A Classification of the Riparian Vegetation of the Gunnison River Basin, Colorado

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Several individuals contributed to the success of this project. Betsy Neely designed and wrote the original proposals, and has provided continued technical support both in the field and in the office. Maureen DeCoursey and Julie Burt assisted in collecting the field data, kept our morale up and cooked many a great camp dinner. We'd like to thank Annalisa Rush for her volunteer field assistance. Many people assisted with the logistics of the field season. Barry Johnston of the USFS was inspirational and supportive of this project, provided great insights on methods, obtained necessary infrared aerial photos, and shared his riparian vegetation data from over 100 plots collected since 1982. Sandy Hayes of the BLM graciously loaned infrared aerial photographs and introduced us to the Gunnison office staff. Lynn Cudlip provided field access within the Curecanti National Recreational Area. Many thanks to BLM folks based in Montrose: Amanda Clements for her hospitality and providing additional funding from the BLM, and a big thank you is due to Karen Tucker for organizing (great food!) and supporting the USGS 1993 research float of the Gunnison River. Thanks to John Elliot of the USGS for allowing us to join the river expedition.

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SUMMARY

In this report, we present results from field surveys conducted in 1994, in the Gunnison River Basin. We collected data from 192 sites along intact, relatively undisturbed reaches of perennial rivers and streams. We classified these stands into alliances and plant associations based on their dominant species and species composition. The classification presented here is placed in the context of the UNESCO Physiognomic-Ecological Classification of Plant Formations of the Earth (Mueller-Dombois and Ellenberg 1974, as revised by Driscoll *et al.* 1984 and The Nature Conservancy), and the Classification of Wetland and Deepwater Habitats of the United States (Cowardin *et al.* 1979).

For each riparian plant association, we describe the regional, state, and basin-wide distributions, and provide a general description including elevation, channel type, geomorphic setting, and vegetative characteristics. A brief soil description is included. The relationship of each plant association to previously described riparian associations is also discussed. Succession and management issues are discussed where successional trends and/or land use impacts were observed, or where information was available from current literature.

This classification is subject to peer review, field testing, and revision. This report is part of an ongoing project to develop a state-wide classification of riparian vegetation. As new data are collected from different basins, information will be incorporated into the classification. This riparian classification will also be incorporated into the Colorado Biological and Conservation Database List of Rare and Imperiled Natural Communities, updated and maintained by the Colorado Natural Heritage Program (CNHP), and the Preliminary Vegetation Classification of the Western United States (Bourgeron and Engelking 1994) maintained by The Nature Conservancy's Western Heritage Task Force.

This project is a cooperative effort of the Riparian Task Force, a group of state and federal government agency representatives, which in cooperation with The Nature Conservancy's Colorado Program and the Colorado Natural Heritage Program, is supporting the project through in-kind services, financial support, and technical assistance. The Riparian Task Force, formalized in 1993 by a Memorandum of Understanding (MOU) between all parties, consists of steering and technical committees that meet once a year to review methods, results, conduct yearly planning, and to discuss the continued support of the statewide classification project.

INTRODUCTION

Riparian areas, highly threatened in Colorado, are of great importance for maintaining water quality and quantity, stabilizing stream banks, and providing habitat for fish and other wildlife species (Hansen *et al.* 1988, Brinson *et al.* 1981). Riparian areas are the biological and physical link between terrestrial and aquatic ecosystems (Youngblood *et al.* 1985). These areas provide critical habitat for wildlife, and are also used extensively for domestic livestock grazing, gravel mining, recreational purposes, and as transportation corridors. The ecology of riparian areas and their response to various land management practices is poorly understood. Consequently, resource management and conservation decisions for many riparian areas are often far from optimal.

Our knowledge of riparian plant associations in Colorado has been both limited and fragmented. Patchy and scattered inventory work, using a variety of methodologies, has been conducted in the Piceance Basin (Baker 1982), along the more accessible portions of the main stem of the Yampa River (by Colorado Natural Areas Program), and the Yampa River within Dinosaur National Monument (Fisher *et al.* 1983). The Nature Conservancy-funded classification and surveys of riparian vegetation in west-central and southwestern Colorado (Baker 1986), and the northern Front Range (Cooper and Cottrell 1990). Previous community classification work in Colorado, such as that for Arapaho-Roosevelt National Forest (Hess and Alexander 1986), White River National Forest (Hess and Wasser 1982), Indian Peaks area (Komarkova 1979), Gunnison and Uncompahgre Forests (Komarkova *et al.* 1988), and southern Colorado (DeVelice *et al.* 1985), have not specifically focused on riparian areas. Riparian classification work is currently underway in the Gunnison River basin and a number of riparian plant associations are listed in the Plant Association and Habitat Type Classification of US Forest Service Region Two (Johnston 1987). In the Rocky Mountain Region, riparian classification has been conducted in eastern Idaho and western Wyoming (Youngblood *et al.* 1985), eastern Wyoming (Jones 1990), New Mexico (Muldavin 1992), Montana (Hansen *et al.* 1988, 1989), Nevada (Manning and Padgett 1989), and Utah (Padgett *et al.* 1989).

This project constitutes the first state-wide comprehensive riparian classification effort for Colorado. Since 1990, basin-wide, systematic riparian classification has been conducted in the Yampa and San Miguel/Dolores River basins (Kittel and Lederer 1993), and in the White and Colorado River basins (Kittel *et al.* 1994).

In this report, we present a classification of riparian vegetation from the Gunnison River Basin. We classified homogeneous stands of riparian vegetation found along intact, relatively undisturbed reaches of perennial rivers and streams and placed them in the context of the UNESCO Physiognomic-Ecological Classification of Plant Formations of the Earth (Mueller-Dombois and Ellenberg 1974), and the Classification of Wetland and Deepwater Habitats of the United States (Cowardin *et al.* 1979). This classification is subject to peer review, field testing, and revision. This report is part of an ongoing project to develop a state-wide classification of riparian vegetation, beginning with the Western Slope of Colorado (Figure 1). As new data are

collected from different basins, information will be incorporated into the classification. This riparian classification will also be incorporated into the Colorado Biological and Conservation Database List of Rare and Imperiled Natural Communities, updated and maintained by the Colorado Natural Heritage Program (CNHP), and the Preliminary Vegetation Classification of the Western United States (Bourgeron and Engelking 1994) maintained by The Nature Conservancy's Western Heritage Task Force.

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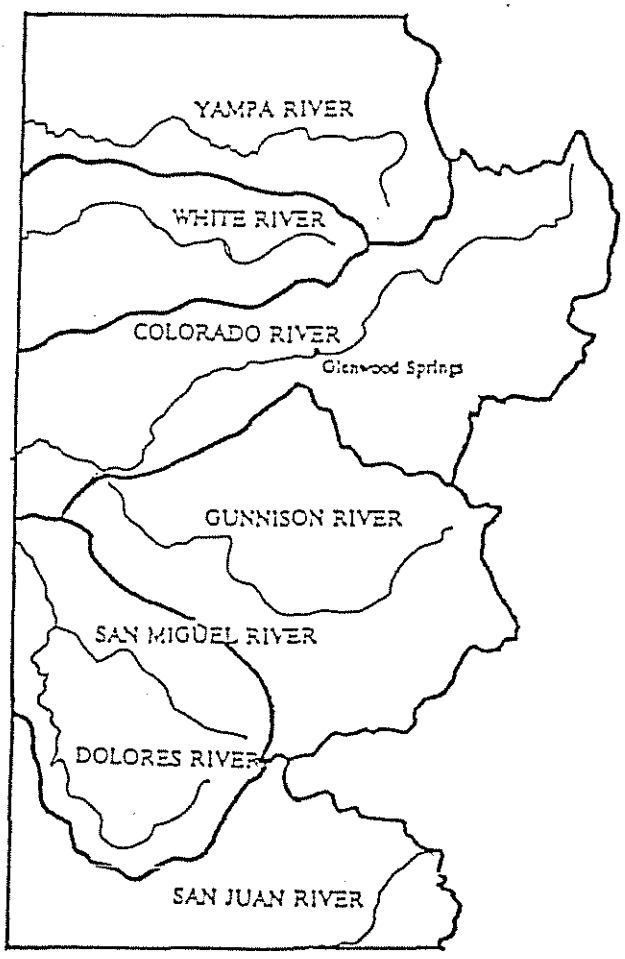


Figure 1. Major River Basins of the Colorado Western Slope.

STUDY AREA

The Gunnison River basin is located in west-central Colorado (Figure 2). Its boundary encompasses an area of approximately 8000 square miles, draining about eight percent of the area of the state of Colorado (HDR Engineering 1988). The basin elevation ranges from 1375 m (4550 feet) at Grand Junction to 4360 m (14,300 feet) at Uncompahgre Peak and has highly varied topography. The upper portions of the basins are mostly glaciated steep peaks, descending into gently and strongly sloping U-shaped mountain valleys. Long, steep-sided ridges running north to south typify the lower slopes of the central portion of the basin. In the lower basin, nearly level to moderately sloping valleys, flanked by low rolling hills are broken abruptly by steep mesas. The Uncompahgre Plateau drains the western half of the watershed and is characterized by highly dissected and steep-sided canyons. The basin has over 3200 perennial stream miles. Over 1,100 of these occur as first-order streams above 2740 m (9,000 feet) while relatively few miles occur at lower elevations, these evenly distributed across stream order (Figure 3a).

The basin is underlain with Precambrian crystalline intrusive and metamorphic rocks such as granite, gneiss, and schist. The cliffs within the Black Canyon of the Gunnison are a dramatic example of the Precambrian crystalline dark-colored gneiss, interlaced with light-colored pegmatite dikes. Volcanic activity gave rise to many of the high mountains that now rim the basin to the north and south. The West Elk and Elk Mountains to the north and the San Juan Mountains to the south are Tertiary volcanos that intruded into the Precambrian rocks, and erupted lava flow upon lava flow that now cap the Grand Mesa and form layers of broken and welded tuft that form the Palisades and vertically banded cliffs that can be seen north of the Blue Mesa Reservoir (Chronic 1980). Sedimentary rocks in the basin are Triassic and Jurassic in age and occur in the central and eastern parts of the basin. These shales (e.g. Mancos shale) and sandstones (e.g. Dakota sandstone) provide the fertile soils of the Delta and Montrose agricultural regions. The Uncompahgre Plateau is an ancient uplift comprised of Precambrian rocks and topped with the same sandstones and shales found in the valleys below. Recent (20,000 years ago) glacier activity carved the current shapes of the high mountain ridges and peaks and deposited thick layers of sand, gravel, and boulders that are re-worked by the lower reaches of the Uncompahgre, Gunnison and North Fork Rivers (Chronic 1980).

Climate in the Gunnison Basin is considered semiarid, although the upper elevations are wetter. Average precipitation varies from more than 40 inches in the upper basin to less than 10 inches in the lower valleys (HDR Engineering 1988). Average annual snowfall varies from more than 460 inches at Ruby, 170 inches at Crested Butte, to 20 inches at Grand Junction. Water supply for the basin is principally from spring snowmelt runoff, augmented by summer precipitation. The upper basin has an annual frost-free period of less than 70 days, while the lower valleys near grand Junction have an average 190 frost-free days (Colorado Climate Center 1984).

Historically, the Gunnison basin was inhabited by the Ute Indians until a large tract was

opened for settlement in 1873, and the remainder of the basin was ceded in 1881 (Vandembusche 1980). The first settlers were miners, many of whom turned to farming and ranching as their means of livelihood when the mining industry declined after 1893 (Vandembusche 1980). Agriculture soon established itself as the industry in the area and extensive water supply systems were developed in the ensuing years (HDR Engineering 1988). For the past century, agriculture has been the largest user of water within the area, although more recently, recreation, such as white water rafting, has become a predominate sector in the local economy (HDR Engineering 1988).

Water resource management began in the early 1900 with the construction of the Gunnison Tunnel, the Taylor Reservoir, and 792 miles of canals and ditches. The Gunnison Tunnel diverts water from the Gunnison River mainstem for irrigation use in the Uncompahgre Valley. The Taylor Park Reservoir supplies water for irrigation, but is presently operated to enhance fisheries and recreation. It also provides flood protection for the Taylor River (HDR Engineering 1988). In 1956, the U.S. Department of the Interior approved construction of the Aspinall project, which comprises three storage reservoirs on the Gunnison mainstem: Blue Mesa, Morrow Point, and Crystal. Stream flows are now controlled by the Blue Mesa dam, and re-regulated by the lower, smaller reservoirs. This permits water to be released to meet commitments to the Lower Colorado River Basin during dry years, without curtailing water development activities in the upper Colorado watershed (HDR Engineering 1988). However the demand for in-stream and more natural flows by recreationalists and biologists has added to the complex issues surrounding the management of water projects.

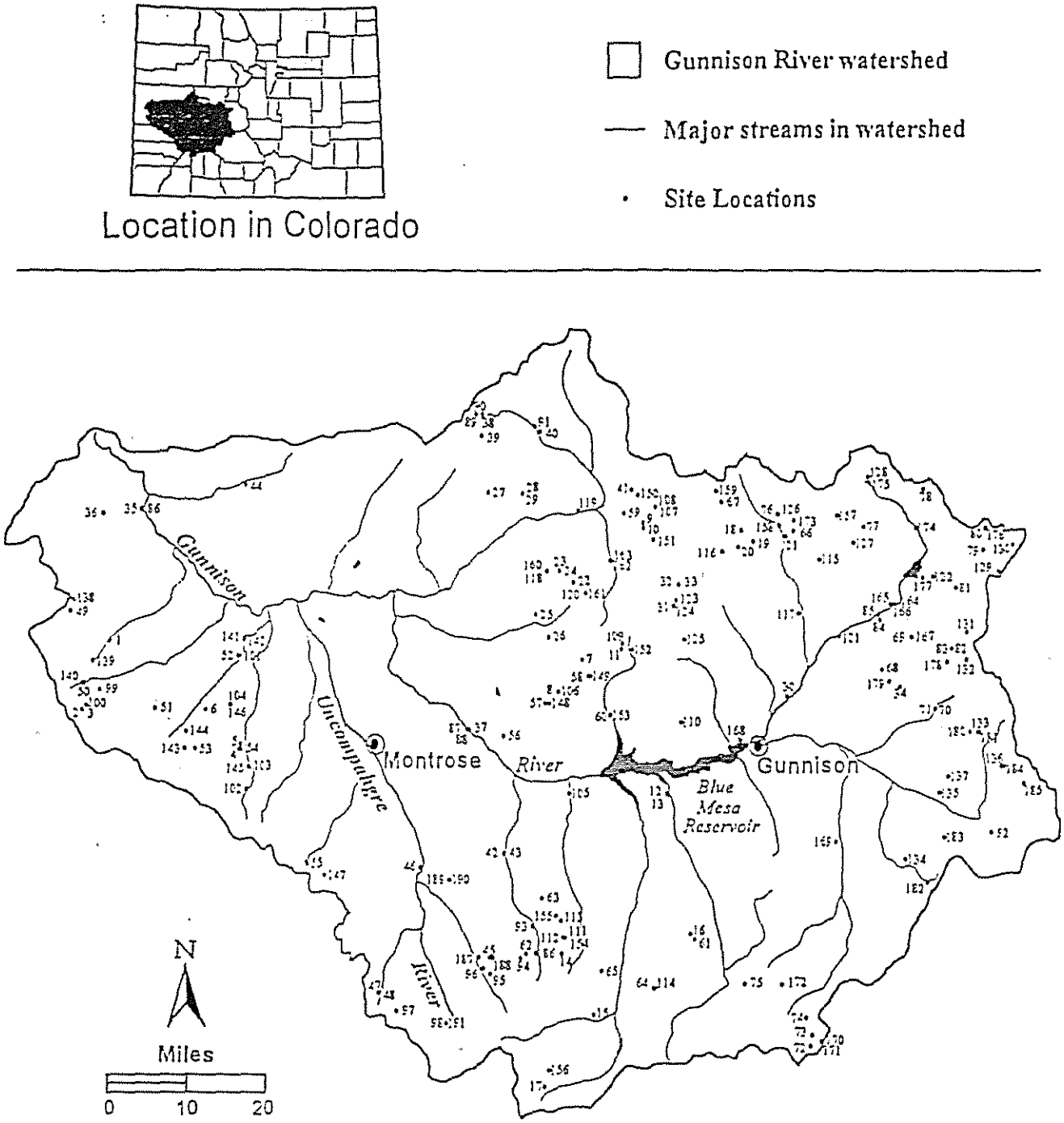


Figure 2. Map of the Gunnison River drainage with plot locations. For specific plot locations, see Table 1 in Appendix 1.

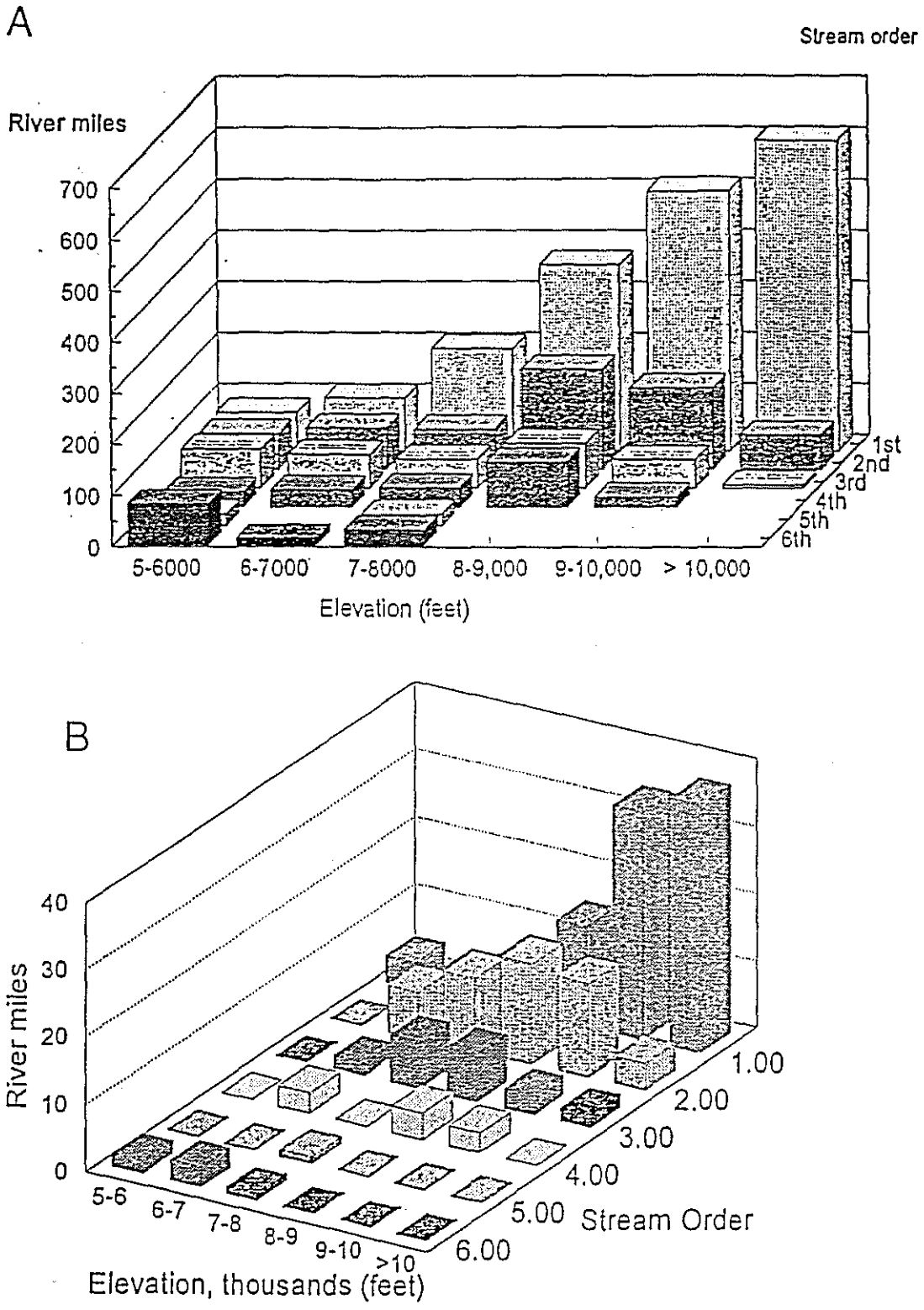


Figure 3. Riparian habitats across the Gunnison Basin stratified by stream order and elevation for (A) all perennial stream miles and (B) sampled stream miles. The relative distribution of habitats within the sampled streams is comparable to that of the entire basin.

METHODS

For the purposes of this project, riparian areas are defined as the interface between the riverine aquatic ecosystem and the adjacent upland ecosystem (Gregory *et al.* 1991, Risser 1990, Knopf *et al.* 1988, Brinson *et al.* 1981). These areas are frequently flooded, or are at least seasonally saturated by a fluctuating water table, and have plant species, soils, and topography that differ considerably from those of the adjacent uplands (Elmore and Beschta 1987, Jones 1990). Riparian areas in this project include vegetation occurring along natural water courses, poorly drained overflow areas, and associated natural bodies of water, such as oxbow lakes. This classification focuses on lands along perennial streams as defined on U.S. Geological Survey 1:24,000 and 1:100,000 topographic maps.

Representative site selection

To sample as much of the diversity within each basin as possible in one field season, we used a stratified-random approach based on Austin and Heyligers (1989) gradsect concept. To stratify the study area we chose two major environmental gradients, elevation and stream order, thought to influence riparian vegetation. Stream order is a surrogate for basin size, channel size and stream volume (Schumm 1977, Knighton 1984). Elevation is an important predictor of climate. Using USGS 1:100,000 topographic maps we denoted 300 meter (1000 ft) elevation bands from 1525 m (5000 ft) to over 3050 m (10,000 ft) and stream order for all perennial streams. Stream order was calculated using Strahler's system (1952). The largest stream order within the Gunnison basin was six. Of thirty-six combinations of elevation and stream order, or stream reach cell types, twenty-eight occurred in the basin (Figure 3a). We tallied the total perennial stream miles in the basin and the total miles within each cell type and calculated their percentage. Next we studied aerial photographs (methods follow) to eliminate areas of heavy disturbance. With heavily degraded riparian areas blocked out, we randomly selected over 200 one-mile long stream reaches representing all classification cell types, weighted by their abundance in the basin. For example, if 20% of the stream miles above 3050 m (10,000 ft) were first order streams, then 20% of the randomly selected one-mile sites would be of that type. The actual number of stream miles sampled per cell type was representative of the basin (Figure 3a,b).

We used 1989 and 1990 NAPP 1:40,000, and 1983 1:24,000 color infra-red (IR) 9 x 9 inch photographs to delineate tree, shrub, or herbaceous dominated riparian areas (Batson *et al.* 1987). Riparian vegetation appears bright red relative to dry hillside vegetation and has a texture unlike irrigated monoculture crop areas. In addition, conifer dominated riparian reaches, which do not stand out as red, were also delineated. Riparian condition was ranked by the degree of disturbance (i.e. deviation from pristine) both within and surrounding the riparian area. From aerial photograph interpretation and field verification work in 1993, we determined that disturbance of surrounding uplands can be a strong indicator of the amount of non-native species in the understory within the riparian corridor. By sampling only riparian areas that have not been drastically altered by human activity, the classification focuses on plant associations native to Colorado and can serve as a reference point for management and restoration needs.

Riparian condition criteria used were: 1) evidence of drastic human disturbance such as agricultural conversion, adjacent irrigated fields, sharp-edged fields, road and railroad embankments, power line maintenance roads, gravel mining, logging, mining, dams, reservoir developments, etc., 2) heavy recreational use, such as off-road vehicle use, etc., 3) heavy livestock use such as over grazing (hillside trailing), or livestock holding sites, etc., and 4) road maintenance sand and gravel piles or other dumping grounds.

Riparian condition was tallied in four categories: 1) Excellent-- riparian corridor and the surrounding area appears natural with no major disturbances. Within the corridor itself, the area appears unfragmented and the vegetation follows a natural alluvial pattern; 2) Good--riparian corridor exhibits excellent vegetative cover but the surrounding area is altered; 3) Fair-- the riparian corridor is fragmented, and/or the surrounding lands disturbed; 4) Poor-- riparian corridor disturbed, vegetation nonexisting or highly fragmented and the surrounding land slightly to drastically altered. Deep canyons are an exception to the above criteria, as they tend to have naturally low amounts of riparian vegetation. If the surrounding land looked undisturbed, a canyon reach would be ranked `good' also.

By visually overlaying BLM 1:100,000 topographic and land ownership maps with the aerial photographs, we also tallied the amount of federal, state and private land by their riparian condition for all perennial streams in the basin.

In the field, we further evaluated random sites for evidence of disturbance and eliminated sites that were dominated by non-native plant species such as tamarisk or salt cedar (*Tamarix ramosissima*) or Russian-olive (*Elaeagnus angustifolia*). However, we included areas with non-natives present in the understory, such as Kentucky bluegrass (*Poa pratensis*), but only where native flora dominated the overstory vegetation, and when the degree of disturbance was minimal. If the site was acceptable, stand data were collected from homogeneous stands of riparian vegetation.

Classification Basis

By eliminating disturbed and degraded sites, the classification is based on existing, relatively undisturbed, or naturally disturbed native vegetation. A plant association, the most specific level in this hierarchical classification, is defined as "natural vegetation with definite floristic composition, uniform physiognomy, and uniform habitat" (Mueller-Dombois and Ellenberg 1974). Our definition differs slightly from the Daubenmire (1952) plant association concept in that we describe existing communities, rather than perceived climax vegetation types. Plant associations are a product of the prevailing environmental setting (where possible, barring human influence or pre-European settlement) including past natural disturbances (such as fire, flooding, or bison grazing) and are "real, extant ... kinds of vegetation, rather than a theoretical end point that is seldom reached on most sites" (Baker 1984). Along riparian corridors, flooding and sediment deposition and scouring, create an environment that is frequently disturbed. Thus most riparian communities are frequently set back in successional time, and the floodplain

mosaic

is often a series successional stages. Most of the plant associations described in this report may be considered "community types" by the Daubenmire Habitat Typing system, in that they are frequently disturbed, and rarely reach a climatic climax.

Collection of vegetation and environmental data

Prior to visiting sites for collection of field data, landowners or managing agencies were notified and permission obtained for all private properties visited. The following data was collected at each plot location:

* elevation (from 7.5 min. topographic maps)
* aspect and stream bearing
* valley floor width (from topographic maps)
* stream gradient (measured with a hand level and stadia rod)
* channel depth and width (measured at bankfull or average annual high water mark) *Bankfull stage* or *Bankfull channel* is the height of the average 1-3 year return flow, also called the average annual high water mark of the active channel (Knighton 1984, Wolman and Leopold 1957). We use this demarkation along the bank as a reference point for measuring stream channel width and depth, and the height and distance of a riparian community from the active channel.
* Stream reaches were placed into Rosgen's Stream channel classification. The system is based on the channel width to depth ratio, available floodplain width, and channel gradient. For a full description and explanation, see Rosgen (1994).
* hydrologic and geomorphic features (beaver dams, point bars, etc.)
* history of use (from landowner or manager) when obtainable
* Each site was ranked A (highest) through D (poorest) for quality, condition, defensibility, and viability, using the following criteria:

  quality--overall size, connectedness to surrounding natural ecosystems, degree of alteration.
  condition--abundance of non-native plant species, degree of soil compaction, amount of species composition change by livestock grazing, degree of human disturbance, appropriateness of current management for riparian ecosystem health.
  viability--extrinsic factors: are natural hydrological processes in place, will site improve, or remain in current condition with current management?
  defensibility--extrinsic and intrinsic factors affecting the long term existence of the ecosystem; any known threats or site specific problems are defined; adjacent land use compatibility is included.

Canopy cover data (%) were collected for woody vegetation using 30-50 m long line-intercept transects, oriented parallel to the stream channel. Transects were subjectively located within a homogeneous portion of each stand to best represent the vegetation of the site.

Herbaceous vegetation was sampled using 10-20 0.5 m^2 micro-plots, located about every third meter along the transect and 1 meter to the side, alternating sides. Data collected at each site included:

* Percent canopy cover by vascular plant species to the nearest 10% in the following cover classes: 5-15%, 16-25%, 26-35%, 36-45%, 46-55%, 56-65%, 66-75%, 76-85%, 86-95%, and >95%. Plant cover 5% or less was estimated into two categories, <1% and 1-5%.
* Total canopy cover by life-form (trees, shrubs, graminoids, and forbs). Overhead tree cover was measured along the transect using a clinometer to find the vertical intercept of the tree canopy.
* Ground cover of bare soil, litter, wood, gravel, rock, bryophyte, and non-vascular plants
* Soils were described from a single pit within each stand sampled. Pit depth varied according to the amount of coarse fragments present (average depth 70 cm). Noted from each horizon: thickness, texture, color, % mottling/gleying, matrix color, % coarse fragments, % organic matter, overall thickness, and parent material, when possible.
* Height above the active channel using a hand held level and stadia rod.
* Distance from transect to active of channel (using a measuring tape or hip-chain).
* Landscape position (point bar, floodplain, abandoned channel, terrace, etc.).
* Signs of wildlife or domestic livestock utilization.
* Signs of disturbance (flooding, fire, wind throw, logging, etc.).
* Successional relationships where trends could be inferred.
* Adjacent riparian and upland vegetation .
* Reference site and plot 35 mm color slides.
* Size of occurrence mapped on 7.5 min. USGS topographic maps with aid of 9 x 9 in. 1:40,000 NAPP color infra-red aerial photos.

All plants not identified in the field, particularly of difficult genera such as *Salix, Carex*, and *Juncus*, were collected, pressed, and identified (to species level when possible) at the University of Colorado and Colorado State University Herbaria. Voucher specimens will be deposited at the University of Colorado Herbarium, the University of Wyoming Rocky Mountain Herbarium, and the Colorado State University Herbarium. Nomenclature in this report follows Kartesz (1994). A list of plant names cross-referenced with Weber and Wittmann (1992) nomenclature is in Appendix 2.

Data Analysis and Classification Criteria

Agglomerative cluster analysis programs were employed using Euclidean distance and average clustering method to determine groups of plots with similar species abundance. Detrended Correspondence Analysis (DCA) was used to further explore the degree of similarity between and among plots. Axises of the DCA were subjected to linear regression with

environmental variables. Means of environmental variables were also compared between plant associations using a Student t-test adjusted for unequal variances (available in Quattro-Pro 6.0).

Associations derived from the cluster analyses were compared with riparian plant association stand data and descriptions from riparian classification work in Colorado, New Mexico, Arizona, Utah, Montana, Idaho and Wyoming (Johnston 1987, Muldavin 1992, Szaro 1989, Padgett *et al.* 1989, Hansen *et al.* 1988, 1989, and Youngblood *et al.* 1985, respectively). Associations were considered either 1) synonymous --where associations matched in species composition, constancy, average cover, environmental setting, 2) similar --when canopy structure, genera, and physical setting were similar, but species composition was different, 3) a new type not described in the literature, or 4) unclassifiable due to insufficient data.

Association names were based on each canopy stratum dominant and codominant plant species, characterized by high constancy (frequency of species occurrence) and high relative abundance (percent canopy cover) values. A slash separates canopy layers (e.g., tree/shrub/herb). A dash indicates codominance within a given canopy layer (e.g., *Populus angustifolia-Picea pungens/Alnus incana.* Plant associations that appear synonymous with those in the literature (by stand table and description comparison) are given the same name. Some published names are long and awkward; we propose shorter names herein.

Riparian plant associations were placed into the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Physiognomic-Ecological Classification of Plant Formations of the Earth (Mueller-Dombois and Ellenberg 1974, as revised by The Nature Conservancy's Western Regional Office), and the Classification of Wetland and Deepwater Habitats of the United States (Cowardin *et al.* 1979) (Table 1.1).

The UNESCO system is currently used by The Nature Conservancy throughout the United States. This hierarchial system uses physiognomy and environment to distinguish vegetation units:

I, II, etc.	Formation Class (Physiognomic type: closed forests, woodlands, shrublands, dwarf-shrublands, terrestrial herbaceous communities, deserts, and aquatic plant formations)
A,B, etc.	Formation subclass (evergreen or deciduous)
1,2, etc.	Formation Group (e.g., temperate vs. tropical)
a,b, etc.	Formation (e.g., evergreen forests with conical crowns, giant vs. non-giant evergreen trees, etc.)
	Alliance (dominant characteristic species, e.g., *Picea engelmannii*)
	Plant association (e.g., *Abies lasiocarpa/Alnus incana*)

The Alliances and plant association levels have been added to the UNESCO system to more finely tune the classification to the dominant species (Alliance) and specific association

levels (Plant Association), similar to U.S. Forest Service regional classifications, such as Johnston (1987).

Table 1. Cross-reference of the UNESCO Plant Formations (Roman numerals) and Cowardin Wetland Types.

UNESCO	Cowardin
I. Closed forests (interlocking crowns)	Palustrine system-Forested class
A. Mainly evergreen forests	Needle-leaved evergreen subclass
9. Temperate coniferous forests	
c. Evergreen (non-giant) conifer forests with conical crowns	
1. (Alliance)	(Dominance type)
a. (Plant Association)	
B. Mainly deciduous forests	Broad-leaved deciduous subclass
2. Cold-deciduous forests with evergreen trees admixed	
c. Cold-deciduous forest with needle-leaved evergreen trees	
1. (Alliance)	(Dominance type)
a. (Plant Association)	
3. Cold-deciduous forests without evergreen trees	
b. Montane or boreal cold-deciduous forests	
1. Mainly broad-leaved	
1. (Alliance)	(Dominance type)
a. (Plant Association)	
III. Shrublands	Palustrine System-Scrub-Shrub class
B. Mainly deciduous shrubland	Deciduous shrubland
3. Cold-deciduous shrublands	
a. temperate (montane)	
1. (Alliance)	(Dominance type)
a. (Plant Association)	
b. Subalpine shrublands	
1. (Alliance)	(Dominance type)
a. (Plant Association)	
c. Deciduous alluvial shrubland	
1. (Alliance)	(Dominance type)
a. (Plant Association)	
d. Deciduous peat shrubland	
1. (Alliance)	

Table1. Continued.

UNESCO	Cowardin
a. (Plant Association)	(Dominance type)
IV. Terrestrial herbaceous communities	Palustrine-Emergent wetlands
C. Meadows	Persistent
1. Below tree-line	
f. Sedge-rush meadow (closest class, although ours are not anthropogenic)	
1. (Alliance)	(Dominance type)
2. (Plant Association)	
2. Above tree-line	
a. Closed alpine mats	
1. (Alliance)	(Dominance type)
a. (Plant Association)	
c. Snow-bed formation	
1. (Alliance)	(Dominance type)
a. (Plant Association)	
E. Salt swamps	
2. Salt meadows	
b. Inland salt meadow	
1. (Alliance)	(Dominance type)
a. (Plant Association)	
VII. Aquatic Plant formations	Riverine System-Upper Perennial
B. Reed-swamps	Persistent-Emergent Wetlands
3. Reed-swamps of flowing water	
b. Temperate reed swamps of river banks	
1. (Alliance)	
a. (Plant Association)	(Dominance type)

Determination of Ecologically-Significant Sites

The Colorado Natural Heritage Program is responsible for gathering and updating information on features of natural diversity in Colorado. Each of these significant natural features (rare plant and animal species, significant plant associations) is a unit, or element, of natural diversity. Each element is assigned a global and a state rank that indicates its relative rarity on a five-point scale (1 = extremely rare; 5 = abundant; Table 1.3). By using the element ranks and the quality of each occurrence, priorities can be established for the management and/or protection of the most imperilled elements of biodiversity.

Each geographical location of any element is called an Element Occurrence. Element occurrences are ranked on four areas of overall quality. These are 1) **quality**-- overall size, vigor, health of population, degree of connectedness to surrounding natural ecosystems, etc.; 2) **condition** or naturalness of the habitat, abundance of non-native species present, intensity of human activity, degree of soil compaction, degree of species composition alteration by grazing, 3) **viability** are natural pollinators in place, is the hydrologic regime altered, will site improve or be maintained by current management practices; 4) **defensibility**-- ease or difficulty of protecting the occurrence from external threats, site specific problems, adjacent land use compatibility. Each criteria is given a rank (A, B, C, or D) and are they are summed for a final, overall Occurrence Rank: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered, D= barely functioning.

For example, an `A' ranked occurrence of a riparian plant association has no, or very few, non-native plant species present, the channel and banks are stable and show no signs of trampling or sloughing, the soils are not compacted. The association is surrounded by other riparian associations of similar quality, creating a connected, high quality mosaic. The surrounding hillslopes and areas up and down stream are in natural condition and have not been drastically altered (no dams or diversions upstream, no logging or mining up stream of adjacent hillslopes). A `B' ranked occurrence of a riparian plant association may have all of the above `A' criteria but is very small in size, or has a higher abundance of non-native plant species present, or may be an area in high condition with surrounding land use that fragments the occurrence. A `C' ranked occurrence is of poor condition, generally with abundant non-native plant species present and/or the area is highly fragmented, and/or the area is very small. Again surrounding land use and condition plays a role in the overall riparian occurrence rank.

Colorado Natural Heritage Program uses the Global/State Rarity and Occurrence Ranks to assess the overall significance of a Site, which may include one or many element occurrences. Based on these ranks, each site, or suite of elements, is assigned a Biodiversity (or "B") Rank:

- B1 Outstanding Significance: only site known for an element or an excellent occurrence of a G1 species or plant association.
- B2 Very High Significance: one of the best examples of a plant association, good occurrence of a G1 species, or excellent occurrence of a G2 or G3 species or plant

association.

B3 High Significance: excellent example of any plant association, good occurrence of a G3 species, or a large concentration of good occurrences of state rare species/associations.

B4 Moderate Significance: good example of an association, excellent or good occurrence of state-rare species/association.

B5 General Biodiversity Significance: good or marginal occurrence of an association type, S1, or S2 species/association.

In this way ecologically significant sites are recognized as the highest-ranked community or species occurrences, including both common and globally rare riparian ecosystems. Sites that contain high-quality (excellent condition) examples of globally rare plant associations, or sites that contain a mosaic of rare and/or more common elements in good to excellent condition quickly rise to the top of the list as the highest priority conservation sites.

Riparian areas recommended for special management or protection are examples of "A" or "B" ranked occurrences. These ecologically significant sites are valuable as reference areas for long-term research and comparison with impacted areas.

High-quality riparian areas found in the Gunnison River basin are proposed as some of the best examples of rare or common riparian plant associations in the State (Table 1.2). The Colorado Natural Heritage Program will be entering data on these areas into the Biological and Conservation Database and ranking these sites for final protection recommendation.

Table 2. Definition of Natural Heritage State Rarity Ranks. Global rarity ranks are similar, but refer to a species' or plant associations's rarity throughout it range. State and Global ranks are denoted, respectively, with an "S" or a "G" followed by a number or character. Note that GA and GN are not used and GX means extinct. These ranks should not be interpreted as legal designations.

S1	Extremely rare: usually 5 or fewer occurrences in the state; or may be few remaining individuals; especially vulnerable to extirpation.
S2	Very rare; usually between 5 and 20 occurrences; or with many individuals in fewer occurrences; often susceptible to becoming endangered.
S3	Rare to uncommon; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale or chronic disturbances.
S4	Common; usually > 100 occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.
S5	Very common; demonstrably secure under present conditions.
SA	Accidental in the state.
SH	Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.
S#B	Same rank as the numbered S-series, but refers to the breeding season rarity of migrants.
S#N	Same rank as the numbered S-series, but refers to the non-breeding season rarity of migrants; where no consistent location can be discerned for migrants or non-breeding populations, a rank of SZN is used.
SU	Status uncertain, often because of low search effort or cryptic nature of the element.
SX	Apparently extirpated from the state, or extinct.

RESULTS and DISCUSSION

Riparian Condition and Site Selection

Lower elevation reaches along larger rivers were more heavily impacted compared to the upper watershed. We eliminated over 50% ("fair" and "poor") of all streams reaches in the watershed from the sampling regime (Figure 4). Most of the impacted areas occurred at lower elevations along large streams (Figures 5a,b). These areas were too degraded to adequately represent native riparian ecosystems. Eliminated areas appeared to be over-grazed, or had altered hydrologic regimes, or have been cleared for intensive agriculture, such as irrigated hay, or were impacted by coal and gravel mining. Land ownership within the basin reflects this pattern of use. Most of the private land in irrigated agricultural production, under active mining, or owned by municipalities has little intact riparian acreage, while lands used primarily for range and non-irrigated agriculture are in public ownership (Figure 4). Occurrences of good to excellent condition native riparian plant associations at lower elevations are limited to small, isolated patches.

