), Carex canescens (1%), Agrostis scabra (1%).

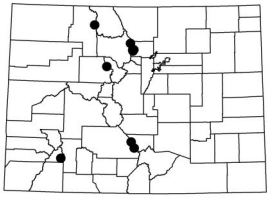
Mountain sedge - Marsh-marigold Herbaceous Vegetation

Carex scopulorum - Caltha leptosepala

Global rank/State rank:
G4 / S4

HGM subclass: S1/2

Colorado elevation range:
10,700-13,200 ft (3,300-4,000 m)



General Description

This plant association occurs in marshy areas adjacent to streams and melting snow fields, often at the headwaters of creeks (stream channels are moderately steep). It is characterized by a moderately dense to dense cover of *Carex scopulorum* (mountain sedge) with a few other graminoid species present. *Caltha leptosepala* (marsh marigold) dominates the forb cover. This is a common association and widely distributed throughout the Rocky Mountain states. Soils are generally poorly drained but not highly organic. Soil textures range from loamy with mottles present near the surface to organic surface layers overlying clay loam.

Vegetation Description

Carex scopulorum (mountain sedge) dominates the vegetation. Other graminoids that can be abundant, but are not consistently present in all stands include *Carex jonesii* (Jones sedge), *Carex illota* (sheep sedge), *Deschampsia caespitosa* (tufted hairgrass), and *Agrostis thurberiana* (Thurber bentgrass). Forbs are generally a conspicuous component of the stand, contributing 10-50+% of the vegetative cover. *Caltha leptosepala* (marsh marigold) is almost always present and often conspicuous and abundant. Other forbs may be more abundant; they include *Ligusticum filicinum* (fernleaf licoriceroot), *Saxifraga odontoloma* (brook saxifrage), and *Pedicularis groenlandica* (elephanthead lousewort).

Carex aquatilis (water sedge) and *Eleocharis quinqueflora* (fewflower spikerush) meadows occur in adjacent lower swales and *Deschampsia caespitosa* (tufted hairgrass) meadows occur on adjacent hummocks and toeslopes. *Salix planifolia* (planeleaf willow) and *Salix brachycarpa* (barrenground willow) shrublands also occur in adjacent riparian areas.

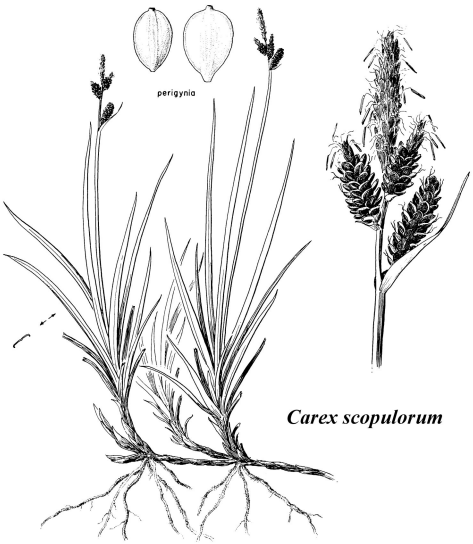
Ecological Processes

This plant association is usually a stable, long-lived community that represents undisturbed sites. Moderate disturbance can convert this community to a "mesic forb"

type where *Carex scopulorum* (mountain sedge) cover is reduced and multiple forb species form the bulk of the biomass of the community. Non-native species may be present and abundant. Continued disturbance can result in bare ground. Moderately disturbed sites can improve rapidly with protection from trampling and grazing due to the abundance of moisture and the dense rhizomatous nature of *Carex scopulorum*.

Avg. Cover %	(Range)	Species Name	# Plots (N=18)
49	(16-87%)	Carex scopulorum	18
16	(0.1-47%)	Caltha leptosepala	14
14	(3-23%)	Ligusticum tenuifolium	4
12	(1-22%)	Saxifraga odontoloma	2
9	(3-15%)	Packera crocata	2
8	(1-20%)	Carex illota	3
7	(3-10%)	Juncus mertensianus	2
6	(0.1-15%)	Carex nigricans	4
6	(0.1-24%)	Deschampsia caespitosa	10
5	(0.1-10%)	Agrostis humilis	2
5	(0.1-9.4%)	Sibbaldia procumbens	2

Other species with < 5% average cover present in at least 10% of plots:
Rhodiola rhodantha (0.1-15%), Pedicularis groenlandica (0.1-10%), Cardamine cordifolia (1-4%), Rhodiola integrifolia (0.1-5%), Eleocharis quinqueflora (1-3%), Geum rossii var. turbinatum (0.1-3%), Carex nelsonii (0.1-3%), Swertia perennis (0.1-3%), Poa reflexa (1-2%), Polygonum bistortoides (0.1-3.5%), Poa arctica (0.1-3%), Artemisia scopulorum (0.1-3%), Calamagrostis canadensis (1-1.2%), Polygonum viviparum (0.1-3%), Trisetum wolfii (14%), Trifolium parryi (0.1-3.1%), Veronica wormskjoldii (0.1-2%), Juncus biglumis (0.1-1.5%), Phleum alpinum (0.1-1%), Juncus drummondii (0.1-1%), Epilobium anagallidifolium (0.1-1%), Carex nova (0.1-1%), Stellaria umbellata (0.1-1%), Potentilla diversifolia (0.1-1%), Carex capillaris (0.1%), Poa glauca ssp. rupicola (0.1%), Gentiana algida (0.1%), Festuca brachyphylla ssp. coloradensis (0.1%), Salix planifolia (0.1%), Stellaria longifolia (0.1%).



Carex scopulorum

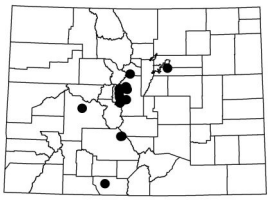
Analogue sedge Herbaceous Vegetation

Carex simulata

Global rank/State rank:
G4 / S3

HGM subclass: S1/2

Colorado elevation range:
5,600-11,700 ft (1,700-3,560 m)



General Description

Carex simulata (analogue sedge) is found only on quaking fens in Colorado (occasionally may persist on drying fens). It is commonly found with many other sedge species, but its presence is associated with deep organic soils and a perennially high water table. *Carex simulata* (analogue sedge) fens are known from Larimer County south to the San Luis Valley, and are more or less restricted to the high mountain valleys in the central part of the state.

This community is located on saturated organic soils in moderate to wide valleys. The surface of the ground is hummocky, and "quakes" when walked or jumped on. Streams are low gradient and highly sinuous to broader and slightly steeper. Soils are deep, dark brown to black, 100% peat, saturated to the surface.

Vegetation Description

Graminoids dominate this meadow association with 90-100% vegetative cover. *Carex simulata* (analogue sedge) may not be the most abundant species, but it is always present, and serves as the indicator species for this association. A variety of other *Carex* (sedge) species may be present, and even more abundant, including *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), and *Carex nebrascensis* (Nebraska sedge). *Juncus balticus* var. *montanus* (mountain rush) and other graminoids may also be present. A variety of forbs may be inconspicuously present (total cover <10%). A few scattered shrubs, usually in stunted form, contribute little cover when present. They may include *Salix geyeriana* (Geyer willow), *Salix monticola* (mountain willow), and *Dasiphora floribunda* (shrubby cinqefoil).

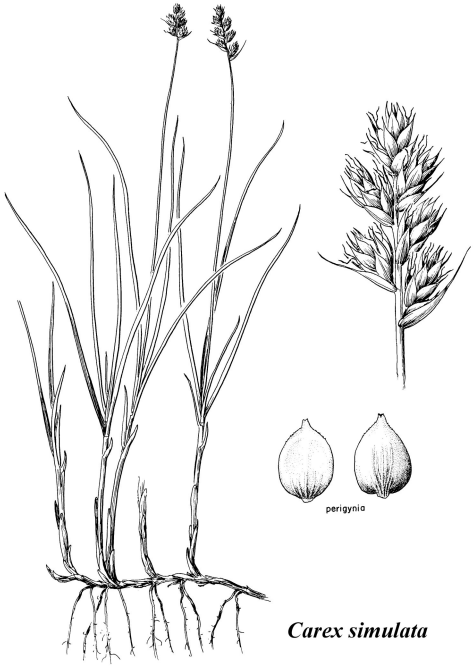
Concentric rings or a mosaic of patches of other herbaceous wetland types can be adjacent and intermixed with *Carex simulata* (analogue sedge) fens. Herbaceous wetland plants include *Carex nebrascensis* (Nebraska sedge), *Carex utriculata* (beaked sedge) and *Juncus balticus* var. *montanus* (mountain rush).

Ecological Processes

Little is known about the successional processes of this plant association. Deep accumulations of peat suggest long-term stability. Changes in the natural hydrological regime have the potential to greatly affect the composition of this association.

Avg. Cover %	(Range)	Species Name	# Plots (N=33)
67	(5-90%)	Carex simulata	33
21	(1-45%)	Carex utriculata	4
16	(1-47%)	Carex aquatilis	10
11	(1-30%)	Carex nebrascensis	5
11	(1-28%)	Juncus balticus var. montanus	9

Other species with < 5% average cover present in at least 10% of plots:
Deschampsia caespitosa (1-10%), Triglochin maritimum (1-10%), Eleocharis palustris (1-7%), Ranunculus cymbalaria (1-5%), Poa pratensis (1-5%), Pedicularis groenlandica (1-2%), Calamagrostis stricta (1-3%), Dodecatheon pulchellum (0.1-1%), Epilobium lactiflorum (0.1-1%).



Carex simulata

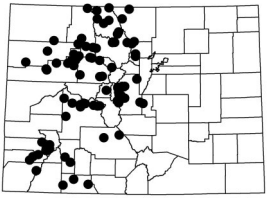
Beaked sedge Herbaceous Vegetation

Carex utriculata

Global rank/State rank:
G5 / S5

HGM subclass: D1, D2/3, R2, S1/2?, S3/4

Colorado elevation range:
5,600-11,000 ft (1,700-3,350 m)



General Description

The *Carex utriculata* (beaked sedge) plant association is a common wet meadow community that occurs around the edges of montane lakes and beaver ponds, along the margins of slow-moving reaches of streams and rivers, and in marshy swales and overflow channels on broad floodplains. The water table is usually near the surface for most of the growing season. This association is well documented throughout the western states. A clear dominance of *Carex utriculata* over other *Carex* species including *C. aquatilis* (water sedge), sets this association apart from closely related types.

Carex utriculata (beaked sedge) grows in standing water or saturated soils. It also occurs along the margins of lakes and beaver ponds. Stream channels are wide and slightly sinuous, to wide and more sinuous. Soils are saturated organics or fine silty clays to clays over cobbles and alluvium. Mottling often occurs within a few centimeters of the surface.

Vegetation Description

This plant association is characterized by stands dominated by *Carex utriculata* (beaked sedge). Stands often appear to be nearly pure *Carex utriculata* (beaked sedge), but a variety of other graminoid species may be present as well. *Carex aquatilis* can be abundant, but if equal in cover to *C. utriculata*, see the *Carex aquatilis-Carex utriculata* association on page 336. Other *Carex* (sedge) species present include *Carex lenticularis* (shore sedge) and *C. microptera* (small-wing sedge), but usually with low cover relative to the amount of *C. utriculata* (beaked sedge) present. Other graminoid species that may be present include *Glyceria striata* (fowl mannagrass), *Calamagrostis canadensis* (bluejoint reedgrass), and *Juncus balticus* var. *montanus* (mountain rush). Forb cover is very inconspicuous and can include *Mentha arvensis* (wild mint), *Mimulus guttatus* (seep monkeyflower), and *Geum macrophyllum* (largeleaf avens). Willow carrs (i.e., shrubland thickets) are often adjacent and a few scattered willows will occur within the *Carex utriculata*

(beaked sedge) stand. Individual willows tend to be very short if present, either from limiting growth conditions (extremely cold and/or extremely wet), or because of heavy browsing by wildlife or livestock. The elevation of the site determines which willow species are in and adjacent to *Carex utriculata* (beaked sedge) stands. Willow species that are present may include *Salix monticola* (mountain willow), *S. drummondiana* (Drummond willow), *S. geyeriana* (Geyer willow), *S. planifolia* (planeleaf willow), and *S. exigua* (sandbar willow).

Ecological Processes

The *Carex utriculata* (beaked sedge) plant association occurs on the wettest sites of the riparian or wetland area, such as low-lying swales, and shallow margins of lakes and ponds, often in standing water. It is an early-seral community and is known to invade margins of newly formed beaver ponds, as well as the freshly exposed silt beds of drained beaver ponds. With time, the *Carex utriculata* plant association will grade into *Carex aquatilis* (water sedge) and *Calamagrostis canadensis* (bluejoint reedgrass) associations.

Successional shifts in species composition can be initiated by a change in the physical environment of the riparian area. Flooding events can result in sediments deposited on the floodplain, raising the surface higher above the water table. As aggradation, or build up, of the floodplain proceeds, the site can become drier and the dominant graminoid cover changes.

Abandoned beaver ponds also go through a similar succession. With time, ponds become silted-in and *Carex utriculata* establishes on the new, saturated substrate. As the site becomes firm and raised above the old pond level, *Carex aquatilis* and willows may become established. With further aggradation and time *Calamagrostis canadensis* may become established in the undergrowth. Depending on site characteristics, various willow species may become established in the overstory as well, creating the *Salix monticola/Carex utriculata* (mountain willow/beaked sedge) plant association or the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) plant association, for example.

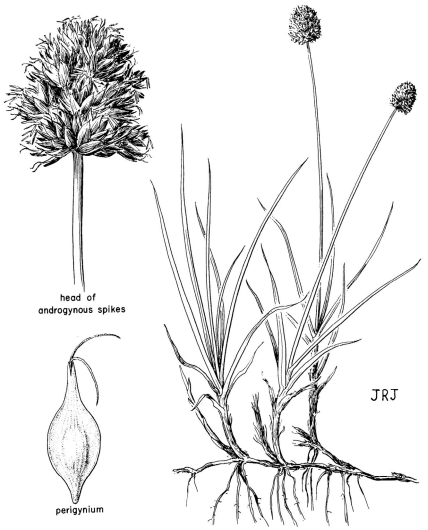
Distance from the stream channel can also differentiate the graminoid dominance spatially within the riparian mosaic. *Carex utriculata* commonly occurs at the stream channel or pond edge where the water table is close to or at the ground surface. As the floodplain surface becomes higher with increased distance from the channel edge, the ground becomes slightly less saturated and shifts to mesic meadows of *Carex aquatilis*, or on higher surfaces, to slightly drier meadows of *Calamagrostis canadensis*.

Avg. Cover %	(Range)	Species Name	# Plots (N=143)
72	(7-100%)	Carex utriculata	143
9	(0.1-50%)	Carex aquatilis	40
7	(1-20%)	Carex microptera	15
7	(0.1-30%)	Calamagrostis canadensis	20
7	(1-20%)	Juncus balticus var. montanus	16
6	(1-10%)	Salix monticola	15
5	(0.1-15%)	Mentha arvensis	15

Other species with < 5% average cover present in at least 10% of plots:
Equisetum arvense (0.1-20%), Glyceria striata (0.1-10%), Deschampsia caespitosa (1-10%), Geum macrophyllum var. perincisum (0.1-15%), Poa pratensis (1-10%).

Native sedge Herbaceous Vegetation

Carex vernacula

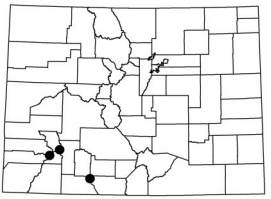


Carex vernacula

Global rank/State rank:
GU / S1

HGM subclass: S1/2

Colorado elevation range:
12,200-12,400 ft (3,700-3,800 m)



General Description

This plant association occurs along narrow and sinuous stream channels in gently-sloping, glaciated, alpine basins. *Carex vernacula* (native sedge) dominates the vegetation cover with *Caltha leptosepala* (marsh marigold) and *Deschampsia caespitosa* (tufted hairgrass) as common sub-dominants. *Carex vernacula* (native sedge) is known to occur from Wyoming and Colorado to Washington. However, stands of the *Carex vernacula* plant association have not been documented outside of Colorado where it is known from three stands in the San Juan National Forest in southwestern Colorado.

This plant association occurs in moderately wide, 85 ft (25 m), gently sloping, snow-melt basins. Stream channels are narrow and sinuous. The soils are stratified alluvial layers overlying gravel.

Vegetation Description

Carex vernacula (native sedge) dominates the graminoid layer with 25-75% cover. *Deschampsia caespitosa* (tufted hairgrass) is often present with up to 20% cover. *Caltha leptosepala* (marsh marigold) is usually the only forb with more than 10% cover.

Caltha leptosepala (marsh marigold) and *Eriophorum altaicum* (whitebristle cottongrass) meadows occur in adjacent swales, while *Deschampsia caespitosa* (tufted hairgrass) meadows occur on drier sites.

Ecological Processes

The *Carex vernacula* plant association is probably stable and long-lived. It is likely to recover very slowly from any disturbance due to cold soil temperatures and the short growing season at such high altitudes.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
48	(25-75%)	Carex vernacula	3
25	—	Juncus drummondii	1
14	(8-19%)	Deschampsia caespitosa	2
12	(5-22%)	Caltha leptosepala	3
10	—	Salix planifolia	1
10	—	Salix brachycarpa	1
5	—	Pedicularis groenlandica	1
5	—	Eriophorum altaicum var. neogaeum	1

Other species with < 5% average cover present in at least 10% of plots:

Carex microglochin (2%), Stellaria umbellata (1%), Primula parryi (1%), Carex microptera (1%).

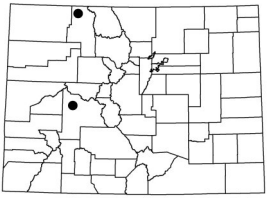
Blister sedge Herbaceous Vegetation

Carex vesicaria

Global rank/State rank:
G4Q / S1

HGM subclass: S1/2, R3/4

Colorado elevation range:
8,000-9,700 ft (2,430-3,000 m)



General Description

The *Carex vesicaria* (blister sedge) plant association forms open meadows similar to the *Carex utriculata* (beaked sedge) plant association. As with *Carex utriculata*, it occurs along the shores of lakes and ponds in shallow water, as well as in poorly drained basins and along rivers and streams. The water table typically remains above the ground surface throughout the year. A single stand of *Carex vesicaria* found on the Colorado West Slope has significant cover of *Carex utriculata*, but is distinct from the *Carex utriculata* plant association because of the high cover of *Carex vesicaria*.

Soils are typically Histosols, except in young stands along streambanks where the soil is coarse- to fine-textured alluvium.

Vegetation Description

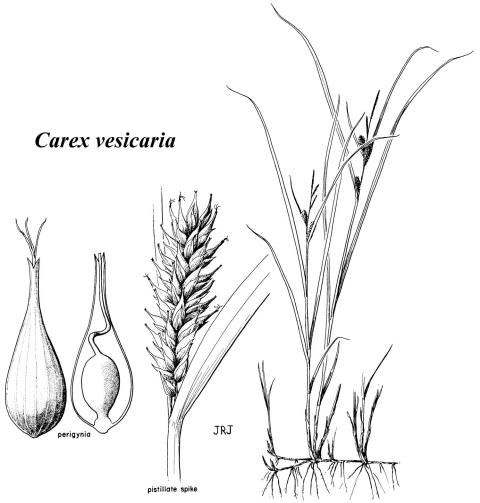
Carex vesicaria (blister sedge) forms nearly monotypic stands, however, *Carex utriculata* may be present. On wetter sites, emergent wetland plants such as *Sparganium* spp. (burreed) may be sparsely present. On drier sites, *Deschampsia caespitosa* (tufted hairgrass) and *Galium trifidum* (three petal bedstraw) may be present in low amounts.

Ecological Processes

A persistently high water table and thick organic soil horizons provide conditions favorable to the long-term dominance of *Carex vesicaria* (blister sedge). As with other wetland communities, vegetation composition will likely change with the alteration of the hydrology. If water levels remain below the soil surface permanently, the dominant species may shift to *Carex utriculata* (beaked sedge).

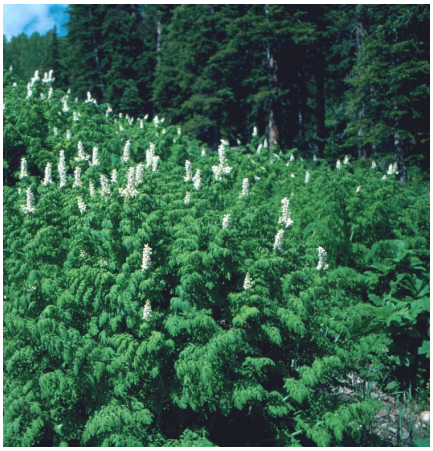
Avg. Cover %	(Range)	Species Name	# Plots (N=2)
68	(50-85%)	Carex vesicaria	2
40	—	Carex aquatilis	1
30	—	Fragaria virginiana ssp. glauca	1
10	—	Potentilla gracilis	1
10	—	Carex utriculata	1
5	—	Salix monticola	1
1	—	Thalictrum fendleri	1

Other species with < 5% average cover present in at least 10% of plots:
Taraxacum officinale (1%), Symphyotrichum foliaceum (1%), Poa palustris (1%), Phleum pratense (1%), Geum macrophyllum var. perincisum (1%), Dasiphora floribunda (1%), Calamagrostis stricta (1%).



Brandegee fumewort -Tall fringed bluebells Herbaceous Vegetation

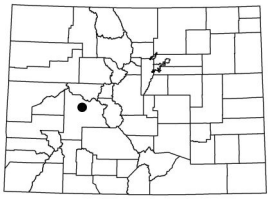
Corydalis caseana ssp. *brandegei* - *Mertensia ciliata*



Global rank/State rank:
G2 / S2

HGM subclass: R1, R2

Colorado elevation range:
8,800-9,000 ft (2,680-2,750 m)



General Description

This plant association has been described only from the vicinity of Crested Butte in Colorado, where it occurs along spring-fed slopes in the subalpine. This association is similar to the *Cardamine cordifolia-Mertensia ciliata-Senecio triangularis* (heartleaf bittercress-tall fringed bluebells-arrowleaf groundsel) association, and may actually be a variation of this type. It is distinguished by the abundance of *Corydalis caseana* ssp. *brandegei* (Brandegee fumewort).

This plant association occurs on moderate slopes with a high water table but with standing water only in the early summer. Soils are generally fine, mineral and saturated seasonally.

Vegetation Description

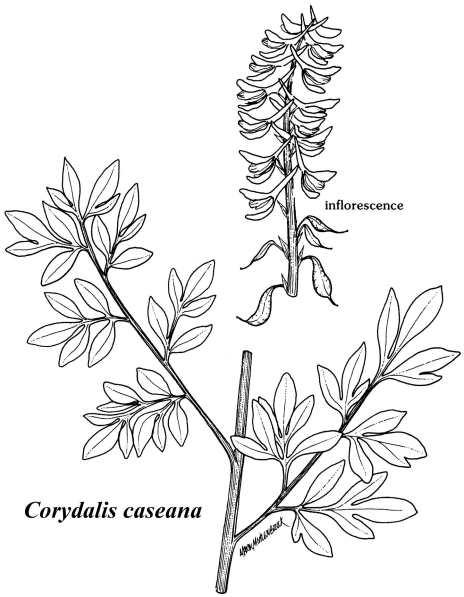
This community is composed of tall (2.5-3 ft, 0.75-1 m), conspicuous plants, with *Corydalis caseana* ssp. *brandegei* (Brandegee fumewort) or *Mertensia ciliata* (tall fringed bluebells) usually dominant. Other species that are commonly present include *Heracleum maximum,* (common cowparsnip) *Senecio serra* (tall ragwort), and *Delphinium barbeyi* (subalpine larkspur).

Ecological Processes

This plant association is usually stable and long-lived as long as hydrologic conditions persist. The saturated soils and easily broken stems of *Corydalis caseana* ssp. *brandegei* (Brandegee fumewort) make this association highly susceptible to trampling by livestock or people.

Avg. Cover %	(Range)	Species Name	# Plots (N=5)
52	(40-60%)	Corydalis caseana ssp. brandegeei	5
35	(20-50%)	Mertensia ciliata	5
26	(20-30%)	Heracleum maximum	4
26	(20-30%)	Delphinium barbeyi	4
15	—	Senecio triangularis	1
10	—	Aconitum columbianum	1
6	(2-10%)	Senecio serra var. serra	3

Other species with < 5% average cover present in at least 10% of plots:
Elymus trachycaulus ssp. trachycaulus (1-5%), Poa leptocoma (0.1-2%), Veronica peregrina ssp. xalapensis (1%).



Corydalis caseana

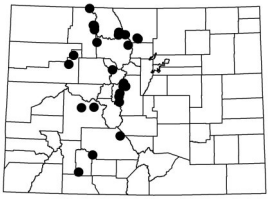
Tufted hairgrass Herbaceous Vegetation

Deschampsia caespitosa

Global rank/State rank:
G4 / S4

HGM subclass: S1/2, S3/4

Colorado elevation range:
7,900-12,300 ft (2,400-3,750 m)



General Description

This dense, bunch-grass meadow occurs in broad, nearly flat, valley bottoms in openings of willow carrs (i.e., shrubland thickets) and coniferous forests in subalpine regions across Colorado. It is characterized by uniform to patchy cover of *Deschampsia caespitosa* (tufted hairgrass) with minor cover of other graminoids and forbs. Drier phases of this association grow on gentle slopes above the valley floor.

This meadow plant association generally occurs in broad, glaciated valleys on well-drained ridges and hummocks adjacent to low to moderate gradient streams. It occurs on sites with a moderately high water table, indicated by the presence of mottles or gleying in the soil at a depth of 8 in (20 cm). Stream channels are wide and moderately sinuous or narrow and highly sinuous. Soils are a shallow to deep organic layer over stratified sandy or silty loams and loamy sands.

