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A Classification of the Riparian Vegetation of the White and Colorado River Basins, Colorado

Final Report Submitted to
the Colorado Department of Natural Resources
and the Environmental Protection Agency

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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. Nan Lederer, Maureen DeCoursey, Todd Barker, Renée Rondeau, Dan Randolph and Susan Spackman collected field data. Nan and Renée logged many hours in the herbarium identifying specimens and entering data into the computer. Dan Randolph classified the soils and conducted soil-vegetation analyses. Dr. William Weber of the University of Colorado Herbarium identified and verified many plant specimens from the White River drainage. Dr. Robert Dorn, of Cheyenne, Wyoming, verified many of the willow specimens. Many volunteers helped us with plant identification: David Buckner identified over 500 grass specimens, Tim Hogan and Miriam Fritts identified over 400 specimens of sedges, Cathy Hartman, Chuck Bell, and many others assisted with the processing of over 3100 plant specimens! Tom Painter, with the Climate System Modeling Project, provided assistance with S-Plus computer analyses. Julie Burt spent many hours editing and typing corrections to this manuscript. There were many others and we thank you all!

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SUMMARY

In this final report, we present results from field surveys conducted in 1992 and 1993 in the White and Colorado River Basins. We classify 59 riparian plant associations found along intact, relatively undisturbed reaches of perennial rivers and streams and place 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).

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 classification of riparian vegetation of the Western Slope of Colorado, known as the Upper Colorado River Basin, which is part of a larger effort to develop a statewide riparian classification. As new data are collected from different basins, information will be incorporated into the classification. This riparian classification will also be incorporated into the Vegetation Classification for Colorado, updated and maintained by the Colorado Natural Heritage Program (CNHP).

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 twice a year to review methods, results and 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). 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 uses is poorly understood. Consequently, resource management and conservation of many riparian areas are often far from optimal.

Our knowledge of riparian plant associations in Colorado is both limited and fragmented. Some inventory work on riparian areas 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.

In this report, we present a classification of riparian vegetation stands from the White and Colorado River Basins. We classify riparian plant associations found along intact, relatively undisturbed reaches of perennial rivers and streams and place 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 classification of riparian vegetation of the Western Slope of Colorado (Figure 1), known as

the Upper Colorado River Basin, which is part of a larger effort to develop a statewide riparian classification. As new data are collected from different basins, information will be incorporated into the classification. This riparian classification will also be incorporated into the Vegetation Classification for Colorado (Reid and Bourgeron, 1991) updated and maintained by the Colorado Natural Heritage Program (CNHP).

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The Gunnison River Basin will be our target watershed for 1994 field season. We solicit critical review and comments on this classification from experts and others from Colorado and other western states.

STUDY AREA

The White River Basin is located in northwestern Colorado (Figure 2). Elevation ranges from over 3600 m (>12,000 ft) in the Flat Top Mountains on the White River Plateau to below 1650 m (5500 ft) near the Utah border west of Rangely. The upper watershed receives on the order of 1000 mm (40") of precipitation annually, mostly as snow, while the western part of the basin receives about 200-254 mm (8-10") a year on average (Colorado Climate Center 1984).

The upper watershed originates in the White River Plateau, a large, steep sided, flat-topped upland capped with thick layers of dark Tertiary basaltic flows that give rise to steep, rocky stream reaches (Chronic 1980). The White River drains this plateau in two forks which join to form enough force to cut through the Grand Hogback near Meeker (Figure 2). The southern edge of the basin is composed of the Uinta Formation sandstones and siltstones, drained by Piceance Creek. Many plant species endemic to Colorado occur on the upslopes of this small, tributary watershed. The low Danforth Hills bound the basin to the north, and the White River flows through more siltstones and sandstones of the Mesa Verde and Green River Formations as it reaches the Utah state line (Benedict 1991).

The basin has floristic ties to the Northern Rocky Mountains in the Flat Top Mountains (Weber 1987) and to the Colorado Plateau/Uinta Mountain flora in the Roan Plateau (Welsh *et al.* 1987). Much of the lower elevations within the basin, however, are floristically more closely related to the Wyoming Basin flora (Benedict 1991).

The Colorado River Basin in Colorado (the Colorado River mainstem and tributaries from the state line, excluding the Gunnison River, see Figures 1 and 3) begins in Rocky Mountain National Park and is flanked on the east by the Continental Divide (including the Front and Mosquito Ranges, the Never Summer Mountains, and the Rabbit Ears Range). The Elk Mountains divide the Colorado from the Gunnison River watersheds, and the Flat Top and Roan Plateaus separate the Colorado from the White River drainage to the west and north. Elevations range from above 4265 m (14,000 ft) to 1370 m (4500 ft) where the Colorado River crosses the state line into Utah. The upper watershed receives 1016-1270 mm (40-50 in.) annual precipitation primarily as snow. The lower watershed in the Grand Junction area receives about 203 mm (8 in.) precipitation annually.

The high tributaries and upper reaches of the Colorado River flow through Precambrian gneiss, schist and granite basement geology. West of Dillon, the geology shifts to mostly sedimentary rocks of Pennsylvanian-Permian age. Sandstone, shale and gypsum characterize this middle section. In Glenwood Canyon Precambrian rocks are exposed again, but they give way to Cretaceous shale and sandstones in the Rifle area. High cliffs of the Wasatch and Green River Formations form the Roan Plateau, Grand and Battlement Mesas, flanking the Colorado River to the north and south. In the Grand Junction valley the Colorado River flows over Dakota sandstone and Triassic and Jurassic sandstone and shale formations.

Floristically the upper portions of the Colorado watershed lie in the heart of the Southern Colorado Rockies flora. Dense spruce-fir (*Picea engelmannii-Abies lasiocarpa)* forests, moist mountain meadows dominated by *Deschampsia cespitosa*, *Festuca thurberi*, and *Calamagrostis canadensis*, and expansive willow carrs of *Salix planifolia, Salix wolfii,* and *Salix brachycarpa* are characteristic of the subalpine elevations. More western portions and lower elevations (below 2134 m, 7000 ft) are strongly influenced by Uinta Basin and Colorado Plateau flora. Piñon-juniper (*Pinus edulis-Juniperus osteosperma*) woodlands, desert shrublands (*e.g.*, *Quercus gambelii* and *Artemisia tridentata*) are common on slopes and open valleys. Sparse saltbush-greasewood (*Atriplex* spp.-*Sarcobatus vermiculatus*) scrub in salt flat basins are less common.

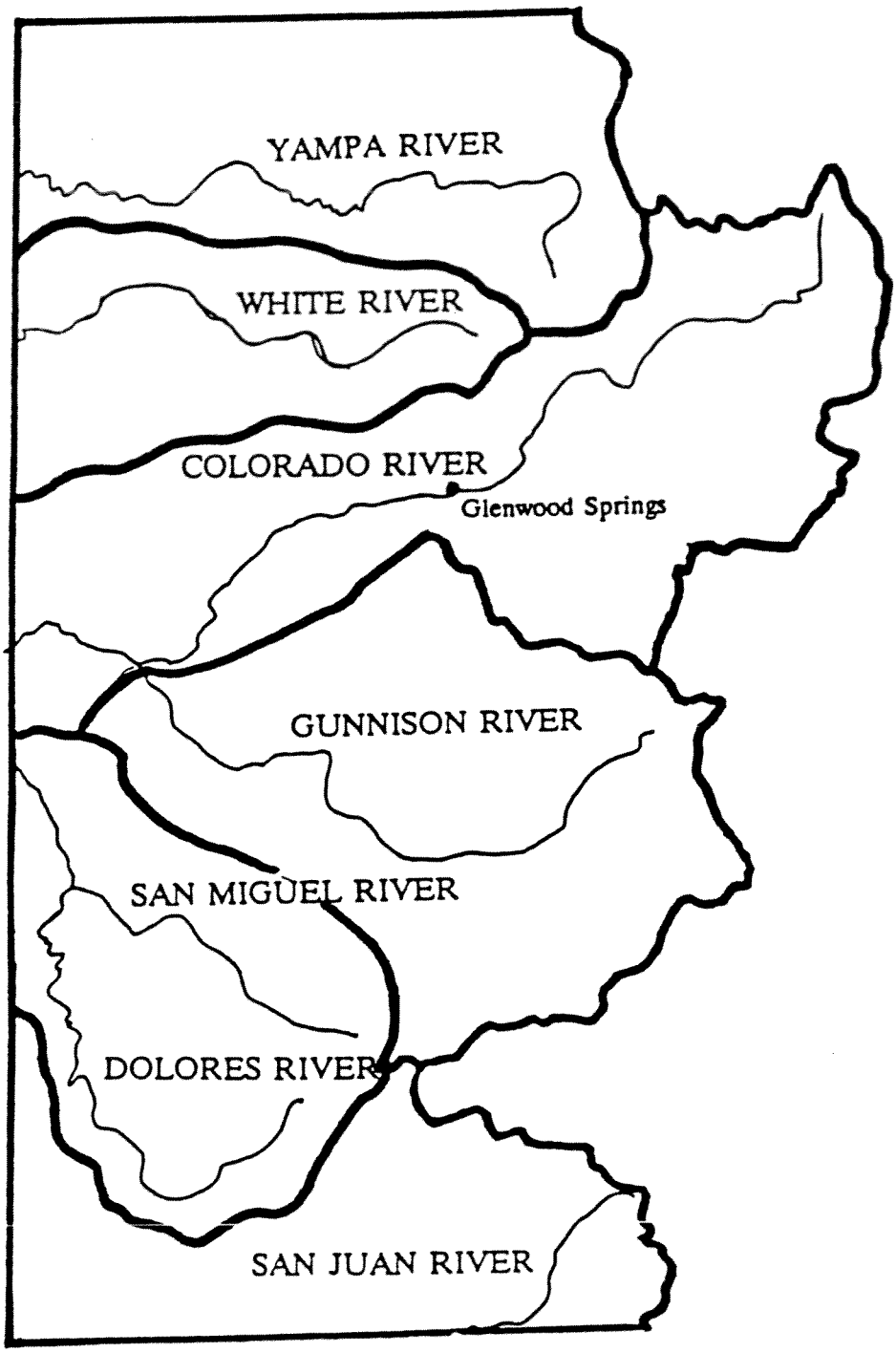
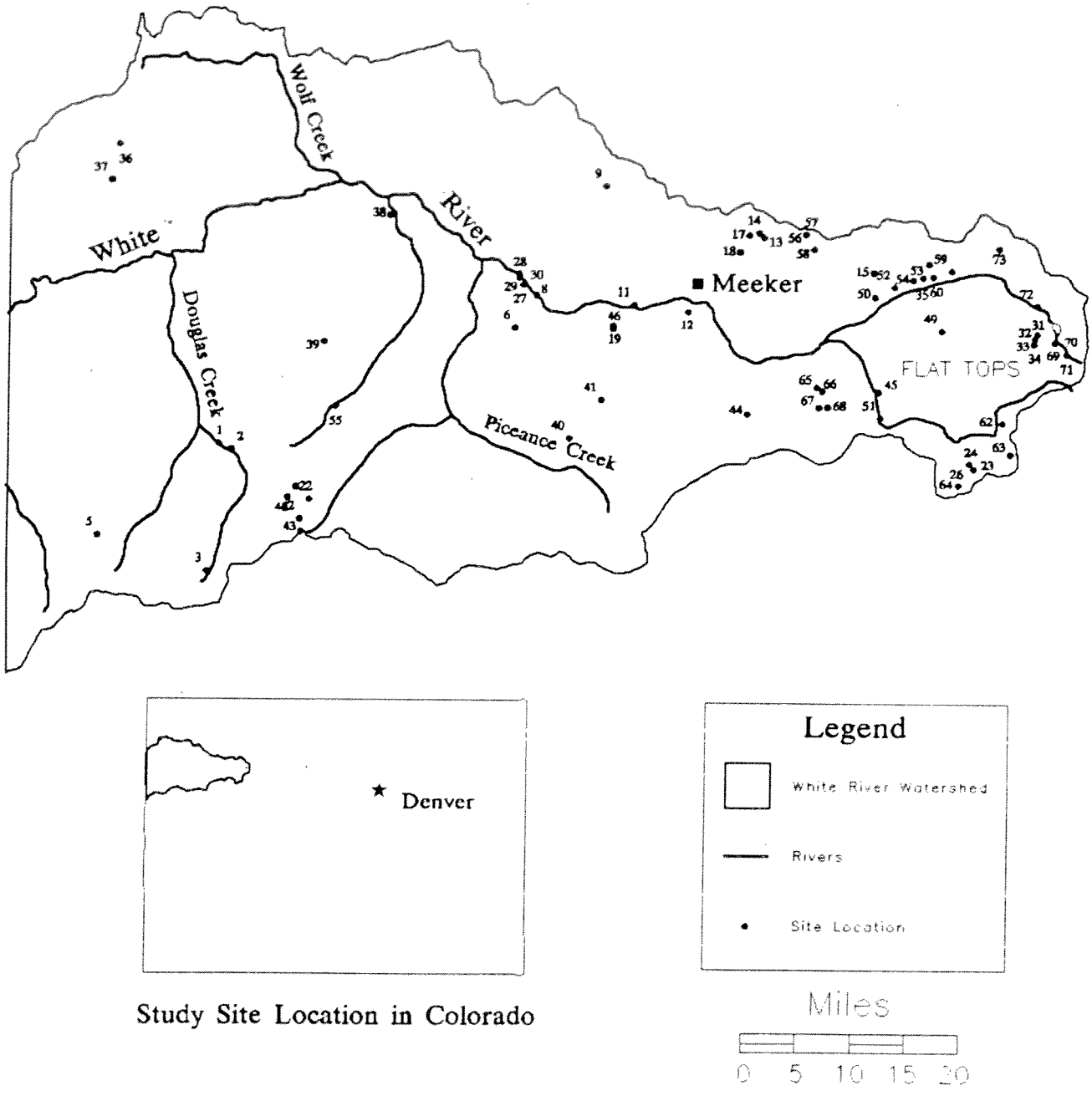


Figure 1. Major River Basins of the Colorado Western Slope.

White River Basin, Colorado

Site Locations



Study Site Location in Colorado

Figure 2. White River drainage map with plot locations.

Colorado River Basin
in Colorado

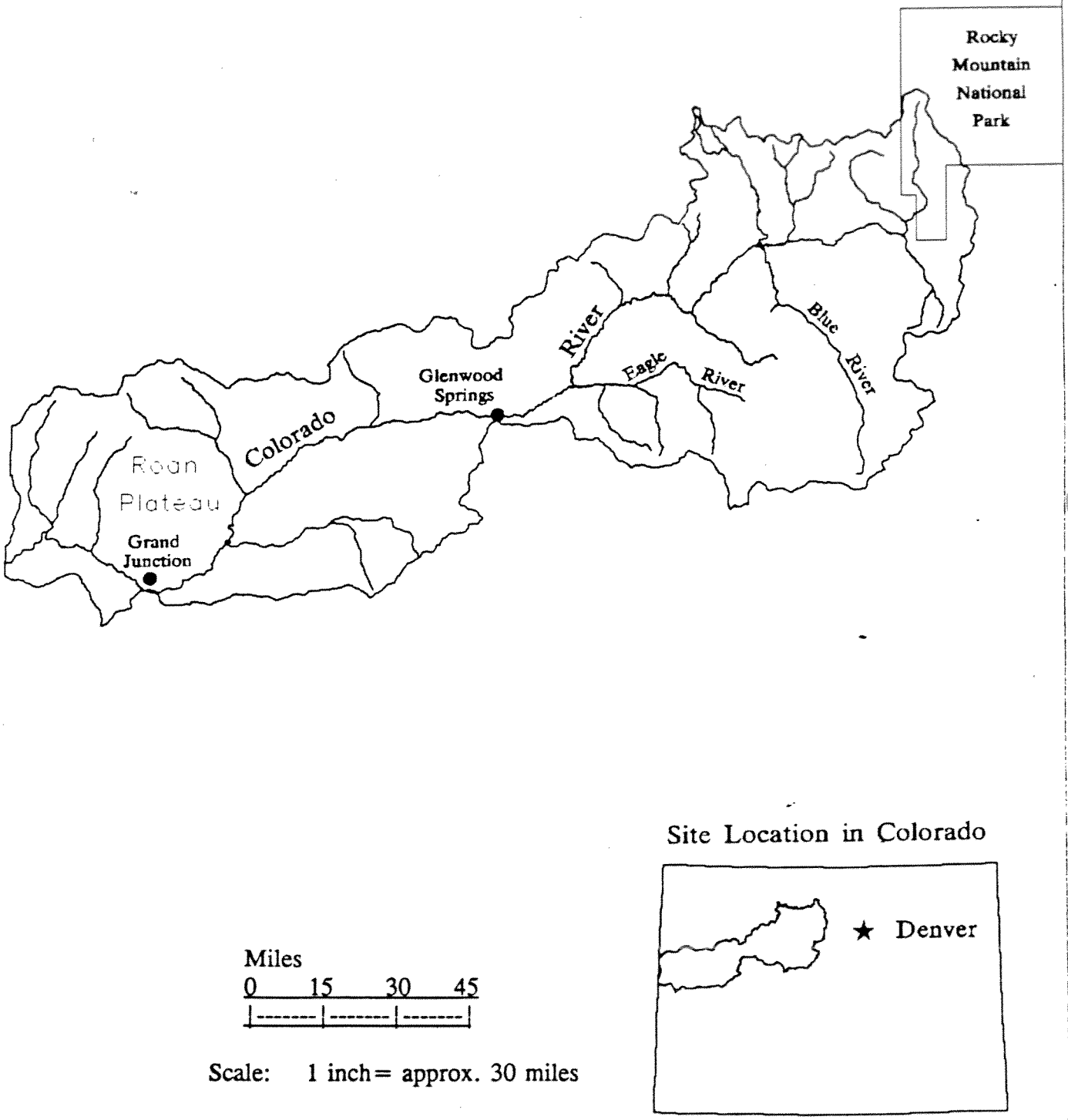


Figure 3. Colorado River drainage study area map.

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). 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 includes 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 7.5 min. 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. We choose two major environmental gradients thought to influence riparian vegetation, elevation and stream order, to stratify the study area. 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 1,000 foot elevation bands (5,000 through $>10,000$ feet) and stream order for all perennial streams. Stream order was calculated using Strahler's system (1952). The largest stream order was six. Thirty six combinations of elevation and stream order, or stream reach cell types, were possible in the two basins. We then 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 to eliminate areas of heavy disturbance. With the heavily degraded riparian areas blocked out we randomly selected 200-300 mile stream reaches representing all the classification cell types, weighted by their abundance in the basin. For example, if 20% of the stream miles above 3048 m (10,000 ft) were first order streams, then 20% of the 200-300 randomly selected stream miles would be of that type.

We included only riparian areas which have not been drastically altered by human activity in the sampling regime. Degraded riparian areas were determined by two criteria: 1) evidence of drastic human disturbance such as agricultural conversion, heavy recreational use, season-long livestock grazing, dumping grounds, or livestock holding sites, and 2) areas 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, such as Kentucky bluegrass (*Poa pratensis*), but only where native flora dominated the overstory vegetation, when the degree of disturbance was minimal. If the site was acceptable, stand data were collected from homogeneous stands of riparian vegetation. Sites that were severely degraded were not sampled.

Collection of vegetation and environmental data

Prior to visiting sites for collection of field data, landowners or managing agencies, whether individuals or agency staff, were notified (and permission obtained for private properties). Within stands of relatively undisturbed vegetation as defined above, we collected the following data:

* 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)
* hydrologic and geomorphic features (beaver dams, point bars, etc.)
* history of use (from landowner or manager) when obtainable

Plot size was adjusted according to the size of the community and the type of vegetation. Minimum sampling area for tree dominated plots was approximately 500 m^2, shrub dominated plots approximately 400 m^2, and herbaceous dominated plots 100 m^2 in area. Each plot was subjectively located in a homogeneous portion of the community to best represent the vegetation of the site. The shape and size of the plot varied, depending on the orientation of the stand. Data collected from individual plots included:

* percent canopy cover by vascular plant species (ocular estimation to nearest cover class: <1%, 1-5%, 5-10%, in 10% increments up to 100%) and life-form (trees, shrubs, graminoids, and forbs)
* ground cover of bare soil, litter, wood, gravel, rock, bryophyte, and non-vascular plants
* size-class structure of trees (based on diameter of trunk 1.5 meters above the ground)
* a brief soil description based on one augered sample or shallow pit within each plot. Noted for each horizon (or layer) were: thickness, texture (via hand-texturing), color, mottling/gleying, structure, matrix color, coarse fragments, and parent material when possible.
* Height above the active channel (average annual high water mark) using a hand held level and stadia rod.
* Distance from center of plot to active of channel at the average annual high water mark (using a measuring tape or hip-chain)
* Landscape position (point bar, floodplain, old 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 Herbarium. Dr. William Weber verified over 200 plant specimens and Dr. Robert Dorn (Rocky Mountain Herbarium) verified all *Salix* spp. specimens. Voucher specimens were 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

Agglomerative cluster analysis programs in S-Plus (available through cooperation with the Climate System Modeling Program Unix workstation at the National Center for Atmospheric Research (NCAR), Boulder) and PC versions were employed using Euclidean distance and average clustering method to determine groups of plots with similar vegetation. Indirect and direct ordination programs in PC-ORD (McCune 1991) were used to determine environmental relationships. Information concerning successional status and trends and management for each association is based on field observations and review of the literature.

This classification is based on existing, relatively undisturbed, or naturally disturbed native vegetation. A plant association, the most specific vegetation type 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 the existing communities, rather than perceived climax vegetation types. Plant associations are considered a product of the prevailing environmental setting (where possible, barring human influence or pre-European settlement) including natural disturbance regimes (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 naturally unstable. Between episodic flooding events, however, plant community succession does occur. Most of the riparian vegetation described here may be considered community types by the Daubenmire Habitat Typing system, in that they are frequently disturbed, and rarely reach a climatic climax.

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, and Idaho and Wyoming (for example, Johnson 1987, Muldavin 1992, Szaro 1990, 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 or 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., *Picea engelmannii-Abies lasiocarpa/Alnus incana* spp. *tenuifolia*). Plant associations that appear synonymous with those in the literature (by stand table and description comparison) are given the same name. Certain published names are long and awkward; shorter names are herein proposed.

Riparian plant associations were placed into the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Physiognomic-Ecological Classification of Plant Formations of the Earth (as presented in Mueller-Dombois and Ellenberg 1974), and the Classification of Wetland and Deepwater Habitats of the United States (Cowardin *et al.* 1979) (Table 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.)
	Series (dominant characteristic species, e.g., *Picea engelmannii*)
	Plant association (e.g., *Picea engelmannii-Abies lasiocarpa/Alnus incana* spp. *tenuifolia*)

The series and plant association levels have been added to the UNESCO system to more finely tune the classification to the dominant species (series) and specific association levels, similar to U.S. Forest Service regional classifications, such as Johnston (1987).

The UNESCO classification system is broader and more comprehensive than the Cowardin (1979) system. The relationship of Cowardin's classification classes to UNESCO

classes used to classify riparian associations can be found in Table 1. It should be stressed that this cross-walk is for riparian vegetation types only.

Table 1. Cross-reference of the UNESCO (1974) classes (Roman numerals) and Cowardin (1979) classes **used in this study.** Alpha-numeric headings of Cowardin's classes are for cross-reference with the UNESCO classes only.

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

Table 1. Continued

UNESCO	Cowardin
IV. Terrestrial herbaceous communities	IV. Palustrine-Emergent wetlands
C. Meadows	C. Persistent
1. Below tree line	
f. Sedge-rush meadow (closest class, although ours are not anthropogenic)	
1. (Series)	*1.* (Dominance type)
2. (Plant Association)	
2. Above tree line	
a. Closed alpine mats	
1. (Series)	*1.* (Dominance type)
a. (Plant Association)	
c. Snow bed formation	
1. (Series)	*1.* (Dominance type)
a. (Plant Association)	
E. Salt swamps	
2. Salt meadows	
b. inland salt meadow	
1. (Series)	*1.* (Dominance type)
a. (Plant Association)	
VII. Aquatic Plant formations	VII. Riverine System-Upper Perennial
B. Reed-swamps	B. Persistent-Emergent Wetlands
3. Reed-swamps of flowing water	
b. Temperate reed swamps of river banks	
1. (Series)	
a. (Plant Association)	*1.* (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 (plant and animal species, 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 2). By using the element ranks and the quality of each occurrence, priorities can be established for the management and/or protection of the most outstanding sites.

Each geographical location of any element is called an element occurrence. Element occurrences are ranked in terms of the **quality** (size, vigor, etc.) of the population or association, the **condition** or naturalness of the habitat, the long-term **viability** of the population or association, and the **defensibility** (ease or difficulty of protecting) the occurrence. Protection efforts can be aimed not only at the rarest elements, but also at the best examples of each.

Colorado Natural Heritage Program uses these element and element occurrence ranks to assess the overall significance of an area, which may include one or many element occurrences. Based on these ranks, each site 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. Noted in particular are 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.

Riparian areas recommended for special management or protection are examples of "A" or "B" ranked occurrences. In riparian areas, an 'A' rank community indicates that it has

geomorphic and hydrologic processes are intact (*e.g.*, natural flood regimes, beaver activity), is relatively large and unfragmented, and has no introduced alien plant species or if present, in very low abundance. Riparian areas must be in good to excellent condition (no signs of bank erosion, channelization, past disturbance, etc), and have signs of resiliency and resistance such as regeneration, and must be defensible from negative human impacts (proximity to housing developments, gravel mines, etc). 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 White River and Colorado River Basins are proposed as some of the best examples of rare or common riparian plant associations in the State. The Colorado Natural Heritage Program will be entering 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 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 a few remaining individuals; often 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 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.

RESULTS

Two hundred ninety nine plots were classified into 59 plant associations (Table 3). While not the classification itself, agglomerative cluster analyses show the degree of similarity or dissimilarity among stands (Figures 4 & 5). Some stands may have different woody overstories, yet are similar in their understory species composition.

Most of the plant associations have been described in the literature. We used the same name when stands fit closely with a published type. Some plant associations were new to Colorado but have been described from elsewhere in the Rocky Mountain Region (e.g., *Acer negundo/Cornus sericea* Padgett *et al.* 1989). Others were new to Colorado and are described here for the first time (*e.g. Populus angustifolia-Juniperus scopulorum*).

Lower elevation reaches along larger rivers were clearly more heavily impacted compared to the upper watershed. Some of Colorado's unique riparian plant associations occur at lower elevations (*e.g., Acer negundo-Populus angustifolia/Cornus sericea*). Land uses such as grazing and agricultural clearing, ski area expansion and other development directly impact riparian communities. Also important however, is the impact of upstream impoundments and flow alterations. These lower elevation riparian communities need periodic flooding for re-establishment and ground water recharge to maintain overall ecosystem health. Changes in the hydrologic regime by dams, irrigation ditches, or channelization, reduce reproductive capacity, resistance and resiliency of riparian ecosystems.

In the following sections we provide a vegetative key to the communities and community descriptions with common and scientific names, Heritage Global and State ranks, the number of plots collected from the western slope river basins, synonyms or similar communities described in the literature, regional and state distributions, environmental setting, soil characteristics, vegetative species composition, and succession/management implications.

Notes and Terminology

1. Scientific nomenclature for plant names follows Kartesz, J.T. 1994. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland, 2nd edition. Portland, Timber Press, 622 pp. Appendix 2 contains a plant list of all scientific names cross referenced with Weber and Wittmann (1992).

2. Heritage Global and State ranks for each plant association are under review and will be updated prior to final publishing of this information.

3. *Bankfull stage* and *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.

Table 3. Riparian plant association of the White and Colorado River Basins, Colorado.

EVERGREEN FORESTS

1. *Abies lasiocarpa/Alnus incana* spp. *tenuifolia-Salix drummondiana* p.a.
2. *Abies lasiocarpa/Mertensia ciliata* p.a.
3. *Abies lasiocarpa/Ribes* spp. p.a
4. *Abies lasiocarpa/Vaccinium myrtillus* p.a.
5. *Juniperus scopulorum/Oryzopsis micrantha* p.a.
6. *Picea pungens/Alnus incana* ssp. *tenuifolia* p.a.
7. *Picea pungens/Amelanchier alnifolia-Cornus sericea* p.a.
8. *Pseudotsuga menziesii/Symphoricarpos rotundifolius* p.a.
9. *Pseudotsuga menziesii/Quercus gambelii* p.a.

MIXED DECIDUOUS-EVERGREEN FORESTS

10. *Populus angustifolia-Juniperus scopulorum* p.a.
11. *Populus angustifolia-Picea pungens/Alnus incana* spp. *tenuifolia* p.a.

DECIDUOUS FORESTS

12. *Acer negundo/Cornus sericea* p.a.
13. *Acer negundo/Prunus virginiana* p.a.
14. *Acer negundo-Populus angustifolia/Cornus sericea* p.a.
15. *Fraxinus anomala/Quercus gambelii* p.a.
16. *Populus angustifolia/Cornus sericea* p.a
17. *Populus angustifolia/Cornus sericea--*
    Betula occidentalis Phase p.a.
18. *Populus angustifolia/Rhus trilobata* p.a.
19. *Populus angustifolia/Salix exigua* p.a.
20. *Populus angustifolia/Salix ligulifolia-Shepherdia argentea* p.a.
21. *Populus deltoides* spp. *wislizenii/Rhus trilobata* p.a.
22. *Populus tremuloides/Acer glabrum* p.a.
23. *Populus tremuloides/Alnus incana* p.a.
24. *Populus tremuloides/Heracleum lanatum* p.a.

DECIDUOUS ALLUVIAL SHRUBLANDS

25. *Alnus incana* spp. *tenuifolia-Cornus sericea* p.a.
26. *Alnus incana* spp. *tenuifolia*/mesic forb p.a.
27. *Betula occidentalis*/mesic forb p.a.
28. *Cornus sericea* p.a.
29. *Prunus virginiana* p.a.
30. *Quercus gambelii/Symphoricarpos rotundifolia* p.a.
31. *Salix boothii/Carex utriculata* p.a.
32. *Salix boothii*/mesic forb p.a.

Table 3, continued.

33. *Salix drummondiana*/mesic forb p.a.
34. *Salix exigua*/Barren ground p.a.
35. *Salix monticola/Calamagrostis canadensis* p.a.
36. *Salix monticola/Carex utriculata* p.a.
37. *Salix monticola*/mesic forb p.a.
38. *Shepherdia argentea-Leymus cinereus* p.a.

DECIDUOUS PEAT SHRUBLANDS

39. *Salix brachycarpa/mesic forb* p.a.
40. *Salix geyeriana/Calamagrostis canadensis* p.a.
41. *Salix planifolia* var. *monica/Calamagrostis canadensis* p.a.
42. *Salix planifolia* var. *monica/Caltha leptosepala* p.a.
43. *Salix planifolia* var. *monica/Carex aquatilis* p.a.
44. *Salix wolfii/Calamagrostis canadensis* p.a.
45. *Salix wolfii/Carex aquatilis* p.a.
46. *Salix wolfii/Carex utriculata* p.a.
47. *Salix wolfii*/mesic forb p.a.

HERBACEOUS DOMINATED PLANT ASSOCIATIONS

48. *Artemisia tridentata/Leymus cinereus* p.a.
49. *Calamagrostis canadensis* p.a.
50. *Carex aquatilis-Carex utriculata* p.a.
51. *Carex scopulorum/Caltha leptosepala* p.a.
52. *Carex utriculata* p.a.
53. *Deschampsia cespitosa-Carex* spp. p.a.
54. *Distichlis spicata* var. *spicata* p.a.
55. *Eleocharis quinqueflora* p.a.
56. *Juncus balticus* p.a.
57. *Phragmites australis* p.a.
58. *Scirpus pungens* p.a.
59. *Typha latifolia* p.a.

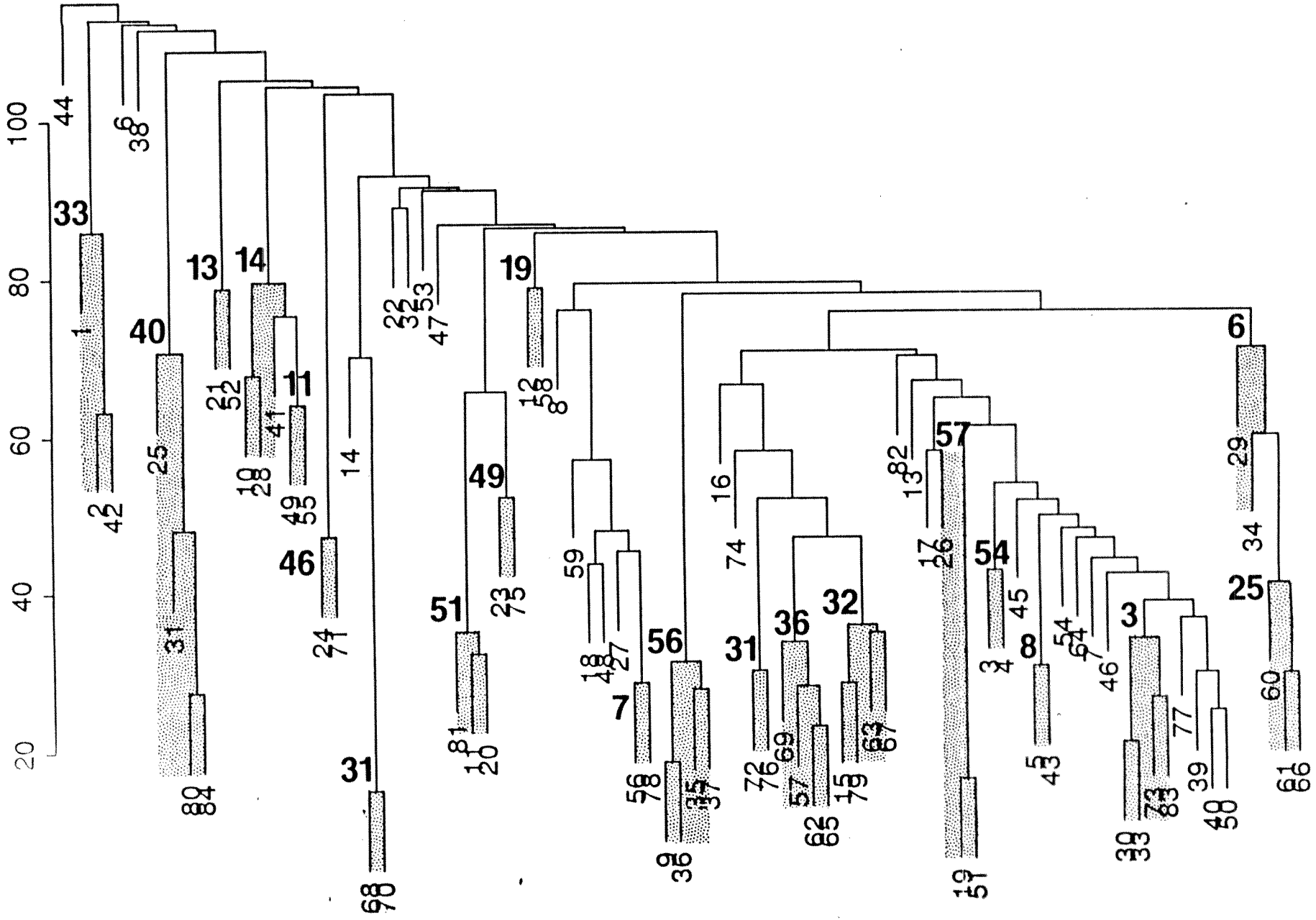


Figure 4. Cluster Analysis Dendrogram for the White River Basin. The diagram shows the relative similarity (in Euclidean distance) among plots based on species composition and abundance. This information assisted in the classification of plant associations. Plot numbers appear at the bottom of clusters. Bolded numbers correspond to numbered plant associations in Table 3.