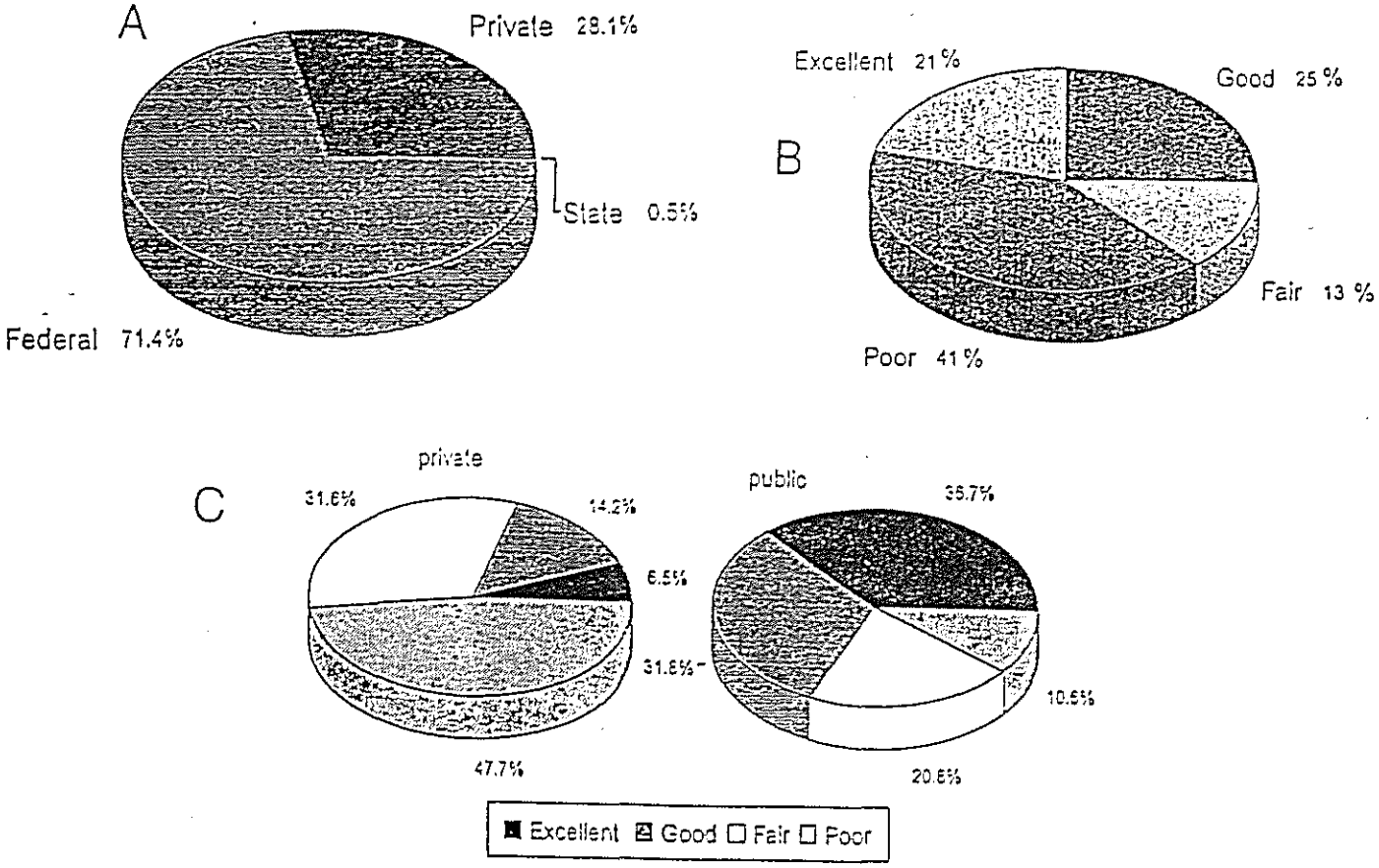


Figure 4. (A) Percentage of federally, state, and private lands within the Gunnison Basin. (B) Percentage of excellent, good, fair, and poor quality riparian area in the Basin. (C) Percentage of riparian condition by private and public lands.

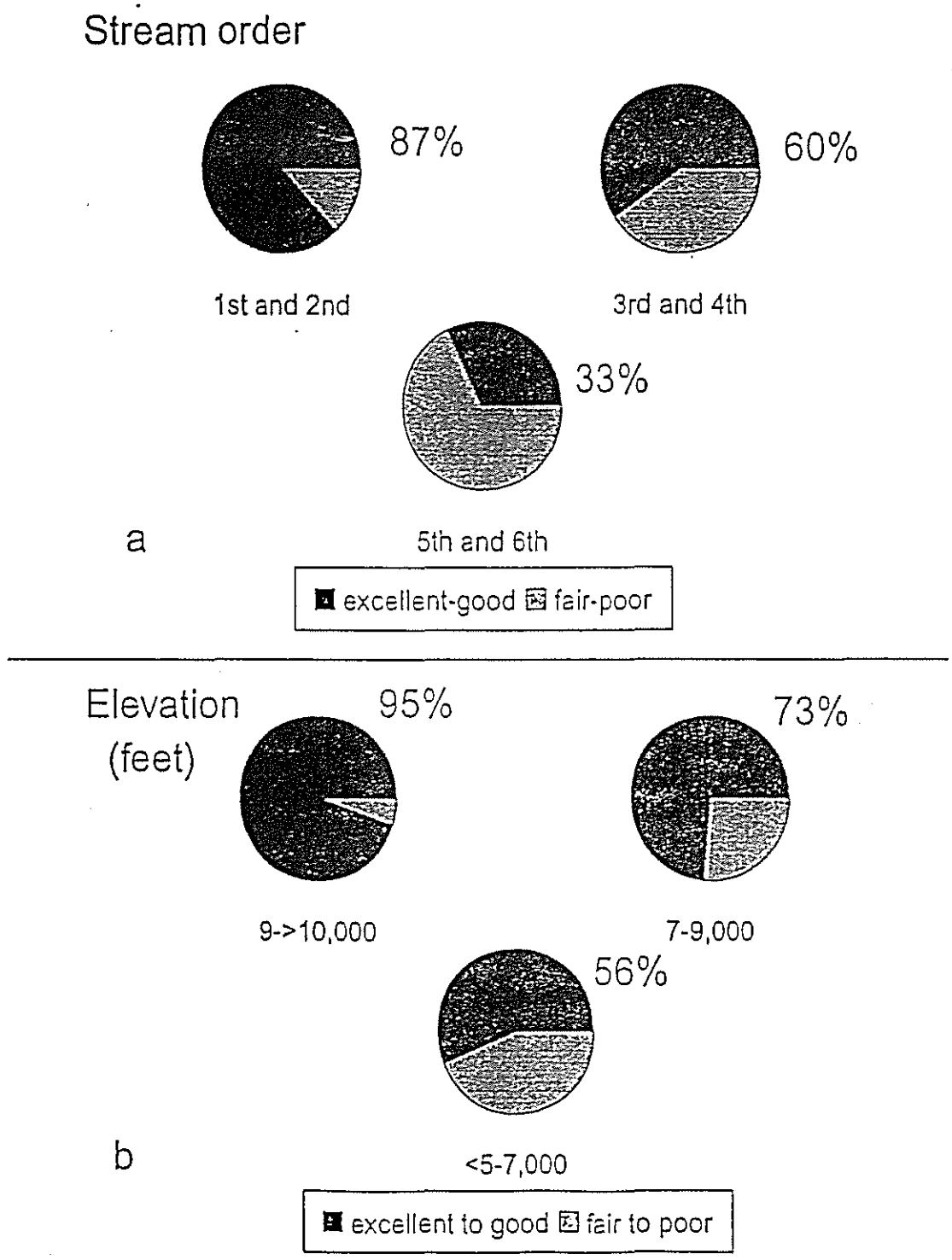


Figure 5. Quality of Gunnison Basin perennial stream miles by stream order (a) and elevation (b).

Plant Associations

One hundred ninetly-one plots were classified into 30 plant associations, and fourteen plots were classified to the Alliance (Dominance type) level (Table 3). The classification is based on agglomerative cluster analyses that show the degree of similarity among stands (Figure 6). While no new plant associations were discovered in the Gunnison basin, several rare and unusual types were more thoroughly documented, and phases of more common plant associations became apparent. One unusual association, *Populus angustifolia/Salix ligulifolia-Shepherdia argentea,* previously known from only two sites, was found at two new locations. Unfortunately these occurrences are heavily degraded, occur below dams, and are over-grazed. This plant association was once a common cottonwood forest of lower reaches of the Gunnison, Uncompahgre, and North Fork rivers (Baker 1984).

The Uncompahgre Plateau stands out as a unique area of the Gunnison watershed for riparian diversity. Many of the roads accessing the Plateau run along mesa tops, leaving the floodplains below intact. The lower reaches of the Plateau are important harbors of quickly disappearing low-elevation riparian ecosystems, for example, the *Populus angustifolia/Rhus trilobata* association appears to be restricted to lower reaches of the Uncompahgre Plateau (see Cottonwood Creek, Table 40, Appendix 1). Many of these lower reaches are over-grazed to some extent, but may be recoverable with different management practices. In addition, several stands dominated by *Pseudotsuga menziesii* were found along steep, north-facing drainages. These stands are similar to ones sampled in the San Miguel River watershed (Kittel and Lederer 1993), and are classified only to the Alliance level, as the understories were varied.

Willow associations thought to be limited to the northern part of the state were found in abundance in the Gunnison watershed. *Salix boothii*, or Booth's willow, plant associations were previously known only from the Yampa River basins, and were not found in the White or Colorado River watersheds (Kittel and Lederer 1993, Kittel *et al.* 1994). In the Gunnison basin, we found some of the largest *Salix boothii* willow-wetlands seen in the state (East River, Table 30, Appendix 1).

Salix monticola, Rocky Mountain willow, is a common species throughout the high, central regions of Colorado, occurs in some of the largest stands seen , and is represented by three plant associations in the Gunnison basin (Table 3).

In the sections that follow we provide a vegetative key to the plant associations and their descriptions with common and scientific names, Heritage Global and State ranks, the number of plots collected from the western slope river basins, related types described in the literature, regional and state distributions, geomorphic setting, soil characteristics, vegetative species composition, and succession/management implications.

Figure 6. Cluster Analysis dendrogram for 191 stands from the Gunnison River Basin. Distance is the degree of dissimilarity between groups. Groups are labled by plant association or alliance (see Table 1.3). * = stands were placed in different groups due to environmental site differences, or for other reasons. # = stands were classified to the Alliance level only.

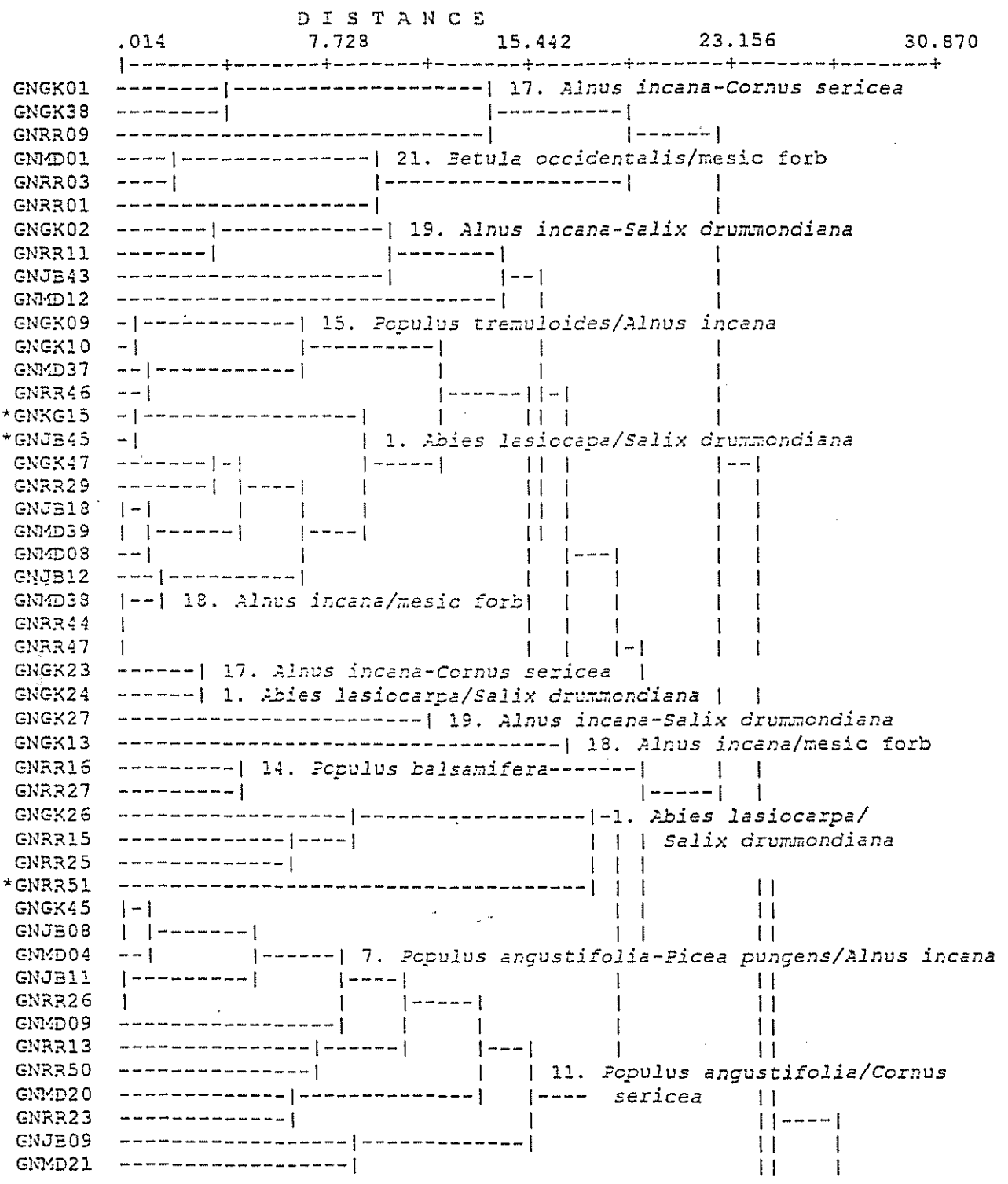
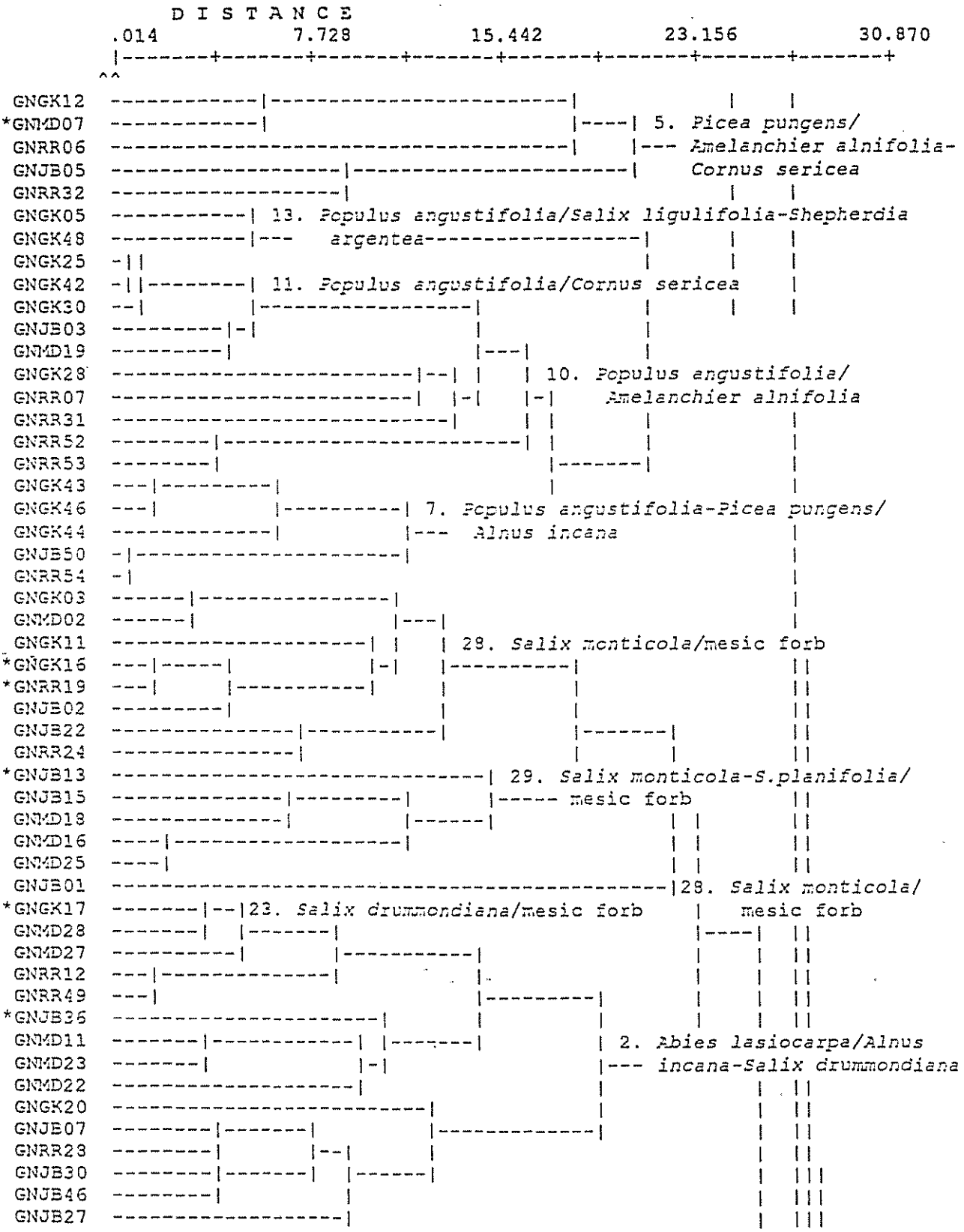


Figure 6. Continued.



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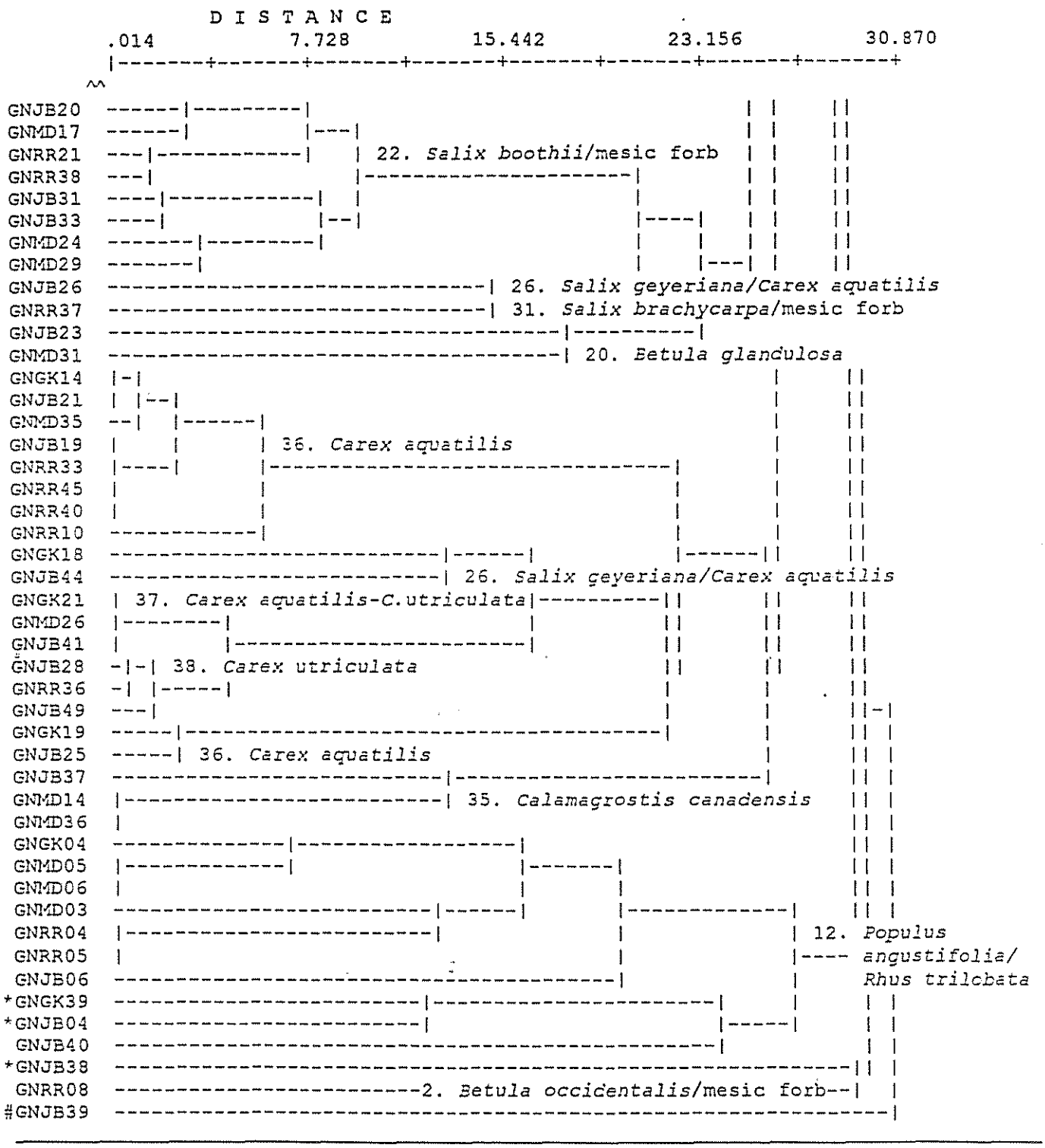

Table 3. Riparian plant associations (p.a.) and alliances of the Gunnison River Basin, Colorado.

EVERGREEN FORESTS

1. *Abies lasiocarpa/Salix drummondiana* p.a.
2. *Abies lasiocarpa/Alnus incana-Salix drummondiana* p.a.
3. *Abies lasiocarpa/Mertensia ciliata* p.a.
4. *Picea pungens/Alnus incana* p.a.
5. *Picea pungens/Amelanchier alnifolia-Cornus sericea* p.a.
6. *Pseudotsuga menziesii* Alliance

MIXED DECIDUOUS-EVERGREEN FORESTS

7. *Populus angustifolia-Picea pungens/Alnus incana* p.a.

DECIDUOUS FORESTS

8. *Populus angustifolia* Alliance
9. *Populus angustifolia/Alnus incana* p.a.
10. *Populus angustifolia/Amelanchier alnifolia* p.a.
11. *Populus angustifolia/Cornus sericea* p.a.
12. *Populus angustifolia/Rhus trilobata* p.a.
13. *Populus angustifolia/Salix ligulifolia-Shepherdia argentea* p.a.
14. *Populus balsamifera* p.a.
15. *Populus tremuloides/Alnus incana* p.a.

DECIDUOUS ALLUVIAL SHRUBLANDS

16. *Alnus incana* Alliance
17. *Alnus incana-Cornus sericea* p.a.
18. *Alnus incana*/Mesic forb p.a.
19. *Alnus incana-Salix drummondiana* p.a.
20. *Betula glandulosa* Alliance
21. *Betula occidentalis*/Mesic forb p.a.
22. *Salix boothii*/Mesic forb p.a.
23. *Salix drummondiana*/Mesic forb p.a.
24. *Salix exigua* Alliance
25. *Salix exigua*/Barren ground p.a.
26. *Salix geyeriana/Carex aquatilis* p.a.
27. *Salix monticola/Carex utriculata* p.a.
28. *Salix monticola*/Mesic forb p.a.
29. *Salix monticola-Salix planifolia*/Mesic forbs p.a.

Table 3. Continued

DECIDUOUS PEAT SHRUBLANDS

30. *Salix brachycarpa* Alliance
31. *Salix brachycarpa*/Mesic forb p.a.
32. *Salix planifolia/Caltha leptosepala* p.a.
33. *Salix planifolia/Carex aquatilis* p.a.
34. *Salix planifolia-Salix wolfii/Carex aquatilis-Calamagrostis canadensis* p.a.

HERBACEOUS PLANT ASSOCIATIONS

35. *Calamagrostis canadensis* p.a.
36. *Carex aquatilis* p.a.
37. *Carex aquatilis-Carex utriculata* p.a.
38. *Carex utriculata* p.a.

Environmental Correlations

Indirect ordination (detrended correspondense analysis, DCA) of the species composition of all plots shows the degree of similarity between plots as classified by the cluster analysis (Figure 7). In addition, the axes of variation were, in varying degrees, correlated with environmental gradients. Axis 1 of the DCA was closely correlated with elevation ($r^2 = 0.75$). Several environmental variables were loosely correlated Axis 3: stream order ($r^2 = 0.12$), elevation ($r^2 = 0.206$), soil organic matter ($r^2 = 0.08$), and Rosgen's channel type ($r^2 = 0.03$). Axis 2 represented very little variation in the data over all (eigenvalue = 0.535), due mostly to a few outlier plots.

To determine if closely aligned plant associations should be combined or left as separate types, further comparisons were made between individual plant associations and their environmental variables. We conducted tests on three groups of plant associations: four *Populus angustifolia* dominated types clustered together at the high end of Axis-1; four *Abies lasiocarpa* dominated groups overlapping left of center of Figure 7, and two *Salix* dominated types, split widely along axis 3 (Figure 7).

Elevation

The cluster analysis indicated several groups of *Populus angustifolia* (POAN) dominated plant associations, while the DCA indicated high species composition similarity among these groups (Figures 6 and 7). Close examination of the environmental data shows that the four POAN dominated plant associations occupy two distinct elevations (Figure 8). *Populus angustifolia/Rhus trilobata* occurs at the base of the Uncompahgre Plateau, on sand-bottomed, meandering streams, while *Populus angustifolia /Shepherdia argentea* is known from only from the main stem of the Uncompahgre River near Ridgeway and on the North Fork of the Gunnison River between Paonia and Sunset. *Populus angustifolia/Cornus sericea* and *Populus angustifolia/Amelanchier alnifolia* plant associations occur on more narrow montane tributary streams. Other environmental changes such as relative soil moisture or degree of disturbance may separate these associations, or they may represent successional stages, as *Amelanchier alnifolia* dominated sites are slightly drier and may be a grazing induced type (Hansen *et al.* 1989).

Subalpine fir (*Abies lasiocarpa*) dominated riparian areas are common along first and second order streams above 2600 m (8500 ft). These streams are generally steep with a very narrow obligate riparian area. Within this fairly uniform zone of subalpine fir and engelmannii spruce (*Picea engelmannii*) forests, there is a subtle but significant change in the riparian understory with increasing elevation. *Alnus incana* and *Salix drummondiana* co-dominate the banks at the lower end of the subalpine fir zone. *Alnus incana* becomes less abundant and is absent from higher stands, and at the upper end, shrubs give way to a thick herbaceous undergrowth of forbs, characterized by *Mertensia ciliata* (Figure 9).

Stream Gradient and Valley Width

Two willow species, *Salix drummondiana* and *S. geyeriana*, are difficult to tell apart in the field without catkins, yet occupy different ecological habitats. *Salix drummondiana*

dominated riparian areas occur on steep gradient streams in narrow valleys, and *S. geyeriana* dominated associations tend to occur on low-gradient streams in broad valleys (Figures 10 and 11). One rule of thumb useful in identifying the two species apart is their leaf width: *S. drummondiana* leaves are, on average, wider than 13 mm.

Height above Stream Channel and Soil Organic Matter

Height above the active stream channel is an indication of height above the water table, thus indicating a degree of wetness. *Salix boothii* associations occur in lower valleys where a majority of the moisture is derived from the channel and water table, thus *S. boothii* cannot occur more than 0.5-1.0 meters above the active channel (Figure 12). *Salix planifolia* dominated associations occur on significantly higher locations relative to the stream channel than *Salix boothii* dominated associations (Figure 12). In addition, *Salix planifolia* associations occur on deep organic soils, and *Salix boothii* occurs on coarse alluvial soils (Figure 13). This relationship can be explained by the larger context of where these two *Salix* spp. associations occur. *Salix planifolia* occurs in swales and at the bottom of saturated snow-fields in subalpine valleys that keep the basin floor saturated. Thus moisture is not limited to the immediate stream channel environment. Peat soils often develop in these basins, providing a deep, rich, stable substrate. *Salix boothii* occurs along montane streams with well drained alluvial soils, and appear to be limited to the soil saturation zone near the stream channel.

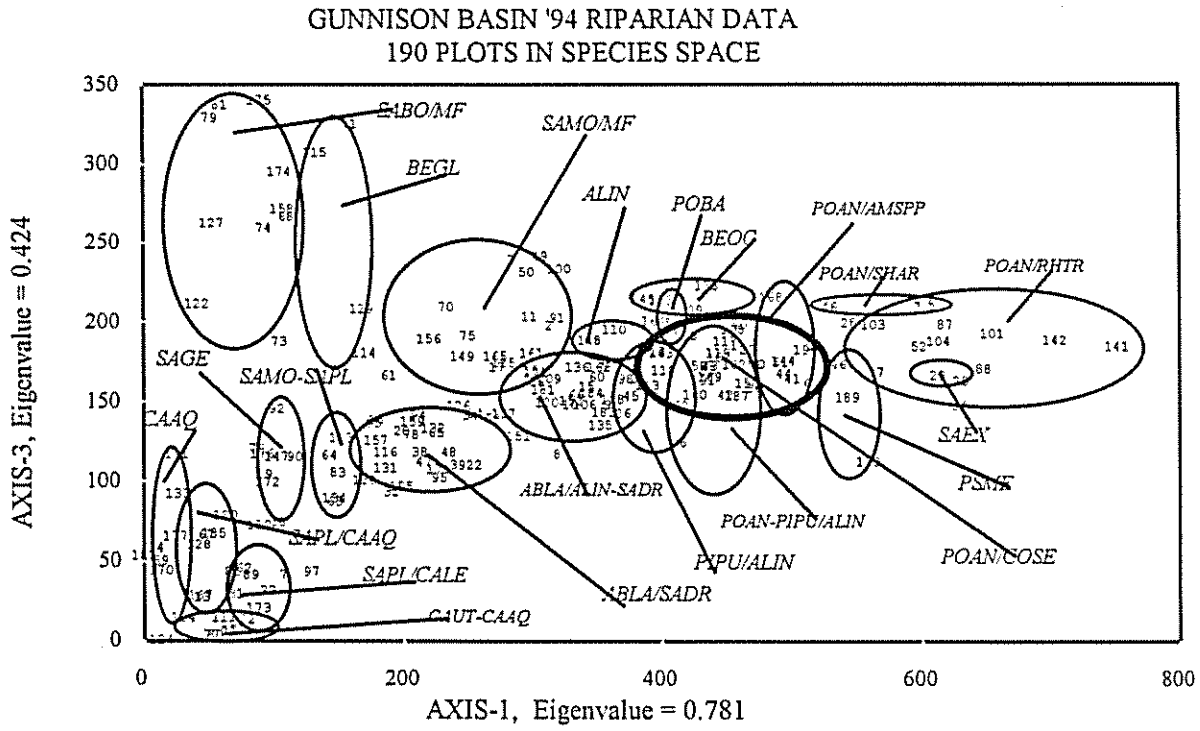

Figure 7. Detrended Correspondence Analysis of 190 plots in species space. Groups indicated are plant associations based on the Cluster Analysis results. See text for acronyms.

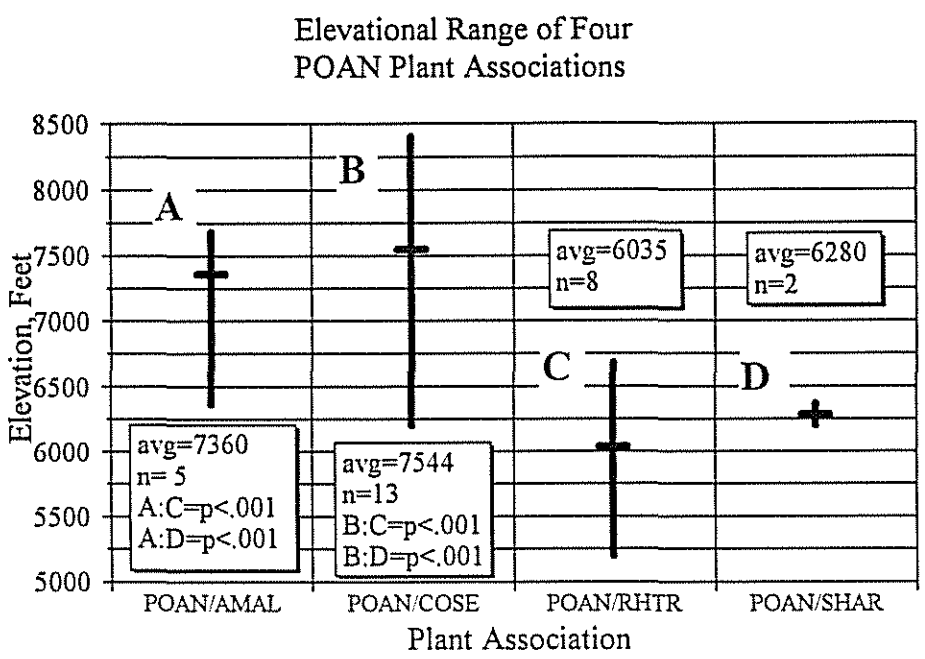

Figure 8. Range and mean elevation of four *Populus angustifolia* dominated plant associations. A) *Populus angustifolia/Amelancheir alinfolia*, B) *Populus angustifolia/Cornus sericea*, C) *Populus angustifolia/Rhus trilobata*, and D) *Populus angustifolia/Shepherdia argentea*. Significance levels (p) are for a one-tailed student-t test of means between plant associations (e.g. between A and C) (n=number of plots, avg=average).

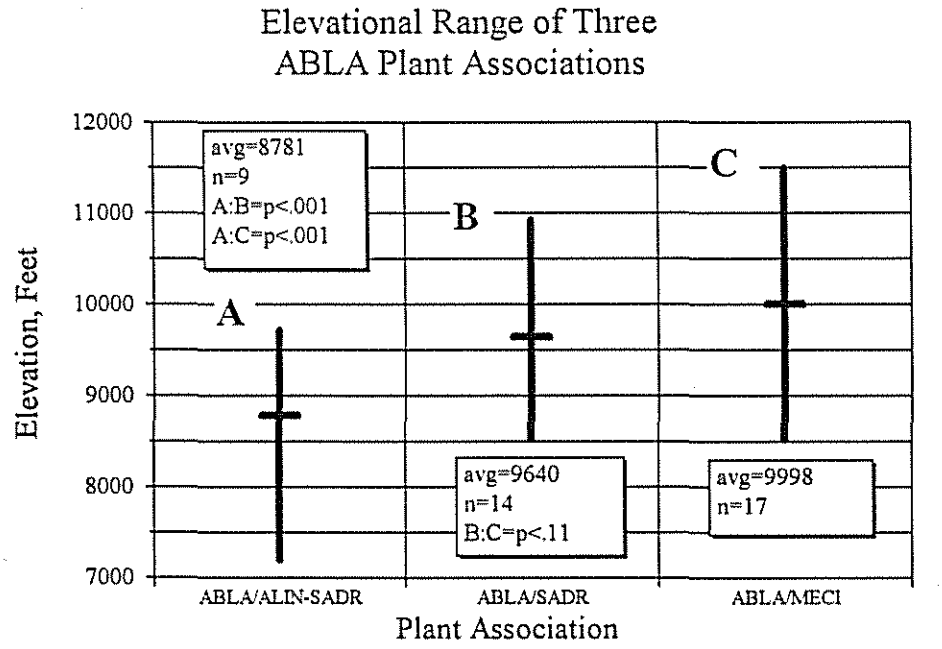

Figure 9. Range and mean elevation of three *Abies lasiocarpa* dominated plant associations. A) *Abies lasiocarpa/Alnus incana-Salix drummondiana*, B) *Abies lasiocarpa/Salix drummondiana*, C) *Abies lasiocarpa/Mertensia ciliata*. Significance levels are one-tailed Student t-test of means between associations (n=number of plots, avg=average).

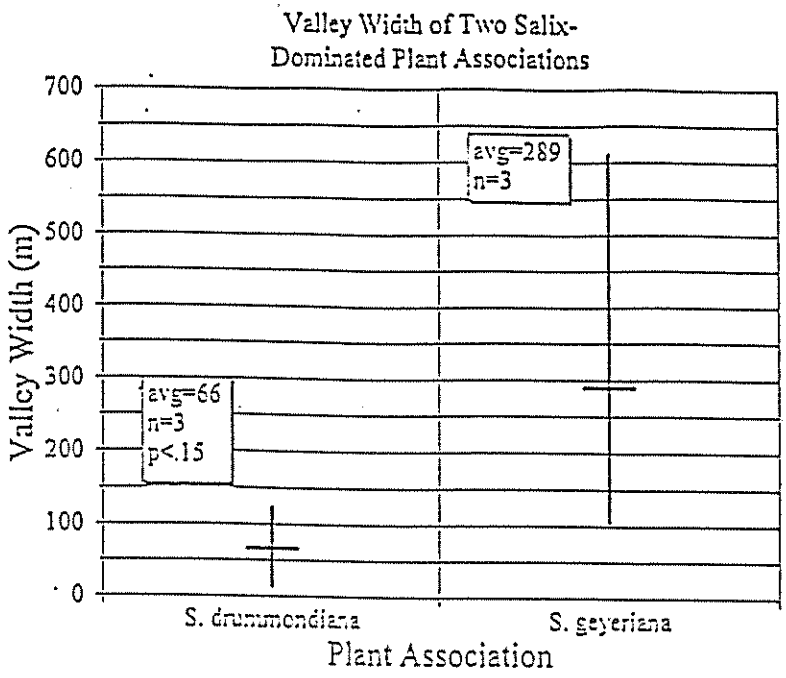

Figure 10. Range and mean valley width of *Salix drummondiana* and *S. geyeriana* dominated plant assiociations. Significance levels (p) are for one-tailed student t-test of means between plant associations (n=number of plots, avg=average).

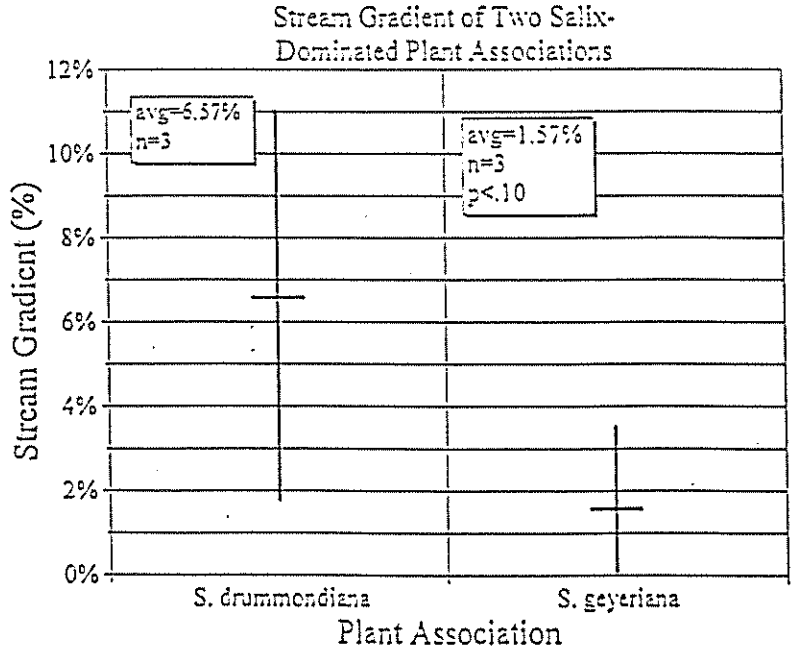

Figure 11. Range and mean stream gradient (%) of *Salix drummondiana* and *S. geyeriana* dominated plant assiociations. Significance levels (p) are for one-tailed student t-test of means between plant associations (n=number of plots, avg=average).

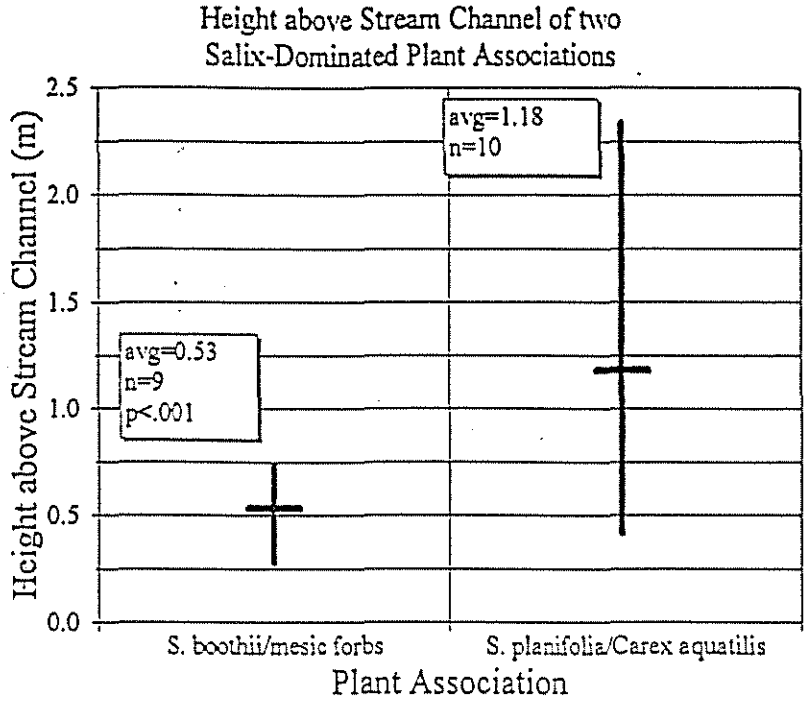

Figure 12. Range and mean height above the active stream channel of two *Salix* dominated plant assiociations. Significance levels (p) are for one-tailed student t-test of means between plant associations (n=number of plots, avg=average).

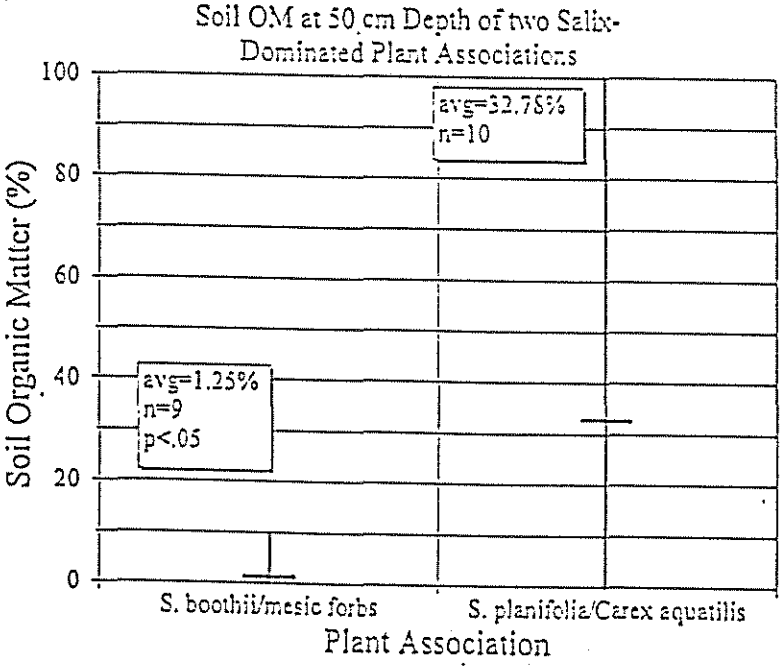

Figure 13. Range and mean percent soil organic matter at 50 cm depth of two *Salix* dominated plant assiociations. Significance levels (p) are for one-tailed student t-test of means between plant associations (n=number of plots, avg=average).