Vegetation Description

This plant association is a meadow dominated by *Deschampsia caespitosa* (tufted hairgrass). Other graminoids may be abundant depending on local conditions, but no other species are consistently present. These include *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), and *Calamagrostis canadensis* (bluejoint reedgrass). Forb cover is highly variable, *Caltha leptosepala* (marsh marigold) is present in about half of all stands. Other forbs often, but not always, present include *Ranunculus alismifolius* (plantainleaf buttercup), *Rhodiola rhodantha* (redpod stonecrop), *Veronica wormskjoldii* (American alpine speedwell), and *Pedicularis groenlandica* (elephanthead lousewort). Occasionally, a few shrub stems from adjacent stands occur within this association, including *Dasiphora floribunda* (shrubby cinquefoil), *Salix planifolia* (planeleaf willow), and *Salix brachycarpa* (barrenground willow).

Ecological Processes

The *Deschampsia caespitosa* (tufted hairgrass) plant association can continue to occupy sites indefinitely under relatively stable conditions. *Deschampsia caespitosa* occurs along a broad moisture gradient from mesic and dry-mesic environments to those that are very wet. As sites become drier, *Deschampsia caespitosa* cover gradually decreases and *Dasiphora floribunda* (shrubby cinquefoil) cover may increase on sites with well-drained soils. In contrast, if a site becomes wetter, *Carex* (sedge) species may become dominant.

The presence of native increaser species such as *Juncus balticus* var. *montanus* (mountain rush) and exotic species such as *Poa pratensis* (Kentucky bluegrass) and *Taraxacum officinale* (dandelion) may indicate disturbed conditions. As disturbance levels increase, *Poa pratensis* may replace *Deschampsia caespitosa*. Many subalpine areas now dominated by *Poa pratensis* may have supported *Deschampsia caespitosa* communities in the past.

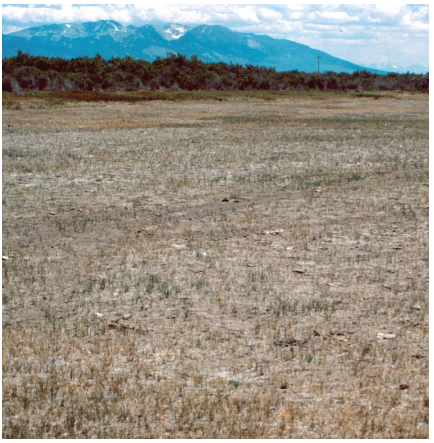
This is a common association in Colorado, however few pristine stands have been documented. It is highly threatened by heavy livestock grazing, invasion by non-native species, and reduced fire frequency.

Avg. Cover %	(Range)	Species Name	# Plots (N=31)
39	(10-80%)	Deschampsia caespitosa	31
16	(1-38%)	Ligusticum tenuifolium	6
16	(2-30%)	Juncus balticus var. montanus	6
13	(1-90%)	Poa pratensis	9
13	(1-50%)	Carex aquatilis	19
12	(6-20%)	Calamagrostis canadensis	3
11	(1-40%)	Carex microptera	7
11	(5-26%)	Argentina anserina	5
10	(1-20%)	Carex utriculata	3
10	(3-20%)	Arnica mollis	4
10	(1-45%)	Caltha leptosepala	16
9	(3-15%)	Hordeum jubatum ssp. jubatum	3
9	(1-15%)	Hordeum brachyantherum ssp. brachyantherum	3
8	(5-12%)	Carex illota	5
7	(2-11%)	Erigeron peregrinus ssp. callianthemus	4
6	(1-11%)	Trollius laxus ssp. albiflorus	4

Other species with < 5% average cover present in at least 10% of plots:
Carex scopulorum (3-4%), Trisetum wolfii (1-7%), Juncus drummondii (1-11%), Phleum alpinum (1-12%), Senecio triangularis (1-8%), Taraxacum officinale (1-9%), Salix planifolia (1-7%), Packera dimorphophylla (1-5%), Carex nigricans (1-8%), Symphyotrichum foliaceum (1-5%), Potentilla diversifolia (2-3%), Pedicularis groenlandica (0.1-5%), Achillea millefolium var. occidentalis (1-5%), Cardamine cordifolia (1-3%), Viola macloskeyi ssp. pallens (1-3%), Agrostis humilis (1-4%), Veronica wormskjoldii (1-4%), Polygonum bistortoides (0.1-5%), Plantago tweedyi (1-2%), Carex ebenea (1-2%), Ranunculus alismifolius var. montanus (1-3%), Juncus mertensianus (1-2%), Rhodiola rhodantha (0.1-3%), Fragaria virginiana ssp. glauca (1%), Castilleja sulphurea (1%), Antennaria corymbosa (1%), Stellaria umbellata (1%).

Inland saltgrass Herbaceous Vegetation

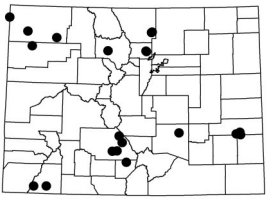
Distichlis spicata



Global rank/State rank:
G5 / S3

HGM subclass: F1

Colorado elevation range:
3,800-8,900 ft (1,150-2,700 m)



General Description

This plant association is characterized by sparse to thick stands of pure *Distichlis spicata* (inland saltgrass) growing on alkaline or saline soils in shallow basins, swales or on pond margins. This is a common association in Colorado, however, it has declined in abundance since European settlement. Large, pristine stands are virtually unknown. This association is threatened by agricultural conversion and groundwater development.

This plant association occurs on alkaline or saline soils (soils that have been formed from the accumulation of bases and soluble salts in poorly drained areas). This association occurs along narrow streams or the margins of playa lakes. Soil textures include sandy clay, sandy loam, or sandy clay loam with gravel and cobbles. The soils may be heavily gleyed and can have fine, distinct mottles at a depth of about 20 inches (50 cm).

Vegetation Description

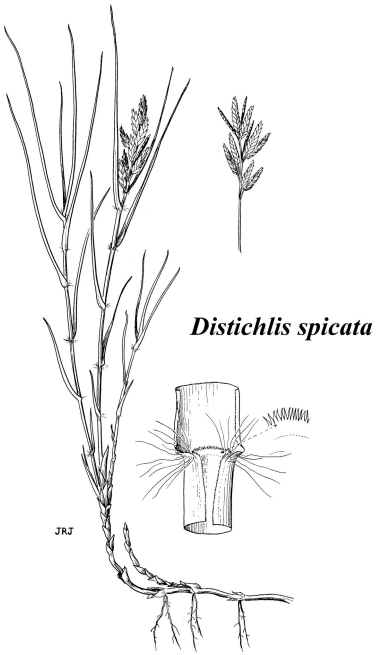
This plant association is characterized by almost pure stands of *Distichlis spicata* (inland saltgrass) with up to 95% cover. Occasionally several clumps of *Ericameria nauseosa* ssp. *nauseosa* var. *glabrata* (rubber rabbitbrush) or *Sarcobatus vermiculatus* (black greasewood) can be present. In degraded stands, *Iva axillaris* (povertyweed) or *Bromus tectorum* (cheatgrass) can be present.

Ecological Processes

Distichlis spicata (inland saltgrass) is a warm season grass and grows from early summer until fall primarily from rhizomes. *Distichlis spicata* can tolerate low to moderately alkaline soils and is resistant to trampling by livestock. Cover of *Distichlis spicata* increases when grazing reduces competition from other plants, but eventually *Hordeum jubatum* (foxtail barley) or weedy species will take over if heavy grazing persists.

Avg. Cover %	(Range)	Species Name	# Plots (N=37)
45	(2-95%)	Distichlis spicata	37
13	(5-30%)	Suaeda calceoliformis	5
9	(5-10%)	Puccinellia nuttalliana	4
8	(2-10%)	Iva axillaris	6
5	(0.1-15%)	Sporobolus airoides	5

Other species with < 5% average cover present in at least 10% of plots:
Schoenoplectus pungens (1-11.1%), Pascopyrum smithii (1-5%), Muhlenbergia asperifolia (0.1-6%), Juncus balticus var. montanus (1-8%), Hordeum jubatum ssp. jubatum (0.1-10%), Triglochin maritimum (0.1-5%), Cirsium arvense (0.1-5%).



Barnyard grass Herbaceous Vegetation

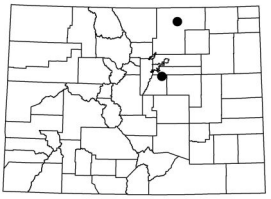
Echinochloa crus-galli

Echinochloa crus-galli

Global rank/State rank:
Not Applicable

HGM subclass: D4/5

Colorado elevation range:
4,930-6,000 ft (1,500-1,830 m)



General Description

Echinochloa crus-galli (barnyard grass) is a non-rhizomatous, warm-season annual grass of Eurasian origin that occurs throughout the continental United States and southern Canada. It is locally common in floodplains, river bottoms and seasonally wet habitats, but is also found in drier areas, and is most often found on disturbed sites. It can occur in a variety of forest, grassland and wetland communities, but as a sole dominant it is most likely to occur in disturbed sites.

Vegetation Description

Echinochloa crus-galli (barnyard grass) is the indicator species for this community, and is dominant or co-dominant with cover percentages ranging from 3 to 98%. This association has no shrub or tree component. Associated forb and graminoid species are quite variable, although *Polygonum lapathifolium* (curlytop knotweed) was present in over half of the stands sampled, with cover values ranging from 3 to 38%. Some of the most frequent associated species include *Amaranthus albus* (prostrate pigweed), *Xanthium strumarium* (rough cocklebur), *Alopecurus aequalis* (shortawn foxtail),

Eleocharis palustris (common spikerush), and *Juncus bufonius* (toad rush), all generally occurring with moderate to low cover.

Ecological Processes

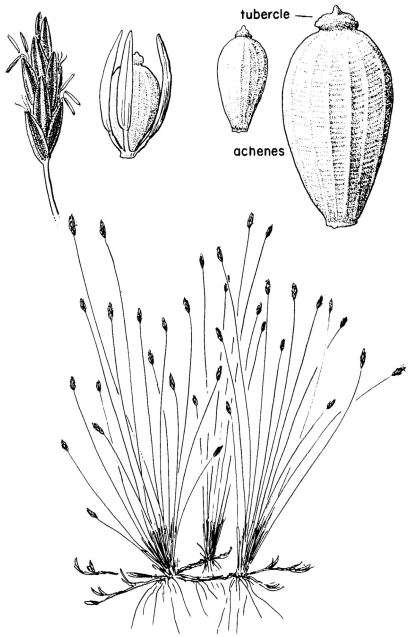
Echinochloa crus-galli (barnyard grass) is a pioneer species that readily invades disturbed sites and is found most often in open, unshaded areas.

Avg. Cover %	(Range)	Species Name	# Plots (N=11)
33	(3-98%)	Echinochloa crus-galli	11
20	(1-38%)	Amaranthus albus	4
8	(3-38%)	Polygonum lapathifolium	6
8	(0.1-15%)	Juncus bufonius	4
7	(3-15%)	Veronica anagallis-aquatica	3
7	(3-15%)	Eleocharis palustris	3

Other species with < 5% average cover present in at least 10% of plots:
Xanthium strumarium (0.1-15%), Alopecurus aequalis (3%), Hordeum jubatum ssp. jubatum (3%), Sagittaria latifolia (1-3%), Limosella aquatica (0.1-3%).

Needle spikerush Herbaceous Vegetation

Eleocharis acicularis

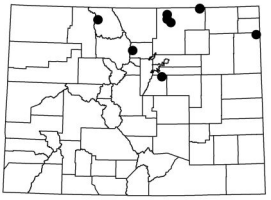


Eleocharis acicularis

Global rank/State rank:
G4? / S3

HGM subclass: D2/3, D4/5

Colorado elevation range:
4,800-11,000 ft (1,460-3,350 m)



General Description

This association is characterized by diminutive, rhizomatous, very slender perennial graminoids that form dense tufts. The canopy cover can range from open (10%) to closed (85%). The association may be found on the edges of marshes, on muddy shores, and other wet places from the lowlands to high elevations in the western United States. Stands typically occur in wet basins, exposed pond bottoms, or concave areas in meadows or grasslands. Sites generally have a high water table throughout the growing season but are only occasionally or seasonally inundated. Widely fluctuating water tables are typical.

This plant association occurs in shallow playas on the northeastern plains of Colorado, and may also be found in intermittently flooded areas of the foothills, montane, and subalpine. Soils vary from fine to coarse, alluvial to colluvial; in the playa lakes they are often fine textured mineral soils with thick dark profiles.

Vegetation Description

Species diversity and vegetation cover are generally low in this association. *Eleocharis acicularis* (needle spikerush) usually provides more cover than other species (4-85%). Other species that may occur include *Eleocharis palustris* (common spikerush)*, Pascopyrum smithii* (western wheatgrass)*, Rorippa sinuata* (spreading

yellowcress), *Marsilea vestita ssp. vestita* (hairy waterclover), and *Ambrosia tomentosa* (skeletonleaf burr ragweed). Non-native graminoids include *Bromus japonicus* (Japanese brome) and *Echinochloa crus-galli* (barnyard grass).

Ecological Processes

Vegetation in this type is highly dependent on the hydrologic regime. Changing hydrologic conditions may result in changes to a more xeric or hydric vegetation type.

Avg. Cover %	(Range)	Species Name	# Plots (N=10)
36	(4-85%)	Eleocharis acicularis	10
19	(1-38%)	Bromus japonicus	2

Other species with < 5% average cover present in at least 10% of plots:
Buchloe dactyloides (1-7 %), Ambrosia tomentosa (2-4%), Echinochloa crus-galli (2-3%), Pascopyrum smithii (0.1-8%), Marsilea vestita ssp. vestita (0.1-3%), Oenothera canescens (0.1-2%), Eleocharis palustris (0.1-2%), Rorippa sinuata (0.1%), Ratibida columnifera (0.1%).

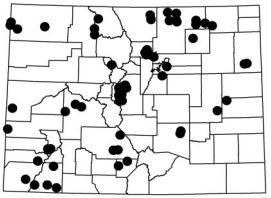
Common spikerush Herbaceous Vegetation

Eleocharis palustris

Global rank/State rank:
G5 / S4

HGM subclass: D2/3, D4/5, S1/2

Colorado elevation range:
3,800-11,400 ft (1,150-3,500 m)



General Description

The *Eleocharis palustris* (common spikerush) plant association is a conspicuous, if small, common emergent association that occurs in shallow, mostly still water. Most of the sites where it occurs experience water levels that fluctuate to some degree throughout the growing season. It is recognized by the clear dominance, although sometimes sparse cover, of *Eleocharis palustris*. The largest known occurrence consists of broad concentric rings around a series of playa lakes at The Nature Conservancy's Mishak Lake Preserve in the San Luis Valley in south central Colorado.

This association occurs on wet sand bars and on finer substrates in backwater areas within the stream channel at low elevations and in shallow waters of ponds in montane and subalpine regions. This association often occurs along narrow, sinuous headwater rivulets where groundwater flow is lateral, primarily fed from toeslope seeps. High elevation stands consistently occur on organic soils, or on a thick organic horizon that overlies fine to coarse alluvial material. Lower elevation stands occur on fresh alluvial deposits of fine-textured loamy sands, clays, clay loams, and sandy clays.

Vegetation Description

This community can be very sparse to quite dense, but *Eleocharis palustris* (common spikerush) is always the dominant species, and the only species always present. Because the *Eleocharis palustris* (common spikerush) plant association occurs within a wide elevational range, the species composition can be quite variable, but this community is easily recognized by its single, low herbaceous canopy cover of bright green, nearly pure stands of *Eleocharis palustris* (common spikerush). Other species, when present, can contribute as much as 40% cover, but never exceed that of the *Eleocharis palustris*. On the Colorado Western Slope in low elevation stands, co-occurring species can include *Phalaris arundinacea* (reed canarygrass) and *Juncus balticus* var. *montanus* (mountain rush) as well as the introduced *Melilotus officinalis* (yellow sweetclover) and *Bromus inermis* (smooth brome). Other species may include

Sparganium angustifolium (narrowleaf burreed), *Lemna* spp. (duckweed) and *Potamogeton* spp. (pondweed). On the eastern plains, co-occurring species can include *Leersia oryzoides* (rice cutgrass), *Schoenoplectus pungens* (threesquare bulrush), *Panicum virgatum* (switchgrass), *Carex pellita* (woolly sedge), and *Spartina pectinata* (prairie cordgrass).

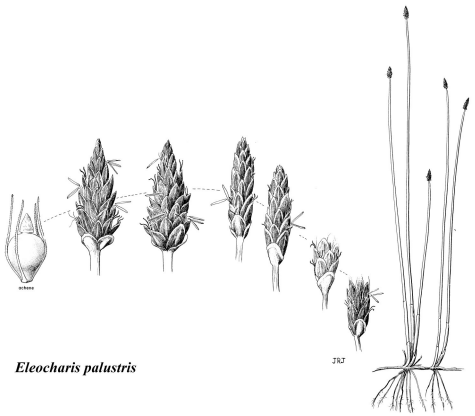
At higher, montane elevations other graminoids present include *Carex aquatilis* (water sedge), *C. utriculata* (beaked sedge), and *Deschampsia caespitosa* (tufted hairgrass). Forb cover is typically low, but can occasionally be abundant in some stands. Common forb species include *Pedicularis groenlandica* (elephanthead lousewort), *Rhodiola integrifolia* (ledge stonecrop), and *Caltha leptosepala* (marsh marigold).

Ecological Processes

At lower elevations the *Eleocharis palustris* (common spikerush) plant association occurs well within the active channel and is inundated annually. This early seral community colonizes backwater eddies and shallow edges of slow moving reaches of small and larger rivers. It is probably an ephemeral community, scoured out each year during high spring flows. At montane elevations, this association occurs in ponded sites on faster moving streams. If siltation occurs, sites may become dominated by *Carex utriculata* (beaked sedge). At higher elevations, this association appears to be stable. It occurs near seeps on soils with deep organic layers, often sapric, and saturated throughout the growing season.

Avg. Cover %	(Range)	Species Name	# Plots (N=142)
47	(3-100%)	Eleocharis palustris	142
14	(0.1-63%)	Agrostis gigantea	12
8	(0.1-88%)	Hordeum jubatum ssp. jubatum	32
6	(0.1-29%)	Schoenoplectus pungens	25
5	(1-15%)	Beckmannia syzigachne	11
5	(0.1-40%)	Polygonum amphibium var. emersum	12

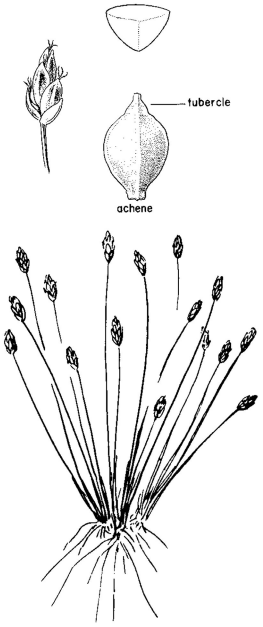
Other species with < 5% average cover present in at least 10% of plots:
Juncus balticus var. montanus (0.1-15%), Xanthium strumarium (0.1-15%), Schoenoplectus acutus\tabernaemontani (0.1-23%), Epilobium ciliatum ssp. glandulosum (0.1-15%), Argentina anserina (0.1-10%), Mentha arvensis (0.1-5%), Salix exigua (0.1-5%).



Eleocharis palustris

Dwarf spikerush Herbaceous Vegetation

Eleocharis parvula

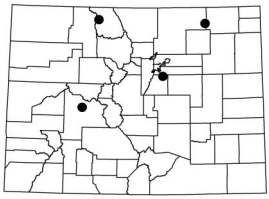


Eleocharis parvula

Global rank/State rank:
GU / S2

HGM subclass: D2/3, D4/5

Colorado elevation range:
4,500-8,900 ft (1,370-2,700 m)



General Description

Eleocharis parvula (dwarf spikerush) is a diminutive, perennial graminoid that often forms a dense cover in shallow ephemeral wetlands, saturated playas, and drying mudflats. The association occurs primarily at low elevations, but may be found up to 9,000 ft. *Eleocharis parvula* cover typically ranges from 30% to 85%. Species diversity is low.

This plant association occurs in shallow playas on the northeastern plains of Colorado, and along Cherry Creek. Soils vary from fine to coarse, alluvial to colluvial; in playa lakes they are often fine textured mineral soils with thick dark profiles and occasionally a significant organic layer.

Vegetation Description

Species diversity and vegetation cover may both be low in this association. *Eleocharis parvula* (dwarf spikerush) usually provides more cover than other species (15-85%). Other species that may occur include *Limosella aquatica* (water mudwort), *Hippurus vulgaris* (common mare's-tail), *Polygonum arenastrum* (oval-leaf knotweed), *Polygonum amphibiaum* var. *emersum* (longroot smartweed), *Eleocharis acicularis* (needle spikerush), *Eleocharis palustris* (common spikerush), *Pascopyrum smithii* (western wheatgrass) and *Alopecurus aequalis* (shortawn foxtail).

Ecological Processes

In the eastern US, *Eleocharis parvula* (dwarf spikerush) occurs in saline marshes or brackish swales. In Colorado this association tends to occur in slightly drier sites, but will disappear where soils do not remain saturated for much of the growing season. On the plains, under drier conditions *Eleocharis parvula* may be replaced by *Pascopyrum smithii* (western wheatgrass) or *Buchloe dactyloides* (buffalograss). At all elevations higher water levels may cover the extremely small *Eleocharis parvula* and emergent marsh vegetation may become more abundant.

Avg. Cover %	(Range)	Species Name	# Plots (N=10)
58	(15-85%)	Eleocharis parvula	10
15	(0.1-30%)	Limosella aquatica	5
9	(2-15%)	Alisma triviale	2
5	(0.1-15%)	Alopecurus aequalis	4

Other species with < 5% average cover present in at least 10% of plots:
Eleocharis palustris (2%), Echinochloa crus-galli (2%), Eleocharis acicularis (2%), Polygonum arenastrum (2%), Xanthium strumarium (0.1%).

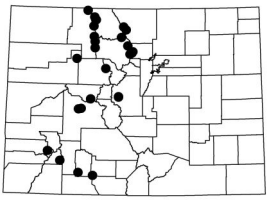
Few-flower spikerush Herbaceous Vegetation

Eleocharis quinqueflora

Global rank/State rank:
G4 / S3S4

HGM subclass: S1/2

Colorado elevation range:
8,700-12,300 ft (2,650-3,800 m)



General Description

The *Eleocharis quinqueflora* (fewflower spikerush) plant association is a uniform peatland community found in upper subalpine and lower alpine wetlands. It is easily recognized by its homogeneity, the presence of usually little more than *Eleocharis quinqueflora* and *Carex aquatilis* (water sedge), and the sparse nature of the vegetation growth. This is a common association of upper subalpine elevations. It is widespread and is well documented throughout the western states.

The *Eleocharis quinqueflora* (fewflower spikerush) plant association occurs in high elevation, marshy meadows associated with seeps where the water table is at the soil surface. Valley bottoms are moderately wide to wide and usually have a gentle to moderate gradient (0.4-6%). Adjacent stream channels are narrow and sinuous headwater rivulets with lateral seepage from surrounding toeslopes. This association occurs on peat occasionally as deep as 7 ft (2 m). The soils remain saturated throughout the growing season and may not be very rich in nutrients.

Vegetation Description

This plant association is characterized by widely-spaced *Eleocharis quinqueflora* (fewflower spikerush) with *Pedicularis groenlandica* (elephanthead lousewort) often present. *Carex aquatilis* (water sedge) is present in 85% of stands. Other forb and graminoid species present are variable. Some of the more frequently encountered species include *Caltha leptosepala* (marsh marigold), *Carex scopulorum* (mountain sedge), *Carex utriculata* (beaked sedge), *Carex illota* (small-headed sedge), and *Carex jonesii* (Jones sedge).

Ecological Processes

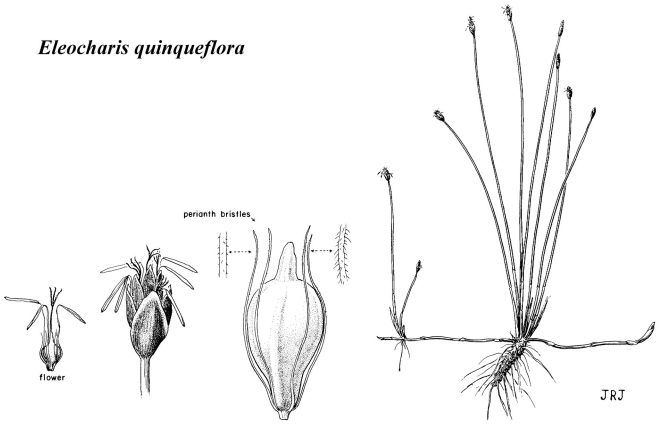
Eleocharis quinqueflora (fewflower spikerush) is an early colonizer and persists under wet conditions. *Carex aquatilis* (water sedge) can be a co-dominant in this plant

association. Grazing can increase the cover of increaser and invader species such as *Agrostis stolonifera* (creeping bentgrass) and *Juncus balticus* var. *montanus* (mountain rush), and will damage the wet soils.

Avg. Cover %	(Range)	Species Name	# Plots (N=41)
56	(7-90%)	Eleocharis quinqueflora	41
11	(0.1-31%)	Carex aquatilis	30
9	(1-30%)	Carex utriculata	5
8	(1-20%)	Triglochin palustre	5
8	(0.1-30%)	Carex scopulorum	5
5	(0.1-16%)	Carex illota	4

Other species with < 5% average cover present in at least 10% of plots:
Caltha leptosepala (0.1-20%), Salix planifolia (0.1-10%), Carex canescens (1-5%), Deschampsia caespitosa (1-8%), Pedicularis groenlandica (0.1-10%), Ligusticum tenuifolium (0.1-3%), Rhodiola rhodantha (0.1-1%), Juncus mertensianus (0.1-1%).