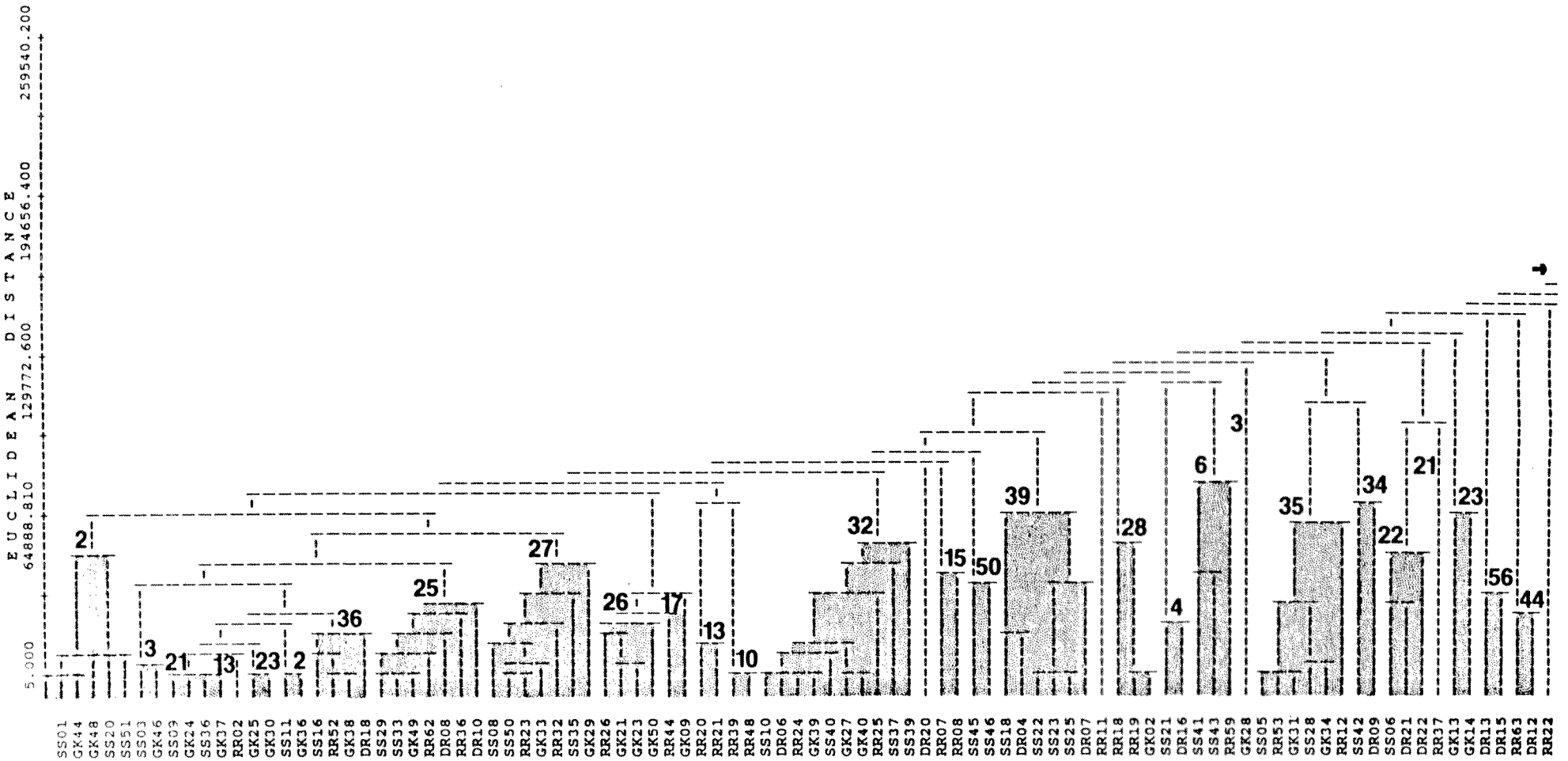


Figure 5. Cluster Analysis Dendrogram for Colorado River data. This diagram shows the relative similarity (in Euclidean distance) among plots based on species composition and abundance. This information assisted in the classification of plant associations. Plot numbers appear across the bottom, bolded numbers correspond to numbered plant associations in Table 3.

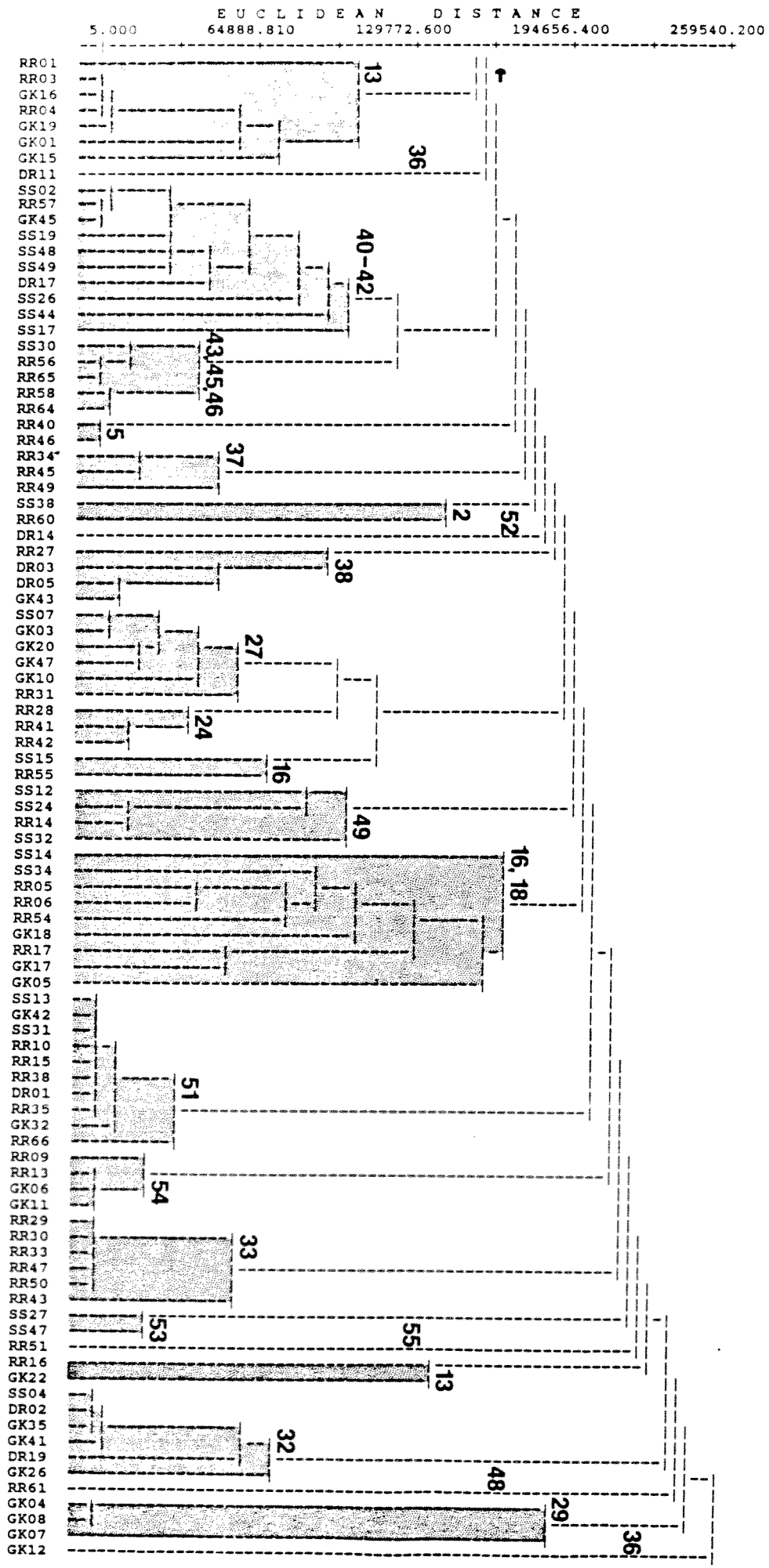


Figure 5, continued.

KEY TO THE RIPARIAN PLANT ASSOCIATIONS OF THE WHITE AND COLORADO RIVER DRAINAGES, COLORADO

Key to Groups:

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

1. Tree overstory not present. 4

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

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

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

      3. *Populus angustifolia* or *Acer negundo* 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 50% cover . . . . . **Group D**

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

Key to Plant Associations:

Group A. Evergreen Forests

1. *Picea pungens* dominates the overstory 2

1. *Picea engelmannii, Abies lasiocarpa, Pseudotsuga menziesii,* or *Juniperus scopulorum* dominate the overstory 3

   2. *Alnus incana* spp. *tenuifolia* lines the stream bank . . . . . ***Picea pungens/Alnus incana* spp. *tenuifolia* p.a.**

   2. *Cornus sericea* forms a dense shrub understory, *Alnus incana* spp. *tenuifolia* may be present in small amounts. . ***Picea.pungens/Amelanchier alnifolia-Cornus sericea* p.a.**

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

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. Well-developed shrub understory of *Alnus incana* spp. *tenuifolia, Salix drummondiana Lonicera involucrata, Ribes* spp., or *Vaccinium myrtillus,* is present often with at least 20% cover individually or together. 5

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

5. *Alnus incana* ssp. *tenuifolia* not present 6

6. *Lonicera involucrata, Salix drummondiana,* or *Ribes* spp. contribute at least 20% cover individually or together . . . . . ***Abies lasiocarpa/Ribes* spp. p.a.**

6. *Vaccinium myrtillus* is the dominant shrub understory . . . . . ***Abies lasiocarpa/Vaccinium myrtillus* p.a.**

3. *Pseudotsuga menziesii* or *Juniperus scopulorum* dominates the overstory 7

7. *Pseudotsuga menziesii* dominates the overstory 8

8. *Symphoricarpos rotundifolia* is a dominant shrub . . . . . ***Pseudotsuga menziesii/Symphoricarpos rotundifolia* p.a.**

8. *Quercus gambelii* is an associate or dominant shrub . . . . . ***Pseudotsuga menziesii/Quercus gambelii* p.a.**

7. *Juniperus scopulorum* dominates the overstory . . . . . ***Juniperus scopulorum/Oryzopsis micrantha* p.a.**

Group B. Mixed Deciduous-Evergreen Forests

1. *Populus angustifolia* dominates the overstory; *Picea pungens* is present; *Cornus sericea* dominates the shrub layer with at least 20% cover; *Alnus incana* spp. *tenuifolia* contributes less than 10% cover . . . . . ***Populus angustifolia-Picea pungens/Alnus incana* spp. *tenuifolia-Cornus sericea* p.a.**

1. *Populus angustifolia* dominates or is a codominant with *Juniperus scopulorum* . . . . . ***Populus angustifolia-Juniperus scopulorum* p.a.**

Group C. Deciduous Dominated Forests

1. *Acer negundo* dominates the overstory; *Populus* spp. contributes < 10% cover 2

   2. *Cornus sericea* is a dominant shrub . . . . . ***Acer negundo/Cornus sericea* p.a.**

   2. *Prunus virginiana, Amelanchier utahensis,* or *Crataegus rivularis* are individually present or abundant . . . . . ***Acer negundo/Prunus virginiana* p.a.**

1. *Populus angustifolia, P. deltoides, P. tremuloides,* or *Fraxinus anomala* dominates the overstory, commonly with at least 10% cover, ... 3

   3. *Populus deltoides* dominates the overstory; *Rhus trilobata* often dominant understory shrub . . . . . ***Populus deltoides* spp. *wislizenii/Rhus trilobata* p.a.**

   3. Not as above 4

4. *Populus angustifolia, Populus tremuloides,* or *Fraxinus anomala* dominant, commonly with at least 10% cover 5

   5. *Populus angustifolia* dominant 6

   5. *Populus tremuloides* or *Fraxinus anomala* dominant 10

      6. *Cornus sericea* is a dominant shrub, commonly > 20% cover 7

         7. *Acer negundo* an important tree sub-canopy dominant (> 10%) cover, occurring on wide, meandering rivers . . . . . ***Acer negundo-Populus angustifolia/Cornus sericea* p.a.**

         7. *Acer negundo* absent, or otherwise not as above 8

            8. *Alnus incana* ssp. *tenuifolia, Amelanchier* spp., or *Ribes* spp. co-dominant with *Cornus sericea* . . . . . ***Populus angustifolia/Cornus sericea* p.a.**

8. *Betula occidentalis* co-dominant shrub . . . . . .
***Populus angustifolia/Cornus sericea* p.a. *Betula occidentalis* Phase**

6. *Rhus trilobata* or *Salix exigua* dominates the shrub understory 9

9. *Rhus trilobata* a dominant shrub . . . .***Populus angustifolia/Rhus trilobata* p.a.**

9. *Salix exigua* dominant, *Populus angustifolia*, if present, canopy is mostly seedling and sapling trees . . . . . ***Populus angustifolia/Salix exigua* p.a.**

10. *Populus tremuloides* the dominant tree 11

11. Shrub layer well developed 12

12. *Alnus incana* ssp. *tenuifolia* dominates the shrub layer along the stream . . . . . .
***Populus tremuloides/Alnus incana* ssp. *tenuifolia* p.a.**

12. *Acer glabrum* a dominant shrub in the understory . . . . . .
***Populus tremuloides/Acer glabrum* p.a.**

11. No shrub understory exists, mainly tall mesic forbs . . . . . .
. . . . . ***Populus.tremuloides/Heracleum lanatum* p.a.**

10. *Fraxinus anomala* is a dominant or scattered tree . . . . . .
***Fraxinus anomala/Quercus gambelii* p.a.**

Group D. Willow Dominated Shrublands

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

1. Willows are of tall stature, 1.5-3 m or more tall, lower subalpine, montane . . . environments 9

2. *Salix brachycarpa* or *Salix wolfii* dominates the willow cover 3

2. *Salix planifolia* var. *monica* dominates with at least 30% cover 7

3. *Salix brachycarpa* dominates the shrub layer with at least 30% cover, *Salix planifolia* var. *monica* may be present. . . . . ***Salix brachycarpa*/mesic forb p.a.**

3. *Salix wolfii* dominates the willow layer with at least 50% cover 4

4. *Carex* spp. dominate the graminoid layer 5

5. *Carex utriculata* dominates . . . . . ***Salix wolfii/Carex utriculata* p.a.**

5. *Carex aquatilis* dominates . . . . . ***Salix wolfii/Carex aquatilis* p.a.**

4. Not as above 6

6. *Calamagrostis canadensis* dominates the understory . . . . . ***Salix wolfii/Calamagrostis canadensis* p.a.**

6. Understory is rich in mesic forbs, no single species more dominant than the others, total forb cover about twice that of graminoid cover . .***Salix wolfii*/mesic forb p.a.**

7. Forbs dominate the understory . . . . . ***Salix planifolia/Caltha leptosepala* p.a.**

7. Graminoids dominate the understory 8

8. *Calamagrostis canadensis* dominates . . . . . .***Salix planifolia/Calamagrostis canadensis* p.a.**

8. *Carex aquatilis* dominates . . . . . ***Salix planifolia/Carex aquatilis* p.a.**

9. *Salix exigua* is present (10-90%) cover, usually a narrow band along stream margins and cobble bars. Montane and foothills environments. . . . . .***Salix exigua*/barren p.a.**

9. Other tall *Salix* spp. are dominant 10

10. *Salix geyeriana* or *Salix drummondiana* dominates. 11

10. *Salix boothii* or *Salix monticola* dominates 12

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

11. *Salix geyeriana* dominates, at least 20% cover, and *Calamagrostis canadensis* at least 25% cover in the understory . . . . . ***Salix geyeriana/Calamagrostis canadensis* p.a.**

12. *Salix boothii* dominates, with at least 20-30% cover 13

13. *Carex utriculata* dominates the graminoid understory . . . . . ***Salix boothii/Carex utriculata* p.a.**

13. Forbs dominate the understory . . . . . ***Salix boothii*/mesic forb p.a.**

12. *Salix monticola* dominates, at least 20-30% cover 14

14. Forbs dominate the understory . . . . . ***Salix monticola*/mesic forb p.a.**

14. Graminoids dominate the understory 15

15. *Calamagrostis canadensis* occurs with at least 40% cover . . . . . ***Salix.monticola/Calamagrostis canadensis* p.a.**

15. *Carex utriculata* occurs with at least 20%, and the forb layer not as rich as above . . . . . ***Salix monticola/Carex utriculata* p.a.**

Group E. Non-Willow Dominated Shrublands

1. *Betula occidentalis*, *Alnus incana* spp. *tenuifolia*, or *Cornus sericea* dominate 2

1. Not as above 5

2. *Alnus incana* ssp. *tenuifolia* contributes at least 20% cover 3

3. Tall mesic forbs dominate the understory, total forb cover at least 30%, other shrubs, if present, are less than 5% cover . ***Alnus incana* ssp. *tenuifolia*/mesic forb p.a.**

3. *Cornus sericea* is a co-dominant, at least 20% cover, commonly as high as 60% cover . . . . . ***Alnus incana* ssp. *tenuifolia-Cornus sericea* p.a.**

2. *Cornus sericea* or *Betula occidentalis* dominates, *Alnus incana* ssp. *tenuifolia*, if present, less than 10% cover 4

4. *Cornus sericea* dominates, at least 30% cover . . . . . ***Cornus sericea* p.a.**

4. *Betula occidentalis* dominates, at least 30% cover . . ***Betula occidentalis* p.a.**

5. *Quercus gambelii* or *Prunus virginiana* is the dominant shrub 6

6. *Quercus gambelii* at least 75% cover . . . . . ***Quercus gambelii/Symphoricarpos rotundifolia* p.a.**

6. *Prunus virginiana* at least 40-50% cover . . . . . ***Prunus virginiana* p.a.**

5. *Shepherdia argentea* dominant with at least 50% cover, *Leymus cinereus* may be present ***Shepherdia argentea/Leymus cinereus* p.a.**

Group F. Herbaceous Plant Associations

1. *Carex* spp. dominate the plant association. 2

1. Not as above 4

2. *Carex aquatilis* or *Carex utriculata* contributes at least 50% cover 3

3. *Carex aquatilis* contributes at least 50% cover***Carex aquatilis-Carex utriculata* p.a.**

3. *Carex utriculata* contributes at least 50% cover . . . . . ***Carex utriculata* p.a.**

2. *Carex scopulorum* dominates, at least 20% ***Carex scopulorum/Caltha leptosepala* p.a.**

4. *Eleocharis quinqueflora* or *Juncus balticus* contributes >50% cover. 5

5. *Eleocharis quinqueflora* dominates . . . . . ***Eleocharis quinqueflora* p.a.**

5. *Juncus balticus* dominates . . . . . ***Juncus balticus* p.a.**

4. Other graminoid species dominate 6

6. Tall (1-2 meters) graminoids, of dry uplands or emergent wetlands 7

6. Medium to short graminoids, usually mesic meadows 10

7. Dry upslopes and floodplains are dominated by *Leymus cinereus* . . . . . ***Artemisia tridentata/Leymus cinereus* p.a.**

7. Tall, emergent graminoids of wetlands 8

8. *Typha latifolia* dominates . . . . . ***Typha latifolia* p.a.**

8. *Phragmites australis* or *Scirpus pungens* dominates 9

9. *Phragmites australis* dominates . . . . . ***Phragmites australis* p.a.**

9. *Scirpus pungens* dominates . . . . . ***Scirpus pungens* p.a.**

10. Alkaline flats, dominated by *Distichlis spicata* . . . . . ***Distichlis spicata* p.a.**

10. Freshwater fed meadows 11

11. *Calamagrostis canadensis* dominates . . . . . ***Calamagrostis canadensis* p.a.**

11. *Deschampsia cespitosa* dominates . . . . . ***Deschampsia cespitosa* p.a.**

DESCRIPTIONS OF VEGETATION TYPES

Physiognomic classes: vegetation types identified by the life form in the tallest canopy layer using UNESCO physiognomic and climatic formations (e.g., Deciduous Forest, Evergreen Forest), followed by Cowardin's equivalent in parentheses.

Series: characteristic species or genera of vegetation within a class (e.g., *Juncus* spp., *Carex utriculata*).

Plant association: a plant community within a series identified by dominant or characteristic overstory and understory species. Most riparian vegetation types are subject to periodic disturbance and are recognized as plant associations that are dependent on these natural disturbances for their regeneration.

Descriptions include: 1) Common and scientific name, 2) plot numbers are given following community names, 3) synonyms or similar plant associations from literature comparison, 4) regional, state, and basin-wide distributions (where available), 5) elevation, channel and floodplain morphological setting, 6) soil texture and depth, 7) vegetation description including dominant and characteristic species structure and composition, and 8) a brief discussion on successional trends, management, or ecology of the association where observations or other information was available.

Stand tables with average percent canopy cover and constancy values for each plant association are in tables following the descriptions for each physiognomic group, e.g. the stand table for *Abies lasiocarpa/Mertensia ciliata* p.a. follow the descriptions for Evergreen Forest and Deciduous Forest with Evergreen Trees riparian communities.

I.A.9.c. EVERGREEN FOREST WITH NON-GIANT CONICAL CROWNED TREES (I.A. PALUSTRINE SYSTEM-FORESTED, NEEDLE-LEAVED EVERGREEN)

Abies lasiocarpa Series

Subalpine fir/thinleaf alder-Drummond's willow (*Abies lasiocarpa/Alnus incana* ssp. *tenuifolia-Salix drummondiana*) plant association
G3S3? (ABLA/ALIN-SADR)
Colorado River Basin--1 stand (92NL31)
Other occurrences: San Miguel River Basin--2 stands, Yampa River Basin--6 stands

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

Distribution: This association occurs from western Wyoming and northern Utah (Youngblood *et al.* 1985 and Padgett *et al.* 1989, as cited in Baker 1989). In Colorado it is a common type, known on the western slope from Rocky Mountain National Park to the San Juan Mountains (Baker, 1989).

Environment: Within the San Miguel/Dolores basin, this association occurs on stream banks in steep narrow valleys at an elevation of approximately 2450 m (8,000 ft), and in the upper reaches of the Dolores watershed, northern Montezuma County, in the San Juan Mountains. The *Abies lasiocarpa/ Alnus incana spp. tenuifolia-Salix drummondiana* plant association is expected to occur at similar elevations on the Uncompahgre Plateau. In the Colorado River basin this association occurs between 2775 and 3030 m (9100-9940 ft) on rocky banks of steep, narrow stream reaches.

Vegetation: *Picea engelmannii* and *Abies lasiocarpa* dominate the open tree canopy. *Populus angustifolia* also occurs in wider valleys. *Alnus incana* spp. *tenuifolia* and *Salix drummondiana* dominate the narrow and open shrub layer lining stream banks. Other shrubs present include *Salix geyeriana, Salix monticola,* and *Lonicera involucrata.* The herbaceous understory is well developed.

Soil: The soils that occur with this community are sandy-clay over loamy sand over cobbles.

Adjacent riparian vegetation: *Alnus incana* spp. *tenuifolia* shrublands, *Abies lasiocarpa-Picea engelmannii* forests.

Adjacent upland vegetation: *Picea engelmannii, Picea pungens,* and *Populus tremuloides* forests.

Succession/management: This appears to be a late-seral, subalpine forest riparian plant association. Padgett *et al.* (1989) suggest this type will eventually become dominated by *Abies lasiocarpa* in moist settings.

Subalpine fir/Mountain bluebells (*Abies lasiocarpa/Mertensia ciliata*) plant association G4S3? (ABLA/MECI)
White River Basin--1 stand (92NL65)
Colorado River Basin--8 stands (93SS01, 93SS11, 93SS20, 93SS51, 93GK36, 93GK44, 93GK48, 93DR20)

Synonyms: *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 ours does not include *Picea pungens* dominated overstories. Also similar to *Picea engelmannii-Abies lasiocarpa/Senecio triangularis* (Hess 1981, Komarkova 1986), however these occur on steep, seepy hillsides, rather than valley bottoms, and do not have *Cardamine cordifolia* or *Mertensia ciliata.*

Distribution: This plant association is known from northwestern New Mexico (DeVelice *et al.* 1985), and is reported from throughout Colorado (Baker 1984, Boyce 1977, Dix and Richards 1976, Peet 1981, as cited in Baker 1989). Specifically it is reported from central Colorado (Steen and Dix 1974, and Alexander 1981), and from the San Juan and San Isabel National Forests (DeVelice *et al.* 1985, Powell 1985, as cited in Johnston 1987).

Environment: In the White River drainage this type occurs on steep first and second order streams in the Flat Top Mountains. This type is found throughout the Colorado River drainage along steep, first order streams in dense spruce-fir forests, at elevations of 2510-3240 m (8240-10,640 ft).

Vegetation: In this plant association, *Picea engelmannii* and *Abies lasiocarpa* co-dominate or associate, immediately bordering the stream, or 2-5 meters from the channel. A dense, rich forb layer along the stream is a good diagnostic character. The forbs typically in high abundance are *Cardamine cordifolia, Mertensia ciliata, Senecio triangularis*, and *Saxifraga odontoloma*. The shrub layer has sparse to moderate cover with *Ribes* and *Salix* spp. and occasionally *Acer glabrum* or *Lonicera involucrata.*

Soil: The soil that occurs with this community type is thin silty loam over colluvial boulders. Classified as fragmental to fine clayey Cryorthents, Cryaquepts, Cryofluvents, Cryoborolls.

Adjacent riparian vegetation: *Alnus incana* shrublands, spruce-fir forests.

Adjacent upland vegetation: *Abies lasiocarpa-Picea engelmannii* forests, *Populus tremuloides* forests.

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.

Subalpine fir/Rocky Mountain whortleberry (*Abies lasiocarpa/Vaccinium myrtillus*) plant association

G5S5 (ABLA/VAMY)

Colorado River Basin-- 2 stands (93SS21, 93DR16)

Synonyms: *Abies lasiocarpa-Picea engelmannii/Vaccinium myrtillus* (Johnston 1987).

Distribution: Occurs from northern Colorado to south eastern New Mexico to east-central Arizona.

Environment: Occurs in the upper spruce-fir zone, on steep north, northeast and southeast-facing slopes between 2560-3150 meters (8400-10,300 feet) in elevation.

Vegetation: This community is typically an upland forest type that occasionally grows adjacent to stream channels. Only a ery few obligate riparian herbaceous species (*Mertensia ciliata, Senecio triangularis,* and *Cardamine cordifolia)* may be present in mossy banks at the stream edge.

Soils: Soils associated with this community type are Loamy Oxyaquic Cryofluvents and Fragmental Oxyaquic Cryorthents.

Adjacent riparian vegetation: *Picea engelmannii-Abies lasiocarpa* forests.

Adjacent upland vegetation: *Picea engelmannii-Abies lasiocarpa* forests.

Succession/Management: The *Abies lasiocarpa/Vaccinium myrtillus* plant association is a dense upland mesic forest habitat type that occurs on steep slopes. It is not considered an obligate riparian community. It can occur on first order streams, with a very dense canopy that may prevent development of riparian herbaceous or shrubby species. This is a very stable plant association which may slowly give way to an *Abies lasiocarpa* dominated forest.

Subalpine fir/Gooseberry (*Abies lasiocarpa/Ribes* spp.) plant association
GUSU (ABLA/RIBES)
White River Basin--6 stands (92GK50, 92GK53, 92NL56, 92NL66, 92NL60, 92NL32)
Colorado River Basin--3 stands (93SS03, 93GK28, 93GK46)

Synonyms: *Abies lasiocarpa-Populus angustifolia/Alnus incana* spp. *tenuifolia* (Baker 1989) and *Abies lasiocarpa-Picea engelmannii/Ribes* spp. (Johnston 1987).

Distribution: This association occurs in western Wyoming and northern Utah (Youngblood *et al.* 1985 and Padgett *et al.* 1989, as cited in Baker 1989). In Colorado it has been reported from Rocky Mountain National Park to the San Juan Mountains (Baker 1989, Kittel and Lederer 1993).

Environment: In the White River Basin, this community type occurs above 2900 meters (9500 feet) in elevation along narrow first order streams in steep ravines and valleys. We found this community type only in the Flat Tops Plateau area of the White River Basin. In the Colorado River drainage we also found this community only on the Flat Tops Plateau, on narrow to moderately wide streams at about 2680 meters (8800 feet).

Vegetation: *Picea engelmannii* and *Abies lasiocarpa* dominate the tree canopy. *Lonicera involucrata* and *Ribes* spp. characterize the shrub layer. *Salix drummondiana* often occurs along the stream edge. Mesic forbs such as *Mertensia ciliata, Senecio triangularis,* and *Mitella pentandra* are also present.

Soil: The soils associated with this plant community are sands over cobbles. Our soils classified as loamy-fragmental, and fragmental aeric Cryaquepts to clayey Cryaquepts.

Adjacent riparian vegetation: *Alnus incana* shrublands, *Abies lasiocarpa-Picea engelmannii* forests, *Carex utriculata* wetlands.

Adjacent upland vegetation: *Picea engelmannii*, *Populus tremuloides* forests.

Succession/management: This appears to be a stable riparian plant association. Padgett *et al.* (1989) suggest the overstory forest may become dominated by *Abies lasiocarpa*. *Picea engelmannii* dominated stands represent the wettest portion of spruce stands. Logging in the wettest sites, such as wetlands and riparian areas, can lead to wind throw and a rise in the water table.

Colorado blue spruce/Thinleaf alder (*Picea pungens/Alnus incana* ssp. *tenuifolia*) plant association
G2S2 (PIPU/ALIN)
White River Basin--4 stands (92NL12, 92NL16, 92GK17, 92GK54)
Colorado River Basin--5 stands (93SS41, 93SS43, 93RR59, 93RR62, 93DR08)

Synonyms: *Picea pungens/Alnus incana* spp. *tenuifolia* (Baker 1989). Similar to *Picea pungens/Alnus incana* spp. *tenuifolia* (Johnston 1987); however in ours *Abies lasiocarpa* appears to have replaced *Abies concolor*. No other reference consulted described an alder shrub undergrowth with *Picea pungens*.

Distribution: This plant association is reported from northwestern Wyoming to northern New Mexico (Johnston 1987). In Colorado, it is known from Routt National Forest south to Rio Grande and San Juan National Forests (Johnston 1987, Baker 1989).

Environment: This community occurs along narrow to moderately wide streams reaches in narrow and deep canyons subject to cold air drainage and limited sunlight. In the White River Basin it occurred at elevations of 2225-2425 meters (7300-7960 feet). In the Colorado River drainage, we found this community along second and third order streams between 2470-2865 meters (8100-9400 feet), in the Vail valley and in Rocky Mountain National Park.

Vegetation: *Picea pungens* dominates a dense overstory, with many understory seedling and saplings. *Alnus incana* spp. *tenuifolia, Lonicera involucrata*, and *Salix drummondiana* create a narrow band of shrubs lining the stream bank. The forb layer is species rich (up to 40 spp.) and dense ranging from 10-40% cover. Characteristic species include *Maianthemum stellatum, Mertensia ciliata* and *Rudbeckia laciniata.* One plot had 40 forb species!

Soil: The soils found with this vegetation association are fine sandy clay loams over gravel and boulders. The soils classify as sandy typic and oxyaquic Cryorthents, loamy typic and oxyaquic Cryoborolls, and fragmental typic Cryochrepts.

Adjacent riparian vegetation: *Alnus incana* ssp. *tenuifolia* shrublands, *Picea engelmannii-Abies lasiocarpa* forests.

Adjacent upland vegetation: *Picea engelmanii, Populus tremuloides*, and *Pinus edulis-Juniperus osteosperma* woodlands.

Succession/management: Along narrow steep second and third order streams, on stream banks and rocky outcrops, *Picea pungens* appears stable. However, more information is needed about the successional status of *Picea pungens*.

Colorado blue spruce/Serviceberry-Red-osier dogwood (*Picea pungens/Amelanchier alnifolia-Cornus sericea*) plant association
G4SU (PIPU/AMAL-COSE)
Colorado River Basin--3 stands (92GK25, 92NL20, 92GK36)
Other occurrences: San Miguel/Dolores River Basin--3 stands

Synonyms: *Picea pungens/Amelanchier alnifolia-Cornus sericea* (Komarkova 1986, Hess and Wasser 1982). Similar to the broader types *Picea* spp./*Cornus sericea* (Youngblood *et al.* 1989) and Conifer/*Cornus sericea* (Padgett *et al.* 1989), as ours includes only those stands dominated by *Picea pungens*.

Distribution: This type 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 reported from the Routt, White River, Gunnison, and San Juan National Forests (Johnston 1987, Hess and Wasser 1982, Komarkova 1986, and DeVelice 1986).

Environment: In the San Miguel/Dolores River Basin it occurs on convex banks and narrow floodplains of canyon tributaries draining the Uncompahgre Plateau, and narrower reaches within cool deep canyons of the San Miguel River in San Miguel and Montrose counties, at elevations of 1800-2500 m (6160-8200 ft).

Vegetation: Dense stands of *Picea pungens* characterize the overstory of this plant association. *Populus tremuloides* is occasionally present as well. *Cornus sericea* forms a dense, almost impenetrable shrub layer. Other shrubs present include *Betula occidentalis, Salix drummondiana, Alnus incana* spp. *tenuifolia*, and *Lonicera involucrata*. Lush herbaceous cover of *Equisetum spp., Carex lanuginosa, Ligusticum porteri, Rudbeckia laciniata*, and *Maianthemum stellatum* characterize the undergrowth.

Soil: The soils associated with this vegetation are thin clay loams to silt loams over lighter colored gravels and cobbles with high organic matter in the top layers.

Adjacent riparian vegetation: *Alnus incana* spp. *tenuifolia, Cornus sericea, Salix monticola* shrublands.

Adjacent upland vegetation: *Populus tremuloides* and *Pinus edulis-Juniperus osteosperma* woodlands, *Quercus gambelii* shrublands.

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 in Colorado blue spruce dominated riparian communities.

Other *Picea pungens* stands:

In the White River drainage two stands (92NL61, 92NL39) of mixed *Picea pungens* and *Abies lasiocarpa* were sampled. One along South Fork of the White River, where an open shrub layer of *Cornus sericea* lined the stream bank. The other stand occurred along a narrower, second order stream.

Other studies: These stands may fit into the *Picea pungens/Amelanchier utahensis-Cornus sericea* type described by Baker (1984) from the Colorado west slope, and Hess and Wasser (1982) from the Colorado Front Range. The species list compiled by Johnston (1987) indicates *Abies* spp. may be present in the tree layer. However our stands lacked the associated *Amelanchier utahensis* and other drier habitat shrubs, such as *Prunus virginiana* and *Symphoricarpos* spp.

Douglas Fir/Snowberry (*Pseudotsuga menziesii/Symphoricarpos rotundifolius*) plant association
G5S4 (PSME/SYRO)
White River Basin--3 stands (92NL06, 92NL09, 92GK06)

Synonymy: *Pseudotsuga menziesii/Symphoricarpos oreophilus* plant association (Johnston 1987).

Distribution: This plant association and several phases are described from Idaho, Wyoming, northern Utah and central Colorado (Johnston 1987).

Environment: In the White River Basin, this community appears to be restricted to steep north facing draws and ravines in the eastern half of the basin. It occurs on steep, mostly first order, often ephemeral streams with steep side slopes.

Vegetation: Dense shade and steep slopes preclude any significant herbaceous or shrub layer. *Symphoricarpos rotundifolius, Rosa woodsii* and *Prunus virginiana* characterize the sparse shrub layer. Very few forbs or graminoids occur within this community type.

Soil: The soils occurring with this plant association are coarse sandy loams with a high volume of coarse rock fragments.

Adjacent riparian vegetation: None.

Adjacent upslope vegetation: *Pinus edulis-Juniperus osteosperma* woodlands.

Succession/Management: Johnston (1987) refers to this type as a plant association, which the Forest Service reserves for stable, climax vegetation stands. This is a very long lived community and not subject to regular fluvial or hydrologic disturbances. This community can occur in large stands on the upslopes, away from stream channels and riparian areas where rainfall is adequate to maintain the community. Steep slopes and coarse substrates make this community highly susceptible to soil erosion.

Douglas fir/Gambel's oak (*Pseudotsuga menziesii/Quercus gambelii*) plant association
G5S3S4 (PSME/QUGA)
Colorado River Basin--2 stands (93GK07, 93RR07)

Synonyms: *Pseudotsuga menziesii/Quercus gambelii* Johnston 1987, *Pseudotsuga menziesii/Amelanchier utahensis-Quercus gambelii-Symphoricarpos oreophilus/Carex geyeri-Poa fendleriana* Baker 1982.