KEY TO THE RIPARIAN PLANT ASSOCIATIONS OF THE GUNNISON RIVER BASIN, COLORADO

Key to Groups:

1. Tree overstory present with at least 20% cover 2

1. Tree overstory not present, or if present, <20% cover in the reach 4

2. Coniferous trees dominate the overstory ..... **Group A**

2. Deciduous trees dominate the overstory; *Picea pungens* or *Picea engelmannii* may be present 3

3. *Picea pungens* and *Populus angustifolia* present ..... **Group B**

3. *Populus angustifolia* dominates the overstory, *Picea pungens* absent ..... **Group C**

4. Shrubs dominate the overstory 5

4. Shrubs do not dominate the overstory; plant association dominated by herbaceous species ..... **Group F**

5. *Salix* spp. dominate the overstory with at least 30% cover ..... **Group D**

5. Other shrubs dominate the overstory (*Salix* spp. may be present). ..... **Group E**

Group A. Evergreen Forests

1. *Picea pungens* or *Pseudotsuga menziesii* dominate the overstory 2

1. *Abies lasiocarpa* and/or *Picea engelmannii* dominate the overstory 4

2. *Pseudotsuga menziesii* dominates the tree canopy ..... ***Pseudotsuga menziesii*** **Alliance**

2. *Picea pungens* dominated the overstory 3

3. *Alnus incana* lines the stream bank ..... ***Picea pungens/Alnus incana*** **p.a.**

3. *Amelanchier utahensis or Cornus sericea* forms an open shrub understory, *Alnus incana* may be present in small amounts. ..... ***Picea pungens/Amelanchier alnifolia-Cornus sericea*** **p.a.**

4. *Cardamine cordifolia, Mertensia ciliata, Senecio triangularis* or other mesic forbs contribute at least 20% cover individually or together; shrub cover is usually less than 20% ..... ***Abies lasiocarpa/Mertensia ciliata*** **p.a.**

4. A well-developed shrub understory of *Alnus incana*, *Salix drummondiana*, or *Lonicera involucrata* is present, often with at least 20% cover individually or together. 5

5. *Alnus incana* is dominant along stream edge ..... ***Abies lasiocarpa/Alnus incana-Salix drummondiana*** **p.a.**

5. *Salix drummondiana* is the dominate shrub, *Alnus incana* may be present, but not dominant ..... ***Abies lasiocarpa/Salix drummondiana*** **p.a.**

Group B. Mixed Deciduous-Evergreen Forests

1. Populus angustifolia dominates the overstory; *Picea pungens* is present; *Alnus incana* dominates the shrub layer near the stream channel . . . . . ***Populus angustifolia-Picea pungens/Alnus incana*** **p.a.**

Group C. Deciduous Dominated Forests

1. *Populus angustifolia* the dominant tree canopy component (>20%) 2

1. *Populus balsamifera* or *P. tremuloides* dominate the overstory 6

2. *Alnus incana*, *Amelanchier* spp., or *Cornus sericea* dominate the shrub layer 3

2. *Rhus trilobata* or *Shepherdia argentea* present with at least 20% cover 5

3. *Alnus incana* dominates the understory, thickly lining stream banks, *Cornus sericea* always present, few other shrubs present . . . . . ***Populus angustifolia/Cornus sericea*** **p.a.**

3. *Alnus incana* present in smaller amounts or absent, *Cornus sericea* or *Amelanchier utahensis* form an open shrub canopy on the floodplain 4

4. *Cornus sericea* dominates the shrub layer . . . . . ***Populus angustifolia/Cornus sericea*** **p.a.**

4. *Amelanchier* spp. forms a scattered, open shrub layer, sites drier than above . . . . . ***Populus angustifolia/Amelanchier alnifolia*** **p.a.**

5. *Rhus trilobata* dominates the shrub understory . . . ***Populus angustifolia/Rhus trilobata*** **p.a.**

5. *Shepherdia argentea* present, often as widely scattered shrubs . . . . . ***Populus angustifolia/Salix ligulifolia-Shepherdia argentea*** **p.a.**

6. *Populus balsamifera* dominates the upper canopy, *Populus angustifolia* may be present with up to 10% cover . . . . . ***Populus balsamifera/Alnus incana*** **p.a.**

6. *Populus tremuloides* the dominant tree, *Alnus incana* forms a scattered to dense understory . . . . . ***Populus tremuloides/Alnus incana*** **p.a.**

Group D. Willow Dominated Shrublands

1. Willows of low stature, 0.5-1.5 m tall, upper subalpine and alpine environments 2

1. Willows of tall stature, 1.5-3 m or more tall, lower subalpine, montane, or foothill environments 4

2. *Salix brachycarpa* dominates the willow cover, occupying drier habitats than the next . . . . . ***Salix brachycarpa/*mesic forb p.a.**

2. *Salix planifolia* dominant, *Salix wolfii* may be present in near equal amounts 3

3. Herbaceous undergrowth is dominated by many forbs, *Caltha leptosepala* usually the most abundant species, >10% . . . . . ***Salix planifolia/Caltha leptosepala* p.a.**

3. Herbaceous undergrowth dominated by graminoides, *Carex aquatilis* usually the most abundant species, >20% . . . . . ***Salix planifolia/Carex aquatilis* p.a.**

4. *Salix exigua* is present (10-90%) cover, usually a narrow band along stream margins and cobble bars, with little to no herbaceous undergrowth. Montane and foothills environments. . . . . ***Salix exigua/*barren p.a.**

4. Other tall *Salix* spp. are dominant 5

5. *Salix geyeriana* or *Salix drummondiana* dominant. 6

5. *Salix boothii* or *Salix monticola* dominant 7

6. *Salix drummondiana* dominant with 20-80% cover, and a rich forb layer of 30-40% . . . . . ***Salix.drummondiana/*mesic forb p.a**

6. *Salix geyeriana* dominant with at least 20% cover, and *Carex aquatilis* at least 25% cover in the understory . . . . . ***Salix geyeriana/Carex aquatilis* p.a.**

7. *Salix boothii* dominant with at least 20-30% cover . . . . . ***Salix boothii/*mesic forb p.a.**

7. *Salix monticola* dominates the shrub canopy with at least 20-30% cover, *Salix planifolia* may be present with up to 30% cover 8

8. Forbs dominate the understory 9

9. *Salix planifolia* co-dominant shrub . . . . . ***Salix monticola-Salix planifolia/*Mesic Forbs p.a.**

9. *Salix planifolia* not present ..... ***Salix monticola*/Mesic Forb p.a.**

8. Graminoids dominate, *Carex utriculata* abundant in the understory .....
..... ***Salix monticola/Carex utriculata* p.a.**

Group E. Non-Willow Dominated Shrublands

1. *Betula occidentalis* dominates the shrub canopy .....
..... ***Betula occidentalis*/Mesic Forb p.a.**

1. Alnus incana contributes at least 20% cover 2

2. Tall mesic forbs dominate the understory, total forb cover at least 30%, other shrubs, if present, are less than 10% cover ..... ***Alnus incana*/mesic forb p.a.**

2. *Cornus sericea* or *Salix drummondiana* co-dominant, at least 20% cover, can be as high as 60% cover 3

3. *Cornus sericea* co-dominant ..... ***Alnus incana-Cornus sericea* p.a.**

3. *Salix drummondiana* abundant and co-dominant in the tall shrub layer .....
..... ***Alnus incana-Salix drummondiana* p.a.**

Group F. Herbaceous Plant Associations

1. *Calamagrostis canadensis* dominates the herbaceous growth, *Carex aquatilis*, if present, has <10% cover ..... ***Calamagrostis canadensis* p.a.**

1. *Carex aquatilis* and/or *Carex utriculata* dominant or co-dominant 2

2. *Carex aquatilis* contributes at least 50% cover, if *Carex utriculata* present, it contributes not more than one third of the total cover ..... ***Carex aquatilis* p.a.**

2. *Carex utriculata* present with at least 50% cover 3

3. *Carex aquatilis* contributes equal cover ..... ***Carex aquatilis-Carex utriculata* p.a.**

3. *Carex utriculata* dominant, *Carex aquatilis*, if present, contributes not more than one third total cover ..... ***Carex utriculata* p.a.**

UNESCO: I.A.9.c. EVERGREEN FOREST WITH NON-GIANT CONICAL CROWNED TREES

COWARDIN: PALUSTRINE SYSTEM-FORESTED, NEEDLE-LEAVED EVERGREEN

Abies lasiocarpa Alliance

Subalpine fir-Engelman spruce/Thin-leaf Alder-Drummond's willow (*Abies lasiocarpa /Alnus incana-Salix drummondiana*) Plant Association
G4S4 (ABLA/ALIN-SADR)
Gunnison River Basin--11 plots (94GK24, 94GK26, 94GK47, 94JB18, 94JB48, 94MD07, 94MD08, 94MD39, 94RR15, 94RR25, 94RR29)
Colorado River Basin--1 plot (92NL31)
Other occurrences sampled: San Miguel River Basin--2 plots, Yampa River Basin--6 plots.

Related types: *Abies lasiocarpa-Picea engelmannii/Alnus incana* ssp. *tenuifolia-Lonicera involucrata-Salix drummondiana* (Baker 1989), *Abies lasiocarpa/Alnus incana* ssp. *tenuifolia-Salix drummondiana* (Reid and Bourgeron 1991).

Distribution: This is a common plant association that occurs from western Wyoming and northern Utah (Youngblood *et al.* 1985 and Padgett *et al.* 1989) to the San Juan Mountains in Colorado (Baker 1989).

Elevation: 2200-10300 m (7200-10,280 ft).

Geomorphology: This association typically occurs along narrow stream benches and channel banks along small, swift-flowing streams. It usually occurs within 5 to 6 meters of the channel edge, and is rarely more than half a meter above the channel elevation. It is generally confined to narrow V-shaped valleys (30-60 m wide).

Rosgen's Channel Type: This association is common along steep streams (A2 and A4) and can occur on narrow, but less steep, stream reaches (B1, B2, and B3).

Vegetation: *Picea engelmannii* dominates the upper canopy (10-40%) with *Abies lasiocarpa* usually present (0-50%), sometimes as seedlings and saplings (0-20%). Other tree species occasionally present are *Picea pungens* (0-10%), *Populus tremuloides* (0-1%), and *Pinus contorta* (0-10%). *Abies concolor* (10%) can be abundant along reachs in the southwestern part of the Gunnison River basin. A dense mid-canopy of *Alnus incana* is always present (10-90%) with some *Salix drummondiana* (0-20%), occurring as a narrow strip bordering the stream channel. *Lonicera involucrata* is usually present in smaller amounts (0-5%). The herbaceous undergrowth is usually rich in forb species, with an overall cover between 20 and 60%.

Characteristic forb species include *Mertensia ciliata, Cardamine cordifolia, Heracleum lanatum,* and *Geum macrophyllum*. Graminoid cover is minimal.

Soil: Soils characteristic of this plant association are shallow, dark-colored loamy sands and sandy clay loams, with high skeletal fraction. Three stands sampled occurred on deeper sandy loams with signs of mottling.

Adjacent riparian vegetation: This plant association generally does not form mosaics, and is commonly the only riparian association along a stream reach. Adjacent riparian associations up or downstream may include *Alnus* shrublands or mesic forbs dominating the understory.

Adjacent upland vegetation: *Picea engelmannii, Picea pungens,* and *Populus tremuloides* forests occur on adjacent hillsides, usually intergrading with the riparian canopy..

Succession/Management: This appears to be a late-seral, or at least a long-lived riparian plant association. Padgett *et al.* (1989) suggest this type will eventually become dominated by *Abies lasiocarpa* in moist settings. While *Picea engelmannii*, *Abies lasiocarpa,* and *A. concolor* are not obligate riparian species, many first order streams above 2450 m (8000 ft) cut through spruce-fir forests, where the overstory canopy is dense, and tall mesic forbs are the only riparian species lining the stream. With a more open forest canopy, shrubs such as *Alnus* or *Salix drummondiana* may be present. Stands with high cover of *Salix drummondiana* may be transitional in elevation, as *Alnus incana* appears to drop out with increasing elevation, and *Salix drummondiana* becomes abundant (see Figure 9 in section 1).

Table 4. Cover Class Codes* for Characteristic Plant Species in the *Abies lasiocarpa/Alnus incana - Salix drummondiana* Plant Association.

Plots (94___)	GK24	GK26	GK47	JB18	JB48	MD07	MD08	MD39	RR15	RR25	RR29
Occurrence Rank**	B	B	A	B	A	B	B	B	A	A	B
TREES											
Abies concolor --mature trees	-	-	-	-	10	-	-	-	-	-	-
Abies concolor --saplings	-	-	-	-	3	-	-	-	-	-	-
Abies lasiocarpa --saplings	-	1	-	-	3	-	-	-	20	20	-
Abies lasiocarpa --mature trees	10	25	10	20	50	-	10	-	-	20	-
Picea engelmannii --saplings	-	1	3	1	-	-	-	20	10	-	-
Picea engelmannii --seedlings	-	1	3	1	-	-	-	10	1	-	-
Picea engelmannii --mature trees	30	3	3	30	-	70	40	40	10	-	20
Picea pungens --mature trees	-	-	10	-	-	-	-	-	-	-	10
Pinus contorta --mature trees	-	-	-	-	-	-	-	3	-	-	10
SHRUBS											
Acer glabrum	20	3	3	-	10	-	-	-	-	3	-
Alnus incana ssp. tenuifolia	40	20	60	50	10	30	70	50	40	30	50
Cornus sericea	50	30	-	-	10	-	-	-	10	20	-
Lonicera involucrata	3	3	10	10	3	10	10	3	10	10	3
Prunus virginiana var. melanocarpa	-	-	-	-	20	-	-	-	-	10	-
Salix drummondiana	20	3	-	20	-	-	10	20	20	-	3
GRAMINOIDES											
Carex sp.	-	3	1	1	-	-	-	1	-	3	-
Poa palustris	1	-	-	-	-	-	-	3	-	-	-
Poa pratensis	1	1	-	1	-	3	-	-	-	-	-
FORBS											
Actaea rubra	3	1	-	-	-	10	-	1	1	1	-
Cardamine cordifolia	-	3	3	-	-	-	-	3	3	-	-
Conioselinum scopulorum	3	-	-	1	-	-	-	1	3	-	1
Fragaria virginiana	1	-	-	1	-	-	-	1	-	-	1
Galium boreale	1	-	1	-	-	3	3	-	-	-	-
Galium trifidum ssp. subbiflorum	10	1	-	-	1	-	-	-	3	3	-
Geranium richardsonii	1	1	-	-	3	-	3	3	1	3	-
Geum macrophyllum	3	3	-	-	-	-	1	1	1	-	-
Heracleum lanatum	3	3	-	-	-	-	3	1	10	10	3
Maianthemum stellatum	1	-	-	3	-	10	-	-	-	3	-
Mertensia ciliata	1	10	-	3	-	-	10	3	10	-	-
Mitella pentandra	3	10	-	-	-	-	1	1	-	-	-
Orthilia secunda	-	-	1	1	1	-	-	1	-	-	-
Osmorhiza depauperata	10	3	-	-	-	-	-	3	-	3	-
Oxypolis fendleri	-	-	-	3	3	-	1	3	-	-	1
Pyrola asarifolia	3	3	-	-	-	-	-	-	1	3	-
Streptopus amplexifolius var. chalazatus	-	-	1	-	1	-	3	-	1	-	-
Taraxacum officinale	1	-	-	1	1	3	-	1	-	-	-
Thalictrum fendleri	1	-	-	-	10	1	-	-	-	1	1
Urtica dioica ssp. gracilis	1	1	-	-	-	10	-	-	3	-	-
Viola canadensis	3	1	-	-	-	3	1	1	-	1	-

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%.
A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered.
See page 15 of the Introduction for complete definitions.

Subalpine fir/Drummond's willow (*Abies lasiocarpa/Salix drummondiana*) Plant Association G3G4 S3S4
Gunnison River Basin--15 plots (94GK17, 94GK20, 94GK35, 94JB07, 94JB27, 94JB30, 94JB36, 94JB46, 94MD11, 94MD22, 94RR12, 94RR20, 94RR28, 94RR49)

Related Types: This appears to be similar to the higher elevation stands mentioned in Baker's description of *Abies lasiocarpa-Picea engelmannii/Alnus incana-Lonicera involucrata-Salix drummondiana* (Baker 1989), where *Alnus incana* drops out, except in the Gunnison basin, where stands have higher *Salix drummondiana* cover.

Distribution: This association is common along small, first-order forested streams throughout the subalpine zone of the Southern Rocky Mountains.

Elevation: 2560-3320 m (8400-10,920 ft).

Geomorphology: This phase occurs as a narrow strip along stream banks, usually within 2.5 meters of channel edge. Streams reaches are steep (2-25% gradient) in narrow, V-shaped valleys (8-150 m wide).

Rosgen's Channel Type: Typically this phase occurs on narrow and steep (A2 and A3) channel reaches. It can also occur in wider valleys along less steep reaches, ranging from bedrock to gravel bottomed channels (B1, B2, B3, and B4). One site sampled (plot 94JB46) occurred along a braided (D2) stream.

Vegetation: This phase has a dense overstory of several age-classes of *Abies lasiocarpa* and *Picea engelmannii*, creating a combined overstory of 30-70% cover. A narrow but dense strip of shrubs consists of *Salix drummondiana* (3-90%), *Salix monticola* (0-40%), *Lonicera involucrata* (0-5%), and occasionally *Salix planifolia* (1-30%) or *Ribes* species (1%). Herbaceous undergrowth is characterized by high forb cover. Common species are *Mertensia ciliata* (1-10%), *Senecio triangularis* (1-10%), and *Mitella pentandra* (1-5%). Total forb cover ranges from 10 to 40%. Graminoids are less important, ranging in cover from 1-20%, e.g. *Calamagrostis canadensis* (10%) and *Carex aquatilis* (10%) can be present.

Four stands sampled (94JB07, 94MD11, 94MD22, 94MD23) in this group had *Alnus incana* present in significant amounts (10-30%). These stands appear to represent a transition between higher elevation occurrences, where *Salix drummondiana* thickly dominates the shrub canopy, compared to stands at lower elevations, where *Alnus incana* becomes more abundant. For this reason the stands with high *Salix drummondiana* are considered a phase of the *Abies lasiocarpa/Alnus incana-Salix drummondiana* plant association (see Figure 9, Section 1).

In another stand (plot 94GK35), forb cover was relatively high (40%) in addition to over 30% cover *Salix drummondiana.* This stand was originally grouped with the *Abies lasiocarpa/Mertensia ciliata* community (Figure 6), but due to high shrub cover, it was placed here.

Soils: Soils are typically shallow (< 1 m) sandy loams to clay loams, with high organic content in the top 10 cm. Two profiles sampled (94GK20 and 94MD22) had thick A horizons (44-75 cm) with abundant mottling.

Adjacent Riparian Vegetation: This plant association generally does not form mosaics, and is commonly the only riparian association along a stream reach. Adjacent riparian associations up or downstream may include *Alnus* shrublands or mesic forbs dominating the understory.

Adjacent Upslope Vegetation: *Abies lasiocarpa-Picea engelmannii* forests occur on adjacent hillsides, usually intergrading with the riparian canopy.

Succession/Management: Dense, forest canopy and thick *Salix drummondiana* cover, along with a thick undergrowth of forbs and grasses suggests that this plant association is late-seral. Stands of *Abies lasiocarpa* with thick *Alnus incana* in the understory occur at lower elevations (Fig XX). High forb cover within the *Abies lasiocarpa/Alnus incana-Salix drummondiana* type suggests that with time and further upper canopy closure, it may shift to an *Abies lasiocarpa/Mertensia ciliata* plant association. Stands with high cover of both *Alnus incana* and *Salix drummondiana* appear to be transitional in elevation. In Montana it has been suggested that stands with *Alnus* may be replaced by *Salix* stands or conifer stands if sites remain undisturbed for sufficient time (Hansen *et al.* 1988).

Table 5. Cover Class Codes* for Characteristic Plant Species in the *Abies lasiocarpa/Salix drummondiana* Plant Association.

Plots (94____)	GK17	GK20	GK35	JB07	JB27	JB30	JB36	JB46	MD11	MD22	RR12	RR20	RR28	RR49
Occurrence Ranks**	B	B	C	B	A	A	B	B	B	B	B	B	B	B
TREES														
Abies lasiocarpa--saplings	-	-	3	-	-	-	1	-	-	-	3	-	-	10
Abies lasiocarpa--trees	-	-	10	-	-	-	-	-	1	10	-	3	-	-
Picea engelmannii--saplings	20	30	10	-	10	10	-	-	-	-	10	10	3	3
Picea engelmannii--seedlings	3	10	1	1	1	10	3	-	-	-	1	-	-	1
Picea engelmannii--trees	10	10	50	40	20	30	10	20	10	10	-	30	20	-
Picea pungens--trees	-	-	-	-	-	-	-	-	-	-	-	-	-	1
SHRUBS														
Alnus incana ssp. tenuifolia	-	-	-	10	-	-	-	-	20	40	-	-	1	-
Lonicera involucrata	1	3	3	-	-	-	10	-	10	-	-	1	1	3
Ribes inerme	-	-	1	-	30	-	-	-	10	-	-	-	1	-
Salix drummondiana	90	20	30	20	20	40	50	30	60	40	50	20	30	60
Salix monticola	20	10	-	10	30	10	3	40	-	-	3	3	10	-
Salix planifolia ssp. planifolia	-	1	-	-	-	20	-	30	-	-	-	3	-	-
Salix wolfii	-	-	-	-	-	-	-	-	-	-	-	10	-	-
GRAMINOIDS														
Calamagrostis canadensis	-	10	-	-	10	3	10	-	-	-	-	-	1	-
Carex aquatilis	-	10	-	-	-	-	1	-	-	-	-	-	-	-
Carex microptera	-	-	-	-	-	-	-	-	3	10	-	-	-	-
Carex rostrata	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex spp.	-	-	10	3	3	1	3	1	-	3	1	1	3	-
Luzula parviflora	-	3	-	-	-	1	1	-	-	-	1	1	1	-
FORBS														
Achillea millefolium var. apicola	-	-	1	-	1	1	1	1	1	1	3	1	1	-
Arnica cordifolia	-	-	1	-	-	-	3	-	-	-	-	10	1	-
Cardamine cordifolia	-	10	10	-	-	3	1	-	-	1	-	10	1	-
Conioselinum scopulorum	1	-	3	-	1	-	-	-	-	-	3	1	-	-
Epilobium angustifolium	1	-	3	-	1	1	3	-	3	3	-	-	1	-
Fragaria virginiana	-	-	-	-	-	3	1	3	-	3	-	3	3	-
Geranium richardsonii	1	-	1	1	-	-	3	1	10	10	3	-	1	1
Geum macrophyllum	1	-	-	-	1	-	1	3	3	-	1	-	-	-
Heracleum lanatum	3	-	-	10	-	-	10	-	10	20	-	-	1	-
Ligusticum porteri	-	-	-	-	-	-	1	10	-	10	-	-	-	-
Maianthemum stellatum	1	-	-	3	-	-	-	-	-	3	-	-	-	-
Mertensia ciliata	1	-	3	-	20	20	20	1	1	10	-	3	1	-
Oxypolis fendleri	1	3	10	1	-	10	1	1	3	1	3	10	3	-
Saxifraga odontoloma	-	-	3	-	-	3	10	1	-	-	1	3	1	-
Senecio triangularis	-	1	3	-	-	10	30	10	3	10	-	1	-	-
Taraxacum officinale	1	-	1	3	1	3	1	10	-	10	1	1	3	3
Thalictrum fendleri	-	-	3	-	3	-	-	-	1	3	-	-	1	-
HORSETAILS														
Equisetum arvense	-	10	-	10	-	-	10	10	3	10	1	1	3	-

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%.
A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered.
See page 15 of the Introduction for complete definitions.

Subalpine fir/Bluebells (*Abies lasiocarpa/Mertensia ciliata*) Plant Association
G4S4 (ABLA/MECI)
Gunnison River Basin--18 plots (94GK08, 94GK22, 94GK32, 94GK40, 94GK41, 94GK49, 94GK50, 94JB10, 94JB17, 94JB35, 94JB47, 94MD32, 94MD33, 94MD34, 94RR14, 94RR18, 94RR42)
White River Basin--1 plot (92NL65)
Colorado River Basin--8 plots (93SS01, 93SS11, 93SS20, 93SS51, 93GK36, 93GK44, 93GK48, 93DR20)

Related Types: *Picea engelmannii-Abies lasiocarpa/Cardamine cordifolia-Mertensia ciliata-Senecio triangularis* (Baker 1989); Conifer/*Aconitum columbianum* (Padgett *et al.* 1989); *Abies lasiocarpa-Picea engelmannii/Mertensia ciliata* (Johnston 1987). Very similar to *Picea* spp./*Galium triflorum* (Youngblood *et al.* 1985), but stands sampled in Colorado do not include *Picea pungens* dominated overstories. Also similar to *Picea engelmannii-Abies lasiocarpa/Senecio triangularis* (Hess 1981, Komarkova 1986), however these occur on steep, wet hillsides, rather than in valley bottoms adjacent to streams, and often do not include *Cardamine cordifolia* or *Mertensia ciliata* in the undergrowth.

Distribution: This plant association is known from northwestern New Mexico (DeVelice *et al.* 1985), and throughout Colorado (Baker 1984, Boyce 1977, Dix and Richards 1976, Peet 1981, as cited in Baker 1989, Steen and Dix 1974, Alexander 1981, DeVelice *et al.* 1985, and Powell 1985, as cited in Johnston 1987). It is a common riparian community of first- and second-order streams in the subalpine zone of the Southern Rocky Mountains.

Elevation: 2740-3500 m (9000-11,489 ft).

Geomorphology: This plant association occurs in narrow (10-100 m wide) valleys on narrow steep streams (2% to 30% gradient). This association is limited to the immediate stream channel edge and overflow areas, and is usually within 4 meters from the channel edge, and not much more than 0.4 meters above channel bankfull elevation.

Rosgen's Channel Type: Typically this association occurs along steep (A2, A3, and A4) stream reaches, but can also be found along less steep reaches (B2, B3, and B4).

Vegetation: In this plant association, *Picea engelmannii* and *Abies lasiocarpa* provide a dense overstory (20-70%) immediately bordering and often overhanging the stream. A dense, rich forb layer along the stream, with little to no shrub cover is a good diagnostic character. Forbs typically in high abundance are *Cardamine cordifolia, Mertensia ciliata, Senecio triangularis*, and *Saxifraga odontoloma*, with a total cover of 40-80%.

Soil: Soils range from a thin layer of skeletal sandy loams to somewhat deep, mottled loamy sands. Consistent to all profiles is a deep dark brown color and high organic content. Total soil depth is never more that about 2 meters, and is typically less than 1 m.

Adjacent riparian vegetation: This association commonly occurs by itself along the stream, and does not form a mosaic, up or downstream areas may have adjacent *Alnus incana* shrublands, or *Abies lasiocarpa-Picea engelmannii* forests with different understories.

Adjacent upland vegetation: *Abies lasiocarpa-Picea engelmannii* and *Populus tremuloides* forests occur on adjacent hill slopes.

Succession/management: Padgett *et al.* (1989) describe this type as seral to an *Abies lasiocarpa* dominated site, and state that dominance by *Populus tremuloides, Pseudotsuga menziesii* and/or *Pinus contorta* represent earlier seral stages of this type. Stands 94GK08 and 94RR14 may represent transitional stage to the forb-dominated undergrowth community.

Table 6. Cover Class Codes* for Characteristic Plant Species in the *Abies lasiocarpa/Mertensia ciliata* Plant Association.

Plots (94____)	GK08	GK22	GK32	GK40	GK41	GK49	GK50	JB10	JB17	JB35	JB47	MD32	MD33	MD34	RR14	RR18	RR42
Occurrence Ranks**	B	B	A	B	B	C	B	A	A	C	A	B	B	B	B	B	A
TREES																	
Abies lasiocarpa--mature trees	10	20	-	3	10	3	20	10	3	-	20	-	-	-	10	-	3
Abies lasiocarpa--saplings	20	-	3	3	-	-	-	10	-	3	10	-	-	-	10	-	-
Abies lasiocarpa--seedlings	10	-	3	3	-	1	1	1	-	3	3	-	-	3	3	1	-
Picea engelmannii--saplings	-	-	20	10	-	3	-	3	-	10	3	30	20	10	-	10	3
Picea engelmannii--seedlings	-	-	10	-	3	3	1	3	1	10	-	1	10	1	3	1	-
Picea engelmannii--mature trees	40	20	20	30	30	20	10	70	20	3	-	20	20	50	30	30	40
Picea pungens--saplings	10	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
Picea pungens--seedlings	10	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
SHRUBS																	
Alnus incana ssp. tenuifolia	20	-	-	-	-	10	-	-	-	-	-	-	-	-	20	-	-
Lonicera involucrata	-	1	-	1	3	-	3	3	-	-	-	-	10	10	3	-	1
Ribes coloradense	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Ribes inerme	-	-	-	10	1	1	1	-	-	-	-	-	3	1	-	-	-
Ribes montigenum	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Salix drummondiana	-	-	-	-	-	-	-	10	3	-	-	-	-	3	3	-	-
Vaccinium myrtillus	-	-	1	-	20	-	-	-	-	1	3	-	-	-	-	-	-
GRAMINOIDS																	
Calamagrostis canadensis	-	-	-	3	-	-	-	-	10	1	10	10	3	3	-	-	-
Carex aquatilis	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex sp.	-	-	-	-	-	-	-	1	1	20	1	3	1	10	-	-	1
Luzula parviflora	-	1	-	-	-	-	-	1	3	10	-	-	1	1	-	-	-
FORBS																	
Achillea millefolium	-	-	-	1	-	-	-	1	1	-	-	1	1	1	1	1	-
Aconitum columbianum	-	-	-	-	-	-	-	-	-	3	-	3	10	10	-	1	3
Arnica cordifolia	1	-	1	-	3	-	-	-	3	-	3	10	1	10	3	-	1
Arnica mollis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-
Aster sp.	-	-	3	-	-	-	-	-	-	1	3	10	1	1	-	-	-
Caltha leptosepala	-	-	10	-	-	-	-	-	-	10	-	10	10	3	1	1	-
Cardamine cordifolia	3	30	30	20	20	40	50	-	10	10	10	1	-	10	1	10	20
Corydalis caseana ssp. brandegii	10	30	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Delphinium barbeyi	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
Epilobium sp.	-	1	1	3	1	10	1	1	1	1	1	-	3	1	-	1	-
Geranium richardsonii	1	-	-	3	-	-	-	1	3	-	3	-	-	3	1	1	1
Mertensia ciliata	3	10	3	3	3	10	30	10	10	3	10	10	3	10	10	3	10
Mitella pentandra	3	3	10	3	3	3	-	3	-	-	3	-	-	-	1	3	-
Oxypolis fendleri	3	3	20	10	10	10	1	3	3	3	20	20	20	1	3	10	3
Saxifraga odontoloma	-	10	20	10	-	10	-	3	1	10	3	-	10	10	10	10	1
Senecio triangularis	1	-	20	1	1	10	-	-	3	10	20	10	10	3	1	20	10
Streptopus amplexifolius	10	-	10	-	10	-	1	-	-	-	3	3	3	-	-	-	-
Taraxacum officinale	1	-	-	1	-	1	-	3	3	1	3	1	-	1	1	-	-
Trifolium longipes	-	-	-	-	-	-	-	-	-	-	-	10	3	-	-	-	-
HORSETAILS																	
Equisetum arvense	1	-	-	-	1	3	-	1	10	-	3	-	-	3	1	-	-

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%.
A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Picea pungens Alliance

Colorado blue spruce/Thin-leaf alder (*Picea pungens/Alnus incana*) Plant Association G3S3 (PIPU/ALIN)
Gunnison River Basin--2 plots (94MD07, 94RR26)
White River Basin--4 plots (92NL12, 92NL16, 92GK17, 92GK54)
Colorado River Basin--5 plots (93SS41, 93SS43, 93RR59, 93RR62, 93DR08)

Related Types: *Picea pungens/Alnus incana* ssp. *tenuifolia* (Baker 1989). Similar to *Picea pungens/Alnus incana* ssp. *tenuifolia* (Johnston 1987), however in ours *Abies lasiocarpa* appears to have replaced the *Abies concolor* component. *Picea pungens/Rosa woodsii* (Cooper and Cottrel 1990), similar with mostly *Alnus incana* and *Rosa woodsii*.

Distribution: This plant association is reported from northwestern Wyoming to northern New Mexico (Johnston 1987). In Colorado, it is minor type, occurring in small patches along larger streams, and is known from Routt National Forest south to Rio Grande and San Juan National Forests (Johnston 1987, Baker 1989). In the Gunnison Basin, it was found in the West Elk Wilderness Area.

Elevation: 2140- 2865 m (7040-9400 ft).

Geomorphology: This association occurs along narrow to moderately wide floodplains and stream benches in narrow canyons subject to cold air drainage and limited sunlight.

Rosgen's Channel Type: Typically this association occurs along slightly meandering, broad stream (B3) reaches. Some stands also occur along steeper (A3) reaches.

Vegetation: *Picea pungens* dominates the overstory (40%) with many understory seedling and saplings. *Abies lasiocarpa* (1%) may also be present. *Alnus incana* (60%), *Cornus sericea* (10%), *Lonicera involucrata* (5%), and *Salix monticola* (10%) create a thick understory of shrubs that are confined to a narrow band lining the stream channel. The forb layer often includes *Actea rubra* (5%), *Conioselinum scopulorum* (5%) and *Oxypolis fendleri* (5%).

Soil: Soils are generally shallow, skeletal silty clay loams.

Adjacent riparian vegetation: This association is often the only type along narrow streams. Up and downstream adjacent reaches may have *Alnus incana* shrublands or additional *Picea pungens* forests.

Adjacent upland vegetation: *Abies lasiocarpa-Picea engelmannii* and *Populus tremuloides* forests often occur on adjacent hill slopes.

Succession/management: In deep, narrow canyons with swift-moving streams and narrow floodplains and benches, *Picea pungens* appears to be a climax riparian community until it is removed or damaged by a catastrophic flood. *Alnus* appears to thrive along streams with highly oxygenated water (steep, fast-flowing), is tolerant of flooding, and can easily re-sprout (Padgett *et al.* 1989).

Table 7. Cover Class Codes* for Characteristic Plant Species in the *Picea pungens/Alnus incana* Plant Association.

Plot (94___)	MD07	RR26
Occurrence Ranks**	B	B
TREES		
Abies lasiocarpa --seedlings	-	1
Picea pungens --saplings	-	3
Picea pungens --seedlings	-	1
Picea pungens --young & mature trees	70	40
SHRUBS		
Acer glabrum	-	3
Alnus incana ssp. tenuifolia	30	60
Amelanchier utahensis	-	3
Cornus sericea	-	10
Lonicera involucrata	10	3
Prunus virginiana var. melanocarpa	-	1
Rosa woodsii	-	3
Salix bebbiana	-	1
Salix monticola	-	10
GRAMINOIDS		
Carex geyeri	30	-
Elymus glaucus	-	1
FORBS		
Achillea millefolium var. apicola	-	1
Actaea rubra	-	3
Angelica ampla	-	1
Conioselinum scopulorum	-	3
Epilobium angustifolium	10	1
Epilobium spp.	-	1
Fragaria virginiana	-	3
Galium trifidum ssp. subbiflorum	-	1
Galium triflorum	-	1
Geranium richardsonii	3	3
Maianthemum stellatum	10	1
Mimulus guttatus	-	1
Osmorhiza depauperata	-	1
Rudbeckia lacinata var. ampla	-	3
HORSETAILS		
Equisetum arvense	-	3
Equisetum hyemale	-	3

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Colorado blue spruce/Serviceberry-Red-osier dogwood (*Picea pungens/Amelanchier alnifolia-Cornus sericea*) Plant Association
G3S3 (PIPU/AMAL-COSE)
Gunnison River Basin--4 plots (94GK12, 94JB05, 94RR06, 94RR32)
Colorado River Basin--3 plots (92GK25, 92NL20, 92GK36)
Other occurrences: San Miguel/Dolores River Basin--3 plots

Related Types: *Picea pungens/Amelanchier alnifolia-Cornus sericea* (Komarkova 1986, Hess and Wasser 1982). Similar to stands dominated by *Picea pungens* within the *Picea* spp./*Cornus sericea* type described by Youngblood *et al.* (1985) and the Conifer/*Cornus sericea* type described by Padgett *et al.* (1989).

Distribution: This plant association is known from western Wyoming (Youngblood *et al.* 1985) to northern New Mexico and Arizona (DeVelice *et al.* 1985, Bourgeron and Tuhy 1989). In Colorado it is a minor type, occurring in small patches along isolated reaches. It is reported from the Routt, White River, Gunnison, and San Juan National Forests (Johnston 1987, Hess and Wasser 1982, Komarkova 1986, and DeVelice *et al.* 1985).

Elevation: 2290-2590 m (7540-8450 ft).

Geomorphology: This plant association occurs on narrow floodplains and benches in narrow valleys (7-30 m wide), with low to moderate stream gradients (1 to 4%).

Rosgen's Channel Type: This plant association occurs mostly along broad, slightly meandering (B2, B3, B4) channel reaches, and occasionally steeper (A3) reaches.

Vegetation: Dense canopies of *Picea pungens* (20-60%) characterize the overstory of this plant association. *Populus tremuloides* (0-1%) is occasionally present as well. *Cornus sericea* forms a dense shrub layer (3-30%). Other shrubs present may include *Salix drummondiana* (0-20%), *Alnus incana* (3-10%), and *Amelanchier utahensis* (0-10%). Characteristic forbs include *Conioselinum scopulorum* (0-5%) and *Maianthemum stellatum* (1-10%).

Soil: The soils of this plant association are deep, dark-colored clay loams to sandy loams, often with signs of mottling. Coarse fragment ranges from 20 to 50%, increasing with depth.

Adjacent riparian vegetation: *Salix drummondiana* shrublands commonly occur on adjacent cobble bars.

Adjacent upland vegetation: *Populus tremuloides* and *Pinus edulis-Juniperus osteosperma* woodlands, *Pseudotsuga menziesii* forests occur on adjacent hill slopes at higher elevations, and *Quercus gambelii* and *Artemisia tridentata* shrublands occur on adjacent hillslopes at lower elevations.

Succession/management: *Cornus sericea* becomes more abundant on level sites due to periodic high water tables (Johnston 1987). More information is needed about regeneration and successional trends of *Picea pungens.*

Table 8. Cover Class Codes* for Characteristic Plant Species in the *Picea pungens/Amelanchier utahensis-Cornus sericea* Plant Association.

Plots (94___)	GK12	JB05	RR06	RR32
Occurrence Ranks**	B	B	B	B
TREES				
Picea pungens --saplings	3	-	-	10
Picea pungens --seedlings	-	-	-	3
Picea pungens --young & mature trees	60	20	40	20
Populus angustifolia --young & mature trees	-	3	-	-
Populus tremuloides	-	1	50	-
SHRUBS				
Alnus incana ssp. tenuifolia	10	3	1	3
Amelanchier utahensis	1	10	3	-
Betula occidentalis	10	-	-	-
Cornus sericea	3	30	3	20
Ribes inerme	10	-	-	-
Salix bebbiana	-	1	1	20
Salix drummondiana	-	10	20	-
Symphoricarpos rotundifolius	-	10	1	-
FORBS				
Actaea rubra	-	-	3	-
Antennaria parvifolia	3	-	-	-
Conioselinum scopulorum	1	-	1	1
Fragaria virginiana	-	1	1	-
Geranium richardsonii	-	3	10	-
Heracleum lanatum	-	-	3	-
Maianthemum stellatum	10	3	1	3
Osmorhiza depauperata	-	3	1	-
Pseudocymopterus montanus	-	-	3	-
Taraxacum officinale	-	1	3	-
Thlaspi montanum	-	10	-	-
Viola canadensis	-	1	1	-

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Pseudotsuga menziesii Alliance

Stands dominated by *Pseudotsuga menziesii* that occur along valley bottoms and streams are uncommon, and appear limited to the Uncompahgre Plateau within the San Miguel and Gunnison River basins.

One stand sampled (94RR02) occurred along an ephemeral stream in a steep-sided sandstone canyon with additional *Pseudotsuga menziesii* on the north-facing slopes, and a *Juniperius osteosperma-Quercus gambelii* mosaic on south-facing slopes. The creek was shaded by 70% *Pseudotsuga menziesii* and a thick layer of *Prunus virginiana* (80%) mixed with some *Quercus gambelii* (1%) and *Ribes cereum* (10%) along the stream bank. This association may be closely related to the *Pseudotsuga menziesii/Quercus gambelii* plant association described by Kittel *et al.* (1994) and Johnston (1987).

Another creek draining the Uncomphagre Plateau (94RR09) had a mixed canopy of *Pseudotsuga menziesii* (30%) and *Populus angustifolia* (10%), with saplings of both species present. A dense shrub layer of *Cornus sericea* (40%), *Rosa woodsii* (30%), *Alnus incana* (10%), *Rhus trilobata* (10%), *Salix ligulifolia* (5%) and *S. exigua* (5%) occurred along the stream bank. The herbaceous undergrowth was very sparse, the ground being covered in thick layer of duff. This stand appears to be closely related to the *Pseudotsuga menziesii/Cornus sericea* plant association described by Kittel *et al.* (1994) and Hansen *et al.* (1989).