Eleocharis quinqueflora



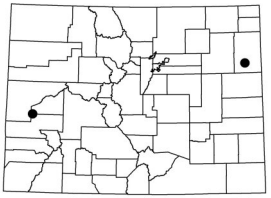
Beaked spikerush Herbaceous Vegetation

Eleocharis rostellata

Global rank/State rank:
G3 / S2

HGM subclass: S3/4

Colorado elevation range:
3,950-5,600 ft (1,200-1,700 m)



General Description

This association is uncommon and localized to calcareous wet meadows, seeps and stream margins, often associated with mineral springs. Stands often form small or narrow patches, restricted to areas of saturated, spring-fed (often alkaline and/or thermally influenced) soils. These areas are restricted in size and irregularly distributed on the landscape.

Eleocharis rostellata (beaked spikerush) is a member of the sedge family and is unique within that family by being stoloniferous. The community type forms near monocultures in saturated sites associated with warm springs or fens. There are two distinct phases of this community: stands with approximately 90% cover of *Eleocharis rostellata*, occurring on relatively deep organic soils and sometimes forming a quaking mat; and stands with less than 70% cover that are more open, with considerable areas of bare soil, gravel, rock, and open water on the surface. The open phase appears to be restricted to mineral substrates and occurs on gentle as well as very steep slopes.

Substrates are composed of travertine and *Chara* (a green algae which precipitates calcium carbonate) deposits. A thin (2 in, 5 cm) layer of undecomposed *Eleocharis* stems covers much of the substrate surface. This type is located in perennially flowing warm water. Electrical conductivity is also high.

Vegetation Description

Species diversity of this plant association is low. In addition to *Eleocharis rostellata* (beaked spikerush), *Scirpus acutus* (hardstem bulrush), *Symphyotrichum eatonii* (Eaton aster), and *Polypogon monspeliensis* (annual rabbitsfoot grass) may be present in small amounts. Colorado stands included *Carex raynoldsii* (Raynolds' sedge), *Juncus balticus* var. *montanus* (mountain rush), *Schoenoplectus pungens* (threesquare bulrush) and *Equisetum hyemale* (scouringrush horsetail). A dense layer of algae is also typically found overlying the travertine substrate. The community type forms

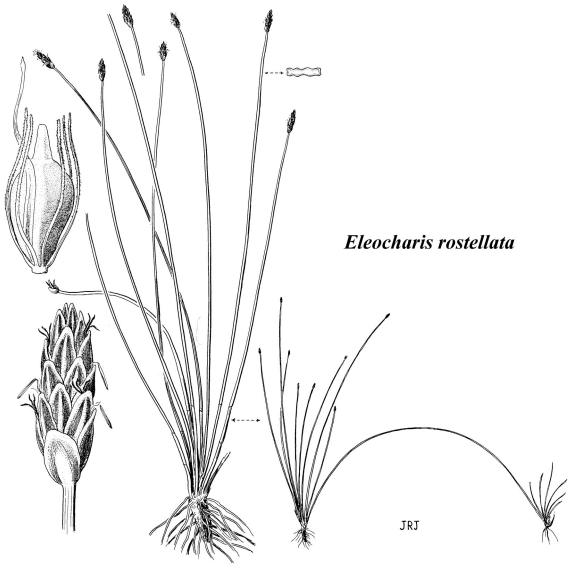
near monocultures, and may occur as a quaking mat, or may be more open with considerable areas of bare soil, gravel, rock, and open water.

Ecological Processes

Because of its stoloniferous growth habit, *Eleocharis rostellata* (beaked spikerush) forms dense patches that are resistant to disturbance. Waterfowl eat the stems, roots and achenes of *Eleocharis rostellata*, but palatability is low for livestock and wildlife. Prolonged disturbance or hydrologic changes may result in loss of this community. *Eleocharis rostellata* is considered threatened and endangered in a number of states, mostly in the midwest and northeast, and it is uncommon to rare in Colorado.

Avg. Cover %	(Range)	Species Name	# Plots (N=2)
57	(16-98%)	Eleocharis rostellata	2
13	—	Carex raynoldsii	1

Other species with < 5% average cover present in at least 10% of plots:
Juncus balticus var. montanus (2%), Schoenoplectus pungens (1%), Panicum virgatum (1%), Muhlenbergia asperifolia (1%), Equisetum hyemale var. affine (1%), Carex pellita (1%), Veronica anagallis-aquatica (0.1%), Juncus confusus (0.1%), Hordeum jubatum ssp. jubatum (0.1%), Eleocharis palustris (0.1%).



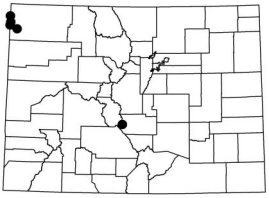
Scouringrush horsetail Herbaceous Vegetation

Equisetum hyemale

Global rank/State rank:
G3 / S3

HGM subclass: R3/4, R5

Colorado elevation range:
5,700-6,800 ft (1,730-2,070 m)



General Description

This plant association occurs on level to moderately sloping sandbars and terraces adjacent to rivers in far western Colorado. One plot from the upper Arkansas drainage, dominated by *Equisetum laevigatum* but with some cover of *E. hymale*, is included here. It generally occurs in small patches composed mainly of *Equisetum hyemale* (scouringrush horsetail) with minor cover of associated species. Sites have a high water table and may be seasonally flooded.

Soils are generally coarse alluvium from sedimentary rock.

Vegetation Description

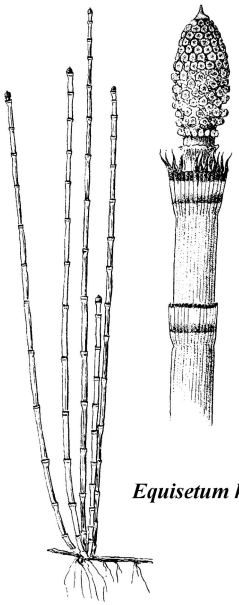
Equisetum hyemale (scouringrush horsetail) typically provides between 10 and 70% cover in these stands. Other vegetation may be sparse. Associated species include *Apocynum cannibinum* (Indianhemp), *Helenium autumnale* (mountain sneezeweed), *Sporobolus airoides* (alkali sacaton), *Distichlis spicata* (inland saltgrass), *Glycyrrhiza lepidota* (American licorice), *Populus deltoides* (plains cottonwood), and *Salix exigua* (sandbar willow).

Ecological Processes

Equisetum hyemale (scouringrush horsetail) is typically an early colonizer of sandbars. It requires wet conditions to become established but can apparently persist as conditions become drier.

Avg. Cover %	(Range)	Species Name	# Plots (N=26)
26	(3-70%)	Equisetum hyemale var. affine	26
15	(1-30%)	Heterotheca villosa	3
5	(0.1-15%)	Tamarix ramosissima	3
5	(0.1-10%)	Rorippa palustris ssp. hispida	3
5	(1-7%)	Bromus tectorum	4

Other species with < 5% average cover present in at least 10% of plots:
Glycyrrhiza lepidota (0.1-10%), Poa pratensis (1-7%), Chrysothamnus linifolius (0.1-10%), Apocynum cannabinum (0.1-10%), Melilotus officinalis (0.1-3%), Populus deltoides (0.1-4%), Asclepias speciosa (0.1-3%), Helenium autumnale var. montanum (0.1-3%), Elymus canadensis (1-1%), Eleocharis palustris (0.1-1%), Argentina anserina (0.1-1%), Salix exigua (0.1-1%), Mentha arvensis (0.1-1%).



Equisetum hymale

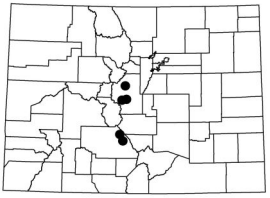
Sea milkwort Herbaceous Vegetation

Glaux maritima

Global rank/State rank:
G3 / S2

HGM subclass: F1, S3/4

Colorado elevation range:
7,900-9,500 ft (2,400-2,900 m)



General Description

Glaux maritima (sea milkwork) is a low-growing, somewhat succulent plant with small, inconspicuous flowers. It dominates sparse stands on alkaline flats that have a high water table and are seasonally wet. The combination of high salt content and high water table limits the species diversity of these sites. This plant association has been described from South Park and the San Luis Valley in Colorado.

This plant association occurs on level or nearly level sites in two of Colorado's intermountain basins. Soils are generally fine, poorly drained, and not highly organic.

Vegetation Description

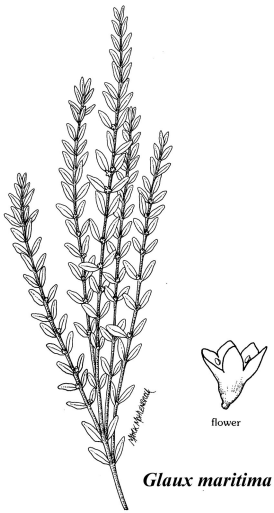
Vegetation is usually sparse and limited to halophytes. *Glaux maritima* is usually the dominant species or co-dominant with another species (10-60% cover). No other species are constant in all stands, but the suite of associated species includes *Poa secunda* (Sandberg bluegrass), *Distichlis spicata* (inland saltgrass), *Puccinellia nuttalliana* (Nuttall alkaligrass), *Plantago eriopoda* (redwool plantain), *Juncus balticus* var. *montanus* (mountain rush) and *Hordeum jubatum* (foxtail barley).

Ecological Processes

Little is known about the successional processes of this plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
38	(15-60%)	Juncus balticus var. montanus	3
36	(10-60%)	Glaux maritima	7
30	—	Schoenoplectus pungens	1
18	(2-60%)	Plantago eriopoda	4
16	(2-40%)	Puccinellia nuttalliana	3
15	(5-25%)	Distichlis spicata	2
15	—	Argentina anserina	1
15	—	Poa secunda	1
12	(1-30%)	Hordeum jubatum ssp. jubatum	3
10	—	Scirpus nevadensis	1
7	(5-10%)	Triglochin maritimum	4
5	—	Eleocharis palustris	1
5	—	Spartina gracilis	1
5	—	Deschampsia caespitosa	1

Other species with < 5% average cover present in at least 10% of plots:
Pascopyrum smithii (2-5%), Iva axillaris (3%), Polygonum amphibium var. emersum (2%), Ranunculus repens (1%), Sisyrinchium pallidum (1%).



Glaux maritima

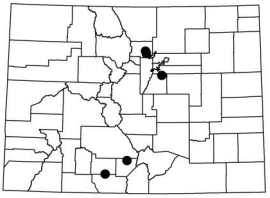
American mannagrass Herbaceous Vegetation

Glyceria grandis

Global rank/State rank:
G2? / S2

HGM subclass: D2/3, D4/5

Colorado elevation range:
5,200-8,900 ft (1,580-2,700 m)



General Description

This tall grass plant association occurs in small depressions along the edges of ditches, small streams, or sloughs. It may develop where a gentle current occurs, or in the wet sands on the edge of the active channel. Stands are seasonally or permanently flooded (Depressional 2/3) or occasionally flooded (Depressional 4/5).

This association occurs in wet areas along the Front Range in the transition zone between the foothills and the plains and in valleys in the mountains at low to moderate elevations, often associated with beaver ponds. Soils are generally coarse, but may be fine, usually sedimentary and alluvial. Soils vary from mineral to organic; mineral soils may have a thick layer of muck-like organic material.

Vegetation Description

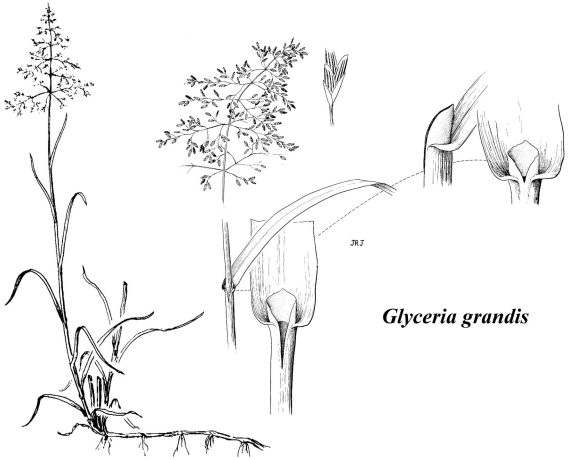
Glyceria grandis (American mannagrass) is generally the most abundant species, with cover values up to 90%. Occasionally it may be the only species present. More often a variety of forbs and graminoids, usually with fairly low cover and constancy occur with the *Glyceria grandis.* Forbs that may occur include *Bidens cernua* (nodding beggartick), *Mentha arvensis* (wild mint), *Solidago* spp. (goldenrod), and *Persicaria* spp. (smartweed). Graminoid species typically provide greater cover than forbs and may include *Eleocharis palustris* (common spikerush), *Phalaris arundinacea* (reed canarygrass), *Agrostis gigantea* (redtop), *Beckmannia syzigachne* (American sloughgrass) and *Leersia oryzoides* (rice cutgrass). *Carex nebrascensis* (Nebraska sedge) was present in one stand in the San Luis Valley.

Ecological Processes

This plant association is usually an indicator of stable water table levels. A drop in water table will eliminate this association. Saturated soils are highly susceptible to damage by livestock.

Avg. Cover %	(Range)	Species Name	# Plots (N=13)
57	(15-90%)	Glyceria grandis	13
37	(10-85%)	Lemna minor	3
29	(15-62%)	Eleocharis palustris	5
26	(2-37%)	Leersia oryzoides	3
19	(0.1-37%)	Juncus nodosus	2
18	(2-37%)	Bidens cernua	4
16	(1-30%)	Carex nebrascensis	2
15	(15-15%)	Carex emoryi	2
9	(2-15%)	Salix exigua	2
9	(2-15%)	Polygonum lapathifolium	2
8	(2-15%)	Agrostis gigantea	3
7	(2-15%)	Beckmannia syzigachne	3
7	(2 -15%)	Schoenoplectus acutus\tabernaemontani	3
6	(2-15%)	Epilobium ciliatum ssp. glandulosum	4
6	(1-15%)	Salix amygdaloides	3
5	(0.1-15%)	Phalaris arundinacea	4

Other species with < 5% average cover present in at least 10% of plots:
Polygonum persicaria (0.1-15%), Schoenoplectus pungens (2-5%), Conyza canadensis (2%), Solidago canadensis (2 %), Lycopus americanus (2%), Bidens frondosa (2%), Rorippa nasturtium-aquaticum (2%), Mentha arvensis (0.1-5%), Veronica anagallis-aquatica (0.1-2.5%), Juncus balticus var. montanus (1-2%), Alopecurus aequalis (0.1-2%), Hordeum jubatum ssp. jubatum (0.1-2%), Juncus dudleyi (0.1-1%), Xanthium strumarium (0.1%).



Glyceria grandis

Fowl mannagrass - Seep monkeyflower - milkflower willowherb Herbaceous Vegetation

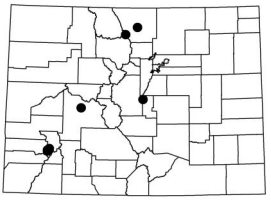
Glyceria striata - Mimulus guttatus - Epilobium lactiflorum

Glyceria striata

Global rank/State rank:
G3 / S3

HGM subclass: R1

Colorado elevation range:
7,800-10,990 ft (2,380-3,350 m)



General Description

The *Glyceria striata-Mimulus guttatus-Epilobium lactiflorum* (fowl mannagrass-seep monkeyflower-milkflower willowherb) association typically occurs in small patches along small creeks and brooks in the montane to subalpine zones. The association includes only herbaceous species, but may occupy a small opening in spruce-fir forests.

This association typically occurs on moderately steep to very steep first order streams, but can occur on less steep stream reaches as well. This association occurs on mud or gravel substrates.

Vegetation Description

This is a small patch community composed of a variable suite of species; either of the three species in the association name may be the dominant species. *Glyceria striata* (fowl mannagrass) is often the most abundant. *Mimulus guttatus* (seep monkeyflower) and *Epilobium lactiflorum* (Milkflower willowherb) are usually present or may occur without *Glyceria striata*. Other species that may occur include *Veronica americana* (American speedwell), *Juncus tracyi* (Tracy rush) and *Carex microptera* (smallwing sedge).

Ecological Processes

This community may be quite unstable due to fluctuating water levels and disturbance from flooding. Successional patterns are unknown, but may vary depending on site topography.

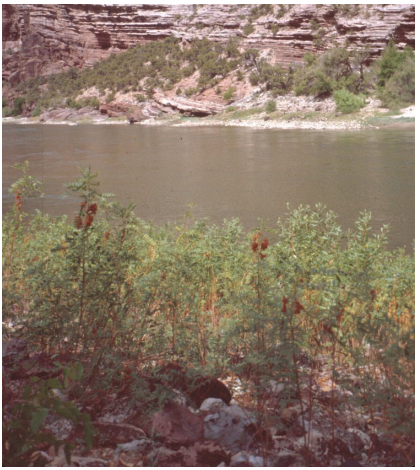
Wet soils, steep gradients, and a short growing season make this association vulnerable to heavy disturbance. These same conditions also deter livestock use somewhat. Forage value and productivity are high for *Glyceria striata* (fowl mannagrass), and low for the other two dominant species. Wet soils are susceptible to compaction and churning by livestock.

Avg. Cover %	(Range)	Species Name	# Plots (N=12)
43	(5-95%)	Glyceria striata	12
18	(5-30%)	Chamerion latifolium	2
16	(2-50%)	Mimulus guttatus	7
14	(3-40%)	Epilobium lactiflorum	10
11	(5-20%)	Veronica americana	7
7	(2-15%)	Juncus tracyi	6
6	(1-15%)	Alopecurus aequalis	3

Other species with < 5% average cover present in at least 10% of plots:
Agrostis stolonifera (2-5%), Oxypolis fendleri (1-5%), Carex microptera (0.1-2%), Equisetum arvense (1%).

American licorice - Scouringrush horsetail Herbaceous Vegetation

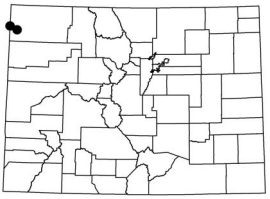
Glycyrrhiza lepidota - Equisetum hyemale



Global rank/State rank:
GU / S3

HGM subclass: R3/4, R5

Colorado elevation range:
5,700-5,850 ft (1,740-1,780 m)



General Description

Although *Glycyrrhiza lepidota* (American licorice), is a common riparian plant, it rarely forms stands. In western Colorado, *Glycyrrhiza lepidota-Equisetum hyemale* (American licorice-scouringrush horsetail) forms a minor, small patch association that occurs on sloping banks, low terraces, and recent alluvial surfaces adjacent to streams and rivers at low elevations.

This plant association occurs in medium gradient sections of larger rivers at low elevations, on sloping banks, low terraces, and recent alluvial surfaces. Soils are generally coarse alluvium derived from sedimentary bedrock.

Vegetation Description

Vegetation cover is typically low; over 50% of the stand may be bare ground. *Glycyrrhiza lepidota* (American licorice) dominates this plant association with 5 to 40% cover. *Equisetum hyemale* (scouringrush horsetail) is present with low cover values in most, but not all, stands. Graminoids that can be present include *Panicum capillare* (witchgrass), *Pascopyrum smithii* (western wheatgrass), *Distichlis spicata* (inland saltgrass), and *Spartina pectinata* (prairie cordgrass). Forb cover is usually sparse; it may include *Helenium autumnale* (mountain sneezeweed), *Asclepias speciosa* (showy milkweed), *Apocynum cannabinum* (Indianhemp). Shrubs and trees may occur in small amounts, including *Populus deltoides* (plains cottonwood), *Salix exigua* (sandbar willow), *Rhus trilobata* (skunkbush sumac), and *Tamarix ramosissima* (saltcedar).

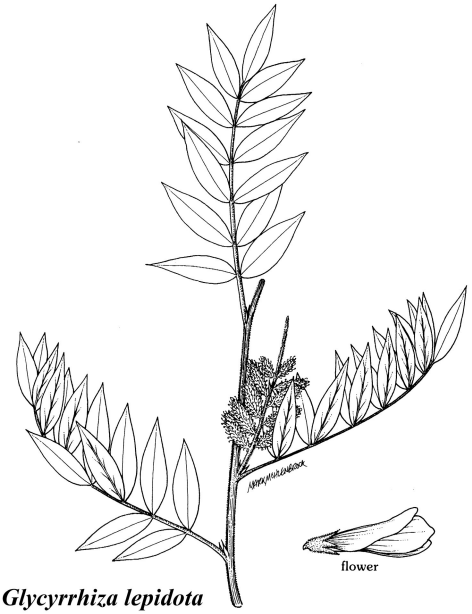
Ecological Processes

In Colorado, this plant association is an early successional community established after disturbance by flood events. Sampled stands along the Green River in Colorado tend to be inaccessible and rarely grazed by livestock. Patches of *Glycyrrhiza lepidota*

(American licorice) have also been observed on large floodplains on the Front Range and plains. *Glycyrrhiza lepidota* will increase with heavy grazing and can be an indicator of past disturbances of any kind.

Avg. Cover %	(Range)	Species Name	# Plots (N=11)
23	(5-40%)	Glycyrrhiza lepidota	11

Other species with < 5% average cover present in at least 10% of plots:
Spartina pectinata (2-5%), Distichlis spicata (0.1-7%), Astragalus pinonis (2-3%), Equisetum hyemale var. affine (0.1-7%), Tamarix ramosissima (1-2%), Pascopyrum smithii (0.1-3%), Populus deltoides (0.1-2%), Helenium autumnale var. montanum (1%), Elymus canadensis (0.1-1%), Asclepias speciosa (0.1-2%), Apocynum cannabinum (0.1-1%), Salix exigua (0.1-1%), Celtis laevigata var. reticulata (0.1%).



Glycyrrhiza lepidota

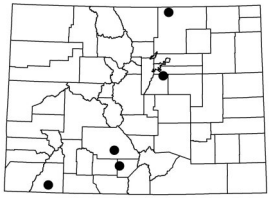
Foxtail barley Herbaceous Vegetation

Hordeum (=Critesion) jubatum

Global rank/State rank:
G4 / S4

HGM subclass: D2/3, D4/5

Colorado elevation range:
5,400-7,700 ft (1,650-2,350 m)



General Description

Hordeum jubatum (foxtail barley) is a short-lived perennial native grass of wet meadows. Stands are common in Colorado but are rarely reported in the literature. Documented stands include a playa on the eastern plains, Cherry Creek near Denver and sites in La Plata, Alamosa and Saguache counties. These documented sites are low elevation shallow basins that may be either seasonally to permanently flooded (the D2/3 HGM subclass) or intermittently to temporarily flooded (D4/5). Intermittently flooded basins tend to be nearly flat; seasonally and permanently flooded basins typically are deeper and *Hordeum jubatum* occurs on pond edges, or in the drawdown zone. Soils are fine to coarse and poorly to very poorly drained. Soil salinity is variable. The soil surface may be covered with white salt crusts with moderately to strongly saline soils.

Vegetation Description

Vegetation in *Hordeum jubatum* meadows is sparse to dense with *Hordeum jubatum* making up 5 to 85% cover of documented stands. Associated species rarely contribute more than 15% cover. Species composition is highly variable between stands, reflecting the moisture and soil differences between sites. *Eleocharis palustris* (common spikerush) is present in about half the stands.

Stands may have an assortment of weedy annual or perennial forbs and graminoids, including *Polygonum* (knotweed) spp., *Echinochloa crus-galli* (barnyard grass), *Xanthium strumarium* (rough cocklebur). *Plantago major* (common plantain), *Erodium cicutarium* (redstem storksbill), *Convolvulus arvensis* (field bindweed), *Bromus japonicus* (Japanese brome), *Chenopodium album* (lambsquarters) and numerous others.

Wetter sites adjacent to *Hordeum jubatum* stands are often open water. Surrounding uplands can be dominated by a variety of grasslands or shrublands.

Ecological Processes

Hordeum jubatum is a common, short-lived pioneer species. It may represent a seral stage that will be taken over by more permanent grasses as conditions change. It is moderately salt tolerant and can densely colonize areas disturbed by flooding along drainages, around playas, and more permanent ponds. Often around playas, this association occupies a zone of intermediate salinity between halophytic vegetation dominated by *Distichlis spicata* (inland saltgrass), *Puccinellia nuttalliana (=airoides)* (Nuttall alkaligrass), or *Salicornia rubra* (red swampfire), and non-saline mesic prairie vegetation dominated by *Pascopyrum smithii* (western wheatgrass), *Poa* spp. (bluegrass), or *Elymus* spp (wild rye). Vegetation cover, species composition, and soil salinity, as well as the direction of succession of this type, depend on the amount and timing of precipitation and flooding.

Avg. Cover %	(Range)	Species Name	# Plots (N=13)
37	(5-85%)	Hordeum jubatum ssp. jubatum	13
20	(2-37%)	Polygonum douglasii	2
9	(2-15%)	Scirpus pallidus	2
9	(2-15%)	Alopecurus aequalis	2
6	(2-15%)	Echinochloa crus-galli	5
5	(2-15%)	Eleocharis palustris	6

Other species with < 5% average cover present in at least 10% of plots:
Polygonum arenastrum (2%), Elymus trachycaulus ssp. trachycaulus (2%), Veronica anagallis-aquatica (2%), Xanthium strumarium (1-2%), Plantago major (1-2%), Conyza canadensis (0.1-2%), Salix amygdaloides (0.1-2%), Rumex salicifolius var. mexicanus (0.1%).

Hordeum jubatum

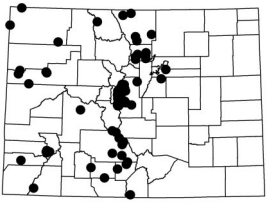
Mountain rush Herbaceous Vegetation

Juncus balticus var. *montanus*

Global rank/State rank:
G5 / S5

HGM subclass: D2/3, D4/5, S3/4, R3/4

Colorado elevation range:
4,900-10,000 ft (1,500-3,050 m)



General Description

This plant association occurs as small, dense patches on flat stream benches, along overflow channels, near springs, and around ponds. It is characterized by a dense sward of *Juncus balticus* var. *montanus* (mountain rush) and often minor cover of *Carex* (sedge) species. Forb cover is generally low. This association is often considered to be a grazing-induced community since it is not palatable to livestock and increases with grazing.

