A Preliminary Classification of the Riparian Vegetation of the Yampa and San Miguel/Dolores River Basins

A Final Report Submitted to

the Colorado Department of Health

and the Environmental Protection Agency

by

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TABLE OF CONTENTS

TABLES

Tables, continued.

FIGURES

SUMMARY

In this final report, we present results from two years of field surveys of the Yampa and San Miguel/Dolores River Basins. We have classified riparian plant associations found along intact, relatively undisturbed reaches of perennial rivers and streams and placed them in the context of the UNESCO Physiognomic-Ecological Classification of Plant Formations of the Earth (Mueller-Dombois and Ellenberg 1974), and the Classification of Wetland and Deepwater Habitats of the United States (Cowardin *et al.* 1979). This classification is preliminary, 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 (Reid and Bourgeron 1991) 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, who 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 and results, and to discuss the continued support of the statewide classification project.

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 for the San Miguel/Dolores River Basin plant associations and for a limited number of the Yampa River Basin associations. 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.

Also included in this report are dichotomous keys to each basin's plant associations, constancy (frequency of species occurrence and average canopy cover values) tables for select plant associations, photocopied 7.5' topographic maps with plot and association occurrence locations, lists describing the locations of proposed high-quality ecologically-significant areas found within each basin, blank field forms, and a blank element occurrence record.

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 management is poorly understood compared to their importance. Consequently, resource management and conservation of many riparian areas are often far from optimal.

Unfortunately, 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). Previous community classification work in Colorado, such as that for northern New Mexico and southern Colorado (DeVelice *et al.* 1985), 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) have not specifically focused on riparian areas. Riparian classification work has been done on the Gunnison National Forest, 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). The Nature Conservancy has funded preliminary classifications and surveys of the riparian vegetation of west-central and southwestern Colorado (Baker 1986) the northern Front Range (Cooper and Cottrell 1990), and the Yampa River Basin. Riparian vegetation work has been done and/or is currently underway in 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), Oregon (Kovalchik 1987), and Utah (Padgett *et al.* 1989).

In this final report, we present results from two years of field surveys from the Yampa and San Miguel/Dolores River Basins. We have classified riparian plant associations found along intact, relatively undisturbed reaches of perennial rivers and streams and placed them in the context of the UNESCO Physiognomic-Ecological Classification of Plant Formations of the Earth (Mueller-Dombois and Ellenberg 1974), and the Classification of Wetland and Deepwater Habitats of the United States (Cowardin *et al.* 1979). This classification is preliminary, 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

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During the 1993 field season, we will be field testing the keys, and gathering more data from the Upper Colorado immediate river drainage, from Glenwood Springs to the Continental Divide. We solicit critical review and comments on this classification from experts and knowledgeable people from around the state.

STUDY AREAS

Yampa River Basin

The Yampa River Basin is located in the north western corner of Colorado (Figures 1 and 2). Elevation ranges from over 3600 m (>12,000 ft) along the Continental Divide in the Park Range to below 1650 m (5500 ft) near the Utah border in Dinosaur National Monument. The upper watershed receives on the order of 60-70" of precipitation annually, mostly as snow, while the western part of the basin receives about 8-10" a year on average (Colorado Climate Center 1984).

The upper watershed lies within the physiographic province of the Southern Rocky Mountains. The geology of this mountainous area is composed of resistant Pre-Cambrian granitic basement rocks in the Park Range and Tertiary basaltic flows that cap the Flat-Top Mountains (Tweto 1979) and give rise to steep, rocky stream reaches. Once out of the high country, the Yampa River enters the southern portion of the Wyoming Basin. Here it meanders across a wide valley of more erodible Cretaceous shales and sandstones of the Morrison, Williams Fork, and Lewis Shale Formations and the Tertiary Brown's Park Formation (Tweto 1979). In this region the Little Snake River joins the Yampa River. The Little Snake River drains a basin comprised mainly of fine claystones and shales of the Tertiary Wasatch Formation. Entering the Uinta Mountain region, the Yampa River cuts through Permian and Pennsylvanian Weber Sandstone and Park City formations (calcareous shales and limestones) within Dinosaur National Monument (Tweto 1979).

The basin has floristic ties to the Northern Rocky Mountains in the Park Range north of Steamboat Springs (Weber 1987) and to the Colorado Plateau/Uinta Mountain flora in the

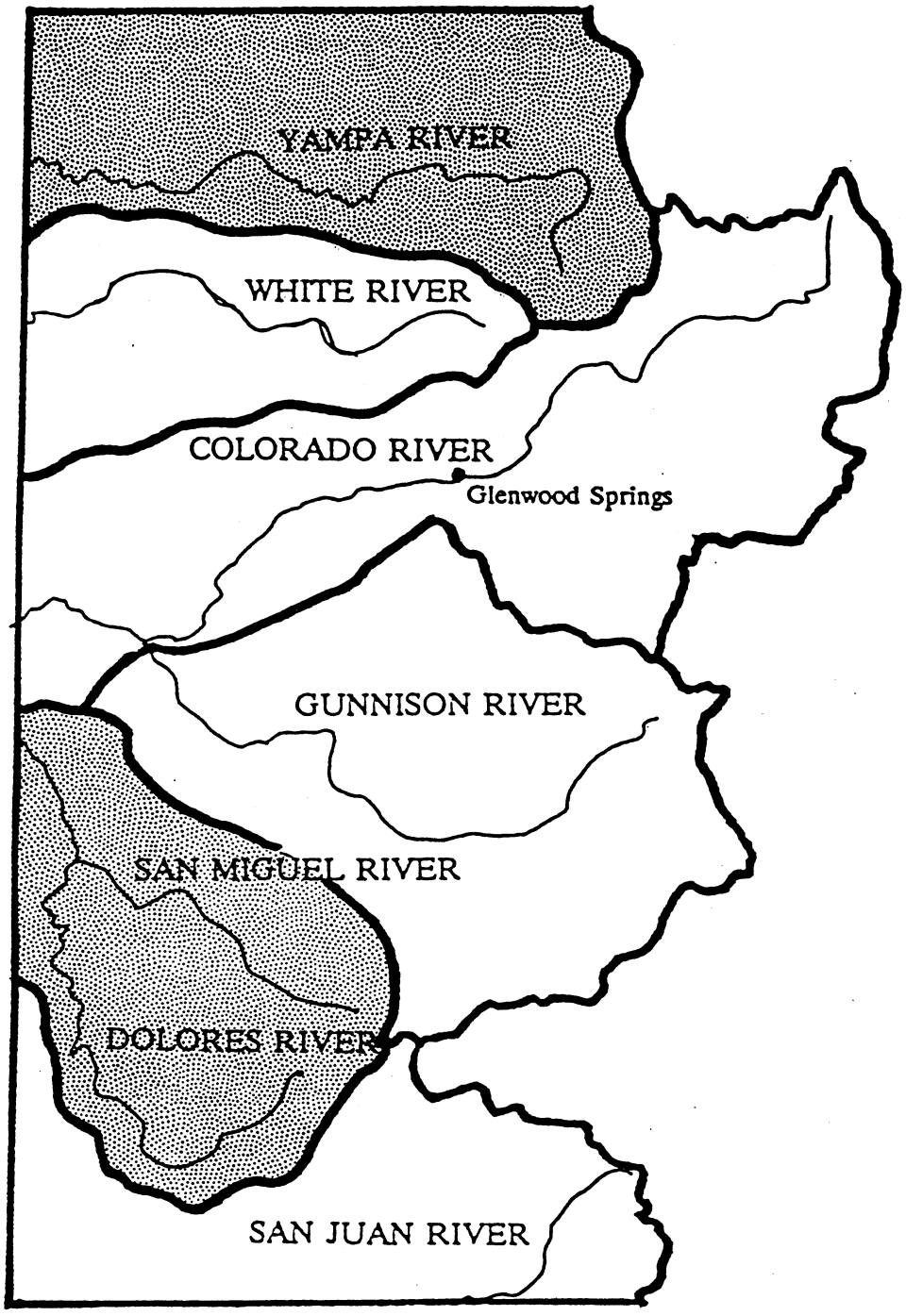


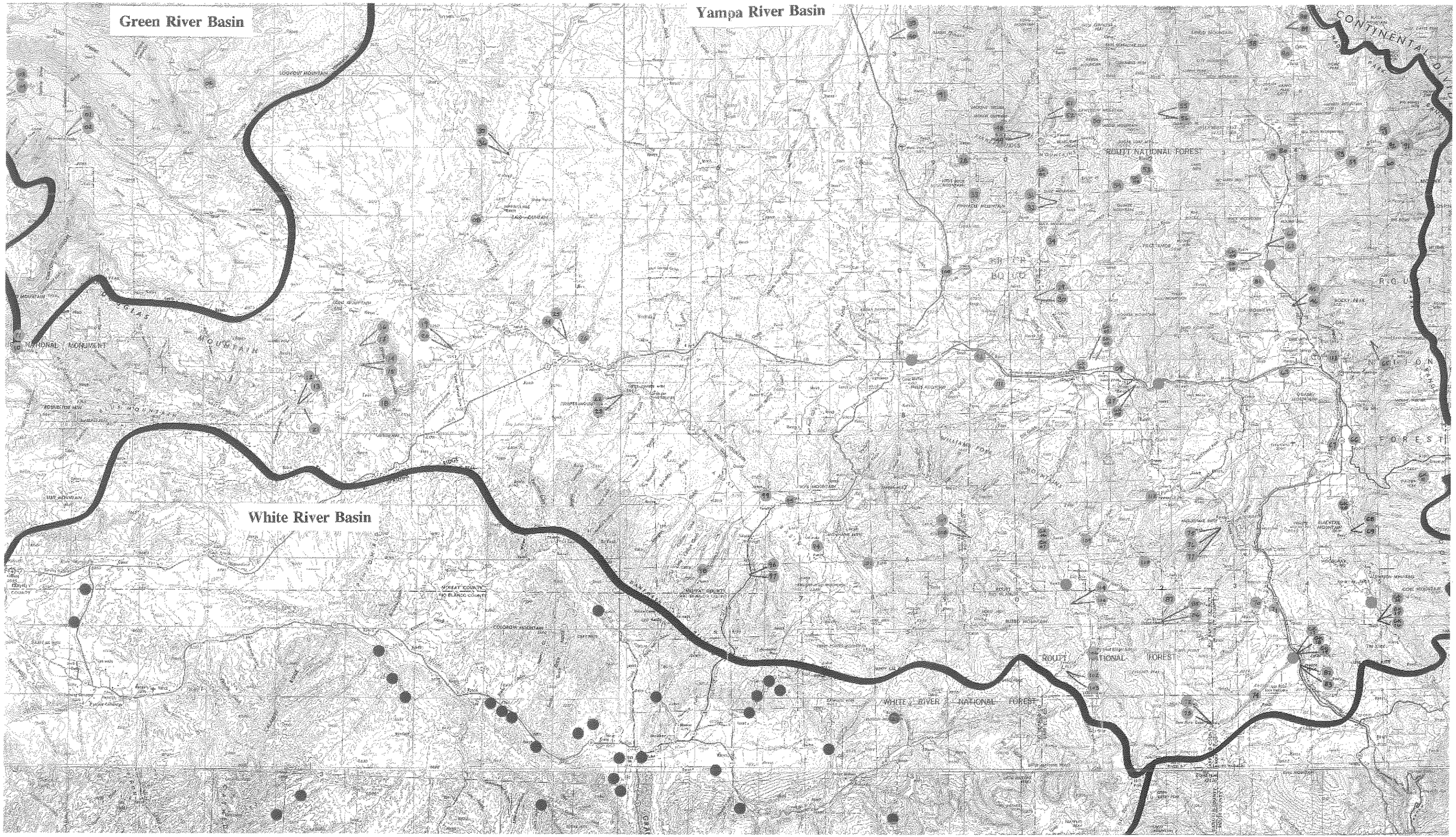
Figure 1. The Upper Colorado River Basin in Colorado. Shaded areas highlight the Yampa and San Miguel/Dolores River Basins.