Distribution: The *Pseudotsuga menziesii/Quercus gambelii* plant association is reported from central and north western Colorado, San Juan, Pike-San Isabel, and Rio Grande National Forests, New Mexico, Utah and Arizona (Johnston 1987).

Environment: In the Colorado River basin it is limited to lower elevations on steep, north-facing slopes of sedimentary rocks. Our stands occurred at 2070 meters (6800 feet) in elevation, on steep colluvial slopes that came right down to small, steep streams.

Vegetation: The vegetation consists of a tall, dense canopy of *Pseudotsuga menziesii* with a dense shrub understory of *Quercus gambelii, Prunus virginiana,* and *Amelanchier utahensis.* Forb and graminoid cover is sparse (< 1%).

Soil: The associated soils are classified as clayey (calcareous) mesic Calciorthids.

Adjacent riparian vegetation: *Juncus balticus* meadows.

Adjacent upslope vegetation: *Pinus edulis-Juniperus osteosperma* woodlands

Succession/Management: *Pseudotsuga menziesii* types are largely considered transitional between riparian and upland sites. In western Colorado they occur in tiny patches on north facing steep slopes and ridges, that occasionally come down to the stream-side or colluvial slopes adjacent to streams. They occupy sites that are moist but not wet, and are probably intolerant of flooding. *Pseudotsuga menziesii* are relatively fire-resistant trees.

Other *Pseudotsuga menziesii* stands:
In the White River drainage one stand (92NL24) occurred at the confluence of two creeks in the western portion of the Piceance watershed. The dense shrub layer of *Acer glabrum* and *Cornus sericea* set this stand apart from the other *Pseudotsuga* stands. This stand was in a narrow, north facing valley along a steep, narrow creek.

Other studies: Johnston (1987) lists a *Pseudotsuga menziesii/Acer glabrum* plant association that occurs on northerly aspects in north-western Wyoming. This community is also reported from southeastern Idaho, northwestern Utah, northeastern Colorado and from the White River National Forest. Hansen et al. (1989) describe a *Pseudotsuga menziesii/Cornus sericea* type from low to mid elevations of the mountains of central Montana. While similar

in shrub understory, the Montana type does not mention *Acer glabrum*. Our stands lacked the more northern cottonwood species, *Populus trichocarpa*.

Rocky Mountain Juniper/Little-seed ricegrass (*Juniperus scopulorum/Oryzopsis micrantha*) plant association
G3SU (JUSC/ORMI)
Colorado River Basin--3 stands (93RR46, 93RR40, 93RR32)

Synonyms: *Juniperus scopulorum* Riparian Site Type (Hansen *et al.* 1989). Johnson (1987) reports a *Juniperus scopulorum/Oryzopsis micrantha* community that grows on steep, northerly slopes, ridges and butte tops, with high moss and lichen cover from sw North Dakota, se and sc South Dakota. Our stands differed in their riparian environment and also lacked *Fraxinus pensylvanica.*

Distribution: This plant community occurs at lower elevations in southwestern Montana (Hansen et al. 1988). North facing slopes, butte tops, ridges, and shale slopes in southwest North Dakota and south-central South Dakota (Johnston 1987). In the Colorado River Drainage, *Juniperus scopulorum* grows in dense stands along the Colorado River mainstem between Burns and Dotsero.

Environment: This plant association was only observed as older, relic stands along the Colorado River (1950-2000 meters, 6390-6600 feet in elevation), on stream banks and terraces about 2 meters above the active stream channel.

Vegetation: A moderately dense canopy of *Juniperus scopulorum* characterizes this uncommon riparian community with a few scattered shrubs such as *Quercus gambelii, Rhus trilobata, Artemisia tridentata* and *Chrysothamnus nauseosus.* One of our stands had a dense shrub layer of *Cornus sericea.* Forbs and grass cover is sparse, *Oryzopsis micrantha* is always present, but not in great abundance.

Soils: The associated soils are classified as calcareous typic Cryopsamments, coarse-loamy borollic Calciorthids, and loamy (calcareous) typic Cryaquents.

Adjacent riparian vegetation: *Salix exigua.*

Adjacent upslope vegetation: *Pinus edulis-Juniperus osteosperma* woodlands.

Succession/Management: *Juniperus scopulorum* is intolerant to flooding (Hansen, et al. 1988), and very susceptible to fire due to its thin bark when young. It provides excellent wildlife habitat with structural diversity, cover and food. This plant association is late-seral and appears limited to the upper flooding mark along the Colorado River. Early seral stages of this type have abundant *Populus angustifolia.*

I.B.2.b. COLD DECIDUOUS FOREST WITH NEEDLE-LEAVED EVERGREEN TREES (I.B. PALUSTRINE SYSTEM, BROAD-LEAVED DECIDUOUS FORESTS)

Populus angustifolia Series

Narrowleaf cottonwood-Rocky Mountain Juniper (*Populus angustifolia-Juniperus scopulorum*) plant association
GUSU (POAN-JUSC)
Colorado River Basin--2 stands (93RR39, 93RR48)

Synonyms: This plant association appears quite similar to *Juniperus scopulorum* Riparian Site Type (Hansen *et al.* 1989). It may be similar to a *Populus angustifolia* Ecological Type described from the Big Horn Mountains (M. Girard, *personnel communitcation*), and *Populus angustifolia/Amelanchier alnifolia* (Johnston 1987).

Distribution: Similar types (see above) are described from southwestern Montana and in limestone canyons of the Big-Horn Mountains of Northern Wyoming. Similar *Populus angustifolia* dominated types with associated *Juniperus scopulorum* are reported from north-central Colorado (Johnston 1987). This plant association is not previously described from Colorado. Observed only along the mainstem of the Colorado River between Burns and Dotsero.

Environment: Relic stands occur on elevated terraces, 1.5-2 meters above the bankfull channel, between 1950-2000 meters (6400-6600 feet) in elevation.

Vegetation: *Populus angustifolia* dominates the tree canopy layer, with *Juniperus scopulorum* an associated sub-canopy tree cover. Shrub cover is sparse; characteristic species are *Rhus trilobata* and *Artemisia tridentata*. Graminoid cover is low with *Oryzopsis micrantha* and *Leymus cinereus* present.

Soils: The soils are classified as sandy-coarse loam, calcareous Camborthids, loamy-clay calcareous typic Cryothents.

Adjacent Riparian Vegetation: *Salix exigua*, *Carex* spp.

Adjacent Upslope Vegetation: *Pinus edulis-Juniperus osteosperma* woodlands, *Artemisia tridentata* shrublands.

Succession/Management: Our stands appear quite old and decadent. These and other stands observed on the Colorado River are on high terraces or upper stream banks that are no longer flooded due to Windy Gap dam operations upstream. Little to no cottonwood regeneration, nor their required substrate (freshly deposited alluvium) appears below the dam. Without periodic flooding and sedimentation, cottonwoods will not be replaced, and this type will likely become the late-seral *Juniperus scopulorum* type (Hansen *et al.* 1989).

The *Populus angustifolia-Juniperus scopulorum* community appears to replace *Populus deltoides/Cornus sericea* at higher elevations, and above the confluence with the Eagle River along the Colorado River.

Narrowleaf cottonwood-Colorado blue spruce/Thinleaf alder (*Populus angustifolia-Picea pungens/Alnus incana* ssp. *tenuifolia*) plant association
G2S2 (POAN-PIPU/ALIN)
White River Basin--3 stands (92NL14, 92NL15, 92NL38)
Colorado River Basin--1 stand (93GK50)

Synonyms: *Populus angustifolia-(Picea pungens)/Alnus incana* spp. *tenuifolia-Cornus sericea* (Baker 1989). Our stands, from the White River have more *Cornus* and less alder. In the Colorado River basin, one stand has more *Betula occidentalis* than Baker's type.

Distribution: This plant association is found from eastern Idaho and western Wyoming to southern Utah (Baker 1989). Within Colorado 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.* 1984, and Komarkova 1986, as cited by Baker 1989, Kittel and Lederer 1993). In the White River Basin we found high quality occurrences only on the western slope of the Flat Tops, along the South Fork of the White River.

Environment: This community occurs in deep canyons and valleys with moderately wide floodplains to allow for *Populus angustifolia* regeneration at about 2075-2285 meters (6800-7500 feet) in elevation.

Vegetation: *Populus angustifolia* dominates the tree layer with *Picea pungens* ranging from 1% to 20% cover. Other trees present may be *Pseudotsuga menziesii* and *Juniperus scopulorum.* The dense shrub layer consists of *Cornus sericea, Acer glabrum,* and *Amelanchier alnifolia*; *Alnus incana* spp. *tenuifolia* rarely occurred within our plots. *Actaea rubra, Osmorhiza depauperata,* and *Maianthemum stellatum* are common and abundant forbs. Graminoid cover is sparse. One stand along the Eagle River had 30% *Betula occidentalis.*

Soil: The associated soils are shallow sandy to silty loams over cobbles and boulders. The soils are classified as loamy-skeletal, calcareous aquic typic Cryochrepts.

Adjacent riparian vegetation: *Salix exigua* and *Salix ligulifolia* stands on point bars and small islands.

Adjacent upland vegetation: *Pinus edulis-Juniperus osteosperma* woodlands, *Quercus gambelii* scrub, *Populus tremuloides* woodlands.

Succession/management: This mixed deciduous-evergreen community type represents 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.

Other mixed Deciduous-Evergreen Forest stands

In the White River drainage one stand (92NL13) along a first order stream had a tree layer of aspen and Colorado blue spruce. *Ribes inerme, Salix boothii* and *S. bebbiana* occurred in the shrub layer. The understory consisted of *Carex utriculata, Rudbeckia laciniata*, and *Mertensia ciliata*. Often on very narrow streams in narrow, V-shaped valleys the upslope, non-riparian vegetation mixes with the plants adjacent to the stream side. With more data this type may be described and classified.

Table 4. Percent canopy cover for POAN-PIPU/ALIN and PIPU/ALIN mixed deciduous and evergreen forest plant associations in the White River Basin. 1 = <1%, 3 = 1-5%. See text for acronym explanations.

Plant association	POAN-PIPU/ALIN			Uncl	PIPU/ALIN				Uncl	
Plot No.	92	92	92	92	92	92	92	92	92	
Species	NL38	NL14	NL15	NL13	NL12	NL16	GK17	GK54	NL61	NL39
TREES										
Abies lasiocarpa	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	1.0	10.0
Acer negundo	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Picea pungens	1.0	20.0	3.0	20.0	30.0	1.0	30.0	30.0	3.0	1.0
Populus angustifolia	70.0	20.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Populus tremuloides	0.0	0.0	1.0	60.0	0.0	3.0	0.0	0.0	3.0	0.0
SHRUBS										
Acer glabrum	0.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
Alnus incana ssp. tenuifolia	0.0	0.0	1.0	10.0	0.0	10.0	20.0	30.0	20.0	10.0
Amelanchier alnifolia	3.0	3.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cornus sericea	1.0	40.0	1.0	0.0	0.0	0.0	0.0	0.0	60.0	70.0
Lonicera involucrata	3.0	3.0	3.0	0.0	3.0	3.0	3.0	10.0	1.0	10.0
Ribes inerme	20.0	0.0	3.0	3.0	3.0	10.0	10.0	10.0	0.0	3.0
Rosa woodsii	3.0	3.0	0.0	0.0	1.0	1.0	10.0	0.0	1.0	3.0
Salix boothii	0.0	0.0	0.0	3.0	1.0	0.0	0.0	10.0	0.0	0.0
Salix drummondiana	0.0	1.0	0.0	0.0	0.0	3.0	40.0	10.0	10.0	1.0
Symphoricarpos rotundifolius	3.0	1.0	1.0	0.0	1.0	3.0	20.0	0.0	3.0	0.0
GRAMINOIDS										
Equisetum arvense	0.0	0.0	1.0	10.0	1.0	0.0	10.0	10.0	1.0	1.0
Bromus inermis	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0
Carex utriculata	0.0	3.0	0.0	20.0	1.0	0.0	0.0	0.0	0.0	0.0
Dactylis glomerata	1.0	0.0	0.0	0.0	3.0	0.0	20.0	0.0	0.0	0.0
Juncus balticus	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0
Phalaris arundinacea	0.0	10.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Phleum pratense	1.0	0.0	0.0	0.0	0.0	1.0	0.0	10.0	3.0	0.0
Poa pratensis	1.0	3.0	3.0	3.0	3.0	10.0	20.0	10.0	10.0	0.0
FORBS										
Actaea rubra	3.0	1.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
Galium triflorum	3.0	0.0	1.0	1.0	0.0	0.0	0.0	10.0	1.0	3.0
Geranium richardsonii	10.0	1.0	3.0	3.0	1.0	3.0	3.0	3.0	3.0	0.0
Heracleum lanatum	10.0	1.0	3.0	3.0	1.0	1.0	3.0	1.0	1.0	3.0
Hydrophyllum fendleri	0.0	0.0	10.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Mertensia ciliata	0.0	0.0	3.0	20.0	1.0	3.0	1.0	0.0	3.0	1.0
Osmorhiza depauperata	10.0	1.0	30.0	3.0	1.0	0.0	3.0	0.0	0.0	3.0
Rudbeckia laciniata	3.0	3.0	1.0	10.0	3.0	0.0	3.0	20.0	3.0	3.0
Maianthemum stellatum	3.0	3.0	3.0	0.0	1.0	0.0	10.0	1.0	1.0	1.0
Solidago gigantea	0.0	0.0	0.0	0.0	0.0	0.0	3.0	20.0	0.0	0.0
Trifolium repens	1.0	0.0	0.0	1.0	1.0	1.0	20.0	1.0	0.0	0.0

Table 5. Percent canopy cover for ABLA/RIBES, ABLA/MECI, and PSME/SYRO evergreen forest plant associations in the White River Basin. 1 = <1%, 3 = 1-5%. See text for acronym explanations.

Plant association	ABLA/RIBES SPP					ABLA/MECI	PSME/SYRO			UNCL
Plot No.	92	92	92	92	92	92	92	92	92	92
Species	NL66	NL60	NL56	GK53	GK50	NL65	NL06	GK06	NL09	NL24
TREES										
Abies lasiocarpa	3.0	1.0	10.0	20.0	10.0	0.0	0.0	0.0	0.0	0.0
Juniperus scopulorum	0.0	0.0	0.0	0.0	0.0	0.0	1.0	10.0	3.0	0.0
Populus tremuloides	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	3.0
Picea engelmannii	3.0	0.0	3.0	1.0	1.0	3.0	0.0	0.0	0.0	0.0
Pseudotsuga menziesii	0.0	0.0	0.0	0.0	0.0	0.0	10.0	20.0	30.0	10.0
SHRUBS										
Acer glabrum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	70.0
Cornus sericea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0
Lonicera involucrata	10.0	3.0	20.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0
Ribes inerme	3.0	3.0	0.0	10.0	20.0	0.0	0.0	0.0	1.0	3.0
Ribes montigenum	0.0	0.0	10.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Rosa woodsii	0.0	0.0	0.0	0.0	0.0	0.0	3.0	20.0	10.0	3.0
Salix boothii	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salix drummondiana	3.0	3.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Symphoricarpos rotundifolius	0.0	0.0	0.0	0.0	0.0	0.0	3.0	20.0	20.0	1.0
GRAMINOIDS										
Elymus canadensis	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Juncus balticus	0.0	0.0	0.0	0.0	0.0	0.0	1.0	10.0	0.0	0.0
Poa pratensis	1.0	20.0	1.0	0.0	0.0	0.0	20.0	10.0	1.0	0.0
FORBS										
Arnica cordifolia	10.0	0.0	3.0	10.0	10.0	40.0	0.0	0.0	0.0	0.0
Epilobium angustifolium	10.0	0.0	1.0	3.0	3.0	1.0	0.0	0.0	0.0	0.0
Geranium richardsonii	3.0	3.0	3.0	3.0	10.0	0.0	1.0	1.0	0.0	0.0
Heracleum lanatum	3.0	0.0	3.0	1.0	1.0	0.0	0.0	0.0	1.0	1.0
Mertensia ciliata	10.0	3.0	3.0	10.0	10.0	20.0	0.0	0.0	0.0	0.0
Senecio triangularis	0.0	1.0	1.0	10.0	20.0	40.0	0.0	0.0	0.0	0.0

Table 6. Percent canopy cover for ABLA/MECI plant association in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym explanation.

Plant Association	ABLA/MECI							
Plot No.	93	93	93	93	93	93	93	93
Species	SS01	SS11	SS20	SS51	GK36	GK44	GK48	DR20
TREES								
Abies lasiocarpa--mature	0	30	0	3	20	1	3	10
Abies lasiocarpa--saplings	0	10	3	10	0	1	10	0
Abies lasiocarpa-seedlings	0	10	10	20	0	3	3	20
Picea engelmannii--mature	0	0	30	30	3	10	3	10
Picea engelmannii--saplings	1	3	1	10	0	3	10	0
Picea engelmannii--seedlings	0	3	1	3	0	0	3	10
Picea pungens--saplings	0	0	0	0	0	0	0	0
Picea pungens--seedlings	0	0	0	0	0	0	0	10
SHRUBS								
Acer glabrum	0	0	0	0	10	0	0	0
Lonicera involucrata	0	1	1	1	1	3	3	3
Ribes coloradense	1	0	0	0	0	0	0	1
Ribes inerme	0	0	0	0	0	0	3	0
Ribes lacustre	0	0	0	0	0	0	0	20
Ribes wolfii	0	1	1	0	0	10	0	0
Salix drummondiana	0	0	0	10	3	0	3	3
Salix monticola	1	0	0	0	0	1	0	20
Vaccinium myrtillus	0	0	0	10	0	0	0	10
Vaccinium scoparium	0	10	10	0	0	0	0	0
GRAMINOIDS								
Calamagrostis canadensis	0	1	0	10	0	0	1	0
Carex lanuginosa	0	0	0	0	0	10	0	0
Carex rossii	0	0	0	0	0	0	0	10
Deschampsia cespitosa	0	0	0	0	0	0	0	10
FORBS								
Aconitum columbianum	1	1	0	0	10	0	1	0
Angelica grayi	0	1	0	0	0	1	0	10
Cardamine cordifolia	10	3	10	3	3	10	3	10
Heracleum lanatum	3	1	0	0	3	1	20	1
Mertensia ciliata	40	10	10	10	0	20	30	10
Oxypolis fendleri	0	0	1	1	0	0	10	0
Saxifraga odontoloma	1	3	3	1	0	3	3	1
Senecio triangularis	1	1	20	1	0	1	10	10
Equisetum arvense	0	0	0	1	0	0	10	0

Table 7. Percent canopy cover for ABLA/RIBES and ABLA/VAMY evergreen forest plant associations in e Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym explanations.

Plant Association	ABLA/RIBES SPP.			ABLA/VAMY	
Plot No.	93	93	93	93	93
Species	SS03	GK28	GK46	SS21	DR16
TREES					
Abies lasiocarpa--mature	10	0	3	10	3
Abies lasiocarpa--saplings	10	20	0	1	10
Abies lasiocarpa-seedlings	10	10	3	1	10
Picea engelmannii--mature	10	1	10	10	20
Picea engelmannii--saplings	10	10	1	1	0
Picea engelmannii--seedlings	1	10	0	3	1
Picea pungens--saplings	0	0	0	0	10
Picea pungens--seedlings	0	0	0	0	10
SHRUBS					
Acer glabrum	0	0	0	0	0
Lonicera involucrata	20	30	30	3	1
Ribes coloradense	0	40	0	0	0
Ribes inerme	0	10	3	0	0
Ribes lacustre	0	0	0	0	0
Ribes wolfii	1	0	20	0	0
Salix drummondiana	0	10	3	0	0
Salix monticola	0	0	0	0	0
Vaccinium myrtillus	0	0	0	50	50
Vaccinium scoparium	0	0	0	10	0
GRAMINOIDS					
Calamagrostis canadensis	1	0	3	1	3
arex lanuginosa	0	0	0	0	0
arex rossii	0	0	0	0	0
Deschampsia cespitosa	1	0	0	0	0
FORBS					
Aconitum columbianum	1	0	0	1	0
Angelica grayi	0	1	0	1	0
Cardamine cordifolia	3	0	3	3	20
Heracleum lanatum	3	10	10	1	0
Mertensia ciliata	3	1	1	10	4
Oxypolis fendleri	0	0	0	3	0
Saxifraga odontoloma	1	3	0	3	10
Senecio triangularis	1	10	0	20	3
Equisetum arvense	0	3	0	1	0

Table 8. Percent canopy cover for PIPU/ALIN and PIPU/AMAL-COSE evergreen forest plant association in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym explanations.

Plant association	PIPU/ALIN					PIPU/AMAL-COSE		
Plot No.	93	93	93	93	93	92	92	92
Species	SS41	SS43	RR59	RR62	DR08	GK25	GK34	NL20
TREES								
Abies lasiocarpa	0	10	0	20	1	10	0	0
Abies lasiocarpa-seedlings	0	10	3	1	3	0	0	0
Juniperus scopulorum	0	0	0	0	0	0	0	0
Juniperus scopulorum--saplings	0	0	0	0	0	0	0	0
Picea engelmannii	0	0	30	3	1	0	0	0
Picea pungens	50	50	30	20	0	30	40	20
Picea pungens--saplings	10	1	0	3	10	0	0	1
Picea pungens--seedlings	3	1	0	3	10	0	0	1
Pinus contorta	10	0	0	0	1	0	0	0
Populus angustifolia	0	0	0	1	1	1	20	40
Pseudotsuga menziesii	0	0	0	0	0	0	0	0
Pseudotsuga menziesii--saplings	0	0	0	0	0	0	0	0
SHRUBS								
Quercus gambelii	0	0	0	0	0	0	0	1
Acer glabrum	0	0	0	0	0	0	3	20
Alnus incana ssp. tenuifolia	20	3	1	20	30	0	10	0
Cornus sericea	1	0	0	0	0	20	20	10
Lonicera involucrata	3	10	1	1	3	10	0	0
Prunus virginiana	0	0	0	0	0	0	0	20
Ribes lacustre	0	3	20	3	0	0	0	0
Symphoricarpos rotundifolius	0	0	0	0	1	3	1	1
Vaccinium myrtillus	0	30	20	0	0	0	0	0
Vaccinium scoparium	0	3	20	0	10	0	0	0
GRAMINOIDS								
Bromus canadensis	1	1	0	0	11	0	0	0
Calamagrostis canadensis	3	1	0	0	20	0	0	0
Poa pratensis	1	0	0	0	3	0	0	0
FORBS								
Aconitum columbianum	1	0	0	0	0	0	0	0
Arnica mollis	0	1	10	0	0	0	0	0
Cardamine cordifolia	0	3	3	1	10	0	0	0
Mertensia ciliata	0	10	1	1	1	1	0	0
Maianthemum stellatum	0	0	0	0	0	1	1	1
Rudbeckia laciniata	0	0	0	0	0	10	0	1
Saxifraga odontoloma	0	0	1	1	10	0	0	0
Streptopus amplexifolius	0	10	3	1	1	0	0	0

Table 9. Percent canopy cover for PSME/QUGA and JUSC/ORMI evergreen forest plant association in e Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym explanations.

Plant association	PSME/QUGA		JUSC/ORMI		
Plot No.	93	93	93	93	93
Species	GK07	RR07	RR46	RR40	RR32
TREES					
Abies lasiocarpa	0	0	0	0	0
Abies lasiocarpa-seedlings	0	0	0	0	0
Juniperus scopulorum	0	1	60	70	30
Juniperus scopulorum--saplings	0	0	1	10	3
Picea engelmannii	0	0	0	0	0
Picea pungens	0	0	0	0	0
Picea pungens--saplings	0	0	0	0	0
Picea pungens--seedlings	0	0	0	0	0
Pinus contorta	0	0	0	0	0
Populus tremuloides	0	0	0	0	0
Pseudotsuga menziesii	60	3	3	0	1
Pseudotsuga menziesii--saplings	10	10	0	0	0
SHRUBS					
Quercus gambelii	40	50	1	0	0
Acer glabrum	0	0	0	0	0
Alnus incana ssp. tenuifolia	0	0	0	0	0
Cornus sericea	0	0	1	0	30
Lonicera involucrata	0	0	0	0	0
Prunus virginiana	20	0	0	0	0
Ribes lacustre	0	0	0	0	0
Symphoricarpos rotundifolius	10	3	0	0	1
Vaccinium myrtillus	0	0	0	0	0
Vaccinium scoparium	0	0	0	0	0

Table 10. Percent canopy cover for POAN-JUSC and POAN-PIPU/ALIN from the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym explanations.

Plant Association	POAN-JUSC		POAN-PIPU/ALIN
Plot No.	93	93	93
Species	RR39	RR48	GK50
TREES			
Juniperus scopulorum--mature	10	10	1
Juniperus scopulorum--saplings	20	30	0
Juniperus scopulorum--seedling	10	10	0
Picea pungens--mature	0	0	20
Populus angustifolia--mature	30	20	10
Populus angustifolia--seedlings	0	10	0
SHRUBS			
Betula occidentalis	0	0	30
Cornus sericea	0	0	10
Prunus virginiana	0	0	20
HERBACEOUS			
Leymus cinereus	1	10	0
Maianthemum stellatum	0	10	1

I.B.3.b. MAINLY COLD-DECIDUOUS FOREST WITHOUT EVERGREEN TREES
(I.B. PALUSTRINE SYSTEM-FOREST CLASS, BROAD-LEAVED DECIDUOUS)

Populus angustifolia Series

Narrowleaf cottonwood/Coyote willow (*Populus angustifolia/Salix exigua*) plant association
G3QS3 (POAN/SAEX)
White River Basin-- 3 stands (92GK13, 92NL41, 92NL25)
Other occurrences: Yampa River Basin-- 3 stands.

Synonyms: *Populus angustifolia/Salix scouleriana* (Baker 1984); *Populus angustifolia/Salix exigua-Betula fontinalis* (Johnston 1987, Komarkova 1986); Hess (1981) describes a *Populus angustifolia/Salix exigua* type but considered it a climax community. Ours were clearly early seral. In Wyoming, Jones (1990) describes a similar type *Populus angustifolia/*Recent Alluvial Bar, that consists of narrowleaf cottonwood saplings and seedlings.

Distribution: This common type occurs in eastern Idaho, northern and se Wyoming, and central Utah (Johnston 1987), and throughout Colorado. In Colorado it occurs in Arapaho-Roosevelt, and Gunnison National Forests (Johnston 1987). It was also reported from Moffat, Conejos, Archuleta, and Hinsdale counties of northwestern and southwestern Colorado (CNHP 1993), and from the Yampa River basin (Kittel and Lederer 1993).

Environment: In the White River Basin the narrowleaf cottonwood/coyote willow is a very common community at lower elevations, 2000-2300 m (6560-7540 ft). It represents an early successional stage and is very susceptible to flooding and scouring, as it usually lies well below the average annual high water mark (bankfull channel) of the stream channel.

Vegetation: Dense 1-2 meter high thickets of *Populus angustifolia* seedlings and saplings intermixed with equally tall *Salix exigua* characterize this plant association. Other willows commonly present include *Salix lucida ssp. caudata* and *Salix ligulifolia*. Forb cover is as much as 25%, although no one species comprised more than 1% total cover.

Soil: This plant association usually occurs on cobbles, and sometimes on stratified layers of sand, gravels and cobbles. One of our stands occurred on silty clay up to 1.2 meters in depth.

Adjacent riparian vegetation: *Salix exigua* shrublands, *Alnus incana ssp. tenuifolia*, shrublands, *Populus angustifolia/Cornus sericea* forests, *Populus angustifolia/Amelanchier alnifolia* forests.

Adjacent upland vegetation: *Artemisia tridentata* shrublands, *Quercus gambelii* scrub.

Succession/Management: The *Populus angustifolia/Salix exigua* plant association represents an early seral stage of more diverse *Populus angustifolia* plant associations. This community develops on freshly deposited alluvium and is the first stage in cottonwood riparian forest development. Continued flooding and sedimentation coupled with lateral channel migration away from the point bar will allow the physical setting of the site to become more stable and less likely to be scoured and eroded away by more severe floods. Hess (1981) describes this plant association as a climax type; however, we found that *Salix exigua* rarely occurs as a dominant shrub understory in stands of narrowleaf cottonwood older than the sapling or pole stage.

Box elder-Narrowleaf cottonwood/Red-osier dogwood (*Acer negundo-Populus angustifolia/Cornus sericea*) plant association
G2S2 (ACNE-POAN/COSE)
White River Basin--3 stands (92GK11, 92GK48, 92NL07)
Other occurrences: Yampa River Basin--8 stands

Synonyms: *Acer negundo-Populus angustifolia/Cornus sericea* (Baker 1984, Peterson *et al.* 1984). May be similar to Padgett *et al.*'s (1989) *Populus angustifolia/Cornus sericea* type, as he states that "*Acer negundo* may rarely codominate".

Distribution: Not reported to occur outside of Colorado. In Colorado, previously known only along the Yampa, Williams Fork, White Rivers in Moffat, Rio Blanco, and Routt counties (CNHP 1993, Kittel and Lederer 1993). In the White River basin we found this plant association along the mainstem of the White River between Rio Blanco Lake and the town of Meeker.

Environment: On wide meandering reaches with broad alluvial floodplains at about 1740-1890 m (5700-6200 feet) in elevation, on terraces approximately 1.3 m above the high water level, and 1-30 meters distant from the channel.

Vegetation: *Populus angustifolia* and *Acer negundo* dominate this deciduous riparian forest. *Cornus sericea* often creates a nearly impenetrable shrub layer. *Salix ligulifolia, Crataegus rivularis* and *Ribes montigenum* are also sometimes present. Herbaceous cover is generally dominated by forbs and ranges from sparse to moderate, including *Maianthemum stellatum, Rudbeckia laciniata, Solidago serotinoides*, and *Mentha arvensis*. Grasses usually are introduced hay-meadow species, including *Phleum pratense, Poa pratensis, Agrostis gigantea,* and *Dactylis glomerata.*

Soil: Usually well over 2 meters of deep un-stratified sandy loam and silty clay loams. Mottling was evident at about 50-60 (90) cm.

Adjacent riparian vegetation: *Salix exigua* shrublands.

Adjacent upland vegetation: *Quercus gambelii* and *Artemisia tridentata* shrublands.

Succession/management: Our stands were late-seral mature cottonwood forests. One stand, across from the town of Meeker, was under a rest-rotation management regime, and was ungrazed for three years prior to 1992 data collection. *Cornus sericea* was not as tall or as dense as other stands presumed ungrazed for longer than 3 years near Rio Blanco Lake. Eroding banks on the outside bend of meanders left mature tree roots exposed and occasionally left large logs lying in the river. Dense stands of *Cornus sericea* occurred within the closed forest canopy between 1 and 2 meters above the high water mark, indicating undisturbed, late-seral forests. Channel migration and meander movement cut into these forests on the outside of meander bends, leaving the mature stands immediately

adjacent to, yet several meters above, the channel. Young, early-seral stands of regenerating cottonwoods were found on the inside bends, on point bars and low terraces with surfaces much lower than those of the more mature stands.

Narrowleaf cottonwood/Red-osier dogwood (*Populus angustifolia/Cornus sericea*) plant association

G4S2 (POAN/COSE)

White River Basin --1 stand (92GK19)
Colorado River Basin--12 stands (92GK29, 92GK33, 92NL37, 92NL33, 92NL35, 92NL36, 93SS14, 93SS15, 93RR55, 93SS34, 93SS09, 93GK18)
Other occurrences: Yampa River Basin--6 stands, San Miguel/Dolores River Basin--7 stands.

Synonyms: Similar to *Populus angustifolia/Cornus sericea* (Padgett et al. 1989, Youngblood *et al.* 1985); *Populus angustifolia/Cornus sericea* (Hansen *et al.* 1989) *Populus angustifolia/Amelanchier alnifolia/Smilacina stellata, (Crataegus rivularis-Cornus sericea* phase) (Hess and Wasser 1982, Johnston 1987).

Distribution: This type 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 also reported from the White River National Forest (Johnston 1987). Only one stand sampled in the White River Basin, along a stream bench below an irrigation headgate, draining Rattlesnake Mesa. Once a more common type within Colorado, it now occurs primarily in very degraded conditions and high quality, near pristine condition stands are very rare.

Environment: This community occurs in moderately wide to narrow alluvial valleys between 1980-2530 meters (6500-8300 feet) in elevation, on stream banks and terraces adjacent to rocky streams.

Vegetation: *Populus angustifolia* dominates an open tree canopy. *Cornus sericea* forms a dense shrub layer. This community can be distinguished from mixed *Populus-Picea* by the absence of *Picea pungens*. Other shrubs often limited to the channel edge include *Alnus incana ssp. tenuifolia, Amelanchier alnifolia* and *Crataegus rivularis*. Forb cover includes *Maianthemum stellata,* and *Rudbeckia laciniata*. Graminoid cover is low, consisting mainly of *Carex utriculata* and *Poa pratensis*.

Soil: The soils occurring with this plant association are clay loams to sandy loam or sandy clay about 1/2 meter deep over cobbles. Soils are classified as argic pachic Cryoborolls (on terraces), and typic or oxyaquic Cryorthents, and typic Craquents on lower floodplains.

Adjacent riparian vegetation: *Salix exigua* shrublands, *Salix monticola* and *Alnus incana* shrublands.

Adjacent upland vegetation: *Artemisia tridentata* scrub, *Juniperus osteosperma* woodlands.

Succession/management: Our stands appear to be 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, sediment deposition and scouring. 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) propose that their similar type be considered early to mid-seral due to its proximity to the channel. 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 (e.g. season long heavy grazing) 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, and (3) with continued disturbance, *Rosa* and *Symphoricarpos* may become quite abundant, and with further degradation, shrub cover begins to decline and the site proceeds to become less mesic. This fits 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.

Narrowleaf cottonwood/Red-osier dogwood (*Populus angustifolia/Cornus sericea*)-- *Betula occidentalis* Phase
GUSU (POAN/COSE-BEOC)
Colorado River Basin--5 stands (92NL22, 93RR26, 93GK21, 93GK23, 93RR54)

Synonyms: *Populus angustifolia/Betula occidentalis* (Padgett *et al.* 1989)

Distribution: Reported from northern Wyoming to central Colorado (Johnston 1987).

Environment: Typically on broad to moderately wide alluvial floodplains at slightly lower elevations than POAN/COSE plant association, approximately 1840-2290 m (6000-7500 ft.) in elevation. It can also occur in narrow canyons.

Vegetation: We found several stands of *Populus angustifolia/Cornus sericea* (POAN/COSE) with a dense sub-canopy of *Betula occidentalis*. These stands are very similar in setting and species composition to other POAN/COSE stands.

Soil: *Betula occidentalis* phase typically occurs on heavier silty clay. Soils from plots are oxyaquic Cryofluvents, lithic ustic Torriorthents, udic Ustorthents, and sandy oxyaquic Cryofluvents.

Succession/Management: This phase appears to occupy warmer and more mesic habitats at slightly lower elevations then the *Populus angustifolia/Cornus sericea* type. *Betula occidentalis* often occurs as narrow bands along the stream edge, with drier *Populus angustifolia* stands further up on the floodplain (Hansen *et al.* 1988). Because *Betula occidentalis* occupies lower elevation riparian communities than *Alnus incana* ssp. *tenuifolia* and *Cornus sericea*, fewer and fewer stands exist today. Large, near pristine stands of *Populus angustifolia/Cornus sericea--Betula occidentalis* phase, and other *Betula occidentalis* communities are uncommon in on Colorado's west slope.

Narrowleaf cottonwood/Skunkbrush (*Populus angustifolia/Rhus trilobata*) plant association
G2G3 (POAN/RHTR)
Colorado River Basin--5 stands (93RR17, 93GK17, 93RR05, 93RR06, 93GK05)
Other occurrences--San Miguel River Basin--14 stands

Synonyms: *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). It was previously not reported in Colorado. In the San Miguel River Basin it occurs in north western Montrose County and south western Mesa County. In the Colorado River Basin, it occurs in the western half of the basin.