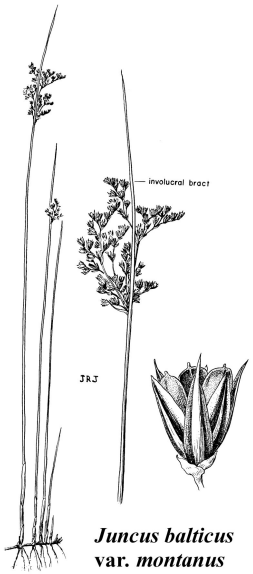
Adjacent stream channels are highly variable and can be narrow and deeply entrenched, moderately wide and moderately sinuous, moderately wide and very sinuous, narrow and very sinuous, or braided. Soil textures are also variable. They range from sandy and well drained, to silty clay loams, to pure organic matter, however most stands occur on coarse-textured sandy loams with a high percentage of cobbles and gravel. Mottles or gleyed horizons are often present.

Vegetation Description

This plant association is very easy to recognize with its band of dark green following the channel path or surrounding depressions. *Juncus balticus* var. *montanus* (mountain rush) is the dominant and indicator species for this community. Because it occurs over a broad elevational and latitudinal range in Colorado, associated species are variable. Some of the more frequently encountered species include *Carex aquatilis* (water sedge), *Carex praegracilis* (clustered field sedge), *Carex utriculata* (beaked sedge), *Glyceria striata* (fowl mannagrass), *Distichlis spicata* (inland saltgrass) and *Eleocharis palustris* (common spikerush).

Forb cover is usually minor, and may include *Argentina anserina* (silverweed cinquefoil), *Achillea millefolium* var. *occidentalis* (western yarrow), *Mentha arvensis* (wild mint) or *Trifolium* spp.(clover). Degraded stands and grazing-induced stands of *Juncus balticus* var. *montanus* (mountain rush) can have high abundance of *Agrostis*

gigantea (redtop), *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (timothy), and *Taraxacum officinale* (dandelion). Occasionally, a few tree or shrub seedlings may be present with 3-15% cover, including *Populus angustifolia* (narrowleaf cottonwood), *Dasiphora floribunda* (shrubby cinquefoil), and *Salix exigua* (sandbar willow).



Juncus balticus* var. *montanus

Ecological Processes

In low-disturbance areas, this plant association appears to be a stable, climax community, often persisting in the absence of wetland conditions. It occupies frequently inundated swales and wet, low- to mid-elevation sites. However, in some areas, this association is considered to be grazing-induced. *Juncus balticus* var. *montanus* (mountain rush) is considered an increaser due to its low forage value and high tolerance to grazing. It usually increases in abundance on sites formerly dominated by *Deschampsia caespitosa* (tufted hairgrass) or *Calamagrostis canadensis* (bluejoint reedgrass). Nearly pure stands of *Juncus balticus* var. *montanus* (mountain rush) indicate that the site may have been heavily grazed in the past.

Avg. Cover %	(Range)	Species Name	# Plots (N=178)
54	(1-100%)	Juncus balticus var. montanus	178
19	(0.1-63%)	Agrostis gigantea	24
17	(1-55%)	Argentina anserina	67
16	(0.1-85%)	Poa pratensis	60
9	(0.1-40%)	Carex praegracilis	34
9	(1-25%)	Carex simulata	20
8	(0.1-30%)	Deschampsia caespitosa	67
8	(0.1-45%)	Phleum pratense	27
7	(0.1-30%)	Hordeum jubatum ssp. jubatum	40
6	(0.1-20%)	Plantago eriopoda	24
6	(0.1-15%)	Dasiphora floribunda	18
5	(0.1-30%)	Iris missouriensis	28
5	(0.1-30%)	Taraxacum officinale	48

Other species with < 5% average cover present in at least 10% of plots:
Poa secunda (0.1-10%), Potentilla gracilis (0.1-10%), Juncus longistylis (1-15%), Elymus trachycaulus ssp. trachycaulus (0.1-25%), Mentha arvensis (0.1-25%), Triglochin maritimum (0.1-15%), Pedicularis crenulata (0.1-15%), Calamagrostis stricta (0.1-15%), Achillea millefolium var. occidentalis (0.1-15%), Crepis runcinata ssp. runcinata (0.1-10%).

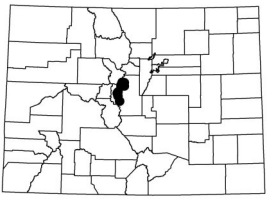
Bellardi bog sedge - Alpine meadowrue Extreme Rich Fen

Kobresia myosuroides - Thalictrum alpinum

Global rank/State rank:
G2 / S1

HGM subclass: S1/2

Colorado elevation range:
8,950-9,900 ft (2,730-3,000 m)



General Description

The *Kobresia myosuroides-Thalictrum alpinum* (Bellardi bog sedge-alpine meadowrue) association is found in extreme rich fens (fens with high levels of calcium, magnesium, and other plant nutrients in the groundwater that feeds this system) in the intermountain valley of South Park, Colorado. This plant association tends to occur on the outer, somewhat drier edges of the peatland, growing on the tops of hummocks that it builds as it grows. Where best developed, these hummocks may be up to 20 inches (50 cm) high.

A similar association occurs in California's Convict Creek Basin. There it occurs in depressions which are very wet or have standing water in early summer. These areas have a long-persisting snow cover and a peaty sod with hummocks or solifluction. Soils are generally deep peats somewhat better drained than lower, surrounding soils.

Vegetation Description

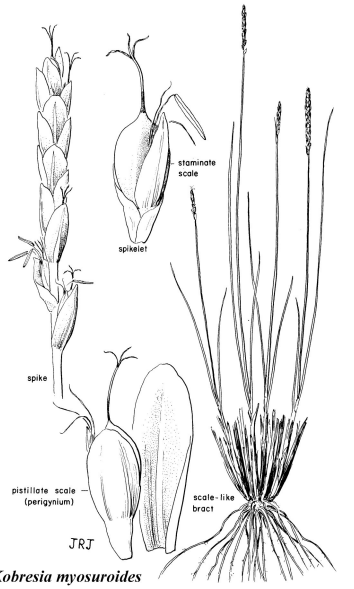
This association is characterized by *Kobresia myosuroides* (10-60% cover) and *Thalictrum alpinum* (5-25% cover) occurring on hummocks often up to 20 inches (50 cm) tall in the drier end of the hydrologic gradient of the fen. The exreme rich fen setting and the presence of *Thalictrum alpinum* at 100% constancy in the community separates this association from the *Kobresia myosuroides*-dominated alpine communities. Associated plant species occurring in at least half of the plots include *Salix brachycarpa* (barrenground willow), *Ptilagrostis porteri* (=*Ptilagrostis mongholica* ssp. *porteri,* Porter false needlegrass), *Juncus balticus* var. *montanus* (mountain rush), *Kobresia simpliciuscula* (simple bog sedge) *Polygonum viviparum* (alpine bistort), *Deschampsia caespitosa* (tufted hairgrass), *Muhlenbergia filiformis* (pullup muhly), *Dasiphora floribunda* (shrubby cinquefoil), *Carex aquatilis* (water sedge), and *Carex capillaris* (hairlike sedge).

A number of rare plant species may occur in this association: *Ptilagrostis porteri* (Porter false needlegrass)*, Sisyrinchium pallidum* (pale blue-eyed grass), *Primula egaliksensis* (Greenland primrose), *Packera pauciflora* (alpine groundsel), and *Carex scirpoidea* (northern singlespike sedge).

Ecological Processes

Extreme rich fens are small-patch communities confined to specific environments defined by groundwater discharge, soil chemistry, and peat accumulation of at least 40 cm. Fens form at low points in the landscape at or near slopes where groundwater intercepts the soil surface. The water chemistry is distinct in that it contains high levels of calcium and magnesium.

Saturated soils in the fens and the cool climate in South Park produce the conditions necessary for the formation of layers of peat in the fens. The rate of peat accumulation in extreme rich fens is even slower than in the rich and intermediate fens found in other parts of the state. While rich fens accumulate 10 to 16 inches of peat in one thousand years, the extreme rich fens of South Park accumulate only about 4.3 inches in one thousand years.



Kobresia myosuroides

Avg. Cover %	(Range)	Species Name	# Plots (N=11)
48	(40-60%)	Kobresia myosuroides	11
15	(5-30%)	Juncus balticus var. montanus	10
12	(1-25%)	Muhlenbergia filiformis	6
10	(1-20%)	Salix brachycarpa	9
9	(5-20%)	Thalictrum alpinum	11
7	(2-10%)	Ptilagrostis porteri	5
6	(2-10%)	Deschampsia caespitosa	5
6	(3-10%)	Kobresia simpliciuscula	4
5	(1-20%)	Dasiphora floribunda	7
5	(1-20%)	Parnassia palustris var. parviflora	5

Other species with < 5% average cover present in at least 10% of plots:
Argentina anserina (3-5%), Polygonum viviparum (1-5%), Carex praegracilis (1-5%), Festuca arizonica (1-5%), Antennaria corymbosa (1-5%), Carex capillaris (1-5%), Carex aquatilis (1-5%), Elymus trachycaulus ssp. trachycaulus (1-5%), Carex scirpoidea (1-3%), Zigadenus elegans ssp. elegans (2%), Galium boreale (2%), Gentianopsis thermalis (1-3%), Packera pauciflora (1-4%), Symphyotrichum foliaceum (1-2%), Pedicularis crenulata (1%), Primula incana (1%), Valeriana edulis (1%), Campanula parryi (1%), Crepis runcinata ssp. runcinata (1%), Triglochin palustre (1%), Trifolium longipes (1%), Dodecatheon pulchellum (1%), Potentilla gracilis (1%), Symphyotrichum spathulatum (1%), Primula egaliksensis (1%), Sisyrinchium pallidum (0.1-1%), Lomatogonium rotatum (0.1-1%).

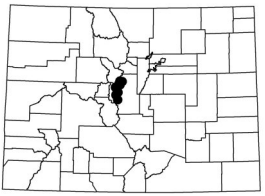
Simple bog sedge - (Rolland bulrush) Extreme Rich Fen

Kobresia simpliciuscula - (Trichophorum pumilum)

Global rank/State rank:
G2 / S1

HGM subclass: S1/2

Colorado elevation range:
8,900-9,800 ft (2,700-3,000 m)



General Description

The *Kobresia simpliciuscula-(Trichophorum pumilum)* (simple bog sedge-(Rolland bulrush)) plant association is generally found growing on hummocks (mounds of organic soil) in wet parts of extreme rich fens (fens with high levels of calcium, magnesium, and other plant nutrients in the groundwater that feeds this system). Depressions beneath the hummocks are usually inundated to the surface throughout most of the growing season and contain stands of species that tolerate saturated conditions.

This plant association occurs on hummocks in level to gently sloping fens. Soils are generally poorly drained and highly organic.

Vegetation Description

Kobresia simpliciuscula (simple bog sedge) is the most conspicuous species in this association, with cover values between 15 and 60%. *Trichophorum pumilum* (Rolland bulrush) occurs almost exclusively in this community, but may not always be present. Cover varies from 0 to 30%. *Thalictrum alpinum* (alpine meadowrue) is the most common and abundant forb in these stands. Typical graminoids include *Juncus balticus* var. *montanus* (mountain rush), *Carex aquatilis* (water sedge), and *Kobresia myosuroides* (Bellardi bog sedge). Shrubs which may be present include *Salix brachycarpa* (barrenground willow), *Salix candida* (hoary willow) and *Salix myrtillifolia* (blueberry willow).

Trichophorum pumilum, *Salix candida* and *Salix myrtillifolia* are rare in Colorado. A number of other rare plant species may occur in this association: *Ptilagrostis porteri* (Porter false needlegrass), *Sisyrinchium pallidum* (pale blue-eyed grass), *Primula egaliksensis* (Greenland primrose), and *Carex scirpoidea* (northern singlespike sedge).

Extreme rich fens consist of a mosaic of associations. *Carex aquatilis* (water sedge) and *Eleocharis quinqueflora* (fewflower spikerush) often occur in the water tracks separating hummocks.

Ecological Processes

This community appears to be stable unless disturbed by grazing, mining, or changes in the hydrologic regime. The community is sensitive to grazing, especially from mid-June through the end of the summer. Peat mining destroys the community and restoration is generally impossible since the peat substrate takes thousands of years to develop. Reduced water levels would result in drying of the substrate and a change to a shrub dominated community. Reduced mineral content of the water supporting the fens would be expected to change the species composition of this community.

Avg. Cover %	(Range)	Species Name	# Plots (N=13)
38	(15-60%)	Kobresia simpliciuscula	13
25	(10-60%)	Thalictrum alpinum	8
11	(1-30%)	Trichophorum pumilum	6
10	(5-15%)	Kobresia myosuroides	3
7	(1-15%)	Carex aquatilis	7
6	(2-10%)	Juncus balticus var. montanus	7
6	(1-10%)	Carex scirpoidea	4
5	(2-10%)	Salix brachycarpa	6

Other species with < 5% average cover present in at least 10% of plots:
Carex simulata (1-5%), Polygonum viviparum (1-10%), Salix candida (1-5%), Eleocharis quinqueflora (1-5%), Ptilagrostis porteri (1-5%), Triglochin maritimum (1-5%), Muhlenbergia filiformis (1-5%), Carex capillaris (1-5%), Carex microptera (1-5%), Carex hassei (1-3%), Dasiphora floribunda (1-2%), Triglochin palustre (1-2%), Primula egaliksensis (1%), Deschampsia caespitosa (1%), Juncus alpinoarticulatus (1%), Primula incana (1%), Carex aurea (1%), Gentiana fremontii (1%), Sisyrinchium pallidum (1%), Dodecatheon pulchellum (1%), Gentianopsis thermalis (1%), Parnassia palustris var. parviflora (1%), Pedicularis groenlandica (1%).

Kobresia simpliciuscula

Rice cutgrass Herbaceous Vegetation

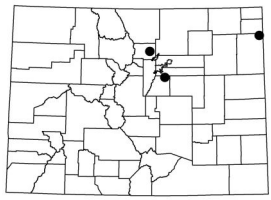
Leersia oryzoides

Leersia oryzoides

Global rank/State rank:
GU / S2

HGM subclass: D2/3

Colorado elevation range:
5,100-6,000 ft (1,550-1,830 m)



General Description

Leersia oryzoides (rice cutgrass) is a perennial native species of wet meadows, sloughs, ditches, and streamsides. A tall rhizomatous grass growing to four feet (1.2 m), it is a common component of nitrophilous communities, growing on nutrient-rich mud or sands close to stream edges. Seasonal inundation and regular disturbance provide the areas of bare mud and open vegetation structure that favor this species.

This association is typically found along ditches, small streams, and sloughs where small currents occur during some part of the growing season. Soils are typically nitrogen rich alluvial deposits.

Vegetation Description

Leersia oryzoides (rice cutgrass) is the characteristic species of this association, and is usually dominant with cover ranging from 2 to 90%. Associated species can include a wide variety of both native and introduced herbaceous species. The most common include *Eleocharis palustris* (common spikerush), *Polygonum douglasii* (Douglas' knotweed) and *Epilobium ciliatum* ssp. *glandulosum* (fringed willowherb). Occasional plots may include small amounts of woody vegetation such as *Salix amygdaloides* (peachleaf willow) from adjacent riparian communities.

Ecological Processes

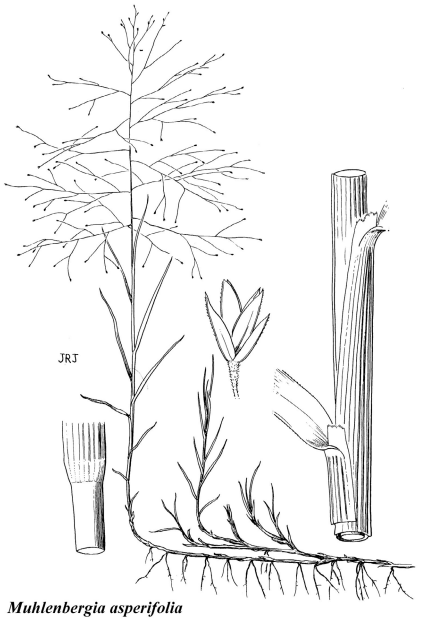
This is an early seral association. Given the rhizomatous growth habit of the dominant species, it is likely to persist and spread over time.

Avg. Cover %	(Range)	Species Name	# Plots (N=4)
42	(2-90%)	Leersia oryzoides	4
38	—	Geum macrophyllum var. perincisum	1
15	—	Juncus articulatus	1
15	—	Glyceria grandis	1
9	(2-15%)	Polygonum douglasii	2
3	(1-5%)	Eleocharis palustris	4

Other species with < 5% average cover present in at least 10% of plots:
Epilobium ciliatum ssp. glandulosum (2%), Beckmannia syzigachne (2%), Bidens cernua (2%), Echinochloa crus-galli (2%), Mentha arvensis (2%), Polygonum lapathifolium (2%), Polygonum persicaria (2%), Rorippa nasturtium-aquaticum (2%), Schoenoplectus acutus\tabernaemontani (2%), Sagittaria cuneata (1%), Berula erecta (0.1%), Bidens frondosa (0.1%), Asclepias incarnata (0.1%), Sparganium eurycarpum (0.1%), Salix amygdaloides (0.1%).

Alkali muhly Herbaceous Vegetation

Muhlenbergia asperifolia

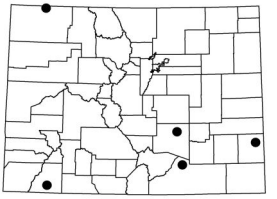


Muhlenbergia asperifolia

Global rank/State rank:
G3? / S3?

HGM subclass: F1, R5

Colorado elevation range:
3,450-5,950 ft (1,050-1,800 m)



General Description

The *Muhlenbergia asperifolia* (alkali muhly) plant association occurs as small, patchy meadows or strips of grass along stream courses and low-lying swales associated with alkaline soils. It occurs in nearly pure stands in saline or alkaline bottomlands where the water table is high.

Associated stream channels were sandy braided systems or meandering, low gradient, broad rivers. This association also occurs in low swales away from riparian areas, and can be found in brackish marshes and roadside ditches. Soils are deep (20-24 in, 50-60 cm) silty clays and sand over sandy loams.

Vegetation Description

Stands of this grassland are small and open, with a generally patchy nature. *Muhlenbergia asperifolia* (alkali muhly) is the dominant graminoid. Other graminoids that may be present include *Spartina gracilis* (alkali cordgrass), *Eleocharis palustris* (common spikerush), *Elymus canadensis* (Canada wildrye). *Bromus tectorum* (cheatgrass) and *Iva axillaris* (povertyweed) may also be present, indicating the site has been disturbed in the recent past.

The surrounding riparian area may include *Scirpus* (bulrush) marshes, *Salix exigua* (sandbar willow) or *Tamarix ramosissima* (saltcedar) shrublands, young *Populus deltoides* (cottonwood) thickets on lower terraces and streambanks, and older, widely spaced, mature cottonwoods on upper terraces.

Ecological Processes

Little information is available on the successional status of this plant association. *Muhlenbergia asperifolia* (alkali muhly) is an indicator of saline or alkaline soil conditions. It appears to be an early-seral community as it occurs in moist alkaline meadows, margins of playa lakes and streams. It invades newly disturbed roadsides and alluvial deposits.

Avg. Cover %	(Range)	Species Name	# Plots (N=10)
44	(10-88%)	Muhlenbergia asperifolia	9*
31	(15-63%)	Eleocharis palustris	3
17	(0.1-38%)	Distichlis spicata	4
6	(1-10%)	Iva axillaris	2
5	(0.1-15%)	Cirsium arvense	3
5	(1-15%)	Schoenoplectus pungens	4
5	(2-7%)	Elymus canadensis	2

Other species with < 5% average cover present in at least 10% of plots:
Glycyrrhiza lepidota (1-5%), Artemisia tridentata (1-5%), Castilleja miniata (0.1-5%), Polypogon monspeliensis (1-5%), Helianthus annuus (1-4%), Hordeum jubatum ssp. jubatum (1-5%), Melilotus officinalis (1-2%), Medicago sativa (0.1-3%), Tamarix ramosissima (1%), Chenopodium album (1%), Equisetum laevigatum (1%), Epilobium ciliatum ssp. glandulosum (0.1-1%), Sonchus asper (0.1-1%), Asclepias speciosa (0.1-1%), Rumex crispus (0.1-1%).,

* Muhlenbergia asperifolia occurred in all stands, but was not captured in every sample plot.

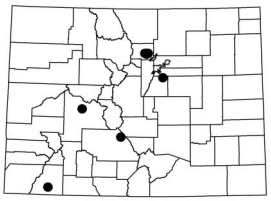
Reed canarygrass Western Herbaceous Vegetation

Phalaris arundinacea

Global rank/State rank:
G5 / S5

HGM subclass: D2/3, S3/4?

Colorado elevation range:
5,180-8,900 ft (1,580-2,700 m)



General Description

The *Phalaris arundinacea* (reed canarygrass) association occurs at lower to middle elevations in Colorado on stream banks, pond and lake margins, and in wet meadows. Flooding can vary from brief to extended periods.

This association occurs in relatively flat to rolling sites, at the edges of streams or ponds or in meadows that remain inundated part of the year. Soils are commonly fine-textured, but can be coarser. Subsoil is often mottled and gleyed due to frequent inundation of the site during the growing season.

Vegetation Description

This association is characterized by a dense, tall herbaceous layer dominated by *Phalaris arundinacea* (reed canarygrass), which often forms near monocultures. Other vegetation in the stands depends on the typical amount and duration of the water level. *Schoenoplectus acutus* var. *acutus* (hardstem bulrush) is a common associate in the wettest sites. Other species that may be present include *Hordeum jubatum* (foxtail barley), *Elymus* spp. (rye grasses) and *Eleocharis palustris* (common spikerush). The non-native species, *Poa pratensis* (Kentucky bluegrass), *Agrostis gigantea* (redtop), *Phleum pratense* (timothy), *Trifolium* spp. (clovers) and *Cirsium arvense* (Canada thistle) may be fairly abundant in drier, disturbed sites.

Ecological Processes

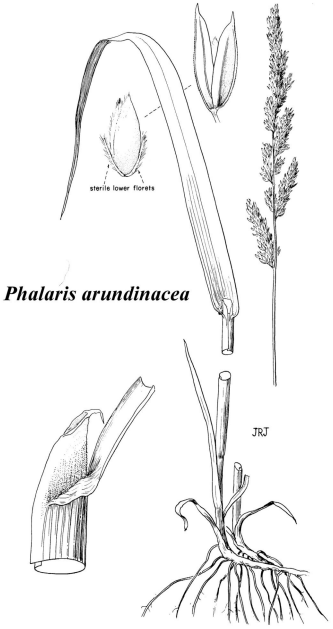
Phalaris arundinacea (reed canarygrass) has been widely distributed as a forage grass, and readily escapes from pastures into wetlands, displacing other wetland species. It is highly competitive because of the thick sod produced by its rhizomes. It often completely dominates stands, excluding other species. It is extremely difficult to

remove once established. Fire may be used to control the spread of reed canarygrass, but success of this method is usually limited due to the high water table where stands occur.

This community often occurs in disturbed wetland sites where the water table has been artificially lowered by stream diversion and channel downcutting. Reed canarygrass is a rapid colonizer of damp, highly organic substrates. Stands are usually wet or poorly drained. Soils are flooded or saturated for much of the growing season. The association has some tolerance for short periods of drought. Soil conditions may be acidic or alkaline.

Avg. Cover %	(Range)	Species Name	# Plots (N=11)
74	(15-100%)	Phalaris arundinacea	11
38	(38-38%)	Schoenoplectus acutus\tabernaemontani	2
34	(5-88%)	Poa pratensis	3
10	(5-30%)	Agrostis gigantea	5
10	(5-15%)	Eleocharis palustris	2
10	(5-15%)	Hordeum jubatum ssp. jubatum	2
5	(5-5%)	Elymus canadensis	2

Other species with < 5% average cover present in at least 10% of plots:
Cirsium arvense (1-5%), Phleum pratense (0.1-1%).



Phalaris arundinacea

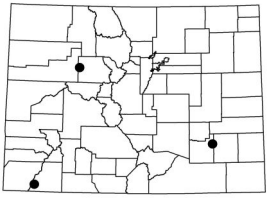
Common reed Herbaceous Vegetation

Phragmites australis

Global rank/State rank:
G5 / S3

HGM subclass: R5

Colorado elevation range:
3,900-6,500 ft (1,200-1,980 m)



General Description

The *Phragmites australis* (common reed) plant association is a tall (3-5 ft, 1-1.5 m) reed community often growing in small wet patches at seeps and backwater areas of large floodplains, around the fringes of irrigation ponds, and ditches, and along railroad embankments that have poor drainage. The *Phragmites australis* (common reed) plant association was once thought to be widespread throughout western Colorado. Now, it occurs only in small, isolated patches where water has become impounded, such as adjacent to raised railroad beds, irrigation ditches, oxbow lakes, and other low-lying swampy areas. It is threatened by stream flow alterations, road building and maintenance.

This plant association occurs in seeps, along irrigation ditches and outflows, and in oxbow lakes. Soils are deep silty clay loams and sands, often with rich mottling at the level of the fluctuating water table.

Vegetation Description

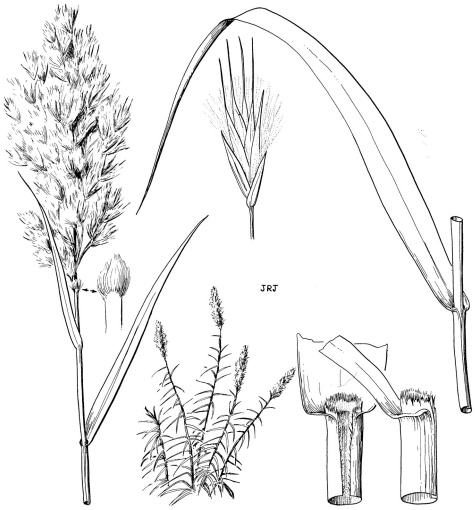
This vegetation is characterized by tall (5-8 ft, 1.6-2.6 m) grasses in small pockets and stands in marshes and wetlands on broad floodplains. *Phragmites australis* (common reed) is the dominant and diagnostic species. While stands appear to be pure, monotypic stands of the grass, there are almost always a few other, if highly variable, species present. These include *Salix exigua* (sandbar willow), *Conyza canadensis* (Canadian horseweed), and *Apocynum androsaemifolium* (spreading dogbane).