Figure 2. Map of the Yampa River Basin and parts of the Green and White River Basins with plot locations (light blue dots). Dot numbers correspond to plot numbers in text. Scale: 1 cm = 4.8 km.

Green River Basin

Yampa River Basin

White River Basin



Williams Fork Mountains (Welsh *et al.* 1987). The majority of the basin, however, is floristically more closely related to the Wyoming Basin flora (Benedict 1991).

San Miguel/Dolores River Basin

The San Miguel/Dolores River Basin is located between Grand Junction and Cortez in southwestern Colorado (Figures 1 and 3). The basin covers a wide elevational range, from over 4000 m (> 14,000 ft) at the highest peaks of the San Juan Mountains to 1500 m (5000 ft) where the Dolores River flows into Utah. The San Juan Mountains receive approximately 50-60" of precipitation annually, and the lower Dolores River vicinity near Gateway receives about 10" a year (Colorado Climate Center 1984).

Upper reaches of the watershed drain high peaks comprised of Tertiary igneous rocks (Tweto 1979). Montane valleys are largely composed of Mancos Shale and Pennsylvanian and Permian Sandstones and Siltstone Formations (Tweto 1979). The geology and climate change rapidly as the two rivers enter the Colorado Plateau region. Here, they cut through Dakota Sandstone capped mesas and plateaus in steep-sided narrow canyons, exposing red sandstones and shales of the Morrison, Glen Canyon Group, and Chinle Formations (Tweto 1979, Chronic 1980). Much of the lower San Miguel/Dolores River basin is related floristically to the Colorado Plateau and Great Basin floras, while the upper reaches in the San Juan Mountains lie within the southern Rocky Mountain floristic region (Weber 1987).

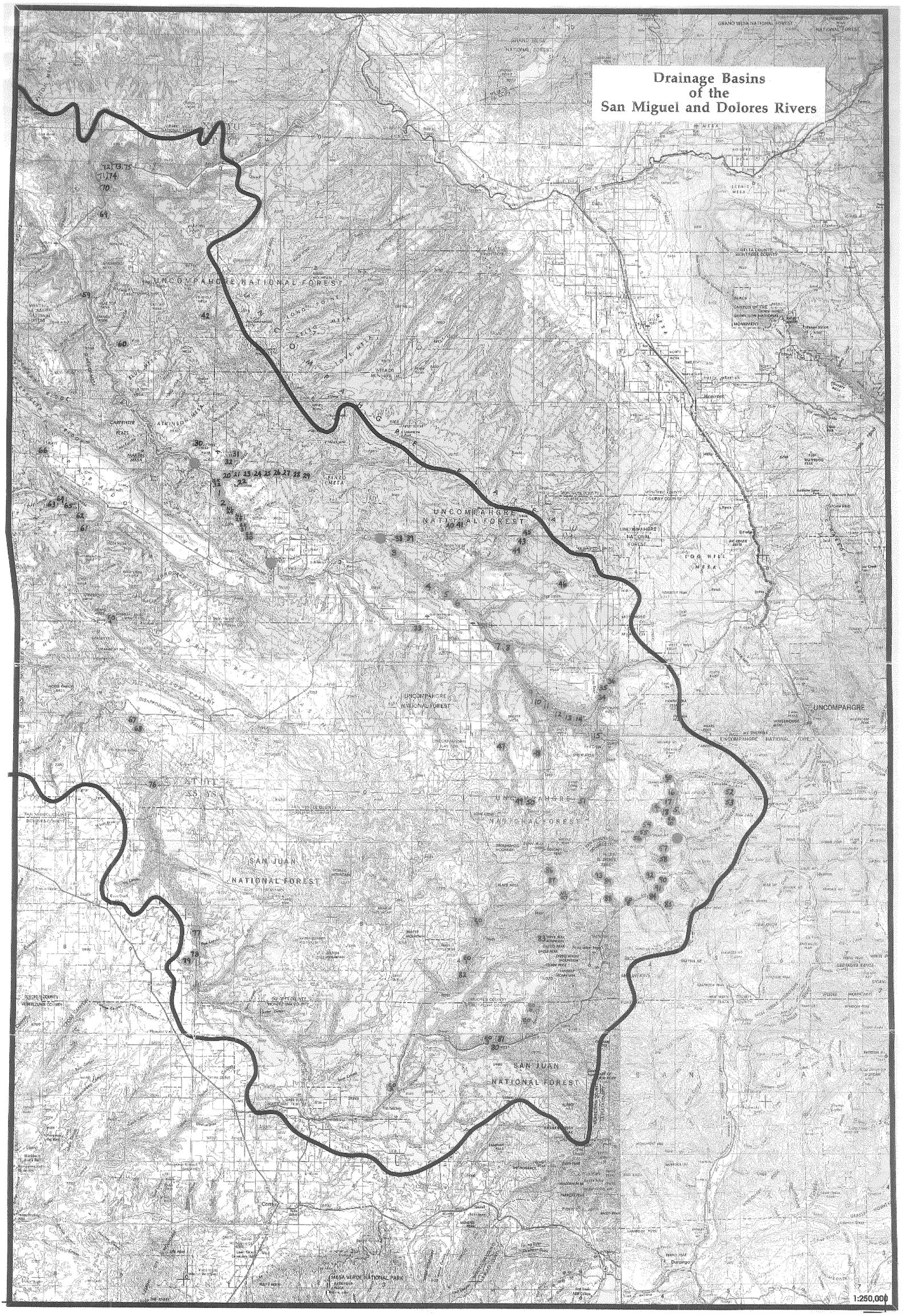
METHODS

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 area are frequently flooded, or are at least seasonally saturated by a fluctuating water table, and often have plant species, soils, and topography that differ considerably from those of the adjacent uplands (Elmore and Beschta 1987, Jones 1990). Riparian areas included vegetation that occur along natural water courses (creeks and rivers), poorly drained overflow areas, and associated natural bodies of water, such as oxbow lakes. This classification focuses on perennial streams as defined on U.S. Geological Survey 7.5" topographic maps.

Representative site selection

A stratified-random approach based on Austin and Heyligers (1989) gradsect concept was used. Major environmental gradients thought to be important in controlling riparian vegetation were used to stratify the study areas. In the San Miguel/Dolores River Basin, much of the variability of streams in the basin are represented with 30 stream types, using two environment gradients: 1) elevation with five classes (1,000 ft. intervals), and 2) stream gradient with six classes (1.5 % intervals). The number of sites (one mile homogeneous stream reaches) selected for study included a representative sample of the abundance of each

Figure 3. Map of the San Miguel/Dolores River Basin with plot locations (orange dots). Dot numbers correspond to plot numbers in text. Scale: 1 cm = 4.8 km.


Drainage Basins
of the
San Miguel and Dolores Rivers
UNCOMPAHGRE NATIONAL FOREST
SAN JUAN NATIONAL FOREST
UNCOMPAHGRE
1:250,000

stream type found in the basin. In the Yampa River Basin, 1) geology, 2) elevation, 3) valley width to depth ratio, and 4) stream length were used to stratify the basin. Again the number of samples per type was representative of the abundance of each stream type in the basin.

Riparian areas which have been drastically altered by human activity were not included in the sampling regime. Such 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 exotic species such as tamarisk or salt cedar (*Tamarix chinensis*), or Russian-olive (*Elaeagnus angustifolia*). However, areas with exotic species present, such as Kentucky bluegrass (*Poa pratensis*), but native flora dominated the overstory vegetation, were included when the degree of disturbance was minimal. If the site was acceptable, with relatively homogeneous stands at least twice the area of the sample plot (50 m^2), stand data were collected for each riparian plant association present.

Collection of vegetation and environmental data

Landowners or managing agencies, whether they be individuals or agency staff, were notified (and permission obtained for private properties) prior to visiting sites for collection of field data. When candidate sample sites did not exceed the disturbance criteria listed above, the following data were collected.

Variables estimated or measured at each stream reach (or site) included (but not limited to):

* elevation (meters)
* aspect (stream bearing)
* valley floor width (from topographic maps)
* stream gradient (in 1990 from topographic maps, in 1991, measured on site)
* channel depth and width
* drainage basin area above site (from maps)
* hydrologic and geomorphic features (beaver dams, point bars, etc.)
* history of use (from landowner or manager) when possible

Sample plots were approximately 50 m^2, and were subjectively located in a homogeneous portion of each community so as to fairly represent the vegetation of the site. The shape of the plot varied, depending on the orientation of the stand, in some instances, stringer-type stands were so narrow that elongated plots, 2.5 m x 20 m, were used. Data collected from individual plots included:

* all plant species present, percent canopy cover by species and life-form (trees, shrubs, etc.)