Environment: This association occurs on immediate river banks, floodplains and terraces in narrow to medium-wide sandstone canyons at elevations between 1500 and 1850 m (5000 and 6100 ft). Stands generally occur within 1 meter of the high water mark, as well as on higher terraces (up to 3 m above the channel). In the western portions of the Colorado River drainage this community occurred on small streams in shale canyon areas, from 1800-2100 meters (5900-6900 feet) in elevation.

Vegetation: The *Populus angustifolia/ Rhus trilobata* plant association overstory is dominated by *Populus angustifolia* or *Populus acuminata*. Other trees occasionally present are *Acer negundo* and *Quercus gambelii*. The shrub layer is dominated by *Rhus trilobata*. In the San Miguel other characteristic shrubs included *Forestiera pubescens, Berberis fendleri, Crataegus rivularis*, and at higher elevations *Cornus sericea, Amelanchier utahensis,* and *Symphoricarpos rotundifolius*. The herbaceous layer is usually sparse, with *Poa pratensis* a common grass, and *Maianthemum stellatum* and *Melilotus officinale* common forbs.

Soil: The soils associated with this community type are fine sandy loams, clay loams and silty clay loams, and classified as ustic Torriorthents, Ustifluvents, mesic ardic Ustorthents, and ustalfic Haplargids.

Adjacent riparian vegetation: *Salix exigua* shrublands, *Populus deltoides ssp. wislizenii/Rhus trilobata* forests.

Adjacent upland vegetation: *Juniperus osteosperma* forests, *Artemisia tridentata* and *Chrysothamnus* sp., and *Quercus gambelii* scrub.

Succession/management: This plant association is considered a late successional sere 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 exotic 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).

Narrowleaf cottonwood/Yellow willow-Silver buffaloberry (*Populus angustifolia/Salix ligulifolia-Shepherdia argentea*) plant association
GUS1 (POAN/SALI-SHAR)
Colorado River Basin--1 stand (93RR49)
Other occurrences: Uncompaghre River--1 stand, San Juan National Forest--1 stand.

Synonyms: Similar to *Populus angustifolia/Salix ligulifolia-Shepherdia argentea* (Baker 1989) except our stand did not have any *Salix ligulifolia*.

Distribution: Reported from only one stand in southwestern Colorado (Baker 1989).

Environment: This association occurs on moderately wide to narrow alluvial and confined floodplains between elevations of 1830 and 2134 m (6000-7000 ft). Older stands occurred on upper terraces up to 2.5 meters above the active channel.

Vegetation: The tree layer is dominated by *Populus angustifolia*. The shrub layer is diverse but dominated by *Shepherdia argentea*. *Shepherdia argentea* occurs only near the stream bank. Other shrub species include *Cornus sericea, Clematis ligusticifolia,* and *Rhus trilobata*. Graminoids and forbs are of minor importance.

Soils: The soils associated with this community type are typic Cryopsamments.

Adjacent Riparian Vegetation: *Salix exigua* shrublands.

Adjacent Upslope Vegetation: *Juniperus osteosperma* woodlands.

Succession/Management: This community is likely a late-seral stage of narrowleaf cottonwood stand. Narrowleaf cottonwood will not reproduce on high alluvial terraces, so this community will probably become an upland shrub or forest type. With flooding and fresh alluvium, cottonwood will become re-established and this community type may be rejuvenated. In Montana *Shepherdia* is reported to revegetate disturbed sites with slightly saline soils and may resist grazing because of its thorny nature (Hansen *et al.* 1988). In Colorado, colonies of the shrub are small and scattered, it may be less tolerant of grazing and other disturbances, and is an uncommon dominant shrub component in riparian communities.

Other *Populus angustifolia* stands :

In the White River drainage: one stand (92GK08) sampled on the main stem of the White River near Beefsteak Gulch had narrowleaf cottonwoods and a high mix of various shrubs including *Quercus gambelii*, *Rhus trilobata*, *Betula occidentalis*, and *Prunus virginiana*. The tree canopy was sparse and the shrubs widely spaced. Exotic grass species such as *Poa pratensis*, *Bromus inermis*, and *Dactylis glomerata* were very abundant. This stand may be a degraded occurrence of *Populus angustifolia/Rhus trilobata* community type described from Utah and the San Miguel River Basin in Colorado (Kittel and Lederer 1993). However due to the degraded condition and abundance of exotic species, this stand remains unclassified.

Another stand (92GK14) sampled within the White River drainage on a second order stream, Coal Creek, had very little narrowleaf cottonwood cover (<5%). It appears to be an early seral community with a high abundance of *Salix lucida ssp. caudata* and *Alnus incana*. This stand may be classified in the *Salix lucida* or *Alnus incana* Series.

In the Colorado River Basin: one stand (93RR22) of saplings (estimated 7-10 year old) *Populus angustifolia* was sampled on a recent point bar. *Populus angustifolia* canopy cover was about 60%, with diverse but widely spaced shrubs, and sparse graminoid and forb cover. Jones (1992) describes this type of community as "recent alluvial bar". It is clearly an early seral-stage to a more mature *Populus angustifolia* forest type.

Rio Grande cottonwood/Skunkbrush (*Populus deltoides ssp. wislizenii/Rhus trilobata*) plant association
G2S2 (PODE/RHTR)
Colorado River Basin--6 stands (92GK21, 92GK22, 92NL18, 92NL19, 92NL68, 92NL21)
Other occurrences: San Miguel/Dolores River Basin--1 stand.

Synonyms: *Populus deltoides ssp. wislizenii/Rhus trilobata* (Baker 1984, Keammerer 1974). Also called River Woodland (USDI Bureau of Reclamation 1976).

Distribution: The *Populus deltoides ssp. wislizenii/Rhus trilobata* plant association is reported from the Grand and Parachute Creek Valleys, on the Colorado western slope (Reid and Bourgeron 1991). We sampled this plant association along the mainstem of the Colorado river between Rifle and Debeque. One occurrence is reported from the lower San Miguel River. This association is not documented outside Colorado, but it is likely to occur in eastern Utah and possibly north western New Mexico (Graham 1937, Campbell and Dick-Peddie 1964).

Environment: Upper terraces of wide (1000-6000 m) alluvial floodplains at between approximately 1490 and 1650 m (4900-5400 ft.).

Vegetation: The tree canopy is dominated by *Populus deltoides ssp. wislizenii*. *Populus angustifolia* becomes more important in higher elevation stands. Younger stands have a dense shrub canopy of *Rhus trilobata*. Other shrubs commonly present are *Shepherdia argentea* and *Tamarix ramosissima*. The forb understory is usually sparse and consists mainly of *Cirsium arvense, Asclepias speciosa* and *Melilotus alba*. Graminoid cover ranges from 10-30%, typically *Poa pratensis* and *Bromus inermis*.

Soil: The soils that occur with this plant association are deep stratified clay loams to sandy loams.

Adjacent Riparian Vegetation: *Salix exigua*, *Typha ssp.* wetlands.

Adjacent Upslope Vegetation: *Juniperus osteosperma* woodlands.

Succession/Management: *Rhus trilobata* appears to become quite dense in medium-aged stands. On the Colorado River, in stands with trees of 90 cm or greater dbh, *Rhus* shrubs become widely spaced and the presence of *Artemisia tridentata* indicates that *Populus deltoides/Rhus trilobata* on higher terraces may be successional to a upland shrub or woodland community. This is similar to the trend observed in *Populus angustifolia/Rhus aromatica* var. *trilobata* in Utah (Padgett *et al.* 1989). It should be noted that Weber and Wittmann (1992) taxonomically equate *Rhus trilobata* with *Rhus aromatica* var. *trilobata.*

Recognition of the early seral stage of this type is important for long term management to maintain cottonwood riparian forests. Activities such as bank stabilization (rip-rap) and channelization restrict channel migration, and may reduce the maturation of seedling/sapling stands into mature cottonwood riparian forests. Point bar "nursery" environments are critical for cottonwood regeneration, as cottonwoods do not recruit from seed under a mature canopy.

Box-elder/Red-osier dogwood (*Acer negundo/Cornus sericea*) plant association
G3SU (ACNE/COSE)
Colorado River Basin--2 stands (92GK23, 92NL26)

Synonyms: *Acer negundo/Cornus sericea* (Padgett *et al.* 1989).

Distribution: The *Acer negundo/Cornus sericea* plant association is reported from central Utah. Not previously reported in Colorado.

Environment: Narrow limestone box canyons at 2130 m (7000 ft.) in elevation.

Vegetation: *Acer negundo* is the only tall tree canopy structure (60%) in this plant association. A dense shrub (10-90%) layer of *Cornus sericea, Ribes inermis,* and *Prunus virginiana* is characteristic. Forb cover is high (50%) to moderate (3%) with *Heracleum lanatum, Mertensia ciliata, Hydrophyllum fendleri* and *Geranium richardsonii.*

Soils: The soils occurring with this plant association are calcareous sandy clay to clay loams.

Adjacent Riparian Vegetation: Found in narrow canyons with only *Acer negundo/Cornus sericea.*

Adjacent Upslope Vegetation: *Pseudotsuga menziesii* forests on cliff tops above canyon walls.

Succession/Management: Box elders appear to flourish in narrow canyons that have altered flows (e.g., Glenwood Canyon, Black Canyon of the Gunnison). With scouring floods, however, box elders may survive only if they grow on upper colluvial slopes. This may provide a seed source after flooding and deposition. Padgett *et al.* (1989) suggest *Acer negundo* may be a riparian climax type until the channel migrates away or downcuts, making the site drier.

Box-elder/Choke-cherry (*Acer negundo/Prunus virginiana*) plant association
GUSU (ACNE/PRVI)
White River Basin--2 stands (92GK27, 92NL23)
Colorado River Basin--12 stands (93RR01 93RR02, 93RR03, 93RR04, 93RR16, 93RR20, 93RR21, 93GK01, 93GK15, 93GK16, 93GK19, 93GK22).

Synonyms: *Acer negundo/Prunus virginiana* (Hansen *et al.* 1989). Similar communities have been described: *Acer negundo* communities from Dinosaur National Monument and from the Yampa and San Miguel River Basins (Kittel and Lederer 1993). In Utah, Padgett *et al.* (1989) describe a minor riparian *Acer negundo/Cornus sericea* community, that with grazing may change to an *Acer negundo/Maianthemum stellatum* community type.

Environment: *Acer negundo/Prunus virginia* occurs on moderately wide, flat valley bottoms, between 1835 and 2100 m (6020-6900 ft.) in elevation. It also occurs on colluvial deposits and narrow, confined terraces where the stream channel had cut away the floodplain.

Vegetation: Two stands dominated by *Acer negundo* were sampled in the Piceance Basin area of the White River drainage. One stand, on upper Cathedral Creek has a very dense forb layer of *Urtica gracilis,* an indication of past disturbance. It is surrounded by an exotic European hay meadow. Few shrubs occur in the shrub layer. The other stand is on upper Solider Creek, in a remote and possibly more pristine location. *Pseudotsuga menziesii* and *Acer glabrum* are present. Total shrub cover is about 50%. Fewer forbs are present and there are fewer signs of disturbance. In the Colorado River basin, most stands have a dense canopy of *Acer negundo* and a high diversity of shrub species. *Prunus virginiana, Amelanchier utahensis, and Crataegus rivularis* are characteristic of the less disturbed stands. Dense forb understory such as *Urtica gracilis, Cynoglossum officinale* and *Geranium richardsonii* characterize the more heavily disturbed stands. A few stands have a dense canopy of sapling and seedling *Acer negundo*. Only four of our twelve stands had an abundance of *Prunus virginiana*, however the variability described by Hansen *et al.* (1989) fits our stands closely.

Soils: The soils associated with this vegetation are fragmental ustic Torrifluvents to clayey ardic Ustorthents. On terraces this plant association occurs with pachic Haplustolls to loamy calcareous Torrifluvents.

Adjacent Riparian Vegetation: *Populus angustifolia* types.

Adjacent Upslope Vegetation: *Amelanchier utahensis* and *Artemisia tridentata* shrublands. *Quercus gambelii,* and *Pseudotsuga menziesii* forests.

Succession/Management: In Montana, Hansen *et al.* (1988, 1989) describe an *Acer negundo/Prunus virginiana* type that occurs in the Great Plains region of the state, along alluvial fans and in V-shaped streams or "woody draws". Hansen states that with moderate

grazing the canopy may be opened up and "less desirable" species will invade, such as *Rosa woodsii* and *Crataegus* sp. Grazing can severely damage standing trees and reduce the success of box-elder reproduction. Many of the stands sampled in Colorado appear in an advanced stage of degradation. They are very open with little shrub cover, little or no regeneration of box-elder, and have compacted soils.

Single-leaf Ash/Gambel's oak (*Fraxinus anomala/Quercus gambelii*) plant association
GUSU (FRAN/QUGA)
Colorado River Basin--2 stands (93RR07, 93RR08)

Synonyms: No *Fraxinus anomala* communities described in the literature.

Distribution: Single-leaf ash occurs on rimrock or along drainages in the mixed desert shrub zones in western Colorado, west and south to Utah, New Mexico, Arizona and California (Welsh *et al.* 1987). Northeast of Grand Junction valley, along streams draining the Roan Plateau.

Environment: This patchy and sparse community occurs along small ephemeral tributaries in narrow, deep sandstone canyons at 1775 meters (5825 feet).

Vegetation: *Fraxinus anomala* and *Quercus gambelii* form a dense mid-height canopy. *Pseudotsuga menziesii* is present on north facing side of the canyon floor. Other shrubs present at our sites are *Rhus trilobata, Holodiscus dumosus,* and *Symphoricarpos rotundifolius.* Graminoid and forb cover is very minor.

Soil: The associated soils are loamy to coarse loamy typic Torriorthents.

Adjacent Riparian Vegetation: *Acer negundo* and *Quercus gambelii* woodlands.

Adjacent Upslope Vegetation: *Juniperus osteosperma* woodlands

Succession/Management: This community is composed of mostly non-obligate riparian species that appear restricted to stream channel edges by steep cliffs. In places along this deep and sinuous canyon, we found dense stands of *Quercus gambelii.* Grazing and flooding sensitivity is unknown.

Aspen/Cow parsnip (*Populus tremuloides/Heracleum lanatum*) plant association
G3SP (POTR/HELA)
Colorado River Basin-- 3 stands (93GK13, 93GK14, 93GK30)

Synonyms: *Populus tremuloides/Heracleum sphondylium* (Johnston 1987). May be the same as the *Populus tremuloides*/Tall forb (Reid and Bourgeron 1991).

Distribution: Known from Routt and White River National Forests in north-central Colorado, and from western Wyoming to Utah. In the Colorado River basin this community occurred on the higher reaches of the Roan Plateau.

Environment: This community occurs on broad, gently sloping valley side slopes and bottoms at 2510 meters (8240 feet) in elevation.

Soil: The soils associated with this vegetation are fine-loamy pachic and cumulic Cryoborolls and fine-loamy or fine clayey mollic Cryofluvents.

Vegetation: This plant association is characterized by a nearly closed canopy of *Populus tremuloides* with a thick and diverse forb layer. The shrub layer is of minor importance. Dominant forbs include *Heracleum lanatum, Hydrophyllum fendleri* and *Osmorhiza occidentalis.*

Adjacent Riparian Vegetation: Forb communities, other *Populus tremuloides* types.

Adjacent Upslope Vegetation: *Populus tremuloides* woodlands, *Artemisia tridentata,* or *Symphoricarpos ssp.* shrublands.

Succession/Management: *Populus tremuloides* woodlands can be self perpetuating, climax plant associations, or they can be seral to conifer types. In riparian areas the moisture regime probably favors *Populus tremuloides* over conifers. *Populus tremuloides* dominates many riparian communities as well as many mesic upland sites.

Aspen/Thin-leaf alder (*Populus tremuloides/Alnus incana* ssp. *tenuifolia*) plant association
GUSU (POTR/ALIN)
Colorado River Basin--3 stands (93SS06, 93DR21, 93DR22)

Synonyms: None previously described in the literature.

Distribution: This plant association is not previously reported outside Colorado.

Environment: Our stands occurred between 2575-2900 meters (8440-9600 feet) in elevation, in narrow valleys along steep (10-27%) first and second order streams.

Vegetation: This narrow, small community type has moderate canopy of *Populus tremuloides*, with a dense stand of *Alnus incana* along the stream edge. Each of our three plots has an associated conifer species present: either *Pinus contorta, Abies lasiocarpa,* or *Picea engelmannii*. Associated shrubs include *Salix bebbiana, Salix monticola,* and *Salix drummondiana*. Two of the stands have a graminoid layer of *Calamagrostis canadensis.*

Soils: Soils associated with this community are coarse-loamy to sandy cumulic Cryaqualls or Cryoborolls to oxyaquic Cryorthents.

Adjacent Riparian Vegetation: *Alnus incana, Salix ssp.* shrublands.

Adjacent Upslope Vegetation: *Pinus contorta, Populus tremuloides* forests.

Succession/Management: *Populus tremuloides* woodlands can be self perpetuating, climax plant associations, or they can be seral to conifer types. In riparian areas the moisture regime probably favors *Populus tremuloides*. *Populus tremuloides* dominates many riparian communities as well as many mesic sites. Sensitivity to heavy grazing and other disturbances is not well known.

Aspen/Rocky Mountain Maple (*Populus tremuloides/Acer glabrum*) plant association
G1G2S1S2 (POTR/ACGL)
Colorado River Basin--2 stands (93SS36, 93GK37)

Synonyms: *Populus tremuloides/Acer glabrum* (Reid and Bourgeron 1991); may be very similar to *Populus tremuloides/Amelanchier alnifolia-Padus virginiana-Acer glabrum* Phase (Johnston 1987); however our stands did not have any *Amelanchier* spp.

Distribution: Similar stands are reported from the White River National Forest and from the Sawatch Range in central Colorado (Johnston 1987).

Environment: This community occurs on small, steep (13-40 % slope) streams between 2390-2500 meters (7850-8200 feet) in elevation.

Vegetation: Tree canopy layer consists of *Populus tremuloides* and one or two conifer species such as *Picea pungens* or *Pseudotsuga menziesii*. The shrub layer is diverse with *Acer glabrum, Lonicera involucrata, Alnus incana, Amelanchier utahensis,* and *Symphoricarpos rotundifolius*. We also found a dense and very diverse forb layer with characteristic aspen understory species such as *Heracleum lanatum, Actaea rubra,* and *Maianthemum racemosum*.

Soils: This vegetation occurs on fine silty or fine loamy (calcareous) pachic Cryoborolls.

Adjacent Riparian Vegetation: *Populus tremuloides* woodlands.

Adjacent Upslope Vegetation: *Pseudotsuga menziesii, Juniperus osteosperma* woodlands.

Succession/Management: *Populus tremuloides* woodlands can be self perpetuating, climax plant associations, or they can be seral to conifer types. In riparian areas the moisture regime probably favors *Populus tremuloides*. *Populus tremuloides* dominates many riparian communities as well as many upland mesic sites. Sensitivity to heavy grazing and other disturbances is not known. This community is relatively stable but may be replaced (albeit very slowly) by the *Pseudotsuga menziesii/Acer glabrum* plant association

Table 11. Percent canopy cover for ACNE/PRVI, POAN/SAEX, POAN/RHTR, and ACNE-POAN/COSE, and POAN/COSE deciduous forest plant associations in the White River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	ACNE/PRVI		POAN/SAEX			POAN/RHTR	ACNE-POAN/COSE			POAN/COSE
Plot No.	92	92	92	92	92	92	92	92	92	92
Species	GK27	NL23	NL25	NL41	GK13	GK08	GK11	GK48	NL07	GK19
TREES										
Acer negundo	70.0	60.0	0.0	0.0	0.0	1.0	30.0	10.0	3.0	0.0
Populus angustifolia	0.0	0.0	30.0	40.0	20.0	3.0	60.0	60.0	90.0	10.0
Pseudotsuga menziesii	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SHRUBS										
Acer glabrum	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alnus incana ssp. tenuifola	0.0	0.0	0.0	3.0	10.0	0.0	0.0	0.0	0.0	3.0
Clematis ligusticifolia	0.0	0.0	0.0	0.0	0.0	1.0	1.0	30.0	20.0	0.0
Cornus sericea	0.0	3.0	0.0	0.0	0.0	0.0	20.0	10.0	10.0	40.0
Crataegus rivularis	0.0	0.0	0.0	10.0	0.0	1.0	20.0	30.0	3.0	1.0
Rhus trilobata	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	1.0	0.0
Ribes inermis	3.0	10.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Rosa woodsii	0.0	3.0	0.0	0.0	3.0	3.0	1.0	20.0	20.0	10.0
Salix bebbiana	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0
Salix exigua	0.0	0.0	20.0	30.0	30.0	0.0	0.0	0.0	1.0	0.0
Salix lasiandra	0.0	0.0	1.0	3.0	20.0	0.0	0.0	0.0	3.0	0.0
Sambucus racemosa	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Symphoricarpos rotundifolius	3.0	10.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	3.0
GRAMINOIDS										
Agrostis gigantea	0.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0
Bromus inermis	1.0	0.0	0.0	0.0	0.0	20.0	3.0	0.0	10.0	0.0
Carex utriculata	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	10.0
Dactylis glomerata	0.0	0.0	0.0	10.0	1.0	10.0	30.0	10.0	0.0	1.0
Elymus glaucus	1.0	10.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0
Juncus balticus	0.0	0.0	10.0	1.0	10.0	0.0	0.0	0.0	1.0	3.0
Pascopyrum smithii	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0
Phleum pratense	0.0	0.0	0.0	10.0	0.0	1.0	10.0	1.0	0.0	1.0
Poa pratensis	3.0	20.0	3.0	10.0	20.0	20.0	40.0	20.0	3.0	30.0
FORBS										
Arctium minus	1.0	0.0	0.0	0.0	0.0	3.0	0.0	40.0	0.0	0.0
Cirsium sp.	3.0	0.0	1.0	0.0	0.0	1.0	1.0	10.0	10.0	1.0
Comandra umbellata	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0
Hackelia floribunda	20.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Medicago lupulina	0.0	0.0	1.0	0.0	20.0	1.0	0.0	0.0	0.0	0.0
Melilotus officinalis	0.0	0.0	1.0	0.0	30.0	10.0	0.0	1.0	1.0	0.0
Mertensia ciliata	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Monarda fistulosa	10.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
Osmorhiza depauperata	60.0	1.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
Rudbeckia laciniata	0.0	0.0	0.0	3.0	0.0	0.0	1.0	0.0	0.0	10.0
Smilacina stellata	1.0	1.0	0.0	1.0	0.0	0.0	3.0	0.0	30.0	20.0
Solidago sp.	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	30.0	0.0
Taraxacum officinale	1.0	0.0	0.0	3.0	20.0	3.0	3.0	1.0	0.0	3.0
Trifolium pratense	0.0	0.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0
Urtica gracilis ssp. gracilis	40.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 12. Percent canopy cover for POAN/COSE and POAN/COSE--BEOC Phase deciduous forest plant association in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	POAN/COSE						POAN/COSE-BEOC PHASE			
Plot No.	93	93	93	93	93	93	93	93	93	93
Species	SS14	SS15	RR55	SS34	SS09	GK18	RR26	GK21	GK23	RR54
TREES										
Acer negundo--mature	0	0	0	0	0	20	0	0	0	0
Populus angustifolia--mature	50	10	50	70	10	40	20	10	10	60
Populus angustifolia--saplings	10	30	30	3	1	0	3	0	0	3
Populus tremuloides	0	20	0	0	0	0	0	0	0	1
Pseudotsuga menziesii--mature	0	0	0	0	0	0	0	10	0	3
Pseudotsuga menziesii--seedlings	10	0	0	0	0	1	0	0	1	0
SHRUBS										
Acer glabrum	0	0	3	0	3	30	0	3	10	0
Alnus incana ssp. tenuifolia	10	10	0	0	0	0	0	0	0	3
Amelanchier utahensis	0	0	0	0	0	20	1	1	3	1
Betula occidentalis	40	0	0	0	0	0	20	30	30	30
Cornus sericea	30	30	50	3	3	20	3	20	20	1
Crataegus rivularis	0	0	0	0	0	0	10	0	0	0
Lonicera involucrata	0	0	0	1	0	0	1	0	10	0
Rhus trilobata	3	0	0	0	0	0	10	0	0	0
Ribes inermis	0	3	3	20	1	1	0	10	1	1
Rosa woodsii	10	3	3	40	1	1	3	0	3	1
Rubus idaeus	10	0	1	0	0	20	0	1	0	0
Rubus parviflorus var. parviflora	0	0	0	0	0	0	0	0	20	0
Salix bebbiana	0	0	0	10	0	0	0	0	1	3
Salix drummondiana	0	0	0	1	10	0	0	0	0	0
Salix monticola	0	10	0	0	0	0	0	0	0	0
GRAMINOIDS										
Agoseris glauca	30	0	0	0	0	0	0	0	0	0
Carex utriculata	0	0	0	0	0	0	0	0	0	20
Glyceria striata	0	0	0	1	0	0	0	0	0	20
Equisetum arvense	1	10	0	0	0	0	1	0	3	1
FORBS										
Angelica ampla	0	0	0	0	0	0	1	0	0	10
Clematis ligusticifolia	30	0	0	0	0	1	10	0	0	0

Table 13. Percent canopy cover for POAN/RHTRI and POAN/SALI-SHAR deciduous forest plant association in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym explanation.

Plant association	POAN/RHTR					POAN/SALI-SHAR	Uncl
Plot No.	93	93	93	93	93	93	93
Species	RR17	GK17	RR05	RR06	GK05	RR49	RR22
TREES							
Acer negundo--mature	1	30	1	30	1	0	0
Acer negundo--saplings	3	10	3	3	10	0	0
Acer negundo--seedling	3	0	1	1	10	0	1
Populus angustifolia--mature	40	50	60	50	50	30	0
Populus angustifolia--seedlings	1	0	1	1	0	0	60
Pseudotsuga menziesii--mature	0	0	0	0	30	0	0
SHRUBS							
Amelanchier utahensis	0	10	1	3	1	0	0
Crataegus rivularis	0	0	0	0	20	0	0
Mahonia repens	0	0	0	0	40	0	0
Prunus virginiana	0	10	3	0	20	0	0
Rhus trilobata	70	40	1	10	1	3	0
Shepherdia argentea	0	0	0	0	0	50	0
Symphoricarpos rotundifolius	1	10	3	3	20	0	1
GRAMINOIDS							
Poa pratensis	0	0	1	30	1	1	1
Clematis ligusticifolia	1	1	0	3	0	20	1
Medicago lupulina	0	0	0	0	0	0	10
Osmorhiza depauperata	0	0	0	0	10	0	0
Thlaspi montanum	0	0	0	0	0	10	0

Table 14. Percent canopy cover for ACNE/PRVI deciduous forest plant association in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	ACNE/PRVI													
Plot No.	93	93	93	93	93	93	93	93	93	93	93	93	93	93
Species	RR01	RR02	RR03	RR04	RR16	RR19	RR20	RR21	GK01	GK02	GK15	GK16	GK19	GK22
TREES														
Acer negundo--mature	30	10	50	60	10	3	10	3	60	20	40	60	50	0
Acer negundo--sap.	20	0	3	10	50	1	10	1	0	0	20	3	0	80
Acer negundo--seedling	3	0	0	10	50	0	40	30	0	0	1	0	0	0
Populus angustifolia	0	0	0	0	20	0	0	30	0	1	20	3	10	0
Pseudotsuga menziesii	1	0	0	0	0	3	0	0	0	0	0	0	0	10
SHRUBS														
Acer glabrum	0	0	0	0	0	0	0	0	0	0	1	0	10	1
Amelanchier utahensis	1	0	3	0	10	3	0	1	1	3	20	0	1	10
Cornus sericea	0	0	0	0	1	1	0	0	0	0	1	0	10	20
Holodiscus dumosus	0	0	0	1	10	0	0	0	0	0	1	0	0	0
Mahonia repens	0	3	1	0	0	1	0	0	40	0	3	0	1	1
Prunus virginiana	1	20	1	0	3	50	0	1	10	60	1	1	20	20
Rhamnus smithii	0	0	0	0	0	0	0	0	10	1	0	0	0	0
Rhus trilobata	0	0	0	0	0	0	0	3	3	10	1	0	0	0
Ribes inermis	1	0	0	0	1	10	0	0	0	0	1	1	0	20
Symphoricarpos rotundifolius	0	10	0	3	3	1	1	1	20	3	30	1	1	20
GRAMINOIDS														
Poa pratensis	1	0	1	0	1	0	1	3	3	0	20	3	0	1
FORBS														
Descurainia incana	0	0	0	0	0	0	0	0	3	10	1	1	0	1
Geranium richardsonii	50	0	0	0	0	0	0	1	0	0	0	0	0	0

Table 15. Percent canopy cover for FRAN/QUGA, POTR/HELA, POTR/ALIN, and POTR/ACGL deciduous forest plant association in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	FRAN/QUGA	POTR/HELA			POTR/ALIN			POTR/ACGL	
Plot No.	93	93	93	93	93	93	93	93	93
Species	RR08	GK13	GK14	GK30	SS04	DR21	DR22	SS36	GK37
TREES									
Abies lasiocarpa--mature	0	0	0	1	10	0	0	0	0
Fraxinus anomala	30	0	0	0	0	0	0	0	0
Picea engelmannii--mature	0	0	0	0	0	0	10	0	0
Picea pungens--mature	0	0	0	1	0	0	0	10	0
Pinus contorta-mature	0	0	0	0	0	20	0	0	0
Populus tremuloides	0	20	10	20	30	30	20	10	3
SHRUBS									
Quercus gambelii	20	0	0	0	0	0	0	0	0
Acer glabrum	0	0	0	0	0	0	0	13	20
Alnus incana ssp. tenuifolia	0	0	0	0	50	30	60	10	0
Lonicera involucrata	0	1	0	1	0	3	10	3	3
Ribes inermis	0	10	0	2	1	0	10	1	0
Ribes wolfii	0	0	0	0	0	0	0	1	10
Rosa woodsii	0	0	0	1	0	3	10	1	0
Salix bebbiana	0	0	0	3	0	0	20	1	0
Salix drummondiana	0	0	0	10	0	0	3	0	0
Salix monticola	0	0	0	10	0	0	3	0	0
GRAMINOIDS									
Calamagrostis canadensis	0	0	0	0	0	20	20	3	0
Elymus canadensis	0	0	0	0	0	0	10	0	0
Poa pratensis	0	20	3	10	1	0	1	0	0
FORBS									
Heracleum lanatum	0	40	10	1	1	1	3	10	1
Hydrophyllum fendleri	0	30	50	0	1	0	0	0	0
Orthilia secunda	0	0	0	0	0	10	1	0	0
Osmorhiza occidentalis	0	0	30	1	0	0	0	0	0

III.B.3.c. DECIDUOUS ALLUVIAL SHRUBLANDS
(III.B. PALUSTRINE SYSTEM-SCRUB-SHRUB, DECIDUOUS SHRUBLAND)

Alnus incana ssp. *tenuifolia* Series

Thinleaf alder-Red-osier dogwood (*Alnus incana ssp. tenuifolia-Cornus sericea*) plant association
G4SU (ALIN-COSE)
Colorado River Basin--6 stands (93RR28, 93RR41, 93RR42, 93SS50, 93RR23, 93RR36)
Other occurrences: Yampa River Basin--5 stands

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

Environment: This plant association occurs on smaller creeks and upper reaches at elevations between 2075 and 2300 m (6800-7540 ft). It occurs on narrow, rocky banks and benches of small channels and narrow constricted reaches of larger rivers. In the Colorado River drainage several stands were sampled along overflow channels, on narrow channel benches and on small, narrow, shady tributaries between 2000-2480 meters (6560-8160 feet) in elevation.

Vegetation: *Alnus incana ssp. tenuifolia* and *Cornus sericea* dominate a dense, tall shrub overstory. Other shrubs commonly present include *Lonicera involucrata, Rubus idaeus, Amelanchier alnifolia,* and *Salix ssp.* in minor amounts; although in one stand *Salix bebbiana* is abundant. Tree species, if present, are scattered. *Heracleum lanatum, Geum macrophyllum, Rudbeckia laciniata,* and *Aster foliaceus* characterize the rich forb undergrowth. Graminoid cover is usually low.

Soil: Soils associated with this community are highly variable ranging from sandy loam to sandy clay loam, with mottling evident at about 30 cm, and gravel or cobble layers appear at 70-100 cm. Soils are classified as recently buried typic Cryaquolls, sandy typic Cryoborolls, Histisols, typic Cryaquents, loamy to clayey Cryofluvents and fragmental Cryaquents.

Adjacent Riparian Vegetation: *Populus angustifolia-Picea pungens* forests, *Populus angustifolia/Cornus sericea* forests.

Adjacent Upland Vegetation: *Quercus gambelii* and *Amelanchier* shrublands, *Populus tremuloides* woodlands, *Abies lasiocarpa-Picea engelmanii* forests.

Succession/management: *Alnus incana-Cornus sericea* is tolerant of flooding, and *Alnus incana* ssp. *tenuifolia* requires highly aerated ground water that flows through the coarse-textured subsurface soils with which they are commonly associated (Padgett *et al.* 1989). 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 community also occurs on small, shady, high gradient streams. This community is more common on stream borders than floodplains.

Thinleaf alder/Mesic forb (*Alnus incana ssp. tenuifolia*/mesic forb) plant association G2G3 (ALIN/mf)
White River Basin--3 stands (92NL43, 92NL44, 92NL49)
Colorado River Basin--4 stands (93SS29, 93SS33, 93GK49, 93DR10)

Synonymy: *Alnus incana*/mesic forb (Padgett *et al.* 1989). A similar *Alnus incana* community type is described from Montana (Hansen et. al. 1989); however it does not seem to have the same diversity and abundance of forb species.

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

Environment: Along alluvial benches of the North Fork of the White River and one second order tributary to the N. Fork in the north-eastern part of the basin. In the Colorado River Basin this community occurs at 2500-2645 m (8200-8680 ft) in elevation, along on a frequently flooded narrow, steeply incised creeks.

Vegetation: The tall shrub canopy is dominated by alders, with a few *Salix drummondiana* and/or *Salix monticola* stems. The understory is characterized by a tall (1-1.5 meter) forb layer with *Heracleum lanatum, Rudbeckia laciniata,* and *Aconitum columbianum.* Mesic graminoids are present, including *Glyceria grandis*, *Festuca subulata* and *Elymus glaucus.*

Soil: Soil textures range from fine textured clay loams to silt loams with heavy organic component in the upper horizons. Profiles are classified as sandy oxyaquic Cryumbrepts, loamy typic Cryorthents, fragmental (calcareous) Cryaquents and loamy over sandy Typic Cryoboralfs.

Adjacent Riparian Vegetation: *Salix drummondiana* willow carrs, *Picea engelmannii/ Abies lasiocarpa* woodland.

Adjacent Upslope Vegetation: *Picea engelmannii/ Abies lasiocarpa* ; *Populus tremuloides* woodlands.

Succession/management: This plant association may be subject to less fluvial scour and deposition as indicated by the dense forb understory and fine, rich soils (Padgett *et al.* 1989). This community may be a stable sere, but subject to impacts and changes by livestock grazing. 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).

Other *Alnus incana* ssp. *tenuifolia* 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 high water level.

In the Colorado River drainage- One stand (93RR37) in the Colorado River basin has dense *Alnus incana ssp. tenuifolia* and *Salix ligulifolia.* It is a heavily disturbed site. Soils are Fragmental Typic Cyraquents. No similar community types are described in the literature.

River birch/Mesic forb (*Betula occidentalis*/mesic forb) plant association
G2G3SU (BEOC/mf)
Colorado River Basin--3 stands (92NL34, 93RR44, 93GK09)

Synonyms: *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).

Environment: This association occurs at lower montane elevations, 1980-2020 m (6640-6520 ft), on narrow floodplains and in seeps adjacent to the stream channel.