Ecological Processes

Phragmites australis (common reed) generally requires seasonal flooding in the spring. This species has strong rhizomes that allow it to out compete all but the most aggressive weedy species. With heavy disturbance, however, exotic species such as *Cirsium arvense* (Canada thistle) may invade this plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
78	(65-88%)	Phragmites australis	3
38	—	Atriplex argentea	1
15	—	Bromus tectorum	1
15	—	Chrysothamnus viscidiflorus	1
10	(5-15%)	Conyza canadensis	2
5	—	Kobresia sibirica	1
5	—	Lactuca serriola	1

Other species with < 5% average cover present in at least 10% of plots:
Lepidium virginicum (4%), Salix exigua (1-5%), Bassia hyssopifolia (2%), Chenopodium album (2%), Cirsium arvense (2%), Asparagus officinalis (1%), Bromus commutatus (1%), Cardamine cordifolia (1%), Carduus nutans ssp. macrolepis (1%), Apocynum androsaemifolium (1%), Cirsium vulgare (1%), Glycyrrhiza lepidota (1%), Helianthus annuus (1%), Maianthemum stellatum (1%), Poa palustris (1%), Rudbeckia laciniata var. ampla (1%), Salix amygdaloides (1%), Artemisia michauxiana (0.1%).



Phragmites australis

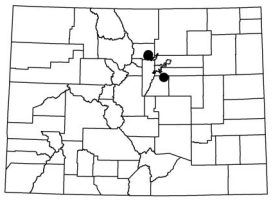
Knotweed spp. - Mesic Graminoid Herbaceous Vegetation

Polygonum spp. - Mesic Graminoid

Global rank/State rank:
Not Applicable

HGM subclass: D4/5

Colorado elevation range:
5,280-6000 ft (1,610-1830 m)



General Description

This is a small patch type at lower elevations along the edges of reservoirs, lakes, ponds, marshes, swales, and other low areas. This ephemeral pond community type occurs widely throughout the Midwestern region of the United States. Stands occur in shallow depressions that may flood for several weeks in the spring, then draw down during the summer. The community may be found in low spots on the plains or in depressions on floodplains.

Soils include most textures from fine clays to sandy loams. The dominant plants of the association are usually intolerant of alkaline or saline conditions.

Vegetation Description

One or two species of *Polygonum* (knotweed), usually introduced species, typically dominate this type with sparse to dense cover (15-98%). Dominants are usually *Polygonum lapathifolium* or *Polygonum arenastrum,* and other knotweed species including *Polygonum hydropiper* and *Polygonum douglasii* may also be present in minor amounts.

Associated species are often introduced and are highly variable from stand to stand. Graminoids tend to be more common than forbs. The most commonly occurring graminoid species include *Echinochloa crus-galli* (barnyard grass), *Hordeum jubatum* (foxtail barley), *Alopecurus aequalis* (shortawn foxtail) and *Eleocharis palustris* (common spikerush). Common forbs include *Xanthium strumarium* (rough cocklebur) and *Rumex salicifolius* var. *mexicanus* (willow dock).

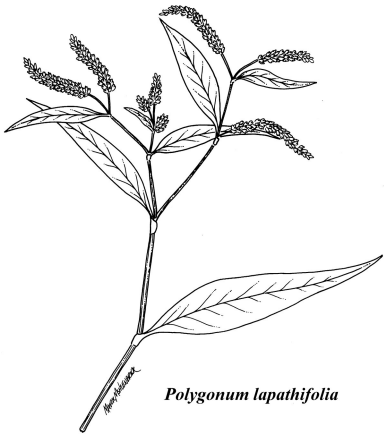
Ecological Processes

Polygonum (knotweed) species are aggressive invaders of shallow water and exposed mud flats. Shore vegetation tends to be a mosaic or bands of short-lived plant communities that survive or disappear depending on water depth in the basin. The vegetation is composed of mostly early successional species that become established when water levels are low. When the shore is inundated for longer periods, some species may be eliminated, but the *Polygonum* species are usually tolerant of longer periods of flooding.

In some areas of the Midwest this association supports rare marsh vegetation. Associated ephemeral ponds may be very important for certain amphibians and invertebrates.

Avg. Cover %	(Range)	Species Name	# Plots (N=16)
64	(2-97%)	Polygonum lapathifolium	9
26	(15-37%)	Polygonum arenastrum	8
13	(2-37%)	Hordeum jubatum ssp. jubatum	6
9	(2-37%)	Echinochloa crus-galli	9

Other species with < 5% average cover present in at least 10% of plots:
Xanthium strumarium (2%), Alopecurus aequalis (1-2%), Rumex salicifolius var. mexicanus (1-2%), Eleocharis palustris (0.1-2%).



Polygonum lapathifolia

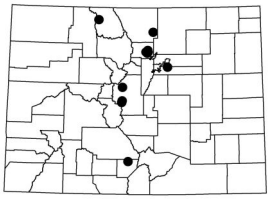
Nuttall alkaligrass Herbaceous Vegetation

Puccinellia nuttalliana (=airoides)

Global rank/State rank:
G3? / S3

HGM subclass: F1

Colorado elevation range:
4,950-9,500 ft (1,510-2,900 m)



General Description

Puccinellia nuttalliana (Nuttall alkaligrass) forms a short grassland (15-30 in, 4-8 dm) with small amounts of forbs and other grasses present. *Puccinellia nuttalliana* needs moist soils of intermediate salinity in seasonally wet meadows. The topography of the area is generally flat, with poor drainage. Much of the ground surface may be bare.

This association is generally found on flat, seasonally wet meadows with fine soil. These moist soils are saline and alkaline and in South Park, Colorado are derived from calcareous shales. The soils usually dry out during the growing season. Soils are generally fine colluvial material and range in moisture from dry to permanently wet.

Vegetation Description

Puccinellia nuttalliana (Nuttall alkaligrass) is the characteristic and diagnostic species of this association, and is always present. Cover values range from 5-100%. It is usually the dominant species, but in a few plots was secondary to *Spergularia maritima* (media sandspurry) or *Trifolium pratense* (red clover). Associated species are usually herbaceous, and commonly include *Hordeum jubatum* ssp. *jubatum* (foxtail barley), *Triglochin maritmum* (seaside arrowgrass) and *Spergularia maritima* (media sandspurry).

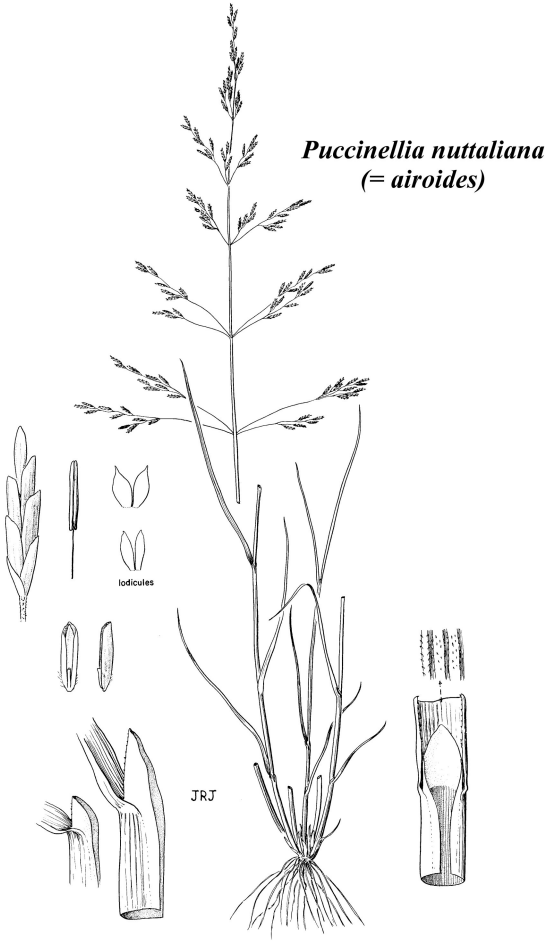
Ecological Processes

In playas, salt flats and saline lakes this community forms a ring around concentrated stands of species that are more tolerant of inundation. In this type of community it is common for *Puccinellia nuttalliana* (Nuttall alkaligrass) to dominate the graminoid layer. *Distichlis spicata* (inland saltgrass) or *Hordeum jubatum* (foxtail barley) can co-dominate some stands. *Hordeum jubatum* can replace *Puccinellia nuttalliana* if a stand receives prolonged disturbance.

Avg. Cover %	(Range)	Species Name	# Plots (N=20)
50	(5-100%)	Puccinellia nuttalliana	20
46	(10-90%)	Spergularia maritima	4
9	(3-25%)	Hordeum jubatum ssp. jubatum	10
9	(0.1-20%)	Triglochin maritimum	4
8	(5-10%)	Distichlis spicata	2
8	(5-10%)	Iva axillaris	2

Other species with < 5% average cover present in at least 10% of plots:

Suaeda calceoliformis (2-7%), Muhlenbergia asperifolia (2-3%), Ranunculus cymbalaria (0.1-1%).



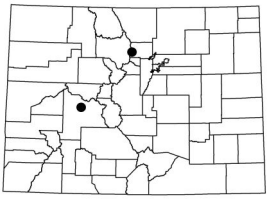
Brook saxifrage Herbaceous Vegetation

Saxifraga odontoloma

Global rank/State rank:
GU / S2

HGM subclass: R1

Colorado elevation range:
8,900-11,800 ft (2,700-3,600 m)



General Description

The *Saxifraga odontoloma* (brook saxifrage) plant association occurs adjacent to streamsides, seeps, marshes, and springs in the subalpine and lower alpine areas. It has been documented from the Indian Peaks Wilderness and Gunnison County in Colorado and is probably widespread in mountainous areas of the state. Documented sites are located on stabilized, west-facing slopes. Soils are skeletal and slightly acidic. This association is characterized by *Saxifraga odontoloma,* a perennial forb that dominates the herbaceous stratum. The graminoid layer is often present and can reach high cover. The non-vascular layer is present, typically at equal percent cover with the forb layer.

Vegetation Description

This association is temporarily flooded during the growing season. *Saxifraga odontoloma* (brook saxifrage) dominates the forb layer. Other constants include *Epilobium anagallidifolium* (pimpernel willowherb)*, Deschampsia caespitosa* (tufted hairgrass)*, Juncus drummondii* (Drummond rush), and *Primula parryi* (Parry primrose). Several species can co-dominate in the moss layer, most often *Philonotis tomentella* (philonotis moss) and *Drepanocladus exannulatus* (warnstorfia moss).

This association is similar to the *Cardamine cordifolia-Mertensia cilliata-Senecio triangularis* association. It may occur in patches adjacent to that association and may include small amounts of these species. It may be considered a variation of that type, but can be distinguished by the high cover (or dominance) of *Saxifraga odontoloma* (brook saxifrage).

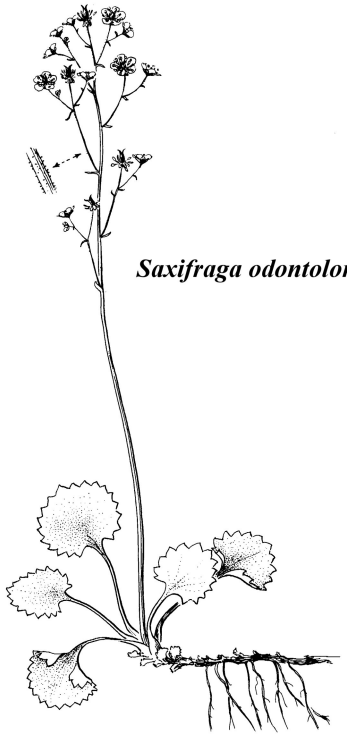
Ecological Processes

Saxifraga odontoloma (brook saxifrage) grows in widely varying light conditions and may occur along small streams in forest openings or may occur in dense forest. It may not bloom, however, when growing in deep shade. This association is unstable due to its frequency on the edges of small streams. Changing hydrologic conditions may influence the composition and structure of the association.

Saxifraga odontoloma (brook saxifrage) is an effective streambank stabilizer when it forms dense stands. Streambank build-up is also common on low-gradient streams associated with this plant association. Residual vegetation cover acts to slow spring flows and filter sediments.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
58	(15-87%)	Saxifraga odontoloma	7

Other species with < 5% average cover present in at least 10% of plots:
Senecio triangularis (0.1-3%), Cardamine cordifolia (0.1-3%), Deschampsia caespitosa (0.1%), Epilobium anagallidifolium (0.1%), Juncus drummondii (0.1%), Primula parryi (0.1%), Carex nigricans (0.1%), Caltha leptosepala (0.1%), Stellaria umbellata (0.1%), Carex scopulorum (0.1%), Polygonum bistortoides (0.1%), Phleum alpinum (0.1%), Ligusticum tenuifolium (0.1%), Oxyria digyna (0.1%), Poa arctica (0.1%), Ranunculus eschscholtzii (0.1%).



Saxifraga odontoloma

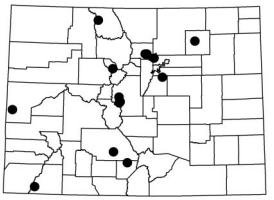
Hardstem bulrush - Softstem bulrush Herbaceous Vegetation

Schoenoplectus acutus var. *acutus - Schoenoplectus tabernaemontani*

Global rank/State rank:
G3 / S2S3

HGM subclass: D2/3, D4/5?

Colorado elevation range:
4,300-10,000 ft (1,300-3,050 m)



General Description

The *Schoenoplectus acutus* var. *acutus-Schoenoplectus tabernaemontani* (hardstem bulrush-softstem bulrush) plant association occurs in marshes, along the margins of lakes and ponds, and in backwater areas of rivers in water up to 3 ft (1 m) deep. This association occurs in small patches, below 10,000 ft (3,050 m). It is highly threatened by development, agricultural conversion, stream flow alterations, and wetland filling activities.

The *Schoenoplectus acutus* var. *acutus-Schoenoplectus tabernaemontani* (hardstem bulrush-softstem bulrush) plant association occurs in wet swales and overflow channels with standing water. It also occurs at the edges of beaver ponds, ditches, and railroad embankments. One stand occurred on a saturated floodplain where a perched water table emerged from the surrounding bedrock. Streams are large and slightly meandering. Soils of this association are deep heavy clays and silty loams with a high organic matter content. Soils remain saturated for most of the growing season and often have an anoxic gleyed layer within 20 inches (50 cm) of the soil surface, although the water table can drop as far as 3 ft (1 m) below the surface.

Vegetation Description

This association is characterized by nearly pure stands of *Schoenoplectus acutus* var. *acutus* (=*Scirpus acutus*) (hardstem bulrush) and/or *Schoenoplectus tabernaemontani* (=*Scirpus tabernaemontani*) (softstem bulrush), with a few other wetland species that may include *Eleocharis palustris* (common spikerush), *E. rostellata* (beaked spikerush), *Mimulus guttatus* (seep monkeyflower), *Sagittaria* spp. (arrowhead), *Carex* spp. (sedge), and *Nuphar lutea* ssp. *polysepala* (Rocky Mountain pondlily).

Other emergent wetland vegetation is commonly found with this plant association, such as stands of *Typha* spp. (cattail) and other *Scirpus* or *Schoenoplectus* spp. (bulrush species). Within the riparian zone, *Populus deltoides* (cottonwood) and *Salix amygdaloides* (peachleaf willow) may be present on the floodplain. On the open prairies along small streams, adjacent riparian vegetation types include stands of *Carex nebrascensis* (Nebraska sedge).

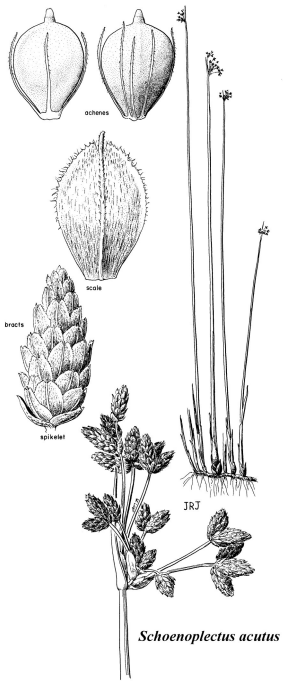
Ecological Processes

Schoenoplectus spp. (bulrush) stands are generally considered permanent wetland communities. They will remain in place unless the hydrologic regime is severely altered. Stands of *Schoenoplectus* are important to wildlife species, especially birds, for cover and nesting habitat.

Avg. Cover %	(Range)	Species Name	# Plots (N=29)
77	(5-100%)	Schoenoplectus acutus\tabernaemontani	29
12	(1-38%)	Typha latifolia	8
9	(1-30%)	Eleocharis palustris	10
8	(0.1-38%)	Rorippa palustris ssp. hispida	5
7	(1-15%)	Rorippa nasturtium-aquaticum	3
6	(0.1-15%)	Lemna minor	4
5	(0.1-15%)	Epilobium ciliatum ssp. glandulosum	7

Other species with < 5% average cover present in at least 10% of plots:

Hippuris vulgaris (1-5%), Mentha arvensis (1%), Ranunculus cymbalaria (1%).



Schoenoplectus acutus

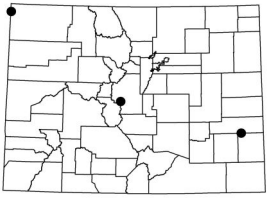
Cosmopolitan bulrush Herbaceous Vegetation

Schoenoplectus maritimus (=Bolboschoenus maritimus)

Global rank/State rank:
G4 / S2

HGM subclass: F1

Colorado elevation range:
3,800-8,950 ft (1,150-2,700 m)



General Description

This wetland plant association often occurs in standing water. The vegetation is characterized by a sparse cover of *Schoenoplectus maritimus* (cosmopolitan bulrush), few associated species and mostly open water. Livestock grazing is limited in this association due to the wet conditions.

This plant association occurs in wet swales and along narrow channels, spring-fed creeks, and back-water eddies of larger rivers.

Vegetation Description

Schoenoplectus maritimus dominates this sparsely vegetated wetland with 15-60% cover. Associated species can include *Salix exigua* (sandbar willow) and *Muhlenbergia asperifolia* (alkali muhly).

Adjacent riparian areas may support *Juncus balticus* var. *montanus* (mountain rush) wetlands, *Salix exigua* (sandbar willow) shrublands, and *Populus deltoides* (cottonwood) forests

Ecological Processes

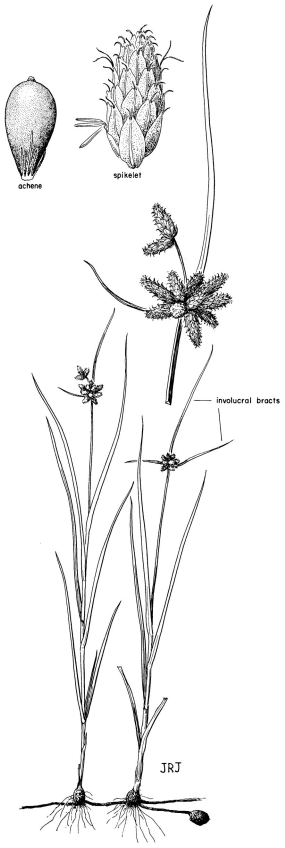
Schoenoplectus maritimus (cosmopolitan bulrush) is an early colonizer and is able to persist under wet conditions. The wet conditions limit most forms of disturbance to this plant association.

Schoenoplectus maritimus helps filter sediments to build stream banks. This species is a prolific seed producer. Its rhizomes spread quickly into exposed areas and colonize mudflats and drawdown areas.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
32	(14-60%)	Schoenoplectus maritimus	3
25	—	Melilotus officinalis	1
20	—	Salix exigua	1
20	—	Argentina anserina	1
6	(1-10%)	Muhlenbergia asperifolia	2
5	—	Puccinellia nuttalliana	1
5	—	Hordeum jubatum ssp. jubatum	1
5	—	Equisetum arvense	1

Other species with < 5% average cover present in at least 10% of plots:

Suaeda calceoliformis (3%).



Schoenoplectus maritimus

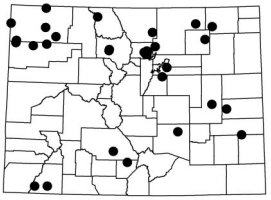
Common threesquare Herbaceous Vegetation

Schoenoplectus pungens

Global rank/State rank:
G3G4 / S3

HGM subclass: D2/3

Colorado elevation range:
3,800-7,800 ft (1,050-2,400 m)



General Description

The *Schoenoplectus pungens (=Scirpus pungens)* (threesquare bulrush) plant association forms small low stature (1-3 ft, 0.3-1 m) marshes in low-lying swales, abandoned channels, and overflow channels where soils remain saturated. This association is characterized by pure stands of *Schoenoplectus pungens,* occasionally associated with a few other graminoid species.

This association also occurs on silt and sand bars within the active channel where the water velocity is lowest. Soils from the Colorado River Basin are black, anoxic, organic soils and gleyed, clay-loam, alkaline soils.

Vegetation Description

This plant association can be pure stands of *Schoenoplectus pungens* (threesquare bulrush). Some stands include other graminoids such as *Juncus balticus* var. *montanus* (mountain rush), *Hordeum jubatum* (foxtail barley), *Phragmites australis* (common reed), *Spartina gracilis* (alkali cordgrass), *Muhlenbergia asperifolia* (alkali muhly), and *Eleocharis palustris* (common spikerush). On alkaline soils, *Distichlis spicata* (inland saltgrass) is a common associate.

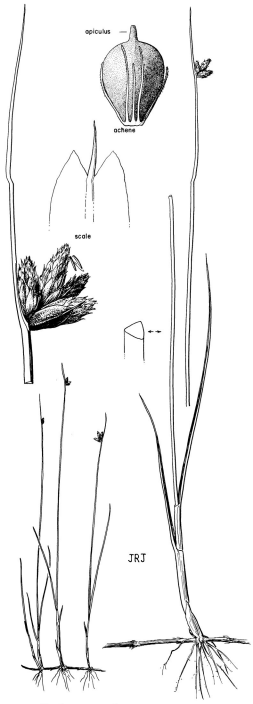
Ecological Processes

Schoenoplectus pungens (threesquare bulrush) is an early colonizer and is adapted to saturated conditions on streamsides, sandy shores, marshes, and reservoir margins. Because of the wet soil conditions and aggressive growth of *Schoenoplectus pungens*, most other species are precluded from the sites. Disturbance can cause the establishment of increaser species such as *Juncus balticus* var. *montanus* (mountain rush) and *Hordeum jubatum* (foxtail barley). Lowering the water table may dry the

site and result in decreased cover of *Schoenoplectus pungens*. An increase in salinity may increase alkaline tolerant species.

Avg. Cover %	(Range)	Species Name	# Plots (N=94)
59	(6.5-100%)	Schoenoplectus pungens	94
19	(1-62%)	Agrostis gigantea	26
19	(0.1-90%)	Eleocharis palustris	34
14	(1-38%)	Juncus balticus var. montanus	21
9	(0.1-80%)	Mentha arvensis	17
5	(0.1-37%)	Hordeum jubatum ssp. jubatum	31
5	(1-15%)	Polygonum douglasii	9

Other species with < 5% average cover present in at least 10% of plots:
Schoenoplectus acutus\tabernaemontani (0.1-10%), Lycopus americanus (0.1-15%), Cirsium arvense (0.1-25%), Epilobium ciliatum ssp. glandulosum (0.1-15%), Muhlenbergia asperifolia (0.1-10%), Typha latifolia (1-5%).



Schoenoplectus pungens

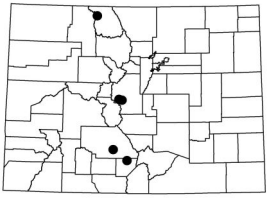
Nevada bulrush Herbaceous Vegetation

Scirpus nevadensis (=Amphiscirpus nevadensis)

Global rank/State rank:
G4 / S2

HGM subclass: F1

Colorado elevation range:
7,500-9,000 ft (2,280-2,740 m)



General Description

Scirpus nevadensis (=Amphiscirpus nevadensis, Nevada bulrush*)* is an association of moist to seasonally flooded alkaline flats in desert and semidesert regions in Canada and northwestern United States. In Colorado, this association occurs in intermountain valleys and parks, typically with low rainfall and alkaline water sources. Although these areas may not look like typical deserts, they can qualify as desert or semidesert based on annual precipitation amounts of about 10 inches. *Scirpus nevadensis* is superficially similar to *Schoenoplectus pungens* (threesquare bulrush), but the arrangement of the spikes and the achenes of each are distinctive.

Vegetation Description

In North and South Park sites, the *Scirpus nevadensis* association tends to be monotypic (3-40% cover) with sparse coverage by other species such as *Hordeum jubatum* (foxtail barley)*, Distichlis spicata* (inland saltgrass)*, Puccinellia nuttalliana (=Puccinellia airoides)* (Nuttall alkaligrass), and *Glaux maritima* (sea milkwort).

Species diversity in the San Luis Valley sites is higher. *Scirpus nevadensis* provides 10 to 80% cover; other species include *Juncus balticus* var. *montanus* (mountain rush), *Spartina gracilis* (alkali cordgrass), *Schoenoplectus pungens* (threesquare bulrush) and *Hordeum jubatum* (foxtail barley). Forb cover is minimal.