* 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)
* in 1991 and 1992, a brief soil description based on one auger within each plot. Noted for each horizon (or layer) were: thickness, texture (via hand-texturing), color, mottling/gleying, matrix color, coarse fragments, depth to water table, overall thickness, and parent material when possible.
* Height above bankfull stage of channel
* Distance from bankfull stage of channel
* Landscape position (point bar, floodplain, old channel, terrace, etc.)
* Signs of wildlife or domestic livestock utilization
* Signs of disturbance (flooding, fire, windthrow, logging, etc.)
* Successional relationships where trends were observed
* Adjacent riparian and upland vegetation
* Reference site and plot 35 mm color slides

Sample field forms are in Appendix 5. 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) in 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.

Data Analysis and Storage

Agglomerative cluster analysis programs in SPSS-PC (Norusis 1986) and PC-ORD (McCune 1991) were employed using average Euclidean distance and Ward's clustering method to determine groups of plots with similar vegetation into associations. Data from the two basins were analyzed separately, as they lie in different floristic provinces. Information concerning successional status and trends and management for each association is based on field observations and review of the literature.

Selected information collected during this project will be entered into the Biological and Conservation Data System (BCD) maintained by the Colorado Natural Heritage Program (CNHP) currently housed at the University of Colorado Museum. The Natural Heritage Program is a continually updated, computer assisted inventory of the biological and ecological features and biodiversity preservations of Colorado. This System also contains descriptions of plant associations and rare plant species, information on locations of rare plants and high-quality examples of plant associations in Colorado, and literature pertinent to the management and protection of biodiversity. Information stored at CNHP is available to biologists, managers, and other interested parties. However, CNHP reserves the right to respect any confidentiality of certain data.

Classification

All classification is based on existing, relatively undisturbed, natural vegetation. Plant associations, the finest unit in this hierarchical classification, are defined as relatively stable, existing 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, relatively stable, or predictable, vegetation that occurs with natural fluvial disturbances. Plant associations are considered a product of the prevailing environmental setting (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 fluvial sediment deposition and scouring, create an environment that is frequently disturbed. In this classification, riparian plant associations are considered either relatively stable, or at least predictable, vegetation units that depend on fluvial dynamics of the river for long-term maintenance and regeneration (Winward and Padgett 1988).

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, Idaho, and Wyoming. The Montana riparian classification publication descriptions were too general for comparison. Correlations with the Montana types will be incorporated when more information becomes available. Associations were considered either 1) synonymous (where associations matched in species composition, constancy, average cover, elevation, and physical setting), 2) similar (when canopy structure, genera, and physical setting were similar, but differed in species composition), or 3) a new type not described in the literature.

Association names are 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/undergrowth). A dash indicates codominance within a given canopy layer (e.g. *Picea engelmannii-Abies lasiocarpa/Alnus incana* spp. *tenuifolia*). Plant associations that appeared synonymous with those in the literature (by stand table and description comparison) were given the same name. When certain published names were long and awkward, shorter names are proposed.

Riparian plant associations were placed into the 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) (Tables 1, 2, and 3).

Table 1. Cross-reference of the UNESCO (1974) classes (as modified by Reid and Bourgeron, 1991, to include series and plant association levels) and Cowardin (1979) classes **used to classify riparian plant associations** found 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)

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.)
1,2, etc.	Series (dominant characteristic species, e.g. *Picea engelmannii*)
a,b, etc.	Plant association (e.g. *Picea engelmannii-Abies lasiocarpa/Alnus incana* spp. *tenuifolia*)

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 a 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.

Determination of Ecologically-Significant Sites

Best examples of riparian areas found in the Yampa and San Miguel/Dolores River Basin 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 in to the Biological and Conservation Database and ranking these sites for final protection recommendation.

The Colorado Natural Heritage Program is responsible for gathering and updating features of natural diversity in Colorado. Each of these significant natural features (species and community types) is an element of natural diversity, or simply an element. Each element is assigned a global and a state rank that indicate 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 protection of the most sensitive sites.

In addition to ranking each element in terms of rarity, Natural Heritage staff scientists rank each element occurrence so that protection efforts can be aimed not only at the rarest elements, but at the best examples of each. 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. Given the intimate relationship between a natural community and its environment, plant association occurrences are largely ranked in terms of their quality and size.

One of the ways that the Colorado Natural Heritage Program uses these element and element occurrence ranks is to assess the overall significance of a site, 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 recommend in this report are examples of "A" or "B+" ranked occurrences, that is, they must be in good to excellent condition, be one of the largest or best known examples, occur along hydrologically intact rivers or streams (without major alteration such as large upstream dams, close proximity to downstream dams, or subject to channelization), show signs of continued existence, 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.

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

During the summers of 1990, 1991, and 1992, we sampled over 200 sites within the Yampa and San Miguel/Dolores River Basins. Presented here are the results of the agglomerative cluster analyses (Figures 4 and 5), comparisons of riparian plant associations with previously described riparian associations in Colorado and neighboring Rocky Mountain states, physical and floristic descriptions, and regional, state, and basin-wide distributions.

In the Yampa River Basin, plant associations ranged from *Picea* and *Abies* spp. dominated evergreen forests, both narrow and broadleaf cottonwood forests, willow-dominated shrublands, non-willow shrublands dominated by *Alnus incana* spp. *tenuifolia* or *Sheperdia argentea*, graminoid dominated wet meadows, to alkaline swales dominated by salt tolerant species such as *Distichlis spicata* or *Iva axillaris* (Table 3). Thirty-eight plant associations are described, seven are new to the state, four are miscellaneous types.

Several high-quality, proposed ecologically-significant riparian areas were identified in the basin (Appendix 1). These sites occur along largely hydrologically intact rivers and have good to excellent examples of globally rare or more common plant associations (see Methods for explanation of ecological site determination). These high-quality riparian areas are presented here as candidate sites for further study to better understand how these riparian ecosystems function, and are recommended for protection.

The San Miguel/Dolores River Basin riparian plant associations had a similar range in diversity of association types (Table 4). Twenty-eight plant associations are described. Five are new to Colorado, four are Unaweep Seep wetland types, and two are miscellaneous types. The San Miguel/Dolores Basin lies near the southwest corner of the state and has a number of willow species that did not occur in the Yampa Basin, due to floristic ties with the Colorado Plateau, including the Canyon Lands province of Utah, and the mountain and desert regions of New Mexico and Arizona. Only about 11% of the riparian associations were common to the two basins (see plant associations marked with an asterisk in Tables 3 and 4). This may be due to floristic differences between the two basins, and because they occur in distinct physiographic regions of Colorado.

Several high-quality, proposed ecologically-significant riparian sites were identified in the San Miguel/Dolores River Basin that have excellent examples of common or globally rare plant associations along hydrologically intact rivers (Appendix 1). These sites are recommended for additional research and protection.

The following sections of the report provide more detailed information about each plant association. A dichotomous key based on vegetation is included for each basin. Each key is to individual plant associations. When these associations occur together as a mosaic, first determine what patches (or parts of a mosaic) are present (ex. forest, shrubland with an adjacent meadow, etc.), and use the key to identify each part or association of the mosaic individually.

Figure 4. Yampa River Basin Agglomerative Cluster Analysis Dendrogram using Euclidean distance and Ward's clustering method. Group numbers indicate the following plant associations (see text for full names): 1= low elevation herbaceous types (IVAX, JUBA, ELPA, SCSP, DISP, MUAS, and EQHY), 2=CAST, 3=CACA, 4=POAN/ALIN, 5=SHAR-LECI, 6=SCAM, 7=ALIN-COSE, 8=PODE/RHTR, 9 & 12=POAN-PIPU/COSE, 10=POAN/AMAL/SMST, 11=POAN/SAEX, 13 & 16=SALA/mf, 14=PIEN-ABLA/LOIN, 15=misc. 17=CAAQ, 18=SAPL/CAAQ, 19=SAMO/CAAQ, 20=CANE, 21=RHTR, 22=ACNE/bare (misc.), 23 & 25=SAWO/mf, 24=SAGE/CARO, 26=CARO, 27=SAEX, 28=SABO/mf, 29= ALIN/mf, 30=PIPU/ALIN, 31= ALIN-COSE, 32=ABLA/ALIN, 33=POAN/COSE & POAN-ACNE/COSE. '*' indicates the stand was placed in another group.