Table 9. Cover Class Codes* for *Pseudotsuga menziesii* Dominated Stands.

Plots (94___)	RR02	RR09
Occurrence Ranks**	C	B
TREES		
Populus angustifolia --saplings	-	10
Populus angustifolia --young & mature trees	-	10
Pseudotsuga menziesii --saplings	-	10
Pseudotsuga menziesii --young & mature trees	70	30
SHRUBS		
Quercus gambelii	1	1
Acer glabrum	20	-
Alnus incana ssp. tenuifolia	-	10
Cornus sericea	-	40
Prunus virginiana var. melanocarpa	80	-
Rhus trilobata var. trilobata	-	10
Ribes cereum	10	-
Rosa woodsii	-	30
Salix ligulifolia	-	3
GRAMINOIDS		
Carex geyeri	10	-
FORBS		
Clematis ligusticifolia	-	1
Heterotheca villosa	-	1
Maianthemum racemosum ssp. racemosum	3	-
Maianthemum stellatum	10	-
Thlaspi montanum	1	-
HORSETAILS		
Equisetum arvense	-	1
Equisetum hyemale	-	10

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

UNESCO: I.B.2.b. COLD DECIDUOUS FOREST WITH NEEDLE-LEAVED EVERGREEN TREES

COWARDIN: PALUSTRINE SYSTEM, BROAD-LEAVED DECIDUOUS FORESTS

Populus angustifolia Alliance

Narrowleaf cottonwood-Colorado blue spruce/Thin-leaf alder (*Populus angustifolia-Picea pungens/Alnus incana*) Plant Association
G3S3 (POAN-PIPU/ALIN)
Gunnison River Basin--10 plots (94GK43, 94GK44, 94GK45, 94GK46, 94JB08, 94JB11, 94JB50, 94MD04, 94MD09, 94RR54)
White River Basin--3 plots (92NL14, 92NL15, 92NL38)
Colorado River Basin--1 plot (93GK50)

Related Types: *Populus angustifolia-(Picea pungens)/Alnus incana* ssp. *tenuifolia-Cornus sericea* (Baker 1989). Stands from the White River have more *Cornus* and less *Alnus incana* while in the Colorado River basin, one stand sampled had more *Betula occidentalis* than in Baker's description.

Distribution: This plant association is found from eastern Idaho and western Wyoming and to southern Utah (Baker 1989). In Colorado it is common riparian type that occurs along a narrow elevational band between the mid-montane and the lower subalpine zones. It is reported from the White River Plateau, the Gunnison and Uncompahgre National Forests, and the San Miguel River Basin (Hess and Wasser 1982, DeVelice *et al.* 1985, and Komarkova 1986, as cited by Baker 1989, Kittel and Lederer 1993). It is also likely to occur along the Colorado Front Range.

Elevation: 2135-2620 m (7000-8600 ft).

Geomorphology: This association occurs in deep canyons and valleys with narrow to moderately wide floodplains (30-130 m), where overbank flow and sediment deposition can occur. Where stream channels have lower gradient and become more sinuous, conditions favor *Populus angustifolia,* and *Picea pungens* becomes less abundant. *Picea pungens* is favored along reaches in deep valleys with steep side-walls that contribute to stong cold-air drainage effects.

Rosgen's Channel Type: This association is commonly found on slightly meandering floodplains of broad (B2 and B3) reaches. Occasionally stands occur along steep (A2 and A3) reaches that are still fairly wide. This mixed plant association may also occur on meandering (C-type) reaches.

Vegetation: *Populus angustifolia* and *Picea pungens* dominate the tree layer, either species ranging from 1% to 40% cover. Other trees present may include *Pseudotsuga menziesii* (0-20%) at lower elevations; *Abies lasiocarpa* (0-10%) and *Picea engelmannii* (0-30%) at higher elevations. *Abies concolor* (0-10%) appears to replace *Picea pungens* along reaches in Ouray county (94JB48, 94JB50), in the southwestern part of the Gunnison Basin. The dense shrub layer consists of *Alnus incana* (10-70%), *Cornus sericea* (0-40%), *Acer glabrum* (0-5%), and *Amelanchier utahensis* (0-10%), as well as variety of *Salix* spp. (<5%). Undergrowth was sparse, rarely more than 10-20% total herbaceous cover. Common forbs are *Actaea rubra* (0-2%), *Osmorhiza depauperata* (0-5%), and *Maianthemum stellatum* (0-10%).

Soil: Soils are shallow sandy to silty loams over cobbles and boulders. Profiles are generally highly stratified, with layers of fines followed by layers of coarser sediments.

Adjacent riparian vegetation: *Alnus incana* and mixed *Alnus incana-Cornus sericea* shrublands may occur adjacent to the floodplain forest on steep-sided banks, and *Salix exigua* stands often occur on point bars and overflow channels.

Adjacent upland vegetation: *Quercus gambelii* scrub, *Populus tremuloides* woodlands occur on adjacent hill slopes at lower elevations and *Picea engelmannii-Abies lasiocarpa* forests occur on hill slopes at higher elevations.

Succession/management: This mixed deciduous-evergreen association represents a transition zone between *Populus angustifolia* dominated reaches further downstream, and *Picea pungens* dominated reaches further upstream. This zone can be several miles long, and within it *Populus angustifolia* becomes less important as a canopy component with increasing elevation. This plant association is a mid-seral stage that is maintained by flooding, channel migration, sediment deposition, and scouring. *Picea* spp. may become the climax tree layer on higher terraces that are no longer flooded. Stands along reaches at higher elevations (e.g. 94JB48 and 94JB50) can have much of the conifer cover represented by *Abies lasiocarpa, Picea engelmannii,* or *Abies concolor,* rather than *Picea pungens.* Stands like these may represent a new plant association, or may simply be transitional from mid- to upper elevations. *Abies concolor* is a facultative riparian species in this setting, and its presence differentiates stands from those further north in Colorado, beyond the geographic limits of *Abies concolor.*

Table 10. Cover Class Codes* for Characteristic Plant Species in the *Populus angustifolia-Picea pungens/Alnus incana* Plant Association.

Plot (94____)	GK43	GK44	GK45	GK46	JB08	JB11	JB50	MD04	MD09	RR54
Occurrence Ranks**	B	B	B	B	B	A	B	B	B	B
TREES										
Abies concolor --mature	-	-	-	-	-	-	3	-	-	-
Abies concolor --saplings	-	-	-	-	-	-	-	-	-	10
Abies concolor --seedlings	-	-	-	10	-	3	1	-	-	3
Abies lasiocarpa --young & mature trees	-	-	-	-	-	-	10	-	-	-
Picea engelmannii --young & mature trees	-	-	-	-	-	-	30	-	-	30
Picea pungens --saplings	10	30	-	10	-	3	-	10	3	20
Picea pungens --young & mature trees	20	-	40	3	40	60	-	20	20	20
Populus angustifolia --saplings	-	-	1	10	-	-	-	1	1	
Populus angustifolia --young & mature trees	40	20	1	40	20	10	50	30	10	50
Pseudotsuga menziesii --young & mature trees	20	20	-	10	-	-	-	-	-	3
SHRUBS										
Acer glabrum	10	1	-	1	-	-	1	-	3	
Alnus incana ssp. tenuifolia	10	30	30	20	30	70	20	30	20	10
Amelanchier utahensis	3	1	-	3	1	3	-	3	1	3
Cornus sericea	10	-	20	1	40	10	3	30	10	-
Lonicera involucrata	1	1	1	1	-	10	20	3	-	20
Prunus virginiana var. melanocarpa	-	-	-	-	10	-	-	-	-	-
Rosa woodsii	1	1	1	-	3	-	-	-	-	-
Rubus idaeus	-	1	1	-	-	1	3	-	1	-
Salix ligulifolia	1	1	-	-	-	20	-	10	20	-
Salix monticola	3	1	-	-	-	1	10	3	3	-
GRAMINOIDS										
Calamagrostis canadensis	-	1	3	-	-	-	-	-	-	-
Carex geyeri	3	-	1	1	-	-	-	-	-	-
Elymus canadensis	-	-	-	-	-	-	-	-	10	-
FORBS										
Achillea millefolium var. apicola	-	-	1	-	-	-	1	-	1	1
Actaea rubra	-	-	-	-	3	3	-	-	1	-
Conioselinum scopulorum	-	-	-	1	-	3	1	-	-	-
Epilobium angustifolium	-	3	-	-	3	3	-	-	-	-
Galium trifidum ssp. subbiflorum	1	-	-	-	-	-	1	3	1	-
Geranium richardsonii	-	3	-	1	-	3	3	3	3	3
Maianthemum stellatum	3	-	3	-	3	3	-	3	3	1
Osmorhiza depauperata	1	-	-	-	-	-	1	3	-	-
Rudbeckia lacinata var. ampla	-	-	-	-	1	10	-	-	10	-
Taraxacum officinale	-	3	-	1	-	1	1	1	3	1
Thalictrum fendleri	1	-	-	1	-	-	-	1	1	3
Vicia americana	-	-	1	1	-	-	-	-	1	-
HORSETAILS										
Equisetum arvense	-	10	3	-	-	10	1	-	-	1

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%.
A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered.
See page 15 of the Introduction for complete definitions.

UNESCO: I.B.3.b. MAINLY COLD-DECIDUOUS FOREST WITHOUT EVERGREEN TREES

COWARDIN: PALUSTRINE SYSTEM-FOREST CLASS, BROAD-LEAVED DECIDUOUS

Populus angustifolia Series

Narrow-leaf cottonwood/thin-leaf alder (*Populus angustifolia/Alnus incana* ssp. *tenuifolia*) Plant Association
GUS2 (POAN/ALIN)
Gunnison River Basin: 6 plots (94JB09, 94MD20, 94MD21, 94RR13, 94RR23, 94RR50)
San Juan National Forest: 3 plots (93KC32, 93KC162, 93KC132)

Related types: This plant association appears to be a variation of the *Populus angustifolia/Alnus incana-Cornus sericea* type (Kittel and Lederer 1993), however stands from the Gunnison basin have lower *Cornus sericea* cover with a high abundance of *Alnus incana.*

Distribution: Currently only known from the Gunnison Basin and the San Juan Forest, Colorado (Kettler *et al.* 1994). Likely to occur on the Front Range.

Elevation: 1890-2590 m (6200-8520 ft).

Geomorphology: This plant association occurs on active floodplains in narrow to broad valleys. Sampled stands have signs of recent flooding and most sites occur along steep, swift flowing streams (3-8% gradient). One stand (plot 94JB09), occured in a broad valley along a low gradient reach located just downstream of the confluence of two steep first order streams.

Rosgen's Channel Type: Stream segments are variable in width and gradient and include steep reaches (A3), moderately sinuous, less steep, broad channel reaches (B2, B4) and low gradient, sinuous (C3) reaches.

Soils: Soils are shallow or deep (0.4- 2 m), dark-colored skeletal sandy loams. Sample pits indicated highly stratified profiles.

Vegetation: This plant association has an open canopy of *Populus angustifolia* (5-20%) with a very dense sub-canopy layer of *Alnus incana* (30-80%). A wide variety of other shrubs may be present, for example: *Salix lasiandra* (0-20%), *Cornus sericea* (0-5%), *Salix monticola* (0-10%) , *Acer glabrum* (0-5%), *Salix bebbiana* (0-5%), and *Amelanchier utahensis* (0-5%). *Abies concolor, Pseudotsuga menziesii,* or *Picea pungens* may be an occasional co-dominant in the overstory (>5%). Sampled stands have high forb cover (10-30%) relative to graminoid cover (1-20%). *Pyrola rotundifolia, Osmorhiza depauperata,* and *Rudbeckia lacinata* are common forb species.

Adjacent riparian vegetation: Younger *Populus angustifolia* stands often occur on adjacent point bars and fresh alluvial deposits. *Salix* spp. shrublands can occur in patches on the floodplain as well.

Adjacent upland vegetation: A mix of *Populus tremuloides* forests, *Quercus gambelii* shrublands often occurs an adjacent hill slopes at lower elevations. *Pseudotsuga menziesii*-mixed conifer forests, or barren talus slopes occur on adjacent valley walls at higher elevations.

Succession/Management: This plant association requires flooding and fresh alluvial deposits for *Populus* regeneration. *Alnus incana* appears to thrive along steeper gradient streams due to more highly oxygenated water (Padgett *et al.* 1989). *Alnus incana* can re-sprout if broken off, and can tolerate inundation of short duration.

Table 11. Cover Class Codes* for Characteristic Plant Species in the *Populus angustifolia/Alnus incana* Plant Association.

Plot (94____)	JB09	MD20	MD21	RR13	RR23	RR50
Occurrence Ranks**	C	B	B	A	B	A
TREES						
Abies concolor --mature	-	-	-	-	-	10
Abies concolor --seedlings	-	-	-	10	-	3
Picea pungens --young & mature trees	-	-	-	-	-	10
Populus angustifolia --saplings	20	3	10	-	-	-
Populus angustifolia --young & mature trees	20	30	20	20	3	20
SHRUBS						
Acer glabrum	-	-	-	10	10	3
Alnus incana ssp. tenuifolia	30	50	80	30	40	30
Amelanchier utahensis	-	3	-	10	3	-
Cornus sericea	3	3	10	30	10	20
Paxistima myrsinites	-	-	-	10	-	-
Salix bebbiana	1	3	-	-	10	-
Salix exigua	1	-	10	-	-	-
Salix geyeriana	10	-	-	-	-	-
Salix lucida ssp. caudata	-	-	20	20	-	-
Salix lucida ssp. lasiandra	-	-	-	-	3	30
Salix monticola	10	3	1	-	-	1
GRAMINOIDS						
Agrostis stolonifera	-	-	10	-	-	-
Carex sp.	1	10	1	-	-	-
Poa pratensis	10	-	10	-	1	-
FORBS						
Cirsium sp.	1	-	10	-	-	-
Heracleum lanatum	-	-	-	10	3	1
Ligusticum porteri	-	10	-	-	1	-
Osmorhiza depauperata	-	3	-	3	3	1
Pyrola americana	-	10	-	-	-	-
Rudbeckia lacinata var. ampla	-	3	10	10	3	-
Urtica dioica ssp. gracilis	10	-	1	-	-	-
Equisetum arvense	1	-	-	3	1	10

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 13 of the Introduction for complete definitions.

Narrowleaf cottonwood/serviceberry (*Populus angustifolia/Amelanchier spp.*) Plant Association
G3S3 (POAN/AMSPP.)
Gunnison River Basin--5 plots (94GK28, 94RR07, 94RR31, 94RR52, 94RR53)
Yampa River Basin--2 plots (90MR33, 90MR107)

Related types: Our stands appear nearly identical to the following published types: *Populus angustifolia/Amelanchier utahensis* (Baker 1984), *Populus angustifolia/Amelanchier alnifolia* (Johnston 1987), and *Populus angustifolia/Amelanchier alnifolia/Smilacina stellata* (Hess and Wasser 1982). Padgett *et al.* (1989) also describes a similar type, *Populus angustifolia/Rosa woodsii*. Our stands are also similar to a *Populus angustifolia-Acer negundo*/Mixed shrub/Mixed grass and mixed forb species type described by Dick-Peddie (1993) and the *Populus angustifolia-Juniperus scopulorum* type (M. Gerard, Big Horn N.F., *personnel communication*).

Distribution: Similar plant associations (listed above) have been reported from southeastern Utah (Padgett *et al.* 1989), montane elevations of New Mexico (Dick-Peddie 1993), and the Big Horn Mountains of Wyoming. In Colorado, it is reported from the White River plateau in the White River National Forest (Johnston 1987), lower elevations of the Yampa River watershed (Kittel and Lederer 1993), and lower elevations of the western half of the Gunnison River basin.

Elevation: 1950-2350 m (6360-7680 ft).

Geomorphology: This plant association occurs in moderately narrow valleys (50 m) and steep streams (5% gradient) on narrow benches and along larger rivers with broad floodplains (>2500 m wide). This plant association is generally positioned between 1 and 2 meters above the stream channel.

Rosgen's Stream Channel Type: This plant association occurs on relatively broad, moderate gradient reaches (B4, B6), as well as on less steep, and more sinuous (C3, C5) reaches.

Soils: Soils associated with this type are deep sandy clay loams, some becoming dark with increased clay content, with skeletal layers at 40-70 cm depth.

Vegetation: This is one of the most diverse cottonwood-dominated forest associations. The upper canopy can be a mix of several species, but *Populus angustifolia* is always the dominant species with 40-60% cover. Other trees likely to be present (individually or together) are *Juniperus scopulorum* (1-20%), *Acer negundo* (0-10%), *Picea pungens* (0-20%), and *Pinus ponderosa* (0-10%). The second canopy layer is comprised of a mixture of many tall and medium-tall shrubs species, usually *Amelanchier utahensis* (0-30%), *Crataegus rivularis* (0-70%), *Cornus sericea* (0-30%), *Rosa woodsii* (1-30%), and occasionally, *Quercus gambelii* (0-

5%). Sites are relatively dry with a number of exotic hay meadow grasses probably introduced from cattle grazing. The herbaceous undergrowth is usually sparse (<10%), except in stands where aspect and deep shade provided a moist environment, where herbaceous cover can be as much as 40%.

Adjacent riparian vegetation: *Salix exigua* shrublands commonly occur on adjacent pointbars.

Adjacent upland vegetation: *Pinus edulis-Juniperus osteosperma* woodlands and *Quercus gambelii* scrub occur on adjacent hill slopes.

Succession/management: This association appears to be one of the drier *Populus angustifolia* associations, occurring on higher terraces and in general at lower altitudes that other, more mesic *Populus angustifolia* types. Many stands of this association show signs of heavy grazing, and may indeed be a grazing-induced type. However, a few stands have very dense and diverse shrub canopies that may indicate high quality examples of this association. Low shrub cover and abundant non-native weeds indicated over-grazing, while the presence of small amounts of *Cornus sericea* and *Osmorhiza depauperata* may indicate the site is capable of supporting a more mesic forest type such as *Populus angustifolia/Cornus sericea* or the *Crataegus rivularis-Cornus sericea* phase of the *Populus angustifolia/Amelanchier* spp. type described by Hess and Wasser (1982).

Table 12. Cover Class Codes* for Characteristic Plant Species in the *Populus angustifolia/Amelanchier spp.* Plant Association.

Plots (94____)	GK28	RR07	RR31	RR52	RR53
Occurrence Ranks**	B	B	C	B	B
TREES					
Acer negundo --saplings	3	-	-	-	-
Acer negundo --young & mature trees	10	-	-	-	-
Juniperus scopulorum --saplings	-	-	-	20	-
Juniperus scopulorum --seedlings	1	-	-	-	-
Juniperus scopulorum --young & mature trees	3	-	-	-	-
Picea pungens --saplings	-	20	-	-	-
Picea pungens --young & mature trees	1	30	-	-	-
Pinus ponderosa --young & mature tree	-	10	-	-	-
Populus angustifolia --saplings	3	-	3	-	1
Populus angustifolia --seedlings	-	-	-	-	3
Populus angustifolia --young & mature trees	60	50	60	40	40
Populus tremuloides	-	30	-	-	-
Pseudotsuga menziesii --seedlings	1	-	-	-	-
SHRUBS					
Quercus gambelii	10	1	-	3	1
Acer glabrum	-	-	-	10	-
Amelanchier utahensis	3	30	-	10	20
Cornus sericea	30	10	-	1	10
Crataegus rivularis	70	30	10	-	-
Mahonia repens	-	1	-	-	-
Pentaphylloides floribunda	-	-	1	-	-
Prunus virginiana var. melanocarpa	-	10	-	30	1
Ribes inerme	-	-	1	3	-
Rosa woodsii	30	1	3	-	3
Salix bebbiana	-	1	-	-	-
Salix exigua	1	-	-	-	-
Salix monticola	1	-	-	-	-
Symphoricarpos rotundifolius	40	1	-	10	10
GRAMINOIDS					
Carex geyeri	-	-	-	10	-
Poa pratensis	10	10	3	-	-
FORBS					
Achillea millefolium var. apicola	1	-	1	-	-
Actaea rubra	10	-	-	-	-
Clematis ligusticifolia	20	-	-	-	-
Conioselinum scopulorum	-	-	1	1	-
Geranium richardsonii	-	3	-	1	-
Maianthemum stellatum	10	10	50	3	3
Melilotus officinale	10	-	-	-	-
Osmorhiza depauperata	3	1	-	-	-
Rudbeckia lacinata var. ampla	1	1	-	-	-
Taraxacum officinale	1	3	3	-	-
Thalictrum fendleri	-	1	1	-	-
Vicia americana	1	-	1	-	1

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 13 of the Introduction for complete definitions.

Narrowleaf cottonwood/red-osier dogwood (*Populus angustifolia/Cornus sericea*) Plant Association
G3S3 (POAN/COSE)
Gunnison River Basin-- 7 plots (94GK25, 94GK30, 94GK39, 94GK42, 94JB03, 94JB04, 94MD19)
White River Basin --1 plot (92GK19)
Colorado River Basin--12 plots (92GK29, 92GK33, 92NL37, 92NL33, 92NL35, 92NL36, 93SS14, 93SS15, 93RR55, 93SS34, 93SS09, 93GK18)
Other occurrences: Yampa River Basin--6 plots, San Miguel/Dolores River Basin--7 plots.

Related types: Similar to *Populus angustifolia/Cornus sericea* (Padgett *et al.* 1989, Youngblood *et al.* 1985); *Populus angustifolia/Cornus sericea* (Hansen *et al.* 1989); and the *Populus angustifolia/Amelanchier alnifolia/Smilacina stellata, (Crataegus rivularis-Cornus sericea* phase) described by Hess and Wasser (1982) as cited in Johnston (1987).

Distribution: This plant association is known from eastern Idaho (Youngblood *et al.* 1985), possibly western Wyoming (Beetle 1961, as cited by Johnston 1987), and Utah (Padgett *et al.* 1989). In Colorado, it is reported from the White River National Forest (Johnston 1987). Once a more common type within Colorado, it now occurs primarily in very degraded conditions. High quality, near pristine condition stands are rare.

Elevation: 1980-2560 m (6500-8360 ft).

Geomorphology: The *Populus angustifolia/Cornus sericea* plant association occurs along narrow benches and banks of straight reaches with limited floodplains (60-150 m in width), as well as along stream banks and floodplains of broad meandering rivers. Streams are of moderate gradient (average gradient 2%) with coarse bed material. Stands generally occur within 0.4-0.9 meters above the channel bankfull mark.

Rosgen's Channel Type: Segments of rivers that support this type vary widely in slope and width and include broad, somewhat steep gradient (B2, B3, B4) reaches, and sinous, low-gradient (C2 and C3) reaches.

Vegetation: The upper canopy layer consists of *Populus angustifolia* (40-70%), occasionally with *Acer negundo* (0-20%), *Picea pungens* (0-10%), and *Pseudotsuga menziesii* (0-1%). The shrub layer is dense and diverse with *Cornus sericea* (50-80%), *Alnus incana* (0-40%), *Amelanchier utahensis* (0-10%) and *Acer glabrum* (0-5%). The forb layer was scatted and diverse, usually not more than 10-20% total cover, represented by 10-25 species. Some additional common forb species are *Maianthemum stellatum* (0-4%), *Aster foliaceous* (0-4%), and *Osmorhiza depauperata* (0-4%).

Soil: Soils are deep, stratified loamy sands and clay loams. Mottling is occasionally present

at a depth of 45 cm. In the Black Canyon of the Gunnison soils are very shallow and skeletal with strong colluvial influence.

Adjacent riparian vegetation: Young sapling/seedling stands of *Populus angustifolia*, *Salix exigua* shrublands, *Carex utriculata* wetlands, *Populus angustifolia/Amelanchier utahensis*, and *Populus angustifolia/Poa pratensis* riparian woodlands.

Adjacent upland vegetation: *Quercus gambelii* shrublands , *Picea engelmannii* and *Pseudotsuga menziesii* forests, *Pinus edulis-Juniperus osteosperma* woodlands.

Succession/management: Sampled stands appear to be mid- to late-seral, mature cottonwood forests. In late-seral stands *Cornus sericea* requires a seasonally high water table (Padgett *et al.* 1989), and cottonwood regeneration will only occur with flooding and sediment deposition. However, more information is needed about the long-term maintenance and response to grazing. *Cornus sericea* seems to be able to withstand periodic flooding and high water tables, and provides stream bank stability because of its strongly rhizomatous rooting structure (Padgett *et al.* 1989). Padgett *et al.* (1989) suggests that this type may be considered early to mid-seral due to its proximity to the channel, and if the channel remains in place, it may be replaced by a Conifer/*Cornus sericea* type at higher elevations. At lower elevations on meandering streams, the community may be replaced by another *Populus angustifolia* dominated type, with a less mesic undergrowth as the channel shifts.

Hansen *et al.* (1989) describe three disturbance stages of *Populus angustifolia/Cornus sericea* community: (1) relatively undisturbed sites have rich dense shrub layer of *Cornus sericea, Amelanchier alnifolia, Prunus virginiana,* and several *Salix* and *Ribes* species, (2) moderately disturbed has *Symphoricarpos* and *Rosa ssp.* increasing in abundance along with a decrease in the shrubs mentioned above, (3) with continued disturbance, *Rosa* and *Symphoricarpos* may become quite abundant, and (4) with further degradation, shrub cover begins to decline and the site proceeds to become less mesic. This concurs with observations throughout the western slope of Colorado (Kittel and Lederer 1993). *Populus angustifolia/Cornus sericea* was probably once widespread throughout its elevation range in Colorado. Pristine, large examples of this community are rare in Colorado.

Table 13. Cover Class Codes* for Characteristic Plant Species in the *Populus angustifolia/Cornus sericea* Plant Association.

Plots (94___)	GK25	GK30	GK39	GK42	JB03	MD19
Occurrence Ranks**	B	B	B	A	C	C
TREES						
Acer negundo --young & mature trees	-	-	10	-	20	-
Picea pungens --saplings	1	-	-	10	-	-
Picea pungens --young & mature trees	-	-	-	10	-	-
Populus angustifolia --saplings	20	20	-	1	-	3
Populus angustifolia --seedlings	10	1	-	-	-	1
Populus angustifolia --young & mature trees	40	50	10	50	70	70
SHRUBS						
Alnus incana ssp. tenuifolia	30	3	-	40	-	20
Amelanchier utahensis	10	-	-	10	-	-
Cornus sericea	50	50	50	50	80	40
Lonicera involucrata	-	-	-	1	1	20
Rosa woodsii	20	10	-	3	1	3
Salix drummondiana	10	-	-	3	20	-
Salix lucida ssp. caudata	-	10	-	-	-	-
Salix monticola	10	-	-	-	1	3
Symphoricarpos rotundifolius	3	-	-	10	-	-
Toxicodendron rydbergii	-	-	30	-	-	-
GRAMINOIDS						
Agrostis sp.	10	-	-	-	-	-
Poa pratensis	10	3	-	3	3	3
FORBS						
Heracleum lanatum	-	-	-	-	-	10
Hydrophyllum fendleri	-	-	-	-	10	-
Maianthemum stellatum	3	3	-	1	3	10
Pyrola americana	-	-	-	-	-	10
Taraxacum officinale	1	-	-	3	1	20

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 13 of the Introduction for complete definitions.

Narrowleaf cottonwood/skunkbrush (*Populus angustifolia/Rhus trilobata*) Plant Association
G2S2 (POAN/RHTR)
Gunnison River Basin--8 plots (94GK04, 94JB06, 94JB40, 94MD03, 94MD05, 94MD06, 94RR04, 94RR05)
Colorado River Basin--5 plots (93RR17, 93GK17, 93RR05, 93RR06, 93GK05)
Other occurrences--San Miguel River Basin--14 plots

Related types: *Populus angustifolia/Rhus aromatica* var. *trilobata* (Padgett *et al.* 1989).

Distribution: This plant association is reported from the central high plateaus, and the Abajo and La Sal Mountains in Utah (Padgett *et al.* 1989). In Colorado it is reported from the Uncompahgre Plateau of the San Miguel and Gunnison River Basins and from small tributaries of the Colorado River in the western half of that watershed.

Elevation: 1585-1980 m (5200-6500 ft.).

Geomorphology: This plant association occurs on immediate river banks, floodplain meanders and narrow benches in narrow to medium-wide sandstone canyons (30-150 m) of the Uncompahgre Plateau. Stands generally occur within 1 meter of the high water mark, but can also occur on higher terraces (up to 3 m above the channel).

Rosgen's Channel Type: This type is often along lower elevation, larger, meandering rivers (C3), such as low elevation reaches of the Gunnison River. It also occurs on moderate floodplains of less sinuous (B3) and along steeper (A3) reaches.

Vegetation: The overstory is dominated by *Populus angustifolia* or *Populus acuminata* (5-50%). *Juniperus osteosperma* (0-10%) is also occasionally present. The shrub layer is dominated by a dense layer of *Rhus trilobata* (30-60%). Other shrubs present may include *Quercus gambelii* (0-5%), *Brickellia longifolia* (0-5%), and *Rosa woodsii* (0-5%). The herbaceous layer is usually sparse, with *Poa pratensis* (1-5%), *Maianthemum stellatum* (0-1%) and *Melilotus officinale* (0-10%).

Soil: Soils are deep, fine sandy loams, often alkaline, and of a calcareous parent material.

Adjacent riparian vegetation: *Salix exigua* shrublands can occur on adjacent pointbars and stream banks. This association may intergrade with *Populus deltoides ssp. wislizenii/Rhus trilobata* forests at lower elevations.

Adjacent upland vegetation: *Pinus edulis-Juniperus osteosperma* woodlands, *Artemisia tridentata*, and *Quercus gambelii* shrublands often occurs on adjacent hill slopes.

Succession/management: This plant association appears to be late-seral in Utah (Padgett *et al.* 1989). In southwestern Colorado, *Rhus trilobata* (= *R. aromatica* var. *trilobata*) is present in young as well as older cottonwood stands, but becomes more dense, excluding other shrubs as the stand matures. Heavy livestock grazing reduces shrub density and increases abundance of non-native herbaceous species, including *Poa pratensis* and *Taraxacum officinale*. On higher terraces that are less frequently flooded, *Populus angustifolia* does not reproduce, indicating succession to an upland shrub community. For example, the presence of *Quercus gambelii* may indicate a trend toward an oak upland shrub community (Padgett *et al.* 1989).

Table 14. Cover Class Codes* for Characteristic Plant Species in the *Populus angustifolia/Rhus trilobata* Plant Association.

Plots (94____)	GK04	JB06	JB40	MD03	MD05	MD06	RR04	RR05
Occurrence Ranks**	A	A	C	B	B	B	B	B
TREES								
Acer negundo --young & mature trees	-	-	30	-	-	-	-	-
Juniperus osteosperma --young & mature	10	-	-	-	-	-	-	-
Juniperus scopulorum --young & mature trees	10	-	-	10	-	3	-	-
Populus angustifolia --saplings	10	-	-	10	-	-	1	1
Populus angustifolia --seedlings	-	-	-	3	1	-	-	-
Populus angustifolia --young & mature trees	10	-	10	-	40	50	-	-
Populus x acuminata --saplings	-	3	-	-	-	-	-	-
Populus x acuminata --young & mature trees	-	10	-	-	-	-	30	3
SHRUBS								
Quercus gambelii	10	1	20	-	10	10	-	-
Acer glabrum	-	70	-	-	-	-	-	-
Alnus incana ssp. tenuifolia	-	-	-	-	3	10	-	-
Amelanchier utahensis	3	-	1	-	-	-	-	-
Artemisia tridentata	-	-	-	10	-	-	10	-
Brickellia longifolia	-	-	-	-	-	-	3	1
Cercocarpus montanus	10	-	-	-	-	-	-	-
Cornus sericea	1	10	-	-	-	10	-	-
Mahonia repens	-	1	10	-	-	-	-	-
Philadelphus microphyllus	-	-	-	-	-	-	-	-
Rhus trilobata var. trilobata	30	30	10	30	40	70	60	70
Rosa woodsii	10	10	-	-	10	10	-	-
Salix exigua	1	-	-	-	3	10	-	10
Salix ligulifolia	-	-	-	-	3	-	-	-
Shepherdia argentea	-	-	-	-	-	3	-	-
Toxicodendron rydbergii	1	-	10	1	-	-	-	-
GRAMINOIDS								
Hordeum jubatum	-	-	-	-	-	3	-	-
Muhlenbergia montana	-	-	10	-	-	-	-	-
Stipa lettermanii	-	-	3	-	-	-	-	-
FORBS								
Artemisia ludoviciana	-	-	3	-	-	-	-	-
Asclepias speciosa	-	-	1	-	-	-	-	-
Cirsium sp.	-	-	-	-	1	-	-	-
Clematis ligusticifolia	-	1	-	10	3	3	1	-
Ligusticum filicinum	-	-	-	-	-	-	-	3
Maianthemum racemosum ssp. racemosum	-	10	1	-	-	-	-	-
Maianthemum stellatum	20	-	-	-	20	-	-	-
Melilotus officinale	-	-	-	1	-	3	1	-
Solidago canadensis	-	-	-	-	3	-	-	-
Solidago sp.	-	-	1	10	-	-	-	-
Thermopsis rhombifolia var. montana	-	-	-	-	-	3	-	-
HORSETAILS								
Equisetum arvense	-	-	-	-	-	3	-	-

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 13 of the Introduction for complete definitions.

Narrow-leaf cottonwood/yellow willow-silver buffaloberry *(Populus angustifolia/Salix ligulifolia-Shepherdia argentea)* Plant Association
G1S1 (POAN/SALI-SHAR)
Estimated number of occurrences: 5, highly threatened, restricted to SW Colorado.
Gunnison River Basin--2 plots (94GK05, 94GK48), plus two other known occurrences.
Colorado River Basin--1 plot (93RR49)

Related types: Originally described by W. Baker, 1986. Not previously described in the literature.

Distribution: Known only from south-western Colorado, possibly occurs in northern New Mexico, however not listed in New Mexico Vegetation (Dick-Peddie 1993).

Elevation: 1890-1950 m (6200-6360 ft).

Geomorphology: This plant association occurs only in broad alluvial valleys (185-300 m) with low to moderate gradient streams (0.9%-5%). Mature stands spread out across the floodplain, but can also occur on narrow floodplains of constricted reaches. Stands of young *Salix, Alnus* or *Populus* seedlings occur on active point bars, while mature stands occur on cut banks and meanders.

Rosgen's Channel Type: This type appears limited to wide, sinuous (C3) reaches.

Soils: Soils are deep sandy loams, slightly to highly effervescent, that become increasingly skeletal with depth.

Vegetation: Stands of this association have widely spaced, mature trees of *Populus angustifolia*, comprising 30% upper canopy cover. Sapling and seedings may also be present in bands parallel to the river, with about 5-40% cover. Shrubs are widely spaced and numerous: *Salix ligulifolia* (0-10%), *Shepherdia argentea* (10-30%), *Alnus incana* (5%), *Rhus trilobata* (1-40%), *Cornus sericea* (0-5%), and *Salix exigua* (1%). The herbaceous undergrowth is dominated by introduced hay grasses and a few native forbs: *Agrostis stolonifera* (20%), *Poa pratensis* (10%), *Maianthemum stellatum* (5%), and *Solidago canadensis* (1%). Unfortunately, none of the stands sampled had an intact native herbaceous canopy, so pre-European characteristic species and abundance of this layer is unknown.

Adjacent riparian vegetation: *Salix exigua, Salix lucida* and young *Populus angustifolia* stands commonly occur on adjacent on point bars.

Adjacent upland vegetation: *Pinus edulis-Juniperus osteosperma* woodlands occur on adjacent hill slopes.

Succession/Management: Like all *Populus* dominated riparian forests, this plant association is dependent on fresh alluvial deposits for regeneration. *Populus* spp. seedlings require bare, moist sands with full sunlight for establishment (Bradely and Smith 1986). All known occurrences of this association are heavily degraded by over-grazing and/or controlled hydrology. Further research is needed to determine the amount, frequency, and duration of spring floods and late-season draw-down rates to provide for riparian forest regeneration and maintenance. Season-long live-stock grazing replaces the native herbaceous undergrowth with non-native species, and with time will remove native shrubs as well.

Table 15. Cover Class Codes* for Characteristic Plant Species in the *Populus angustifolia/Salix ligulifolia-Shepherdia argentea* Plant Association.

Plot (94____)	GK05	GK48
Occurrence Ranks**	C	C
TREES		
Populus angustifolia --saplings	3	40
Populus angustifolia --young & mature trees	30	30
SHRUBS		
Alnus incana ssp. tenuifolia	3	10
Betula occidentalis	3	-
Cornus sericea	-	3
Rhus trilobata var. trilobata	40	1
Rosa woodsii	3	-
Salix exigua	1	1
Salix ligulifolia	-	10
Salix monticola	-	3
Shepherdia argentea	30	20
GRAMINOIDS		
Agrostis stolonifera	-	20
Dactylis glomerata	-	3
Elymus lanceolatus ssp. lanceolatus	3	-
Juncus balticus	1	-
Pascopyrum smithii	-	3
Phleum pratense	-	1
Poa pratensis	10	10
FORBS		
Aster laevis	3	-
Clematis ligusticifolia	30	20
Galium boreale	-	1
Glycyrrhiza lepidota	1	3
Heterotheca villosa	3	-
Ipomopsis aggregata	1	-
Maianthemum stellatum	3	1
Melilotus alba	-	1
Melilotus officinale	-	1
Prunella vulgaris	3	-
Solidago canadensis	-	1
Taraxacum officinale	1	3
Trifolium pratense	1	-
Trifolium repens	-	1
HORSETAILS		
Equisetum arvense	-	3
Equisetum hyemale	1	-

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 13 of the Introduction for complete definitions.

Other *Populus angustifolia* stands:

One stand sampled (94JB39) is located on a point bar of the main stem of the Gunnison River within the Black Canyon of the Gunnison. *Populus angustifolia* seedlings (30% cover) are about 0.3 meters tall and were interspersed with *Melilotus alba, Artemisia ludoviciana,* and *Heterotheca villosa* (each <1%). Jones (1992) describes this type of community as "recent alluvial bar". This early seral-stage is a necessary step to a more mature *Populus angustifolia* forest type. Point bars are uncommon in the Black Canyon, and the establishment of *Populus* is a new ecological process since the dams have been in place.

Three stands sampled (94GK39, 94JB04, and 94JB40) occured on lower, drier reaches with scattered *Populus angustifolia* (10%) and a thick shrub understory with *Toxicodendron rhydbergii* (10-30%) in common to all three reaches. Each of the sites showed signs of heavy recrational disturbance (trampling by fishermen, etc.) Two of the stands had *Cornus sericea* (20-50%), and one plot had 20% *Sherpherdia argentia*, while one stand had *Quercus gambeli* (20%) and *Acer negundo* (30%). The first two stands (94GK30 and 94JB04) may represent degraded occurances of the *Populus angustifolia/Cornus sericea* plant association. The third stand (94JB40) occured at the high water mark within a steep canyon section of Black Canyon of the Gunnison National Monument, and receives some trampling by recreationalists, and may represent a semi-stable riparian deciduous forest within the canyon. This association has likely developed due to the controlled flows and lack of the high scouring floods since the upstream dams have been in place.

Populus balsamifera Series

Balsam poplar/thin-leaf alder (*Populus balsamifera/Alnus incana ssp. tenuifolia)* Plant Association
GUSU (POBA/ALIN)
Gunnison River Basin-- 2 plots (94RR16, 94RR27)
Colorado River Basin-- 2 known occurrences, South Platte River Basin-- 1 known occurrence
Routt NAtional Forest--1 knowm occurrence.

Related types: This plant association may be similar to a *Populus balsamifera/Cornus sericea* type described from southern Saskatchewan (Jones and Peterson 1970, cited in Johnston 1987). However Colorado stands lack *Cornus sericea*.

Distribution: *Populus balsamifera* dominated valley bottoms and floodplains have been reported from Alaska (Vierteck *et al.* 1992), the northern contiguous U.S. and New England (Gleason and Conquist 1963). It forms extensive floodplain forests north and east of the Great Plains Region and extends sparingly into the Rocky Mountains (McGregor *et al.* 1986). *Populus balsamifera* has a limited distribution in Colorado, and is somewhat restricted to the north-central regions of the state (Harrington 1954, McGregor *et al.* 1986). Stands observed in the Gunnison basin expand it's distribution south to about 38.5° latitude. Other stands have been observed along the Cache la Poudre River near Ft. Collins (author observation) and on tributaries of the Colorado River near Eagle. *Populus balsamifera* dominated riparian areas are infrequent in the Rocky Mountains.

Elevation: 2500-2650 m (8100-8700 ft).

Geomorphology: This plant association occurs along a variety of streams (first through fourth order) in moderate to wide (60-180 m) glacial out-wash valleys. It appears limited to immediate stream banks, overflow channels, and floodplains.

Rosgen's Channel Type: Stands occur along slightly meandering, broad (B2 and B4) reaches.

Soils: Soils are fine sandy and silty loams, generally fairly deep on skeletal alluvial deposits. Pale mottles may be observed within the top 30 cm.

Vegetation: Mature trees and saplings of *Populus balsamifera* create an overstory canopy of 40-50% cover. Other trees present include *Populus tremuloides* and *Picea spp.* (0-10%). A thick band of shrubs occurs along the stream edge and consists primarily of *Alnus incana* (30-60%), *Lonicera involucrata* (1-3%), *Rosa woodsii* (1-10%), and *Ribes inerme* (0-3%). *Sambucus racemosa* (0-1%) and *Juniperus communis* (0-3%) may also be present. The herbaceous understory can highly variable (<10->30%).

Adjacent Riparian Vegetation: *Picea engelmannii/Alnus incana-Salix drummondiana* forests can occur on adjacent, narrow floodplains and banks, and *Alnus incana* shrublands can occur along adjacent steep-sided stream banks.

Adjacent Upland Vegetation: *Pinus contorta* and *Populus tremuloides* forests occur on adjacent hill slopes.