Vegetation: *Betula occidentalis* forms a dense shrub layer. Other shrubs present but not abundant are *Amelanchier utahensis, Cornus sericea, Quercus gambelii* and several *Salix ssp.* Due to the dense shrub canopy, herbaceous growth is limited (< 10%), but forb growth is diverse with *Rudbeckia lacinata, Maianthemum stellatum, Mentha arvense* and *Thalictrum fendleri*, and a few wetland indicator graminoids, such as *Glyceria striata, Carex lanuginosa*, and *Carex utriculata.*

Soil: Sandy clays with mottling, classified as fragmental calcareous lithic Cryorthents, fine-loamy ustic Torrifluvents.

Adjacent riparian vegetation: *Populus tremuloides,* and *Cornus sericea* types.

Adjacent upslope vegetation: *Juniperus osteosperma* woodlands.

Succession/Management: *Betula occidentalis* may be a successional stage for a conifer dominated vegetation type. This species provides shading over the stream, improving fish habitat, and can stabilize stream banks. Because *Betula occidentalis* occupies lower elevation riparian communities than *Alnus incana* ssp. *tenuifolia* and *Cornus sericea*, fewer and fewer stands exist today. Large, near pristine stands of *Populus angustifolia/Cornus sericea--Betula occidentalis* phase, and other *Betula occidentalis* communities are uncommon in on Colorado's west slope.

Red-osier dogwood (*Cornus sericea*) plant association
G3SU (COSE)
White River Basin-- 2 stands (92GK47, 92NL42)
Colorado River Basin--11 stands (93SS08, 93GK33, 93SS35, 93SS07, 93GK03, 93GK20, 93GK47, 93GK10, 93RR31, 93RR43, 93GK29)

Synonyms: *Cornus sericea* Dominance type (Hansen *et al.* 1988). Similar to *Alnus incana-Cornus sericea* plant association (Kittel and Lederer 1993).

Distribution: This plant association is reported from Montana (Hansen *et al* 1988). It is suspected to occur throughout the Rocky Mountains.

Environment: In the White River drainage stands occur on narrow river benches often at the base of cliffs, where the river is confined in its lateral migration. In the Colorado River drainage this community occurs in narrow ravines and on confined terraces 1985-2535 meters (6520-8320 feet) in elevation.

Vegetation: A dense, almost impenetrable layer of 2-3 meters tall *Cornus sericea* (20-90%) characterizes this community type. Other shrubs often present are *Acer glabrum, Alnus incana, Lonicera involucrata,* and *Salix ssp.* (1-10%). *Betula occidentalis* (2-30%) co-dominates in some lower elevation stands. Occasionally scattered trees overtop the shrub layer (< 10%), for example *Populus angustifolia, Picea pungens, and Pseudotsuga menziesii.*

Soils: Fine loamy to coarse-loamy (calcareous) cumulic or pachic Cryoborolls, oxyaquic and mollic Cryorthents, fine clayey Haplustolls, fragmental ustic Torriorthents, and loamy Ustorthents.

Adjacent Riparian Vegetation: *Juniperus scopulorum* and *Pseudotsuga menziesii* woodlands.

Adjacent Upslope Vegetation: *Quercus gambelii*, *Juniperus osteosperma* woodlands, *Picea pungens-Populus tremuloides* forests.

Succession/Management: *Cornus sericea* has a strong root structure and is very good for stabilizing banks. It can re-sprout after burial by fluvial deposition, and following fire. It is believed to form a relatively stable community because of its strong rhizomes and stolons (Hansen *et al.* 1988). Soils in this plant association are often stratified showing recent alluvial deposition. While stabilizing banks, *Cornus sericea* does not provide as good stream-overhanging shade as does river birch or alder (Hansen *et al.* 1988).

Chokecherry (*Prunus virginiana*) plant association
GUSU (PRVI)
Colorado River Basin--3 stands (93RR18, 93RR19 93GK10)

Synonyms: *Prunus virginiana* Dominance Type (Hansen *et al.* 1988). Also similar to *Acer negundo/Prunus virginiana* and *Pinus ponderosa/Prunus virginiana* types (Hansen *et al.* 1989).

Distribution: Similar types are found in Montana (Hansen *et al.* 1988). Reported from Colorado on drier, upland sites.

Environment: Commonly on steep colluvial slopes and drier floodplains between 1980 and 2280 m (6500-7500 ft.) in elevation.

Vegetation: The tree canopy is open (< 10%) and consists of *Pseudotsuga menziesii*, *Acer negundo*, and *Populus angustifolia*. A very dense shrub layer of *Prunus virginiana, Cornus sericea*, and *Amelanchier utahensis* make the stands impenetrable. Graminoid and forb cover is minor.

Soil: Soils were classified as ustic Torriorthents and ardic Ustorthents.

Adjacent riparian vegetation: *Pseudotsuga menziesii* and *Acer negundo* woodlands.

Adjacent upslope vegetation: *Juniperus osteosperma* woodlands, *Amelanchier ssp.* and *Artemisia tridentata* shrublands.

Succession/Management: Without disturbance *Prunus virginiana* becomes quite dense. Grazing and browsing can open up a stand allowing other shrubs to establish (Hansen *et al.* 1988). Presence of *Acer negundo* or *Pseudotsuga menziesii* may indicate the site will become dominated by *Acer negundo* with flooding disturbance, and *Pseudotsuga menziesii* if left undisturbed.

Gambel's oak/Snowberry (*Quercus gambelii/Symphoricarpos rotundifolius*) plant association
G5S3S4 (QUGA/SYRO)
Colorado River Basin--2 stands (93GK04, 93GK08)

Synonyms: *Quercus gambelii/Symphoricarpos oreophilis* (Johnston 1987). Taxonomically *Symphoricarpos oreophilis* has been placed with *S. rotundifolius* (Weber and Wittmann 1992). *Quercus gambelii-Amelanchier utahensis-(Artemisia tridentata-Cercocarpus montanus-Symphoricarpos oreophilis/Carex geyeri* (Baker 1982).

Distribution: This plant association is reported from north central to south western Colorado, central and north western Utah (Johnston 1987).

Environment: It is found in the southwestern portions of the Colorado River Basin in narrow gulches and draws, usually several meters above the active channel.

Vegetation: This plant association consists of almost pure stands of *Quercus gambelii*. Associated shrubs are *Symphoricarpos rotundifolius* and *Prunus virginiana*. Graminoid and forb cover is of minor importance.

Soils: Fine-loamy mesic ardic Ustifluvents or Ustorthents, and fine-loamy mesic xeric Torrifluvents.

Adjacent riparian vegetation: *Artemisia tridentata* shrublands.

Adjacent upslope vegetation: *Juniperus osteosperma* woodlands.

Succession/Management: This plant association appears to be transitional between the oak and sagebrush zones. It is adapted to deep well-drained soils in cool moist sites (Johnston 1987).

Silver buffaloberry/giant wild-rye (*Shepherdia argentea-Leymus cinereus*) plant association
(tentative type) GUSU (SHAR/LECI)
Colorado River Basin--2 stands (93RR34, 93RR45).
Other occurrences: Yampa River Basin--1 stand (91MR35).

Synonyms: This plant association may be similar to the *Populus angustifolia/Salix ligulifolia-Shepherdia argentea* type that Baker (1989) describes from the Uncompahgre River. However, our relict stands have no *Populus angustifolia*, and similar but smaller isolated stands further upstream on the Little Snake River rarely have *Populus ssp.* associated with them. Near the Wyoming border, however, cottonwood trees become more frequent, and it may be that historically the plant association was a cottonwood dominated riparian woodland. More study is needed from Wyoming to verify the relationship of this plant association to that described previously by Baker.

Distribution: Not reported outside Colorado. See discussion under synonyms, above. In the Yampa River Basin we found this type only along the Little Snake River in Moffat county at an elevation of 1915 m (6280 ft). Along the Colorado River we observed several small but dense patches.

Environment: This relic community occurs on moderate to wide floodplains below 1980 m (6500 ft) in elevation.

Vegetation: *Shepherdia argentea* dominates the dense, but patchy, tall shrub layer in this vegetation type. Associated shrubs include *Artemisia tridentata* and *Chrysothamnus linifolius*. The undergrowth is also patchy with a heavy litter layer between clumps of the large bunch grass *Leymus cinereus*. Few other forbs or graminoids are present.

Soils: Loamy (calcareous) aeric Halaquepts or Cryaquepts, to fragmental (calcareous) lithic Cryorthents.

Adjacent riparian vegetation: *Iva axillaris* and *Distichlis spicata* meadows in the Yampa Basin, *Eleocharis palustris* wetlands along the Colorado River.

Adjacent upland vegetation: *Artemisia tridentata, Sarcobatus vermiculatus* shrublands in the Yampa River Basin. *Juniperus osteosperma* and *Pseudotsuga menziesii* woodlands in the Colorado River Basin.

Succession/management: More information is needed about the historical range of *Shepherdia argentea*, requirements for regeneration, and moisture tolerance/needs. It was probably more widespread, but is now being replaced by Russian olive. *Shepherdia* is apparently widespread in Montana, and is considered a disturbance increaser (Hansen *et al.*

1988). In Colorado it is an uncommon riparian shrub, and may be on the decline with the loss of lower elevation riparian habitats.

Booths willow/Beaked sedge (*Salix boothii/Carex utriculata*) plant association
G5SU (SABO/CARO)
White--1 stand (92GK18)

Synonyms: *Salix boothii/Carex utriculata* (Padgett *et al.* 1989, Youngblood *et al.* 1985, and Kittel and Lederer 1993).

Distribution: This plant association is found in north western Wyoming, central Utah, and north western Colorado (Padgett *et al.* 1989, Youngblood *et al.* 1985, and Kittel and Lederer 1993).

Environment: The one stand sampled along Coal Creek was adjacent to beaver ponds, and had saturated soils. The site was heavily disturbed by recent housing development and the hydrology may be altered by man-made ponds and a driveway-bridge crossing the creek.

Vegetation: The tall shrub layer consists of *Salix boothii* with a few stems of *Salix lasiandra* and *Salix monticola.* The saturated soils support a dense graminoid layer, dominated by *Carex utriculata, Carex lanuginosa,* and *Juncus balticus.* Characteristic mesic grass species are also present including *Glyceria grandis* and *Alopecurus acqualis.*

Soil: Sandy clay loam to clay loam with a buried A horizon.

Adjacent riparian vegetation: *Alnus incana* ssp. *tenuifolia* and *Salix drummondiana* shrublands, Conifer woodlands, *Carex ssp.* meadows.

Adjacent upland vegetation: Mixed conifer-*Populus tremuloides* forests, *Populus tremuloides* forests, *Artemisia tridentata* scrub.

Succession/Management: *Salix boothii* appears to grow on mesic sites that are neither saturated nor totally dry throughout the growing season (Padgett *et al.* 1989). 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). Where these willow species occur together, *Salix geyeriana* may be preferentially browsed over *Salix boothii* and *Salix drummondiana* (Hansen *et al.* 1989).

Booths willow/mesic forb (*Salix boothii*/mesic forb) plant association
G3?SU (SABO/mf)
White--6 stands (92NL51, 92NL53, 92NL40, 92NL45, 92NL59, 92NL55)

Synonyms: *Salix boothii-Salix geyeriana-Salix lasiandra* var. *caudata* (CNHP 1993). Padgett *et al.* (1989) *Salix boothii*/mesic forb and Youngblood *et al.*'s (1985) *Salix boothii/Smilacina stellata* types. May be similar to stands dominated by *Salix boothii* included in the *Salix geyeriana/Poa pratensis* type described by Hansen *et al.* (1989)

Distribution: Similar types (listed above) occur in eastern Idaho and western Wyoming. This type was previously reported in Colorado from Routt county, in the upper Yampa valley (CNHP 1993).

Environment: This plant association occurs between 2315-2560 m (7600-8400 ft) in elevation, in sunny, medium to broad valleys along low gradient (1-2%) streams, usually within half a meter of the water table, but occasionally on low terraces.

Vegetation: *Salix boothii* forms large continuous shrublands ranging from 40% to over 80% canopy cover. *Salix drummondiana* is often co-dominant with cover ranging from 1 to 80%. Other shrubs present are shaded by the willow canopy, and include *Ribes inerme, Lonicera involucrata* and *Alnus incana* ssp. *tenuifolia.* The undergrowth is characterized by a sparse to lush forb layer, including *Achillea millefolium, Fragaria virginiana, Galium boreale, Geranium richardsonii, Maianthemum stellata,* and *Geum macrophyllum.* We chose the understory name "mesic forbs" to emphasize that no one species dominates that layer.

Soil: Soils are highly stratified, alternating sandy loams with clay loams, and commonly have mottling within top 10 cm.

Adjacent riparian vegetation: *Alnus incana* ssp. *tenuifolia* and *Salix drummondiana* shrublands, Conifer woodlands, *Carex* spp. meadows.

Adjacent upland vegetation: Mixed conifer-*Populus tremuloides* forests, *Populus tremuloides* forests, *Artemisia tridentata* scrub.

Succession/Management: *Salix boothii* appears to grow on mesic sites that are neither saturated nor dry throughout the growing season (Padgett *et al.* 1989). 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* and *Salix drummondiana* (Hansen *et al.* 1989).

Other *Salix boothii* stands :
In the White River Basin two *Salix boothii* stands (92GK15 and 92NL42) do not fit into the *S. boothii*/mesic forb community. One stand is surrounded by a hay meadow pasture converted to introduced European grasses and is managed for hay production and sheep grazing. *Salix monticola* and *Alnus incana* co-dominate the tall shrub layer with *Salix boothii*. The dense forb understory covers the ground with *Heracleum lanatum*. The other stand has high abundance of *Cornus sericea* and occurs adjacent to a *Picea pungens* and *Abies lasiocarpa* stream-side community.

Drummond's willow/mesic forb (*Salix drummondiana*/mesic forb) plant association
G3S3 (SADR/mf)
White River Basin--4 stands (92GK16, 92NL62, 92NL52, 92NL48)
Colorado River Basin--16 stands (93SS04, 92SS10, 93SS37, 93SS39, 93SS40, 93DR02, 93DR06, 93DR19, 93RR24, 93RR25, 93GK26, 93GK27, 93GK35, 93GK39, 93GK40, 93GK41)
Other occurrences: San Miguel/Dolores River Basin-- 1 stand

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

Distribution: This plant association occurs in Idaho and Utah (Baker 1989, Padgett *et al.* 1989). In Colorado it was 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).

Environment: This type occurs at mid to high elevations, 2380-2650 m (7800-8700 ft), and tends to occur on steeper gradient streams (2-4%), in narrow valleys (60-100 meters). It is a major type in the Colorado River Basin along narrow, steep, V-shaped valleys, commonly in the in the spruce-fir zone 2540-3130 m (8320-10,280 ft) in elevation.

Vegetation: The tall shrub layer consists of dense *Salix drummondiana* with *Salix exigua* and one or two *Alnus incana ssp. tenuifolia* on cobble and gravel point bars and floodplains. Along steep narrow first order streams, *Salix drummondiana, Alnus incana,* and *Lonicera involucrata* occur as a narrow band between the stream channel and the adjacent subalpine fir or lodgepole forests. Sparse to rich diversity of forbs, between 4 and 40 species usually including *Mertensia ciliata, Heracleum lanatum, Geranium richardsonii.*

Soil: Soils were often shallow silty clay loams to sandy clay loams over coarse angular cobbles. These were classified as typic and oxyaquic Cryorthents, pachic and typic Cryofluvents, histic and typic Cryaquents, and pachic and typic Cryoborolls.

Adjacent Riparian Vegetation: *Salix monticola* shrublands, *Picea engelmannii/ Abies lasiocarps* forests, more *Salix drummondiana.*

Adjacent Upland vegetation: *Picea engelmannii/ Abies lasiocarpa, Populus tremuloides,* or *Pinus contorta* forests, dry upland meadows.

Succession/management: *Salix drummondiana*/mesic forb community can occur as a narrow

strip between the stream channel and the adjacent forest. It also occurs where the stream channel gradient increases, for example, immediately downstream of a beaver dam. Alders often line the stream edge where *Salix drummondiana* occurs as a wide shrubland community. 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.

Coyote Willow/barren ground (*Salix exigua*/barren ground) plant association
G5S5 (SAEX/barren)
White River Basin--3 stands (92GK02, 92GK03, 92NL08)
Colorado River Basin--5 stands (93RR29, 93RR30, 93RR33, 93RR47, 93RR50)
Other occurrences: Yampa River Basin--4 stands

Synonyms: *Salix exigua*/barren (Padgett *et al.* 1989). Probably very similar to *Salix exigua* plant association (Reid and Bourgeron 1991) and *Salix exigua-Salix* spp./*Poa* spp. (Johnston 1987).

Distribution: This type is reported from the higher elevations of Utah, eastern Idaho, and western Wyoming (Padgett *et al.* 1989 and Youngblood *et al.* 1985). In Colorado a similar community is reported from the eastern plains (Baker 1984, Johnston 1987). On Colorado's western slope it is found in the Yampa, San Miguel, Dolores, and Colorado River drainages, and is expected to occur throughout the state (Kittel and Lederer 1993).

Environment: In the White River Basin it occurs primarily below 2000 m (6560 ft). In the Colorado River Basin we sampled this plant association between 1920 and 2085 m (6300-6840 ft) and observed it at much lower elevations 1525 m (5000 ft). It commonly occurs on cobble point bars and stream channel edges that are annually flooded, even in drier years.

Vegetation: *Salix exigua* forms a dense, multi-stemmed canopy about 1-2 meters tall. Forb and graminoid cover is usually very low, with mostly bare ground and cobbles underneath.

Soil: Stratified sand/loam/clay, classified as Cryorthents, oxyaquic Cryorthents, typic Cryaquents, typic Cryopsamments, and oxyaquic Cryofluvents.

Adjacent Riparian Vegetation: Highly variable because this community is so wide ranging. On the Colorado River: *Populus angustifolia* and *Juniperus scopulorum* woodlands.

Adjacent Upslope Vegetation: *Juniperus osteosperma* woodlands, *Artemisia tridentata* and *Sarcobatus vermiculatus* scrub.

Succession/Management: This plant association represents one of the most common early seral riparian communities in Colorado. *Salix exigua* is a good colonizer and stream bank stabilizer. It can withstand flooding by lying flat and then bouncing back upright. 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, providing a protected seed bed for a number of tree species. Presence of *Populus angustifolia* seedlings and saplings within this plant association may indicate succession to a cottonwood community, if scouring flows do not occur in subsequent years.

Rocky Mountain willow/Bluejoint reedgrass (*Salix monticola/Calamagrostis canadensis*) plant association
GUSU (SAMO/CACA)
Colorado--2 stands (93SS42, 93DR09)
Other occurrences: Front Range--9 stands

Synonyms: *Salix monticola/Calamagrostis canadensis* (Cooper and Cottrell 1990). May also be similar to *Salix drummondiana-Salix monticola/Calamagrostis canadensis-Carex utriculata* (Baker 1989). May be related to *Salix monticola-Salix geyeriana/mesic forb* from the San Miguel (Kittel and Lederer 1993), except that in the Colorado stands, *Calamagrostis canadensis* is much more abundant.

Distribution: Reported from Colorado Front Range and a few scattered locations above 2135 m (7000 ft) on the western slope. Not reported outside of Colorado.

Environment: This community occurs on flat broad floodplains (300 m), are not usually with beaver ponds.

Vegetation: This plant association is characterized by a dense, nearly impenetrable, shrub layer of *Salix monticola* (50%) and *Salix geyeriana* (10%). Other shrubs present include *Salix lucida* ssp. *lasiandra* (up to 30%), *Betula glandulosa, Salix planifolia,* (<5%) and *Salix wolfii* (<5%). *Calamagrostis canadensis* comprises a dense graminoid layer of 40-50% cover. Forb cover is diverse with up to 30 to 40 species within 600-1000 m^2, with total cover ranging from 10-50%. Common species include *Geum macrophyllum, Solidago canadensis, Senecio biglovii*, and *Galium boreale.*

Soils: Soil textures are silty loams over sand and coarse sand; both sites have mottling at 20-40 cm depth. Soils were classified as fluventic Cryoborolls and oxyaquic Cryorthents.

Adjacent Riparian Vegetation: Other *Salix* spp. shrublands, open meadows.

Adjacent Upslope Vegetation: Spruce-fir forests, *Pinus contorta* forests.

Succession/Management: Presence of dying conifer trees may indicate an increase in the water table due to decreased transpiration rates, allowing for expansion of *Calamagrostis canadensis* and conversion from a Conifer/*Calamagrostis canadensis* type to a *Salix monticola/Calamagrostis canadensis* association (Padgett *et al.* 1989).

Rocky Mountain willow/Beaked sedge (*Salix monticola/Carex utriculata*) plant association
G5SU (SAMO/CAUT)
Colorado River Basin--6 stands (93SS05, 93RR53, 93GK31, 93SS28, 93GK34, 93RR12)

Synonyms: 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 central region, within the Colorado River Basin.

Environment: This type occurs on flat floodplains and stream margins with a saturated soil surface or shallow water table, at about 2525-2680 m (8320-8800 ft) in elevation.

Vegetation: This plant association is characterized by a thick, closed willow canopy dominated by *Salix monticola* (30-70%), with *Salix drummondiana*, *S. geyeriana*, and *Lonicera involucrata* also present (1-10%). *Carex utriculata* usually dominates the understory (20%). The forb layer is rich with 15-30 species within 1000 m^2, and commonly includes such species as *Heracleum lanatum, Geum macrophyllum, Senecio triangularis,* and *Mimulus guttatus*.

Soils: Soil textures are predominantly heavy silty clays with occasional mottling evident. Some profiles have buried organic layers. Soils were classified as oxyaquic Ustorthents, typic Cryaquents, oxyaquic Cryofluvents, cumulic and histic Cryaquolls, and pachic Cryoborolls.

Adjacent Riparian Vegetation: *Alnus incana* ssp. *tenuifolia* shrublands and *Picea pungens* forests.

Adjacent Upslope Vegetation: Conifer mixed with *Populus tremuloides* forest, *Artemisia tridentata* scrub.

Succession/management: This plant association occupies sites usually influenced by beaver ponds. Padgett's theory (Padgett *et al.* 1989) is that with a rising water table, *Carex utriculata* can establish on newly saturated substrates. They maintain that the willows may have occupied the site prior to beaver moving in, and manage to persist under the new water regime. 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.

Rocky Mountain willow/mesic forbs (*Salix monticola*/mesic forb) plant association
G3SU (SAMO/mf)
White River Basin--4 stands (92NL11, 92NL50, 92NL46, 92NL10)
Colorado River Basin--6 stands (93SS16, 93RR52, 93GK38, 93DR18, 93GK12, 93DR11)

Synonym: 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* community that included *Salix monticola* in the species list. Another similar community may be *Salix geyeriana-Salix* spp./*Calamagrostis canadensis* (Johnston 1987). Our stands may be similar to some stands included in *Salix monticola/Calamagrostis canadensis* or *Salix drummondiana/Mertensia ciliata* communities 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). Appears to be common in north-central Colorado.

Environment: In central Colorado, it is found between 2725 and 3255 m (8950-10680 ft) in elevation, in moderate to wide subalpine valleys and along narrow channels at lower elevations.

Vegetation: *Salix monticola* creates an open to scattered canopy over very diverse and rich forb cover. Other willows present are *Salix brachycarpa*, *Salix planifolia,* and *Salix drummondiana*. No single forb species is dominant or abundant, most occur with less than 1% cover, however total forb cover ranges from 10-40%, and is species rich with 19 to 40 species within 1000 m^2.

Soil: Textures are predominantly silty clays to sandy clay loam. Soils are classified as Cryofluvents and Cryorthents.

Succession/Management: The *Salix monticola/* mesic forbs community appears stable, occurring in mesic conditions that support a rich diversity of forbs. It may be transitional between the higher, more saturated subalpine sites and the wider montane area where *Salix monticola* becomes abundant. Season long (2-3 month) grazing will further open the canopy and allow more sunlight to reach the ground, drying the site. In two heavily grazed stands we found forb diversity much reduced and the understory dominated by *Poa pratensis* or *Urtica dioica*.

Table 16. Percent canopy cover for SABO/MF, SABO/CAUT, AND SADR/MF alluvial shrubland plant association in the White River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	SABO/MF						SABO/CAUT	UNCL	SADR/MF			
Plot No.	92	92	92	92	92	92	92	92	92			
Species	NL51	NL53	NL40	NL45	NL59	NL55	GK18	GK15	NL52	NL48	GK16	NL62
TREES												
Abies lasiocarpa	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	10.0	1.0
Alnus incana	1.0	0.0	1.0	0.0	3.0	0.0	1.0	30.0	10.0	3.0	20.0	10.0
SHRUBS												
Potentilla fruticosa	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0
Salix boothii	0.0	80.0	20.0	20.0	40.0	30.0	30.0	40.0	0.0	0.0	0.0	0.0
Salix drummondiana	80.0	1.0	60.0	80.0	40.0	20.0	0.0	0.0	70.0	80.0	30.0	40.0
Salix exigua	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0
Salix monticola	0.0	0.0	0.0	0.0	1.0	0.0	10.0	20.0	0.0	0.0	0.0	0.0
Salix wolfii	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0
GRAMINOIDS												
Equisetum arvense	3.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0	10.0	10.0
Bromus inermis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0
Carex lanuginosa	0.0	1.0	0.0	0.0	0.0	0.0	30.0	0.0	0.0	0.0	0.0	0.0
Carex utriculata	0.0	0.0	1.0	0.0	1.0	0.0	40.0	1.0	0.0	0.0	0.0	0.0
Elymus glaucus	1.0	3.0	3.0	0.0	3.0	0.0	0.0	0.0	10.0	3.0	0.0	3.0
Festuca subulata	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0
Glyceria grandis	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	1.0	0.0
Juncus balticus	0.0	0.0	0.0	0.0	0.0	0.0	10.0	10.0	0.0	0.0	0.0	0.0
Phleum pratense	3.0	3.0	1.0	1.0	0.0	0.0	0.0	10.0	3.0	1.0	0.0	1.0
Poa pratensis	3.0	1.0	10.0	1.0	0.0	1.0	1.0	10.0	3.0	1.0	3.0	1.0
Scirpus microcarpus	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0
FORBS												
Geranium richardsonii	3.0	10.0	3.0	1.0	3.0	3.0	3.0	3.0	3.0	3.0	10.0	3.0
Heracleum lanatum	3.0	10.0	3.0	3.0	3.0	1.0	3.0	40.0	3.0	3.0	3.0	3.0
Melilotus officinalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0
Osmorhiza depauperata	1.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	10.0	1.0
Rudbeckia laciniata	3.0	0.0	0.0	3.0	3.0	0.0	3.0	20.0	3.0	0.0	1.0	3.0
Thalictrum sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	10.0	0.0
Viola canadensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	1.0

Table 17. Percent canopy cover for SAMO/MF and SAEX/BARREN alluvial shrubland plant association in the White River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	SAMO/MF			Uncl	SAEX/BARREN		
Plot No.	92	92	92	92	92	92	92
Species	NL46	NL50	NL11	NL10	GK02	GK03	NL08
TREES							
Acer negundo	0.0	0.0	0.0	0.0	10.0	20.0	1.0
SHRUBS							
Alnus incana ssp. tenuifolia	20.0	0.0	0.0	0.0	0.0	0.0	0.0
Chrysothamnus nauseosus	0.0	0.0	0.0	0.0	10.0	0.0	0.0
Cornus sericea	3.0	0.0	0.0	0.0	0.0	0.0	10.0
Ribes inerme	1.0	0.0	20.0	0.0	0.0	0.0	0.0
Rosa woodsii	3.0	0.0	0.0	0.0	10.0	3.0	10.0
Salix drummondiana	50.0	40.0	20.0	0.0	0.0	0.0	0.0
Salix exigua	0.0	0.0	0.0	0.0	80.0	80.0	70.0
Salix monticola	20.0	10.0	20.0	80.0	0.0	0.0	0.0
GRAMINOIDS							
Agropyron sp.	0.0	1.0	0.0	0.0	0.0	50.0	0.0
Bromus porteri	0.0	1.0	0.0	10.0	0.0	0.0	0.0
Carex utriculata	0.0	20.0	0.0	0.0	0.0	0.0	10.0
Dactylis glomerata	1.0	0.0	0.0	0.0	10.0	1.0	0.0
Elytrigia repens	0.0	0.0	0.0	0.0	70.0	0.0	0.0
Phalaris arundinacea	0.0	0.0	0.0	0.0	0.0	0.0	10.0
Phleum pratense	10.0	1.0	0.0	0.0	0.0	0.0	0.0
Poa pratensis	3.0	1.0	20.0	20.0	20.0	20.0	3.0
FORBS							
Cirsium sp.	3.0	1.0	0.0	0.0	1.0	10.0	1.0
Cynoglossum officinale	0.0	0.0	0.0	0.0	1.0	10.0	0.0
Geum macrophyllum	1.0	1.0	10.0	0.0	0.0	0.0	0.0
Melilotus officinalis	0.0	0.0	0.0	0.0	20.0	1.0	0.0
Mertensia ciliata	0.0	1.0	20.0	1.0	0.0	0.0	0.0
Maianthemum stellata	1.0	0.0	10.0	0.0	0.0	0.0	3.0
Solidago serotinoides	0.0	0.0	0.0	0.0	0.0	0.0	10.0
Urtica dioica ssp. gracilis	1.0	1.0	3.0	50.0	0.0	0.0	0.0

Table 18. Percent canopy cover for ALIN-COSE, ALIN/MF, and BEOC/MF alluvial shrubland plant association in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	ALIN-COSE						ALIN/MF				Uncl	BEOC/MF	
Plot No.	93	93	93	93	93	93	93	93	93	93	93	93	93
Species	RR28	RR41	RR42	SS50	RR23	RR36	SS29	SS33	GK49	DR10	RR37	RR44	GK09
TREES													
Juniperus scopulorum	3	30	0	0	0	1	0	0	0	0	0	3	0
Pseudotsuga menziesii	0	0	3	10	0	0	0	0	0	0	0	0	1
Quercus gambelii	0	0	0	0	0	0	0	0	0	0	0	0	20
SHRUBS													
Alnus incana	60	40	30	10	20	40	20	30	20	20	40	10	0
Amelanchier utahensis	0	0	1	1	0	0	1	0	0	0	0	0	20
Betula occidentalis	3	3	0	0	0	20	0	0	0	0	1	50	30
Cornus sericea	40	60	70	30	30	10	0	0	0	0	1	1	0
Ribes inerme	0	0	0	3	0	0	3	0	10	0	0	0	0
Rosa woodsii	1	0	1	3	0	0	1	1	1	3	0	1	10
Salix drummondiana	0	0	0	10	0	0	10	0	1	0	0	0	0
Salix exigua	10	3	1	0	0	1	0	0	0	1	10	1	0
Salix ligulifolia	0	0	0	0	0	3	0	0	1	0	40	1	0
Salix lucida *ssp.* caudata	0	0	0	0	0	0	10	0	0	0	0	0	0
Symphoricarpos rotundifolius	0	0	1	1	0	0	1	0	1	0	0	0	10
GRAMINOIDS													
Agrostis gigantea	0	0	0	0	0	3	0	0	0	0	10	0	0
Calamagrostis canadensis	0	0	0	3	0	0	10	0	3	0	0	1	0
Phalaris arundinacea	0	0	0	0	0	10	0	0	0	0	1	0	0
[illegible]a pratensis	3	0	0	1	0	3	3	0	1	1	10	0	3
FORBS													
Heracleum lanatum	0	0	0	1	3	1	10	1	3	0	1	1	0
Senecio triangularis	0	0	0	0	3	0	1	10	0	0	0	0	0
Solidago canadensis	0	0	0	0	0	1	1	0	0	30	0	0	0

Table 19. Percent canopy cover of COSE alluvial shrubland plant association in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definintion.

Plant association	COSE										
Plot No.	93	93	93	93	93	93	93	93	93	93	93
Species	SS08	GK33	SS35	SS07	GK03	GK20	GK47	GK10	RR31	RR43	GK29
TREES											
Abies lasiocarpa--mature	10	0	0	0	0	0	0	0	0	0	0
Acer negundo--saplings	0	0	0	0	0	0	0	0	0	0	30
Picea pungens--mature	10	0	0	3	0	0	10	0	0	0	20
Picea pungens--saplings	1	0	0	10	0	0	1	0	0	0	0
Populus angustifolia--mature	0	0	0	0	0	20	1	0	0	0	0
Populus tremuloides	0	1	0	1	0	0	0	20	0	0	0
Pseudotsuga menziesii--mature	0	0	1	0	0	0	1	0	0	0	10
SHRUBS											
Acer glabrum	20	3	1	10	0	0	0	0	0	0	1
Alnus incana ssp. tenuifolia	0	0	10	0	0	0	1	0	1	0	0
Betula occidentalis	0	0	3	0	20	20	30	0	0	3	0
Cornus sericea	20	30	20	60	50	80	70	90	60	30	30
Prunus virginiana	0	3	10	0	1	10	0	0	0	0	0
Rhus trilobata	0	0	10	0	0	0	1	0	0	1	0
Ribes inerme	10	1	0	1	0	3	0	0	0	0	3
Rosa woodsii	0	1	1	1	3	10	1	0	1	1	0
Salix drummondiana	3	3	0	10	0	0	0	0	0	0	0
Salix exigua	0	0	3	0	10	0	0	0	1	40	0
Symphoricarpos rotundifolius	0	10	0	1	3	1	1	1	0	0	1
GRAMINOIDS											
Poa pratensis	2	10	0	0	1	0	0	0	1	1	0
Equisetum hyemale	0	0	0	0	0	0	20	0	40	0	0
FORBS											
Clematis ligusticifolia	0	0	30	0	0	0	0	0	0	1	0
Heracleum lanatum	1	10	0	0	0	0	0	0	0	0	0
Urtica dioica ssp. gracilis	0	10	0	0	1	1	0	0	0	0	0

Table 20. Percent canopy cover for PRVI, QUGA/SYRO, and SHAR/LECI alluvial shrubland plant association in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant associations	PRVI	QUGA/SYRO		SHAR/LECI	
Plot No.	93	93	93	93	93
Species	RR18	GK04	GK08	RR34	RR45
SHRUBS					
Quercus gambelii	1	95	80	0	0
Cornus sericea	40	0	0	0	30
Prunus virginiana	40	3	1	0	1
Shepherdia argentea	0	0	0	60	70
Symphoricarpos rotundifolius	0	40	50	0	3
FORBS					
Maianthemum stellatum	0	0	10	10	0
Rudbeckia lacinata var. ampla	0	0	0	10	0
Thlaspi montanum	0	0	10	3	0

Table 21. Percent canopy cover for SADR/MF alluvial shrubland plant association in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definition.