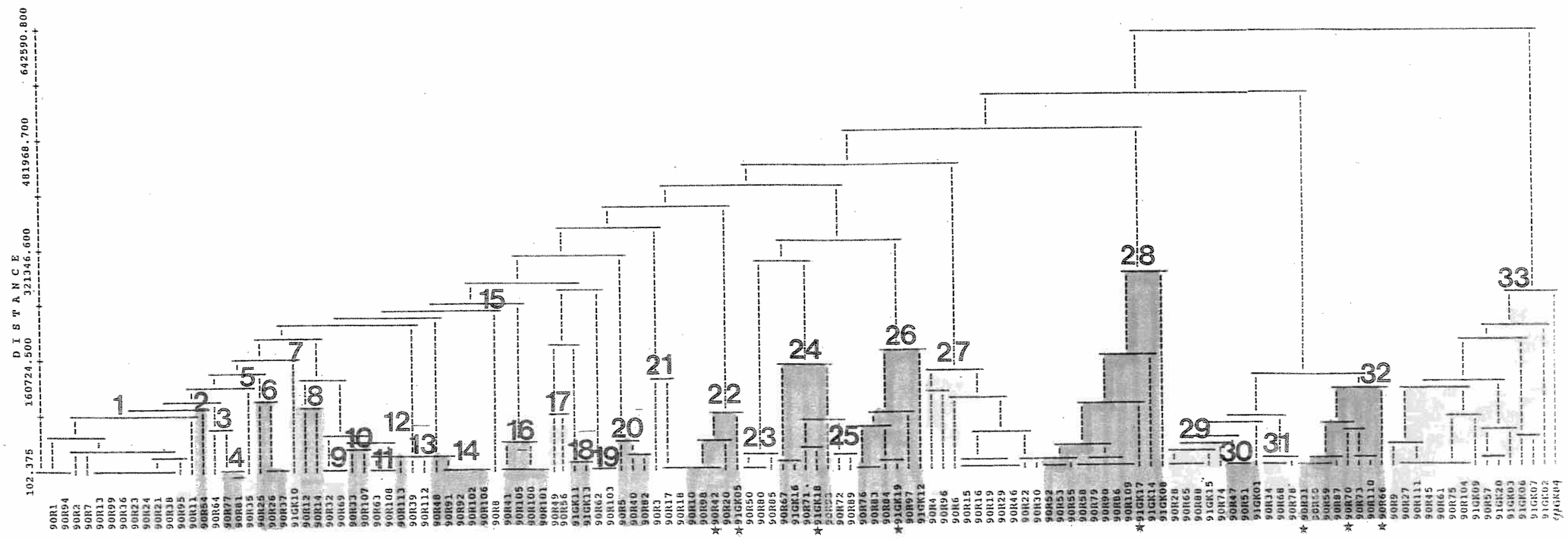
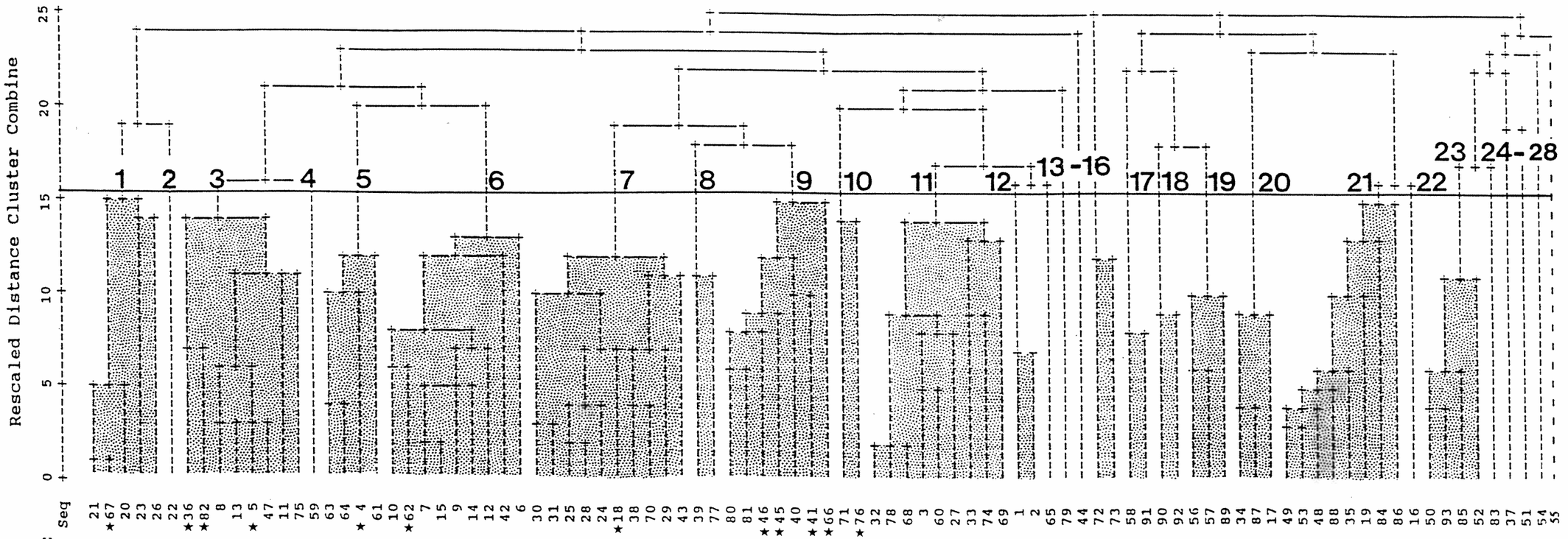


Figure 5. San Miguel/Dolores River Basin Agglomerative Cluster Analysis Dendrogram, using Euclidean distance and average linkage clustering method. Group numbers indicate the following plant associations (see text for full names): 1=POAN/RHTR, 2=SPAI, 3=PIPU-POAN/ALIN-COSE, 4=PODEL (misc.), 5=ACNE/BEOC, 6=POAN-PIPU/COSE, 7=POAN/RHTR & POAN/COSE, 8=RHTR-SALI, 9=POAN/COSE, 10=Unaweep misc., 11=SAEX, 12=PODE/RHTR, 13=ELPA, 14-15=Carex sp.(misc.), 16=ELPA Unaweep misc., 17=CAAQ, 18=SAWO/CAAQ, 19=SAPL/CALE, 20=CARO, 21-22=SAMO-SAGE/mf, 23=PIEN-ABLA/mf, 24=PIPU/ALIN, 25=PIPU-POAN/ALIN-LOIN, 26=Misc., 27=SADR, 28=SABR/mf. '★' indicates the stand was placed into another group.



Plant association descriptions include: 1) synonyms or similar plant associations from literature comparison, 2) regional, state, and basin-wide distributions (where available), and channel and floodplain morphological setting, 3) soil texture and depth, 4) vegetation description including dominant and characteristic species structure and composition, and 5) a brief discussion on successional trends and/or ecology of the association where observations or other information was available.

Constancy tables (Tables 5-11 for Yampa data, Tables 12-28 for San Miguel/Dolores data) provide constancy (frequency of species occurrence) and average percent canopy cover values for dominant and other frequently encountered plant species for plant associations represented by more than one plot, grouped by physiognomic type (evergreen forests, tall-willow shrublands, etc.).

Full plant species lists with scientific and common names are in Appendix 2A and 2B. Color photographs of selected sites from the Yampa and San Miguel River Basins are in Appendices 6 and 7.

Further information is being compiled from CNHP on the total number of known occurrences in Colorado and the statewide distribution, and will be added to this report as the information becomes available.

Table 3. Riparian Plant Associations of the Yampa River Basin. (UNESCO and Cowardin Classification classes are in parentheses, as listed in Table 1)

Evergreen Forests (Closed Evergreen Forests; Palustrine needle-leaved evergreen forested wetlands)

Picea engelmannii Series
- *Picea engelmannii-Abies lasiocarpa/Alnus incana* spp. *tenuifolia* *
- *Picea engelmannii-Abies lasiocarpa/Lonicera involucrata*

Picea pungens Series
- *Picea pungens/Alnus incana* spp. *tenuifolia**

Mixed Deciduous-Evergreen Forests (Closed cold-deciduous forests with evergreen trees; Palustrine broad-leaved deciduous forests wetlands)

Populus angustifolia Series
- *Populus angustifolia-Picea pungens/Alnus incana* spp. *tenuifolia-Cornus sericea**

Deciduous Forests (Closed cold-deciduous mainly broad-leaved forests; Palustrine broad-leaved deciduous forested wetlands)

Populus angustifolia Series
- *Populus angustifolia-Acer negundo/Cornus sericea*
- *Populus angustifolia/Alnus incana* spp. *tenuifolia*†
- *Populus angustifolia/Amelanchier alnifolia*
- *Populus angustifolia/Cornus sericea*†*
- *Populus angustifolia/Salix exigua*

Populus deltoides Series
- *Populus deltoides* ssp. *wislizenii/Rhus trilobata**

Tall-Willow Shrublands (Cold-deciduous temperate shrublands;Palustrine deciduous scrub-shrub wetlands)

Salix spp. Series
- *Salix boothii*/mesic forb†
- *Salix boothii/Carex rostrata*†
- *Salix drummondiana/Calamagrostis canadensis*
- *Salix exigua*/mesic graminoid*
- *Salix geyeriana/Carex rostrata*†
- *Salix lasiandra* var. *caudata*/mesic graminoid
- *Salix monticola/Carex aquatilis*†

Low-Willow Shrublands (Cold-deciduous subalpine or peat shrublands; Palustrine deciduous scrub-shrub wetlands)

Salix spp. Series
- *Salix planifolia* var. *monica/Carex aquatilis**
- *Salix wolfii*/mesic forb*

Table 3. Continued.

Non-Willow Shrublands (Cold-deciduous subalpine or peat shrublands; Palustrine deciduous scrub-shrub wetlands)

- *Alnus incana* spp. *tenuifolia* Series
  - *Alnus incana* spp. *tenuifolia-Cornus sericea*
  - *Alnus incana* spp. *tenuifolia-Salix geyeriana*†
  - *Alnus incana* spp. *tenuifolia*/mesic forb†
- *Rhus trilobata* Series
  - *Rhus trilobata*†*
- *Shepherdia argentea* Series
  - *Shepherdia argentea-Leymus cinereus*† (tentative type)

Herbaceous Plant Associations (Terrestrial herbaceous communities; Palustrine-emergent wetlands)

- *Carex* spp. Series
  - *Carex aquatilis**
  - *Carex rostrata**
  - *Carex nebrascensis*
- *Distichlis spicata* Series
  - *Distichlis spicata* (tentative type)
- *Eleocharis palustris* Series
  - *Eleocharis palustris** (Aquatic reed-swamp of flowing water; Riverine-upper perennial-emergent wetlands) (tentative type)
- *Iva axillaris* Series
  - *Iva axillaris*
- *Juncus* spp. Series
  - *Juncus balticus*
- *Muhlenbergia asperifolia* Series
  - *Muhlenbergia asperifolia* (tentative type)
- *Scirpus* spp. Series
  - *Scirpus americanus*
  - *Scirpus maritimus* (tentative type)

Miscellaneous Plant Associations

- *Acer negundo*/bare (tentative type)
- *Calamagrostis stricta* (tentative type)
- *Chrysothamnus* sp. (tentative type)
- *Equisetum hyemale* (tentative type)

* Also found in the San Miguel/Dolores River Basin.

† New plant association for Colorado.