Succession/Management: Like all *Populus* dominated riparian forests, this plant association is dependent on fresh alluvial deposits for regeneration. *Populus* spp. seedlings require bare, moist sands with full sunlight for establishment (Bradley and Smith 1986). *Populus balsamifera* 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.

Table 16. Cover Class Codes* for Characteristic Plant Species in the *Populus balsamifera/Alnus incana* ssp. *tenuifolia* Plant Association.

Plots (94____)	RR16	RR27
Occurrence Ranks**	B	B
TREES		
Picea pungens --seedlings	-	1
Picea pungens --young & mature trees	10	10
Pinus contorta --young & mature trees	-	3
Populus balsamifera --mature trees	40	40
Populus balsamifera --saplings	50	3
Populus balsamifera --seedlings	1	20
Populus tremuloides	1	-
SHRUBS		
Alnus incana ssp. tenuifolia	30	60
Juniperus communis	-	3
Lonicera involucrata	3	1
Ribes inerme	3	-
Rosa woodsii	10	1
Sambucus racemosa ssp. pubens var. microbotrys	1	-
GRAMINOIDS		
Carex geyeri	-	3
Carex sp.	1	1
Poa pratensis	3	1
Stipa sp.	3	-
FORBS		
Actaea rubra	3	-
Cardamine cordifolia	3	-
Conioselinum scopulorum	1	1
Erigeron sp.	-	3
Fragaria virginiana	1	1
Galium boreale	3	1
Geranium richardsonii	10	1
Heracleum lanatum	10	-
Maianthemum stellatum	3	-
Osmorhiza depauperata	3	-
Taraxacum officinale	1	1
Equisetum arvense	3	3

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 13 of the Introduction for complete definitions.

Populus tremuloides Series

Aspen/Thin-leaf alder (*Populus tremuloides/Alnus incana* ssp. *tenuifolia*) Plant Association GUSU (POTR/ALIN)
Gunnison River Basin--4 plots (94GK09, 94GK10, 94MD37, 94RR46)
Colorado River Basin--3 plots (93SS06, 93DR21, 93DR22)

Related types: *Populus tremuloides/Alnus incana* (Kittel *et al.* 1994). These stands may represent an overlap of two plant associations, the *Populus tremuloides* forest occurring on the hillslopes and the *Alnus incana* riparian shrubland along the stream banks, rather than a new riparian plant association.

Distribution: This plant association is known from the Colorado River Basin in Colorado south to the Gunnison River basin (Kittel and Lederer 1993, Kittel *et al.* 1994).

Elevation: 2650-2930 m (8720-9600 ft).

Geomorphology: This plant association occurs along the narrow stream banks of steep gradient (1-10%) first-order streams in narrow (10-70 m), deep valleys.

Rosgen's Channel Type: Stands occur along steep, relatively narrow (A3, A4) reaches, occasionally along somewhat less steep streams (B3).

Vegetation: This plant association has a tall overstory of *Populus tremuloides* (10-70%) with *Alnus incana* (50-70%) and a dense undergrowth rich in forb species. The adjacent hillslopes are often also covered with *Populus tremuloides*, and thus in upper canopy is indistinguishable from the riparian community. Therefore the understory shrub and forb species present along the immediate stream bank are the distinguishing features that separate this riparian type from adjacent hillslope forests. Forb cover along the stream ranges from 10 to 70% cover and includes *Mertensia ciliata, Conioselinum scopulorum,* and *Osmorhiza depauperata* (each contributing about 10-20% cover).

Soils: Soils are in general skeletal shallow sandy and sandy clay loams, or deeper sandy clay loams.

Adjacent Riparian Vegetation: *Alnus incana* shrublands often occur on adjacent, rockier and steeper gradient stream reaches.

Adjacent Upslope Vegetation: *Pinus contorta* and *Populus tremuloides* forests occur on adjacent hill slopes.

Succession/Management: *Populus tremuloides* woodlands can be self perpetuating climax

plant associations, or they can be seral to coniferous types (DeByle and Winokur 1985). Where valley bottoms are moist and stable, *Populus tremuloides* dominates as well as on mesic hillslope sites. With heavy grazing the understory shrubs have been known to become dominated by *Symphoricarpos* spp. (DeByle and Winokur 1985). This is likely to occur in valley bottom stands where over grazing has dried the soil and dropped the water table.

Table 17. Cover Class Codes* for Characteristic Plant Species in the *Populus tremuloides/Alnus incana* Plant Association.

Plots (94___)	GK09	GK10	MD37	RR46
Occurrence Ranks**	A	B	B	B
Trees				
Picea engelmannii --young & mature	-	-	20	-
Populus tremuloides	70	10	50	40
Pseudotsuga menziesii --young & mature	10	-	10	-
Shrubs				
Alnus incana ssp. tenuifolia	50	50	60	70
Graminoids				
Calamagrostis canadensis	-	-	-	3
Carex disperma	-	-	20	-
Forbs				
Achillea millefolium var. apicola	-	3	-	1
Cardamine cordifolia	1	1	10	1
Conioselinum scopulorum	3	3	3	3
Corydalis caseana ssp. brandegei	10	10	-	-
Delphinium barbeyi	-	-	-	10
Galium boreale	3	1	-	-
Geranium richardsonii	3	3	3	1
Mertensia ciliata	20	20	3	1
Orthilia secunda	-	-	3	1
Osmorhiza depauperata	3	3	-	10
Osmorhiza occidentalis	3	-	1	-
Oxypolis fendleri	3	-	3	3
Ranunculus sp.	3	1	-	-
Rudbeckia lacinata var. ampla	10	-	-	-
Senecio triangularis	3	-	3	3
Viola canadensis	3	1	-	-
Equisetum arvense	-	-	20	1

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 13 of the Introduction for complete definitions.

UNESCO: III.B.3.c. DECIDUOUS ALLUVIAL SHRUBLANDS
COWARDIN: PALUSTRINE SYSTEM-SCRUB-SHRUB, DECIDUOUS SHRUBLAND

Alnus incana ssp. *tenuifolia* Alliance

Thinleaf alder-Red-osier dogwood (*Alnus incana* ssp. *tenuifolia-Cornus sericea*) Plant Association
G4S2 (ALIN-COSE)
Gunnison River Basin--3 plots (94GK01, 94GK23, 94GK38).
Colorado River Basin--6 plots (93RR28, 93RR41, 93RR42, 93SS50, 93RR23, 93RR36).
Other occurrences: Yampa River Basin--5 plots.

Related Types: *Alnus incana* ssp. *tenuifolia-Cornus sericea* (Komarkova 1986, Johnston 1987, Padgett *et al.* 1989, Kittel and Lederer 1993); similar to *Alnus incana* ssp. *tenuifolia/Ribes hudsonianum* and *Cornus sericea/Galium triflorum* types described by Youngblood *et al.* (1985).

Distribution: This plant association is reported from the high central plateaus and the La Sal Mountains of Utah and from eastern Nevada (Padgett *et al.* 1989). In Colorado it is reported from Gunnison National Forest (Johnston 1987), the eastern portion of the Yampa River Basin in Routt County (Kittel and Lederer 1993), along the mainstem of the Colorado River, and along small drainages in the western portion of the Gunnison River Basin.

Elevation: 1950-2470 m (6400-8140 ft).

Geomorphology: This plant association occurs on narrow, rocky banks and benches of small channels and narrow constricted reaches of larger rivers. Stands also occur along overflow channels, and on small, narrow tributaries.

Rosgen's Channel Type: Stands of this association occur on cobbly, wide (B3) type reaches.

Vegetation: *Alnus incana* and *Cornus sericea* form a dense thicket (40-70%). A wide variety of other shrub species may also be present, such as *Lonicera involucrata* (0-20%), *Salix ligulifolia* (0-30%), *S. lucida* var. *caudata* (0-30%), or *S. monticola* (1-20%). Tree species, if present, are scattered. Forb cover is highly variable (10-40% total cover), depending on the amount of light penetration through the canopy layer. Species include *Heracleum lanatum* (0-3%), *Rudbeckia laciniata* (0-30%), *Conioselinum scopulorum* (0-20%), *Maianthemum stellatum* (0-10%), and *Ozmorhiza depauperata* (0-10%). Graminoid cover is usually low.

Soil: Soils are thin sandy loam to sandy clay loams, with mottling evident at about 30 cm, and gravel or cobble layers becoming common at 70-100 cm.

Adjacent Riparian Vegetation: *Salix exigua* shrublands occurs on point bars and stream banks, *Populus angustifolia-Picea pungens/Alnus incana* ssp. *tenuifolia* and *Populus angustifolia/Cornus sericea* forests occur on adjacent, wider floodplains and stream banks.

Adjacent Upland Vegetation: *Quercus gambelii* and *Amelanchier* spp. shrublands occur on steep south-facing slopes, and at lower elevations; *Populus tremuloides* woodlands or *Abies lasiocarpa-Picea engelmannii* forests occur on adjacent hillslopes at higher elevations, or on north-facing slopes.

Succession/management: This plant association is tolerant of flooding and requires a high water table each spring. Both *Alnus* and *Cornus* are capable of sprouting and have extensive rooting structure that provides good bank stabilization. In Colorado, this type is often found on rocky benches, the surface of which may be not periodically flooded, but where rhizomatous roots may reach well aerated ground water near the stream. This plant association also occurs on small, shady high gradient streams, and is more common on stream borders than floodplains.

Alnus incana is considered a long-lived seral species that can established after severe flooding disturbance (Hansen *et al.* 1988). *Alnus* also sprouts, so can remain after subsequent flooding disturbance (Hansen *et al.* 1988). It requires moist soils throughout the growing season, and stands are limited to narrow bands along swift-moving streams. It is a prolific seed producer, and is one of the first species to become established on cobble bars. The nitrogen fixing bacteria associated with its roots may speed the development of the soil organic content (Hansen *et al.* 1989). It is thought that *Alnus* stands will become dominated by willow or conifer trees if sites remain undisturbed (Hansen *et al.* 1989).

With disturbance the canopy opens and the shrub and herbaceous species diversity increases. Stands left undisturbed by cattle grazing develop a thick, heavily intertwined shrub canopy that limits herbaceous undergrowth. For example, compare the species composition in plot 94GK23, a "C" rank occurrence that has been grazed, with the less disturbed "B" ranked occurrences, plots 94GK01 and 94GK38, in Table 17.

Table 18. Cover Class Codes* for Characteristic Plant Species in the *Alnus incana* ssp. *tenuifolia-Cornus sericea* Plant Association.

Plots (94___)	GK01	GK23	GK38
Occurrence Ranks**	B	C	B
SHRUBS			
Alnus incana ssp. tenuifolia	70	70	40
Betula occidentalis	20	-	10
Cornus sericea	70	40	40
Lonicera involucrata	-	20	-
Ribes inerme	-	10	-
Rosa woodsii	20	10	10
Salix drummondiana	-	10	-
Salix exigua	-	-	10
Salix ligulifolia	-	-	30
Salix lucida ssp. caudata	-	30	-
Salix monticola	10	20	1
GRAMINOIDS			
Carex lanuginosa	-	-	10
Eleocharis palustris	-	-	10
FORBS			
Conioselinum scopulorum	-	3	-
Galium trifidum ssp. subbiflorum	-	3	-
Geranium richardsonii	-	3	-
Heracleum lanatum	-	3	-
Maianthemum stellatum	10	-	-
Mertensia franciscana	-	3	-
Osmorhiza depauperata	-	10	-
Rudbeckia lacinata var. ampla	-	20	-
Solidago canadensis	-	-	10
Urtica dioica ssp. gracilis	-	3	-
Vicia americana	-	1	1
HORSETAILS			
Equisetum arvense	-	3	10
Equisetum laevigatum	-	-	10

*Cover Codes represent the middle value for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Thinleaf alder/Mesic Forb (*Alnus incana* ssp. *tenuifolia*/Mesic Forb) Plant Association G3S3 (ALIN/MF)
Gunnison River Basin--5 plots (94GK13, 94MD38, 94RR44, 94RR47, 94RR51)
White River Basin--3 plots (92NL43, 92NL44, 92NL49)
Colorado River Basin--4 plots (93SS29, 93SS33, 93GK49, 93DR10)
Routt National Forest--13 known occurrences

Related Types: *Alnus incana*/mesic forb (Padgett *et al.* 1989). Similar *Alnus incana* types are described from Montana (Hansen *et al.* 1989).

Distribution: The *Alnus incana*/mesic forb plant association is found in central and eastern Utah (Padgett *et al.* 1989) and has been reported from the Colorado Front Range by Cooper and Cottrell (1990) as *Alnus incana/Rudbeckia laciniata.*

Elevation: 2290-2930 m (7540-9560 ft).

Geomorphology: This association occurs along narrow alluvial benches and terraces of narrow canyons and valleys (43-70 m wide), and as narrow, stringer bands in wider valleys (120 m). It is usually confined to narrow bands at the edge of the stream channel, but on rare occasion does form a wide band on the floodplain. Stream gradients range from 0.3% to 12%.

Rosgen's Channel Type: Stands occur along rocky, wide reaches (B4, B5) and narrow, steep reaches (A3 and A4).

Vegetation: *Alnus incana* creates a dense tall-shrub canopy layer (8-15 m tall) of 30-80% cover. A few trees may be present along the edges of the stand, including *Abies lasiocarpa* or *Picea engelmannii* (0-10%). Other shrub species present include *Lonicera involucrata* (0-5%), *Salix drummondiana* (0-5%) and *Ribes inerme* (0-30%). Characteristic of this association is a tall, lush forb undergrowth, with a total cover ranging from as low 30 to 70%. Early seral stages of this type may have as little as 10% forb cover. Noticeable tall species include *Heracleum lanatum* (0-20%), *Rudbeckia laciniata* (0-20%), and *Aconitum columbianum* (0-10%). Abundant mesic graminoids may also be present, including *Calamagrostis canadensis* (0-10%), *Carex microptera* (0-10%), and *Poa palustris* (0-3%).

Soils: Soils have deep A horizons that are well drained loams and sandy loams, either skeletal or stratified with skeletal layers.

Adjacent Riparian Vegetation: *Salix drummondiana* shrublands occur on stream banks and floodplains, *Abies lasiocarpa-Picea engelmannii* forests occur along narrower reaches, or on higher ground along stream banks and floodplains. The *Alnus incana*/Mesic forb plant association may also occur next to and grade into the *Picea pungens/Alnus incana*

riparian forest type.

Adjacent Upslope Vegetation: *Abies lasiocarpa-Picea engelmannii* forests and *Populus tremuloides* woodlands occur on adjacent hillslopes at subalpine elevations. *Pinus contorta* and *Pseudotsuga menziesii* forests occur on adjacent hillslopes at lower elevations.

Succession/management: After establishment, stands of *Alnus* slow flood waters and trap sediment, accumulating fine textured sediments on top of coarser alluvial material. As fine sediment is deposited and the surface of the landform rises above flood levels, the surface is less and less frequently flooded, allowing soil and forb undergrowth development (Padgett *et al.* 1989). This association may be a stable sere, but is subject to impacts and changes by livestock grazing. A key diagnostic character of this association is the abundant mesic forb undergrowth. These herbaceous species are sensitive to trampling. Large (>50 m x 50 m) occurrences are unusual. Occurrences with the native herbaceous undergrowth intact are somewhat rare. The presence of sapling *Abies lasiocarpa* or other tree species suggests replacement of the *Alnus* community with conifers, or *Acer negundo* in more xeric sites (Padgett *et al.* 1989).

Alnus incana is considered a long-lived seral species that established after severe flooding disturbance (Hansen *et al.* 1989). *Alnus* is capable of sprouting, so can remain after subsequent flooding disturbance (Hansen *et al.* 1988). It requires moist soils throughout the growing season, and stands can be limited to narrow bands along swift-moving streams. It is a prolific seed producer, and is one of the first species to become established on cobble bars. *Alnus* has nitrogen fixing bacteria association with its roots, thereby speeding the development of the soil organic content (Hansen *et al.* 1989). It is thought that *Alnus* stands will become dominated by willow or conifer stands if sites remain undisturbed (Hansen *et al.* 1989).

Table 19. Cover Class Codes* for Characteristic Plant Species in the *Alnus incana* ssp. *tenuifolia*/Mesic forb Plant Association.

Plots	GK13	MD38	RR44	RR47	RR51
Occurrence Ranks**	C	A	B	A	B
TREES					
Picea engelmannii --saplings	-	3	1	-	1
Picea engelmannii --young & mature tree	-	10	10	-	10
Pinus contorta --young & mature trees	-	20	10	10	-
SHRUBS					
Alnus incana ssp. tenuifolia	70	80	70	80	30
Lonicera involucrata	-	30	10	1	-
Ribes inerme	30	-	-	-	-
Rosa woodsii	10	1	-	1	-
Salix drummondiana	-	10	-	-	-
GRAMINOIDS					
Calamagrostis canadensis	20	3	3	3	-
Carex microptera	-	1	-	1	-
Carex sp.	3	-	10	3	-
Poa pratensis	10	-	-	1	-
FORBS					
Cardamine cordifolia	-	1	10	1	-
Galium boreale	-	10	-	3	-
Geranium richardsonii	3	3	3	3	1
Heracleum lanatum	10	10	10	20	-
Maianthemum stellatum	3	10	-	1	-
Mentha arvensis	10	-	-	-	-
Mertensia ciliata	-	10	10	10	-
Rudbeckia lacinata var. ampla	20	-	-	-	-
Thalictrum fendleri	3	1	3	-	3

*Cover Codes represent the middle value for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Thinleaf alder-Drummond's willow (*Alnus incana* ssp. *tenuifolia-Salix drummondiana*) Plant Association
GUSU (ALIN-SADR)
Gunnison River Basin--4 plots (94GK15, 94GK27, 94JB12, 94JB45).

Related Types: *Alnus incana* ssp. *tenuifolia-Salix drummondiana/Equisetum arvense* (Komarkova 1986, as cited in Johnston 1987). *Alnus incana* spp. *tenuifolia/Equisetum arvense* (Reid and Bourgeron, 1991).

Distribution: This association has not been reported outside of Colorado. Within Colorado this plant association has been described from the Gunnison and Roosevelt National Forests (Komarkova 1986 and Hess 1981, as cited in Johnston 1987). It is an uncommon type, probably overlooked, and naturally occurs in small patches. It is likely to occur throughout the Rocky Mountains.

Elevation: 2380-2865 m (7760-9400 ft).

Geomorphology: This association occurs along very steep and fast-moving rocky streams, in steep, sheer-walled confined canyons and along entrenched channels in wider valleys.

Rosgen's Channel Type: This association is found along gravel and cobble bottomed, flat channel reaches with limited floodplains (B3 and B4) and along steep, rocky (A2) streams.

Vegetation: *Alnus incana* (40-98%) and *Salix drummondiana* (30-60%) create a dense, closed canopy (50-98%) bordering the stream edge. *Lonicera involucrata* is often also present (1-20%). The herbaceous undergrowth is often sparse (<10%), especially in heavily shaded stands on coarse substrates, where both recent flooding scour and sunlight limit herbaceous growth. Other stands can have more abundant herbaceous growth, including *Heracleum lanatum* (0-20%), *Angelica ampla* (0-10%), and *Mertensia ciliata* (0-10%).

Soils: Stands with little herbaceous growth have coarse, skeletal soils, with no accumulated fine layer at the surface. Stands with a rich herbaceous undergrowth can have thick layer (10-30 cm) of fine sandy loam over a coarse alluvial deposit.

Adjacent Riparian Vegetation: *Populus angustifolia* or *Picea pungens* woodlands occur on stream banks and floodplains; *Salix exigua* shrublands can occur along adjacent gravel bars and stream banks.

Adjacent Upslope Vegetation: *Abies lasiocarpa-Picea engelmannii* and *Populus tremuloides* forests occur on adjacent hillslopes at higher elevations; *Pinus ponderosa* woodlands, and *Quercus gambelii* shrublands occur on hillslopes at lower elevations.

Succession/Management: This association is an early-seral stage. *Alnus incana* and *Salix drummondiana* are prolific seed producers and are one of the first species to colonize coarse-textures cobble bars and recently scoured alluvial surfaces. They seem to require moist soils throughout the growing season, and need well oxygenated roots. When young they are flexible and can tolerate most flooding, and can readily re-sprout. *Salix drummondiana* may become more abundant with time, taking advantage of the nitrogen rich soils associated with *Alnus*. This type is limited to stream margins, and rarely forms large, extensive stands.

Table 20. Cover Class Codes* of Characteristic Plant Species of the *Alnus incana* spp. *tenuifolia-Salix drummondiana* Plant Association

Plots (94____)	GK15	GK27	JB12	JB45
Occurrence Ranks**	B	C	B	B
TREES				
Picea engelmannii --mature trees	-	-	10	1
Picea pungens --young & mature trees	-	1	10	3
SHRUBS				
Alnus incana ssp. tenuifolia	98	50	70	80
Lonicera involucrata	-	20	10	1
Salix drummondiana	60	30	30	30
Symphoricarpos rotundifolius	-	10	-	-
GRAMINOIDS				
Calamagrostis canadensis	10	-	-	-
Carex microptera	1	-	-	-
Elymus glaucus	-	3	-	-
Phleum pratense	-	3	-	-
Poa palustris	-	-	1	-
Poa pratensis	1	10	10	-
FORB				
Achillea millefolium var. apicola	3	3	-	1
Angelica ampla	-	-	10	-
Fragaria virginiana	-	1	-	10
Geranium richardsonii	-	3	10	3
Geum macrophyllum	-	3	1	-
Heracleum lanatum	-	-	20	-
Lomatium dissectum	-	3	-	-
Mertensia ciliata	1	1	10	1
Osmorhiza depauperata	-	3	-	-
Oxypolis fendleri	-	1	1	-
Rudbeckia lacinata var. ampla	-	10	-	-
Taraxacum officinale	-	10	3	10
Urtica dioica ssp. gracilis	3	-	3	-
Vicia americana	-	1	-	1
HORSETAILS				
Equisetum arvense	1	30	1	1

*Cover Codes represent the middle value for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Other *Alnus incana* dominated stands:

In the White River Basin- One stand (92GK49) along the White River near Rio Blanco lake is overgrown with woody vines such as *Clematis ligusticifolia* and *Humulus lupulus*. The area is near the stream channel but about 1.5 meters above the channel elevation.

In the Colorado River drainage- One stand (93RR37) has dense *Alnus incana* and *Salix ligulifolia*. It is a heavily disturbed site.

In the Gunnison River Basin- Three stands (94GK02, 94JB43, 94RR11) in the Gunnison River Basin have a dense canopy of *Alnus incana* (40-60%) with *Salix monticola* (20-40%) co-dominant. Other willow species present are *Salix drummondiana* (0-5%) and *Salix geyeriana* (0-1%). One stand has *Picea pungens* (20%) and *Picea engelmannii* (10%) in the overstory, and in another, *Populus angustifolia* saplings (10%). Two of the stands have lush forb undergrowth (30-40% total forb cover). Graminoids present included abundant non-natives, such as *Agrostis stolonifera* (30%) and *Phleum pratensis* (10%). These stands appear to be disturbed, and may be grazing induced degradation of the *Alnus incana/mesic forb* plant association. These stands occurred on flat alluvial benches between 2440-2590 m (8000-8500 ft) in elevation.

Also in the Gunnison River basin, another stand (94MD12) of *Alnus incana* had *Salix lucida* ssp. *caudata* with 50% cover. This stand may be similar to stands described from the Yampa River Basin (Kittel and Lederer 1993), which are low elevation, early-seral associations, that typically occur in small patches on large alluvial floodplains.

Table 21. Cover Class Codes* for Characteristic Plant Species in *Alnus incana* spp. *tenuifolia* Dominated Stands.

Plots (94____)	GK02	JB43	RR11	MD12
Occurrence Ranks**	B	C	C	C
TREES				
Picea engelmannii --young & mature trees	10	-	-	-
Picea pungens --young & mature trees	-	20	-	-
Populus angustifolia --saplings	-	-	10	-
SHRUBS				
Alnus incana ssp. tenuifolia	40	50	60	40
Lonicera involucrata	3	3	-	1
Salix drummondiana	-	3	3	1
Salix monticola	40	20	30	-
Salix lucida spp. caudata	-	-	-	50
GRAMINOIDS				
Agrostis scabra	-	10	-	-
Agrostis stolonifera	-	30	-	-
Calamagrostis canadensis	-	10	-	1
Poa pratensis	-	1	10	20
Glyceria elata	-	-	-	1
FORBS				
Achillea millefolium var. apicola	3	-	10	10
Aster lanceolatus ssp. hesperius	-	20	-	-
Cirsium sp.	1	-	3	1
Conioselinum scopulorum	-	10	-	-
Geum macrophyllum	-	3	3	-
Heracleum lanatum	10	-	10	1
Maianthemum stellatum	1	3	-	-
Mertensia ciliata	3	-	2	3
Oxypolis fendleri	3	3	1	3
Taraxacum officinale	3	10	10	20
Trifolium repens	-	1	3	-
HORSETAILS				
Equisetum hyemale	3	3	-	-

*Cover Codes represent the middle value for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Betula occidentalis Alliance

River birch/Mesic Forb (*Betula occidentalis*/Mesic Forb) Plant Association
G2G3S2 (BEOC/MF)
Gunnison River Basin--4 plots (94MD01, 94RR01, 94RR03, 94RR08)
Colorado River Basin--3 plots (92NL34, 93RR44, 93GK09)

Related Types: *Betula occidentalis*/mesic forb (Padgett *et al.* 1989).

Distribution: This plant association is reported from Utah and Idaho (Padgett *et al.* 1989, and Youngblood *et al.* 1985). In Colorado, this type has not been well documented. Other *Betula occidentalis* associations have been reported from the Front Range (Cooper and Cottrell 1990), and from lower reaches of the Colorado and Gunnison River basins.

Elevation: 1980-2320 m (6640-7600 ft).

Geomorphology: This plant association occurs on moderate to wide floodplains (45-330 m), in bands up to 30 m wide, often extending well away from the channel edge. It can also occur in small patches at higher elevations. This plant association also occurs around seeps and isolated springs on hillslopes away from the valley bottom.

Rosgen's Channel Type: Stream reaches with stands of this association are rocky and cobble-bottomed wide (B2, B3) reaches, and meandering, cobble-bottomed (C3) reaches.

Vegetation: *Betula occidentalis* forms a dense canopy (40-90%) with *Cornus sericea* (3-20%) and *Salix monticola* (0-10%). Along narrow reaches, *Picea pungens* or *Pseudotsuga menziesii* may also be present (0-40%). Due to the thick canopy cover, herbaceous growth is limited in cover (<10%), but is diverse and often includes *Rudbeckia lacinata* (0-5%), *Conioselinum scopulorum* (0-5%), *Maianthemum stellatum* (0-5%). Graminoid and other non-forb cover is low, often less than 10% total cover, and includes *Juncus balticus* (1%), *Equisetum* spp. (5%), and *Poa pratense* (1%).

Soil: *Betula occidentalis* stands occur on deep pockets of sandy loams, often with signs of mottling within the top 30 cm.

Adjacent riparian vegetation: *Salix monticola* stands occur on adjacent floodplains; *Populus angustifolia/Rhus trilobata* woodlands occur along narrow reaches with limited floodplains.

Adjacent upslope vegetation: *Pseudotsuga menziesii-Picea engelmannii* forests occur on hillslopes at higher elevations; *Pinus edulis-Juniperus osteosperma* woodlands occur on adjacent slopes at lower elevations.

Succession/Management: *Betula occidentalis* may be a successional stage for other, conifer dominated vegetation types (Padgett *et al.* 1989). This species provides shading over the stream, improved fish habitat, and can stabilize stream banks. Because *Betula occidentalis* occupies low elevation (foothill) habitats, it is more threatened by development and stream impoundments than *Alnus* or *Cornus* riparian communities, and consequentially fewer undisturbed and unaltered stands exist today. Large, near pristine stands of *Betula occidentalis*/Mesic Forb plant association are very uncommon on the west slope.

Table 22. Cover Class Codes* for Characteristic Plant Species in the *Betula occidentalis*/Mesic Forb Plant Association.

Plots (94___)	MD01	RR01	RR03	RR08
Occurrence Ranks**	B	A	B	A
TREES				
Picea pungens --young & mature trees	-	-	20	10
Populus angustifolia --young & mature trees	-	-	-	10
Pseudotsuga menziesii --young & matures	-	-	10	-
SHRUBS				
Alnus incana ssp. tenuifolia	40	1	10	3
Betula occidentalis	40	90	40	40
Cornus sericea	20	20	20	20
Rhus trilobata var. trilobata	-	-	-	10
Ribes inerme	1	10	-	-
Rosa woodsii	-	10	1	3
Salix ligulifolia	-	-	-	10
Salix monticola	10	10	1	-
Shepherdia argentea	-	-	-	10
GRAMINOIDS				
Juncus balticus	-	1	3	-
Poa pratensis	-	1	1	-
FORBS				
Achillea millefolium var. apicola	-	1	1	-
Androsace septentrionalis	-	1	-	-
Maianthemum stellatum	-	10	-	10
Mertensia ciliata	-	1	1	-
Mertensia franciscana	1	-	-	-
Osmorhiza depauperata	-	-	-	1
Rudbeckia lacinata var. ampla	10	-	1	-
Taraxacum officinale	-	-	1	1
HORSETAILS				
Equisetum hyemale	10	1	-	1

*Cover Codes represent the middle value for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Betula glandulosa Alliance

Two stands with significant amounts of *Betula glandulosa* did not fit any known plant association and remain unclassified.

In one stand (94JB23), *Betula glandulosa* dominates the shrub (60%) cover, and is about 1.2 meters tall. Other shrubs also present are *Pentaphylloides floribunda* (20%), *Salix monticola* (20%), *Salix brachycarpa* (5%), and *Lonicera involucrata* (10%). Herbaceous undergrowth is open, with about 20% forb cover and 10% graminoid cover. Herbaceous species include *Maianthemum stellatum*, *Epilobium angustifolium*, *Bistorta bistortoides, Conioselinum scopulorum*, *Calamagrostis canadensis*, and *Carex aquatilis*. The ground is wet and thick with moss cover. The soil is a deep organic peat. This stand is small, about 30 m by 45 m in size, and occurs on a moderately wide bench or floodplain dissected by many small channels in a relatively narrow valley. No other stands like this one were observed in the valley. *Betula glandulosa* is known to occur in subalpine meadows and willow communities, intermixed with *Salix planifolia*, for example, but is rarely a dominate canopy component.

In another stand (94MD31), *Picea engelmannii* and *Pinus contorta* dominate the upper canopy (50%) along a very narrow reach, just below a wide, wet subalpine valley. The shrubby understory consists of *Betula glandulosa* (20%), *Salix wolfii* (10%), *Salix brachycarpa* (10%), *Pentaphylloides floribunda* (5%), and other *Salix* species. The herbaceous undergrowth is very lush, with nearly 50% cover in forbs and 10-20% cover from graminoids. Some of the more abundant species are *Angelica pinnata* (10%), *Mertensia ciliata* (10%), *Thalictrum alpinum* (10%), *Conioselinum scopulorum* (5%), *Carex norvegica* (5%), *Carex aquatilis* (5%), *Calamagrostis canadensis* (5%), and *Trisetum spicatum* (1%). This community may be classified as a *Picea engelmannii* type.

Additional data collected from 4 more stands also from the Gunnison River basin (USFS, B. Johnston, *personnel communication*) show *Betula glandulosa* as co-dominant with *Salix planifolia*. These stands were classified as *Salix planifolia/Carex aquatilis--Betula glandulosa* Phase.

Table 23. Cover Class Codes* for Some of the Plant Species in Stands of the *Betula glandulosa* Alliance.

Plots (94____)	JB23	MD31
Occurrence Ranks**	B	B
TREES		
Picea engelmannii --saplings	3	10
Picea engelmannii --seedlings	-	10
Picea engelmannii --young & mature trees	-	30
Pinus contorta --young & mature trees	-	20
SHRUBS		
Betula glandulosa	60	20
Lonicera involucrata	10	3
Pentaphylloides floribunda	20	10
Salix boothii	3	-
Salix brachycarpa	3	10
Salix geyeriana	-	3
Salix monticola	20	3
Salix wolfii	-	10
GRAMINOIDES		
Calamagrostis canadensis	3	3
Carex aquatilis	-	3
Carex norvegica	-	1
Deschampsia cespitosa	-	3
Luzula parviflora	-	1
Phleum alpinum	-	1
Trisetum spicatum	-	1
Trisetum wolfii	-	1
FORBS		
Achillea millefolium var. apicola	1	3
Angelica pinnata	-	10
Arnica cordifolia	-	3
Caltha leptosepala	-	3
Cardamine cordifolia	-	1
Conioselinum scopulorum	3	10
Epilobium angustifolium	10	10
Fragaria virginiana	-	10
Galium boreale	1	1
Maianthemum stellatum	3	-
Mertensia ciliata	-	10
Oxypolis fendleri	-	3
Polemonium pulcherrimum	-	1
Polygonum bistortoides	-	1
Pyrola minor	-	3
Sedum rhodanthum	-	1
Taraxacum officinale	-	3
Thalictrum alpinum	-	3
Trifolium repens	-	1
Veronica wormskjoldii	-	1
HORSETAILS		
Equisetum arvense	1	-

*Cover Codes represent the middle value for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Salix boothii Alliance

Booths willow/Mesic forb (*Salix boothii*/Mesic forb) Plant Association
G3S2 (SABO/MF)
Gunnison River Basin--8 plots (94JB20, 94JB31, 94JB33, 94MD17, 94MD24, 94MD29, 94RR21, 94RR38)
White--6 plots (92NL51, 92NL53, 92NL40, 92NL45, 92NL59, 92NL55)

Related Types: Very similar in species composition and relative abundance to *Salix boothii-Salix geyeriana-Salix lasiandra* var. *caudata* (CNHP 1993), *Salix boothii*/mesic forb (Padgett *et al.* 1989), and *Salix boothii/Smilacina stellata* (Youngblood *et al.* 1985). May be similar to stands dominated by *Salix boothii* included in the *Salix geyeriana/Poa pratensis* type described by Hansen *et al.* (1989).

Distribution: *Salix boothii* dominated (or co-dominated) plant associations (listed above) occur from eastern Idaho and western Wyoming south to cental Utah and western Colorado. In Colorado this is a minor type (occurs infrequently), reported from Routt county, the upper Yampa valley (CNHP 1993), and the Gunnison River basin.

Elevation: 2315-3140 m (7600-10,280 ft).

Geomorphology: This association occurs in medium to broad valleys along low gradient (1-2%) sinuous streams, within 0.75 m of the water table, but occasionally on low terraces of straighter reaches. The surface under stands is often uneven and hummocky from past flooding or beaver activity. In Idaho, *Salix boothii* can occupy a wide variety of riparian sites, ranging from gravely bars near water to drier benches with deep soils (Brunsfeld and Johnson 1985). In Colorado, where *Salix boothii* is approaching the southern-most portion of its range, it occupies only the wetter sites of undulating floodplains.

Rosgen's Channel Type: *Salix boothii* stands occur along a wide variety of stream channel reaches, ranging from steep (A3) to broad and sinuous (B3, C4) to narrow and meandering (E4, E6), to recently eroding reaches (F3, F4). In common to all these reaches is a low gradient floodplain, either narrow or broad, often with the impacts of past or recent beaver activity.

Vegetation: *Salix boothii* can form large stands with a canopy ranging from 40% to over 80% cover. Other willows and shrubs are always present, but species varied widely, including *Salix brachycarpa* (0-5%), *S. monticola* (0-30%), *S. geyeriana* (0-20%), *Betula glandulosa* (0-10%), and *Pentaphylloides floribunda* (10-30%). The undergrowth is characterized by a sparse to lush forb layer growing underneath the willow canopy on raised, better drained hummocks and ridges, while mesic graminoid species dominate the wetter swales and low-lying areas between the shrubs. Forb species include *Swertia perennis* (10%), *Pedicularis*

groenlandica (5-10%) and *Polygonum bistortoides* (10%). Graminoid species are highly variable, depending on the environment of the understory, including *Carex aquatilis* (10-60%), *C. utriculata* (10%), and *Calamagrostis canadensis* (20%). The name "mesic forbs" is used to emphasize that no single herbaceous species dominates the undergrowth.

Soil: Soils range from highly stratified, alternating sandy loams with clay loams, with mottling within the top 10 cm, to deep, dark-colored, with high organic content and often mottled silty clay loams.

Adjacent riparian vegetation: *Alnus incana* and *Salix drummondiana* shrublands occur on rocky, better drained streambanks or beaver dams; *Abies* spp., *Picea* spp. or *Pinus* spp. woodlands can occupy adjacent steep and narrow reaches; and *Carex* spp. meadows occupy swales and pond edges in and around the floodplain.

Adjacent upland vegetation: Mixed conifer or *Populus tremuloides* forests occur on adjacent hillslopes; *Artemisia tridentata* scrub occurs on hillsides at lower elevations.

Succession/Management: *Salix boothii* appears to grow on mesic sites that are neither completely saturated nor dry throughout the growing season (Padgett *et al.* 1989). The undergrowth of *Salix boothii* dominated associations varies according to the substrate and water regime. Wetter stands have an understory of *Carex utriculata*, while drier stands may have *Calamagrostis canadensis* (Hansen *et al.* 1988). With excessive grazing this type may be replaced with a *Salix boothii/Poa pratensis* type, which often has remnant forbs indicative of the *Salix boothii/mesic forb* type growing at the shrub bases (Padgett *et al.* 1989). *Salix geyeriana* may be preferentially browsed over *Salix boothii* (Hansen *et al.* 1989).

Salix boothii is an effective stream bank stabilizer, however banks with an undergrowth of *Poa pratensis* may be subject to sloughing which is aggravated by livestock grazing when soils are wet (Hansen *et al.* 1988). *Salix boothii* sprouts rapidly following fire. Hot, quick fires are most effective, producing more sprouts and killing fewer plants. Prescribed burns can be a useful tool for rejuvenating decadent stands (Hansen *et al.* 1988). *Salix boothii* plantings have been used successfully in rejuvenating degraded riparian areas. For cutting information, see Hansen *et al.* (1988).

Table 24. Cover Class Codes* for Characteristic Plant Species in the *Salix boothii/mesic forb* Plant Association.

Plots (94____)	JB20	JB31	JB33	MD17	MD24	MD29	RR21	RR38
Occurrence Ranks**	B	B/C	C	C	B	A	B/C	B
SHRUBS								
Betula glandulosa	-	20	10	-	-	10	10	10
Pentaphylloides floribunda	3	-	10	3	-	3	3	1
Ribes inerme	-	-	-	10	-	-	-	-
Salix boothii	50	50	70	70	50	80	40	80
Salix brachycarpa	-	3	10	-	3	-	-	-
Salix geyeriana	20	-	-	-	-	-	-	-
Salix monticola	30	-	-	30	-	-	-	-
Salix planifolia ssp. planifolia	-	10	-	-	20	20	-	-
Salix wolfii	-	-	-	1	-	-	10	-
GRAMINOIDS								
Calamagrostis canadensis	10	20	10	3	-	-	3	-
Carex aquatilis	10	3	3	-	30	20	-	1
Carex utriculata	-	-	-	3	-	-	10	-
Deschampsia cespitosa	-	3	-	-	3	10	-	-
Phleum alpinum	3	-	-	-	1	1	-	1
Poa pratensis	1	-	1	-	-	-	1	1
FORBS								
Achillea millefolium var. apicola	1	3	1	1	1	1	1	1
Aconitum columbianum	1	-	-	-	1	-	1	1
Caltha leptosepala	-	-	-	-	3	20	-	-
Cardamine cordifolia	-	1	1	10	-	-	-	1
Conioselinum scopulorum	-	3	3	1	3	10	3	3
Fragaria virginiana	3	1	-	3	-	10	10	3
Mertensia ciliata	10	10	3	3	-	-	-	1
Pedicularis groenlandica	10	-	-	-	-	3	3	1
Perideridia gairdneri	-	30	-	-	-	-	-	-
Polemonium foliosissimum	-	-	1	-	-	10	-	-
Swertia perennis	10	3	3	-	3	10	-	-
Taraxacum officinale	1	-	1	3	-	1	3	10
Thalictrum alpinum	-	20	10	-	-	1	-	1
HORSETAILS								
Equisetum arvense	-	-	-	3	1	3	3	1

*Cover Codes represent the middle value for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Salix drummondiana Alliance

Drummond's willow/Mesic forb (*Salix drummondiana*/Mesic forb) Plant Association G3S3 (SADR/MF)
Gunnison River Basin--3 plots (94MD18, 94MD27, 94MD28)
White River Basin--4 plots (92GK16, 92NL62, 92NL52, 92NL48)
Colorado River Basin--16 plots (93SS04, 92SS10, 93SS37, 93SS39, 93SS40, 93DR02, 93DR06, 93DR19, 93RR24, 93RR25, 93GK26, 93GK27, 93GK35, 93GK39, 93GK40, 93GK41)
Other occurrences: San Miguel/Dolores River Basin-- 1 plot

Related Types: *Salix drummondiana/Mertensia ciliata* (Cooper and Cottrell 1990). Similar to *Salix drummondiana-Salix monticola/Calamagrostis canadensis-Carex utriculata* (Baker 1989), *Salix drummondiana-Salix monticola* (Phillips 1977) and *Salix monticola*/mesic forb (Padgett *et al.* 1989), however our stands are more narrowly defined with dominance only by *Salix drummondiana*.

Distribution: This plant association occurs in Idaho and Utah (Baker 1989, Padgett *et al.* 1989), and in Colorado it is a minor type, reported from the Front Range (Cooper and Cottrell 1990, Phillips 1977) and the Gunnison and Uncompahgre National Forests (Komarkova 1986, as cited in Baker 1989). It is not an uncommon type, often occurring as a small patch within a larger riparian mosaic.

Elevation: 2380-3170 m (7800-10,360 ft).