Plant association	SADR/MF															
Plot No.	93 SS	93 SS	93 SS	93 SS	93 SS	93 DR	93 DR	93 DR	93 RR	93 RR	93 GK	93 GK	93 GK	93 GK	93 GK	93 GK
Species	04	10	37	39	40	02	06	19	24	25	26	27	35	39	40	41
TREES																
Abies lasiocarpa	0	0	0	0	0	0	0	3	0	0	0	10	0	0	3	0
Picea engelmannii	0	0	0	0	0	0	0	0	0	30	0	10	0	1	10	0
Picea engelmannii (saplings)	1	0	0	0	0	0	1	0	0	3	0	1	0	0	10	0
Picea pungens	0	0	0	1	0	1	0	10	0	0	0	0	0	0	0	0
Picea pungens (seedlings)	0	0	0	3	0	1	10	3	0	0	0	0	0	0	0	0
SHRUBS																
Lonicera involucrata	1	3	3	3	1	3	0	10	0	0	1	10	10	1	10	0
Ribes inerme	1	0	0	1	1	0	0	20	0	0	1	3	0	3	3	0
Ribes wolfii	1	0	0	3	0	0	0	0	0	0	0	10	0	0	20	0
Salix bebbiana	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0
Salix drummondiana	80	40	20	20	40	80	40	60	60	30	80	30	80	50	30	90
Salix geyeriana	0	0	0	0	0	0	0	10	0	0	0	0	1	0	0	0
Salix ligulifolia	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
Salix lucida ssp. caudata	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
Salix monticola	0	0	10	0	0	1	0	0	0	0	3	1	1	10	1	0
Salix planifolia	0	0	10	0	0	0	0	0	0	20	0	0	0	0	0	0
Sambucus racemosa	0	0	0	3	3	1	0	0	0	0	0	0	1	0	10	3
GRAMINOIDS																
Agrostis gigantea	0	1	20	0	0	0	0	0	0	0	0	0	0	0	0	0
Calamagrostis canadensis	0	3	0	10	1	1	0	10	0	0	0	0	0	0	0	0
Carex sp.	0	0	0	1	0	1	1	10	1	0	0	0	0	1	0	0
FORBS																
Aconitum columbianum	1	1	0	0	0	0	0	20	0	0	0	0	1	1	0	0
Cardamine cordifolia	3	1	3	30	1	3	3	10	1	0	1	1	0	1	3	1
Delphinium barbeyi	0	0	0	0	0	0	0	0	0	0	30	0	0	1	0	0
Geranium richardsonii	1	1	1	20	1	3	0	3	1	0	0	1	1	1	1	3
Heracleum lanatum	3	1	0	0	30	10	0	20	3	3	40	3	1	1	1	1
Ligusticum porteri	0	0	0	0	0	0	0	0	0	0	10	0	1	10	0	1
Mertensia ciliata	3	0	1	1	0	10	1	10	1	3	20	3	0	3	3	30
Osmorhiza occidentalis	0	0	0	0	0	0	0	0	0	0	1	10	0	1	0	1

Table 22. Percent canopy cover for SAEX/BARREN and SAMO/CACA alluvial shrubland plant association in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	SAEX/BARREN					SAMO/CACA	
Plot No.	93	93	93	93	93	93	93
Species	RR29	RR30	RR33	RR47	RR50	SS42	DR09
TREES							
Juniperus scopulorum--saplings	0	10	0	0	0	0	0
Pinus contorta--saplings	0	0	0	0	0	0	10
Pinus contorta-mature	0	0	0	0	0	0	30
SHRUBS							
Lonicera involucrata	0	0	0	0	0	10	1
Salix boothii	0	0	0	0	0	0	10
Salix exigua	60	70	80	80	90	0	0
Salix geyeriana	0	0	0	0	0	10	10
Salix lucida ssp. lasiandra	0	0	0	0	0	0	
30							
Salix monticola	0	0	0	0	0	40	30
GRAMINOIDS							
Calamagrostis canadensis	0	0	0	0	0	50	40
Carex sp.	0	0	10	1	0	0	0
Solidago canadensis	0	0	0	0	0	20	1

Table 23. Percent canopy cover for SAMO/CAUT and SAMO/MF alluvial shrubland in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant associations	SAMO/CAUT					SAMO/MF						
Plot no.	93	93	93	93	93	93	93	93	93	93	93	93
Species	SS05	RR53	GK31	GK34	RR12	SS16	RR52	GK38	DR18	GK12	DR11	SS28
TREES												
Picea engelmannii--mature	0	0	0	0	0	0	1	0	10	0	0	1
Picea engelmannii--seedlings	0	0	0	0	0	10	1	0	1	0	0	0
Picea pungens--seedlings	0	0	0	0	0	0	0	0	10	0	0	1
SHRUBS												
Lonicera involucrata	3	0	1	1	0	1	3	1	3	20	1	1
Ribes inerme	1	0	1	1	3	0	0	1	0	70	1	0
Salix brachycarpa	0	0	0	0	0	10	0	20	10	0	0	0
Salix drummondiana	0	0	3	0	10	10	10	0	1	0	0	0
Salix geyeriana	0	0	0	20	0	0	0	0	0	0	30	40
Salix monticola	60	50	40	30	70	4	20	30	10	90	20	40
Salix planifolia ssp. planifolia	0	0	0	0	0	10	0	1	3	0	0	1
GRAMINOIDS												
Bromus canadensis	0	0	0	0	0	0	0	0	20	0	0	0
Carex aquatilis	0	0	0	0	0	10	0	1	0	0	0	1
Carex geyeri	0	0	0	0	0	0	0	0	10	0	0	0
Carex microptera	0	0	0	0	10	0	0	0	0	1	0	0
Carex sp.	0	0	1	0	20	1	0	0	0	0	1	1
Carex utriculata	20	10	20	20	0	0	0	0	0	0	0	1
Elymus glaucus	0	0	10	0	0	0	0	0	0	0	0	0
Phleum pratense	0	0	0	0	0	0	0	0	0	0	30	1
Poa pratensis	1	0	3	1	0	0	0	0	1	30	50	1
Trisetum wolfii	1	0	0	0	0	3	0	0	10	0	0	0
Equisetum arvense	3	1	1	1	0	10	0	0	1	0	0	1

III.B.3.d. DECIDUOUS PEAT SHRUBLANDS
(III.B. PALUSTRINE SYSTEM-SCRUB-SHRUB, DECIDUOUS SHRUBLAND)

Salix brachycarpa Series

Barren-ground willow/mesic forb (*Salix brachycarpa*/mesic forb) plant association
GUSU (SABR/mf)
White River Basin-- 1 stand (92GK40)
Colorado River Basin--2 stands (93RR27, 93DR03)

Synonyms: Similar to *Salix planifolia-Salix wolfii/Caltha leptosepala-Carex aquatilis* (Baker 1989), our stands have much higher cover of *Salix brachycarpa*; *Salix wolfii/Deschampsia cespitosa* (Johnston 1987). While our stands did not have *Deschampsia cespitosa,* this is the only willow community described by Johnston that includes *Salix brachycarpa.*

Distribution: Similar types (listed above) are known from western Wyoming and Utah (Johnston 1987 and Padgett *et al.* 1989). In Colorado it is often reported as part of a *Salix planifolia-Salix brachycarpa* mixed type, known 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). In the White and Colorado River Basin it occurs on the Flat Top Plateau and in the Mosquito Range, near the Continental Divide.

Environment: *Salix brachycarpa* occurs in subalpine, glaciated basins above 2950 m (9680 ft) in elevation. This community occupies elevated hummocks and drier side slopes, often surrounding wetter low areas with *Salix planifolia* communities.

Soil: Soil textures range from sandy clay loams to fine sandy loams. Profiles were classified as typic Cryaquolls and Cryorthents.

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 lower, poorly drained areas, and the two species intermix at the ecotone between these micro-sites. *Deschampsia cespitosa, Caltha leptosepala, Pseudocymopterus montanus* and *Senecio triangularis* 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, *Carex aquatilis* meadows.

Adjacent upland vegetation: *Picea engelmannii/ Abies lasiocarpa* 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.

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.

Geyer willow/Bluejoint reedgrass (*Salix geyeriana/Calamagrostis canadensis*) plant association
G5S2S3 (SAGE/CACA)
Colorado River Basin--6 stands (93SS22, 93SS23, 93SS25, 93DR07, 93SS18, 93DR04)

Synonyms: *Salix geyeriana-Salix monticola/Calamagrostis canadensis* (Reid and Bourgeron 1991), *Salix geyeriana-Salix spp./Calamagrostis canadensis* (Johnston 1987), *Salix geyeriana/Calamagrostis canadensis* (Padgett *et al.* 1989, Youngblood *et al.* 1985).

Distribution: This type is reported from northern Wyoming to eastern Idaho, and northern Colorado south to the Gunnison River Basin (Johnston 1987). In the Colorado River Basin we found this plant association in Grand county,

Environment: This community occurs in the wide Kawuneeche Valley where the Colorado River is sinuous and of low gradient (8%) and in similar settings nearby at 2500-2800 m (8190-9200 ft) in elevation.

Vegetation: This plant association has a tall, almost closed canopy of *Salix geyeriana* with a dense graminoid understory dominated by *Calamagrostis canadensis* and occasionally *Carex aquatilis*, or *Carex utriculata*. The forb layer is quite diverse, averaging about 30 species. Two sites were heavily grazed and were dominated by *Poa pratensis* and *Agrostis gigantea*.

Soils: Fine silty clayey loams and organic matter characterize soil textures. Profiles were classified as typic and cumulic Cryaquolls, and oxyaquic Cryorthents.

Adjacent riparian vegetation: *Carex* spp. meadows, mesic *Pinus contorta/Calamagrostis canadensis* forests, *Salix geyeriana* shrublands.

Adjacent upslope vegetation: *Pinus contorta-Picea engelmannii* forests, *Artemisia tridentata* shrublands.

Succession/Management: Presence of *Pinus contorta* in or near this plant association suggests a possible conversion to a *Conifer/Calamagrostis canadensis* type (Padgett *et al.* 1989). They state however, this is not likely to occur over a short time frame. High water tables and frequent flooding may keep the *Pinus contorta* at bay. This community has an open physiognomy and high productivity. There is a high risk of bank erosion due to the sparse rooting nature of the undergrowth species that make it sensitive to livestock impacts.

Planeleaf willow/Blue-joint reedgrass (*Salix planifolia var. monica/Calamagrostis canadensis*) plant association
GUS2S4 (SAPL/CACA)
White River Basin--3 stands (92GK51, 92NL63, 92NL67)

Synonyms: *Salix planifolia/Calamagrostis canadensis-Carex aquatilis* (Baker 1989), and *Salix planifolia/Calamagrostis canadensis* (Cooper and Cottrell 1990).

Distribution: Baker (1989) states this association is not reported outside Colorado, however similar types (i.e. *Salix planifolia/Carex aquatilis*) are reported from Montana (Hansen *et al.* 1989), Wyoming and Utah (Johnston 1987). In the White River Basin this type occurs only on the Flat Tops Plateau, in the eastern-most portion of the basin, within White River National Forest.

Environment: This is a high elevation wetland community, usually occurring between 2740 and 3350 m (9,000-11,000 ft) in elevation. It occurs in very broad glacial valleys and swales where direct snow melt is the primary moisture source.

Vegetation: This low-stature shrub community is dominated almost exclusively by *Salix planifolia* var. *monica*, with a small amount of *Salix wolfii* cover. *Calamagrostis canadensis, Carex utriculata, Carex aquatilis, Carex microptera,* and *Deschampsia cespitosa* make up a mesic, grassy understory. Few forbs occur in this type.

Soil: *Salix planifolia* shrublands occur on peat and other organic soils, but are not restricted to them; some stands occur on mineral soils derived from glacial till.

Adjacent riparian vegetation: *Salix wolfii* types occur on drier adjacent hummocks and hill slopes; open wet meadows of *Carex aquatilis*, *Deschampsia cespitosa* and *Carex utriculata.*

Adjacent upland vegetation: *Picea engelmannii/Abies lasiocarpa* forests.

Succession/management: *Salix planifolia* var. *monica* low-stature willow carrs appear to be sensitive to trampling and soil compaction. Lowering the water table through increased grazing or soil compaction may alter the community to support more forbs and fewer mesic grass species. Johnston (1987) notes that *Calamagrostis canadensis* is often more abundant in early seral stages of a *Salix phylicifolia* spp. *planifolia (=S. planifolia)/Carex aquatilis* type.

Planeleaf willow/Marsh marigold (*Salix planifolia var. monica/Caltha leptosepala*) plant association

G4S4? (SAPLM/CALE)

Colorado River Basin--6 stands (93SS02, 93GK45, 93SS26, 93DR17, 93SS49, 93RR57)
Other occurrences: San Miguel/Dolores River Basin-- 3 stands

Synonyms: *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 occurs throughout the high country of Colorado and is reported from Roosevelt, Arapaho, Gunnison, Pike, and Routt National Forests (Johnston 1987).

Environment: This common plant association occurs between 3100 and 3340 m (10,160-10,950 ft) in wide, moist glaciated valleys adjacent to streams and in swales and depressions where snow melt runoff accumulates.

Vegetation: The shrub layer is dominated by dense, low stature *Salix planifolia* var. *monica*. Other willows often present in lesser amounts include *Salix monticola* and *Salix wolfii*. 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* and *Calamagrostis canadensis*; common forbs include *Caltha leptosepala, Senecio triangularis* and *Mertensia ciliata*. Slightly drier sites have *Salix brachycarpa* co-dominant.

Soil: Wetter sites have soil textures of silt loams, while slightly drier sites have loamy sands. Soils are classified as oxyaquic Cryumbrepts, typic Cryoborolls, Cryochrepts, typic Cryorthents, and typic Cryaquents.

Adjacent riparian vegetation: *Carex aquatilis* and *Carex utriculata* meadows, *Salix brachycarpa* shrublands.

Adjacent Upland vegetation: *Picea engelmannii/ Abies lasiocarpa* 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.

Planeleaf willow/Aquatic sedge (*Salix planifolia var. monica/Carex aquatilis*) plant association
G4S4 (SAPLM/CAAQ)
Colorado--7 stands (92NL30, 92GL28, 93SS19, 93SS48, 93SS17, 93SS44, 93DR05)
Other occurrences: Yampa--2 stands

Synonyms: *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 the Uinta mountains and central Utah (Padgett *et al.* 1989), northwestern and north-central Wyoming (Johnston 1987). It occurs throughout the high country of Colorado and is 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).

Environment: It occurs at elevations above 2760 m (9030 ft) in wide valleys and wet, open subalpine meadows, on broad, gently sloping snow melt-fed swales and in valley bottoms. In the Colorado River Basin this plant association occurs along first order streams of the Eagle River, 2800-3160 m (9200-10360 ft) in elevation.

Vegetation: *Salix planifolia* var. *monica* dominates the low willow overstory. *Salix brachycarpa* and *Salix wolfii* are also often present with less than 25% cover, usually confined to steeper slopes and outer edges of wet swales. The understory is characterized by a thick graminoid layer dominated by *Carex aquatilis*. Two of our plots have considerable amounts of *Carex utriculata*. Johnston (1987) notes that patches of *Carex utriculata* can occur within this plant association. Other graminoids commonly present in varying amounts include *Deschampsia cespitosa, Calamagrostis canadensis*, and *Agrostis stolonifera*. Forbs include *Caltha leptosepala, Pedicularis groenlandica,* and *Osmorhiza depauperata*.

Soil: Silty clay loams, organics. Soils are classified as Histosols, Cryaquolls, Hemists, and Borohemists.

Adjacent Riparian Vegetation: *Carex aquatilis* meadows, *Salix brachycarpa* shrublands.

Adjacent Upland Vegetation: *Picea engelmannii/ Abies lasiocarpa* forests.

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 (see plot 92GK28) (Padgett *et al.* 1989). 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.

Wolf's willow/Bluejoint reedgrass (*Salix wolfii/Calamagrostis canadensis*) plant association G3SU (SAWO/CACA)
Colorado River Basin--1 stand (93SS30)

Synonyms: *Salix wolfii/Calamagrostis canadensis* (Youngblood *et al.* 1985 and Johnston 1987). Similar to *Salix planifolia-Salix wolfii/Caltha leptosepala-Carex aquatilis* (Baker 1989).

Distribution: This plant association is reported from eastern Idaho. Similar types are reported from central Colorado (Baker 1989). While sampled once in the Colorado River Basin, it is likely a wide spread high elevation riparian community (Dr. David Cooper *personal communication*).

Environment: It occurs in moderately narrow valleys, along flat to undulating floodplains above 2670 m (8760 ft) in elevation.

Vegetation: The mid-to-tall shrub layer is a mix of *Salix wolfii* and *Salix planifolia*. A few other willow species may also be present (e.g. *Salix monticola*). A dense and rich herbaceous layer is dominated by *Calamagrostis canadensis*, *Carex utriculata, Carex aquatilis* and *Deschampsia cespitosa*. The forb layer is diverse but only a minor component of this community.

Soils: We found soil textures to be silty loam to sandy clay loam with mottling. The soils are classified as typic Cryaquents.

Adjacent riparian vegetation: *Carex* spp. meadows, other tall *Salix* spp. shrublands.

Adjacent upslope vegetation: *Pinus contorta* forests, *Artemisia tridentata* scrub.

Succession/Management: Dense canopy layers indicate stable conditions. This plant association may be sensitive to lowered water table (Youngblood *et al.* 1985).

Wolf's willow/Aquatic sedge (*Salix wolfii/Carex aquatilis*) plant association
G4S4? (SAWO/CAAQ)
Colorado River Basin--1 stand (93RR63)
Other occurrences: San Miguel/Dolores River Basin--1 stand

Synonyms: *Salix wolfii/Carex aquatilis* (Youngblood *et al.* 1985, Padgett *et al.* 1989, Johnston 1987). Similar to *Salix planifolia-Salix wolfii/Calamagrostis canadensis-Carex aquatilis* (Baker 1989), ours lacking the other willow components.

Distribution: This type occurs from central and eastern Idaho, western Wyoming (Padgett *et al.* 1989). In Colorado it is reported from the western slope (Baker 1989), the San Miguel/Dolores River Basin, eastern San Miguel County, and in the Colorado River Drainage it occurs in the Williams Fork Mountains (Kittel and Lederer 1993).

Environment: This community occurs in saturated peat bogs, mesic swales and hummocks within glaciated basins above 2800 m (9180 ft) in elevation.

Soil: We found silty clay textured mineral soils over deep peat, classified as hydric Borofibrists. In the San Miguel/Dolores Basin soils are shallow silty clays over gravels and rocks.

Vegetation: This low-stature willow community is dominated by *Salix wolfii*, with *Salix planifolia* var. *monica* often present in adjacent wetter areas. On better-drained micro-sites, *Salix brachycarpa* and *Salix monticola* also occur. *Caltha leptosepala* and *Carex aquatilis* are abundant in the herbaceous layer.

Adjacent riparian vegetation: *Carex utriculata* meadow, *Salix planifolia, Salix brachycarpa* shrublands.

Adjacent upland vegetation: *Picea engelmannii/ Abies lasiocarpa* forests.

Succession/management: *Carex aquatilis* is well suited to wet, organic soils at these elevations. Succession will occur slowly under these conditions (Padgett *et al.* 1989).

Wolf's willow/Beaked sedge (*Salix wolfii/Carex utriculata*) plant association
G5SU (SAWO/CAUT)
Colorado River Basin-3 stands (93RR65, 93RR58, 93RR64)

Synonyms: *Salix wolfii/Carex utriculata* (Padgett *et al.* 1989, Johnston 1987). May be similar to *Salix geyeriana-Salix monticola-Salix planifolia-Salix wolfii/Calamagrostis canadensis-Carex aquatilis-Carex utriculata* (Baker 1989).

Distribution: Reported from Uinta Mountains, Utah (Padgett *et al.* 1989) and from central Colorado mountains (Baker 1989). In the Colorado River drainage in Grand and Eagle counties.

Environment: This community occurs on saturated floodplains in broad to narrow valleys, 2600-2900 m (8550-9520 ft) in elevation. It is often associated with beaver pond wetlands.

Vegetation: A low dense shrub layer is dominated by *Salix wolfii* with *Salix planifolia* as an occasional co-dominant. Sites are fairly moist and have moderate to rich forb layers. *Carex utriculata* dominates the lush graminoid layer.

Soil: Soil textures are silty loams to silty clay loams. Profiles are classified as histic Cryaquepts, cumulic Cryoborolls, and terric Borofibrists.

Adjacent riparian vegetation: *Carex* spp. meadows, other tall *Salix* spp. shrublands.

Adjacent upslope vegetation: *Pinus contorta* forests, *Artemisia tridentata* scrub.

Succession/Management: This plant association has saturated soils that are sensitive to trampling and heavy vehicles. Prolonged grazing may open the canopy and cause the water table to lower, pushing the community towards a *Salix planifolia*/mesic graminoid type.

Wolf's willow/Mesic forb (*Salix wolfii*/mesic forb) plant association
G3SU (SAWO/mf)
White River Basin--3 stands (92GK42, 92GK43, 92NL54)
Colorado River Basin--1 stand (93RR56)
Other occurrences: Yampa River Basin--5 stands

Synonyms: *Salix wolfii*/mesic forb (Padgett *et al.* 1989, Youngblood *et al.* 1985); *Salix wolfii/Fragaria virginiana* (Johnston 1987). *Salix wolfii*/mesic forb (Kittel and Lederer 1993). Jones (1992) describes a *Salix wolfii/Deschampsia cespitosa* community from the Sierra Madre Mountains in south-eastern Wyoming.

Distribution: This type occurs from central and eastern Idaho to western Wyoming (Padgett *et al.* 1989). In Colorado it is reported from the western slope (Baker 1989), and from the upper reaches of the Yampa River Basin (Kittel and Lederer 1993). In the White River Basin this type was found in the Flattop Mountains above 3050 m (10,000 ft) in elevation.

Environment: The *Salix wolfii*/mesic forb plant association is commonly found in broad glaciated or non-glaciated high mountain valleys on well drained slopes and hummocks, usually about one meter above the water table. In the Colorado River drainage, we found one occurrence along a steep first order stream at 2920 m (9590 ft) in elevation.

Vegetation: *Salix wolfii* forms a low, patchy canopy ranging from 60 to 80% cover. *Salix planifolia* var. *monica* can occur as a co-dominant. Graminoid cover averages approximately 20% with highly variable species composition, including *Carex aquatilis, C. utriculata, Deschampsia cespitosa,* and *Calamagrostis canadensis*. Forbs are diverse with an average cover of 35%, and include *Caltha leptosepala, Cardamine cordifolia, Gentianella thermalis* and *Pedicularis groenlandica.*

Soil: Soil textures are silty clays and silty loams to silty clay loams over gravels and rocks. One profile classifies as a dystric Cryochrept.

Adjacent riparian vegetation: *Salix planifolia* var. *monica/Calamagrostis canadensis* shrublands, *Carex utriculata* meadows.

Adjacent upland vegetation: *Picea engelmannii/ Abies lasiocarpa, Pinus contorta* and *Populus tremuloides* forests on steep sided valleys, *Artemisia tridentata* scrub in broad valleys.

Succession/management: This plant association tends to occur on drier hummocks above wetter swales where *Salix planifolia* plant associations occur. This drier type is more likely to be grazed by livestock. Heavy grazing may reduce the dense forb cover.

Other *Salix wolfii* stands:

In the White River Basin one stand of *Salix wolfii* stand (92NL57) sampled within the Flattop Wilderness boundary was similar in understory to the *Salix wolfii/mesic forb* type. Several other willow species (*Salix drummondiana, Salix monticola,* and *Salix geyeriana*) were part of the shrub layer. Forb understory was diverse and abundant, with *Mertensia ciliata, Cardamine cordifolia, Saxifraga odontoloma,* and *Geum macrophyllum.* This stand may represent a transition from the higher elevation low-stature willow shrublands to the lower, montane tall-stature willow shrublands.

Table 24. Percent canopy cover for SAPL/CACA and SAWO/MF alluvial shrubland plant association of the White River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	SAPL/CACA			SAWO/MF			Uncl.	SABR/MF
Plot No.	92	92	92	92	92	92	92	92
Species	GK51	NL63	NL67	GK42	GK43	NL54	NL57	GK40
SHRUBS								
Pentaphlylloides floribunda	0.0	0.0	0.0	10.0	0.0	3.0	0.0	0.0
Salix brachycarpa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0
Salix drummondiana	0.0	0.0	0.0	0.0	0.0	0.0	30.0	0.0
Salix geyeriana	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
Salix monticola	0.0	0.0	0.0	0.0	1.0	0.0	10.0	0.0
Salix planifolia var. monica	80.0	70.0	90.0	3.0	80.0	3.0	0.0	30.0
Salix wolfii	0.0	3.0	0.0	70.0	60.0	90.0	40.0	3.0
GRAMINOIDS								
Calamagrostis canadensis	50.0	10.0	3.0	0.0	0.0	0.0	0.0	0.0
Carex aquatilis	1.0	3.0	0.0	10.0	0.0	0.0	0.0	0.0
Carex microptera	0.0	10.0	3.0	1.0	3.0	1.0	3.0	1.0
Carex utriculata	10.0	10.0	1.0	3.0	3.0	0.0	3.0	0.0
Deschampsia cespitosa	0.0	3.0	3.0	40.0	10.0	3.0	1.0	20.0
Phleum alpinum	1.0	1.0	0.0	10.0	0.0	1.0	0.0	3.0
FORBS								
Caltha leptosepala	1.0	0.0	10.0	3.0	20.0	3.0	0.0	30.0
Cardamine cordifolia	0.0	1.0	3.0	1.0	10.0	0.0	3.0	3.0
Conioselinum scopulorum	0.0	3.0	3.0	0.0	10.0	1.0	0.0	0.0
Dugaldia hoopesii	0.0	0.0	0.0	0.0	0.0	10.0	0.0	10.0
Mertensia ciliata	0.0	1.0	1.0	0.0	1.0	1.0	10.0	1.0
Pseudocymopterus montanus	0.0	0.0	0.0	1.0	0.0	1.0	0.0	30.0
Senecio triangularis	0.0	3.0	3.0	1.0	3.0	1.0	1.0	20.0
Stellaria calycantha	10.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0

Table 25. Percent canopy cover for SABR/MF and SAGE/CACA in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	SABR/MF		SAGE/CACA					
Plot No.	93	93	93	93	93	93	93	93
Species	RR27	DR3	SS22	SS23	SS25	DR07	SS18	DR04
TREES								
Picea engelmannii--mature	0	10	0	0	0	0	0	0
SHRUBS								
Pentaphylloides floribunda	1	0	3	10	1	1	0	3
Salix boothii	0	0	0	0	0	1	0	20
Salix brachycarpa	60	40	0	0	0	0	0	0
Salix geyeriana	0	0	30	23	20	20	40	40
Salix monticola	50	0	1	0	20	3	10	3
Salix planifolia ssp. planifolia	0	3	3	20	10	0	0	0
Salix wolfii	3	0	3	0	3	0	10	0
GRAMINOIDS								
Agrostis scabra	0	1	0	1	1	1	1	20
Calamagrostis canadensis	0	3	30	30	40	10	3	1
Carex aquatilis	0	0	0	10	3	30	1	0
Carex microptera	1	0	0	0	0	10	0	0
Carex scopulorum	0	10	0	0	0	0	0	0
Carex utriculata	0	0	10	0	1	3	10	20
Phleum pratense	0	0	0	0	1	0	10	3
Poa pratensis	0	0	2	1	1	2	10	20
FORBS								
Fragaria sp.	1	1	0	0	1	10	0	1

Table 26. Percent canopy cover for SAPL/CALE and SAPL/CAAQ in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definition.

Plant association	SAPL/CALE						SAPL/CAAQ				
Plot No.	93	93	93	93	93	93	93	93	93	93	93
Species	SS02	GK45	SS26	DR17	SS49	RR57	SS19	SS48	SS17	SS44	DR05
TREES											
Picea pungens--seedlings	0	0	0	1	0	1	0	0	0	0	10
SHRUBS											
Betula glandulosa	0	0	0	1	3	0	0	0	0	10	0
Salix brachycarpa	0	1	0	30	0	10	0	0	0	0	80
Salix geyeriana	0	0	0	0	20	0	0	1	0	0	0
Salix planifolia var. monica	60	90	30	50	50	80	70	30	70	60	0
Salix wolfii	0	0	0	0	10	0	0	3	0	30	0
GRAMINOIDS											
Calamagrostis canadensis	0	0	0	1	20	0	0	3	1	40	0
Carex aquatilis	1	0	0	0	3	0	30	10	0	20	30
Carex geyeri	0	0	0	10	0	0	0	0	0	0	0
Carex utriculata	0	0	0	0	3	0	0	10	50	0	0
Deschampsia cespitosa	0	0	2	1	0	3	2	20	0	0	4
FORBS											
Caltha leptosepala	3	3	30	1	0	0	10	0	0	0	0
Cardamine cordifolia	3	3	0	3	0	6	10	0	0	0	3
Erigeron peregrinus	0	1	20	0	0	3	1	0	0	0	1
Senecio triangularis	3	3	3	3	1	4	20	0	0	1	3

Table 27. Percent canopy cover for SAWO/CACA, SAWO/CAAQ, SAWO/CAUT, and SAWO/mf in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	SAWO/CACA	SAWO/CAAQ	SAWO/CAUT			SAWO/
Plot No.	93	93	93	93	93	93
Species	SS30	RR63	RR64	RR65	RR58	RR56
TREES						
Juniperus sp.	0	0	0	0	10	0
SHRUBS						
Betula glandulosa	0	20	3	0	3	0
Salix planifolia var. monica	30	1	20	40	0	30
Salix wolfii	30	20	60	40	60	40
GRAMINOIDS						
Calamagrostis canadensis	31	0	10	3	0	0
Carex athrostachya	0	0	10	0	0	0
Carex aquatilis	0	50	0	10	3	0
Carex utriculata	3	0	10	10	20	0
FORBS						
Total forbs	20	10	20	10	20	80

V.A.2.c. TALL BUNCH GRASSLANDS WITH A SHRUB LAYER
(IV.C. PALUSTRINE-EMERGENT, PERSISTENT WETLANDS)

Leymus cinereus Series

Big sagebrush/Great Basin wild rye (*Artemisia tridentata/Leymus cinereus*) plant association G2G4SU (ARTR/LECI)
White River Basin--2 stands (2GK07, 92NL05)

Synonyms: *Elymus cinereus* (Baker, 1982).

Distribution: This plant association was formerly widespread in the northern Great Basin from southeast Oregon to Colorado (Baker 1982). In the White River Basin we encountered this community type only in the Piceance basin where a fire had recently swept through a drainage.

Environment: This community occurs on upper terraces and side slopes of narrower valleys, and occupies more mesic habitats than adjacent *Artemisia* spp. shrublands

Vegetation: This grassland is primarily dominated by large bunches of *Leymus cinereus*. *Artemisia tridentata* occurs at the edges and few other grasses or forbs occur within the plot.

Soil: The soils are relatively deep sandy clay loams.

Adjacent riparian vegetation: *Salix exigua*, *Artemisia tridentata* (right in the draw).

Adjacent upslope vegetation: *Artemisia tridentata* shrublands, *Juniperus osteosperma* woodlands, *Pseudotsuga menziesii* on steep, north-facing draws.

Succession/Management: Fire appears to maintain pure stands of *Leymus cinereus*. Without periodic fires every 20-30 years, the area will revert to *Artemisia tridentata* shrubland (Baker 1982).

V.A.4.a. TALL SOD-FORMING GRASSLANDS
(IV.C. PALUSTRINE-EMERGENT, PERSISTENT WETLANDS)

Phragmites australis Series

Common reed (*Phragmites australis*) plant association
GUS2S3 (PHAU)
Colorado River Basin-1 stand (93RR51)

Synonyms: *Phragmites australis* (Baker 1982), *Phragmites australis/Carex lacustris* (Johnston 1987).

Distribution: This plant association is reported from northwestern Colorado (Baker 1982) and from Nebraska. In Colorado along the White and Colorado Rivers it exists in small, isolated patches.

Environment: This community occurs in seeps and along irrigation ditches and their outflows, and in oxbow lakes, usually below 1980 m (6500 ft) in elevation.

Vegetation: The vegetation is characterized by almost pure stands of *Phragmites australis*, with a few twigs of *Salix exigua*.

Soil: The soils we found were coarse-loamy, calcareous typic Cryaquents.

Adjacent riparian vegetation: *Salix exigua* shrublands, *Typha* spp. wetlands.

Adjacent upslope vegetation: *Juniperus osteosperma* woodland.

Succession/Management: The *Phragmites australis* plant association was once thought to be widespread throughout western Colorado (Baker 1982). Now this community type occurs in isolated, very small patches where water has become impounded, such as adjacent to raised railroad beds, along irrigation ditches, oxbow lakes, and other low-lying swampy areas. It generally requires seasonal flooding in the spring (Johnston 1987).

V.B.4.a. MEDIUM TALL SOD-FORMING GRASSLANDS
(IV.C. PALUSTRINE-EMERGENT, PERSISTENT WETLANDS)

Scirpus spp. Series

American bulrush wetland (*Scirpus pungens*) plant association
GUSU (SCPU)
White River Basin--4 stands (92GK10, 92NL01, 92NL02, 92NL03)
Colorado River Basin--2 stands (93DR13, 93DR15)

Synonyms: *Scirpus americanus/Carex* spp. (Johnston 1987), *Scirpus americanus* wetland (Baker 1984, as cited in Reid and Bourgeron 1991.

Distribution: This plant association is known primarily from eastern Colorado and the Great Plains region (Kansas, Nebraska north to Saskatchewan). It is also reported from Utah and northwestern Colorado and central Wyoming (Johnston 1987). It occurs in the Piceance basin and elsewhere in the western half of the White River basin, and in North Park near Kremmling.

Environment: This community occurs along low elevation, low gradient streams, with alkaline soils, 2360 m (7750 ft) in elevation.

Vegetation: The vegetation may consist of pure *Scirpus pungens* stands. Our stands often had varying amounts of other graminoids such as *Juncus balticus, Hordeum jubatum,* and *Phragmites australis.* On the alkaline soils, *Distichlis spicata* is a strong associate in the graminoid layer.

Soils: We found black anoxic organic soils and gleyed clay-loam alkaline soils, classified as loamy typic Cryaquents.

Adjacent riparian vegetation: *Salix exigua*, *Sarcobatus vermiculatus* shrublands.

Adjacent upslope vegetation: *Juniperus osteosperma* woodlands, *Artemisia tridentata* shrublands.

Succession/Management: This community type is adapted to continually saturated conditions in sandy shores, streamsides, alluvial silt soils, marshes and reservoir margins (Johnston 1987). Lowering the water table may dry the habitat and cause the *Scirpus* spp. to die off. Increasing the salinity may increase alkaline tolerant species.

Bluejoint reed grass (*Calamagrostis canadensis*) plant association
G4SU (CACA)
Colorado River Basin-- 1 stand (93RR61)

Synonyms: *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).

Environment: This meadow community occurs in broad glaciated valleys 2930 m (9600 ft) in elevation and on more narrow floodplains of lower montane canyons.

Vegetation: The vegetation consists of dense *Calamagrostis canadensis* meadows. Forbs present include *Cardamine cordifolia, Senecio triangularis,* and *Heracleum lanatum.*

Soils: The soil in our plot classified as typic Cyaquolls.

Adjacent riparian vegetation: *Salix planifolia, Salix brachycarpa,* or other *Salix* spp. shrubland.

Adjacent upslope vegetation: *Pinus contorta, Picea engelmannii/ Abies lasiocarpa* forests.

Succession/Management: This plant association often occurs in association with *Pinus contorta.* 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

V.B.4.b. MEDIUM TALL BUNCH GRASSLANDS
(IV.C. PALUSTRINE-EMERGENT, PERSISTENT WETLANDS)

Deschampsia cespitosa Series

Tufted hairgrass-sedges (*Deschampsia cespitosa-Carex* spp.) plant association
G4SU (DECE-CASP)
White River Basin--1 stand (92GK52)

Synonyms: *Deschampsia cespitosa-Carex nebrascensis* wet montane meadow (USDA SCS 1978, as cited in Johston 1987), *Deschampsia cespitosa/Carex* spp. (Johnston 1987). *Deschampsia cespitosa* community type (Padgett *et al.* 1989, Youngblood *et al.* 1985).

Distribution: This community is described from eastern Oregon, eastern Idaho, western Montana, Wyoming, northern Utah, and Colorado (Rocky Mountain National Park south to Gunnison National Forest). Also found on the Flat Top Plateau.

Environment: This community type occurs only above 2900 m (9500 ft) in elevation on well drained ridges and hummocks.

Vegetation: Dense swards of *Deschampsia cespitosa* with *Carex aquatilis, Carex utriculata* and other *Carex* spp. make up the herbaceous layer. A few stems of *Salix planifolia* or *Salix brachycarpa* from adjacent stands may occur within the community. Forb cover is very low with *Caltha leptosepala*, *Clementsia rhodantha* and *Galium* sp. contributing less than 1% cover.

Soil: The soils in our plots were saturated organic.

Adjacent riparian vegetation: *Salix planifolia* shrublands, *Salix brachycarpa* shrublands, *Carex aquatilis* meadows.

Adjacent upslope vegetation: *Picea engelmannii/ Abies lasiocarpa* forests.

Succession/Management: Presence of this community type without abundance of *Poa pratensis, Juncus balticus* and *Taraxacum officinale* may indicate non-disturbance conditions according to Padgett *et al.* (1989). Many subalpine areas now dominated by *Poa pratensis* may have supported *Deschampsia cespitosa* communities in the past, although Padgett notes the danger of making that assumption for all habitats with *Poa pratensis.* The *Deschampsia cespitosa* is highly palatable, thus subject to heavy grazing. The soil is easily compacted and scarred by off-road vehicles.