Table 4. Riparian Plant Associations of the San Miguel/Dolores River Basin. (UNESCO and Cowardin classification classes are in parentheses, as listed in Table 1)

Evergreen Forests (Closed Evergreen Forests; Palustrine needle-leaved evergreen forested wetlands)

Picea engelmannii Series
- *Picea engelmannii-Abies lasiocarpa/Alnus incana* spp. *tenuifolia**
- *Picea engelmannii-Abies lasiocarpa*/mesic forbs

Picea pungens Series
- *Picea pungens/Alnus incana* spp. *tenuifolia**
- *Picea pungens/Cornus sericea*

Mixed Deciduous-Evergreen Forests (Closed cold-deciduous forests with evergreen trees; Palustrine broad-leaved deciduous forested wetlands)

Populus angustifolia Series
- *Populus angustifolia-Picea pungens/Alnus incana* spp. *tenuifolia-Cornus sericea**
- *Picea pungens-Populus angustifolia/Alnus incana* spp. *tenuifolia-Lonicera involucrata*

Deciduous Forests (Closed cold-deciduous mainly broad-leaved forests; Palustrine broad-leaved deciduous forested wetlands)

Acer negundo Series
- *Acer negundo/Betula occidentalis*†

Populus angustifolia Series
- *Populus angustifolia/Cornus sericea**
- *Populus angustifolia/Rhus trilobata*†

Populus deltoides Series
- *Populus deltoides* ssp. *wislizenii/Rhus trilobata**

Tall-Stature Willow Shrublands (Cold-deciduous temperate shrublands; Palustrine deciduous shrubland wetlands)

Salix spp. Series
- *Salix exigua*/mesic graminoids* (Deciduous alluvial shrubland)
- *Salix monticola-Salix geyeriana*/mesic forb†
- *Salix drummondiana*/mesic forb

Low-Stature Willow Shrublands (Cold-deciduous subalpine or peat shrublands; Palustrine deciduous shrubland wetlands)

Salix spp. Series
- *Salix brachycarpa/mesic forb*
- *Salix wolfii/Carex aquatilis**
- *Salix planifolia* var. *monica/Caltha leptosepala**

Table 4. Continued.

Non-Willow Shrublands (Cold-deciduous temperate shrublands; Palustrine deciduous shrubland wetlands)

Forestiera pubescens Series

Forestiera pubescens-Salix exigua/Phragmites australis†

Rhus trilobata Series

Rhus trilobata†*

Herbaceous Plant Associations (Terrestrial herbaceous communities; Palustrine-emergent wetlands)

Carex spp. Series

*Carex aquatilis**

*Carex rostrata**

Eleocharis spp. Series

*Eleocharis palustris** (Aquatic reed-swamps of flowing water; Riverine emergent wetlands)

Sporobolus spp. Series

Sporobolus airoides (Inland salt meadow)

Unaweep Seep Wetlands

Celtis reticulata/Clematis ligusticifolia

Eleocharis palustris-Phragmites australis

Eleocharis palustris-Scirpus validus

Alnus incana spp. *tenuifolia/Eupatorium maculatum*

Miscellaneous Plant Associations

Pseudotsuga menziesii/Acer glabrum

Pseudotsuga menziesii/Cornus sericea

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* Plant association also found in the Yampa River Basin.

† New plant association for Colorado

KEY TO YAMPA RIVER BASIN RIPARIAN PLANT ASSOCIATIONS

Key to Groups:

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

1. Tree overstory not present 3

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

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

3. Shrubs dominate the overstory 4

3. Shrubs not dominating the overstory; plant association dominated by herbaceous species . **Group E**

   4. *Salix* spp. dominate the overstory with at least 20% cover . . . . . **Group C**

   4. Other shrubs dominate the overstory (a few willows may be present) . . . . . **Group D**

Key to Plant Associations:

Group A. Coniferous Dominated Woodlands

1. *Abies lasiocarpa* and/or *Picea engelmannii* present in the overstory 2

1. *Picea pungens* present in the overstory 3

   2. *Alnus incana* spp. *tenuifolia* lines the river banks . . . . . ***Picea engelmannii-Abies lasiocarpa/Alnus incana* spp. *tenuifolia* p.a.**

   2. *Lonicera involucrata* present in the shrub understory . . . . . ***Picea engelmannii-Abies lasiocarpa/Lonicera involucrata* p.a.**

3. *Picea pungens* dominant with at least 20% cover . . . . . ***Picea pungens/Alnus incana* spp. *tenuifolia* p.a.**

3. Not as above . . . . . **Miscellaneous plant associations**

Group B. Deciduous Dominated Woodlands

1. *Populus deltoides* present with at least 25% cover . . . . . ***Populus deltoides/Rhus trilobata* p.a**

1. *Populus angustifolia* the dominant cottonwood 2

   2. *Acer negundo* present with at least 15% cover . . . . . ***Populus angustifolia-Acer negundo/Cornus sericea* p.a.**

   2. *Acer negundo* absent, or with less than 15% cover 3

3. Dense *Cornus sericea* in the undergrowth 4

3. *Alnus incana* spp. *tenuifolia*, *Amelanchier alnifolia*, and/or *Salix exigua* present; *Cornus sericea* less than 10% cover 5

   4. *Picea pungens* present with at least 15% cover . . . . . ***Populus angustifolia-Picea pungens/Alnus incana* spp. *tenuifolia-Cornus sericea* p.a.**

   4. Not as above . . . . . ***Populus angustifolia/Cornus sericea* p.a.**

5. *Populus angustifolia* cover consists mainly of seedlings and or saplings, *Salix exigua* co-dominant, usually on point bars . . . . . ***Populus angustifolia/Salix exigua* p.a.**

5. Not as above. 6

   6. *Alnus incana* spp. *tenuifolia* present . . . . . ***Populus angustifolia/Alnus incana* spp. *tenuifolia* p.a.**

   6. *Amelanchier alnifolia* or *Quercus gambelii* present with at least 15% cover . . . . . ***Populus angustifolia/Amelanchier alnifolia* p.a.**

Group C. Willow-dominated Shrublands

1. Willows of low stature (<1.5 m tall), upper subalpine and alpine environments 2

1. Willows of tall stature (>2 m tall), lower subalpine, montane environments 3

   2. *Salix planifolia* var. *monica* dominant with at least 25% cover . . . . . ***Salix planifolia/Caltha leptosepala* p.a.**

   2. *Salix wolfii* dominant with at least 30% cover . . . . . ***Salix wolfii*/mesic forb p.a.**

3. *Salix exigua* with at least 10% cover 4

3. Other *Salix* spp. clearly dominant 5

4. *Salix lasiandra* var. *caudata* present with at least 25% cover . . . . . **_Salix lasiandra_ var. _caudata_/mesic graminoid p.a.**

4. *Salix exigua* 10-90% cover, typically at stream margins . . . . . **_Salix exigua_/mesic graminoid p.a.**

5. *Salix boothii* at least 25% cover 6

5. Not as above 7

6. *Carex rostrata* at least 25% cover . . . . . **_Salix boothii/Carex rostrata_ p.a.**

6. Low forbs characterize the undergrowth individually or together 20% cover . . . . . **_Salix boothii_/mesic forb p.a.**

7. *Salix monticola* or *Salix drummondiana* dominant with at least 25% cover. 8

7. *Salix geyeriana* dominant with at least 25% cover . . . . . **_Salix geyeriana/Carex rostrata_ p.a.**

8. *Salix monticola* the dominant willow, on moderate to flat gradient streams . . . . . **_Salix geyeriana/Carex rostrata_ p.a.**

8. *Salix drummondiana* the only willow present, on steep, boulder strewn streams . . . . **_Salix drummondiana/Calamagrostis canadensis_ p.a.**

Group D. Non-Willow Dominated Shrublands

1. *Alnus incana* spp. *tenuifolia* dominant or co-dominant with at least 20% cover 2

1. *Rhus trilobata* or *Shepherdia argentea* dominant 4

2. *Alnus incana* spp. *tenuifolia* at least 35% cover; tall forbs, e.g. *Rudbeckia laciniata* and *Aconitum columbianum* dominate the undergrowth . . . . . **_Alnus incana_ spp. _tenuifolia_/mesic forb p.a.**

2. *Alnus incana* spp. *tenuifolia* co-dominant with *Salix* spp. or *Cornus sericea* 3

3. *Cornus sericea* at least 20% cover . . . **_Alnus incana_ spp. _tenuifolia-Cornus sericea_ p.a.**

3. *Salix geyeriana* co-dominant with at least 20% cover . . . . . **_Alnus incana_ spp. _tenuifolia-Salix geyeriana_ p.a.**

4. *Rhus trilobata* at least 25% cover, *Cornus sericea* sometimes a co-dominant . . . . . ***Rhus trilobata* p.a.**

4. *Shepherdia argentea* at least 20% cover . . . . . ***Shepherdia argentea* p.a.**

Group E. Herbaceous Dominated Plant Associations

1. *Carex* spp. dominant with at least 25% cover 2

1. Not as above 4

2. *Carex aquatilis* at least 25% cover . . . . . ***Carex aquatilis* p.a.**

2. Not as above 3

3. *Carex nebrascensis* at least 25% cover . . . . . ***Carex nebrascensis* p.a.**

3. *Carex rostrata* at least 25% cover . . . . . ***Carex rostrata* p.a.**

4. Freshwater wetlands (seasonally ponded) dominated by *Eleocharis palustris, Scirpus* spp. or *Juncus* spp. 5

4. Sites tending to be alkaline and disturbed, with seasonally high water tables 8

5. *Eleocharis* or *Juncus* spp. dominant 6

5. *Scirpus* spp. dominant 7

6. *Eleocharis palustris* at least 25% cover . . . . . ***Eleocharis palustris* p.a.**

6. *Juncus balticus* at least 25% cover . . . . . ***Juncus balticus* p.a.**

7. *Scirpus americanus* at least 25% cover . . . . . ***Scirpus americanus* p.a.**

7. *Scirpus maritimus* at least 25% cover . . . . . ***Scirpus maritimus* p.a.**

8. Alkaline graminoids present 9

8. *Iva axillaris* at least 10% cover . . . . . ***Iva axillaris* p.a.**

9. *Distichlis spicata* at least 20% cover . . . . . ***Distichlis spicata* p.a.**

9. *Muhlenbergia asperifolia* at least 20% cover . . . . . ***Muhlenbergia asperifolia* p.a.**

YAMPA RIPARIAN PLANT ASSOCIATION DESCRIPTIONS

Some Yampa riparian plant associations lack soil information as data were not collected in 1990. 1991 stands correspond to those stand numbers preceded by the letters GK. Stand numbers correspond to those on the color Yampa River basin map (Figure 2) and on the individual plot location maps (Appendix 3). Four letter acronyms (in capital letters) for plant association names are used in the constancy tables at the end of the Descriptions section.

A. EVERGREEN FORESTS

Our concept of evergreen (conifer) dominated riparian plant associations is narrower than that described by riparian classifications of Utah and southeastern Idaho (Padgett *et al.* 1989) and eastern Idaho and western Wyoming (Youngblood *et al.* 1985), which can have *Abies* spp., *Picea* spp. and/or *Pseudotsuga menziesii* in the overstory. We feel that elevation and other environmental characteristics of different conifer species warrant splitting them out at the species level.