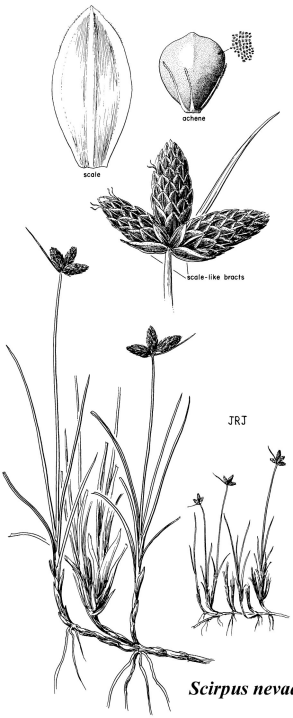
Ecological Processes

The *Scirpus nevadensis* association always occurs on saline soils and can tolerate a range of moisture conditions. Stands in the San Luis Valley tend to occur on drier sites than those in South Park. In the San Luis Valley this association is typically found above the zone of *Juncus balticus* var. *montanus* (mountain rush) where soils are periodically saturated, but flooding is rare; in South Park stands have seasonal

standing water. Soils in South Park stands have extremely high salinity and low species diversity.

Avg. Cover %	(Range)	Species Name	# Plots (N=15)
21	(3-40%)	Scirpus nevadensis	15
9	(2-15%)	Spartina gracilis	6
6	(2-10%)	Juncus balticus var. montanus	5
6	(0.1-25%)	Triglochin maritimum	5
5	(2-10%)	Hordeum jubatum ssp. jubatum	3

Other species with < 5% average cover present in at least 10% of plots:
Ranunculus cymbalaria (0.1-7%), Distichlis spicata (2.5-5%), Glaux maritima (0.1-10%), Schoenoplectus pungens (2-3%), Pyrrocoma lanceolata (1-2%), Cleome multicaulis (1-2%), Puccinellia nuttalliana (0.1-3%), Almutaster pauciflorus (1%).



Scirpus nevadensis

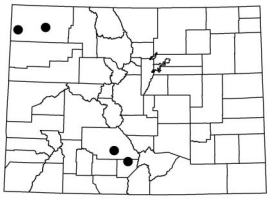
Alkali cordgrass Herbaceous Vegetation

Spartina gracilis

Global rank/State rank:
GU / S2

HGM subclass: F1

Colorado elevation range:
5,800-7,650 ft (1,760-2,330 m)



General Description

The *Spartina gracilis* (alkali cordgrass) plant association is a wetland meadow with sparse to thick cover of grasses and grass-like plants.

This association occurs on moist sandy overflow channels and backwater areas of large rivers, and poorly drained swales. One plot occurred adjacent to a strongly meandering, low gradient channel. The soils are fine-textured silt-loam and clay loam.

Vegetation Description

Spartina gracilis (alkali cordgrass) is clearly the dominant species, although cover can be sparse (15-60%). Other graminoids that may be present include *Distichlis spicata* (inland saltgrass), *Triglochin maritimum* (seaside arrowgrass), *Schoenoplectus pungens* (common threesquare), *Elymus repens* (quackgrass) and *Agrostis gigantea* (redtop). Forbs species tend to be weedy and present in lesser amounts.

Ecological Processes

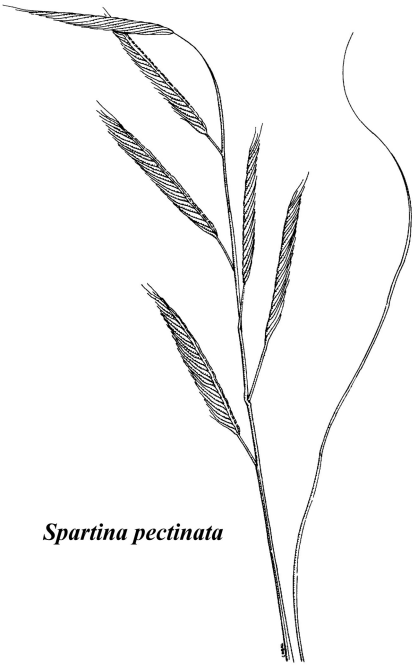
The *Spartina gracilis* (alkali cordgrass) plant association tolerates alkaline soils to the exclusion of other species. It also tolerates burial by flood deposition and readily re-sprouts, pushing up sharp shoots. If soil alkalinity drops, other species that are less tolerant of alkaline conditions will increase in abundance.

Avg. Cover %	(Range)	Species Name	# Plots (N=8)
29	(15-60%)	Spartina gracilis	8
20	—	Elymus repens	1
14	(10-15%)	Distichlis spicata	4
13	(5-20%)	Schoenoplectus pungens	2
7	—	Carex praegracilis	1
5	—	Melilotus officinalis	1
5	—	Pascopyrum smithii	1
5	—	Sarcobatus vermiculatus	1
5	—	Scirpus nevadensis	1

Other species with < 5% average cover present in at least 10% of plots:
Suaeda calceoliformis (0.1-7%), Juncus balticus var. montanus (3%), Hordeum jubatum ssp. jubatum (1-3%), Symphyotrichum spathulatum (2%), Cleome multicaulis (1-2%), Crepis runcinata ssp. runcinata (0.1-2%), Triglochin maritimum (1%), Almutaster pauciflorus (1%), Plantago eriopoda (1%), Taraxacum officinale (1%), Lepidium alyssoides (1%), Pyrrocoma lanceolata (0.1-1%), Agrostis gigantea (0.1-1%), Panicum capillare (0.1%), Clematis ligusticifolia (0.1%), Elymus trachycaulus ssp. trachycaulus (0.1%), Euphorbia chamaesula (0.1%), Glycyrrhiza lepidota (0.1%), Conyza canadensis (0.1%), Xanthium strumarium (0.1%), Plantago lanceolata (0.1%), Verbena bracteata (0.1%), Vulpia octoflora (0.1%).

Prairie cordgrass Western Herbaceous Vegetation

Spartina pectinata

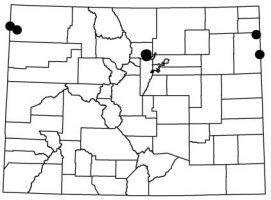


Spartina pectinata

Global rank/State rank:
G3? / S3

HGM subclass: R5

Colorado elevation range:
3,370-5,800 ft (1,030-1,770 m)



General Description

This is a tall-grass meadow consisting almost entirely of *Spartina pectinata* (prairie cordgrass). It occurs in small swales on the plains as well as on floodplains of larger rivers. Stands of this grass have been included in other tall-grass prairie plant associations. On large river floodplains, this type occurs as distinct patches and is distinguished from adjacent riparian types by micro-topography and degree of soil saturation. Historically, large stands of *Spartina pectinata* (prairie cordgrass) occurred on mud flats of the Missouri River. This association once formed large wet meadows on the Platte River. It is now restricted to smaller tributaries.

Spartina pectinata (prairie cordgrass) stands occur in low swales and overflow areas of large river floodplains and on moist swales on the plains. Stands may be found in shallow overflow areas between two slightly raised ridges with linear bands of *Populus deltoides* (cottonwood), on large meandering rivers with a mostly sand bed. The soil is a fine loam to silty clay with mottles abundant below a depth of 5 inches (12 cm).

Vegetation Description

Spartina pectinata (prairie cordgrass) can co-dominate with *Panicum virgatum* (switchgrass). Other tall graminoids that may be present include *Andropogon gerardii*

(big bluestem), *Carex praegracilis* (clustered field sedge) and *Schoenoplectus pungens* (common threesquare). A non-native weed, *Cirsium arvense* (Canada thistle), is abundant in some stands, indicating chronic disturbance.

Ecological Processes

Spartina pectinata (prairie cordgrass) is tolerant of sediment deposition and has sharp-pointed shoots that push their way upward through a foot (0.3 m) of new soil. On the South Platte River floodplain it appears to be an early colonizer of the fresh sediments laid down by the 1995 flood.

Avg. Cover %	(Range)	Species Name	# Plots (N=14)
75	(30-100%)	Spartina pectinata	14
15	(0.1-30%)	Panicum virgatum	3
7	(0.1-20%)	Cirsium arvense	3
5	(5-5%)	Schoenoplectus pungens	2

Other species with < 5% average cover present in at least 10% of plots:
Glycyrrhiza lepidota (2-2.5%), Agrostis stolonifera (0.1-2.5%), Verbena hastata (0.1-2%), Equisetum hyemale var. affine (0.1-2.5%), Elymus canadensis (0.1%), Equisetum laevigatum (0.1%), Apocynum cannabinum (0.1%), Distichlis spicata (0.1%), Carex emoryi (0.1%), Medicago lupulina (0.1%).

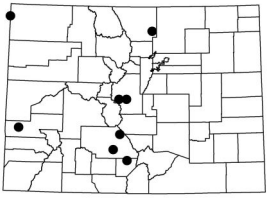
Alkali sacaton Southern Plains Herbaceous Vegetation

Sporobolus airoides

Global rank/State rank:
G3Q / S3

HGM subclass: F1, R3/4, R5

Colorado elevation range:
4,900-9,000 ft (1,900-3,550 m)



General Description

This plant association occurs on alkaline or saline soils in floodplain depressions and on sandy stream banks. *Sporobolus airoides* (alkali sacaton) dominates the vegetative cover with a few woody species also present. The association occurs in small but frequent patches on the Western Slope.

This plant association occurs in floodplain depressions and on sandy stream banks. Soils are alkaline (basic) or saline (contain a high concentration of soluble salts).

Vegetation Description

This plant association is characterized by a dense, narrow stand of *Sporobolus airoides* (alkali sacaton) lining and overhanging the stream bank or by a monotypic stand in playa lakes. Other grass species that may be present include *Panicum obtusum* (vine mesquite), *Bouteloua gracilis* (blue grama), *Schizachyrium scoparium* (little bluestem), and *Sporobolus cryptandrus* (sand dropseed). Woody species which can be present along streams and rivers, include *Populus angustifolia* (narrowleaf cottonwood), *Fraxinus anomala* (singleleaf ash), *Rhus trilobata* (skunkbush sumac), *Amelanchier alnifolia* (Saskatoon serviceberry), and *Salix exigua* (sandbar willow). Forb cover is minimal.

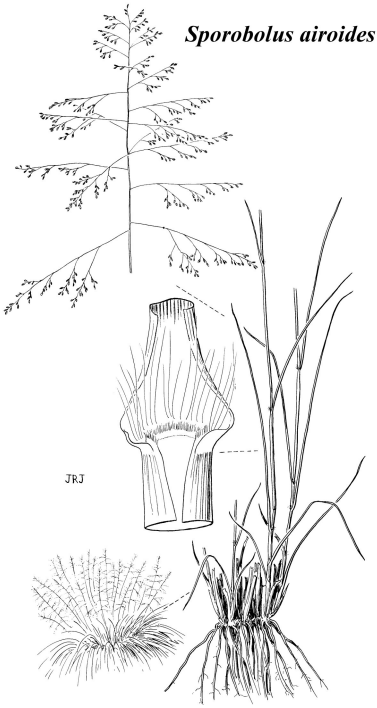
Ecological Processes

This is an early-seral community that occurs on floodplains and depressions with moderately alkaline or saline soils. Stands may be flooded infrequently, or have high water tables. The intermittent flood regime affects soil moisture and salinity which can alter species composition. Sudden increases in salinity will result in a decrease in cover of *Sporobolus airoides* (alkali sacaton). With no change in salinity, this plant association will form hummocks that accumulate sand. Gradually the sites will decrease in salinity and moisture and invasion by other grasses will follow.

Sporobolus airoides (alkali sacaton) will decrease in abundance with increased soil salinity.

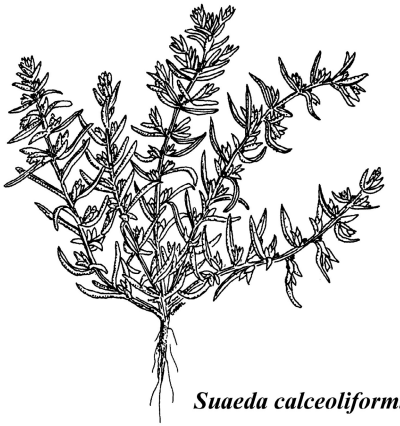
Avg. Cover %	(Range)	Species Name	# Plots (N=10)
41	(10-100%)	Sporobolus airoides	10
13	(10-15%)	Distichlis spicata	3
7	(3-10%)	Spartina gracilis	2

Other species with < 5% average cover present in at least 10% of plots:
Juncus balticus var. montanus (1-10%), Suaeda calceoliformis (1-7%), Sarcobatus vermiculatus (1-5%), Triglochin maritimum (3-3%), Iva axillaris (0.1-6%), Lepidium alyssoides (2-3%), Pascopyrum smithii (0.1-5%), Gutierrezia sarothrae (1-2%), Plantago eriopoda (1%), Equisetum hyemale var. affine (0.1-1%).



Pursh seepweed Herbaceous Vegetation

Suaeda calceoliformis

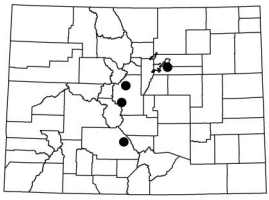


Suaeda calceoliformis

Global rank/State rank:
GU / S2

HGM subclass: F1

Colorado elevation range:
5,600-9,400 ft (1,700-2,870 m)



General Description

This plant association has been described from seasonally flooded, alkaline or saline mud flats near Antero Reservoir in South Park, the San Luis Valley, and Arapahoe County. In Montana, the association has been described as also occurring in seeps, basins, swales, and on pond and lake margins. The association is characterized by dominance of the annual forb *Suaeda calceoliformis* (Pursh seepweed) and bare soil often covered with white salt crusts. Other species may occur, but the seasonally deep water and the high salinity limit the species that can occur.

This plant association occurs in nearly level, seasonally flooded sites. Soils are generally poorly drained, ranging from fine clay soils to silt loams. The association tolerates highly alkaline and saline conditions.

Vegetation Description

Suaeda calceoliformis (Pursh seepweed) may occur as a near monoculture or with other species. *Suaeda calceoliformis* cover values range from 25 to 70%. Other species that may be present include *Puccinellia airoides* (Nuttall alkaligrass), *Hordeum jubatum* (foxtail barley), *Triglochin maritima* (seaside arrowgrass), and *Salicornia rubra* (red swampfire). The rare plant, *Thellungiella salsuginea* (salt-lick mustard) may be associated with these sites.

Ecological Processes

Suaeda calceoliformis (Pursh seepweed) is an annual species and may be much more abundant in some years than in others, depending mainly on moisture conditions. Associations occupying these sites may change as salinity and alkalinity and hydrologic regime change.

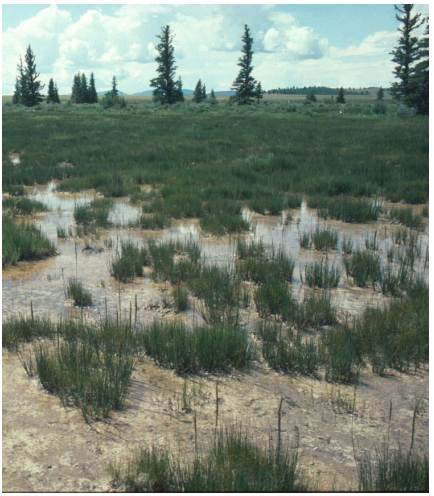
Avg. Cover %	(Range)	Species Name	# Plots (N=4)
54	(25-70%)	Suaeda calceoliformis	4
15	(10-20%)	Salicornia rubra	2
10	—	Triglochin maritimum	1
6	(1-10%)	Puccinellia nuttalliana	2
5	—	Hordeum jubatum ssp. jubatum	1

Other species with < 5% average cover present in at least 10% of plots:

Schoenoplectus pungens (3%).

Seaside arrowgrass - Marsh arrowgrass Herbaceous Vegetation

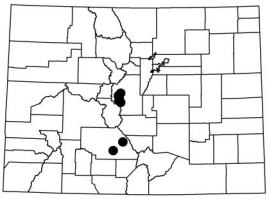
Triglochin maritimum - Triglochin palustre



Global rank/State rank:
GU / S3

HGM subclass: F1, S1/2

Colorado elevation range:
7,645-9,400 ft (2,330-2,870 m)



General Description

The *Triglochin maritimum-Triglochin palustre* (seaside arrowgrass-marsh arrowgrass) association occurs at calcareous springs in extreme rich fens and has been documented from high-elevation intermountain parks in Colorado. These habitats are flooded throughout the growing season in most years.

Soils are poorly drained, deep, saline and alkaline, often derived from calcareous clays or limestone. Soils remain saturated even if the water table drops below the surface during periods of drought. This saturation permits the development of organic peat.

Vegetation Description

This association is characterized by a sparse to moderately dense herbaceous layer dominated by rhizomatous perennial graminoids. Generally, vegetation height, cover, and species diversity tend to vary inversely with salinity.

In general, vegetation is dominated by *Triglochin maritimum*, with cover of 5-70%. *Triglochin palustre* often co-occurs or substitutes for *T. maritimum* with cover of 1-60%. *Schoenoplectus maritimus* (cosmopolitan bulrush) or *Eleocharis quinqueflora* (fewflower spikerush) may also occur with greater than 10% cover.

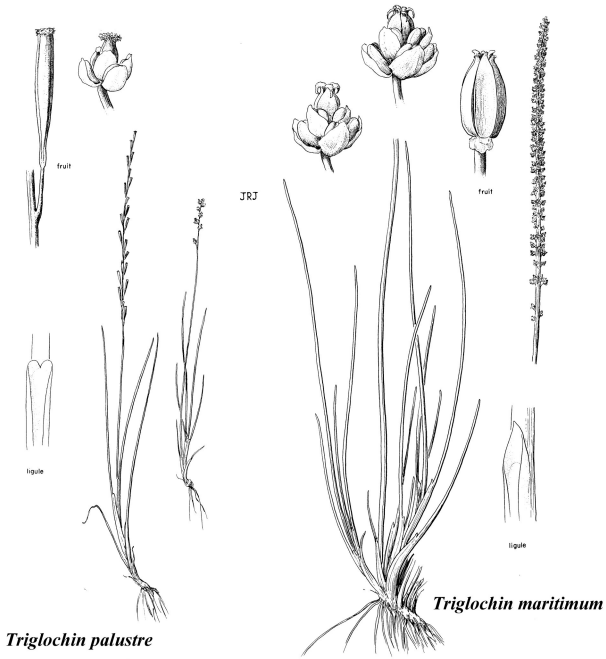
Other species which may occur with less than 5% cover include *Puccinellia nuttalliana* (Nuttall alkaligrass), *Pedicularis groenlandica* (elephanthead lousewort), *Ranunculus cymbalaria* (alkali buttercup), *Schoenoplectus acutus* var. *acutus/S. tabernaemontani* (softstem/hardstem bulrush), *Salicornia rubra* (red swampfire) and *Salix candida* (hoary willow).

Ecological Processes

Cover and species composition is primarily determined by soil salinity, which in turn is dependent on the amount and timing of precipitation and flooding. Flooding saturates the soil and dilutes growth-inhibiting salt concentrations, allowing the growth of less salt tolerant species. Conversely, as soils dry, salts are concentrated and precipitate on the soil surface. This process may result in the stratification of species abundance by salt tolerance in some sites. Hummocks formed by soil accumulation may also support less salt-tolerant species.

Avg. Cover %	(Range)	Species Name	# Plots (N=24)
30	(2-60%)	Triglochin palustre	12
28	(5-70%)	Triglochin maritimum	18
13	(5-20%)	Eleocharis quinqueflora	2
10	(10-10%)	Campylium stellatum	2
7	(1-20%)	Ranunculus cymbalaria	3
6	(2-10%)	Argentina anserina	2
6	(2-10%)	Eleocharis palustris	2

Other species with < 5% average cover present in at least 10% of plots:
Carex aquatilis (1-10%), Hordeum jubatum ssp. jubatum (2%), Schoenoplectus acutus\tabernaemontani (1-2%), Puccinellia nuttalliana (1-2%), Pedicularis groenlandica (1%), Deschampsia caespitosa (1%).



Triglochin palustre

Triglochin maritimum

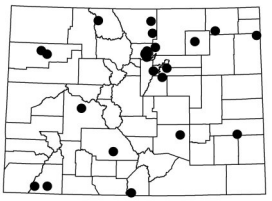
Cattail Herbaceous Vegetation

Typha angustifolia - Typha latifolia - (Typha domingensis)

Global rank/State rank:
G5 / S4

HGM subclass: D2/3, D4/5?

Colorado elevation range:
3,900-8,900 ft (1,530-3,500 m)



General Description

The *Typha angustifolia-Typha latifolia-(Typha domingensis)* (cattail) plant association is a commonly seen tall, dark green community growing in 2-4 feet of standing water. It is found in the shallow edges of ponds and lakes, and can occur in backwaters of larger river floodplains. This association is a common wetland community occurring throughout the western and midwestern states.

This plant association occurs in standing water at least 1 foot (0.3 m) in depth, although it will persist during drier periods. It is found along the margins of beaver ponds, overflow channels, backwater sloughs, floodplain swales, drainage ditches, behind railroad embankments, and any place where water collects and remains for two-thirds of the growing season. This association can be found on nearly every type of stream channel, but typically along meandering, low gradient streams. Soils are deep, heavy silty clay loam and organic mucks. Some profiles have 10-30% coarse material and are fairly well drained, others remain anoxic throughout most of the year.

Vegetation Description

Typha angustifolia (narrowleaf cattail) and/or *Typha latifolia* (broadleaf cattail) forms near-monotypic (70-85%) stands between 3 and 6 feet tall (1-2 m). *Typha domingensis* (southern cattail) is much less common than the other two species. It may or may not be present and is restricted to Western Slope stands. *Schoenoplectus acutus* and *Schoenoplectus tabernaemontani* are common associates. Other species which may be present include *Potamogeton* (pondweed) spp., *Spartina pectinata* (prairie cordgrass), and *Veronica* (speedwell) spp.

Ecological Processes

Typha angustifolia (narrowleaf cattail) occupies inundated and disturbed grounds and can tolerate deeper water and higher alkalinity levels than *T. latifolia* (broadleaf cattail). *Typha* species are prolific seed producers, spreading rapidly to become the

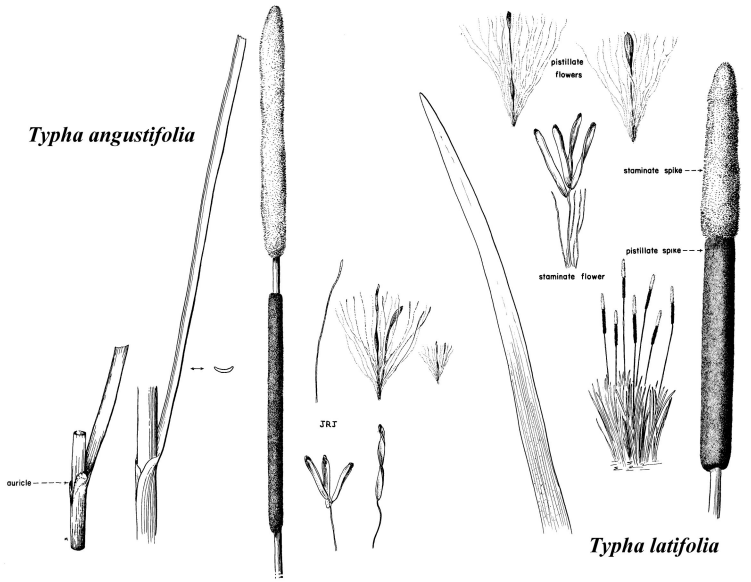
early colonizers of wet mineral soil, and will persist under wet conditions. The roots and lower stems are well adapted to prolonged submergence but germination and establishment require periods of drawdown to expose bare soil.

This association may be declining in Colorado. It is threatened by development, wetland draining, and stream flow alterations. However it is also a natural invader to newly created wetlands, and will appear in newly ponded areas on its own.

Avg. Cover %	(Range)	Species Name	# Plots (N=107)
75	(0.1-100%)	Typha latifolia	97
55	(2 -99%)	Typha angustifolia	18
36	(0.1-85%)	Lemna minor	23
17	(1-88%)	Eleocharis palustris	22
9	(0.1-37%)	Schoenoplectus acutus\tabernaemontani	36
7	(0.1-62%)	Polygonum lapathifolium	12
6	(0.1-37%)	Epilobium ciliatum ssp. glandulosum	27
5	(0.1-20%)	Schoenoplectus pungens	12

Other species with < 5% average cover present in at least 10% of plots:

Scirpus pallidus (0.1-10%).



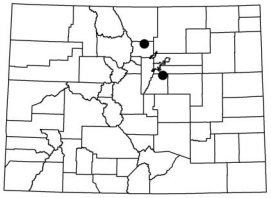
Water speedwell - (Toad rush) Herbaceous Vegetation

Veronica anagallis-aquatica - (Juncus bufonius)

Global rank/State rank:
GU / S2

HGM subclass: D4/5

Colorado elevation range:
6,000-6,350 ft (1,830-1,940m)



General Description

The *Veronica anagallis-aquatica-(Juncus bufonius)* (water speedwell-toad rush) association is common along creeks in the Great Plains, where it typically occurs on stream margins in slow moving shallow water. On Cherry Creek above Cherry Creek Reservoir, the combination of these two species is usually found on seasonally disturbed sand bars. The biennial/perennial *Veronica anagallis-aquatica* is native to Eurasia, but is now widely naturalized throughout North and South America. The associated species *Juncus bufonius* (toad rush) is a common, widely distributed native annual.

This plant association occurs on low to medium gradient streams where seasonal disturbance from flooding is common. It is normally found on flooded alluvial sands and gravels. Soil development is minimal.

Vegetation Description

This association is characterized by the presence of *Veronica anagallis-aquatica* (water speedwell), which is present with cover ranging from 0.1 to 70%. *Juncus bufonius* (toad rush) is present in most, but not all plots, with cover values ranging from 15 to 63%. Although one of these two species is usually dominant, other disturbance tolerant species such as *Agrostis gigantea* (redtop), *Eragrostis pilosa* (Indian lovegrass) and *Echinochloa crus-galli* (barnyard grass) may be present with equal or greater cover.