V.C.5.a. SHORTGRASS SOD-FORMING GRASSLAND
(IV.C. PALUSTRINE-EMERGENT, PERSISTENT WETLANDS)

Distichlis spicata var. *spicata* Series

Saltgrass (*Distichlis spicata* var. spicata) plant association
G3G5S3 (DISP)
White River Basin--1 stand (92NL04)
Colorado River Basin--1 stand (93DR14)

Synonyms: *Distichlis spicata/Sporobolus airoides-Elytrigia smithii* (Johnston 1987, Baker 1984) and several similar types described by many authors, cited in Reid and Bourgeron (1991).

Distribution: This plant association is described from the Great Plains region, eastern Colorado and the Great Basin area in Nevada (Johnston 1987).

Environment: This community occurs on small, alkaline creeks from below 1530 m (5000 ft.) to 2300 m (7550 ft.) in elevation.

Vegetation: The vegetation is characterized by almost pure stands of *Distichlis spicata* with a stem or two of *Chysothamnus nauseosus* or *Sarcobatus vermiculatus*. *Triglochin maritima* may be also present.

Soil: Our soils were sandy clay loams with a high volume of gravel and cobbles. Fine, distinct mottles were present in one profile at about 50 cm depth. The soils were strongly gleyed and classified as loamy (calcareous) typic Cryaquents.

Adjacent riparian vegetation: *Triglochin* spp. forb meadows, *Juncus balticus* and *Carex* spp. meadows.

Adjacent upslope vegetation: *Sarcobatus vermiculatus* and *Artemisia tridentata* shrublands, *Juniperus osteosperma* Woodlands.

Succession/Management: This community type may be considered climax if the salt content of the soil is steady. Increasing the salt content may drive the community to a *Puccinellia airoides* dominated type (Johnston 1987).

Table 28. Percent canopy cover for JUBA, ART/LECI, DISP, and CACA, grassland plant association in the White River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant associations	JUBA		ARTR/LECI		DISP	CACA
Plot No.	92	92	92	92	92	92
Species	GK04	GK05	GK07	NL05	NL04	GK52
TREES						
Picea pungens	1.0	10.0	0.0	0.0	0.0	0.0
SHRUBS						
Artemisia tridentata	0.0	3.0	3.0	10.0	0.0	0.0
Betula occidentalis	0.0	20.0	0.0	0.0	0.0	0.0
Crataegus rivularis	0.0	10.0	0.0	0.0	0.0	0.0
Symphoricarpos rotundifolius	3.0	20.0	0.0	0.0	0.0	0.0
GRAMINOIDS						
Equisetum arvense	10.0	3.0	0.0	0.0	0.0	0.0
Bromus inermis	0.0	0.0	10.0	0.0	0.0	0.0
Calamagrostis canadensis	0.0	0.0	0.0	0.0	0.0	20.0
Carex nebrascensis	0.0	0.0	0.0	0.0	0.0	0.0
Carex utriculata	10.0	0.0	0.0	0.0	0.0	10.0
Carex sp.	0.0	0.0	0.0	0.0	0.0	10.0
Deschampsia cespitosa	0.0	0.0	0.0	0.0	0.0	70.0
Distichlis spicata	0.0	0.0	0.0	0.0	90.0	0.0
Eleocharis palustris	0.0	0.0	0.0	0.0	0.0	0.0
Leymus cinereus	0.0	0.0	90.0	20.0	0.0	0.0
Hordeum jubatum	0.0	0.0	0.0	0.0	0.0	0.0
Juncus balticus	40.0	20.0	0.0	1.0	0.0	0.0
Pascopyrum smithii	0.0	0.0	10.0	0.0	0.0	0.0
Poa pratensis	20.0	30.0	20.0	10.0	0.0	3.0
Puccinellia nuttalliana	0.0	0.0	0.0	1.0	0.0	0.0
Scirpus validus	0.0	0.0	0.0	0.0	0.0	0.0
FORBS						
Bassia sp.	0.0	0.0	0.0	0.0	10.0	0.0
Nasturtium officinale	0.0	0.0	0.0	0.0	0.0	0.0

Table 29. Percent canopy cover for PHAU, SCPU, CACA, and DISP grasslands in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	PHAU	SCPU		CACA	DISP
Plot No.	93	93	93	93	93
Species	RR51	DR13	DR15	RR61	DR14
GRAMINOIDS					
Calamagrostis canadensis	0	0	0	90	0
Distichlis spicata	0	30	3	0	60
Eleocharis palustris	0	0	20	0	0
Juncus balticus	0	1	3	0	1
Phragmites australis	80	0	0	0	0
Poa secunda	0	20	10	0	3
Scirpus pungens	0	60	40	0	1
Scirpus tabernaemontanii	0	0	10	0	0
FORBS					
Cardamine cordifolia	1	0	0	3	0
Senecio triangularis	0	0	0	3	0
Suaeda calceoliformis	0	1	1	0	30

V.C.6.a. MESOPHYTIC SOD-FORMING SUBALPINE-ALPINE GRASSLANDS
(IV.C. PALUSTRINE-EMERGENT, PERSISTENT WETLANDS)

Carex aquatilis Series

Water sedge-Beaked sedge (*Carex aquatilis-Carex utriculata*) plant association
G?S2S3 (CAAQ-CAUT)
White River Basin--2 stands (92GK41, 92NL58)
Colorado River Basin--3 stand (93SS24, 93RR14, 93SS32)

Synonyms: *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.

Environment: This community occurs from 2510 m to above 3050 m (8240-10,000 ft) in elevation in broad glaciated subalpine meadows that remain saturated with snowmelt runoff for most of the growing season.

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

Soil: This community commonly occurs on organic soils, but can occur on mineral glacial till. Loamy, clayey or sandy typic and cumulic Cryaquolls.

Adjacent riparian vegetation: *Salix planifolia*, *Salix brachycarpa*, or *Salix geyeriana* shrublands, *Deschampsia cespitosa* grasslands.

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

Succession/Management: Padgett *et al.* (1989) discuss the taxonomic problem of the intergradation 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*.

Carex nebrascensis stands:

In the western portion of White River Basin we sampled one stand dominated by *Carex nebrascensis* at 2040 m (6700 ft) in elevation along a flat marshy area surrounding a spring. This stand had a little *Catabrosa aquatica* and a lot of an introduced species, *Nasturtium officinale*. It may be similar to a *Carex nebrascensis-Catabrosa aquatilis-Juncus balticus* spring wetland described by Baker (1984).

In the Colorado River Basin one stand (93RR11) occurs on a drier area adjacent to a wet *Carex aquatilis* meadow. *Carex nebrascensis*, *Carex douglasii* and *Carex microptera* were abundant in this small occurrence. This site may be an indication of past heavy grazing, as *Carex douglasii* thrives on heavy grazing, and can tolerate dry, alkaline soils (Herman 1970). It may be similar to *Carex douglasii* plant association (G4S4) reported from Nevada (Manning and Padgett 1989) at the edges of drying ponds.

Rock sedge/Marsh marigold (*Carex scopulorum/Caltha leptosepala*) plant association
G4S3S4 (CASC-CALE)
Colorado River Basin--2 stands (93SS45, 93SS46)

Synonyms: *Carex scopulorum/Caltha leptosepala* (Johnston 1987).

Distribution: Reported from southern Wyoming to the San Juan Mountains in southwestern Colorado.

Environment: This plant association is restricted to marshy areas next to streams or melting snow fields above 3200 m (10,500 ft) in elevation.

Vegetation: *Carex scopulorum* (20-40%) dominates this low grassy community. *Carex jonesii* was abundant in one stand (30%), while *Carex illota* (20%) was abundant in the other stand we sampled.

Soils: We found the soils to be cumulic and histic Cryaquolls.

Adjacent riparian vegetation: Other *Carex* spp. meadows, *Salix planifolia* and *Salix brachycarpa* shrublands.

Adjacent upland vegetation: Alpine talus slopes, *Picea engelmannii/ Abies lasiocarpa* forests.

Succession/Management: Growing under saturated conditions at near alpine elevations makes this community very susceptible to trampling and damage by heavy equipment. *Carex scopulorum* has moderate livestock palatability.

Beaked sedge (*Carex utriculata*) plant association
G3G4S3 (CAUT)
White River Basin--3 stands (92NL64, 92GK12, 92GK26)
Colorado River Basin--10 stands (93SS13, 93GK42, 93SS31, 93RR10, 93RR15, 93RR38, 93DR01, 93RR35, 93GK32, 93RR66)
Other occurrences: Yampa River Basin--6 stands, San Miguel/Dolores River Basin--3 stands.

Synonyms: *Carex utriculata* wetland (Komarkova 1986 as cited in Reid and Bourgeron 1991). Some stands included in *Carex aquatilis/Carex utriculata* in Johnston 1987). This type has been described by many authors throughout the Rocky Mountain region (Johnston 1987). *Carex utriculata* is commonly and mistakenly referred to as *C. rostrata* in Colorado literature (Weber and Wittmann 1992).

Distribution: This plant association is known throughout the Rocky Mountains- eastern Idaho, western and central Montana, western and central-southern Wyoming, northern Utah and in all national forests in Colorado.

Environment: This community type occurs on flat saturated floodplains and backwater areas from 1730-3030 m (5680-9950 ft) in elevation.

Vegetation: *Carex utriculata* often occurs as an emergent at lake edges and along slow-moving reaches of rivers and streams. This community often intergrades into a *Carex aquatilis* community on slightly better drained soils. *Carex* spp. such as *Carex microptera,* and *C. lanuginosa* are common associates. *Eleocharis palustris, Juncus balticus,* and *Deschampsia cespitosa* are occasionally present.

Soil: We found saturated organic soils or fine silty clays over mottled clays, to within a few centimeters of the surface. Soils classified as very-fine clayey to loamy skeletal calcareous cumulic or typic Cryaquolls, Aquepts, fine-loamy and sandy-skeletal typic Cryaquents, and histic Cryaquepts.

Adjacent riparian vegetation: *Carex aquatilis* wetland, *Salix planifolia* or *Salix wolfii* shrublands at higher elevations; *Populus angustifolia* woodlands, or other tall-deciduous shrublands at lower elevations.

Adjacent upslope vegetation: *Picea engelmannii* forests, *Juniperus osteosperma* woodlands.

Succession/Management: *Carex utriculata* has low palatability and occurs on saturated soils unlikely to be heavily utilized. This community can also occur on organic soils, and has been documented to invade fresh mineral soils (Padgett *et al.* 1989).

Other *Carex* spp. stands:

In the Colorado River drainage one stand (93DR12) is dominated by *Carex foenea*. This may be similar to *Carex foenea/Acomastylis rossii* reported from the Gunnison National Forest and the Front Range (Johnston 1987), however ours occurs at a much lower elevation (2350 m, 7720 ft) than reported (3050-3660 m, 10,000-12,000 ft). Soils are Loamy-skeletal (calcareous) Typic Cryaquolls.

Table 30. Percent canopy cover for HCAUT, CAAQ-CAUT, and SCPU plant associations in the White River Basin. 1 = <1%, 3 = 1-5%. See text for acronym explanations.

Plant associations	CAUT			CAAQ-CAUT		SCPU			
Plot No.	92	92	92	92	92	92	92	92	92
Species	NL64	GK12	GK26	GK41	NL58	GK10	NL01	NL02	NL03
GRAMINOIDS									
Calamagrostis canadensis	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carex aquatilis	1.0	0.0	0.0	50.0	30.0	0.0	0.0	0.0	0.0
Carex lanuginosa	0.0	10.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Carex microptera	20.0	3.0	0.0	1.0	10.0	0.0	0.0	0.0	0.0
Carex utriculata	60.0	70.0	80.0	50.0	20.0	0.0	0.0	0.0	0.0
Deschampsia cespitosa	3.0	0.0	0.0	0.0	30.0	0.0	0.0	0.0	0.0
Eleocharis palustris	0.0	10.0	0.0	0.0	0.0	3.0	0.0	0.0	1.0
Glyceria striata	0.0	10.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Hordeum jubatum	0.0	0.0	1.0	0.0	0.0	3.0	3.0	1.0	3.0
Juncus balticus	0.0	0.0	10.0	0.0	0.0	30.0	20.0	20.0	0.0
Phragmites australis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
Poa palustris	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Puccinellia nuttalliana	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	10.0
Scirpus pungens	0.0	0.0	0.0	0.0	0.0	70.0	40.0	60.0	50.0
Scirpus validus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Torreyochloa pauciflora	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Typha latifolia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Typha sp.	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0
Typha x glauca	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FORBS									
Caltha leptosepala	0.0	0.0	0.0	3.0	20.0	0.0	0.0	0.0	0.0
Sedum rhodanthum	0.0	0.0	0.0	1.0	10.0	0.0	0.0	0.0	0.0

Table 31. Percent canopy cover for CAUT grassland plant association in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	CAUT									
Plot No.	93	93	93	93	93	93	93	93	93	93
Species	SS13	GK42	SS31	RR10	RR15	RR38	DR01	RR53	GK32	RR66
GRAMINOIDS										
Calamagrostis canadensis	0	0	0	0	0	0	3	0	0	30
Carex aquatilis	3	10	3	0	0	0	0	0	0	10
Carex utriculata	70	70	60	90	90	80	80	80	50	50
Eleocharis palustris	0	0	0	0	3	10	0	0	0	0
Phleum pratense	0	0	0	0	0	0	0	0	10	0
Scirpus microcarpus	0	0	0	0	0	1	0	10	0	0

Spike-rush (*Eleocharis quinqueflora*) plant association
G4SU (ELQU)
Colorado River Basin--2 stands (93SS27, 93SS47)

Synonyms: *Eleocharis pauciflora* (Padgett *et al.* 1989), *Eleocharis quinqueflora* alpine wetland (Komarkova 1976). *Carex aquatilis--Eleocharis quinqueflora* Phase (Johnston 1987).

Distribution: The *Eleocharis quinqueflora* plant association is reported from Routt county south to Gunnison National Forest and northeastern Utah.

Environment: This type occurs above 3200 m (10,500 ft) on organic soils that are saturated year-round.

Vegetation: The vegetation is characterized by widely spaced *Eleocharis quinqueflora* plants (50-70%). *Carex aquatilis* and *Pedicularis groenlandica* are common associates.

Soil: Soils are saturated organics.

Adjacent riparian vegetation: *Carex* spp. meadows, *Salix planifolia* shrublands.

Adjacent upslope vegetation: *Picea engelmannii/ Abies lasiocarpa* forests.

Succession/Management: This community is sensitive to trampling and heavy equipment.

Wiregrass (*Juncus balticus*) plant association
G5SU (JUBA)
White River Basin--1 stand (92GK04)
Colorado River Basin--4 stands (93RR09, 93RR13, 93GK06, 93GK11)
Other occurrences: Yampa River Basin--2 stands

Synonyms: *Juncus arcticus-Carex* spp. (Johnston 1987). This community type is described by many authors and occurs throughout the Rocky Mountain Region (Reid and Bourgeron 1991).

Distribution: This type occurs in Oregon, Idaho, Wyoming, northwest, central and the Front Range of Colorado (Johnston 1987).

Environment: In the White River Basin this community occurs over a wide range of elevations, although it is more common at lower elevations. It occurs as small, dense patches on flat stream benches, overflow channels and eddies. In the Colorado River drainage it occurs from 2025 to 2510 m (6640-8240 ft) in elevation on isolated seeps.

Vegetation: This herbaceous community type consists of a dense sward of *Juncus balticus,* with *Equisetum arvense* and *Eleocharis palustris.* One or two *Populus angustifolia* or *Salix* spp. seedlings may also be present.

Soil: The soils in our plots were sandy to silty clay loams, often with mottled or gleyed horizons. Sometimes we found coarse textured sandy loams with a high volume of cobbles and gravel. Soils classified as sandy to clayey typic Cryoborolls, fine-loamy typic Hydraquents, and fine-clayey Aquepts.

Adjacent riparian vegetation: *Carex* spp. meadows.

Adjacent upslope vegetation: *Pseudotsuga menziesii* and/or *Populus tremuloides*, or *Picea engelmannii* forests, *Juniperus osteosperma* Woodlands, *Artemisia tridentata* shrublands.

Succession/Management: Padgett *et al.* 1989 consider this community type to be grazing induced in some circumstances. The rhizomatous roots of *Juncus balticus* withstand grazing pressure well, and can stabilize stream banks. As *Juncus* spp. matures, its palatability declines.

Table 32. Percent canopy cover for CAAQ, CASC, ELQU, and JUBA grassland *plant association* in the Colorado River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	CAAQ			CASC		ELQU		JUBA			
Plot No.	93	93	93	93	93	93	93	93	93	93	93
Species	SS24	RR14	SS32	SS45	SS46	SS27	SS47	RR09	RR13	GK06	GK11
SHRUBS											
Salix brachycarpa	0	0	10	0	0	0	0	0	0	0	0
GRAMINOIDS											
Carex aquatilis	90	60	40	0	0	20	0	0	0	0	0
Carex illota	0	0	0	20	1	0	0	0	0	0	0
Carex jonesii	0	0	0	0	30	0	1	0	0	0	0
Carex microptera	0	1	0	0	0	0	0	0	10	0	0
Carex praegracilis	0	0	0	0	0	0	0	0	0	10	0
Carex scopulorum	0	0	0	40	20	1	30	0	0	0	0
Carex utriculata	10	0	0	0	0	0	0	30	0	0	0
Deschampsia cespitosa	0	0	40	3	1	0	0	0	0	0	0
Eleocharis quinqueflora	0	0	0	3	1	80	70	0	0	0	0
Juncus balticus	0	3	0	0	0	0	0	60	70	80	70
FORBS											
Caltha leptosepala	0	0	10	20	10	0	0	0	0	0	0
Fragaria sp.	0	10	0	0	0	0	0	0	0	0	0
Pedicularis groenlandica	0	0	0	10	3	1	1	0	0	0	0
Viola adunca	0	0	0	0	0	0	0	0	0	0	20

V.E.1.B. HYDROPHYTIC FRESHWATER ROOTED VEGETATION
(VII. RIVERINE SYSTEM-UPPER PERENNIAL, PERSISTENT-EMERGENT WETLANDS)

Typha spp. Series

Narrowleaf cattail (*Typha latifolia*) plant association
G5S3? (TYLA)
White River Basin--3 stands (92GK20, 92NL17, 92GK44)

Synonyms: *Typha latifolia-Sagittaria latifolia* (Johnston 1987).

Distribution: This plant association is found in North Dakota, Nebraska, Idaho, Wyoming, northeastern Colorado (Johnston 1987).

Environment: In the White River Basin cattail marshes occur in small patches throughout the lower elevations, often adjacent to roads, railroad tracks, ditches, and other poorly drained areas. This community also occurs along the margins of small reservoirs and stock ponds.

Vegetation: The vegetation is characterized by almost pure stands of 1-1.5 meter tall *Typha latifolia.* We collected *Typha x glauca* from one or two stands but not the second species with which *T. latifolia* is apparently crossing. *Carex lanuginosa, Juncus balticus,* and *Eleocharis palustris* are sometimes quite abundant along the edges.

Soil: The soils are seasonally saturated and fine-textured, with strong mottling and/or gleying.

Adjacent Riparian Vegetation: *Juncus balticus, Eleocharis palustris* or *Scirpus pungens* wetlands, *Carex* spp. meadows.

Adjacent Upslope Vegetation: *Artemisia tridentata* shrublands, *Juniperus osteosperma* woodlands, *Sarcobatus vermiculatus* shrublands.

Succession/Management: This community is adapted to continual flooding and soil saturation, but can also withstand, and actually needs, periodic draw-downs (Padgett *et al.* 1989). Soil compaction and permanent draining of these communities will cause them to decline. It is best to wait for fully dry soils before allowing grazing to avoid soil compaction. Periods of bare soil after draw-down is critical for the germination and establishment of *Typha latifolia* (Padgett *et al.* 1989). Prolific seed production means that this community can quickly invade wet mineral soil (Hansen *et al.* 1988, cited in Padgett *et al.* 1989).

Table 33. Percent canopy cover for TYLA hydrophytic freshwater plant association the White River Basin. 1 = <1%, 3 = 1-5%. See text for acronym definitions.

Plant association	TYLA		
Plot No.	92	92	92
Species	GK20	NL17	GK44
GRAMINOIDS			
Carex lanuginosa	0.0	0.0	40.0
Carex utriculata	0.0	0.0	3.0
Eleocharis palustris	0.0	10.0	3.0
Hordeum jubatum	10.0	3.0	0.0
Juncus balticus	20.0	20.0	0.0
Scirpus validus	0.0	0.0	10.0
Typha latifolia	30.0	30.0	20.0
Typha x glauca	30.0	40.0	0.0

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APPENDIX 1. Memoradum of Understanding.

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:

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.

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 — Date

12/1/92

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

Dec 1, 1992

Colorado Division of Wildlife
Perry D. Olson, Director — Date

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

1-25-93
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

12/17/92
Date

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

11-30-92
Date

APPENDIX 2. Plant species list.

Nomenclature follows Kartesz (1993). An asterisk denotes where this name is also accepted by Weber and Wittmann (1992). Where nomenclature differs, Weber and Wittmann (1992) synonyms are given in the right column, marked by an asterisk. Older synonmyns (without an asterisk) also appear in the right hand column.

Scientific name	Code	Synonyms and other notes
Abies lasiocarpa (Hook.) Nutt.*--seedlings	ABILA1	
Abies lasiocarpa (Hook.) Nutt.*--saplings	ABILA2	
Abies lasiocarpa (Hook.) Nutt.*--young & mature trees	ABILAS	
Acer glabrum Torr.*	ACEGLA	
Acer negundo L.--seedlings	ACENE1	
Acer negundo L.--saplings	ACENE2	
Acer negundo L.--young & mature trees	ACENEG	*Negundo aceroides (L.) Moench
Achillea millefolium var. apicola	ACHMIL	*A. lanulosa Nutt. var. alpicola Ryd.
Aconitum columbianum Nutt.*	ACOCOL	
Acroptilon repens (L.) D.C.*	ACRREP	
Actaea rubra (Ait.) Willd.*	ACTRUB	
Agastache urticifolia (Benth.) Kuntze*	AGAURT	
Agoseris aurantiaca (Hook.) Greene*	AGOAUR	
Agoseris glauca (Pursh) Raf.*	AGOGLA	
Agropyron sp.*	AGP SP	
Agropyron cristatum (L.) Gaerth.	AGRCRI	
Agrostis exarata Trin.*	AGREXA	
Agrostis gigantea Roth.*	AGRGIG	
Agrostis scabra Willd.*	AGRSCA	
Agrostis sp.*	AGRSSP	
Agrostis stolonifera L.*	AGRSTO	
Allium sp.*	ALL SP	
Allium geyeri S. Wats.*	ALLGEY	
Alnus incana ssp. tenuifolia (Nutt.) Breitung*	ALNINC	
Alopecurus aequalis Sobol.*	ALOAEQ	
Alopecurus alpinus L.*	ALOALP	*ssp.glaucus
Alyssum desertorum Stapf.*	ALYDES	
Ambrosia sp.*	AMB SP	
Ambrosia tomentosa Nutt.*	AMBTOM	
Amelanchier alnifolia (Nutt.) Nutt. ex M. Roemer*	AMEALN	
Amelanchier utahensis Koehne*	AMEUTA	
Ammannia robusta Heer & Regel*	AMMROB	
Anaphalis margaritacea (L.) Benth. & Hook. f.*	ANAMAR	
Androsace filiformis Retz.*	ANDFIL	
Androsaceae occidentalis Pursh*	ANDOCC	
Androsace septentrionalis L.*	ANDSEP	
Anemone narcissiflorum ssp. zephyra (A.Nels.) Hulten	ANENAR	*Anemonastrum narcissiflorum
Angelica sp.*	ANG SP	
Angelica ampla A. Nels.*	ANGAMP	
Angelica grayi (Coult. & Rose.) Coult. & Rose.*	ANGGRA	
Angelica pinnata S.Wats.*	ANGPIN	
Antennaria sp.*	ANT SP	
Antennaria microphylla Rydb.*	ANTMIC	
Antennaria parvifolia Nutt.*	ANTPAR	
Antennaria rosea Greene*	ANTROS	
Apocynum cannabinum L.*	APOCAN	
Apocynum x floribundum Greene	APOFLO	Not listed in Weber and Wittmann
Aquilegia sp.*	AQU SP	
Aquilegia coerulea James*	AQUCOE	
Aquilegia elegantula Greene*	AQUELE	
Arabis x divaricarpa A. Nels	ARADIV	*Boechera divaricarpa
Arabis drummondii Gray	ARADRU	*Boechera drummondii
Arabis glabra (L.) Bernh.	ARAGLA	*Turritus glabra
Arabis hirsuta (L.) Scop.*	ARAHIR	
Arctium minus Bernh*	ARCMIN	
Arctostaphalus uva-ursi (L.) Spreng.*	ARCUVA	*Arctostaphalus adenotricha ssp. coactilis
Argentina anerina (L.) Rydb.*	ARGANE	Potentilla anserina
Arnica chamissonis Less.*	ARNCHA	
Arnica cordifolia Hook.*	ARNCOR	
Arnica latifolia Bong.*	ARNLAT	
Arnica mollis Hook.*	ARNMOL	

Arnica parryi Gray*	ARNPAR	
Artemisia biennis Willd.*	ARTBIE	
Artemesia cana Pursh	ARTCAN	*Seriphidium canum
Artemisia dracunculus L.	ARTDRA	*Oligosporus dracunculus (L.) Poljakov
Artemisia frigida Willd.*	ARTFRI	
Artemisia ludoviciana Nutt.*	ARTLUD	
Artemisia tridentata Nutt.	ARTTRI	*Seriphidium tridentatum
Asclepias speciosa Torr.*	ASCSPE	
Asparagus officinalis L.*	ASPOFF	
Aster sp.*	AST SP	
Astragalus agrestis Dougl ex G. Don*	ASTAGR	
Astragalus alpinus L.*	ASTALP	
Aster ascendens Lindl.	ASTASC	*Virgulaster ascendens
Aster bracteolatus Nutt.*	ASTBRA	
Astragalus convallarius Greene*	ASTCON	
Aster engelmanii (D.C. Eat.) Gray	ASTENG	*Eucephalus engelmannii (D.C. Eaton) Greene
Aster foliaceus Lindl. ex D.C.	ASTFOL	*Aster brachteolatus Nutt.
Aster glaucodes Blake	ASTGLA	*Eucephalus glaucodes
Aster laevis L.*	ASTLAE	
Aster lanceolatus ssp. hesperius (Gray) Semple & Chmielewski	ASTLAH	*Aster hesperius
Astragalus lutosus M.E. Jones*	ASTLUT	
Astragalus miser var oblongifolius (Rydb.) Cong*	ASTMIS	
Astragalus sp.*	ASTRSP	
Astragalus tenellus Pursh*	ASTTEN	
Astragalus wingatanus S.Wats.*	ASTWIN	
Atriplex argentea Nutt.*	ATRARG	
Atriplex micrantha C.A. Mey	ATRMIC	*Atriplex heterosperma
Barbarea sp.*	BAR SP	
Barbarea orthoceras Ledeb.*	BARORT	
Barbarea vulgaris R. Br.*	BARVUL	
Bassia sp.*	BAS SP	
Beckmannia syzigachne (Steud.) Fern*	BECSYZ	
Berberis fendleri Gray*	BERFEN	
Betula glandulosa Michx.**	BETGLA	Kartesz lumps this with B. nana. We disagree.
Betula occidentalis Hook.	BETOCC	*Betula fontinalis
Bidens frondosa L.*	BIDFRO	
Blepharoneuron tricholepis (Torr.) Nash*	BLETRI	
Brachyactis ciliata (Lebeb.) Lebeb.*	BRACIL	
Brickellia californica (Torr. & Gray) Gray*	BRICAL	
Brickellia grandiflora (Hook.) Nutt.*	BRIGRA	
Bromus sp.*	BRO SP	
Bromus anomalus Rupr. ex Fourn.	BROANO	*Bromopsis porteri
Bromus canadensis Michx.	BROCAN	*Bromopsis canadensis
Bromus carinatus Hook. & Arn.	BROCAR	*Ceratochloa carinata
Bromus ciliatus L.	BROCIL	*Bromopsis canadensis
Bromus inermis Leyss.	BROINE	*Bromopsis inermis
Bromus japonicus Thunb. ex Murr.*	BROJAP	
Bromus lanatipes (Shear.) Rydb.	BROLAN	*Bromopsis lanatipes
Bromus secalinus L.*	BROSEC	
Bromus tectorum L.	BROTEC	*Anisantha tectorum
Calamagrostis sp.*	CAL SP	
Calamagrostis canadensis (Michx.) Beauv.*	CALCAN	
Caltha leptosepala D.C.	CALLEP	*Psychrophila leptosepala
Calystegia sepium ssp. americana (Sims) Brummitt	CALSEP	*Calystegia sepium ssp. angulata
Calamagrostis stricta (Timm) Koel*	CALSTR	
Campanula rotundifolia L.*	CAMROT	
Capsella bursa-pastoris (l.) Medik.*	CAPBUR	
Carex sp.*	CAR SP	
Carex aquatilis Wahlenb.*	CARAQU	
Carex athrostachya Olney*	CARATH	
Carex aurea Nutt.*	CARAUR	
Carex bella Bailey*	CARBEL	
Cardimine breweri S.Wats.*	CARBRE	
Carex canescens L.*	CARCAN	
Carex capillaris L.*	CARCAP	
Cardamine cordifolia Gray*	CARCOR	
Carex deweyana Schwein.*	CARDEW	
Carex disperma Dewey*	CARDIS	
Carex douglasii Boot*	CARDOU	
Cardaria draba ssp. chalapensis (L.) O.E. Schulz	CARDRC	*Cardaria chalapensis
Cardaria sp.*	CARDSP	
Carex emoryi Dewey*	CAREMO	
Carex foenea Willd.*	CARFOE	

Carex geyeri Boot*	CARGEY	
Carex hoodii Boott*	CARHOO	
Carex illota Bailey*	CARILL	
Carex interior Bailey*	CARINT	
Carex jonesii Bailey*	CARJON	
Carex lanuginosa Michx.*	CARLAN	
Carex lasiopcarpa Ehrb.*	CARLAS	
Carex lenticularis Michx.*	CARLEN	
Carex microptera MacKenzie*	CARMIC	Carex festivella
Carex nebrascensis Dewey*	CARNEB	
Carex nigrans Bailey*	CARNIG	
Carex norvegica Retz.*	CARNOR	
Carex norvegica ssp. stevenii (Holm) E. Murr.*	CARNOS	Carex norvegica var. stevenii
Carex nova Bailey*	CARNOV	
Carex occidentalis Bailey*	CAROCC	
Carex parryana Dewey*	CARPAR	
Carex praegracilis W. Boot.*	CARPRA	
Cardaria pubescens (C.A. Mey.) Jarmolenko*	CARPUB	
Carex raynoldsii Dewey*	CARRAY	
Carex rossii Boot.*	CARROX	? C. roxii
Carex scopulorum Holm*	CARSCO	
Carex simulata MacKenzie*	CARSIM	
Carex sprengelii Dewey ex Spreng*	CARSPR	
Carex utriculata F. Boot*	CARUTR	
Carex vesicaria L.*	CARVES	
Castilleja Cerv.	CAS SP	
Castilleja flava S.Wats.*	CASFLA	
Castilleja miniata Dougl. ex. Hook.*	CASMIN	
Castilleja minor (Gray) Gray*	CASMIO	
Castilleja rhexifolia Rydb.*	CASRHE	
Castilleja sulphurea Rydb.*	CASSUL	
Catabrosa aquatica (L.) Beauv.*	CATAQU	
Celtis laevigata var. reticulata (Torr.) L. Benson	CELLAE	*Celtis reticulata
Centaurium calycosum (Buckl.) Fern.*	CENCAL	
Cerastium sp.*	CER SP	
Cerastium arvense L.	CERARV	
Cerastium fontanum Baumg.*	CERFON	
Chenopodium sp.*	CHE SP	
Chenopodium album L.*	CHEALB	
Chenopodium atrovirens Rydb.*	CHEATR	
Chenopodium berlandieri Moq.*	CHEBER	
Chenopodium foliosum (Moench) Aschers*	CHEFOL	
Chenopodium fremontii S.Wats.*	CHEFRE	
Chenopodium glaucum L.*	CHEGLA	
Chenopodium leptophyllum (Moq.) Nutt. ex S.Wats.*	CHELEP	
Chenopodium rubrum L.*	CHERUB	
Chenopodium simplex (Torr.) Raf.*	CHESIM	Chenopodium gigantospermum
Chrysothamnus sp.*	CHR SP	
Chrysothamnus linifolius Greene*	CHRLIN	
Chrysothamnus nauseosus (Pallas ex Pursh) Britt.*	CHRNAU	
Chrysothamnus viscidiflorus (Hook.) Nutt*	CHRVIS	
Cicuta douglasii (D.C.) Coult. & Rose.*	CICDOU	
Cinna latifolia (Trev. ex Goepp) Griseb*	CINLAT	
Cirsium sp.*	CIR SP	
Cirsium arvense (L.) Scop.*	CIRARV	
Cirsium centaureae (Rydb.) K. Schum*	CIRCEN	
Cirsium eatonii (Gray) B.L. Robins*	CIREAT	
Cirsium ownbeyi Welsh*	CIROWN	
Cirsium parryi (Gray) Petrak*	CIRPAR	
Cirsium vulgare (Savi) Ten.*	CIRVUL	
Claytonia lanceolata Pursh*	CLALAN	
Clematis ligusticifolia Nutt.*	CLELIG	
Collomia linearis Nutt.*	COLLIN	
Collinsia parviflora Lindl.*	COLPAR	
Comandra umbellata (L.) Nutt.*	COMUMB	
Convolvulus arvensis L.*	CONARV	
Conyza canadensis (L.) Cronq. (L.) Cronq.*	CONCAN	
Conium maculatum L.*	CONMAC	
Conringia orientalis (L.) Andrz.*	CONORI	
Conioselinum scopulorum (Gray) Coulter. & Rose.*	CONSCO	
Corallorhiza sp.*	COR SP	
Corydalis aurea Willd.*	CORAUR	
Corallorhiza maculata (Raf.) Raf.*	CORMAC	