Channel migration and sediment-deposition serve a key role in regeneration of these associations. As increase sediment deposition over time transforms point bars into terraces, coniferous species begin to increase in abundance within forest stands. Where deciduous species cannot regenerate on terraces above the river, conifers can and do regenerate, and thus may represent potentially long-lived plant associations. Mature coniferous communities are subject to the cyclical destruction by river channel migration; migrations in river channels provide opportunities for deciduous riparian species to once again gain a foothold (The Nature Conservancy 1992).

Picea engelmannii-subalpine fir/thinleaf alder (*Picea engelmannii-Abies lasiocarpa/Alnus incana* spp. *tenuifolia*) p.a.

(PIEN-ABLA/ALIN) 6 stands (59, 60, 65, 73, 87, 110)

Synonyms: *Abies lasiocarpa-Picea engelmannii/Alnus incana* spp. *tenuifolia-Lonicera involucrata-Salix drummondiana* (Baker 1989).

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).

In the Yampa River Basin, this type was found only in the eastern and highest portions of the watershed, at elevations between 2370-2780 m (7770-9100 ft) in Routt and Garfield counties. Subalpine fir/thinleaf alder type occurred on immediate river banks and toe slopes adjacent to narrow, steep streams in V-shaped, narrow valleys.

Soil: Sandy soils over cobbles.

Vegetation: *Abies lasiocarpa* and *Picea engelmannii* were present but did not form a closed canopy and usually accounted for less than 10% cover. *Alnus incana* spp. *tenuifolia* dominated a dense shrub layer. *Lonicera involucrata* and *Rubus idaeus* were often present in

low amounts. Forb and graminoid coverage was usually low due to shading, but diversity was fairly high; *Equisetum* spp. were often present.

Adjacent riparian vegetation: Thinleaf alder/mesic forb shrublands, Wolf's willow-Booth's willow shrublands, and blue-joint reedgrass meadows.

Adjacent upland vegetation: Subalpine fir-Engelmann spruce forests, aspen/mesic forb woodlands.

Succession/management: Appears to be a late-seral, subalpine riparian plant association. Padgett *et al.* (1989) suggests this type would eventually become dominated by *Abies lasiocarpa*. More information is need about the soil and successional trends of this type.

Engelmann spruce-subalpine fir/black twinberry (*Picea engelmannii-Abies lasiocarpa/Lonicera involucrata*) p.a.

(PIEN-ABLA/LOIN) 5 stands (48, 91, 92, 102, 106)

Synonyms: Similar to *Abies lasiocarpa-Picea engelmannii-Populus angustifolia/Lonicera involucrata* (Baker 1989), but no *Populus angustifolia* was present in our plots.

Distribution: Reported from northern New Mexico into southern Colorado (DeVelice *et al.* 1986). Known in Colorado from the San Juan Mountains in La Plata, San Juan, and Ouray Counties, and from the Roaring Fork River Basin near Aspen, Gunnison County (CNHP 1993).

In the Yampa River Basin this type was found mostly in the eastern and higher portions of the basin, in Routt and Garfield counties, at elevations between 2540-2870 m (8330-9400 ft). Engelmann spruce-subalpine fir/black twinberry type occurred on immediate stream banks of very narrow streams in V-shaped, steep valleys.

Vegetation: *Abies lasiocarpa* and *Picea engelmannii* dominated the tall tree canopy, creating a moist, low light environment. *Lonicera involucrata* was always present at 10% cover. *Alnus incana* spp. *tenuifolia* was absent, or present only in very low amounts. *Ribes montigenum* and *Vaccinium scoparium* were also occasionally present. Indicator mesic forbs were *Mertensia ciliata*, *Osmorhiza depauperata*, and *Equisetum arvense*.

Adjacent riparian vegetation: Rocky Mountain willow/aquatic sedge shrublands, aquatic sedge meadows.

Adjacent upland vegetation: Engelmann spruce-subalpine fir forests, aspen/mesic forb woodlands.

Succession/management: Appears to be a relatively stable, subalpine forest riparian plant association. Padgett *et al.* (1989) suggests this type would eventually become dominated by *Abies lasiocarpa*. More information is need about soils and successional trends or status of this type.

Colorado blue spruce/thinleaf alder (*Picea pungens/Alnus incana* spp. *tenuifolia*) p.a.

(PIPU/ALIN) 3 stands (47, 51, GK01)

Synonyms: *Picea pungens/Alnus incana* spp. *tenuifolia* (Baker 1989, Johnston 1987).

Distribution: This plant association has been reported from northwestern Wyoming to northern New Mexico (Johnston 1987). In Colorado, it is reported from Routt National Forest south to Rio Grande and San Juan National Forests (Johnston 1987, Baker 1989), and recently from the eastern slope, Jefferson County (CNHP 1993).

In the Yampa River Basin we found it only in northern Routt County, from 2180 to 2700 m (7150-8850 ft) in elevation on immediate stream banks of narrow channels in narrow V-shaped valleys. This type is expected to occur elsewhere in the basin at similar elevations.

Soil: Shallow loamy sand with heavy organic matter content, over gravel and cobbles. One plot showed mottling at 8 cm the around roots.

Vegetation: *Picea pungens* dominated the tree canopy with about 20% cover while *Alnus incana* spp. *tenuifolia* formed thick bands of dense shrubs overhanging the creek. Forb cover was low but diverse and included *Fragaria* sp., *Geum macrophyllum* and *Osmorhiza depauperata.*

Adjacent riparian vegetation: Booth's willow-Geyer willow/mesic forb shrublands, thinleaf alder/horsetail shrublands.

Adjacent upland vegetation: Engelmann spruce-subalpine forests, aspen woodlands.

Succession/management: More information is need about the regeneration requirements and successional status of *Picea pungens* dominated associations.

B. MIXED DECIDUOUS-EVERGREEN FORESTS

Padgett *et al.* (1989) did not describe any mixed conifer-deciduous riparian types. In their conifer/*Cornus sericea* community type deciduous trees (cottonwood, aspen) present were considered remnant, indicating that the conifers were the climax over story. In all of our stands, however, we found regeneration of both *Picea pungens* and *Populus angustifolia.*

Intact fluvial processes of flooding and deposition allow narrowleaf cottonwood to regenerate, keeping the community in a mid to late-seral stage, while seasonally high water tables and cold-air drainage provide habitat for *Picea pungens*. These mixed deciduous-evergreen plant associations are subject to cyclical destruction by river channel migration; migrations in river channels provide opportunities for deciduous riparian species to once again gain foothold. These montane floodplain environments are a dynamic part of the landscape, and with continued natural processes such as channel migration and flooding, will support a constantly changing patchwork of all age classes and association types (The Nature Conservancy 1992).

Narrowleaf cottonwood-Colorado blue spruce/thinleaf alder-red osier dogwood (*Populus angustifolia-Picea pungens/Alnus incana* spp. *tenuifolia-Cornus sericea*) p.a.

(POAN-PIPU/ALIN-COSE) 6 stands (31, 32, 69, 104, 113, GK06, GK07)

Synonyms: *Populus angustifolia-(Picea pungens)/Alnus incana* spp. *tenuifolia-Cornus sericea* (Baker 1989).

Distribution: Baker (1989) reports that this type occurs from eastern Idaho and western Wyoming and in Utah, citing Youngblood *et al.* (1985) and Padgett and Youngblood (1986). In Colorado, this plant association is known from the San Juan Mountains on the San Miguel River, Eagle and Pitkin Counties on the Eagle River and tributaries, and north to Grand County.

In the Yampa River Basin this type occurred in Routt County at elevations between 2100

and 2260 m (6880-7410 ft), in narrow valleys on immediate stream banks and rocky, low terraces.

Soil: Shallow sandy to silty loams over approximately 0.5 meter thick sands, often stratified with finer textures from sedimentary events. Signs of mottling within 5 cm or the soil surface occurred in one plot.

Vegetation: *Populus angustifolia* dominated the canopy, and *Picea pungens* ranged from present (<5%) to codominant (20%). A dense shrub understory of *Cornus sericea* characterized undisturbed occurrences. The undergrowth was usually dominated by mesic forbs such as *Rudbeckia laciniata, Smilacina stellata*, and *Actaea rubra.*

Adjacent riparian vegetation: Alder/mesic forb, Pacific willow/mesic graminoid shrublands.

Adjacent upland vegetation: Gambel's oak, serviceberry shrublands, aspen woodlands, subalpine fir-Engelmann spruce, Douglas-fir forests.

Succession/management: The narrowleaf cottonwood-Colorado blue spruce/red-osier dogwood p.a. is a variation of the narrowleaf cottonwood/red-osier dogwood type as elevation increases, and/or where canyons and valleys become narrower, and cool air drainage, topographic shading, and cooler mean summer temperatures create more favorable conditions for Colorado blue spruce. These two important plant associations may grade into each other, and a few areas may be considered transitional. However for the purposes of identification, if blue spruce is present, the stand will key to this type.

C. DECIDUOUS FORESTS

Plant associations dominated by cottonwoods are often not considered climax vegetation types. Where cottonwood communities become separated from the current fluvial processes of seasonal water tables and semi-annual flooding, either by channel down cutting or by terrace development, they will eventually succeed to non-riparian shrub or other upland plant communities. However, within the active channel and its current floodplain, cottonwood forests are subjected to a successional cycle described well elsewhere (Bradley and Smith 1986, McBride and Strahan 1984, Akashi 1988, and others).

Snowmelt runoff in the spring can produce heavy flows that erode the outside bend. As a result, the river channel moves, and cottonwood seedlings take hold on the newly-deposited point bars. In the absence of large floods in subsequent years, seedlings gain a strong foothold from which they trap sediment from smaller flows. After a few years, enough sediment is trapped to begin to form riverside terraces, elevating the young forest community above the river channel. In its new elevated position, with an absence of excessive browsing, fire, and agricultural conversion, the community can grow into a mature riparian forest. At the same time, meandering river channels continually create oxbows and other geomorphic formations resulting in a constantly changing patchwork of all age classes and association types (The Nature Conservancy 1992).

Narrowleaf cottonwood-box elder/red osier dogwood (*Populus angustifolia-Acer negundo/Cornus sericea*) p.a.