Geomorphology: This plant association occurs as a narrow strip along stream banks of narrow, fast moving streams (2-11% gradient) in V-shaped valleys (60-100 meters wide).

Rosgen's Stream Channel Type: This type occurs on higher gradient streams (A3) and along wide, actively eroding reaches (F6).

Vegetation: The tall shrub layer consists of dense *Salix drummondiana* (80-98%) with a thick undergrowth of mesic and wet forbs. Total forb cover ranged from 40% to 50%. *Salix drummondiana* grows thickly along steep narrow first order streams, as a narrow band between the stream channel and the adjacent subalpine fir or lodgepole forests. A rich diversity of forbs, between 12 and 40 species, characterize the undergrowth. Dominate forbs include *Mertensia ciliata* (10-20%), *Heracleum lanatum* (5%), *Angelica parryi* (5%), *Saxafragia odontoloma* (5%), *Cardamine cordifolia* (5%), and *Hydrophyllum fendleri* (5%).

Soil: Soils range from deep (60+ cm) sandy loams with no coarse fragments to shallow silty clay loams and sandy clay loams over coarse angular cobbles.

Adjacent Riparian Vegetation: At lower altitudes, *Salix monticola* shrublands can often occur on adjacent floodplains, and *Abies lasiocarpa-Picea engelmannii* forests may dominate adjacent stream banks of narrow reaches at higher elevations.

Adjacent Upland vegetation: *Picea engelmannii/Abies lasiocarpa*, *Populus tremuloides*, or *Pinus contorta* forests often occur on adjacent hillslopes; dry upland *Danthonia* or *Festuca* spp. grasslands may occur on steep, fine-textures hillsides.

Succession/management: This community type appears to tolerate flooding and is early-seral. It can often be an early colonizer of boulder-strewn, steep, first order streams.

Table 25. Cover Class Codes* for Characteristic Plant Species in the *Salix drummondiana/Mesic forb* Plant Association.

Plots (94____)	MD18	MD27	MD28
Occurrence Ranks**	A/B	A	B
SHRUBS			
Lonicera involucrata	-	30	-
Ribes inerme	-	10	-
Rubus idaeus	-	3	-
Salix drummondiana	40	80	98
Salix monticola	10	-	3
GRAMINOIDS			
Calamagrostis canadensis	20	10	3
Carex utriculata	20	-	10
FORBS			
Aconitum columbianum	-	1	1
Angelica ampla	-	3	-
Cardamine cordifolia	3	3	30
Conioselinum scopulorum	1	-	3
Heracleum lanatum	20	3	1
Mertensia ciliata	10	20	10
Oxypolis fendleri	-	1	3
Saxifraga odontoloma	3	3	-
Taraxacum officinale	3	1	1
HORSETAILS			
Equisetum arvense	3	-	10

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Salix exigua Alliance

Coyote Willow/Barren ground (*Salix exigua*/Barren ground) Plant Association
G5S5 (SAEX/Barren)
Gunnison River Basin--2 plots (94GK29, 94GK37)
White River Basin--3 plots (92GK02, 92GK03, 92NL08)
Colorado River Basin--5 plots (93RR29, 93RR30, 93RR33, 93RR47, 93RR50)
Other occurrences: Yampa River Basin--4 stands

Related Types: *Salix exigua*/barren (Padgett *et al.* 1989). Probably very similar to *Salix exigua* listed in Reid and Bourgeron (1991), and *Salix exigua-Salix* spp./*Poa* spp. type described by Johnston (1987).

Distribution: This type is reported from Utah, eastern Idaho, and western Wyoming (Padgett *et al.* 1989 and Youngblood *et al.* 1985). In Colorado, this type is one of the most common riparian shrub associations, occurring throughout the state on lower elevation gravel bars of larger rivers, and along the banks and floodplains of smaller tributaries.

Elevation: 1220-2440 m (4000-8000 ft)

Geomorphology: This early seral community 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 the Gunnison and Colorado Rivers, or narrow stringer bands on small, rocky tributaries.

Vegetation: *Salix exigua* forms a dense, multi-stemmed canopy about 1-2 meters tall. It commonly forms a mono-typic stand, however other shrubs may be present (usually with $<10\%$ cover), such as *Salix monticola, Salix lutea* spp. *caudata, Rosa woodsii,* or *Tamarix ramosissima.* Forb and graminoid cover is usually very low, with mostly bare ground and cobbles underneath. Characteristic forbs present at lower elevations are *Melilotus alba, M. officinale, Plantago major,* and *Lepidium* spp.

Soil: Soils are in general undeveloped alluvial deposits of sand, silt and cobbles that are highly stratified with depth from flooding scour and deposition.

Adjacent Riparian Vegetation: Adjacent riparian communities are highly variable because this community is so wide ranging. On the mainstem of the Colorado River *Populus angustifolia-Juniperus scopulorum* woodlands occur on adjacent floodplains and stream banks,along with *Alnus* shrublands. Along the Gunnison River mainstem below Blue Mountain reservoir *Carex lanuginosa* forms a continuous band at waters edge with *Salix exigua* occurring immediate stream banks. *Populus angustifolia/Tamarix ramosissima* stands

also occur on adjacent floodplains.

Adjacent Upslope Vegetation: At lower elevations the adjacent hillsides have *Pinus edulis-Juniperus osteosperma* woodlands, *Artemisia tridentata* and *Sarcobatus vermiculatus* scrub.

Succession/Management: *Salix exigua* is a good colonizer and stream bank stabilizer. It can withstand flooding with its flexible stems that lie flat and then standing upright again. Succession without disturbance may lead to *Salix exigua*/mesic graminoid, or a *Populus* spp. type. *Salix exigua* stabilizes point bars and other new fluvial deposits, by trapping sediments during floods and building a protected seed bed for a number of tree species. The presence of *Populus angustifolia* seedlings and saplings within this plant association may indicate succession to a cottonwood community, if flooding does not disturb establishing seedlings in subsequent years.

Table 26. Cover Class Codes* for Characteristic Plant Species in the *Salix exigua/barren* Plant Association.

Plots (94___)	GK29	GK37
Occurrence Ranks**	C	B
TREES		
Populus angustifolia --seedlings	1	-
SHRUBS		
Salix exigua	90	90
Chrysothamnus viscidiflorus	-	1
Tamarix ramosissima	-	1
Rosa woodsii	1	-
Salix monticola	1	-
GRAMINOIDS		
Agrostis gigantea	10	-
Pascopyrum smithii	10	-
Poa pratensis	3	-
Dactylis glomerata	3	-
FORBS		
Melilotus officinalis	3	-
Cirsium arvense	3	-
Melilotus alba	1	1
Mentha arvensis	1	-
Plantago major	1	-
Trifolium repens	1	-
HORSETAILS		
Equisetum arvense	3	-

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Other *Salix exigua* stands

In the Gunnison River basin two stand sampled (94GK06, 94MD10) were dominated by a mixture of *Salix exigua* and *Alnus incana* (1-20%) and *Cornus sericea* (1-40%). One stand occurred on a large point bar away from the stream channel, and appeared to be a transition between the highly disturbed areas immediately adjacent to the stream, and the higher terrace further back. Saplings of *Populus angustifolia* (5%) were becoming established and the herbaceous undergrowth (50-60%) and litter covering the ground was substantial (50%). In the other stand, beavers ponds had recently blown out, and *Salix exigua* appeared to be colonizing the newly exposed silt substrate. This stand graded into *Cornus sericea* dominated stands at the edges of the pond-area. Both stands appeared to occupy sites in transition from high disturbance to less frequently disturbed sites. In these cases, other shrubs are moving in, and *Salix exigua* may be loosing it's competitive advantage.

Table 27. Cover Class Codes* of Plant Species in *Salix exigua* Dominated Stands.

Plots (94____)	GK06	MD10
Occurrence Ranks**	A	B
TREES		
Populus angustifolia --saplings	-	3
Populus angustifolia --seedlings	-	10
Pseudotsuga menziesii --mature trees	3	-
SHRUBS		
Alnus incana ssp. tenuifolia	1	20
Cornus sericea	40	-
Rosa woodsii	3	-
Salix exigua	70	30
Salix ligulifolia	10	3
Salix monticola	-	3
GRAMINOIDS		
Elymus canadensis	-	10
Juncus balticus	3	-
Poa pratensis	3	30
Scirpus microcarpus	3	-
FORBS		
Achillea millefolium var. apicola	-	3
Arctium minus	3	-
Fragaria virginiana	-	1
Galium boreale	-	3
Galium triflorum	1	-
Geranium richardsonii	3	-
Heracleum lanatum	-	3
Oxypolis fendleri	3	-
Penstemon spp.	-	1
Rudbeckia lacinata var. ampla	10	20
Solidago canadensis	3	3
Taraxacum officinale	3	3
Veronica wormskjoldii	-	1
HORSETAILS		
Equisetum arvense	20	1

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Salix geyeriana Alliance

Geyer's willow/aquatic sedge (*Salix geyeriana/Carex aquatilis*) Plant Association
GUSU (SAGE/CAAQ)
Gunnison River Basin--3 plots (94GK18, 94JB26, 94JB44)

Related Types: *Salix geyeriana/Carex aquatilis* (Padgett *et al.* 1989, Youngblood *et al.* 1985). Appears to be similar to the *Salix geyeriana-Salix* spp./*Calamagrostis canadensis* type (Johnston 1987). Our stands had consistent *Calamagrostis* cover, although it was not dominant and *Carex aquatilis* and *Carex utriculata* are present in significant amounts as well.

Distribution: Known from central and eastern Idaho and northern Utah (Padgett *et al.* 1989). Similar types are reported from northern and southeastern Wyoming, eastern Idaho, and in Colorado from Arapaho, Gunnison, and Routt National Forests (Johnston 1987). In the Gunnison River Basin, it was sampled only in Saguache county.

Elevation: 2070-3200 m (6790-10,450 ft).

Geomorphology: This plant association occurs along moderately broad, low gradient (1-5%) valley bottoms with sinuous stream channels. Floodplains are undulating, creating a heterogeneous understory environment. Swales and ridges, overflow channels and hummock areas all occur below a nearly closed canopy of willows. Floodplains are broad and usually inundated in early spring/summer, while soils remain saturated throughout the growing season.

Rosgen's Channel Type: This association occurs on broad, meandering channel reaches (C3).

Vegetation: *Salix geyeriana* dominates (30-50%) the tall shrub canopy with several other willow species. In one stand *Salix planifolia* occurred with (10%) cover, while in another stand *Salix brachycarpa* (30%) and *Salix boothii* (30%) were abundant. Wet graminoid cover is high in low-lying swales. Total graminoid cover is 20-50% with *Carex utriculata* (20%), *C. aquatilis* (10-20%), *Calamagrostis canadensis* (10%), and *Deschampsia cespitosa* (20%). Forb cover is low in the swales and abundant on the ridges and higher areas, where the shrubs are rooted. Forb species include *Achillea millifolium* (10%), *Geum macrophyllum* (5%), *Conioselinum scopulorum* (10%), and *Noccea montanum* (5%).

Soil: Soils are deep silty loams alternating with layers of coarse sand. Mottles is often evident within 11 cm of surface.

Adjacent riparian vegetation: *Carex* spp. meadows occur on adjacent low-lying flat floodplains, and *Alnus incana* or *Salix drummondiana* stands often occur along the channel edge where water is moving swiftly through the soil profile.

Adjacent upland vegetation: *Picea engelmannii* forests, *Populus tremuloides* woodlands, and *Artemisia tridentata* shrublands occur on adjacent hill slopes.

Succession/management: *Salix geyeriana* appears to gain dominance where a high water table saturates soils for much of the growing season. It is a wet willow-complex association and the soils are easily compacted by livestock. *Carex utriculata* apparently becomes established more readily than *Carex aquatilis* when soils are saturated all season (Padgett *et al.* 1989). Willow dominated areas that occur on undulating floodplains are often a mosaic of inter-mingled wet meadows and willow shrubland communities. However, in the stands we sampled, the willow canopy completely overlapped low-lying swales and other topographic variations, such that we considered the stand to be one plant association.

Table 28. Cover Class Codes* of Characteristic Plant Species in the *Salix geyeriana/Carex aquatilis* Plant Association.

Plots (94___)	JB26	JB44	GK18
Occurrence Ranks**	A	B	A
SHRUBS			
Pentaphylloides floribunda	10	-	10
Salix boothii	30	-	-
Salix brachycarpa	30	-	-
Salix geyeriana	50	30	60
Salix planifolia ssp. planifolia	-	10	1
GRAMINOIDS			
Agropyron cristatum	-	1	-
Calamagrostis canadensis	10	10	20
Carex aquatilis	10	10	10
Carex microptera	-	3	-
Carex utriculata	-	20	20
Deschampsia cespitosa	10	20	-
FORBS			
Achillea millefolium var. apicola	3	10	-
Aconitum columbianum	3	-	1
Conioselinum scopulorum	10	-	-
Epilobium angustifolium	1	-	1
Geum macrophyllum	3	3	1
Mertensia franciscana	3	-	-
Rumex crispus	-	1	-
Stellaria longifolia	1	-	-
Taraxacum officinale	3	1	-
Thalictrum alpinum	1	-	3
Thlaspi montanum	1	-	-
Vicia americana	-	1	-

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Salix monticola Alliance

Rocky Mountain willow/Beaked sedge (*Salix monticola/Carex utriculata*) Plant Association G5S3 (SAMO/CAUT)
Gunnison River basin--2 plots (94GK16, 94RR19)
Colorado River Basin--6 plots (93SS05, 93RR53, 93GK31, 93SS28, 93GK34, 93RR12)

Related Types: Similar to *Salix drummondiana-Salix monticola/Calamagrostis canadensis-Carex utriculata* (Baker 1989).

Distribution: Reported from central and northern Utah. In Colorado, this plant association is known from the upper Colorado and Gunnison River basins.

Elevation: 2740-3100 m (9000-10,240 ft).

Geomorphology: This type is commonly associated with beaver ponds, with the willows on hummocks of higher ground and *Carex utriculata* at the pond margins.

Rosgen's Channel Type: Stream reaches are altered by beaver activity, creating multiple channels cascading from one beaver pond to the next. It is not clear which of Rosgen's channel types would adequately describe this situation.

Vegetation: This plant association is characterized by a thick, closed willow canopy dominated by *Salix monticola* (60%), with *Salix drummondiana*, *S. geyeriana*, and *Lonicera involucrata* (1-10%). *Carex utriculata* usually dominates the understory (10-50%). Most stands are so saturated that the forb cover is low (10%).

Soils: Soil are predominantly heavy silty clays with occasional mottling evident. Some profiles have buried organic layers.

Adjacent Riparian Vegetation: *Alnus incana* shrublands and *Picea pungens* forest stands occur on better drained stream banks and occasional on beaver dams, where the water is flowing and well oxygenated.

Adjacent Upslope Vegetation: Conifer mixed with *Populus tremuloides* forest, *Artemisia tridentata* scrub occur on the adjacent hill slopes.

Succession/management: This plant association occupies sites usually influenced by beaver activity. *Carex utriculata* usually forms monotypic stands at the edge of ponds, where persistent high water table limits the occurrence of other species. *Carex* stands are slowly invaded by *Salix* spp. as the ground becomes less saturated (Hansen *et al.* 1988). In some instances, *Salix* spp. may have occupied floodplains that are not directly flooded by beaver

ponds and manage to persist under the new, higher water table. With the removal of beaver, the site will become drier and support less mesic *Carices* and forbs. Saturated soils that support this plant association are easily damaged by trampling by livestock and vehicles.

Table 29. Cover Class Codes* for Characteristic Plant Species in the *Salix monticola/Carex utriculata* Plant Association.

Plots (94____)	GK16	RR19
Occurrence Ranks**	B	B
SHRUBS		
Salix drummondiana	1	20
Salix monticola	60	60
Shepherdia canadensis	1	-
GRAMINOIDS		
Calamagrostis canadensis	1	1
Carex utriculata	50	10
FORBS		
Achillea millefolium var. apicola	1	-
Aconitum columbianum	-	3
Angelica ampla	1	-
Cardamine cordifolia	-	3
Conioselinum scopulorum	3	-
Epilobium spp.	1	-
Geranium richardsonii	3	-
Geum macrophyllum	3	1
Heracleum lanatum	3	-
Mertensia ciliata	1	3
Senecio triangularis	-	3
Stellaria spp.	1	-
Thalictrum fendleri	3	-
GRAMINOIDS		
Equisetum arvense	-	1
Equisetum hyemale	1	-

*Cover Codes represent the middle value for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Rocky Mountain willow/Mesic forbs (*Salix monticola*/Mesic forb) Plant Association G3S3 (SAMO/MF)
Gunnison River Basin --8 plots (94GK03, 94GK11, 94JB01, 94JB02, 94JB13, 94JB23, 94MD02, 94RR24)
White River Basin--4 plots (92NL11, 92NL50, 92NL46, 92NL10)
Colorado River Basin--6 plots (93SS16, 93RR52, 93GK38, 93DR18, 93GK12, 93DR11)

Related Types: Padgett *et al.* (1989) describe a *Salix boothii*/mesic forb community that includes stands dominated by *Salix drummondiana* with *Salix monticola* occasionally present in small amounts. In Colorado, *Salix monticola* is more common and an important component in the tall shrub layer. Johnston (1987) lists a *Salix drummondiana/Calamagrostis canadensis* association that included *Salix monticola* in the species list. Another similar plant association may be *Salix geyeriana-Salix* spp./*Calamagrostis canadensis* (Johnston 1987). Our stands are similar to some stands included in *Salix monticola/Calamagrostis canadensis* or *Salix drummondiana/Mertensia ciliata* associations described by Cooper and Cottrell (1990) from the Colorado Front Range.

Distribution: In central and eastern Utah, *Salix monticola* dominated stands are infrequent, and, due structural similarities, were included in *Salix boothii* associations (Padgett *et al.* 1989). In Idaho, it has a limited distribution, and occupies similar habitats, associating with *Salix planifolia* on wetter habitats, and *Salix geyeriana* on mesic sites (Brunsfeld and Johnson 1985). In addition, described stands from Idaho and Colorado have similar soils. In Colorado it is a major type in the upper montane areas of central Colorado (Copper and Cottrell 1990, Kittel and Lederer 1993, and Kittel *et al.* 1994).

Elevation: 2310-2740 m (7560-9600 ft).

Geomorphology: *Salix monticola* dominates stream reaches in moderately wide to narrow valleys (20-120 m) with broad, swift-moving streams and active floodplains. The ground surface is usually undulating, from past flooding or beaver activity. Stands occur right at streams edge, and up to 15 m from the channel, usually >0.5 m (0.5-2.32) above the channel elevation.

Rosgen's Channel Type: Most stands occurred adjacent to fairly straight, wide, and shallow channels, that range from bedrock controlled to silty-bottomed reaches (B1, B2, B3, B6). A few stands occur on meandering, cobble-bottomed reaches (C3).

Vegetation: *Salix monticola* is a dense to open canopy (50-98%) with a very diverse and rich forb layer. Other shrubs are usually present, but with no consistent associated species. These include *Salix drummondiana* (0-60%), *Ribes inerme* (0-30%), and *Pentaphylloides floribunda* (0-10%). Total forb cover ranges from 10-70%, and graminoid cover from 5-40%, and include *Calamagrostis canadensis* (0-20%), *Carex aquatilis* (0-5%), *Poa pratensis* (0-40%),

Hydrophyllum fendleri (0-10%), *Heracleum lanatum* (0-30%), *Urtica dioica* (0-10%) and *Fragaria virginiana* (0-20%). Graminoids dominate in the low-lying, wetter swales, while forbs concentrate under the shrubs on hummocks and ridges.

Soil: Soils are fine textured clay loams and sandy clay loams of varying depths (10-45 cm). Mottling and gleyed layers are not uncommon within 12 cm of the ground surface.

Adjacent Riparian Vegetation: *Salix boothii, Salix geyeriana,* and *Alnus* shrublands occur on well drained, adjacent floodplains; mesic meadows of *Carex* may also occur on flat areas of the floodplain.

Adjacent Upslope Vegetation: *Picea contorta, Picea* spp. forests and *Populus tremuloides* woodlands occur on adjacent hill slopes.

Succession/Management: The *Salix monticola*/mesic forbs association appears to be stable, occurring in mesic conditions that support a rich diversity of forbs. On broad, hummocky floodplains it can form extensive willow carrs. This association grades into the *Salix monticola-Salix planifolia/mesic forb* association at higher elevations. Season long (2-3 month) grazing will open the canopy and allow more sunlight to reach the ground, drying the site. In three heavily grazed stands (94GK03, JB02 and 94MD02), we found forb diversity much reduced and the understory dominated by *Poa pratensis* or *Urtica dioica*.

Table 30. Cover Class Codes* for Characteristic Plant Species in the *Salix monticola*/Mesic Forb Plant Association.

Plots (94___)	GK03	GK11	JB01	JB02	JB13	JB22	MD02	RR24
Occurrence Ranks**	C	B	C	C	B	B	C	B
SHRUBS								
Ribes inerme	30	-	40	-	-	-	20	3
Salix drummondiana	-	-	-	-	-	40	-	60
Salix geyeriana	-	3	-	-	10	-	-	-
Salix monticola	98	70	20	50	20	50	50	50
Symphoricarpos rotundifolius	1	-	-	-	-	-	5	3
GRAMINOIDS								
Calamagrostis canadensis	-	-	-	-	1	20	-	-
Carex geyeri	-	10	-	-	-	-	-	-
Carex utriculata	-	-	-	-	20	-	-	-
Elymus glaucus	-	-	-	-	-	-	-	10
Poa pratensis	10	3	-	-	-	5	40	-
FORBS								
Achillea millefolium var. apicola	3	3	1	-	3	3	10	-
Dugaldia hoopesii	-	10	10	-	-	-	-	-
Epilobium angustifolium	-	3	-	-	1	10	-	-
Fragaria spp.	-	20	-	-	-	-	-	-
Geranium richardsonii	10	3	-	3	3	3	-	10
Heracleum lanatum	3	10	-	-	-	3	-	30
Hydrophyllum fendleri	3	1	-	-	-	-	-	10
Ligusticum porteri	-	-	-	-	-	-	-	10
Maianthemum stellatum	1	10	1	-	1	-	-	1
Mertensia ciliata	-	3	-	-	3	-	3	10
Mertensia franciscana	10	1	-	-	-	-	-	-
Rudbeckia lacinata var. ampla	-	1	-	-	-	-	-	10
Taraxacum officinale	3	1	1	3	3	3	3	-
Thalictrum fendleri	-	1	1	-	-	-	-	1
Urtica dioica ssp. gracilis	-	3	3	-	-	1	10	10
HORSETAILS								
Equisetum arvense	1	-	-	-	3	1	-	1

*Cover Codes represent the middle value for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Rocky Mountain willow-Plane-leaf willow/Mesic forbs (*Salix monticola-Salix planifolia*/Mesic forbs) Plant Association
GUSU
Gunnison River Basin--4 plots (94JB15, 94MD16, 94MD25, 94RR22)

Related Types: Padgett *et al.* (1989) describe a *Salix boothii*/mesic forb association that includes stands dominated by *Salix drummondiana* with *Salix monticola* occasionally present in small amounts. In Colorado, *Salix monticola* is more common and an important component in the tall shrub layer. Johnston (1987) lists a *Salix drummondiana/Calamagrostis canadensis* association that includes *Salix monticola* in the species list. Another similar association may be *Salix geyeriana-Salix* spp./*Calamagrostis canadensis* (Johnston 1987). Our stands appear to be similar to some stands included in *Salix monticola/Calamagrostis canadensis* or *Salix drummondiana/Mertensia ciliata* associations described by Cooper and Cottrell (1990) from the Colorado Front Range.

Distribution: Similar plant associations (see above) are reported from central and eastern Utah (Padgett *et al.* 1989), and the Front Range of Colorado (Cooper and Cottrell 1990). It appears to be common in north-central Colorado.

Elevation: 2865-3350 m (9420-10,960 ft).

Geomorphology: This mixed shrub community occurs on narrow to moderately wide (50-250 m) flat (3-8%) valley bottoms and floodplains. Large wide stands occur between meanders and at the edges of beaver ponds.

Rosgen's Channel Type: In wider valleys this association occurs where beavers are active. Along narrower reaches, the channels were classified as shallow and broad reaches (B3), or meandering reaches (C2 and C3).

Vegetation: This association has a mixed closed canopy of willows with *Salix monticola* (10-50%) and *Salix planifolia* (5-30%) dominant. Other willows present are *Salix drummondiana* (0-50%), and *Salix geyeriana* (0-20%). The understory herbaceous growth is sparse under the dense shade of shrub cover, however, in open swales and ridges forb cover can be quite high (20-40%), with *Heracleum lanatum* (0-20%), *Mertensia ciliata* (10%), and *Senecio triangularis* (0-5%).

Soils: Soils are silt loams, often saturated to within 30 cm of the surface, with mottles abundant (10-45%). One stand was sampled on coarse, well drained alluvium.

Adjacent Riparian Vegetation: *Salix monticola* and *Salix planifolia* shrublands occur on broad floodplains up and down stream of the mixed association. Mesic meadow species often occupy adjacent floodplains area, such as *Carex aquatilis* and *Carex utriculata*.

Adjacent Upland Vegetation: *Pinus contorta, Picea* spp. and *Populus tremuloides* woodlands occur on adjacent hillslopes.

Succession/Management: *Salix monticola* dominated associations appear stable, occurring in mesic conditions that support a rich diversity of forbs. Stands with abundant *Salix planifolia* present may indicate that this association is transitional between the higher, more saturated subalpine sites dominated by *Salix planifolia* and the wider, lower montane areas where *Salix monticola* becomes abundant. The *Salix monticola-Salix planifolia* association occupies wetter sites than *Salix monticola* stands, and saturated soils can be compacted with extended grazing.

Table 31. Cover Class Codes* for Characteristic Plant Species in the *Salix monticola-Salix planifolia/mesic forb* Plant Association.

Plots (94____)	JB15	MD16	MD25	RR22
Occurrence Ranks**	B	C	B	B
SHRUBS				
Salix drummondiana	3	-	-	20
Salix geyeriana	-	20	10	-
Salix monticola	30	40	50	50
Salix planifolia ssp. planifolia	40	10	30	30
GRAMINOIDS				
Calamagrostis canadensis	10	10	30	-
Carex aquatilis	1	-	-	1
Carex utriculata	20	-	-	-
Carex spp.	1	10	1	3
FORBS				
Cardamine cordifolia	1	3	3	3
Conioselinum scopulorum	1	-	1	3
Epilobium spp.	1	3	1	1
Heracleum lanatum	20	-	1	-
Mertensia ciliata	20	10	10	10
Senecio triangularis	3	-	10	10
Stellaria spp.	-	1	3	1
Taraxacum officinale	-	3	1	3

*Cover Codes represent the middle value for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

UNESCO III.B.3.d. DECIDUOUS PEAT SHRUBLANDS
COWARDIN PALUSTRINE SYSTEM-SCRUB-SHRUB, DECIDUOUS SHRUBLAND

Salix brachycarpa Alliance

Barren-ground willow/Mesic forb (*Salix brachycarpa*/Mesic forb) Plant Association G4S4 (SABR/MF)
Gunnison River Basin--1 plot (94RR37)
White River Basin-- 1 plot (92GK40)
Colorado River Basin--2 plots (93RR27, 93DR03)

Related Types: Similar to *Salix planifolia-Salix wolfii/Caltha leptosepala-Carex aquatilis* (Baker 1989) except that our stands have a much higher cover of *Salix brachycarpa*. Also similar to *Salix wolfii/Deschampsia cespitosa* (Johnston 1987), except our stand had much lower *Deschampsia cespitosa* cover, and did not have significant *Salix wolfii* cover.

Distribution: Similar types (listed above) are known from western Wyoming and Utah (Johnston 1987 and Padgett *et al.* 1989). In Colorado, this is a major type in the subalpine areas, and has been reported as part of a *Salix planifolia-Salix brachycarpa* mixed type from the San Juan Mountains, the Front Range, and from Gunnison National Forest (Baker 1989, Hess and Wasser 1982, Komarkova 1986, Kittel and Lederer 1993). It occurs on the Flat Top Plateau and in the Mosquito Range, near the Continental Divide. It is less abundant, but still quite common, in the Gunnison River drainage.

Elevation: Generally above 2930 m (9600 ft).

Geomorphology: *Salix brachycarpa* occurs along the drier fringes of broad, glaciated basins in the subalpine zone. This community occupies elevated hummocks and drier side slopes, often surrounding wetter low areas with *Salix planifolia* associations. It can also intergrade with the wetter communities, creating a complex mosaic.

Rosgen's Channel Type: Channels are wide and shallow (B2) or narrow, deep and sinuous (E4).

Soil: Soils range from silty clay loams to fine sandy loams, with some mottling (5%).

Vegetation: *Salix brachycarpa* occurs in almost pure stands on hummocks and well drained slopes on the valley floor. *Salix planifolia* occurs as pure stands in adjacent lower, poorly drained areas, and the two species intermix at the ecotone between these micro-sites. *Carex aquatilis* (10%), *Deschampsia cespitosa* (5%), *Caltha leptosepala (5%),* and *Thalictrum alpinum* (10%), among others, create a dense herbaceous understory. Boulders at the surface are often covered with lichens and mosses.

Adjacent riparian vegetation: *Salix planifolia* and *Salix wolfii* shrublands occur on adjacent more poorly drained swales and hummocks; *Carex aquatilis* meadows occur on adjacent wet, flat areas.

Adjacent upland vegetation: Adjacent hillslopes can be covered in *Salix brachycarpa* shrublands, dry subalpine meadows (e.g. *Danthonia*) or *Abies lasiocarpa-Picea engelmannii* forests.

Succession/management: This type occurs on slightly drier locations than the *Salix planifolia* types. It is sometimes heavily grazed by sheep, which may alter the species composition. It appears stable, but little is known about the successional trends or status.

Table 32. Cover Class Codes* for Characteristic Plant Species in the *Salix brachycarpa/Mesic forb* Plant Association.

Plots (94___)	RR37
Occurrence Ranks**	B
SHRUBS	
Betula glandulosa	3
Pentaphylloides floribunda	10
Salix brachycarpa	70
Salix monticola	3
GRAMINOIDS	
Agrostis scabra	1
Carex aquatilis	10
Deschampsia cespitosa	1
FORBS	
Achillea millefolium var. apicola	3
Anaphalis margaritacea	3
Cardamine cordifolia	1
Conioselinum scopulorum	3
Fragaria virginiana	3
Galium triflorum	3
Maianthemum stellatum	7
Mertensia ciliata	3
Mertensia franciscana	3
Parnassia fimbriata	3
Polygonum bistortoides	1
Taraxacum officinale	3
Thalictrum alpinum	10
HORSETAILS	
Equisetum arvense	1

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Other *Salix brachycarpa* stands :

In the Colorado River drainage one stand (93GK43) was dominated by *Salix brachycarpa* and had a mixed understory of *Carex aquatilis* and *Carex utriculata*. This type is not well documented in the literature, as *Salix brachycarpa* is usually associated with well drained sites that are relatively dry.

Planeleaf willow/Marsh marigold (*Salix planifolia/Caltha leptosepala*) Plant Association G4S4 (SAPLM/CALE)
Gunnison River Basin--12 plots (94GK07, 94GK33, 94JB14, 94JB24, 94JB29, 94JB32, 94JB34, 94JB42, 94MD13, 94RR39, 94RR41)
Colorado River Basin--6 plots (93SS02, 93GK45, 93SS26, 93DR17, 93SS49, 93RR57)
Other occurrences: San Miguel/Dolores River Basin-- 3 plots

Related Types: *Salix planifolia-Salix wolfii/Caltha leptosepala-Carex aquatilis* (Baker 1989); *Salix planifolia/Caltha leptosepala* (Cooper and Cottrell 1990, Hess and Wasser 1982).

Distribution: This type is known from northwestern and north-central Wyoming (Johnston 1987). It is a major subalpine wetland type that occurs throughout the high country of Colorado. It has been documented from Roosevelt, Arapaho, Gunnison, Pike, and Routt National Forests (Johnston 1987).

Elevation: 2960-3535 m (9660-11,600 ft).

Geomorphology: This plant association typically occurs in wide, glaciated valleys adjacent to streams and in swales and depressions, and on slopes where snow melt runoff continues to saturate soils at or near the surface for much of the growing season. The ground may be flat or uneven with raised hummocks.

Vegetation: The shrub layer is dominated by dense, low (0.5 m) canopy of *Salix planifolia* (50-90%). Other willows present in lesser amounts include *Salix monticola* (0-10%) and *Salix geyeriana* (0-20%) at lower altitudes (3020 m, 9900 ft), and *Salix brachycarpa* (0-30%) on drier sites, or *Salix wolfii* (0-10%) in wetter locations, and at higher elevations (>3050, m, >10,000 ft). The willow canopy is closed so that the herbaceous understory is not well developed except in openings between willow patches. Common graminoids include *Carex aquatilis* (10-20%) and *Calamagrostis canadensis* (10-40%). Common abundant forbs include *Caltha leptosepala* (5-30%), *Senecio triangularis* (10%), and *Mertensia ciliata* (10%). Other mesic forbs characteristic to this association include *Pedicularis groenlandica* (1-10%), *Polygonum bistortoides* (1-10%), and *Sedum rhodanthum* (1-10%).

Soil: Soils are predominately mineral and well drained, with well oxygenated soil water. Mottled or gleyed layers are uncommon or not extensive in the profile. Wetter sites have soil textures of silt loams, while slightly drier sites have loamy sands.

Adjacent riparian vegetation: *Carex aquatilis* and *Carex utriculata* meadows occur on adjacent saturated areas. *Salix brachycarpa* shrublands or *Deschampsia cespitosa* grasslands on adjacent, drier slopes.

Adjacent Upland vegetation: Adjacent hillslopes are often covered in *Salix brachycarpa* stands, upland meadows (*e.g. Danthonia*), or *Abies lasiocarpa-Picea engelmannii* forests.

Succession/management: This plant association occurs in wet swales that are saturated throughout the growing season. Soils are susceptible to compaction by livestock. Heavy grazing will open the canopy and lower the water table through increased evapotranspiration, allowing *Salix brachycarpa* or *Salix wolfii* to become established.

Table 33. Cover Class Codes* for Characteristic Plant Species in the *Salix planifolia/Caltha leptosepala* Plant Association.

Plots (94____)	GK07	GK33	JB14	JB24	JB29	JB32	JB34	JB42	MD13	RR39	RR41
Occurrences Ranks**	A	A	B	A	A	A	C	C	B	B	B
TREES											
Picea engelmannii --young & mature	-	10	-	-	-	-	-	-	-	10	-
SHRUBS											
Betula glandulosa	-	-	-	-	-	-	-	-	-	3	-
Salix brachycarpa	-	-	-	10	-	3	-	20	-	30	-
Salix geyeriana	20	-	-	-	-	-	-	-	-	-	-
Salix monticola	-	-	-	-	-	-	-	10	-	-	-
Salix planifolia ssp. planifolia	70	60	70	90	95	80	90	50	70	40	90
Salix wolfii	-	-	-	-	-	-	-	-	1	-	10
GRAMINOIDS											
Calamagrostis canadensis	-	3	-	-	3	10	3	10	-	1	1
Carex aquatilis	-	3	20	-	3	3	3	10	10	-	-
Carex microptera	-	10	-	-	-	-	-	1	-	-	-
Carex spp.	-	-	1	1	3	-	25	3	3	3	1
Deschampsia cespitosa	-	-	3	3	3	1	-	1	1	1	1
FORBS											
Achillea millefolium var. apicola	1	3	3	3	3	-	3	1	3	1	1
Aconitum columbianum	-	3	-	-	-	-	1	10	-	-	10
Caltha leptosepala	1	40	20	-	30	30	10	3	-	10	3
Cardamine cordifolia	1	-	10	-	-	-	3	1	20	3	3
Conioselinum scopulorum	-	10	-	3	3	3	1	3	-	1	1
Gentianopsis thermalis	-	1	-	-	-	-	1	1	-	-	-
Geranium richardsonii	20	3	-	-	-	-	-	10	-	-	1
Mertensia ciliata	1	-	10	10	3	3	10	10	3	3	3
Oxypolis fendleri	-	10	-	-	-	3	-	-	-	1	10
Pedicularis groenlandica	1	3	10	-	3	-	3	10	-	-	1
Polemonium pulcherrimum	-	-	-	12	-	-	-	-	-	1	-
Polygonum bistortoides	-	-	-	-	3	1	1	10	1	1	1
Saxifraga odontoloma	1	1	3	-	-	1	1	1	1	1	1
Sedum lanceolatum ssp. lanceolatum	-	-	-	-	10	1	-	-	-	-	-
Sedum rhodanthum	1	-	3	10	1	1	3	-	1	3	1
Senecio triangularis	1	10	-	-	10	10	20	10	-	-	10
Swertia perennis	-	1	-	-	-	1	10	-	-	1	-

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Planeleaf willow/Aquatic sedge (*Salix planifolia/Carex aquatilis*) Plant Association G4S2S3 (SAPL/CAAQ)
Gunnison River Basin--4 plots (94MD15, 94RR17, 94RR34, 94RR35)
Colorado--7 plots (92NL30, 92GL28, 93SS19, 93SS48, 93SS17, 93SS44, 93DR05)
Other occurrences: Yampa--2 plots

Related Types: *Salix planifolia/Carex aquatilis* (Padgett *et al.* 1989, Johnston 1987, Komarkova 1986, Hess 1981); *Salix planifolia/Caltha leptosepala-Carex aquatilis* phase (Hess and Wasser 1982). *Salix planifolia/Carex aquatilis* (Cooper and Cottrell 1990).

Distribution: This type is known from northwestern and north-central Wyoming (Johnston 1987), and the Uinta mountains and central Utah (Padgett *et al.* 1989). This plant association is a major type and occurs throughout the high country of Colorado. It has been reported from Roosevelt, Arapaho, Gunnison, Pike, and Routt National Forests (Johnston 1987), and in the higher elevations of the Front Range (Cooper and Cottrell 1990). In the Yampa River Basin this type is abundant throughout the Park Range, the Elkhead Mountains and the Flat Top Mountains (Kittel and Lederer 1993). In the Gunnison River Basin it occurs in the upper reaches of the Big Blue and West Elk Wilderness Areas.

Elevation: 2760-3415 m (9030-11,200 ft)

Geomorphology: This plant association occurs in wide, wet valleys on gently sloping snow-melt fed swales. It also occurs in narrow valleys with sinuous streams and wet floodplains.

Rosgen's Channel Type: This type occurs on narrow, sinuous stream reaches (E4), and wider streams (B3), often associated with beaver ponds.

Vegetation: *Salix planifolia* creates a low (0.5 m tall) shrub canopy of 30-50% cover. Other willows present include *Salix monticola* (0-30%) or *Salix geyeriana* (0-1%). The understory is characterized by a thick graminoid layer of *Carex aquatilis* (20-30%) with *Calamagrostis canadensis* usually also present (5-10%). Forbs contribute less that 20% total herbaceous cover and include species such as *Caltha leptosepala (5%), Pedicularis groenlandica (5%)* and *Conioselinum scopulorum* (1-5%).

Soil: Soils are mostly organic peaty. Some profiles have thin layers (20 cm) of organic material over deep loamy sands (60 cm) with mottling (<25%).

Adjacent Riparian Vegetation: This association often forms a mosaic with *Carex aquatilis* meadows, and *Salix brachycarpa* shrublands.

Adjacent Upland Vegetation: Adjacent hillslopes are often covered in *Picea engelmannii/ Abies lasiocarpa* forests or subalpine grasslands (e.g. *Danthonia*).

Succession/management: This plant association occurs in wet swales that are saturated throughout the growing season. Both *Caltha leptosepala* and *Carex aquatilis* can tolerate saturated soils, and occasionally they co-dominate (Padgett *et al.* 1989). Johnston (1987) notes that patches of *Carex utriculata* can occur within this plant association. Soils are susceptible to compaction by livestock. Heavy grazing will open the canopy and lower the water table through increased evapotranspiration, allowing *Salix brachycarpa* or *Salix wolfii* to become established.

Table 34. Cover Class Codes* for Characteristic Plant Species in the *Salix planifolia/Carex aquatilis* Plant Association.

Plots (94____)	MD15	RR17	RR34	RR35
Occurrence Ranks**	A	A	A	A
SHRUBS				
Salix boothii	-	-	20	-
Salix geyeriana	-	-	1	1
Salix monticola	-	-	1	30
Salix planifolia ssp. planifolia	40	50	30	30
GRAMINOIDS				
Alopecurus aequalis	-	-	3	1
Calamagrostis canadensis	10	10	3	3
Carex aquatilis	30	30	30	20
Carex canescens	-	-	-	3
Carex utriculata	10	-	-	-
Deschampsia cespitosa	1	3	1	1
Eleocharis palustris	-	3	-	-
FORBS				
Achillea millefolium var. apicola	1	-	1	1
Caltha leptosepala	3	1	-	-
Cardamine cordifolia	3	1	3	3
Conioselinum scopulorum	3	-	1	3
Mertensia ciliata	1	-	-	3
Pedicularis groenlandica	3	-	-	-
Sedum rhodanthum	3	-	-	-

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Plane-leaf willow-Wolf's willow/Aquatic sedge-Bluejoint reedgrass (*Salix planifolia-Salix wolfii/Carex aquatilis-Calamagrostis canadensis*) Plant Association
G3SU (SAWO/CACA)
Gunnison River Basin--5 plots (94GK31, 94MD30, 94RR30, 94RR43, 94RR48)
Colorado River Basin--1 plots (93SS30)

Related Types: This association could be included in the *Salix planifolia/Carex aquatilis* type. Similar communities in the literature include *Salix wolfii/Calamagrostis canadensis* and *Salix wolfii/Carex aquatilis* (Youngblood *et al.* 1985 and Johnston 1987). It appears to be identical to the *Salix planifolia-Salix wolfii/Caltha leptosepala-Carex aquatilis* described by Baker (1989) from Colorado.