Total vegetative cover varies widely from extremely sparse to dense, but averages about 70%. Stands may include occasional stems of *Populus deltoides* (cottonwood) or *Salix amygdaloides* (peachleaf willow), but normally the associated species are strictly herbaceous. The most common associated species include *Echinochloa crus-galli* (barnyard grass), *Polygonum lapathifolium* (curlytop knotweed), *Epilobium ciliatum* ssp. *glandulosum* (fringed willowherb), *Alopecurus aequalis* (shortawn foxtail), *Polygonum douglasii* (Douglas' knotweed), *Eleocharis palustris* (common

spikerush), *Conyza canadensis* (Canadian horseweed), *Bidens cernua* (nodding beggartick) and *Typha latifolia* (cattail).

Ecological Processes

The *Veronica anagallis-aquatica-(Juncus bufonius)* (water speedwell-toad rush) association is an early seral vegetation type and is unstable, due to its reliance on seasonal flood events which prohibit the growth of longer-lived species.

On Cherry Creek above the reservoir, these two species are the primary colonizers of bare sand bars in the braided stream channel, where, as nitrophilous species, they are able to grow in the enriched water.

Avg. Cover %	(Range)	Species Name	# Plots (N=12)
32	(15-63%)	Juncus bufonius	7
26	(15-37%)	Eragrostis pilosa	2
23	(0.1-70%)	Veronica anagallis-aquatica	12
11	(0.1-25%)	Alopecurus aequalis	4
9	(2-15%)	Hordeum jubatum ssp. jubatum	2
8	(0.1-15%)	Populus deltoides	2
7	(2-15%)	Eleocharis palustris	3
6	(0.1-15%)	Typha latifolia	3
5	(0.1-15%)	Echinochloa crus-galli	9
5	(0.1-15%)	Epilobium ciliatum ssp. glandulosum	5

Other species with < 5% average cover present in at least 10% of plots:
Polygonum lapathifolium (2%), Polygonum douglasii (2%), Xanthium strumarium (2%), Juncus nodosus (2%), Schoenoplectus pungens (2%), Juncus interior (2%), Conyza canadensis (0.1-2%), Bidens cernua (0.1-2%), Polygonum persicaria (0.1-2%).

Veronica anagallis-aquatica

Juncus bufonius

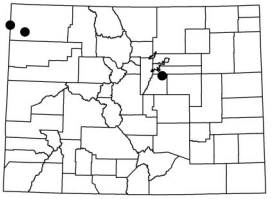
Rough cocklebur Herbaceous Vegetation

Xanthium strumarium

Global rank/State rank:
Not Applicable

HGM subclass: D4/5

Colorado elevation range:
5,700-6,000 ft (1,740-1,830 m)



General Description

Xanthium strumarium (rough cocklebur) is a broadleaved, taprooted, annual forb which produces bur-like fruits covered with hooked prickles. It is widespread across most of the contiguous United States, southern Canada, and Mexico. *Xanthium strumarium* (rough cocklebur) occurs primarily in disturbed, open habitats, and as a riparian association in Colorado is found primarily in river floodplains or reservoir and pond drawdown zones.

Soil conditions range from moist clay to dry sand. *Xanthium strumarium* is tolerant of flooding at all growth stages and favors compact sandy soil that is slightly moist below the soil surface and that contains a small amount of organic matter.

Vegetation Description

This association is characterized by the presence of *Xanthium strumarium* (rough cocklebur) varying from extremely sparse to dense coverage (0.1-98%). In cases where the coverage of *Xanthium strumarium* (rough cocklebur) is sparse, it is likely to be the only species present. Associated species are primarily other disturbance or open ground specialists, and include *Polygonum arenastrum* (oval-leaf knotweed), *Hordeum jubatum* (foxtail barley), *Echinochloa crus-galli* (barnyard grass), *Helianthus annuus* (annual sunflower), *Polygonum lapathifolium* (curlytop knotweed), *Rumex salicifolius* var. *mexicanus* (Mexican dock), *Amaranthus albus* (prostrate pigweed), *Verbena bracteata* (bigbract verbena) and *Chamaesyce glyptosperma* (ribseed sandmat).

Ecological Processes

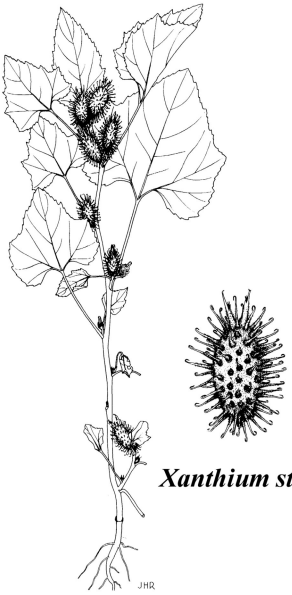
Because *Xanthium strumarium* (rough cocklebur) is a pioneer species requring open ground, this association will only persist under situations where disturbance regimes are maintained.

The bur-like fruits are dispersed as they cling to the fur of animals and the clothing of humans. In riparian habitats, fruits on the soil surface may later be dispersed by water.

Avg. Cover %	(Range)	Species Name	# Plots (N=14)
57	(0.1-98%)	Xanthium strumarium	14
33	(2.5-63%)	Amaranthus albus	2
13	(0.1-37%)	Polygonum lapathifolium	3
13	(0.1-37%)	Rumex salicifolius var. mexicanus	3
11	(2-37%)	Polygonum arenastrum	4
9	(2-15%)	Verbena bracteata	2
9	(2-15%)	Chamaesyce glyptosperma	2
7	(2-15%)	Hordeum jubatum ssp. jubatum	3
7	(2-15%)	Echinochloa crus-galli	3

Other species with < 5% average cover present in at least 10% of plots:

Helianthus annuus (0.1-2%), Alopecurus aequalis (0.1-2%).



Xanthium strumarium

LIST OF UNDESCRIBED ASSOCIATIONS

Associations incorporated into the USNVC, but not described in this guide (these associations may be described from other states or in other sources):

Artemisia tridentata spp. / *Leymus cinereus* Shrubland
Betula occidentalis / Cornus sericea Shrubland
Carex limosa Herbaceous Vegetation
Carex nebrascensis - Catabrosa aquatica Herbaceous Vegetation
Glyceria borealis Herbaceous Vegetation
Panicum obtusum - Buchloe dactyloides Herbaceous Vegetation
Pascopyrum smithii - Bouteloua gracilis Herbaceous Vegetation
Pascopyrum smithii - Eleocharis spp. Herbaceous Vegetation
Pascopyrum smithii Herbaceous Vegetation
Picea engelmannii / Caltha leptosepala Forest
Picea engelmannii / Cornus sericea Woodland
Pinus ponderosa / Alnus incana ssp. *tenuifolia* Woodland
Populus fremontii / Salix goodingii Woodland
Populus tremuloides / Calamagrostis canadensis Forest
Populus tremuloides / Salix drummondiana Forest
Pseudotsuga menziesii / Acer glabrum Forest
Quercus gambelii / Symphoricarpos oreophilus Shrubland
Salicornia rubra Herbaceous Vegetation
Salix boothii / Calamagrostis canadensis Shrubland
Salix drummondiana / Carex utriculata Shrubland
Salix planifolia / Deschampsia caespitosa Shrubland
Sarcobatus vermiculatus / Suaeda moquinii Shrubland

Associations not listed in the USNVC, needing further verification:

Acer negundo - Juniperus scopulorum/Salix exigua Woodland
Artemisia cana Shrubland
Baccharis salicina Shrubland
Bothriochloa springfieldii Herbaceous Vegetation
Calamagrostis stricta Western Herbaceous Vegetation
Carex scirpoidea Herbaceous Vegetation
Catabrosa aquatica - Mimulus ssp. Herbaceous Vegetation
Elaeagnus angustifolia Woodland
Eleocharis quinqueflora - Triglochin spp. Herbaceous Vegetation
Fraxinus anomala - Quercus gambelii Shrubland
Heterotheca villosa Herbaceous Vegetation
Hippurus vulgaris Herbaceous Vegetation
Menyanthes trifoliata Herbaceous Vegetation
Pascopyrum smithii - (Buchloe dactyloides) - Ambrosia linearis - Ratibida tagetes Playa Herbaceous Vegetation
Populus x *acuminata* Woodland
Populus angustifolia / Mesic graminoid Woodland
Salix exigua / Eleocharis palustris Shrubland
Salix exigua / Equisetum hyemale Shrubland

Salix exigua / Schoenoplectus pungens Shrubland
Salix fragilis Woodland
Salix geyeriana - Salix monticola / Carex aquatilis Shrubland
Salix geyeriana - Salix monticola / Mesic graminoid Shrubland
Scirpus pallidus Herbaceous Vegetation
Sparganium eurycarpum Herbaceous Vegetation
Sporobolus airoides - Panicum obtusum Herbaceous Vegetation
Sullivantia hapemanii var. *purpusii* Hanging Garden

APPENDIX A:
ASSOCIATIONS BY HGM SUBCLASS

FLATS 1

Distichlis spicata Herbaceous Vegetation
Glaux maritima Herbaceous Vegetation
Muhlenbergia asperifolia Herbaceous Vegetation
Puccinellia nuttalliana (=airoides) Herbaceous Vegetation
Sarcobatus vermiculatus / Barren ground Shrubland
Sarcobatus vermiculatus / *Distichlis spicata* Shrubland
Schoenoplectus maritimus (=Bolboschoenus maritimus) Herbaceous Vegetation
Scirpus nevadensis (=Amphiscirpus nevadensis) Herbaceous Vegetation
Spartina gracilis Herbaceous Vegetation
Sporobolus airoides Southern Plains Herbaceous Vegetation
Suaeda calceoliformis Herbaceous Vegetation
Triglochin maritimum - *Triglochin palustris* Herbaceous Vegetation

DEPRESSIONAL 1

Carex aquatilis - *Carex utriculata* Herbaceous Vegetation
Carex utriculata Herbaceous Vegetation

DEPRESSIONAL 2 and 3

Alopecurus aequalis Herbaceous Vegetation
Bidens cernua - *Bidens frondosa* Herbaceous Vegetation
Carex nebrascensis Herbaceous Vegetation
Carex pellita (=lanuginosa) Herbaceous Vegetation
Carex utriculata Herbaceous Vegetation
Eleocharis acicularis Herbaceous Vegetation
Eleocharis palustris Herbaceous Vegetation
Eleocharis parvula Herbaceous Vegetation
Glyceria grandis Herbaceous Vegetation
Hordeum (=Critesion) jubatum Herbaceous Vegetation
Juncus balticus var. *montanus* Herbaceous Vegetation
Leersia oryzoides Herbaceous Vegetation
Phalaris arundinacea Western Herbaceous Vegetation
Schoenoplectus acutus var. *acutus* - *Schoenoplectus tabernaemontani* Herbaceous Vegetation
Schoenoplectus pungens Herbaceous Vegetation
Typha angustifolia - *Typha latifolia* - *(Typha domingensis)* Herbaceous Vegetation

DEPRESSIONAL 4 and 5

Alopecurus aequalis Herbaceous Vegetation
Carex pellita (=lanuginosa) Herbaceous Vegetation
Echinochloa crus-galli Herbaceous Vegetation
Eleocharis acicularis Herbaceous Vegetation
Eleocharis palustris Herbaceous Vegetation
Eleocharis parvula Herbaceous Vegetation
Glyceria grandis Herbaceous Vegetation
Hordeum (=Critesion) jubatum Herbaceous Vegetation
Juncus balticus var. *montanus* Herbaceous Vegetation

Polygonum spp. - Mesic graminoid Herbaceous Vegetation
Salix exigua / Barren ground Shrubland
Veronica anagallis-aquatica - *Juncus bufonius* Herbaceous Vegetation
Xanthium strumarium Herbaceous Vegetation

SLOPE 1 and 2

Abies lasiocarpa - *Picea engelmannii / Carex aquatilis* Forest
Betula nana (=glandulosa) / Mesic forb - Mesic graminoid Shrubland
Caltha leptosepala Herbaceous Vegetation
Cardamine cordifolia - *Mertensia ciliata* - *Senecio triangularis* Herbaceous Vegetation
Carex aquatilis - *Carex utriculata* Herbaceous Vegetation
Carex aquatilis Herbaceous Vegetation
Carex capillaris - *Polygonum viviparum* Herbaceous Vegetation
Carex illota Herbaceous Vegetation
Carex microptera Herbaceous Vegetation
Carex nigricans - *Juncus drummondii* Herbaceous Vegetation
Carex saxatilis Herbaceous Vegetation
Carex scopulorum - *Caltha leptosepala* Herbaceous Vegetation
Carex simulata Herbaceous Vegetation
Carex vernacula Herbaceous Vegetation
Carex vesicaria Herbaceous Vegetation
Deschampsia caespitosa Herbaceous Vegetation
Eleocharis palustris Herbaceous Vegetation
Eleocharis quinqueflora Herbaceous Vegetation
Kalmia microphylla - *Gaultheria humifusa* Dwarf Shrubland
Kobresia myosuroides - *Thalictrum alpinum* Herbaceous Vegetation (Extreme rich fens)
Kobresia simpliciuscula - *(Trichophorum pumilum)* Herbaceous Vegetation
(Picea engelmannii)/Betula nana (=glandulosa) / Carex aquatilis / Sphagnum Iron Fen
Salix boothii / Mesic forb Shrubland
Salix brachycarpa / Carex aquatilis Shrubland
Salix brachycarpa / Mesic forb Shrubland
Salix candida - *Triglochin maritimum* Shrubland
Salix drummondiana / Calamagrostis canadensis Shrubland
Salix geyeriana / Carex aquatilis Shrubland
Salix ligulifolia (=Salix eriocephala var. *ligulifolia)* Shrubland
Salix monticola / Carex utriculata Shrubland
Salix monticola / Mesic forb Shrubland
Salix monticola / Mesic graminoid Shrubland
Salix planifolia / Calamagrostis canadensis Shrubland
Salix planifolia / Caltha leptosepala Shrubland
Salix planifolia / Carex aquatilis Shrubland
Salix planifolia / Carex utriculata Shrubland
Salix planifolia / Mesic forb Shrubland
Salix wolfii / Calamagrostis canadensis Shrubland
Salix wolfii / Carex aquatilis Shrubland
Salix wolfii / Carex utriculata Shrubland
Salix wolfii / Mesic forb Shrubland
Triglochin maritimum - *Triglochin palustris* Herbaceous Vegetation

SLOPE 3 and 4

Agrostis gigantea Herbaceous Vegetation

Alnus incana ssp. *tenuifolia* / Mesic graminoid Shrubland
Aquilegia micrantha -(Mimulus eastwoodiae) Hanging Garden
Carex aquatilis - Carex utriculata Herbaceous Vegetation
Carex nebrascensis Herbaceous Vegetation
Carex pellita (=lanuginosa) Herbaceous Vegetation
Carex praegracilis Herbaceous Vegetation
Carex saxatilis Herbaceous Vegetation
Carex utriculata Herbaceous Vegetation
Dasiphora (=Pentaphylloides) floribunda / Deschampsia caespitosa Shrubland
Dasiphora (=Pentaphylloides) floribunda / Juncus balticus var. *montanus* Shrubland
Deschampsia caespitosa Herbaceous Vegetation
Eleocharis rostellata Herbaceous Vegetation
Glaux maritima Herbaceous Vegetation
Juncus balticus var. *montanus* Herbaceous Vegetation
Salix brachycarpa / Carex aquatilis Shrubland
Salix drummondiana / Mesic forb Shrubland
Salix monticola / Mesic graminoid Shrubland

RIVERINE 1

Betula nana (=glandulosa) / Mesic forb - Mesic graminoid Shrubland
Calamagrostis canadensis Herbaceous Vegetation
Cardamine cordifolia - Mertensia ciliata - Senecio triangularis Herbaceous Vegetation
Corydalis caseana ssp. *brandegei - Mertensia ciliata* Herbaceous Vegetation
Glyceria striata - Mimulus guttatus - Epilobium lactiflorum Herbaceous Vegetation
Salix brachycarpa / Mesic forb Shrubland
Salix planifolia / Calamagrostis canadensis Shrubland
Salix planifolia / Caltha leptosepala Shrubland
Salix wolfii / Calamagrostis canadensis Shrubland
Salix wolfii / Carex aquatilis Shrubland
Salix wolfii / Carex utriculata Shrubland
Salix wolfii / Mesic forb Shrubland
Saxifraga odontoloma Herbaceous Vegetation

RIVERINE 2

Abies lasiocarpa - Picea engelmannii - Populus angustifolia / (Lonicera involucrata) Forest
Abies lasiocarpa - Picea engelmannii / Alnus incana ssp. *tenuifolia* Forest
Abies lasiocarpa - Picea engelmannii / Calamagrostis canadensis Forest
Abies lasiocarpa - Picea engelmannii / Carex aquatilis Forest
Abies lasiocarpa - Picea engelmannii / Equisetum arvense Forest
Abies lasiocarpa - Picea engelmannii / Mertensia ciliata Forest
Abies lasiocarpa - Picea engelmannii / Ribes spp. Forest
Abies lasiocarpa - Picea engelmannii / Salix drummondiana Forest
Alnus incana ssp. *tenuifolia* / Mesic forb Shrubland
Alnus incana ssp. *tenuifolia* / Mesic graminoid Shrubland
Alnus incana ssp. *tenuifolia - Salix drummondiana* Shrubland
Betula nana (=glandulosa) / Mesic forb - Mesic graminoid Shrubland
Calamagrostis canadensis Herbaceous Vegetation
Cardamine cordifolia - Mertensia ciliata - Senecio triangularis Herbaceous Vegetation
Carex utriculata Herbaceous Vegetation
Corydalis caseana ssp. *brandegei-Mertensia ciliata* Herbaceous Vegetation
Crataegus rivularis Shrubland

Picea pungens / Alnus incana ssp. *tenuifolia* Woodland
Picea pungens / Betula occidentalis Woodland
Populus angustifolia - Picea pungens / Alnus incana ssp. *tenuifolia* Woodland
Populus balsamifera Forest
Populus tremuloides / Acer glabrum Forest
Populus tremuloides / Tall forb Forest
Salix bebbiana Shrubland
Salix boothii / Carex utriculata Shrubland
Salix boothii / Mesic forb Shrubland
Salix boothii / Mesic graminoid Shrubland
Salix brachycarpa / Mesic forb Shrubland
Salix drummondiana / Calamagrostis canadensis Shrubland
Salix drummondiana / Carex aquatilis Shrubland
Salix drummondiana / Mesic forb Shrubland
Salix geyeriana - Salix monticola / Calamagrostis canadensis Shrubland
Salix geyeriana - Salix monticola / Mesic forb Shrubland
Salix geyeriana / Calamagrostis canadensis Shrubland
Salix geyeriana / Carex aquatilis Shrubland
Salix geyeriana / Carex utriculata Shrubland
Salix geyeriana / Mesic forb Shrubland
Salix ligulifolia (=Salix eriocephala var. *ligulifolia)* Shrubland
*Salix lucida (*ssp. *caudata* or ssp. *lasiandra)* Shrubland
Salix monticola / Calamagrostis canadensis Shrubland
Salix monticola / Carex aquatilis Shrubland
Salix monticola / Carex utriculata Shrubland
Salix monticola /Equisetum arvense Shrubland
Salix monticola / Mesic forb Shrubland
Salix monticola / Mesic graminoid Shrubland
Salix planifolia / Mesic forb Shrubland
Saxifraga odontoloma Herbaceous Vegetation

RIVERINE 3 and 4

Abies concolor - (Picea pungens) - Populus angustifolia / Acer glabrum Forest
Abies lasiocarpa - Picea engelmannii / Alnus incana ssp. *tenuifolia* Forest
Abies lasiocarpa - Picea engelmannii / Equisetum arvense Forest
Abies lasiocarpa - Picea engelmannii / Mertensia ciliata Forest
Abies lasiocarpa - Picea engelmannii / Salix drummondiana Forest
Abies lasiocarpa - Picea engelmannii - Populus angustifolia / (Lonicera involucrata) Forest
Acer negundo - Populus angustifolia / Celtis laevigata var. *reticulata* Forest
Acer negundo - Populus angustifolia / Cornus sericea Forest
Acer negundo / Betula occidentalis Woodland
Acer negundo / Cornus sericea Forest
Acer negundo / Prunus virginiana Forest
Alnus incana ssp. *tenuifolia - Cornus sericea* Shrubland
Alnus incana ssp. *tenuifolia* / Mesic forb Shrubland
Alnus incana ssp. *tenuifolia* / Mesic graminoid Shrubland
Alnus incana ssp. *tenuifolia - Salix (monticola, lucida, ligulifolia)* Shrubland
Alnus incana ssp. *tenuifolia - Salix drummondiana* Shrubland
Alnus incana ssp. *tenuifolia / Equisetum arvense* Shrubland
Betula occidentalis / Mesic forb Shrubland
Betula occidentalis / Mesic graminoid Shrubland

Carex vesicaria Herbaceous Vegetation
Celtis laevigata var. *reticulata* Shrubland
Cornus sericea Shrubland
Crataegus rivularis Shrubland
Equisetum hyemale Herbaceous Vegetation
Forestiera pubescens Shrubland
Glycyrrhiza lepidota-Equisetum hymale Herbaceous Vegetation
Juncus balticus var. *montanus* Herbaceous Vegetation
Juniperus scopulorum / Cornus sericea Woodland
Picea pungens / Alnus incana ssp. *tenuifolia* Woodland
Picea pungens / Cornus sericea Woodland
Picea pungens / Equisetum arvense Woodland
Populus angustifolia - Juniperus scopulorum Woodland
Populus angustifolia - Pseudotsuga menziesii Woodland
Populus angustifolia / Alnus incana ssp. *tenuifolia* Woodland
Populus angustifolia / Betula occidentalis Woodland
Populus angustifolia / Cornus sericea Woodland
Populus angustifolia / Crataegus rivularis Woodland
Populus angustifolia / Prunus virginiana Woodland
Populus angustifolia / Rhus trilobata Woodland
Populus angustifolia / Salix (monticola, drummondiana, lucida) Woodland
Populus angustifolia / Salix drummondiana - Acer glabrum Woodland
Populus angustifolia / Salix exigua Woodland
Populus angustifolia / Salix irrorata Woodland
Populus angustifolia / Salix liguifolia (=Salix eriocephala ssp. *ligulifolia) - Shepherdia argentea* Woodland
Populus angustifolia / Salix lucida ssp. *caudata* or ssp. *lasiandra* Woodland
Populus angustifolia / Symphoricarpos albus Woodland
Populus angustifolia Sand Dune Forest
Populus balsamifera Forest
Populus deltoides / Bromus inermis Woodland
Populus deltoides / Prunus virginiana Woodland
Populus deltoides / Rhus trilobata Woodland
Populus deltoides - (Salix amygdaloides) / Salix exigua Woodland
Populus tremuloides / Acer glabrum Forest
Populus tremuloides / Alnus incana ssp. *tenuifolia* Forest
*Populus tremuloides / Betula occidentali*s Forest
Populus tremuloides / Cornus sericea Forest
Populus tremuloides / Corylus cornuta Forest
Populus tremuloides / Tall forb Forest
Prunus virginiana - (Prunus americana) Shrubland
Pseudotsuga menziesii / Betula occidentalis Woodland
Pseudotsuga menziesii / Cornus sericea Woodland
Pseudotsuga menziesii / Symphoricarpos ssp. Forest
Rhus trilobata - (Salix exigua) Shrubland
Salix amygdaloides Woodland
Salix bebbiana Shrubland
Salix drummondiana / Mesic forb Shrubland
Salix exigua / Barren ground Shrubland
Salix exigua / Mesic graminoid Shrubland
Salix exigua - Salix liguifolia (=Salix eriocephala ssp. *ligulifolia)* Shrubland

Salix geyeriana / Carex utriculata Shrubland
Salix geyeriana / Mesic forb Shrubland
Salix ligulifolia (=Salix eriocephala var. *ligulifolia)* Shrubland
*Salix lucida (*ssp. *caudata* or ssp. *lasiandra)* Shrubland
Salix monticola / Mesic forb Shrubland
Salix planifolia / Calamagrostis canadensis Shrubland
Shepherdia argentea Shrubland
Sporobolus airoides Southern Plains Herbaceous Vegetation
Tamarix ramosissima Shrubland

RIVERINE 5

Andropogon gerardii - Sorghastrum nutans - (Spartina pectinata) Herbaceous Vegetation
Carex emoryi Herbaceous Vegetation
Carex pellita (=lanuginosa) Herbaceous Vegetation
Cornus sericea Shrubland
Equisetum hyemale Herbaceous Vegetation
Glycyrrhiza lepidota-Equisetum hymale Herbaceous Vegetation
Muhlenbergia asperifolia Herbaceous Vegetation
Phragmites australis Herbaceous Vegetation
Picea pungens / Alnus incana ssp. *tenuifolia* Woodland
Populus angustifolia / Prunus virginiana Woodland
Populus angustifolia / Salix exigua Woodland
Populus deltoides - (Salix amygdaloides) / Salix exigua Woodland
Populus deltoides - (Salix nigra) / Spartina pectinata - Carex spp. Woodland
Populus deltoides / Bromus inermis Woodland
Populus deltoides / Carex pellita (=lanuginosa) Woodland
Populus deltoides / Distichlis spicata Woodland
Populus deltoides / Elymus trachycaulus Woodland
Populus deltoides / Forestiera pubescens Woodland
Populus deltoides / Muhlenbergia asperifolia Forest
Populus deltoides / Panicum virgatum-Schizachyrium scoparium Woodland
Populus deltoides / Pascopyrum smithii - Panicum obtusum Woodland
Populus deltoides / Prunus virginiana Woodland
Populus deltoides / Rhus trilobata Woodland
Populus deltoides / Sporobolus airoides Woodland
Populus deltoides / Sporobolus compositus var. *compositus* Woodland
Populus deltoides / Sporobolus cryptandrus Woodland
Populus deltoides / Symphoricarpos occidentalis Woodland
Salix amygdaloides Woodland
Salix exigua - Salix liguifolia (=Salix eriocephala ssp. *ligulifolia)* Shrubland
Salix exigua / Barren ground Shrubland
Salix exigua / Mesic graminoid Shrubland
Spartina pectinata Western Herbaceous Vegetation
Sporobolus airoides Southern Plains Herbaceous Vegetation
Symphoricarpos occidentalis Shrubland
Tamarix ramosissima Shrubland