(POAN-ACNE/COSE) 8 Stands (9, 27, 42, 111, GK02, GK03, GK04, GK05)

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, it is known to occur only along the Yampa, Williams Fork, and White Rivers in Moffat, Rio Blanco, and Routt counties (CNHP 1993).

In the Yampa River basin it was found only along the mainstem of the Yampa River at elevations between 1910 and 1960 m (6260 and 6430 ft), on terraces approximately 1.3 m above the high water level, and from 1-30 meters distant from the channel. This p.a. is expected to occur as far west as the town of Craig.

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

Vegetation: *Populus angustifolia* and *Acer negundo* dominated this deciduous riparian forest. *Cornus sericea* often created an impenetrable shrub layer. *Salix ligulifolia, Crataegus rivularis* and *Ribes montigenum* were also sometimes present. Herbaceous cover was generally dominated by forbs and ranged from sparse to moderate, including *Smilacina stellata, Rudbeckia laciniata, Solidago serotinoides*, and *Mentha arvensis*. Grasses usually were introduced hay species, including *Phleum pratense, Poa pratensis, Agrostis gigantea,* and *Dactylis glomerata.*

Adjacent riparian vegetation: Coyote willow shrublands.

Adjacent upland vegetation: Gambel's oak, big sagebrush shrublands.

Succession/management: Our stands appear to be late-seral, mature cottonwood forests. Eroding banks on the outside bend of meanders had mature tree roots exposed and occasionally 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.

Holly Richter, a graduate student at Colorado State University, Range Science Department is studying the Yampa River in the Hayden area. She is devising an ecological model of this deciduous riparian forest. This model incorporates river channel migration, vegetation succession, flooding, deposition and scouring, as well as human-induced changes in hydrology and other disturbances.

Narrowleaf cottonwood/thinleaf alder (*Populus angustifolia/Alnus incana* spp. *tenuifolia*) p.a.

(POAN/ALIN) 4 stands (66, 74, 77, 81)

Synonyms: May be similar to *Populus angustifolia/Alnus incana-Cornus sericea* (Johnston 1987), however our stands always lacked any *Cornus sericea*. May also be similar to *Alnus*

incana spp. *tenuifolia*/mesic forb (Padgett *et al.* 1989), as *Populus angustifolia* occurred in one or two stands.

Distribution: Similar types (listed above) may occur in central and eastern Utah (Padgett *et al.* 1989), western Wyoming, and south-central Colorado in Gunnison National Forest (Johnston 1987).

In the Yampa River Basin it occurred in the northwestern portion of the watershed in Routt county at elevations between 2090 and 2220 m (6850-7280 ft). This type occurred on immediate stream banks and in swales on the active floodplain.

Vegetation: The narrowleaf cottonwood/thinleaf alder type was distinguished by the lush band of *Alnus incana* spp. *tenuifolia* overhanging the banks, with an open canopy of *Populus angustifolia* overhead. Other shrubs often present included *Salix lucida* spp. *caudata, Salix ligulifolia,* and *Salix drummondiana,* with usually not more than 10% canopy cover.

Adjacent riparian vegetation: Narrowleaf cottonwood/red-osier dogwood forests, beaked sedge meadows.

Adjacent upland vegetation: Gambel's oak scrub, Douglas-fir forests, aspen woodlands.

Succession/management: More information is need about the successional status of this type. Alder appears to withstand periodic flooding and requires more aerated ground water (Padgett *et al.* 1989). Also, the root structure can hold coarse-textured subsurface soils in place, stabilizing the stream bank, and can act as a coarse filter for upland soil and water movement (Padgett *et al.* 1989).

Narrowleaf cottonwood/serviceberry (*Populus angustifolia/Amelanchier alnifolia*) p.a. (POAN/AMAL) 2 stands (33, 107)

Synonyms: *Populus angustifolia/Amelanchier utahensis* (Baker 1984); *Populus angustifolia/Amelanchier alnifolia* (Johnston 1987); *Populus angustifolia/Amelanchier alnifolia/Smilacina stellata* (Hess and Wasser 1982).

Distribution: Not reported from outside Colorado. In the state, this type is reported from the White River plateau in the White River National Forest (Johnston 1978).

In the Yampa River Basin this type was found in the central and southern portions of the watershed, in Routt and Moffat counties at elevations from 2010 to 2150 m (6590-7050 ft). This plant association occurred on immediate stream banks and active floodplains in narrow valleys where colluvium may come right down to the rivers edge.

Vegetation: *Populus angustifolia* was the only tree species present on the floodplain; *Amelanchier alnifolia* and *Crataegus rivularis* comprised a shrub understory, along with *Rosa woodsii*. The sites were quite dry with a number of exotic hay meadow grasses probably introduced from cattle grazing.

Adjacent riparian vegetation: Coyote willow shrublands.

Adjacent upland vegetation: Gambel's oak scrub, big sagebrush shrublands.

Succession/management: In our stands low shrub cover appears to be induced by grazing and/or reduced flooding frequency. The presence of small amounts of red-osier dogwood and sweet cicely may indicate the site is capable of supporting a more mesic forest type such as narrowleaf cottonwood/red-osier dogwood or the river hawthorn-red-osier dogwood phase of the narrowleaf cottonwood/serviceberry/false solomon's seal type described by Hess and Wasser (1982).

Narrowleaf cottonwood/red-osier dogwood (*Populus angustifolia/Cornus sericea*) p.a. (POAN/COSE) 6 stands (45, 57, 61, 75, GK09, GK20)

Synonyms: Very similar to Padgett *et al.* (1989) *Populus angustifolia/Cornus sericea* type; however, ours has a *Salix boothii* instead of a *Salix lasiolepis* component. Also appears similar to *Populus angustifolia/Amelanchier alnifolia/Smilacina stellata (Crataegus rivularis-Cornus sericea* phase) described by Hess and Wasser (1982).

Distribution: Similar types (listed above) occur in central and eastern Utah and central Idaho (Padgett *et al.* 1989). In Colorado similar types have been described from Arapaho-Roosevelt and White River National Forests in north-central and central Colorado (Hess 1981, Hess and Wasser 1982).

In the Yampa River Basin this type was found mostly in Routt County with one stand crossing over to Rio Blanco County, between elevations of 2060 and 2300 m (6750-7540 ft). It occurred usually on immediate stream banks and active floodplains, occasionally on terraces of narrow channels in narrow valleys (<.8 km wide).

Soil: Stratified layers of loam, silty clay, sand, and cobbles with alternating light and dark color, indicating that depositional events have created this substrate, rather than in-place soil development. Overall depth up to 1 meter.

Vegetation: *Populus angustifolia* formed a tall canopy with a dense population of *Cornus sericea* and several tall willow species, such as *Salix lasiandra* var. *caudata* and *Salix boothii* in the understory. High cover of *Cornus sericea* distinguished this p.a. from the narrowleaf cottonwood/thinleaf alder p.a. *Rudbeckia laciniata, Smilacina stellata*, and *Solidago gigantea* were common abundant forbs.

Adjacent riparian vegetation: Booth's willow-Geyer's willow shrublands, thinleaf alder-Geyer's willow shrublands.

Adjacent upland vegetation: Aspen woodlands, Gambel's oak scrub, big sagebrush shrublands.

Succession/management: Our stands appear to be late-seral, mature cottonwood forests. Eroding banks on the outside bend of meanders had mature tree roots exposed and occasionally 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. Mid-seral stands had a mix of *Salix boothii* and *Salix lasiandra* var. *caudata.*

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 need about the long-term maintenance and response to grazing impacts. *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) proposes that his similar type may be considered early to mid-seral due to it's proximity to the channel. If the channel remains in place, it may be replaced by a Conifer/*Cornus sericea* type, and if the channel moves away it

may be replaced by another *Populus angustifolia* dominated type, with a less mesic undergrowth.

Narrowleaf cottonwood/coyote willow (*Populus angustifolia/Salix exigua*) p.a. (POAN/SAEX) 2 stands (63, 108)

Synonyms: *Populus angustifolia/Salix scouleriana* (Baker 1984); *Populus angustifolia/Salix exigua-Betula fontinalis* (Johnston 1987, Komarkova 1986); *Populus angustifolia/Salix exigua* (Hess 1981).

Distribution: This common type occurs from eastern Idaho, northern Wyoming, central Utah (Johnston 1987). In Colorado it occurs from Arapaho-Roosevelt, Medicine Bow, and Gunnison National Forests (Johnston 1987). It has also been reported from Moffat, Conejos, Archuleta, and Hinsdale counties of northwestern and southwestern Colorado (CNHP 1993).

In the Yampa River Basin the narrowleaf cottonwood/coyote willow is a very common riparian p.a. at elevations between approximately 2000-2300 m (6560-7540 ft). It represents a very early successional stage and is very susceptible to flooding and scouring, as it usually lies well below the annual average high water mark.

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

Adjacent riparian vegetation: Narrowleaf cottonwood/red-osier dogwood forests, narrowleaf cottonwood/serviceberry forests, coyote willow shrublands.

Adjacent upland vegetation: Big sagebrush shrublands, Gambel's oak scrub.

Succession/Management: The narrowleaf cottonwood/coyote willow plant association represents an early seral stage of other, more diverse narrowleaf cottonwood plant associations. This p.a. develops on freshly deposited alluvium and is the first stage in cottonwood riparian forest development. Continued flooding and sedimentation coupled with lateral channel migration 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 p.a. 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.

Rio Grande cottonwood/skunkbrush (*Populus deltoides ssp. wislizenii/Rhus trilobata*) p.a. (PODE/RHTR) 3 stands (1, 12, 14)

Synonyms: *Populus deltoides* ssp. *wislizenii/Rhus trilobata* (Baker 1984).

Distribution: This plant association has not been well documented outside of Colorado, but is likely to occur in eastern Utah and possibly in northwestern New Mexico (Graham 1937, Campbell and Dick-Peddie 1964). In Colorado this type has been reported from the Colorado River from about Silt to Palisade, and on the San Miguel River between Vancorum and Uravan.

In the Yampa River Basin we found one or two occurrences on the main stem of the Yampa river at elevations below 1720 m (5640 ft), near the confluence with the Green River, in the western portion of the basin in Moffat County. It occurred on immediate stream banks

and upper terraces (as high as 4 meters above channel).

Soil: Deep stratified sandy loam with cobbles; fresh alluvial sand and gravels on point bars.