Distribution: This plant association is reported from eastern Idaho and northern Utah. Similar types are reported from central Colorado (Baker 1989). This is a minor, but widespread, wet-willow carr type, located in isolated pockets of the subalpine zone.

Elevation: 2670-3290 m (8760-10,800 ft).

Geomorphology: This plant association occurs in moderately narrow valleys, along flat to undulating floodplains where there is ground water lateral seepage. *Salix wolfii* appears to come in when the soils are heavier and the site wetter than sites supporting *Salix planifolia* associations.

Rosgen's Channel Classification: Stream channels adjacent to this association are narrow and sinuous (E4), shallow and broad (B3), and some channels were highly divided by beaver activity (D4).

Vegetation: The mid-to-tall shrub layer is a mix of *Salix wolfii* (10-50%) and *Salix planifolia* (10-50%). A few other willow species may also be present (e.g. *Salix monticola*). A dense and rich herbaceous layer is dominated by *Calamagrostis canadensis* (0-50%) and *Carex aquatilis* (10-30%). The forb layer is diverse but only a minor component (0-10% total cover).

Soils: Soils are primarily organic or heavy silt clay loams with signs of mottling. Elsewhere the soil textures were silty loam to sandy clay loam with mottling.

Adjacent riparian vegetation: Adjacent areas can be wet meadows of *Carex aquatilis, Carex utriculata,* or *Calamagrostis canadensis*, that intergrade with the shrubland; *Salix brachycarpa* shrublands may occur on higher ground.

Adjacent upslope vegetation: *Abies lasiocarpa-Picea engelmannii* or *Pinus contorta* forests may be on adjacent hillsides at higher elevations, and *Artemisia tridentata* scrub at lower

elevations.

Succession/Management: The dense canopy layers and thick undergrowth indicate stable conditions. If the water table is lowered, tne herbaceous undergrowth may give way to non-native graminoid species such as *Poa pratensis* (Youngblood *et al.* 1985). In Idaho, the presence of *Salix wolfii* appears to indicate a transitional habitat between the wetter sites dominated by *Salix planifolia* and the drier habitats dominated by *Salix geyeriana* (Brunsfeld and Johnson 1985). In Colorado, *Salix wolfii* appears in abundance in small patches, never forming the large, expansive willow carrs common to *Salix planifolia*. *Salix wolfii* occurs in wetter habitats at lower altitudes than *Salix planifolia*. This mixed plant association represents the transition from *Salix wolfii* habitats to the more abundant and more widespread *Salix planifolia* habitat. Therefore management practices for the *Salix wolfii/Carex aquatilis* and *Salix planifolia/Carex aquatilis* types may be very similar (Padgett, *et al.* 1989). In Montana *Salix wolfii* dominance types intergrade with *Salix planifolia* communities and *Salix wolfii* may increase as conditions become drier (Hansen *et al.* 1988).

Table 35. Cover Class Codes* of Characteristic Plant Species in the *Salix planifolia-Salix wolfii/Carex aquatilis-Calamagrostis canadensis*) Plant Association

Plots (94____)	GK31	MD30	RR30	RR43	RR48
Occurrence Ranks**	B	A	A	B	B
SHRUBS					
Betula glandulosa	-	3	-	-	3
Pentaphylloides floribunda	-	3	3	3	10
Salix boothii	-	3	-	1	-
Salix monticola	-	-	1	3	-
Salix planifolia ssp. planifolia	30	50	40	10	30
Salix wolfii	50	40	10	30	50
GRAMINOIDS					
Calamagrostis canadensis	50	10	1	20	1
Carex aquatilis	-	10	10	10	30
Carex utriculata	-	-	10	10	1
FORBS					
Achillea millefolium var. apicola	-	1	1	1	3
Caltha leptosepala	-	-	10	-	10
Conioselinum scopulorum	-	3	3	1	3
Fragaria virginiana	-	3	1	1	1
Mertensia ciliata	3	1	1	3	1
Pedicularis groenlandica	1	-	3	1	1
Polemonium foliosissimum	-	3	-	-	1
Senecio triangularis	10	1	1	-	-
Solidago canadensis	-	-	-	-	10
Taraxacum officinale	-	1	1	1	3
Thalictrum alpinum	-	3	1	1	1
Vicia americana	10	-	-	-	1

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

UNESCO V.B.4.a. MEDIUM TALL SOD-FORMING GRASSLANDS
COWARDIN PALUSTRINE-EMERGENT, PERSISTENT WETLANDS

Calamagrostis canadensis **Alliance**

Bluejoint reed grass (*Calamagrostis canadensis*) Plant Association
G4S4 (CACA)
Gunnison River Basin--3 plots (94JB37, 94MD14, 94MD36)
Colorado River Basin-- 1 plots (93RR61)

Related types : *Calamagrostis canadensis* (Padgett *et al.* 1989, Reid and Bourgeron 1991, Baker 1984).

Distribution: Known from high elevations in Utah and central Colorado (Padgett *et al.* 1989, Baker 1984).

Elevation: 2265-3420 m (9390-11,160 ft).

Geomorphology: This meadow association occurs in broad glaciated valleys and on narrow floodplains of lower montane canyons.

Rosgen's Channel Type: Adjacent channel types are narrow and sinuous (E3, E6).

Vegetation: A dense sward of *Calamagrostis canadensis* (80-90%) with few other species present is typical for this association. Other graminoids may include *Carex aquatilis* (3-10%). Forbs may include *Cardamine cordifolia* (1%), *Senecio triangularis* (5%), and *Heracleum lanatum* (1%).

Soils: Soils are thin (15 cm) to thick (70 cm) organic layer over silty loams.

Adjacent riparian vegetation: This association often intergrades with adjacent meadows dominated by *Carex aquatilis,* and with adjacent shrublands dominated by *Salix planifolia, Salix brachycarpa,* or other *Salix* spp. shrubland.

Adjacent upslope vegetation: *Pinus contorta, Picea engelmannii/ Abies lasiocarpa* forests occur on the adjacent hillslopes.

Succession/Management: This plant association appears to be a ling-lived mid-seral meadow association. One of the largest, and purest (few other species present) stands occurs in the Big Blue Wilderness Area, along Fall Creek. In Utah, this plant association is reported to occur with a *Pinus contorta* overstory. Due to pine bark beetle invasions, dead trees at the meadow/forest ecotone may allow for high water tables (less evapotranspiration), and thus

allow for expansion of the *Calamagrostis canadensis* plant association (Padgett *et al.* 1989). Higher elevation stands of *Calamagrostis canadensis* in Colorado do not show this relationship with adjacent forests communities. But rather is a common component of subalpine riparian mosaics.

Table 36. Cover Class Codes* for Characteristic Plant Species in the *Calamagrostis canadensis* Plant Association.

Plots (94___)	JB37	MD14	MD36
Occurrence Ranks**	B	A	C
SHRUBS			
Alnus incana ssp. tenuifolia	3	-	-
Salix drummondiana	10	-	-
GRAMINOIDS			
Agrostis stolonifera	-	-	1
Calamagrostis canadensis	40	80	90
Carex aquatilis	3	10	3
Carex microptera	3	-	-
Carex rostrata	1	-	1
Deschampsia cespitosa	-	1	-
Glyceria striata	1	-	-
Luzula parviflora	10	-	-
FORBS			
Achillea millefolium var. apicola	1	-	1
Aster spp.	3	-	-
Caltha leptosepala	-	1	-
Cardamine cordifolia	-	1	-
Conioselinum scopulorum	1	-	-
Epilobium spp.	1	-	-
Fragaria virginiana	3	-	-
Geum macrophyllum	10	1	1
Heracleum lanatum	3	-	-
Mentha arvensis	-	-	1
Mertensia ciliata	-	-	1
Mimulus guttatus	1	-	-
Oxypolis fendleri	1	-	-
Taraxacum officinale	1	-	-
Thalictrum fendleri	-	-	1
Trifolium repens	3	-	-
Urtica dioica ssp. gracilis	-	-	10
Veronica wormskjoldii	1	-	-
Viola spp.	1	-	-
Horsetails			
Equisetum arvense	3	-	-

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

UNESCO V.C.6.a. MESOPHYTIC SOD-FORMING SUBALPINE-ALPINE GRASSLANDS

COWARDIN PALUSTRINE-EMERGENT, PERSISTENT WETLANDS

Carex aquatilis Alliance

Water sedge (*Carex aquatilis*) Plant Association
G5S3S4 (CAAQ)

Gunnison River Basin--9 plots (94GK14, 94JB19, 94JB21, 94JB25, 94MD35, 94RR10, 94RR33, 94RR40, 94RR45)
San Miguel/Dolores River Basin-- 2 plots (91NL58, 91NL91)

Related types : *Carex aquatilis* (Cooper and Cottrell 1990, Padgett *et al.* 1989, Youngblood *et al.* 1985); probably included with the broader type *Carex aquatilis-Carex rostrata* (Hess and Wasser 1982), and *Carex aquatilis-Carex rostrata-Deschampsia cespitosa* (Baker 1989).

Distribution: This common type is widespread throughout the Rocky Mountain region. It is reported from mid to high-elevations in Montana (Hansen *et al.* 1988, as cited in Padgett *et al.* 1989), eastern Idaho, western Wyoming, and Utah (Johnston 1987). In Colorado, the *Carex aquatilis* plant association has been reported from Roosevelt, Arapaho, White River, Routt, and Gunnison National Forests, and from Rocky Mountain National Park (Johnston 1987).

Elevation: 2650-3475 m (8660-11,400 ft)

Geomorphology: This plant association occurs in a variety of valley types, but large expanses of it 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 on lakes and beaver ponds.

Rosgen's Channel Type: Largest occurrences are found near narrow, deep, sinuous streams (E4, E5, E6). Some stands occur along steep stream (A3), other along wide, shallow streams (B3), as well as where beaver dams and ponds have altered the channel morphology.

Vegetation: This plant association is characterized by a dense rhizomatous sward of *Carex aquatilis* (50-80%), usually accompanied a few other graminoids species such as *Calamagrostis canadensis* (0-40%) or *Deschampsia cespitosa* (0-5%). *Carex utriculata* can often be present but is usually not more than 10-30% cover. A few forbs are commonly present, such as *Pedicularis groenlandica* (0-1%), *Catha leptosepala* (0-10%), or *Epilobium* spp. (0-5%).

Soil: 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.

Adjacent riparian vegetation: This meadow association almost always occurs in a mosaic of many riparian plant associations, including *Salix planifolia*, *Salix wolfii*, and *Salix monticola-Salix geyeriana* shrublands, and *Carex utriculata* wetlands in standing water.

Adjacent upland vegetation: *Abies lasiocarpa-Picea engelmannii* forests, alpine fell-fields. occur on adjacent hillslopes.

Succession/management: The *Carex aquatilis* type occurs on soils that are typically wet throughout the growing season, and livestock grazing can often cause hummocking and pitting of the soil (Padgett *et al.* 1989). Presence of *Carex utriculata* may indicate the site has progressed from the more wet *Carex utriculata* community to the current more mesic conditions, and, with time, may become dominated by *Salix planifolia* or *Salix wolfii*.

Table 37. Cover Class Codes* of Characteristic Plant Species in the *Carex aquatilis* Plant Association.

Plots (94____)	GK14	JB19	JB21	JB25	MD35	RR10	RR33	RR40	RR45
Occurrence Ranks**	A	A	A	A	C	C	A	C	C
SHRUBS									
Salix monticola	-	3	-	-	-	3	-	3	-
Salix planifolia ssp. planifolia	1	3	20	-	-	-	10	3	-
Salix wolfii	-	3	1	-	-	-	-	10	-
GRAMINOIDS									
Calamagrostis canadensis	20	40	10	3	3	-	1	10	1
Carex aquatilis	70	50	70	60	80	50	50	50	60
Carex rostrata	-	10	-	3	1	-	20	20	20
Deschampsia cespitosa	-	-	-	3	3	-	1	-	1
Poa pratensis	-	-	-	-	3	1	-	-	-
FORBS									
Caltha leptosepala	10	-	-	-	-	10	-	-	-
Cirsium spp.	-	-	-	-	10	-	-	-	-
Fragaria virginiana	-	1	-	-	3	1	-	-	-
Mertensia ciliata	-	3	3	-	-	-	1	-	-
Sedum rhodanthum	1	-	1	-	-	-	1	-	-
Taraxacum officinale	-	-	-	1	-	1-	-	-	-

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.
**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Water sedge-Beaked sedge (*Carex aquatilis-Carex utriculata*) Plant Association
G4S4 (CAAQ-CAUT)
Gunnison River Basin--3 plots (94GK21, 94JB41, 94MD26)
White River Basin--2 plots (92GK41, 92NL58)
Colorado River Basin--3 plots (93SS24, 93RR14, 93SS32)

Related types : Many authors appear to included stands dominated individually by either species under this name. We include only those stands with a true co-dominance of both species. *Carex utriculata-Carex aquatilis* (Hess and Wasser 1982) and *Carex utriculata-Carex aquatilis* (Komarkova 1986) as cited in Reid and Bourgeron (1991). *Carex aquatilis/Carex utriculata* (Johnston 1987).

Distribution: The *Carex aquatilis-Carex utriculata* plant association is known throughout the high subalpine meadows of the Rocky Mountains. It occurs in Idaho, Montana, Utah, Wyoming and is reported from most forests in Colorado. It also occurs on the Flat Top and Roan Plateaus, and Rocky Mountain National Park in Colorado.

Elevation: 2510-3050 m (8240-10,000 ft).

Geomorphology: This association occurs in broad glaciated subalpine meadows that remain saturated with snowmelt runoff for most of the growing season. It also occurs around beaver ponds.

Vegetation: This association consists of dense sedge stands with intermixed *Carex aquatilis* and *Carex utriculata*. These stands have low species diversity with only a few characteristic high elevation wetland forbs present such as *Caltha leptosepala* and *Pedicularis groenlandica*.

Soil: Soils are often thick peaty mucks, but stands also occur on mineral glacial till.

Adjacent riparian vegetation: Stands are almost always a part of a riparian or wetland mosaic, intermixing with *Salix planifolia*, *Salix brachycarpa*, or *Salix geyeriana* shrublands, and *Deschampsia cespitosa* grasslands on the drier margins.

Adjacent upslope vegetation: *Picea engelmannii/ Abies lasiocarpa*, *Pinus contorta* forests, *Artemisia tridentata* shrublands occur on adjacent hillslopes.

Succession/Management: Padgett *et al.* (1989) discuss the taxonomic problem of the inter-gradation of *Carex aquatilis* and *Carex utriculata* community types. A difference may be noted in the soil on which these two types occur: *Carex aquatilis* appears to occur more often on Histisols, while *C. utriculata* can occur on mineral soils. *Carex utriculata* appears to tolerate standing water and may be the more pioneering of the two species (Padgett *et al.* 1989). *Carex aquatilis* is more palatable to livestock, and grazing in this community may

favor *Carex utriculata*. This association may also represent a successional transition between the pioneer *Carex utriculata* to the sightly drier habitat of *Carex aquatilis*, in which willows may become established. In Colorado, *Carex utriculata* appears to occur more often in standing water, and often grades from an aquatic habitat to a mesic terrestrial habitats, where *Carex aquatilis* will become more dominant.

Table 38. Cover Class Codes* of Characteristic Plant Species in the *Carex aquatilis-Carex utriculata* Plant Association.

Plots (94___)	GK21	JB41	MD26
Occurrence Ranks**	C	C	B
SHRUBS			
Salix planifolia ssp. planifolia	-	3	-
GRAMINOIDS			
Calamagrostis canadensis	1	3	3
Carex aquatilis	10	20	20
Carex canescens	-	-	10
Carex lanuginosa	3	-	-
Carex microptera	-	3	-
Carex rostrata	50	50	40
FORBS			
Achillea millefolium var. apicola	-	3	-
Arctium minus	3	-	-
Caltha leptosepala	-	3	-
Cardamine cordifolia	-	3	-
Geranium richardsonii	-	3	-
Geum macrophyllum	-	3	-
Potentilla spp.	3	-	-
Taraxacum officinale	-	3	-
Viola canadensis	-	3	-

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Carex utriculata Alliance

Beaked sedge (*Carex utriculata*) Plant Association
G3G4S3 (CARO)
Gunnison River Basin--4 plots (94GK19, 94JB28, 94JB49, 94RR36)
San Miguel/Dolores River Basin--3 plots (91NL17, 91NL34, 91NL87)

Related types : *Carex utriculata* (Cooper and Cottrell 1990); *Carex rostrata* (Youngblood *et al.* 1985, Padgett *et al.* 1989). Probably included within the broader type *Carex rostrata-Carex aquatilis* (Hess and Wasser 1982), *Carex aquatilis-Carex utriculata--Carex utriculata* Phase (Johnston 1987), and *Carex aquatilis-Carex rostrata-Deschampsia cespitosa* (Baker 1989).

Distribution: This type has been described by many authors from central and eastern Oregon, central and eastern Idaho, western Wyoming, and western and central Montana (Padgett *et al.* 1989). In Colorado it is reported from Roosevelt, Arapaho, White River, Routt, and Gunnison National Forests, and from Rocky Mountain National Park (Johnston 1987).

Elevation: 1800-3200 m (6000-10,500 ft)

Geomorphology: *Carex utriculata* grows in standing water and saturated soils around lakes and beaver ponds. It also grows in wet swales and overflow channel where standing water occurs.

Soil: Soils are thick and saturated organics, often intergrading with mineral soils.

Vegetation: This plant association is characterized by nearly pure stands of *Carex utriculata*. *Carex aquatilis* and *Carex nebrascensis* may also be present in minor amounts (<10%). Willow carrs are often adjacent, and a few scattered individual willows occur, particularly *Salix planifolia* at higher elevations and *Salix monticola* at lower elevations.

Adjacent riparian vegetation: This association is often part of a wetland mosaic, with *Salix planifolia, Salix monticola*, and *Salix geyeriana* shrublands. It also occurs adjacent to and intergrades with, *Carex aquatilis* meadows.

Adjacent upland vegetation: *Abies lasiocarpa-Picea engelmannii* forests, *Populus tremuloides* woodlands, *Quercus gambelli* shrublands occur on adjacent hillslopes.

Succession/management: *Carex utriculata* appears to occupy the wettest sites, while *Carex aquatilis* occurs in slightly better drained areas. These two species intermix at intermediate habitats, and thus create the confusion in the literature as to whether there are one or two plant

associations. We chose to follow Padgett *et al.*'s (1989) and Youngblood *et al.*'s (1985) lead in distinguishing between plant associations which often have different environmental characteristics as well as different species composition, and because in Colorado, pure stands of both species occur, as well as large stands of completely intermixed stands. *Carex utriculata* is known to become abundant at the margins of newly formed beaver ponds (Padgett *et al.* 1989).

Table 39. Cover Class Codes* for Characteristic Plant Species in the *Carex utriculata* Plant Association.

Plots (94___)	GK19	JB28	JB49	RR36
Occurrence Ranks**	B	C	A	A
SHRUBS				
Salix boothii	-	20	-	-
Salix monticola	-	10	-	-
Salix planifolia ssp. planifolia	-	3	-	-
Salix wolfii Bebb	3	-	-	-
GRAMINOIDS				
Calamagrostis canadensis	10	-	-	10
Carex aquatilis	-	3	-	-
Carex microptera	-	-	20	-
Carex rostrata	40	60	60	60
Deschampsia cespitosa	-	3	10	-
Conioselinum scopulorum	-	3	-	-
FORBS				
Epilobium spp.	-	1	10	1
Galium boreale	-	3	-	-
Heracleum lanatum	-	-	-	3
Pedicularis groenlandica	-	3	-	-
HORSETAILS				
Equisetum arvense	-	3	20	3

*Cover Codes represent the mid-point for the range, for example 3=1-5%, 10=5-15%, and 20=15-25%. A Cover Code of 1 denotes values <1%.

**Occurrence Ranks: A= Pristine or undisturbed, B= Undisturbed to sightly altered, C= Disturbed to highly altered. See page 15 of the Introduction for complete definitions.

Other *Carex* spp. stands:

Below Marrow Point Reservoir, the third large dam in a Alliance of three on the Gunnison River, *Carex lanuginosa* grows in a dense band along the river's edge for several miles. The stable water levels caused by the controlled flows create a lake-like margin like environment, in which *Carex lanuginosa* apparently thrives. Plot 94JB38 had 40% *Carex lanuginosa* and 10% *Phalaroides arundinacea*.

Other herbaceous dominated stands:

Forb dominated associations are never very large, and one stand (94JB16) was sampled at the base of a talus slope, where large boulders covered the bank of small subalpine stream at 3475 m (11,400 ft). Typical of the margins of many subalpine streams, the herbaceous layer was dominated by *Cardamine cardifolia* (10%), *Mertensia ciliata* (20%),and *Dugaldia hoopesii* (10%). A few stems of *Salix planifolia* (1%) were also present. This stand occurs along a mesic habitat that is apparently too rocky for the establishment of woody species.

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APPENDIX 1. Best Riparian Sites in the Gunnison Basin (Table 40), Plot Locations (Table 41), and a Plant Association Name and Occurrance Rank for each Plot (Table 42).

Table 40. Best Riparian Sites in the Gunnison Basin. These Reaches are in Excellent to Good Condition and Have High Quality Examples of Native Riparian Plant Associations.

Creek Name Plot #	Element Rank	Occurrence Rank	Plant Association Comments
1. Anthracite Creek 94RR13	G3S2	A	*Populus angustifolia/Cornus sericea* Excellent example of a lower elevation type.
2. Big Dominquez 94RR01	G2G3S2	A	*Betula occidentalis*/Mesic forb Large stand with few non-native plant species.
3. Brush Creek 94JB21	G5S3S4	A	*Carex aquatilis* Large pristine stand.
4. Brush Creek 94RR30	G4S2S3	A	*Salix planifolia/Carex aquatilis* Large, unfragmented stand in excellent condition.
5. Cathedral Creek 94JB27	GUSU	A	*Abies lasiocarpa/Salix drummondiana* Good condition example.
6. Cottonwood Crk 94RR04	G2S2	B	*Populus angustifolia/Rhus trilobata* Light grazing, stand in good shape.
7. Cottonwood Crk 94JB04	n/a	BC	*Populus angustifolia* Alliance Small stand, in patchy condition.
8. Cow Creek 94RR16	GUSU	AB	*Populus balsamifera* Small but good condition, unusual type.
9. Curecanti Creek 94GK07	G4S4	A	*Salix planifolia/Caltha leptosepala* Unfragmented, pristine example of common type.
10. East River 94RR21	G3S2	BC	*Salix boothii*/Mesic forb Very large wetland with some areas in excellent condition and other areas in poor condition.

Table 40., Continued.

Creek Name Plot #	Element Rank	Occurrence Rank	Plant Association Comments
11. East Soap Creek 94RR15	G3G4S3S4	A	*Abies lasiocarpa/Alnus incana-Salix drummondiana* Long and unfragmented stand.
12. Fall Creek 94GK14	G5S3S4	A	*Carex aquatilis* Very large stand in good condition.
13. Grouse Spring 94GK09	_____	A	*Populus tremuloides/Alnus incana* Very dense undergrowth of native forbs.
14. Kelso Creek 94MD01	G2G3S2	AB	*Betula occidentalis*/Mesic forb Good vegetation, water quality diminished by upstream siltation.
15. Little Monitor 94GK06	n/a	A	*Salix exigua* Alliance Very dense willow stand.
16. Munsey Creek 94GK43	G2S2	B	*Populus angustifolia-Picea pungens/Alnus incana-Cornus sericea* Stand shows response to flooding disturbance.
17. North Fork East 94GK38	G4S2	B	*Alnus incana-Cornus sericea* Long, disturbed in past, lots of regrowth
18. Oben Creek 94JB48	G3S3	A	*Populus angustifolia-Picea pungens/Alnus incana-Cornus sericea* Excellent example, recovering from recent flooding.
19. Porophyry Crk 94RR47	G4S2	A	*Alnus incana*/Mesic forb Large and pristine, no roads.
20. Robideau Creek 94RR08	G2G3S2	A	*Betula occidentalis*/Mesic forb Nice example, fairly large.
21. Robideau Creek 94MD04	G3S3	A	*Picea Pungens/Alnus incana* Remote, intact, few non-native plant species.

Table 40., Continued.

Creek Name Plot #	Element Rank	Occurrence Rank	Plant Association Comments
22. Slate River 94JB19	G4S4	A	*Carex aquatilis* Large stand, no non-native plant species.
23. Snowshoe Creek 94JB11	G3S3	A	*Populus angustifolia-Picea pungens/Alnus incana-Cornus sericea* Large and remote stand in good condition.
24. Traver Creek 94JB06, 94GK04	G2S2	A	*Populus angustifolia/Rhus trilobata* Small stand but pristine, good example of low elevation type.
25. West Brush Crk 94RR36	G5S5	A	*Carex utriculata* Large stand in excellent condition.
27. West Muddy 94GK42	G3S2	B	*Populus angustifolia/Cornus sericea* Remote, large, some non-native plant species.

Table 41. Plot Locations. Abbreviations used are: BLM= Bureau of Land Management, CPW= Collegiate Peaks Wilderness Area, BBW= Big Blue Wilderness Area, FRW= Fossil Ridge Wilderness, LGW= La Garita Wilderness Area, NF=National Forest, NM= National Monument, NRA= National Recreational Area, PHW= Powderhorn Wilderness Area, WEW= West Elk Wilderness, RW= Raggeds Wilderness Area.

MAP#	PLOT#	CREEK NAME	COUNTY	TOWNSHIP/RANGE/SECTION	OWNERSHIP
1	94GK01	Big Dominguez Creek	Mesa	T15S R100W SEC 13	BLM
2	94GK02	Kelso Creek	Mesa	T49N R15W SEC 6	Uncompahgre NF
3	94GK03	Kelso Creek	Mesa	T49N R15W SEC 6	Uncompahgre NF
4	94GK04	Traver Creek	Montrose	T49N R12W SEC 28	Uncompahgre NF
5	94GK05	Roubideau Creek	Montrose	T49N R12W SEC 21	Uncompahgre NF
6	94GK06	Little Monitor Creek	Montrose	T50N R13W SEC 35	BLM
7	94GK07	Curecanti Creek	Gunnison	T51N R5W SEC 23	Gunnison NF, WEW
8	94GK08	Dyer Creek	Gunnison	T50N R5W SEC 7	Gunnison NF
9	94GK09	Grouse Spring Creek	Gunnison	T13S R88W SEC 21	Gunnison NF
10	94GK10	Grouse Spring Creek	Gunnison	T13S R88W SEC 28	Gunnison NF
11	94GK11	Soap Creek	Gunnison	T51N R4W SEC 15	Gunnison NF, WEW
12	94GK12	Cebolla Creek	Gunnison	T48N R3W SEC 11	BLM-Curecanti NRA
13	94GK13	Cebolla Creek	Gunnison	T48N R3W SEC 11	BLM-Curecanti NRA
14	94GK14	Fall Creek	Hinsdale	T45N R5W SEC 22	Uncompahgre NF, BBW
15	94GK15	Henson Creek	Hinsdale	T44N R4W SEC 32	BLM
16	94GK16	Middle Fork Powderhorn Creek	Gunnison	T45N R2W SEC 8	Gunnison NF, PHW
17	94GK17	Cottonwood Creek	Hinsdale	T42N R5W SEC 18	BLM
18	94GK18	Slate River	Gunnison	T13S R86W	Private
19	94GK19	Slate River	Gunnison	T13S R86W	Private
20	94GK20	Coal Creek	Gunnison	T14N R86W	Private
21	94GK21	East Creek	Gunnison	T13S R85W SEC 29	Gunnison NF
22	94GK22	Hoodoo Creek	Gunnison	T14S R90W SEC 25	Gunnison NF
23	94GK23	East Fork Minnesota Creek	Gunnison	T14S R90W SEC 22	Gunnison NF
24	94GK24	East Fork Minnesota Crk	Gunnison	T14S R90W SEC 22	Gunnison NF
25	94GK25	North Smith Fork	Gunnison	T15S R90W SEC 21	Gunnison NF
26	94GK26	Virginia Creek	Gunnison	T51N R5.5 SEC 12	Gunnison NF
27	94GK27	West Fork Terror Creek	Delta	T12S R92W SEC 36	Gunnison NF
28	94GK28	Hubbard Creek	Delta	T12S R91W SEC 35	Gunnison NF
29	94GK29	Hubbard Creek	Delta	T13S R91W SEC 2	Gunnison NF/Private
30	94GK30	Gunnison River	Gunnison	T50N R1E	Private
31	94GK31	Castle Creek	Gunnison	T15S R87W SEC 7	Gunnison NF
32	94GK32	Unnamed trib. to Pass Creek	Gunnison	T14S R87W SEC 30	Gunnison NF
33	94GK33	Unnamed trib to Pass Creek	Gunnison	T14S R87W SEC 30	Gunnison NF
34	94GK35	Comanche Gulch	Gunnison	T50N R3E SEC 3	Gunnison NF
35	94GK37	Gunnison River	Mesa	T13S R88W SEC 27	BLM
36	94GK38	North Fork East Creek	Mesa	T13S R100W SEC 26	BLM
37	94GK39	Gunnison River	Montrose	T49N R7W SEC 3	Black Canyon NM
38	94GK40	Dyke Creek	Delta	T11S R92W SEC 12	Gunnison NF
39	94GK41	Main Hubbard Creek	Delta	T11S R92W SEC 35	Gunnison NF
40	94GK42	W. Muddy Creek	Gunnison	T11S R91W SEC 25	Gunnison NF
41	94GK43	Munsey Creek	Gunnison	T12S R88W SEC 31	Gunnison NF
42	94GK44	Cimarron River	Montrose	T37N R6W SEC 30	State Wildlife Area
43	94GK45	Cimarron River	Montrose	T37N R6W SEC 30	State Wildlife Area
44	94GK46	Cow Creek	Ouray	T45N R7W SEC 27	Uncompahgre NF, BBW
45	94GK47	Red Creek	Ouray	T45N R7W SEC 26	Uncompahgre NF, BBW
46	94GK48	Uncompahgre River	Ouray	T47N R8W SEC 22	State Wildlife Area
47	94GK49	W. Fork Dallas Creek	Ouray	T44N R9W SEC 21	Gunnison NF
48	94GK50	W. Fork Dallas Creek	Ouray	T44N R9W SEC 21	Gunnison NF
49	94JB01	Big Dominquez Creek	Mesa	T15S R100W SEC 31	BLM
50	94JB02	North Fork Escalante	Mesa	T50N R15W SEC 19	Uncompahgre NF
51	94JB03	East Fork Escalante Creek	Mesa	T50N R14W SEC 35	Uncompahgre NF
52	94JB04	Cottonwood Creek	Montrose	T50N R12W SEC 33	BLM
53	94JB05	Potter Creek	Montrose	T49N R13W SEC 27	
54	94JB06	Traver Creek	Montrose	T49N R12W SEC 28	BLM
55	94JB07	Middle Fork Spring Creek	Ouray	T47N R11W SEC 36	Uncompahgre NF
56	94JB08	Crystal Creek	Montrose	T49N R6W SEC 17	Gunnison NF
57	94JB09	North Dyer Creek	Gunnison	T50N R5.5W	Private

Table 41., Continued.

MAP#	PLOT#	CREEK NAME	COUNTY	TOWNSHIP/RANGE/SECTION	OWNERSHIP
58	94JB10	Curecanti Creek @ Dry Fork	Gunnison	T51N R5W SEC 35	Gunnison NF, WEW
59	94JB11	Snowshoe Creek	Gunnison	T13S R89W	Gunnison NF
60	94JB12	Cow Creek	Gunnison	T50N R4W	Gunnison NF, WEW
61	94JB13	E. Fork Powderhorn	Gunnison	T45N R2W	Gunnison NF, PHW
62	94JB14	Fall Creek	Hinsdale	T45N R5W	Uncompahgre NF, BBW
63	94JB15	Little Cimmeron River	Gunnison	T46N R6W SEC 13	
64	94JB16	Devil's Canyon	Hinsdale	T44N R3W SEC 15	Gunnison NF
65	94JB17	Independence Gulch	Hinsdale	T44N R4W SEC 4	Gunnison NF
66	94JB18	West Brush Creek	Gunnison	T13N R85W SEC 27	Gunnison NF
67	94JB19	Slate River	Gunnison	T13S R86W SEC 7	Gunnison NF
68	94JB20	Fivemile River	Gunnison	T15S R83W SEC 19	Gunnison NF
69	94JB21	Brush Creek	Gunnison	T15S R82W SEC 30	Gunnison NF, FRW
70	94JB22	Quartz Creek	Gunnison	T50N R4E SEC 20	Gunnison NF
71	94JB23	Quartz Creek	Gunnison	T50N R4E SEC 20	Gunnison NF
72	94JB24	Lake Fork Cochetopa Creek	Saguache	T43N R1E SEC 13	Gunnison NF, LGW
73	94JB25	Cochetopa Creek	Saguache	T43N R1E SEC 11	Gunnison NF, LGW
74	94JB26	Stewart Creek	Saguache	T44N R1E SEC 34	Gunnison NF, LGW
75	94JB27	Cathedral Creek	Saguache	T44N R1N SEC 9	Gunnison NF
76	94JB28	Dry Basin	Gunnison	T13S R85W SEC 17	Gunnison NF
77	94JB29	Mysterious Creek	Gunnison	T13S R5W SEC 19	Gunnison NF
78	94JB30	Red Mountain	Gunnison	T12S R82W SEC 29	Gunnison NF, CPW
79	94JB31	Texas Creek	Gunnison	T13S R81W SEC 34	Gunnison NF, CPW
80	94JB32	Waterloo	Gunnison	T13S R81W SEC 15	Gunnison NF, CPW
81	94JB33	Willow Creek	Gunnison	T14S R81W	Private
82	94JB34	West Willow Creek	Gunnison	T51N R4E SEC 10	Gunnison NF
83	94JB35	West Willow Creek	Gunnison	T51N R4E SEC 10	Gunnison NF
84	94JB36	Summerville Creek	Gunnison	T15S R83W SEC 16	Gunnison NF, FRW
85	94JB37	Summerville Creek	Gunnison	T15S R83W SEC 16	Gunnison NF, FRW
86	94JB38	Gunnison River	Mesa	T13S R94W SEC 27	BLM
87	94JB39	Gunnison River	Montrose	T49N R7W SEC 3	Black Canyon NM
88	94JB40	Gunnison River	Montrose	T49N R7W SEC 3	Black Canyon NM
89	94JB41	Dyke Creek	Delta	T11S R92W SEC 14	Gunnison NF
90	94JB42	Dyke Creek	Delta	T11S R92W SEC 14	Gunnison NF
91	94JB43	West Muddy Creek	Delta	T11S R91W SEC 24	Gunnison NF
92	94JB44	Long Branch	Saguache	T47N R5E SEC 4	Gunnison NF
93	94JB45	E. Fork Cimarron Creek	Gunnison	T45N T6W SEC 2	Uncompahgre NF, BBW
94	94JB46	Mid. Fork Cimarron Creek	Hinsdale	T45N R6W SEC 27	Uncompahgre NF, BBW
95	94JB47	Oben Creek	Ouray	T44N R7W SEC 1	Uncompahgre NF, BBW
96	94JB48	Oben Creek	Ouray	T44N R7W SEC 2	Uncompahgre NF
97	94JB49	East Fork Dallas Creek	Ouray	T44N R9W SEC 35	Uncompahgre NF
98	94JB50	Canyon Creek	Ouray	T43N R8W SEC 12	Uncompahgre NF
99	94MD01	Kelso Creek	Mesa	T50N R15W SEC 27	Uncompahgre NF
100	94MD02	Kelso Creek	Mesa	T50N R15W SEC 32	Uncompahgre NF
101	94MD03	Cottonwood Creek	Montrose	T50N R12W SEC 33	BLM
102	94MD04	Roubideau Creek	Montrose	T48N R12W SEC 21	Uncompahgre NF
103	94MD05	Roubideau Creek	Montrose	T48N R12W SEC 4	Uncompahgre NF
104	94MD06	Potter Crk	Montrose	T50N R12W SEC	BLM
105	94MD07	Blue Creek	Gunnison	T48N R5W SEC 14	Black Canyon NM
106	94MD08	Dyer Creek	Gunnison	T50N R5W SEC 7	Gunnison NF
107	94MD09	Ruby Anthracite Creek	Gunnison	T13S R88W SEC 10	Gunnison NF, RW
108	94MD10	Ruby Anthracite Creek	Gunnison	T13S R88W SEC 10	Gunnison NF, RW
109	94MD11	Soap Creek	Gunnison	T51N R4W SEC 10	Gunnison NF
110	94MD12	Willow Creek	Gunnison	T50N R3W SEC 36	Gunnison NF
111	94MD13	Fall Creek	Gunnison	T45N R5W SEC 10	Uncompahgre NF, BBW
112	94MD14	Fall Creek	Gunnison	T45N R5W SEC 10	Uncompahgre NF, BBW
113	94MD15	Firebox Creek	Gunnison	T46N R5W SEC 34	Uncompahgre NF, BBW
114	94MD16	Devils Canyon	Hinsdale	T44N R3W SEC 15	Gunnison NF
115	94MD17	Cement Creek	Gunnison	T14S R84W SEC 7	Gunnison NF
116	94MD18	Coal Creek	Gunnison	T14S R86W SEC 6	Gunnison NF
117	94MD19	East River	Gunnison	T15S R85W SEC 11	Private
118	94MD20	So Frk	Gunnison	T14S R90W SEC 20	Gunnison NF
119	94MD21	North Fork Gunn River	Gunnison	T13S R90W SEC 12	BLM
120	94MD22	Willow Crk	Gunnison	T15S R89W SEC 6	Gunnison NF, WEW

Table 41., Continued.

MAP#	PLOT#	CREEK NAME	COUNTY	TOWNSHIP/RANGE/SECTION	OWNERSHIP
121	94MD23	Beaver Creek	Gunnison	T15S R84W SEC 34	Gunnison NF
122	94MD24	Willow Creek	Gunnison	T14S R82W SEC 21	Gunnison NF
123	94MD25	N. Castle Creek	Gunnison	T14S R87W SEC 7	Gunnison NF, WEW
124	94MD26	Castle Creek	Gunnison	T14S R87W SEC 7	Gunnison NF, WEW
125	94MD27	Mill Creek	Gunnison	T15S R87W SEC 32	Gunnison NF, WEW
126	94MD28	Dry Basin	Gunnison	T25N R85W SEC 17	Gunnison NF
127	94MD29	Flag Creek	Gunnison	T13S R84W SEC 36	Gunnison NF
128	94MD30	Bowman Creek	Gunnison	T12S R85W SEC 18	Gunnison NF, CPW
129	94MD31	Pass Creek	Gunnison	T14S R81W SEC 9	Gunnison NF
130	94MD32	Trib. to Texas Creek	Gunnison	T35S R80W SEC 29	Gunnison NF
131	94MD33	Middle Willow Crk	Gunnison	T15S R81W SEC 29	Private
132	94MD34	North Quartz Crk	Gunnison	T51N R4E SEC 24	Gunnison NF
133	94MD35	Canyon Creek	Gunnison	T50N R5E SEC 32	Gunnison NF
134	94MD36	Razor Creek	Saguache	T47N R3E SEC 23	Gunnison NF
135	94MD37	Left Hand Creek	Saguache	T47N R4E SEC 9	Gunnison NF
136	94MD38	Porophyry Creek	Gunnison	T49N R5E SEC 26	Gunnison NF
137	94MD39	North Fork Agate Creek	Gunnison	T49N R6E SEC 31	Gunnison NF
138	94RR01	Big Dominguez Crk	Mesa	T15S R100W SEC 18	BLM
139	94RR02	Keith Creek	Mesa	T51N R15W SEC 20	BLM
140	94RR03	North Frk Escalante Creek	Mesa	T50N R15W SEC 19	Uncompahgre NF
141	94RR04	Cottonwood Creek	Delta	T51N R12W SEC 15	BLM
142	94RR05	Cottonwood Creek	Delta	T51N R12W SEC 15	BLM
143	94RR06	Monitor Creek	Montrose	T49N R13W SEC 29	Uncompahgre NF
144	94RR07	Little Monitor Crk	Montrose	T49N R13W SEC 17	Uncompahgre NF
145	94RR08	Robideau Creek	Montrose	T48N R12W SEC 4	Uncompahgre NF
146	94RR09	Potter Creek	Montrose	T50N R12W SEC 32	Uncompahgre NF
147	94RR10	E. Fork Spring Creek	Ouray	T46N R10W SEC 8	Uncompahgre NF
148	94RR11	Dyer Creek	Gunnison	T50N R5.5W SEC 24	Uncompahgre NF
149	94RR12	Curecanti Creek	Gunnison	T51N R5W SEC 35,36	Gunnison NF
150	94RR13	Anthracite Creek	Gunnison	T21N R88W SEC 5	Gunnison NF
151	94RR14	Trout Creek	Gunnison	T13S R88W SEC 34	Gunnison NF
152	94RR15	East Soap Creek	Gunnison	T51N R4W SEC 13,	Gunnison NF
153	94RR16	Cow Creek	Gunnison	T50N R4W SEC 28	Gunnison NF, WEW
154	94RR17	Fall Creek	Gunnison	T45N R5W SEC 10	Uncompahgre NF, BBW
155	94RR18	Firebox Creek	Gunnison	T46N R5W SEC 33	Uncompahgre NF
156	94RR19	Lake Fork Gunnison River	Hinsdale	T42N R5W SEC 6	BLM
157	94RR20	Cement Crk	Gunnison	T13S R85W SEC 16	Gunnison NF
158	94RR21	East River	Gunnison	T13S R85W SEC 20	Private
159	94RR22	Slate River	Gunnison	T12S R87W SEC 35	Gunnison NF
160	94RR23	So Frk	Gunnison	T14S R90W SEC 20	Gunnison NF
161	94RR24	Willow Crk	Gunnison	T15S R89W SEC 6	Gunnison NF, WEW
162	94RR25	Cascade Creek	Gunnison	T14N R89W SEC 15	Gunnison NF, WEW
163	94RR26	Coal Creek	Gunnison	T14S R89W SEC 15	Gunnison NF
164	94RR27	Taylor River	Gunnison	T15S R83W SEC 10	Gunnison NF
165	94RR28	Taylor River	Gunnison	T15S R83W SEC 10	Gunnison NF
166	94RR29	Taylor River	Gunnison	T15S R83W SEC 6	Gunnison NF
167	94RR30	Brush Creek	Gunnison	T15S R82W SEC 30	Private
168	94RR31	Gunnison River	Gunnison	T49N R1W SEC 8	BLM--Curecanti NRA
169	94RR32	Cochetopa Canyon	Saguache	T47N R2E SEC 17	Gunnison NF
170	94RR33	Lake Fork Cochetopa Creek	Saguache	T43N R1E SEC 13	Gunnison NF
171	94RR34	Lake Fork Cochetopa Creek	Saguache	T43N R1E SEC 13	Gunnison NF
172	94RR35	Pauline Creek	Saguache	T44N R1E SEC 7	Gunnison NF
173	94RR36	West Brush Creek	Gunnison	T13S R85W SEC 15	Gunnison NF
174	94RR37	Taylor River	Gunnison	T13S R82W SEC 19	Gunnison NF
175	94RR38	Taylor Crk	Gunnison	T12S R83W SEC 19	Gunnison NF
176	94RR39	Waterloo Gulch	Gunnison	T13S R81W SEC 15	Gunnison NF, CPW
177	94RR40	Willow Crk	Gunnison	T14S R82W SEC 20	Gunnison NF
178	94RR41	Jackson Gulch	Gunnison	T51N R4E SEC 22	Gunnison NF
179	94RR42	E. Fork Alder Creek	Gunnison	T50N R3E SEC 4	Gunnison NF
180	94RR43	Canyon Creek	Gunnison	T50N R5E SEC 31	Gunnison NF
181	94RR44	Canyon Creek	Gunnison	T50N R5E SEC 32	Gunnison NF
182	94RR45	Razor Creek	Saguache	T46N R4E SEC 5	Gunnison NF
183	94RR46	Owens Creek	Saguache	T47N R4E SEC 3	Gunnison NF

Table 41., Continued.