Cornus sericea L.	CORSER	*Swida sericea
Corallorhiza striata Lindl.*	CORSTR	
Crataegus rivularis Nutt.*	CRARIV	
Cymopteris bulbosus A. Nels.*	CYMBUL	
Cynoglossum officinale L.*	CYNOFF	
Cystopteris sp.*	CYS SP	
Cystopteris fragilis (L.) Bernh.*	CYSFRA	
Cystopteris reevsiana Lellingr*	CYSREE	
Dactylis glomerata L.*	DACGLO	
Danthonia californica Boland*	DANCAL	
Danthonia parryi Scrib.*	DANPAR	
Danthonia spicata (L.) Beauv. ex Roemer & J.A. Schultes*	DANSPI	
Delphinium sp.	DEL SP	
Delphinium barbeyi (Huth) Huth*	DELBAR	
Delphinium nuttalianum Pritz ex Walp.*	DELNUT	
Delphinium occidentale (S.Wats.) S.Wats.*	DELOCC	
Delphinium ramosum Rydb.*	DELRAM	
Descurainia sp.*	DES SP	
Descurainia californica (Gray) O.E. Schulz*	DESCAL	
Deschampsia cespitosa (L.) Beauv.*	DESCES	
Descurainia incana* spp. incana (Bernh. ex Fisch. & C.A. Mey	DESINC	Descurainia richardsonii
Descurainia sophia (L.) Webb ex Prant*	DESSOP	
Distichlis spicata (L.) Greene*	DISSPI	Distichlis spicata var. stricta
Disporum trachycarpum (S.Wats.) Benth. & Hook. f.*	DISTRA	
Dodecatheon pulchellum (Raf.) Merr.*	DODPUL	
Draba sp.*	DRA SP	
Draba albertina Greene*	DRAALB	
Draba aurea Vahl. ex Hornem.*	DRAAUR	
Draba cana Rydb.*	DRACAN	
Draba spectabilis Greene*	DRASPE	
Dryopteris filix-mas (L.) Schott*	DRYFIL	
Dugaldia hoopesii (Gray) Rydb.*	DUGHOO	
Eleocharis sp.*	ELE SP	
Eleagnus angustifolia L.*	ELEANG	
Eleocharis palustris (L.) Roemer & J.A. Schultes*	ELEPAL	
Eleocharis quinqueflora (F.X. Hartman) Schwarz*	ELEQUI	
Elymus sp.*	ELY SP	
Elymus canadensis L.*	ELYCAN	
Elymus x critesion	ELYCRI	Not listed in Kartesz
Elytriga elongata (Host) Nevski	ELYELO	*Thinopyrum ponticum=Lophopyrum elongatum
Elymus elymoides (Raf) Swezey*	ELYELY	
Elymus glaucus Buckl.*	ELYGLA	
Elymus lanceolatus ssp. lanceolatus (Scribn. & J.G. Sm.) Gou	ELYLAN	
Elytrigia repens (L.) Desv. ex B.D. Jackson*	ELYREP	
Elymus trachycaulus (Link) Gould ex Shinners*	ELYTRA	
Elymus virginicus L.*	ELYVIR	
Epilobium sp.*	EPI SP	
Epilobium angustifolium L.	EPIANG	*Chamerion danielsii
Epilobium ciliatum Raf.*	EPICIL	
Epipactis gigantea Dougl. ex Hook*	EPIGIG	
Epilobium hornemannii Reichenb.*	EPIHOR	
Epilobium lactiflorum Hausskin*	EPILAC	
Epilobium saximontanum Hausskin*	EPISAX	
Equisetum sp.*	EQU SP	
Equisetum arvense L.*	EQUARV	
Equisetum hyemale L.	EQUHYE	*Hippochaete hymalis
Equisetum laevigatum A. Braun	EQULAE	*Hippochaete laevigata
Equisetum variegatum Schleich ex F. Weber & D.M.H. Mohr	EQUVAR	*Hippochaete variegata
Erigeron sp.*	ERI SP	
Erigeron concinnus var. concinnus (Hook. & Arn.) Torr & Gray	ERICON	*Erigeron pumilus
Erigeron coulteri Porter*	ERICOU	
Erigeron divergens Torr & Gray	ERIDIV	*Erigeron colo-mexicanus
Erigeron eatonii Gray*	ERIEAT	
Erigeron elatior (Gray) Greene*	ERIELA	
Erigeron engelmannii A. Nels.*	ERIENG	
Erigeron eximius Greene*	ERIEXI	
Erigeron flagellaris Gray*	ERIFLA	
Erigeron formosissimus Greene*	ERIFOR	
Erigeron glabellus Nutt.*	ERIGLA	
Eriogonom lonchophyllum Torr. & Gray*	ERILON	
Erigeron peregrinus (Banks ex Pursh) Greene*	ERIPER	*ssp. callianthemus
Erigeron speciosus (Lindl.) D.C.*	ERISPE	
Erigeron subtrinervis Rydb. ex Porter & Britt.*	ERISUB	

Eriogonum umbellatum var. majus Hook.	ERIUMB	*Eriogonum subalpinum
Erodium cicutarium (L.) L'Her. ex Ait.*	EROCIC	
Erysimum asperum (Nutt.) D.C.*	ERYASP	
Erysimum cheiranthoides L.*	ERYCHE	
Erythronium grandiflorum Pursh*	ERYGRA	
Euphorbia esula var. uralinsis (Fish ex Link) Dorn	EUPESU	*Tithymalus uralensis
Eupatorium maculatum L.*	EUPMAC	
Euthamia occidentalis Nutt.*	EUTOCC	
Festuca arundinacea Schreb.*	FESARU	
Festuca brachyphylla ssp. coloradensis Frederiksen*	FESBRA	
Festuca idahoensis Elmer*	FESIDA	
Festuca pratensis Huds*	FESPRA	
Festuca saximontana Rydb.*	FESSAX	
Festuca subulata Trin.	FESSUB	not listed in Weber and Wittmann
Festuca thurberi Vasey*	FESTHU	
Forestiera pubescens Nutt.*	FORPUB	
Fragaria sp.*	FRA SP	
Fraxinus anomala Torr. ex. S.Wats.*	FRAANO	
Frasera speciosa Dougl. ex Griseb.*	FRASPE	
Fragaria vesca ssp. bracteata (Heller) Standt*	FRAVES	
Fragaria virginiana Duchesne	FRAVIR	*ssp. glauca
Gaillardia aristata Pursh*	GAIARI	
Galium sp.*	GAL SP	
Galium aparine L.*	GALAPA	
Galium boreale L.	GALBOR	Weber claims our specimens belong to *G. septentrionale
Galium coloradoense W. Wight*	GALCOL	
Galium mexicanum Kunth*	GALMEX	
Galium spurium L.*	GALSPU	
Galeopsis tetrahit L.	GALTET	*Galeopsis bifida
Galium triflorum Michx.*	GALTRI	
Galium trifidum ssp. subbiflorum (Wieg) Piper*	GALTRS	
Gaura coccinea Nutt. ex Pursh*	GAUCOC	
Gentiana affinis Griseb.	GENAFF	*Pneumonanthe affinis
Gentianella amarella ssp. acuta (Michx) J. Gillett	GENAMA	*Gentianella acuta
Gentianella amerella ssp. heterosepala (Engelm) J. Gillett	GENAMH	*Gentianella heterosepala
Gentiana parryi Engelm.	GENPAR	*Pneumonanthe parryi
Gentianopsis thermalis (Kuntze) Iltis*	GENTHE	
Geranium L.*	GER SP	
Geranium richardsonii Fisch. & Trautv.*	GERRIC	
Geranium viscossimum Fisch. & C.A. Mey ex C.A. Mey*	GERVIS	*ssp. nervosum
Geum aleppicum Jacq.*	GEUALE	*ssp. strictum
Geum macrophyllum Willd.*	GEUMAC	*var. perincisum
Geum rivale L.*	GEURIV	
Geum triflorum Pursh	GEUTRI	*Erythrocoma triflora
Glaux maritima L.*	GLAMAR	*var. angustifolia
Glyceria sp.*	GLY SP	
Glyceria elata (Nash ex Rydb.) M.E. Jones*	GLYELA	
Glyceria grandis S.Wats.*	GLYGRA	
Glycyrrhiza lepidota Pursh*	GLYLEP	
Glyceria striata (Lam.) A.S. Hitchc.*	GLYSTR	*var. stricta
Grindelia fastigiata Green*	GRIFAS	
Gutierrezia sarothrae (Pursh) Britt. & Rusby*	GUTSAR	
Hackelia floribunda (Lehm) I.M. Johnston*	HACFLO	
Halimolobos virgata (Nutt.) O.E. Schulz*	HALVIR	
Hedysarum boreale Nutt.*	HEDBOR	
Helenium autumnale L.*	HELAUT	*var. montanum
Heliomeris multiflora Nutt.*	HELMUL	
Helianthus pauciflorus ssp. paucifloris Nutt.	HELPAU	*Helianthus rigidus ssp. subrhomboideus
Heracleum lanatum Michx.	HERLAN	*Heracleum sphondylium ssp. montanum
Hesperis matronalis L.*	HESMAT	
Heterotheca villosa (Pursh) Shinners*	HETVIL	
Heuchera parvifolia Bartl.*	HEUPAR	
Hieracium triste var. triste Hulten	HIETRI	*Chlorocrepis tristis ssp. gracilis
Holcus lanatus L.*	HOLLAN	
Hordeum brachyantherum Nevski	HORBRA	*Critesion brachyantherum
Hordeum jubatum L.	HORJUB	*Critesion jubatum
Hordeum murinum ssp. glaucum (Steud) Tzvelev	HORMUR	*Critesion murinum=C. m. ssp. glaucum
Humulus lupulus L.*	HUMLUP	*ssp. americanus
Hydrophyllum capitatum Dougl. ex Benth.*	HYDCAP	
Hydrophyllum fendleri (Gray) Heller*	HYDFEN	
Hypericum scouleri ssp. nortoniae (M.E. Jones) J. Gillett	HYPSCO	*Hypericum formosum
Ipomopsis aggregata (Pursh) V. Grant*	IPOAGG	
Iris missouriensis Nutt.*	IRIMIS	

Iva axillaris Pursh*	IVAAXI	
Juniperus sp.*	JUN SP	
Juncus articulatus L.*	JUNART	
Juncus balticus Willd.	JUNBAL	*J. ater=J. arcticus (Kartesz also accepts J. arcticus)
Juncus bufonius L.*	JUNBUF	
Juniperus communis L.*	JUNCOM	
Juncus confusus Coville*	JUNCON	
Juncus compressus Jacq.*	JUNCOP	
Juncus sp.*	JUNCSP	
Juncus drummondii E. Mey*	JUNDRU	
Juncus dudleyi Wieg.*	JUNDUD	
Juncus longistylis Torr.*	JUNLON	
Juncus mertensianus Bong.*	JUNMER	
Juniperus osteosperma (Torr.) Little--seedlings	JUNOS1	
Juniperus osteosperma (Torr.) Little--saplings	JUNOS2	
Juniperus osteosperma (Torr.) Little--young & mature trees	JUNOST	*Sabina osteosperma
Juncus saximontanus A. Nels.*	JUNSAX	
Juniperus scopulorum Sarg.--seedlings	JUNSC1	
Juniperus scopulorum Sarg.--saplings	JUNSC2	
Juniperus scopulorum Sarg.--young & mature trees	JUNSCO	*Sabina scopulorum
Juncus torreyi Coville*	JUNTOR	
Juncus tracyi Rydb.*	JUNTRA	
Kochia scoparia (L.) Schrad	KOCSCO	Weber claims CO plants are *Bassia sieversiana
Koeleria macrantha (Ledeb.) J.A. Schutes*	KOEMAC	
Lactuca sp.*	LAC SP	
Lactuca biennis (Moench) Fern*	LACBIE	
Lactuca serriola L.*	LACSER	
Lactuca tatarica (L.) C.A. Mey*	LACTAT	*ssp. pulchella
Lappula occidentalis var. occidentalis (S.Wats) Greene	LAPOCC	*Lappula redowskii
Lathyras lanszwerttii var. leucanthus (Rydb.) Dorn	LATLAN	*Lathyras leucanthus. Weber cites other authors
Lepidium sp.*	LEP SP	
Lepidium latifolium L.	LEPLAT	*Cardaria latifolia
Lepidium perfoliatum L.*	LEPPER	
Leptodactylon sp.*	LEPTSP	
Lesquerella rectipes Woot & Standl.*	LESREC	
Leucanthemum vulgare (Am. Merr.) A. Love*	LEUVUL	
Leymus cinereus Scribn.*	LEYCIN	
Leymus salina (M.E. Jones) A. Love*	LEYSAL	
Ligusticum filicinum S.Wats.*	LIGFIL	*var. tenuifolium
Ligusticum porteri Coult. & Rose*	LIGPOR	
Linnaea borealis L.*	LINBOR	*ssp. americana
Linum lewisii Pursh	LINLEW	*Adenolinum lewisii
Linaria vulgaris P. Mill*	LINVUL	
Listera cordata (L.) R. Br.*	LISCOR	*ssp. nephrophylla
Lithospermum multiflorum Torr. & Gray*	LITMUL	
Lithophragma parviflorum (Hook) Nutt. ex Torr & Grey*	LITPAR	
Lomatium dissectum (Nutt.) Mathius & Constance*	LOMDIS	*var. multifidum
Lonicera involucrata Banks ex Spreng	LONINV	*Distegia involugrata
Lotus tenuis Waldst. & Kit ex Willd.*	LOTTEN	
Lupinus sp.*	LUP SP	
Lupinus argenteus Pursh*	LUPARG	
Lupinus bakeri ssp. amplus (Greene) Fleak & D. Dunn.*	LUPBAK	
Luzula congests (Thuill.) Lej.	LUZCON	*L. comosa
Luzula parviflora (Ehrh.) Desv.*	LUZPAR	
Luzula subcapitata (Rydb.) Harrington*	LUZSUB	
Lycopodium annotinum L.*	LYCANN	
Lysimachia ciliata L.*	LYSCIL	
Mahonia repens (Lindl.) G. Dorn*	MAHREP	
Maianthemum racemosum ssp. racemosum (L.) Link	MAIRAC	*Maianthemem amplexicaule=Smilicina racemosa
Maianthemum stellatum (L.) Link*	MAISTE	*Maianthemem stellatum=Smilicina stellata
Medicago lupulina L.*	MEDLUP	
Medicago sativa L.*	MEDSAT	
Melilotus alba Medikus*	MELALB	
Melilotus officinalis (L.) Lam.*	MELOFF	
Melica spectabilis Scribn.	MELSPE	*Bromelica spectabilis
Mentha arvensis L.*	MENARV	
Mertensia sp.*	MER SP	
Mertensia ciliata (James & Torr.) G. Don*	MERCIL	
Mertensia franciscana Heller*	MERFRA	
Mertensia fusiformis Greene*	MERFUS	
Mimulus glabratus W.A. Weber*	MIMGLA	
Mimulus guttatus D.C.*	MIMGUT	
Mimulus moschatus Dougl. ex Lindl.*	MIMMOS	

Mitella pentandra Hook.*	MITPEN	
Mitella stauropetala var. stenopetala Piper*	MITSTA	
Moehringia lateriflora (L.) Fenzl*	MOELAT	
Moehringia macrophylla (Hook.) Fenzl*	MOEMAC	
Montia chamissoi (Ledeb. ex Spreng.) Greene	MONCHA	*Crunocallis chamissoi
Monarda fistulosa L.*	MONFIS	*var. menthifolia
Moneses uniflora (L.) Gray*	MONUNI	Pyrola uniflora L.
Muhlenbergia asperifolia (Nees & Meyen ex Trin) Parodi*	MUHASP	
Muhlenbergia montana Buckl.*	MUHMON	
Muhlenbergia racemosa (Michx.) B.S.P.*	MUHRAC	
Nepeta cataria L.*	NEPCAT	
Oenothera L.*	OEN SP	
Oenothera cespitosa Nutt.*	OENCES	
Oenothera elata Kunth*	OENELA	*ssp. hirsutissma
Oreochrysum parryi*	OREPAR	Happlopappus parryi
Orthilia secunda (L.) House*	ORTSEC	Pryola secunda
Oryzopsis sp.*	ORY SP	
Oryzopsis hymenoides (Roemer & J.A. Achultes) Ricker ex Pipe	ORYHYM	*Stipa hymenoides
Oryzopsis micrantha (Trin. & Rup.) Thurber*	ORYMIC	
Osmorhiza chilensis Hook. & Arn.*	OSMCHI	
Osmorhiza depauperata Phil.*	OSMDEP	
Osmorhiza occidentalis (Nutt. ex Torr. & Gray) Torr*	OSMOCC	
Oxytropis deflexa (Pallas) D.C.*	OXYDEF	
Oxyria digyna (L.) Hill*	OXYDIG	
Oxypolis fendleri (Gray) Heller*	OXYFEN	
Panicum virgatum L.*	PANVIR	
Parnassia fimbriata Koenig*	PARFIM	
Pastinaca sativa L.*	PASSAT	
Pascopyrum smithii (Rydb.) A. Love*	PASSMI	
Paxistima myrsinites (Pursh) Raf.*	PAXMYR	
Pedicularis sp.*	PED SP	
Pedicularis groenlandica Retz.*	PEDGRO	
Pedicularis parryi Gray*	PEDPAR	
Pedicularis procera Gray*	PEDPRO	
Pedicularis racemosa Dougl. ex Benth*	PEDRAC	*ssp. alba
Penstemon sp.* Schmidel	PEN SP	
Penstemon barbatus (Cav.) Roth*	PENBAR	
Pentaphylloides floribunda (Pursh) A. Love*	PENFLO	Potentilla fruticosa
Penstemon watsonii Gray*	PENWAT	
Penstemon whippleanus Gray*	PENWHI	
Perideridia gairdneri (Hook. & Arn) Mathias*	PERGAI	*ssp. borialis
Phalaris arundinacea L.	PHAARU	*Phalariodes aurundinacea
Phacelia heterophylla Pursh*	PHAHET	
Phacelia sericea ssp. ciliosa (Rydb.) Gillett*	PHASER	
Philadelphus microphyllus Gray*	PHIMIC	
Phleum alpinum L.	PHLALP	*Phleum commutatum
Phlox gracilis spp. humilis (Greene) Mason	PHLGRA	*Microsterius gracilis ssp. humilis
Phlox longifolia Nutt.*	PHLLON	
Phleum pratense L.*	PHLPRA	
Phragmites australis (Cav.) Trin & Steud.*	PHRAUS	
Physaria acutifolia Rydb.*	PHYACU	
Physaria floribunda Rydb.*	PHYFLR	
Picea engelmannii Parry ex Engelm.--seedlings*	PICEN1	
Picea engelmannii Parry ex Engelm.--saplings*	PICEN2	
Picea engelmannii Parry ex Engelm.--young & mature trees*	PICENG	
Picea pungens Engelm.--seedlings*	PICPU1	
Picea pungens Engelm.--saplings*	PICPU2	
Picea pungens Engelm.--young & mature trees*	PICPUN	
Pinus contorta Dougl. ex Loud--seedlings*	PINCO1	
Pinus contorta Dougl. ex Loud--saplings*	PINCO2	
Pinus contorta Dougl. ex Loud--young & mature trees*	PINCON	
Pinus edulis Engelm.--seedlings*	PINED1	
Pinus edulis Engelm.--saplings*	PINED2	
Pinus edulis Engelm.--young & mature trees*	PINEDU	
Pinus ponderosa P. &. C. Lawson--seedlings*	PINPO1	
Pinus ponderosa P. &. C. Lawson--saplings*	PINPO2	
Pinus ponderosa P. &. C. Lawson--young & mature trees*	PINPON	
Platanthera species	PLA SP	see Limnorchis
Platanthera dilatata (Pursh) Lindl. ex Beck	PLADIL	*Limnorchis dialiata ssp. albiflora=Habenaria dialiata
Plantago elongata Pursh*	PLAELO	
Plantago lanceolata L.*	PLALAN	
Plantago major L.*	PLAMAJ	
Platanthera stricta Lindl.	PLASTR	*Limnorchis stricta=Habinaria saccata

Plantago tweedyi Gray*	PLATWE	
Poa sp.*	POA SP	
Poa abbreviata R. Br.*	POAABB	
Poa alpina L.*	POAALP	
Poa arctica R. Br.*	POAARC	
Poa arida Vasey*	POAARI	
Poa compressa L.*	POACOM	
Poa fendlerana (Steud.) Vasey*	POAFEN	
Poa leptocoma Trin.*	POALEP	
Poa nemoralis L.*	POANEM	*ssp. interior
Poa nervosa (Hook.) Vasey*	POANER	
Poa palustris L.*	POAPAL	
Poa pratensis L.*	POAPRA	
Poa reflexa Vaesy & Scribn. ex Vasey*	POAREF	
Poa secunda J. Presl*	POASEC	
Podistera eastwoodiae (Coult. & Rose) Mathias & Constance*	PODEAS	
Polemonium sp.*	POL SP	
Polygonum amphibium var. emersum Michx.	POLAMP	*Persicaria amphibia
Polygonum arenastrum Jord. ex Boreau*	POLARE	
Polygonum bistortoides Pursh	POLBIS	*Bistorta bistortoides
Polygonum douglasii Greene*	POLDOU	
Polemonium foliosissimum Gray*	POLFOL	
Polypogon monspeliensis (L.) Desf.*	POLMON	
Polemonium occidentale ssp. occidentale Greene	POLOCC	*Polemonium caeruleum ssp. amygdalium
Polygonum persicaria L.	POLPER	*Persicaria maculata
Polemonium pulcherrimum Hook.*	POLPUL	*ssp. delicatum
Polemonium viscosum Nutt.*	POLVIS	
Polygonum viviparum L.	POLVIV	*Bistorta vivipara
Populus x acuminata Rydb.--seedlings*	POPAC1	
Populus x acuminata Rydb.--saplings*	POPAC2	
Populus x acuminata Rydb.--young & mature trees*	POPACU	
Populus angustifolia James--seedlings*	POPAN1	
Populus angustifolia James--saplings*	POPAN2	
Populus angustifolia James--young & mature trees*	POPANG	
Populus deltoides ssp. wislizenii--seedllings*	POPDE1	
Populus deltoides ssp. wislizenii--saplings*	POPDE2	
Populus deltoides ssp. wislizenii (Swats) Eskenwalden young	POPDEW	
Populus tremuloides Michx.*	POPTRE	
Potentilla sp.*	POT SP	
Potentilla diversifolia Lehm.*	POTDIV	
Potentilla gracilis Dougl. ex Hook.*	POTGRA	
Potentilla norvegica L.*	POTNOR	
Potentilla pulcherrima Lehm.*	POTPUL	
Potentilla pulcherrima X hippiana	POTPXH	not listed in Kartesz 1993
Primula parryi Gray*	PRIPAR	
Prunus virginiana var. melanocarpa (A. Nels.) Sarg.	PRUVIR	*Padus virginiana
Prunella vulgaris L.*	PRUVUL	
Pseudostellaria jamesiana (Torr.) W.A. Weber & R.J. Hartman*	PSEJAM	
Pseudotsuga menziesii (Mirbel) Franco--seedlings*	PSEME1	
Pseudotsuga menziesii (Mirbel) Franco--saplings*	PSEME2	
Pseudotsuga menziesii (Mirbel) Franco--young & mature trees*	PSEMEN	
Pseudocymopterus montanus (Gray) Coult. & Rose*	PSEMON	
Pteridium aquilinum (L.) Kuhn.*	PTEAQU	*ssp. lanuginosum
Puccinellia nuttalliana (J.A. Schultes) A.S. Hitchc.	PUCNUT	*Puccinellia airoides
Purshia tridentata (Pursh) D.C.*	PURTRI	
Pyrola sp.*	PYR SP	
Pyrola americana Sweet	PYRAME	Pyrola rotundifolia. Not listed in Weber and Wittmann.
Pyrola asarifolia Michx.	PYRASA	*Pyrola rotundifolia ssp. asarifolia
Pyrrocoma crocea (Gray) Greene*	PYRCRO	
Pyrola minor L.*	PYRMIN	
Quercus gambelii Nutt*	QUEGAM	
Ranunculus sp.*	RAN SP	
Ranunculus acriformis Gray*	RANACR	
Ranunculus cymbalaria var. saximontanus Fernald (CHECK IN KA	RANCYM	Halerpestes cymbalaria ssp. saximontana
Ranunculus gmelinii D.C.*	RANGME	*var. hookeri
Ranunculus macounii Britt.*	RANMAC	
Ranunculus ranunculinus (Nutt.) Rydb.	RANRAN	*Cytorhyncha ranunculina
Ranunculus uncinatus D. Don ex G. Don*	RANUNC	
Rhus trilobata var. trilobata	RHUTRI	*Rhus aromatica var. trilobata
Ribes sp.*	RIB SP	
Ribes aureum Pursh*	RIBAUR	
Ribes cereum Dougl.*	RIBCER	
Ribes coloradense Coville*	RIBCOL	

Ribes inerme Rydb.*	RIBINE	
Ribes lacustre (Pers.) Poir*	RIBLAC	
Ribes leptanthum Gray*	RIBLEP	
Ribes montigenum McClatchie*	RIBMON	
Ribes wolfii Rothrock*	RIBWOL	
Rorippa sp.*	ROR SP	
Rorippa alpina (S.Wats) Rybd.	RORALP	*Rorippa curvipes var. alpina
Rorippa nasturnium (L.) Hayek.	RORNAS	*Nasturtium officinale
Rorippa palustris spp. hispida (Desv.) Jonsell*	RORPAL	
Rorippa sphaerocarpa (Gray) Britt.*	RORSPH	
Rorippa teres (Michx.) R. Stuckey*	RORTER	
Rosa woodsii Lindl.*	ROSWOO	
Rubus sp.*	RUB SP	
Rubus arcticus ssp. acaulis	RUBARC	*Cylactis arctica ssp. acaulis
Rubus discolor Weihe & Nees	RUBDIS	not listed in Weber and Whitman
Rubus idaeus L.	RUBIDA	*ssp. melanolasius
Rubus parviflorus var. parviflorus Nutt.	RUBPAR	*Rubacer parviflorum
Rudbeckia lacinata var. ampla (A.Nels) Conq.	RUDLAC	*Rudbeckia ampla
Rumex aquaticus L.*	RUMAQU	*ssp. occidentalis
Rumex crispus L.*	RUMCRI	
Rumex salicifolius var. mexicanus (Meisn.) C.L. Hitchc.	RUMSAL	*Rumex triangulivalvis
Sagina saginoides (L.) Karst.*	SAGSAG	
Salix sp.*	SAL SP	
Salsola australis R. Br.*	SALAUS	
Salix bebbiana Sarg.*	SALBEB	
Salix boothii Dorn*	SALBOO	
Salix brachycarpa Nutt.*	SALBRA	
Salix drummondiana Barratt ex Hook*	SALDRU	
Salicornia europaea ssp. rubra*	SALEUR	Not listed in Kartesz 1993
Salix exigua Nutt.*	SALEXI	
Salix geyeriana Anderss*	SALGEY	
Salix irrorata*	SALIRR	
Salix lucida ssp. caudata (Nutt.) E. Murr.*	SALLAC	Salix lasiandra var. caudata
Salix lucida ssp. lasiandra (Benth.) E. Murr.*	SALLAL	Salix lasiandra var. lasiandra (not listed in Kartesz)
Salix ligulifolia (Ball) Ball ex Schneid	SALLIG	*Salix rigida var. watsonii
Salix lutea Nutt.*	SALLUT	
Salix monticola Bebb*	SALMON	
Salix planifolia ssp. planifolia Pursh*	SALPLA	=includes varieties monica and planifolia.
Salix scouleriana Barrett ex Hook*	SALSCO	
Salix serissima (Bailey) Fern.*	SALSER	
Salix wolfii Bebb*	SALWOL	
Sambucus sp.*	SAM SP	
Sambucus racemosa ssp. pubens var microbotrys (Rydb) Kearney	SAMRAC	*Sambucus microbotrys
Sarcobatus vermicularis (Hook) Torr.*	SARVER	
Saxifraga sp.*	SAX SP	
Saxifraga bronchialis ssp. austromontana (Wieg) Piper	SAXBRO	*Ciliaria austromontana
Saxifraga odontoloma Piper	SAXODO	*Micranthes odontoloma
Saxifraga oregana J.T. Howell	SAXORE	*Micranthes oregana
Schoenocrambe linifolia (Nutt.) Greene*	SCHLIN	
Schizachyrium scoparium (Michx.) Nash*	SCHSCO	
Scirpus acutus Muhl. ex Bigelow	SCIACU	*Scoenoplectus lacustris ssp. acutus
Scirpus americana Pers	SCIAME	Weber claims S. americana doesn't occur in CO.
Scirpus maritimus L.	SCIMAR	*Bolboschoenus maritimus
Scirpus microcarpus J.& K. Presl.	SCIMIC	*Scirpus microcarpus
Scirpus pallidus (Britt.) Fern.	SCIPAL	*Scirpus pallidus
Scirpus pungens Vahl.	SCIPUN	*Schoenoplectus pungens
Scirpus tabernaemontanii K.C. Gmel.	SCITAB	*Schoenoplectus lacustris ssp. validus
Scrophularia lanceolata Pursh*	SCRLAN	
Scutellaria galericulata L.*	SCUGAL	*var. epilobiifolia
Sedum integrifolium (Raf.) A. Nels.	SEDINT	*Rhodiola integrifolia
Sedum lanceolatum ssp. lanceolatum Torr.	SEDLAN	*Amerosedum lanceolatum
Sedum rhodanthum Gray	SEDRHO	*Clementsia rhodantha
Senecio sp.*	SEN SP	
Senecio amplectens var. amplectens Gray	SENAMP	*Ligularia amplectens
Senecio atratus Greene*	SENATR	
Senecio bigelovii var. biglovii Gray	SENBIG	*Ligularia biglovii
Senecio canus Hook.	SENCAN	*Packera canus
Senecio crassulus Gray*	SENCRA	
Senecio crocata Rydb.	SENCRO	*Packera crocata
Senecio dimorphophyllus var. dimorphophyllus Greene	SENDIM	*Packera dimorphophyllus
Senecio eremophilus Richards*	SENERE	*ssp. kingii
Senecio hydrophilus Nutt.*	SENHYD	
Senecio integerrimus Nutt.*	SENINT	

Senecio multilobatus Torr. & Gray ex Gray	SENMUL	*Packer multilobata
Senecio neomexicanus var. mutabilis (Greene) T.M. Burkl.	SENNEM	*Packer neomexicana=P.n. var. mutabilis
Senecio pseudoaurea var. pseudoaurea Rydb.	SENPSE	*Packera pseudaurea ssp. pseudaurea
Senecio serra Hook.*	SENSER	*var. serra
Senecio streptanthifolius Greene	SENSTR	*Packera streptanthifolia
Senecio triangularis Hook.*	SENTRI	
Shepherdia argentea (Prush) Nutt.*	SHEARG	
Sibbaldia procumbens L.*	SIBPRO	
Sidalcea sp.*	SID SP	
Sidalcea candida Gray*	SIDCAN	
Sidalcea neomexicana Gray*	SIDNEO	
Silene drummondii Hook.	SILDRU	not listed in Weber and Whitman
Silene menziesii Hook.	SILMEN	*Anotites mensiesii
Silene scouleri Hook.*	SILSCO	*ssp. hallii
Sisymbrium sp.*	SIS SP	
Sisymbrium altissimum L.*	SISALT	
Sisymbrium loeselii L.*	SISLOE	
Sisyrinchium sp.*	SISYRI	
Sium suave Walt.*	SIUSUA	
Solidago sp.*	SOL SP	
Solidago canadensis L.*	SOLCAN	
Solidago gigantea Ait.	SOLGIG	*Solidago serotinoides
Solidago multiradiata var. scopulorum Gray*	SOLMUL	
Solidago nana Nutt.*	SOLNAN	
Solidago parryi (Gray) Greene	SOLPAR	not listed in Weber and Wittmann
Solidago spathulata D.C.*	SOLSPA	
Sonchus arvensis ssp. uliginosus (Bieb.) Nyman	SONARV	*Sonchus arvensis L.
Sorbus scopulina Greene*	SORSCO	
Spartina gracilis Trin.*	SPAGRA	
Sphenopholis obtusata (Michaux.) Scribn.*	SPHOBT	
Spiranthes romanzoffiana Cham.*	SPIROM	
Sporobolus airoides (Torr.) Torr.*	SPOAIR	
Stachys palustris L.*	STAPAL	
Stellaria sp.*	STE SP	
Stellaria calycantha (Ledeb.) Bong.*	STECAL	
Stellaria longifolia Muhl ex Willd.*	STELNF	
Stellaria longipes Goldie*	STELON	
Stellaria obtusa Engelm.*	STEOBT	
Stellaria umbellata Turcz. ex Kar. & KIr.*	STEUMB	
Stipa lettermanii Vasey*	STILET	
Stipa viridula Trin.*	STIVIR	
Streptopus amplexifolius var. chalazatus Fassett	STRAMP	*Streptopus fassettii
Streptanthus cordatus*	STRCOR	Euklisia cordatus, E. crassifolia
Suaeda sp.*	SUA SP	
Suaeda calceoliformis (Hook.) Moq.*	SUACAL	
Sullivantia hapmannii (Coult.& Fisher) Coult.	SULHAP	*var. purpusii
Swertia perennis L.*	SWEPER	
Symphoricarpos longiflorus Gray*	SYMLON	
Symphoricarpos occidentalis Hook.*	SYMOCC	
Symphoricarpos oreophilus Gray	SYMORE	*Symphoricarpus rotundifolius.
Symphoricarpos rotundifolius Gray*	SYMROT	
Tamarix ramosissima Lebeb.*	TAMRAM	
Taraxacum officinale ssp. ceratophorum (Ledeb.) Schinz ex Th	TAROFC	*Taraxacum ovinum
Taraxacum officinale G.H. Weber ex Wiggers*	TAROFF	
Tetraneuris ivesiana Greene*	TETIVE	
Thalictrum sp.*	THA SP	
Thalictrum alpinum L.*	THAALP	
Thalictrum fendleri Engelm ex. Gray*	THAFEN	
Thalictrum sparsiflorum Turcz. ex Fisch & C.A. Mey*	THASPA	
Thelypodium integrifolium (Nutt.) Endl. ex Walp.*	THEINT	
Thermopsis rhombifolia var. montana (Nutt.) Isely	THERHM	*Thermopsis montana
Thermopsis rhombifolia (Nutt. ex Pursh) Nutt ex Richards*	THERHO	
Thlaspi arvense L.*	THLARV	
Thlaspi montanum L.	THLMON	Noccea montana
Torreyochloa pauciflora (J.Presl) Church*	TORPAU	
Toxicodendron rydbergii (Small ex Rydb.) Greene*	TOXRYD	
Tragopogon sp.*	TRA SP	
Tragopogon dubius Scop.*	TRADUB	*ssp. major
Tragopogon pratensis L.*	TRAPRA	
Trifolium sp.*	TRI SP	
Triticum aestivum L.*	TRIAES	
Trifolium hybridum L.*	TRIHYB	
Trimorpha lonchophylla var. lonchophyllay (Hook.) Nesom.	TRILON	*Erigeron lonchophyllus

Trifolium longipes ssp. pygmaeum (Gray) J. Gillett	TRILOP	*Trifolium rusbyi ssp. rusbyi
Triglochin maritimum L.*	TRIMAR	
Trillium ovatum Pursh*	TRIOVA	
Triglochin palustre L.*	TRIPAL	
Trifolium parryi Gray*	TRIPAR	
Trifolium pratense L.*	TRIPRA	
Trifolium repens L.*	TRIREP	
Trisetum spicatum (L.) Richer*	TRISPI	
Trisetum wolfii Vasey*	TRIWOL	
Trollius laxus ssp. albiflorus (Gray) A.D. Love & Kapoor	TRLLAX	*Trollius albiflorus
Typha sp.*	TYP SP	
Typha x glauca Godr.	TYPGLA	A hybrid--not listed in Weber and Wittmann.
Typha latifolia L.*	TYPLAT	
Unknown forb	UNKFOR	
Unknown graminoid	UNKGRA	
Urtica dioica ssp. gracilis (Ait.) Seland.	URTDIO	*Urtica gracilis ssp. gracilis
Vaccinium cespitosum Michx.*	VACCES	
Vaccinium myrtillus L.*	VACMYR	*ssp. oreophilum
Vaccinium scoparium Leib. ex Coville*	VACSCO	
Valeriana acutiloba var. acutiloba Rydb.	VALACT	*Valeriana capitata ssp. acutiloba
Valeriana edulis Nutt. ex Torr. & Gray*	VALEDU	
Valeriana occidentalis Heller*	VALOCC	
Veronica americana Schwein. ex Benth.*	VERAME	
Veronica anagallis-aquatica L.*	VERANA	Veronica catenata
Veronica serpyllifolia L.	VERSER	*Veronicastrum serpyllifolium
Veratrum tenuipetalum Heller*	VERTEN	
Verbascum thapsus L.*	VERTHA	
Veronica wormskjoldii Roemer & J.A. Schultes	VERWOR	Weber states that reports belong to V. nutans.
Vicia americana Muhl. ex Willd.*	VICAME	
Viola sp.*	VIO SP	
Viola adunca Sm.*	VIOADU	
Viola canadensis L.	VIOCAN	*V. scopulorum
Viola macloskeyi Lloyd	VIOEPE	previously missidentified as V. epipsiloides
Viola praemorsa Dougl. ex Lindl.*	VIOPRA	
Viola vallicola var. vallicola A. Nels*	VIOVAL	Viola nuttallii var. vallicola
Xanthium strumarium L.*	XANSTR	
Zigadenus elegans ssp. glaucus (Nutt.) Hulten	ZIGELE	*Anticlea elegans