APPENDIX B:
GLOSSARY OF TERMS

alkaline - Water or soils containing an amount of alkali substances (strongly basic substances such as soda, potash, etc.) sufficient to raise the pH value above 7.0 and be harmful to the growth of plants. Generally, the term alkaline is applied to water with a pH greater than7.4.

alluvial - (1) Pertaining to processes or materials associated with transportation or deposition by running water. (2) Pertaining to or composed of alluvium, or deposited by a stream or running water. (3) An adjective referring to soil or earth material which has been deposited by running water, as in a riverbed, flood plain, or delta.

alluvium - (1) A general term for deposits of clay, silt, sand, gravel, or other particulate material that has been deposited by a stream or other body of running water in a streambed, on a flood plain, on a delta, or at the base of a mountain. (2) A general term for such unconsolidated detrital material deposited during comparatively recent geologic time by a stream or other body of running water as a sorted or semi-sorted sediment in the bed of the stream or its flood plain or delta, or as a cone or fan at the base of a mountain slope; especially such a deposit of fine-grained texture (silt or silty clay) deposited during time of flood.

alpine - That portion of mountains above tree growth; or organisms living there. In Colorado, generally above 11,400 feet.

annual plant- Living through one season only.

arroyo - A water-carved channel or gully in an arid country which is usually rather small with steep banks and is dry much of the time due to infrequent rainfall and the shallowness of the cut, which does not penetrate below the level of permanent ground water.

aspect - The compass direction toward which a sloping land area faces. The direction is measured downslope and normal to the contours of elevation.

association - A plant community type of definite floristic composition, uniform habitat conditions, and uniform physiognomy.

backwater - A small, generally shallow body of water attached to the main channel, with little or no current of its own.

bankfull channel - The stream channel that is formed by the dominant discharge, also referred to as the active channel, which meanders across the floodplain as it forms pools, riffles, and point bars.

bankfull stage - The stage at which a stream first begins to overflow its natural banks. More precisely, an established river stage at a given location along a river which is intended to represent the maximum safe water level that will not overflow the river banks or cause any significant damage within the river reach.

basin - A geographic area drained by a single major stream; consists of a drainage system comprised of streams and often natural or man-made lakes.

bed material - The sediment mixture of which a streambed, lake, pond, reservoir, or estuary bottom is composed.

biennial plant - A plant that lives two years, usually producing vegetative growth the first year and reproducing the second year.

bottoms - Low-lying alluvial land adjacent to a river, also referred to as bottomland.

bottomland, also bottom land - A general term describing generally rich, loamy or fine-textured and poorly drained soils, overlying a shallow water table or possibly adjacent to a stream, lake or other body of water, that exhibits relatively good water holding capacity and slow to moderate infiltration of irrigation water; often associated with a river's floodplain.

braided stream - (1) A stream which divides into a network of channels branching and reuniting, separated by islands. (2) A complex tangle of converging and diverging stream channels *(Anabranches)* separated by sand bars or islands. Characteristic of flood plains where the amount of debris is large in relation to the discharge.

calcareous - Formed of calcium carbonate or magnesium carbonate by biological deposition or inorganic precipitation in sufficient quantities to effervesce carbon dioxide visibly when treated with cold 0.1 normal hydrochloric acid. Calcareous sands are usually formed of a mixture of fragments of mollusk shell, echinoderm spines and skeletal material, coral, foraminifera, and algal platelets.

calcareous fens - Peatlands formed in areas of groundwater discharge, where cold, anoxic, mineral-rich water provides a specialized habitat for disproportionately large numbers of rare and endangered plants. Many of the plants found in calcareous fens are species which would be typical of more northern habitats. The health of such fens is inextricably linked to the presence of the upwelling mineral-rich groundwater.

canopy - (1) The overhanging cover formed by leaves, needles, and branches of vegetation. (2) The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees and shrubs.

catkin - A dense, scaly spike of flowers that fall after flowering or fruiting, as in the willow or birch; an ament.

channel - (1) (Watercourse) A natural stream that conveys water; a natural or artificial watercourse with definite bed and banks to confine and conduct flowing water; a ditch or channel excavated for the flow of water. River, creek, run, branch, anabranch, and tributary are some of the terms used to describe natural channels, which may be single or braided. (2) (Landform) The bed of a single or braided watercourse that commonly is barren of vegetation and is formed of modern alluvium. Channels may be enclosed by banks or splayed across and slightly mounded above a fan surface and include bars and dumps of cobbles and stones. Channels, excepting floodplain playas, are landform elements.

channelization - (1) The artificial enlargement or realignment of a stream channel. (2) Straightening a stream or river to allow water to travel through the area more quickly. (3) The process of changing and straightening the natural path of a waterway. Although channelization is often used as a means of flood control, it often damages wetlands which would otherwise provide natural amelioration of flood damage.

clay - (1) A sedimentary material with grains smaller than 0.2 millimeters in diameter. (2) Moist, sticky earth; mud.

climax community - The final stage of vegetation succession; a climax community reproduces itself and is in equilibrium with the existing environment.

closed basin - A hydrographic basin (basin, area or sub-area) is considered closed with respect to surface water flow if its topography prevents the occurrence of visible surface water outflow. It is closed hydrologically if neither surface nor underground water outflow can occur.

colluvial - Pertaining to material consisting of alluvium in part and also containing angular fragments of the original rocks. Typically found at the bottom or on the lower slopes of a hill.

colluvium - (1) A general term used to describe loose and incoherent deposits of rock moved downslope by gravitational force in the form of soil creep, slides, and local wash. (2) A general

term applied to any loose, heterogeneous, and incoherent mass of soil material or rock fragments deposited chiefly by gravity-driven mass wasting usually at the base of a steep slope or cliff, for example, talus, cliff debris, and avalanche material. (3) Alluvium deposited by unconcentrated surface run-off or sheet erosion, usually at the base of a slope.

conifer - A plant that produces cones such as a plant belonging to the family Coniferae, such as Pines, Cypresses, Junipers and Cedars.

cut bank - The outside bank of a bend, often eroding opposite a *point bar*.

dbh - Diameter (of a tree) at breast height.

deciduous - (1) A plant with leaves falling at maturity or at the end of a growing season. (2) A community where greater than 75% of the total woody cover sheds its foliage simultaneously in connection with the unfavorable season.

deposition - The accumulation of material dropped because of a slackening movement of the transporting medium, e.g., water or wind.

diagnostic species - A species which is characteristic of an association, and is always present in occurrences of that association.

disclimax - A stable community that has replaced the normal climax in a given area, owing to disturbance by humans or domestic animals.

dominant - The species having the most influence on community composition and form. Often used in reference to the largest or most abundant species.

drainage class, soils - The relative terms used to describe natural drainage and corresponding types of soils are as follows:

[1] ***Excessive*** – Excessively drained soils are commonly very porous and rapidly permeable, and have low water-holding capacity;
[2] ***Somewhat Excessive*** – Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile;
[3] ***Good*** – Well drained soils that are nearly free of mottling and are commonly of intermediate texture;
[4] ***Moderately Good*** – Moderately well drained soils that commonly have a slowly permeable layer in or immediately beneath the developed layers of the soil. They have uniform color in the surface layers and upper subsoil, and mottling in the lower subsoils and substrata;
[5] ***Somewhat Poor*** – Somewhat poorly drained soils are wet for significant periods, but not all the time. They commonly have a slowly permeable layer in their profile, a high water table, additions through seepage, or a combination of these conditions;
[6] ***Poor*** – Poorly drained soils are wet for long periods of time. They are light gray and generally are mottled from the surface downward, although mottling may be absent or nearly so in some soils.

draw - A ravine or small intermittent stream drainage.

dwarf shrubland - A community characterized by low-growing shrubs usually under 2 feet (0.5 m) tall. Individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees and tall shrubs generally less than 25% cover). Dwarf shrub cover may be less than 25% where it exceeds tree, shrub, herb, and nonvascular cover.

fen - A groundwater driven wetland with organic material accumulation (peat).

floristic - In vegetation classification, a system based on species composition or species groups.

fluvial - Of or pertaining to rivers and streams; growing or living in streams or ponds; produced by the action of a river, stream or flood flow, as in a fluvial plain.

forb - Broad-leaved herbaceous plant that dies back to the ground each year and is generally known as a wildflower.

forest - A community characterized by trees with their crowns overlapping (generally forming 60-100% cover).

friable - (1) Said of a rock or mineral that crumbles naturally or is easily broken, pulverized, or reduced to powder, such as a soft or poorly cemented sandstone. (2) Said of a soil consistency in which moist soil material crushes easily under gentle to moderate pressure (between thumb and forefinger) and coheres when pressed together.

frost heave - Ruptured soil, rock, or pavement caused by the expansion of freezing water immediately beneath the surface.

geomorphology - That branch of both physiography and geology that deals with the form of the earth, the general configuration of its surface, and the changes that take place in the evolution of land forms. The term usually applies to the origins and dynamic morphology (changing structure and form) of the earth's land surfaces, but it can also include the morphology of the sea floor and the analysis of extraterrestrial terrains. Sometimes included in the field of physical geography, geomorphology is really the geological aspect of the visible landscape.

gleyed - A soil condition resulting from prolonged soil saturation, which is manifested by the presence of bluish or greenish colors through the soil mass or in mottles (spots or streaks) among the colors. Gleying occurs under reducing conditions, by which iron is reduced predominantly to the ferrous state.

graminoids - Grasses and grass-like plants such as sedges and rushes.

herbaceous - Not woody.

herbaceous vegetation - Herbs (graminoids, forbs, and ferns) dominant (generally forming at least 25% cover, trees, shrubs, and dwarf-shrubs generally with less than 25% cover). Herb cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and nonvascular cover.

histosols - Organic soils.

hummock - A small but steep, irregular mound or ridge of earth rising above the general level of the surrounding land.

hydric soil - A soil that, in its undrained condition, is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that affect the growth of plants.

hydrogeomorphic - Taking into account the hydrologic (i.e., water source and hydrodynamics) and geomorphic (i.e., landscape position) factors which control the functions and distribution of wetlands. The hydrogeomorphic approach differs from other wetland assessment procedures in that it classifies wetlands based on hydrologic and geomorphic features.

introduced - A plant species which is NOT indigenous to the state of Colorado or to the natural plant community in which it is found.

inundated - Covered with water, especially floodwaters.

litter - The vegetative material on the surface of the soil.

loam - (1) A soil consisting of a friable mixture of varying proportions of clay, silt, and sand. A soil which has nearly equal proportions of silt, sand and clay. The word is used by gardeners to mean a soil that is rich in organic material, does not compact easily, and drains well after watering. (2) A rich, permeable soil composed of a friable mixture of relatively equal and moderate proportions of clay, silt, and sand particles, and usually containing organic matter

(humus) with a minor amount of gravelly material. It has somewhat gritty feel yet is fairly smooth and slightly plastic.

loamy - Said of a soil (such as a clay loam and a loamy sand) whose texture and properties are intermediate between a coarse-textured or sandy soil and a fine-textured or clayey soil.

matrix species - The species that makes up the bulk of the structure and biomass of an association.

mesic - (from Greek. *mesos*, middle) Conditioned by temperate moist climate; neither xeric nor hydric; pertaining to conditions of medium moisture supply.

microsite - A small area where environmental conditions differ from those of the surrounding area.

mineral soil - Soil composed of predominantly mineral rather than organic materials.

monotypic - Consisting almost entirely of one species.

montane - In Colorado, the ecological zone occurring between approximately 7,500 and 9,300 feet in elevation. The lower montane or foothills extends from about 6,000 to7,500 feet.

mottles - Spots or blotches of different color interspersed with the dominant soil color. Indicative of anoxic soil conditions.

native - A plant species which is indigenous to the state of Colorado or to the natural plant community in which it is found.

obligate - Of necessity, by requirement. Said of species which are always found in a certain habitat, or which require certain conditions to exist.

organic soil - Soil composed of predominantly organic rather than mineral material. Equivalent to Histosol.

peat - Any mass of semi-carbonized vegetable tissue formed by partial decomposition in water of various plants, especially mosses of the genus *Sphagnum*. Peat varies in consistency from turf to slime. As it decomposes its color deepens, old peat being dark brown or black, and keeping little of the plant texture.

perennial plant - A plant living more than two years

perennial stream - See entry under *stream*

perigynium - The inflated sac enclosing the ovary in *Carex* spp.

phreatophyte - Literally, a water-loving plant, one that thrives in wet sites and/or has the ability to tap deep saturation zones. A deep rooted plant that obtains its water from the water table.

physiognomic - In vegetation classification, a system based on the physical features of the vegetation, such as height and spacing, growth form, leaf characters etc.

playa - (1) Generally, a dry or intermittently dry lakebed in the lowest spot of a closed valley. (2) An ephemerally flooded, barren area on a basin floor that is veneered with fine textured sediment and acts as a temporary or the final sink for drainage water (3) Also, a nearly level area at the bottom of an undrained desert basin, sometimes temporarily covered with water. Salt contents are generally quite high.

point bar - A bank on the inside of a meander bend that has built up due to sediment deposition opposite a pool.

quaking fen - A fen formed of peat, wholly or partially floating, so that it shakes when trodden upon.

ravine - (1) A deep, narrow valley or gorge in the earth's surface worn by running water. (2) A small narrow steep-sided valley that is larger than a gully and smaller than a canyon and that is usually worn by running water.

reach (of river) - (1) Most generally, any specified length of a stream, channel, or conveyance. (2) A length of channel which is uniform in its discharge depth, area, and slope; a relatively homogeneous length of stream having a similar sequence of characteristics.

riparian - Pertaining to the banks of a river, stream, waterway, or other, typically, flowing body of water as well as to plant and animal communities along such bodies of water. This term is also commonly used for other bodies of water, e.g., ponds, lakes, etc., although littoral is the more precise term for such stationary bodies of water.

riparian ecosystem - A transitional ecosystem located between aquatic (usually riverine) and terrestrial (upland) environments. Riparian ecosystems are identified by distinctive soil characteristics and vegetation communities that require free water.

rivulet - A small stream or brook; a streamlet.

runoff - (1) That portion of precipitation that moves from the land to surface water bodies. (2) That portion of precipitation which is not intercepted by vegetation, absorbed by the land surface or evaporated, and thus flows overland into a depression, stream lake or ocean (runoff called "immediate subsurface runoff" also takes place in the upper layers of the soil). (3) That part of the precipitation, snow melt, or irrigation water that appears in uncontrolled surface streams, rivers, drains or sewers. It is the same as streamflow unaffected by artificial diversions, imports, storage, or other works of man in or on the stream channels. Runoff may be classified according to speed of appearance after rainfall or melting snow as direct runoff or base runoff, and according to source as surface runoff, storm interflow, or ground-water runoff. (4) The total discharge described in (1), above, during a specified period of time. (5) Also defined as the depth to which a drainage area would be covered if all of the runoff for a given period of time were uniformly distributed over it.

saline soil -A nonalkali soil containing soluble salts (sodium chloride or salts of the alkali metals or magnesium) in such quantities that they interfere with the growth of most plants.

saturated soils - Soils that have absorbed, to the maximum extent possible, water from rainfall, snowmelt, or groundwater. Any further precipitation on saturated soils will result in surface runoff with down-gradient effects on flooding and erosion.

scour - (1) To clear, dig, or remove by or as if by a powerful current of water. (2) The erosive action of running water in streams, which excavates and carries away material from the bed and banks. Scour may occur in both earth and solid rock material. (3) The powerful and concentrating clearing and digging action of flowing air or water, especially the downward erosion by stream water in sweeping away mud and silt on the outside curve of a bend, or during time of flood. (4) A place in a stream bed swept (scoured) by running water, generally leaving a gravel bottom. (5) The process by which flood waters remove soil around objects that obstruct flow, such as the foundation walls of a house.

seep - A spot where water contained in the ground oozes slowly to the surface and often forms a pool; a small spring.

seral – In a transitional stage in plant succession. Environmental conditions, species, or biotic communities may be described as seral in contrast to climax.

shrub - A woody plant which at maturity is usually less than 20 feet (6 m) tall and generally exhibits several erect, spreading, or prostrate stems and has a bushy appearance.

shrubland - Characterized by shrubs generally greater than 2 feet (0.5 m) tall with individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees generally less than 25% cover). Shrub cover may be less than 25% if it still exceeds the cover of other strata. Vegetation dominated by woody vines is generally treated in this class.

silt - (1) Sedimentary particles smaller than sand particles, but larger than clay particles. (2) An intermediate soil textural class consisting of particles between 0.05 and 0.002 millimeters in diameter.

skeletal soil - Soil in which limited amounts of organic material are found and in which soil horizons have had insufficient time to form.

slough - A place of deep mud or mire; a wet or marshy place as a swamp or marshland creek. Also a side channel or inlet as from a river; ordinarily found on or at the edge of the flood plain or a river.

snowmelt - (1) The runoff from melting snow. (2) The net decrease in water equivalent of the snowpack after allowing for increases due to precipitation. It does not include water which refreezes or is retained as liquid water within the snowpack. (3) A period or season when such runoff occurs.

sodic (soils) - Soils having an excess concentration of sodium ions. Excess sodium results in poor aeration, slow infiltration rates, and causes serious nutritional disturbances in plants by affecting the availability of calcium, magnesium, and other ions required by plants.

soil horizon - A layer of soil that can be distinguished from the surrounding soil by such features as chemical composition, color, and texture.

spp.- Species, plural.

ssp.- Subspecies.

stand - A biotic community, particularly of trees, possessing sufficient uniformity of composition, age, and spatial arrangement to be distinguishable from adjacent communities. Stand structure refers to the composition, age, and arrangement of the trees in a delimited biotic community.

stratified - Having distinct horizontal layers (strata) in geological deposits. Each layer may differ from adjacent layers in terms of texture, grain size, chemical composition, or other geological criteria. The term is also applied to layering of other material such as the atmosphere.

stream - A general term for a body of flowing water; natural water course containing water at least part of the year. In hydrology, the term is generally applied to the water flowing in a natural channel as distinct from a canal. Some classifications of streams include, in relation to time:

[1] ***Ephemeral Streams*** - Streams which flow only in direct response to precipitation and whose channel is at all times above the water table.

[2] ***Intermittent or Seasonal Streams*** - Streams which flow only at certain times of the year when receiving water from springs, rainfall, or from surface sources such as melting snow.

[3] ***Perennial Streams*** - Streams which flow continuously.

And, in relation to ground water:

[4] ***Gaining Streams*** - Streams or a reach of a stream that receive water from the zone of saturation. Also referred to as an effluent stream.

[5] ***Insulated Streams*** - Streams or a reach of a stream that neither contribute water to the zone of saturation nor receive water from it. Such streams are separated from the zones of saturation by an impermeable bed.

[6] ***Losing Streams*** - Streams or a reach of a stream that contribute water to the zone of saturation. Also referred to as an influent stream.

[7] ***Perched Streams*** - Perched streams are either losing streams or insulated streams that are separated from the underlying ground water by a zone of aeration.

stream order - (1) Designation of stream segments within a drainage basin; a system of numbering streams according to sequence of tributary size. The smallest perennial tributary is designated as order 1, the junction of two first-order streams produces a stream segment of order 2, and so on, the main stream being always of the highest order.

stream terrace - (1) A surface representing remnants of a stream's channel or flood plain when the stream was flowing at a higher level. Subsequent downward cutting by the stream leaves remnants of the old channel or flood plain standing as a terrace above the present level of the stream. (2) A transversely level erosional remnant of a former axial stream or major desert stream floodplain that slopes in the same direction as the adjacent, incised stream, and is underlain by well sorted and stratified sand and gravel or by loamy or clayey sediments.

subalpine - In Colorado, the ecological zone between approximately 9,300 and 11,400 feet in elevation.

succession - The progressive replacement of one community by another until a climax community is established.

toeslope - The outermost gently inclined surface at base of a slope. In profile, commonly gentle and linear and characterized by alluvial deposition.

var. - Variety

willow carr - A wetland shubland or thicket dominated by willows.

woodland - Open stands of trees with crowns not usually touching (generally forming 25-60% cover). Canopy tree cover may be less than 25% in cases where it exceeds shrub, dwarf-shrub, herb, and nonvascular cover.

xeric - (from Greek. *xeros*, dry) Characterized by a scanty supply of moisture, tolerating, or adapted to, arid conditions.

Most of the above definitions were adapted from the following sources:

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APPENDIX C:
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APPENDIX D:
NATURAL HERITAGE METHODOLOGY

The Natural Heritage Methodology is used by Natural Heritage Programs throughout North, Central, and South America, forming an international database network. The 85 Natural Heritage Network data centers are located in each of the 50 U.S. states, five provinces of Canada, and 13 countries in South and Central America and the Caribbean. This network enables scientists to monitor the status of species or natural communities from a state, national, and global perspective. Information collected by the Natural Heritage Programs can provide a means to protect species before the need for legal endangerment status arises. It can also enable conservationists and natural resource managers to make informed, objective decisions in prioritizing and focusing conservation efforts.

The Natural Heritage Methodology ranks species and communities according to their rarity or degree of imperilment. The ranking system is scientifically based upon the number of known locations of the element as well as its ecology and known threats. By ranking the relative rareness or imperilment of a species or community, the quality of its populations, and the importance of associated conservation sites, the methodology can facilitate the prioritization of conservation efforts so the most rare and imperiled elements may be preserved first. Because plant communities are as important as individual species, this methodology has also been applied to ranking and preserving rare plant communities, as well as the best examples of common communities.

Element imperilment ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State or S-rank) and the element's imperilment over its entire range (its Global or G-rank). Taken together, these two ranks indicate the degree of imperilment of an element. For example, the lynx, which is thought to be secure in northern North America but is known from fewer than 5 current locations in Colorado, is ranked G5S1 (globally secure, but critically imperiled in this state). The Rocky Mountain Columbine (*Aquilegia saximontana*), which is known only in Colorado from about 30 locations, is ranked a G3S3 (vulnerable both in the state and globally, since it only occurs in Colorado and then in small numbers). A narrowleaf cottonwood sand dune forest community that is only known from one location in the world at the Great Sand Dunes National Monument is ranked G1S1 (critically imperiled both in the state and globally, because it exists in a single location).

Definition of Natural Heritage Imperilment Ranks

Global imperilment ranks are based on the range-wide status of a species or community. State imperilment ranks are based on the status of an element in an individual state. State and Global ranks are denoted with an "S" or a "G" respectively, followed by a number or letter. **These ranks should not be interpreted as legal designations.**

G/S1	Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state; or 1,000 or fewer individuals), or because some factor of its biology makes it especially vulnerable to extinction.
G/S2	Imperiled globally/state because of rarity (6 to 20 occurrences, or

	1,000 to 3,000 individuals), or because other factors demonstrably make it very vulnerable to extinction throughout its range.
G/S3	Vulnerable through its range or found locally in a restricted range (21 to 100 occurrences, or 3,000 to 10,000 individuals).
G/S4	Apparently secure globally/state, though it may be quite rare in parts of its range, especially at the periphery. Usually more than 100 occurrences and 10,000 individuals.
G/S5	Demonstrably secure globally/state, though it may be quite rare in parts of its range, especially at the periphery.
G/SX	Presumed extinct globally, or extirpated within the state.
G#?	Indicates uncertainty about an assigned global rank.
G/SU	Unable to assign rank due to lack of available information.
GQ	Indicates uncertainty about taxonomic status.
S?	Unranked. Some evidence that species may be imperiled, but awaiting formal rarity ranking.
Not Applicable	Indicates that the community is not eligible for Heritage ranking, due to its status as an invasive, weedy, cultural, modified or highly managed type.

Note: Where two numbers appear in a state or global rank (for example, S2S3), the rank of the element is unclear but likely within the stated range.

Element Occurrence Ranking

Actual locations of elements, whether they are single organisms, populations, or plant communities, are referred to as **element occurrences**. The element occurrence is considered the most fundamental unit of conservation interest and is at the heart of the Natural Heritage Methodology. To prioritize element occurrences for a given species or community, an element occurrence rank (EO-Rank) is assigned according to the ecological quality of the occurrences whenever sufficient information is available. This ranking system is designed to indicate which occurrences are the healthiest and ecologically the most viable, thus focusing conservation efforts where they will be most successful. The EO-Rank is based on three factors:

Size – a measure of the area or abundance of the element's occurrence, relative to other known, and/or presumed viable, examples. Takes into account factors such as area of occupancy, population abundance, population density, population fluctuation, and minimum dynamic area (which is the area needed to ensure survival or re-establishment of an element after natural disturbance).

Condition/Quality – an integrated measure of the composition, structure, and biotic interactions that characterize the occurrence. This includes factors such as reproduction, age structure, biological composition (such as the presence of exotic versus native species), structure (for example, canopy, understory, and ground cover in a forest community), and biotic interactions (such as levels of competition, predation, and disease).

Landscape Context – an integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the element, and connectivity. *Dominant environmental regimes and processes* include herbivory, hydrologic and water chemistry regimes (surface and groundwater), geomorphic processes, climatic regimes (temperature and precipitation), fire regimes, and many kinds of natural disturbances.

Connectivity includes such factors as a species having access to habitats and resources needed for life cycle completion, fragmentation of ecological communities and systems, and the ability of the species to respond to environmental change through dispersal, migration, or re-colonization.

Each of these factors is rated on a scale of A through D, with A representing an excellent grade and D representing a poor grade. These grades are then averaged to determine an appropriate EO-Rank for the occurrence. If not enough information is available to rank an element occurrence, an EO-Rank of E is assigned. EO-Ranks and their definitions are as follows:

EO Rank	Description
A	excellent estimated viability
B	good estimated viability
C	fair estimated viability
D	poor estimated viability
E	verified extant (viability not assessed)
H	historical
F	failed to find
X	extirpated

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