MAP#	PLOT#	CREEK NAME	COUNTY	TOWNSHIP/RANGE/SECTION	OWNERSHIP
184	94RR47	Porophyry Creek	Gunnison	T49N R5E SEC 26	Gunnison NF
185	94RR48	Agate Creek	Gunnison	T49N R6E SEC	Gunnison NF
186	94RR49	E. Frk. Cimarron River	Hinsdale	T45N R6W SEC 24	Uncompahgre NF
187	94RR50	Red Creek	Ouray	T45N R7W SEC 27	Uncompahgre NF, BBW
188	94RR51	Red Creek	Ouray	T45N R7W SEC 25	Uncompahgre NF, BBW
189	94RR52	Burro Creek	Ouray	T46N R8W SEC 12	State Wildlife Area
190	94RR53	Burro Creek	Ouray	T46N R8W SEC 12	State Wildlife Area
191	94RR54	Canyon Creek	Ouray	T43N R8W SEC 12	Uncompahgre NF

Table 42. Occurrence Ranks and Plant Association for Each Plot.

Map #	Plot #	EO Rank	Plant Association
1	94GK01	B	*Alnus incana-Cornus sericea*
2	94GK02	B	*Alnus incana* Alliance
3	94GK03	C	*Salix monticola*/Mesic forb
4	94GK04	A	*Populus angustifolia/Rhus trilobata*
5	94GK05	C	*Populus angustifolia/Salix ligulifolia-Sherperdia argentea*
6	94GK06	A	*Salix exigua* Alliance
7	94GK07	A	*Salix planifolia/Caltha leptosepala*
8	94GK08	B	*Abies lasiocarpa/Mertensia ciliata*
9	94GK09	A	*Populus tremuloides/Alnus incana*
10	94GK10	B	*Populus tremuloides/Alnus incana*
11	94GK11	B	*Salix monticola*/Mesic forb
12	94GK12	B	*Picea pungens/Amelanchier alnifolia-Cornus sericea*
13	94GK13	C	*Alnus incana*/Mesic forb
14	94GK14	A	*Carex aquatilis*
15	94GK15	B	*Alnus incana-Salix drummondiana*
16	94GK16	B	*Salix monticola/Carex utriculata*
17	94GK17	B	*Abies lasiocarpa/Salix drummondiana*
18	94GK18	A	*Salix geyeriana/Carex aquatilis*
19	94GK19	B	*Carex utriculata*
20	94GK20	B	*Abies lasiocarpa/Salix drummondiana*
21	94GK21	BC	*Carex aquatilis-Carex utriculata*
22	94GK22	B	*Abies lasiocarpa/Mertensia ciliata*
23	94GK23	C	*Alnus incana-Cornus sericea*
24	94GK24	B	*Abies lasiocarpa/Alnus incana-Salix drummondiana*
25	94GK25	B	*Populus angustifolia/Cornus sericea*
26	94GK26	B	*Abies lasiocarpa/Alnus incana-Salix drummondiana*
27	94GK27	C	*Alnus incana-Salix drummondiana*
28	94GK28	B	*Populus angustifolia/Amelanchier alnifolia/Smilicina stellata*
29	94GK29	C	*Salix exigua*/Barren
30	94GK30	BC	*Populus angustifolia/Cornus sericea*
31	94GK31	B	*Salix planifolia/Carex aquatilis*
32	94GK32	A	*Abies lasiocarpa/Mertensia ciliata*
33	94GK33	A	*Salix planifolia*/Mesic forb
34	94GK35	C	*Abies lasiocarpa/Salix drummondiana*
35	94GK37	B	*Salix exigua*/Barren
36	94GK38	B	*Alnus incana-Cornus sericea*

Table 42., Continued.

Map #	Plot #	EO Rank	Plant Association
37	94GK39	C	*Populus angustifolia/Cornus sericea*
38	94GK40	B	*Abies lasiocarpa/Mertensia ciliata*
39	94GK41	B	*Abies lasiocarpa/Mertensia ciliata*
40	94GK42	B	*Populus angustifolia/Cornus sericea*
41	94GK43	B	*Populus angustifolia-Picea pungens/Alnus incana-Cornus sericea*
42	94GK44	B	*Populus angustifolia-Picea pungens/Alnus incana-Cornus sericea*
43	94GK45	B	*Populus angustifolia-Picea pungens/Alnus incana-Cornus sericea*
44	94GK46	AB	*Populus angustifolia-Picea pungens/Alnus incana-Cornus sericea*
45	94GK47	A	*Abies lasiocarpa/Alnus incana-Salix drummondiana*
46	94GK48	C	*Populus angustifolia/Salix ligulifolia-Sherperdia argentea*
47	94GK49	C	*Abies lasiocarpa/Mertensia ciliata*
48	94GK50	AB	*Abies lasiocarpa/Mertensia ciliata*
49	94JB01	C	*Salix monticola*/Mesic forb
50	94JB02	C	*Salix monticola*/Mesic forb
51	94JB03	A	*Populus angustifolia/Cornus sericea*
52	94JB04	BC	*Populus angustifolia* Alliance
53	94JB05	B	*Picea pungens/Amelanchier almifolia-Cornus sericea*
54	94JB06	A	*Populus angustifolia/Rhus trilobata*
55	94JB07	B	*Abies lasiocarpa/Salix drummondiana*
56	94JB08	B	*Populus angustifolia-Picea pungens/Alnus incana-Cornus sericea*
57	94JB09	C	*Populus angustifolia/Cornus sericea*
58	94JB10	A	*Abies lasiocarpa/Mertensia ciliata*
59	94JB11	A	*Populus angustifolia-Picea pungens/Alnus incana-Cornus sericea*
60	94JB12	B	*Alnus incana-Salix drummondiana*
61	94JB13	B	*Salix monticola*/Mesic forb
62	94JB14	B	*Salix planifolia/Caltha leptosepala*
63	94JB15	B	*Salix monticola-Salix planifolia*/Mesic forb
64	94JB16	B	*Mertensia ciliata* Alliance
65	94JB17	A	*Abies lasiocarpa/Mertensia ciliata*
66	94JB18	B	*Abies lasiocarpa/Alnus incana-Salix drummondiana*
67	94JB19	A	*Carex aquatilis*
68	94JB20	B	*Salix boothii*/Mesic forb
69	94JB21	A	*Carex aquatilis*
70	94JB22	B	*Salix monticola*/Mesic forb
71	94JB23	B	*Betula glandulosa* Alliance
72	94JB24	A	*Salix planifolia/Caltha leptosepala*
73	94JB25	A	*Carex aquatilis*
74	94JB26	A	*Salix geyeriana/Carex aquatilis*
75	94JB27	A	*Abies lasiocarpa/Salix drummondiana*

Table 42., Continued.

Map #	Plot #	EO Rank	Plant Association
76	94JB28	BC	*Carex utriculata*
77	94JB29	A	*Salix planifolia/Caltha leptosepala*
78	94JB30	A	*Abies lasiocarpa/Salix drummondiana*
79	94JB31	BC	*Salix boothii*/Mesic forb
80	94JB32	A	*Salix planifolia/Caltha leptosepala*
81	94JB33	C	*Salix boothii*/Mesic forb
82	94JB34	BC	*Salix planifolia/Caltha leptosepala*
83	94JB35	BC	*Abies lasiocarpa/Mertensia ciliata*
84	94JB36	AB	*Abies lasiocarpa/Salix drummondiana*
85	94JB37	B	*Calamagrostis canadensis*
86	94JB38	C	*Carex* spp. Alliance
87	94JB39	C	*Populus angustifolia* Alliance
88	94JB40	C	*Populus angustifolia/Rhus trilobata*
89	94JB41	C	*Carex aquatilis-Carex utriculata*
90	94JB42	C	*Salix planifolia/Caltha leptosepala*
91	94JB43	C	*Alnus incana* Alliance
92	94JB44	AB	*Salix geyeriana/Carex aquatilis*
93	94JB45	B	*Alnus incana-Salix drummondiana*
94	94JB46	B	*Abies lasiocarpa/Salix drummondiana*
95	94JB47	A	*Abies lasiocarpa/Mertensia ciliata*
96	94JB48	A	*Populus angustifolia-Picea pungens/Alnus incana-Cornus sericea*
97	94JB49	A	*Carex utriculata*
98	94JB50	B	*Populus angustifolia-Picea pungens/Alnus incana-Cornus sericea*
99	94MD01	AB	*Betula occidentalis*/Mesic forb
100	94MD02	D	*Salix monticola*/Mesic forb
101	94MD03	B	*Populus angustifolia/Rhus trilobata*
102	94MD04	A	*Picea Pungens/Alnus incana*
103	94MD05	B	*Populus angustifolia/Rhus trilobata*
104	94MD06	B	*Populus angustifolia/Rhus trilobata*
105	94MD07	B	*Picea Pungens/Alnus incana*
106	94MD08	B	*Abies lasiocarpa/Alnus incana-Salix drummondiana*
107	94MD09	B	*Populus angustifolia-Picea pungens/Alnus incana-Cornus sericea*
108	94MD10	B	*Salix exigua* Alliance
109	94MD11	B	*Abies lasiocarpa/Salix drummondiana*
110	94MD12	C	*Alnus incana* Alliance
111	94MD13	B	*Salix planifolia/Caltha leptosepala*
112	94MD14	A	*Calamagrostis canadensis*
113	94MD15	A	*Salix planifolia/Carex aquatilis*
114	94MD16	C	*Salix monticola-Salix planifolia*/Mesic forbs

Table 42., Continued.

Map #	Plot #	EO Rank	Plant Association
115	94MD17	C	*Salix boothii*/Mesic forb
116	94MD18	AB	*Salix drummondiana*/Mesic forb
117	94MD19	BC	*Populus angustifolia/Cornus sericea*
118	94MD20	B	*Populus angustifolia/Cornus sericea*
119	94MD21	B	*Populus angustifolia/Cornus sericea*
120	94MD22	B	*Abies lasiocarpa/Salix drummondiana*
121	94MD23	B	*Populus angustifolia/Cornus sericea*
122	94MD24	B	*Salix boothii*/Mesic forb
123	94MD25	B	*Salix monticola-Salix planifolia*/Mesic forbs
124	94MD26	B	*Carex aquatilis-Carex utriculata*
125	94MD27	A	*Salix drummondiana*/Mesic forb
126	94MD28	BC	*Salix drummondiana*/Mesic forb
127	94MD29	A	*Salix boothii*/Mesic forb
128	94MD30	A	*Salix planifolia/Carex aquatilis*
129	94MD31	B	*Betula glandulosa* Alliance
130	94MD32	B	*Abies lasiocarpa/Mertensia ciliata*
131	94MD33	B	*Abies lasiocarpa/Mertensia ciliata*
132	94MD34	B	*Abies lasiocarpa/Mertensia ciliata*
133	94MD35	C	*Carex aquatilis*
134	94MD36	C	*Calamagrostis canadensis*
135	94MD37	B	*Populus tremuloides/Alnus incana*
136	94MD38	A	*Alnus incana*/Mesic forb
137	94MD39	B	*Abies lasiocarpa/Alnus incana-Salix drummondiana*
138	94RR01	A	*Betula occidentalis*/Mesic forb
139	94RR02	C	*Psuedotsuga menziesii* Alliance
140	94RR03	B	*Betula occidentalis*/Mesic forb
141	94RR04	B	*Populus angustifolia/Rhus trilobata*
142	94RR05	B	*Populus angustifolia/Rhus trilobata*
143	94RR06	B	*Picea pungens/Amelanchier alnifolia-Cornus sericea*
144	94RR07	B	*Populus angustifolia/Amelanchier alnifolia/Smilicina stellata*
145	94RR08	A	*Betula occidentalis*/Mesic forb
146	94RR09	B	*Psuedotsuga menziesii* Alliance
147	94RR10	C	*Carex aquatilis*
148	94RR11	C	*Alnus incana* Alliance
149	94RR12	B	*Abies lasiocarpa/Salix drummondiana*
150	94RR13	A	*Populus angustifolia/Cornus sericea*
151	94RR14	B	*Abies lasiocarpa/Mertensia ciliata*
152	94RR15	A	*Abies lasiocarpa/Alnus incana-Salix drummondiana*
153	94RR16	AB	*Populus balsamifera*

Table 42., Continued.

Map #	Plot #	EO Rank	Plant Association
154	94RR17	A	*Salix planifolia/Carex aquatilis*
155	94RR18	B	*Abies lasiocarpa/Mertensia ciliata*
156	94RR19	B	*Salix monticola/Carex utriculata*
157	94RR20	B	*Abies lasiocarpa/Salix drummondiana*
158	94RR21	BC	*Salix boothii*/Mesic forb
159	94RR22	B	*Salix monticola-Salix planifolia*/Mesic forb
160	94RR23	B	*Populus angustifolia/Cornus sericea*
161	94RR24	B	*Salix monticola*/Mesic forb
162	94RR25	A	*Abies lasiocarpa/Alnus incana-Salix drummondiana*
163	94RR26	B	*Picea pungens/Alnus incana*
164	94RR27	B	*Populus balsamifera*
165	94RR28	B	*Abies lasiocarpa/Salix drummondiana*
166	94RR29	B	*Abies lasiocarpa/Alnus incana-Salix drummondiana*
167	94RR30	A	*Salix planifolia/Carex aquatilis*
168	94RR31	C	*Populus angustifolia/Amelanchier alnifolia/Smilicina stellata*
169	94RR32	B	*Picea pungens/Amelanchier alnifolia-Cornus sericea*
170	94RR33	A	*Carex aquatilis*
171	94RR34	A	*Salix planifolia/Carex aquatilis*
172	94RR35	A	*Salix planifolia/Carex aquatilis*
173	94RR36	A	*Carex utriculata*
174	94RR37	B	*Salix brachycarpa*/Mesic forb
175	94RR38	B	*Salix boothii*/Mesic forb
176	94RR39	A	*Salix planifolia*/Mesic forb
177	94RR40	C	*Carex aquatilis*
178	94RR41	B	*Salix planifolia*/Mesic forb
179	94RR42	A	*Abies lasiocarpa/Mertensia ciliata*
180	94RR43	B	*Salix planifolia/Carex aquatilis*
181	94RR44	B	*Alnus incana*/Mesic forb
182	94RR45	C	*Carex aquatilis*
183	94RR46	B	*Populus tremuloides/Alnus incana*
184	94RR47	A	*Alnus incana*/Mesic forb
185	94RR48	B	*Salix planifolia/Carex aquatilis*
186	94RR49	B	*Abies lasiocarpa/Salix drummondiana*
187	94RR50	A	*Populus angustifolia/Cornus sericea*
188	94RR51	B	*Alnus incana*/Mesic forb
189	94RR52	B	*Populus angustifolia/Amelanchier alnifolia/Smilicina stellata*
190	94RR53	B	*Populus angustifolia/Amelanchier alnifolia/Smilicina stellata*
191	94RR54	B	*Populus angustifolia-Picea pungens/Alnus incana-Cornus sericea*

APPENDIX 2. Plant Species List. Nomenclature follows Kartez (1994).

TREES

- Abies concolor(Grenier & Godron) Lindley--mature
- Abies concolor(Grenier & Godron) Lindley--saplings
- Abies concolor(Grenier & Godron) Lindley--seedlings
- Abies lasiocarpa (Hook.) Nutt.--saplings
- Abies lasiocarpa (Hook.) Nutt.--seedlings
- Abies lasiocarpa (Hook.) Nutt.--young & mature trees
- Acer negundo L.--saplings
- Acer negundo L.--young & mature trees
- Juniperus osteosperma (Torr.) Little--young & mature trees
- Juniperus scopulorum Sarg.--saplings
- Juniperus scopulorum Sarg.--seedlings
- Juniperus scopulorum Sarg.--young & mature trees
- Picea engelmannii Parry ex Engelm.--saplings
- Picea engelmannii Parry ex Engelm.--seedlings
- Picea engelmannii Parry ex Engelm.--young & mature trees
- Picea pungens Engelm.--saplings
- Picea pungens Engelm.--seedlings
- Picea pungens Engelm.--young & mature trees
- Pinus contorta Dougl. ex Loud--seedlings
- Pinus contorta Dougl. ex Loud--young & mature trees
- Pinus edulis Engelm.--young & mature trees
- Pinus flexilis--young & mature
- Pinus ponderosa P. &. C. Lawson--young & mature trees
- Populus angustifolia James--saplings
- Populus angustifolia James--seedlings
- Populus angustifolia James--young & mature trees
- Populus balsamifera L.--mature trees
- Populus balsamifera L.--saplings
- Populus balsamifera L.--seedlings
- Populus tremuloides Michx.
- Populus x acuminata Rydb.--saplings
- Populus x acuminata Rydb.--young & mature trees
- Pseudotsuga menziesii (Mirbel) Franco--saplings
- Pseudotsuga menziesii (Mirbel) Franco--seedlings
- Pseudotsuga menziesii (Mirbel) Franco--young & mature trees
- Quercus gambelii Nutt

SHRUBS

- Acer glabrum Torr.
- Alnus incana ssp. tenuifolia (Nutt.) Breitung
- Amelanchier alnifolia (Nutt.) Nutt. ex M. Roemer

APPENDIX 2. Continued.

SHRUBS, continued

Amelanchier utahensis Koehne
Arctostaphalus uva-ursi (L.) Spreng.
Artemisia tridentata Nutt.
Betula glandulosa Michx.
Betula occidentalis Hook.
Brickellia longifolia S. Watson
Cercocarpus montanus Raf.
Chrysothamnus viscidiflorus (Hook.) Nutt
Cornus sericea L.
Crataegus rivularis Nutt.
Holodiscus dumosus
Juniperus communis L.
Linnaea borealis L.
Lonicera involucrata Banks ex Spreng
Mahonia repens (Lindl.) G. Dorn
Paxistima myrsinites (Pursh) Raf.
Pentaphylloides floribunda (Pursh) A. Love
Philadelphus microphyllus Gray
Prunus virginiana var. melanocarpa (A. Nels.) Sarg.
Rhus trilobata var. trilobata
Ribes aureum Pursh
Ribes cereum Dougl.
Ribes coloradense Coville
Ribes inerme Rydb.
Ribes montigenum McClatchie
Ribes sp.
Ribes wolfii Rothrock
Rosa woodsii Lindl.
Rubus idaeus L.
Rubus parviflorus var. parviflorus Nutt.
Salix bebbiana Sarg.
Salix boothii Dorn
Salix brachycarpa Nutt.
Salix drummondiana Barratt ex Hook
Salix exigua Nutt.
Salix geyeriana Anderss
Salix ligulifolia (Ball) Ball ex Schneid
Salix lucida ssp. caudata (Nutt.) E. Murr.
Salix lucida ssp. lasiandra (Benth.) E. Murr.
Salix monticola Bebb
Salix planifolia ssp. planifolia Pursh

APPENDIX 2. Continued.

SHRUBS, continued

Salix sp.
Salix wolfii Bebb Sambucus racemosa ssp. pubens var microbotrys (Rydb) Kearney
Shepherdia argentea (Prush) Nutt.
Shepherdia canadensis (L.) Nuttall
Sorbus scopulina Greene
Symphoricarpos rotundifolius Gray
Tamarix ramosissima Lebeb.
Toxicodendron rydbergii (Small ex Rydb.) Greene
Vaccinium myrtillus L.
Vaccinium scoparium Leib. ex Coville

GRAMINOIDS

Agoseris glauca (Pursh) Raf.
Agropyron cristatum (L.) Gaerth.
Agropyron sp.
Agrostis gigantea Roth.
Agrostis scabra Willd.
Agrostis sp.
Agrostis stolonifera L.
Alopecurus aequalis Sobol.
Beckmannia syzigachne (Steud.) Fern
Bromus carinatus Hook. & Arn.
Bromus ciliatus L.
Bromus inermis Leyss.
Bromus japonicus Thunb. ex Murr.
Bromus sp.
Bromus tectorum L.
Calamagrostis canadensis (Michx.) Beauv.
Carex aquatilis Wahlenb.
Carex canescens L.
Carex disperma Dewey
Carex geyeri Boot
Carex lanuginosa Michx.
Carex microptera MacKenzie
Carex norvegica Retz.
Carex parryana Dewey
Carex praegracilis W. Boot.
Carex rostrata Stokes
Carex sp.
Dactylis glomerata L.
Deschampsia cespitosa (L.) Beauv.
Eleocharis palustris (L.) Roemer & J.A. Schultes

APPENDIX 2. Continued.

GRAMINOIDS , continued

Eleocharis sp.
Elymus canadensis L.
Elymus glaucus Buckl.
Elymus lanceolatus ssp. lanceolatus (Scribn. & J.G. Sm.) Gou
Elytrigia repens (L.) Desv. ex B.D. Jackson
Equisetum pratense Ehrhart
Festuca idahoensis Elmer
Festuca thurberi Vasey
Glyceria elata (Nash ex Rydb.) M.E. Jones
Glyceria grandis S.Wats.
Glyceria sp.
Glyceria striata (Lam.) A.S. Hitchc.
Hordeum jubatum L.
Juncus balticus Willd.
Juncus compressus Jacq.
Juncus confusus Coville
Juncus longistylis Torr.
Juncus sp.
Luzula parviflora (Ehrh.) Desv.
Luzula subcapitata (Rydb.) Harrington
Muhlenbergia montana Buckl.
Oryzopsis hymenoides (Roemer & J.A. Achultes) Ricker ex Pipe
Pascopyrum smithii (Rydb.) A. Love
Phalaris arundinacea L.
Phleum alpinum L.
Phleum pratense L.
Phragmites australis (Cav.) Trin & Steud.
Poa alpina L.
Poa arctica R. Br.
Poa palustris L.
Poa pratensis L.
Poa reflexa Vaesy & Scribn. ex Vasey
Poa sp.
Scirpus microcarpus J.& K. Presl.
Scirpus pungens Vahl.
Stipa lettermanii Vasey
Stipa sp.
Stipa viridula Trin.
Trisetum spicatum (L.) Richer
Trisetum wolfii Vasey
Unknown graminoid

APPENDIX 2. Continued.

FORBS

Achillea millefolium var. apicola
Aconitum columbianum Nutt.
Actaea rubra (Ait.) Willd.
Allium sp.
Anaphalis margaritacea (L.) Benth. & Hook. f.
Androsace septentrionalis L.
Anemone narcissiflorum ssp. zephyra (A.Nels.) Hulten
Angelica ampla A. Nels.
Angelica grayi (Coult. & Rose.) Coult. & Rose.
Angelica pinnata S.Wats.
Angelica sp.
Antennaria parvifolia Nutt.
Antennaria sp.
Apocynum cannabinum L.
Aquilegia coerulea James
Aquilegia elegantula Greene
Aquilegia sp.
Arabis drummondii Gray
Arabis glabra (L.) Bernh.
Arctium minus Bernh
Arnica chamissonis Less.
Arnica cordifolia Hook.
Arnica latifolia Bong.
Arnica mollis Hook.
Arnica parryi Gray
Artemisia dracunculus L.
Artemisia ludoviciana Nutt.
Asclepias speciosa Torr.
Asparagus officinalis L.
Aster foliaceus Lindl. ex D.C.
Aster glaucodes Blake
Aster laevis L.
Aster lanceolatus ssp. hesperius (Gray) Semple & Chmielewski
Aster sp.
Astragalus sp.
Balsamorhiza sagittata (Putsh) Nutt.
Brickellia grandiflora (Hook.) Nutt.
Caltha leptosepala D.C.
Cardamine cordifolia Gray
Castilleja Cerv.
Castilleja rhexifolia Rydb.

APPENDIX 2. Continued.

FORBS, continued

Castilleja sulphurea Rydb.
Chenopodium album L.
Cirsium arvense (L.) Scop.
Cirsium sp.
Clematis ligusticifolia Nutt.
Collomia linearis Nutt.
Comandra umbellata (L.) Nutt.
Conioselinum scopulorum (Gray) Coulter. & Rose.
Corallorhiza striata Lindl.
Corydalis aurea Willd.
Corydalis caseana (Gray) spp. brandegii (Wat.) Ownbey
Cystopteris sp.
Delphinium barbeyi (Huth) Huth
Delphinium nuttalianum Pritz ex Walp.
Delphinium occidentale (S.Wats.) S.Wats.
Delphinium ramosum Rydb.
Descurainia sp.
Disporum trachycarpum (S.Wats.) Benth. & Hook. f.
Dodecatheon pulchellum (Raf.) Merr.
Draba aurea Vahl. ex Hornem.
Draba sp.
Dugaldia hoopesii (Gray) Rydb.
Epilobium angustifolium L.
Epilobium lactiflorum Hausskin
Epilobium sp.
Erigeron peregrinus (Banks ex Pursh) Greene
Erigeron sp.
Erythronium grandiflorum Pursh
Fragaria sp.
Fragaria virginiana Duchesne
Galium boreale L.
Galium sp.
Galium spurium L.
Galium trifidum ssp. subbiflorum (Wieg) Piper
Galium triflorum Michx.
Gentianella amarella ssp. acuta (Michx) J. Gillett
Gentianopsis thermalis (Kuntze) Iltis
Geranium L.
Geranium richardsonii Fisch. & Trautv.
Geranium viscossimum Fisch. & C.A. Mey ex C.A. Mey
Geum macrophyllum Willd.

APPENDIX 2. Continued.

FORBS, continued Geum rivale L.
Glycyrrhiza lepidota Pursh
Hackelia floribunda (Lehm) I.M. Johnston
Heracleum lanatum Michx.
Heterotheca villosa (Pursh) Shinners
Hydrophyllum fendleri (Gray) Heller
Ipomopsis aggregata (Pursh) V. Grant
Iris missouriensis Nutt.
Lactuca serriola L.
Lappula occidentalis var. occidentalis (S.Wats) Greene
Lepidium sp.
Ligusticum filicinum S.Wats.
Ligusticum porteri Coult. & Rose
Listera cordata (L.) R. Br.
Lomatium dissectum (Nutt.) Mathius & Constance
Lomatogonium rotatum (L.) Fries ex. Fern.
Lupinus argenteus Pursh
Lupinus sp.
Maianthemum racemosum ssp. racemosum (L.) Link
Maianthemum stellatum (L.) Link
Medicago lupulina L.
Medicago sativa L.
Melilotus alba Medikus
Melilotus officinalis (L.) Lam.
Mentha arvensis L.
Mertensia ciliata (James & Torr.) G. Don
Mertensia franciscana Heller
Mertensia fusiformis Greene
Mertensia sp.
Mimulus guttatus D.C.
Mitella pentandra Hook.
Orthilla secunda (L.) House
Osmorhiza chilensis Hook. & Arn.
Osmorhiza depauperata Phil.
Osmorhiza occidentalis (Nutt. ex Torr. & Gray) Torr
Oxypolis fendleri (Gray) Heller
Parnassia fimbriata Koenig
Pedicularis groenlandica Retz.
Pedicularis procera Gray
Pedicularis racemosa Dougl. ex Benth
Pedicularis sp.
Penstemon sp. Schmidel

APPENDIX 2. Continued.

FORBS, continued

Penstemon whippleanus Gray
Perideridia gairdneri (Hook. & Arn) Mathias
Physaria floribunda Rydb.
Plantago lanceolata L.
Plantago major L.
Platanthera species
Platanthera stricta Lindl.
Polemonium foliosissimum Gray
Polemonium pulcherrimum Hook.
Polemonium sp.
Polygonum bistortoides Pursh
Polygonum viviparum L.
Potentilla sp.
Primula parryi Gray
Prunella vulgaris L.
Pseudocymopterus montanus (Gray) Coult. & Rose
Pseudostellaria jamesiana (Torr.) W.A. Weber & R.J. Hartman
Pyrola americana Sweet
Pyrola asarifolia Michx.
Pyrola minor L.
Pyrola sp.
Ranunculus acriformis Gray
Ranunculus sp.
Rorippa sp.
Rudbeckia lacinata var. ampla (A.Nels) Conq.
Rumex crispus L.
Saxifraga odontoloma Piper
Sedum integrifolium (Raf.) A. Nels.
Sedum lanceolatum ssp. lanceolatum Torr.
Sedum rhodanthum Gray
Senecio bigelovii var. biglovii Gray
Senecio serra Hook.
Senecio sp.
Senecio triangularis Hook.
Sibbaldia procumbens L.
Sidalcea candida Gray
Sidalcea neomexicana Gray
Sidalcea sp.
Sisyrinchium sp.
Solidago canadensis L.
Solidago multiradiata var. scopulorum Gray

APPENDIX 2. Continued.

FORBS, continued

Solidago sp.
Solidago spathulata D.C.
Stellaria calycantha (Ledeb.) Bong.
Stellaria longifolia Muhl ex Willd.
Stellaria longipes Goldie
Stellaria sp.
Streptopus amplexifolius var. chalazatus Fassett
Swertia perennis L.
Taraxacum officinale G.H. Weber ex Wiggers
Taraxacum officinale ssp. ceratophorum (Ledeb.) Schinz ex Th
Thalictrum alpinum L.
Thalictrum fendleri Engelm ex. Gray
Thalictrum sp.
Thelypodium integrifolium (Nutt.) Endl. ex Walp.
Thermopsis rhombifolia (Nutt. ex Pursh) Nutt ex Richards
Thermopsis rhombifolia var. montana (Nutt.) Isely
Thlaspi montanum L.
Trifolium longipes ssp. pygmaeum (Gray) J. Gillett
Trifolium pratense L.
Trifolium repens L.
Trifolium sp.
Unknown forb
Urtica dioica ssp. gracilis (Ait.) Seland.
Valeriana edulis Nutt. ex Torr. & Gray
Valeriana sp.
Veratrum tenuipetalum Heller
Verbascum thapsus L.
Veronica americana Schwein. ex Benth.
Veronica sp.
Veronica wormskjoldii Roemer & J.A. Schultes
Vicia americana Muhl. ex Willd.
Viola canadensis L.
Viola sp.
Equisetum arvense L.
Equisetum hyemale L.
Equisetum laevigatum A. Braun
Equisetum variegatum Schleich ex F. Weber & D.M.H. Mohr

A. The Steering Committee is responsible for guiding the development of and supporting the Statewide Riparian Classification Project. A chairperson shall be elected by the committee members to serve a term of 2 years. The responsibility of the chairperson shall be to facilitate the Committee meetings. The roles of the Steering Committee are to:

1. Facilitate inter-agency cooperation in meeting the objectives of this MOU, and to oversee the Technical Committee (see below).

2. Seek continued support for the project.

3. Appoint scientific experts to serve on the Technical Committee.

4. Meet at least twice annually.

5. Set long-term goals, objectives and direction of the project.

B. The Technical Committee, composed of scientific experts appointed by the Steering Committee, advises the Steering Committee on actions to carry out the goals of this MOU. Recognized experts not represented by signatories of this MOU may serve on the Technical Committee subject to mutual agreement of the Technical and Steering Committees. A chairperson shall be elected by the committee members to serve a term of 2 years. The responsibility of the chairperson shall be to facilitate the Committee meetings. The roles of the Technical Committee are to:

1. Revise and update, where necessary, the project methodology.

2. Ensure that the data collected are compatible with the needs of participating agencies and organizations.

3. Meet at least twice annually.

C. Participating agencies and organizations may provide staff to carry out activities recommended by the Colorado Riparian Task Force, subject to funding availability. A Riparian Ecologist, currently housed at The Nature Conservancy, is responsible for working with the Steering and Technical Committees in accomplishing the objectives (stated in Section III, A-F) subject to the availability of funding. The roles of the Riparian Ecologist are:

1. To provide overall coordination of field teams, data collection, data analysis and report writing, and to administer the budget.

2. To collect vegetation, soil, hydrologic, and other data from sample sites on a drainage-by-drainage basis, in a form that is compatible with the needs of the parties.

3. To produce annual reports to include: hierarchical classification, dichotomous keys, and ecological descriptions of community types for each major river basin.

4. To ensure data are entered into the statewide databases (BCD) and the classification incorporated into the statewide community classification at the Colorado Natural Heritage Program.

V. AUTHORITIES

Nothing in this MOU alters the statutory authorities of the parties. Rather, this MOU is intended to facilitate the accomplishments of those statutory requirements, to cooperative efforts including mandates for consultation on policy matters, and mutual provision of research and technical assistance of all parties in the conduct of programs affecting the quality of human environment and the production of goods and services from forest, range, and other lands.

The program or activities conducted under this memorandum of understanding will be in compliance with the nondiscrimination provisions contained in the Titles VI and VII of the Civil Rights Act of 1964, as amended; the Civil Rights Restoration Act of 1987 (Public Law 100-259); and other nondiscrimination statutes: namely, Section 504 of the Rehabilitation Act of 1973, Title IX of the Education Amendments of 1972, and the Age Discrimination Act of 1975. They will also be in accordance with regulations which provide that no person in the United States shall on the grounds of race, color, national origin, age, sex, religion, marital status, or handicap be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving federal financial assistance.

VI. GENERAL PROVISIONS

A. Term of Agreement and Periodic Review. This MOU will remain in effect for 5 years from signature date. The participants will review this MOU at least every 5 years to assess its adequacy, effectiveness, and continuing need.

MEMORANDUM OF UNDERSTANDING
among
COLORADO DEPARTMENT OF HEALTH
COLORADO DIVISION OF PARKS AND OUTDOOR RECREATION
COLORADO DIVISION OF WILDLIFE
COLORADO NATURAL HERITAGE PROGRAM
DENVER BOARD OF WATER COMMISSIONERS
THE NATURE CONSERVANCY
U.S. BUREAU OF LAND MANAGEMENT
U.S. BUREAU OF RECLAMATION
U.S. ENVIRONMENTAL PROTECTION AGENCY
U.S. FISH AND WILDLIFE SERVICE
U.S. FOREST SERVICE
U.S. GEOLOGICAL SURVEY
U.S. NATIONAL PARK SERVICE
U.S. SOIL CONSERVATION SERVICE
for
COORDINATION AND SUPPORT OF
A COLORADO RIPARIAN COMMUNITY CLASSIFICATION

I. GENERAL

This Memorandum of Understanding (MOU) is entered into by the Colorado Department of Health, Colorado Division of Parks and Outdoor Recreation, Colorado Division of Wildlife, Colorado Natural Heritage Program, Denver Board of Water Commissioners, The Nature Conservancy, United States Bureau of Land Management, United States Bureau of Reclamation, United States Environmental Protection Agency, United States Fish and Wildlife Service, United States Forest Service, United States Geological Survey, United States National Park Service, United States Soil Conservation Service, each herein referred to as "party" or collectively as "parties".

II. BACKGROUND

Preventing the loss of valuable riparian areas and associated wetlands is critical, particularly in the arid western United States. Our knowledge of the ecology and distribution of riparian community types in Colorado is both limited and fragmented. There is a strong need for a statewide inventory and classification of riparian vegetation that crosses ownership and political boundaries in Colorado. A coordinated effort would help prevent the proliferation of fragmented studies by different agencies, organizations, and individuals. The statewide riparian community classification project (hereinafter referred to as "the project") will succeed only with the cooperation of state, federal and private land managers. The inter-agency

Colorado Riparian Task Force, composed of representatives from state and federal agencies and private organizations, was established in 1989 to promote and support a statewide classification of riparian vegetation. The Nature Conservancy hired a Riparian Ecologist to begin this statewide effort, coordinate the field collection of data, and complete final reports.

III. PURPOSE AND OBJECTIVES

The Colorado Riparian Task Force, composed of representatives from state and federal agencies and private organizations which sign as a party to this MOU, consists of a Steering Committee and an appointed Technical Committee. The purpose of this MOU is to formalize the membership of the Colorado Riparian Task Force in order to facilitate cooperative efforts to produce a statewide riparian community classification system for Colorado. The objectives of the Colorado Riparian Task Force are to:

A. Promote inter-agency communication, coordination and data-sharing for managing riparian areas; data and information generated by the project will be incorporated into the Colorado Natural Heritage Program's Biological and Conservation Databases (BCD).

B. Develop a hierarchical classification of the riparian vegetation for Colorado.

C. Produce annual technical reports with information on general physiographic, hydrologic, edaphic, and floristic features, as well as successional trends, of riparian plant communities in Colorado.

D. Identify riparian sites with high natural values or exceptional ecological importance.

E. Ensure products are useful for planning and management tools for resource managers to effectively protect and manage Colorado's riparian resources.

F. Provide financial or other resource assistance for continuation of the riparian community classification project.

IV. PROCEDURES

The Steering Committee is composed of representative decision makers and budget managers of each party of this MOU. The Technical Committee is composed of scientific experts representative of the parties to this MOU and are appointed by the Steering Committee.

A. The Steering Committee is responsible for guiding the development of and supporting the Statewide Riparian Classification Project. A chairperson shall be elected by the committee members to serve a term of 2 years. The responsibility of the chairperson shall be to facilitate the Committee meetings. The roles of the Steering Committee are to:

1. Facilitate inter-agency cooperation in meeting the objectives of this MOU, and to oversee the Technical Committee (see below).

2. Seek continued support for the project.

3. Appoint scientific experts to serve on the Technical Committee.

4. Meet at least twice annually.

5. Set long-term goals, objectives and direction of the project.

B. The Technical Committee, composed of scientific experts appointed by the Steering Committee, advises the Steering Committee on actions to carry out the goals of this MOU. Recognized experts not represented by signatories of this MOU may serve on the Technical Committee subject to mutual agreement of the Technical and Steering Committees. A chairperson shall be elected by the committee members to serve a term of 2 years. The responsibility of the chairperson shall be to facilitate the Committee meetings. The roles of the Technical Committee are to:

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VI. GENERAL PROVISIONS

A. Term of Agreement and Periodic Review. This MOU will remain in effect for 5 years from signature date. The participants will review this MOU at least every 5 years to assess its adequacy, effectiveness, and continuing need.

B. Amendments. Amendments to this agreement may be proposed at any time by any party and shall become effective upon approval by all parties then signatory to this MOU.

C. Cancellation. This MOU may be cancelled at any time during its term by mutual agreement among the participants. Any individual participant may withdraw by giving the other participants at least 30 days notice.

D. Adding Participants. New participants may be added to this agreement upon approval by the Steering Committee.

E. Financial Obligations. Nothing in this agreement shall be construed as obligating any agency or organization to the expenditure of funds. Separate instruments will be developed to provide for the transfer or reimbursement of funds for specific activities related to this agreement.

APPROVED:

J. David Holm — 12/13/92

Colorado Department of Health
J. David Holm, Director of Water
Quality Control Division

Laurie A. Mathews — 12/1/92

Colorado Division of Parks
and Outdoor Recreation
Laurie A. Mathews, Director

Perry D. Olson — Dec 1, 1992

Colorado Division of Wildlife
Perry D. Olson, Director

Christopher A. Pague — Dec. 10, 1992

Colorado Natural Heritage Program
Christopher A. Pague, Coordinator

Date

Denver Board of Water Commissioners
Hamlet J. Barry, Manager

12/1/92
Date

The Nature Conservancy
Sydney S. Macy, State Director

11-22-92
Date

U.S. Bureau of Land Management
Robert Moore, State Director

12/10/92
Date

U.S. Bureau of Reclamation
Roland Robison, Upper Colorado
Regional Director

1/28/93
Date

D.S. LAUVER

FOR U.S. Bureau of Reclamation
J. Neil Stessman, Great Plains
Regional Director

1-15-93
Date

U.S. Environmental Protection Agency
Jack W. McGraw
Acting Regional Administrator

12/23/92
Date

U.S Fish and Wildlife Service
Ralph Morgenweck Regional Director

12/22/92
Date

U.S. Forest Service
Elizabeth Estill, Regional Forester

12/16/92
Date

U.S. Geological Survey
Harry Tourtelot, Director's
Representative, Central Region

December 10, 1992
Date

U.S. National Park Service
for Robert Baker, Regional Director

12/14/92
Date

U.S. Soil Conservation Service
Duane Johnson, State Conservationist

11-30-92
Date