Vegetation: *Populus deltoides* spp. *wislizenii* with *Rhus trilobata* understory formed this mature, late-seral plant association. A greater amount of *Rhus trilobata* relative to other shrubs present was a good indication of an older stand. Other shrubs commonly present were *Cornus sericea, Chrysothamnus linifolius, Symphoricarpos* spp., and *Salix exigua.* Forb and graminoid cover was usually quite low. Plot 1 was heavily disturbed with an undergrowth dominated by quackgrass (*Elytrigia repens*), an introduced species (this stand was not included in the constancy table).

Adjacent riparian vegetation: Rio grande cottonwood/coyote willow forests, coyote willow shrublands.

Adjacent upland vegetation: Piñon-juniper woodlands, greasewood scrub.

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 early 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).

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 sexually reproduce under a mature canopy.

D. TALL-WILLOW SHRUBLANDS

Deciduous shrublands are highly dependent upon hydrologic conditions and substrate types and textures. Willow carrs (shrublands) along these rivers require nearly saturated soil conditions during the growing season. As hydrologic conditions change, or if there is excessive elk or cattle browsing, shrublands may be converted to other, less mesic, associations. Alien species and conversion to agricultural use (clearing) also threaten riparian shrublands (see also discussion under Herbaceous Communities, below). Additionally, because beavers play a significant role in the dynamic conversion of patches from shrublands to wet meadows and back to shrublands, threats to the natural role of beavers in these communities present serious threats to the communities themselves (The Nature Conservancy 1992).

Booth's willow/mesic forb (*Salix boothii*/mesic forb) p.a.

(SABO/mf) 10 stands (52, 53, 55, 58, 79, 86, 90, 109, GK08, GK14)

Synonyms: *Salix boothii-Salix geyeriana-Salix lasiandra* var. *caudata* (CNHP 1993). Very similar to Padgett *et al.* (1989) *Salix boothii*/mesic forb and Youngblood *et al.*'s (1985) *Salix boothii/Smilacina stellata* types, except *Salix drummondiana* appears to be absent from our occurrences.

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

In the Yampa River Basin the Booth's willow/mesic forb type is a major type occurring throughout the eastern quarter of the basin at elevations between 2260 and 2720 m (7410-8920 ft) in the Park Range, the Elkhead Mountains, and in the Flat Tops. This type occurred on well drained flat and gently sloping floodplains in narrow to very broad valleys, usually within half a meter of the water table, but occasionally on low terraces.

Soil: About 3/4 of a meter deep loams and fine sandy loams over silty clay loams over cobbles. Mottling evident at about 50 cm with some gleying.

Vegetation: *Salix boothii* formed large continuous shrublands ranging from 40% to over 80% canopy cover. Other willows included *Salix geyeriana* and *Salix lasiandra* var. *caudata*. *Salix wolfii* was sometimes present as a low shrub layer. The undergrowth was characterized by a sparse to lush layer of forbs, including *Achillea millefolium*, *Fragaria virginiana*, *Galium boreale*, *Geranium richardsonii*, *Smilacina stellata*, and *Geum macrophyllum*. The understory name "mesic forbs" was chosen to emphasize that no one species dominated that layer. One stand, however, (plot GK14) had *Calamagrostis canadensis* (80%) and *Carex rostrata* (20%) because a low swale ran through the center of the plot. Due to the undulating pattern of the ground at this site, the more mesic graminoids where quite patchy and did not form a continuous understory layer, as they do in *Salix boothii/Carex rostrata* p.a., for example.

Adjacent riparian vegetation: Thinleaf alder shrublands, sedge meadows.

Adjacent upland vegetation: Mixed conifer-aspen forests, aspen forests, big sagebrush scrub.

Succession/Management: *Salix boothii* appears to grow on mesic sites that are neither saturated nor dry throughout the growing season (Padget *et al.* 1989). With excessive grazing of this type may be replaced with a *Salix boothii/Poa pratensis* type, which often has remnant forbs indicative of the *SALBOO*/MF type growing at the shrub bases (Padgett *et al.* 1989) grazing.

Booth's willow/beaked sedge (*Salix boothii/Carex rostrata*) p.a.

(SABO/CARO) 3 stands (GK17, GK18, GK19)

Synonyms: *Salix boothii/Carex rostrata* (Padgett *et al.* 1989, Youngblood *et al.* 1985).

Distribution: From central and eastern Idaho, western wyoming and the central plateau regions of Utah. Not previously described from Colorado.

In the Yampa River Basin, one large occurrence was found on Phillips Creek near the town of Yampa, at an elevation of 2400 m (7870 ft). The p.a. occurred on a gently sloping floodplain with saturated soils due to irrigation runoff and hillside seepage.

Soil: About a meter thick peat with some minerals (clays, fine sands), gleying throughout the profile in one plot. Some mottling evident at 20 cm over a gleyed layer., after 60 cm, peat/clay became very dense and more anoxic.

Vegetation: The saturated soils supported a dense layer of *Carex rostrata* under a mosaic of *Salix boothii, Salix geyeriana* and *Salix planifolia* spp. *planifolia* var. *planifolia. Salix serissima*, a rare Colorado willow, also occurred at this site. Other shrubs present included *Lonicera involucrata, Rosa woodsii*, and *Ribes inerme*. Other graminoids present were *Calamagrostis canadensis, C. stricta* and *Carex aquatilis*. Forb cover was sparse but included *Smilacina stellata, Fragaria virginiana*, and *Ligusticum porteri.*

Adjacent riparian vegetation: Narrowleaf cottonwood/red-osier dogwood forests, thinleaf alder forests.

Adjacent upland vegetation: Big sagebrush scrub, aspen woodlands.

Succession/Management: Padgett *et al.* (1989) suggests that the *Salix boothii/Carex rostrata* type becomes established when beaver ponds have raised the water table. Saturated soils of this type make it susceptible to soil compaction from livestock or heavy machinery (Padgett *et al.* 1989).

<u>**Drummond's willow/Canadian reedgrass (*Salix drummondiana/Calamagrostis canadensis*) p.a.**</u> (tentative type)
(SADR/CACA) 1 stand (64)

Synonyms: *Salix drummondiana/Calamagrostis canadensis* (Komarkova 1986, Johnston 1987). This p.a. may also be closely related to *Calamagrostis canadensis* (Padgett *et al.* 1989, Komarkova 1986), due to a high abundance of *Calamagrostis canadensis.*

Distribution: This type may be included in the broader types described from Utah by Padgett *et al.* (1989). In Colorado, it has been reported form the Gunnison National Forest (Johnston 1987), and from San Juan, San Miguel, Gunnison, Pitkin, Eagle, and Routt counties (CNHP 1993).

In the Yampa River Basin one stand was sampled in the north-central portion of the study area on Soda creek at an elevation of 2370 m (7770 ft). This plant association occurred as small isolated patches in forest and shrubland openings, along smaller channels in narrow valley bottoms. *Salix drummondiana* usually occurs along steep, narrow stream margins.

Vegetation: *Salix drummondiana* formed an open, corridor-like canopy with a dense graminoid layer dominated by *Calamagrostis canadensis. Calamagrostis canadensis* is often associated with a conifer overstory, either bordering small streams in forested watersheds, or in mesic forest openings (Padgett *et al.* 1989).

Adjacent riparian vegetation: Rocky mountain willow, Geyer's willow tall-willow shrublands, beaked sedge meadows.

Adjacent upland vegetation: Aspen woodlands, engelmann spruce-subalpine fir forests.

Succession/management: This type most likely has a successional pattern closely aligned with beaver activity. With a maintained high water table, this type will withstand moderate grazing. Heavy grazing will pocket the wet soil, and the type may become a more open, less mesic site, dominated by exotic herbaceous species.

Coyote willow/mesic graminoid (*Salix exigua*/mesic graminoid) p.a.
(SAEX/mg) 10 stands (4, 6, 15, 16, 19, 22, 29, 30, 46, 96)

Synonyms: *Salix exigua*/mesic graminoid (Padgett *et al.* 1989). Very similar to *Salix exigua-Salix* spp./*Poa* sp. (Johnston 1987); *Populus angustifolia/Salix exigua* Hess 1981; and *Salix exigua/Poa pratensis* (Youngblood *et al.* 1985).

Distribution: This plant association is known from central and eastern Idaho, western and southeastern Wyoming (Youngblood *et al.* 1985, Olsen and Gerhart 1982, as cited in Padgett 1989), is widespread throughout Utah, Arizona, and New Mexico (Padgett *et al.* 1989, Szaro 1989). In Colorado, this type is reported from the eastern plains and the Colorado Front Range (Bunin 1985, Cooper and Cottrell 1990) and is expected to occur throughout the state.

In the Yampa River Basin the coyote willow plant association occurred throughout the area, although more abundant at elevations below 2000 m (6560 ft). It commonly occurred on cobble and point bars that are inundated each year. This type can also occur in swales and overflow channels on the active floodplain where moisture is available during spring flows.

Soil: Fresh alluvium, thin layers of sandy loam over cobbles at channel edges and point bars. Deeper loamy sand over gravels along overflow channels and floodplain depressions.

Vegetation: *Salix exigua* dominated this tall willow p.a. *Salix ligulifolia, Salix lucida* spp. *caudata, Alnus incana* spp. *tenuifolia* and *Cornus sericea* were occasionally present. The undergrowth was characterized by moderate to sparse growth of *Agrostis stolonifera, Carex lanuginosa,* or *Eleocharis palustris.* Often bare fresh alluvial cobbles and sands dominated the undergrowth. Seedlings of *Populus deltoides* ssp. *wislizenii* or *P. angustifolia* sometimes also occurred within this p.a.

Adjacent riparian vegetation: Rio Grande cottonwood and narrowleaf cottonwood woodland types on higher ground, creeping spikerush and bulrush wetlands on adjacent saturated ground.

Adjacent upland vegetation: Since coyote willow riparian p.a. is so common, it can occur adjacent to almost any upland community common to the western slope, except for the highest elevation forests and alpine community types. Some of the more common upland communities are piñon-juniper woodlands, big sagebrush scrub, and Gambel's oak scrub at low elevations; mixed-conifer forests and aspen woodlands at higher elevations.

Succession/management: This p.a. is tolerant of flooding, and is one of the first pioneering types on freshly deposited alluvial surfaces. This early seral community is a common type that stabilizes banks and channel edges throughout the basin.

Geyer's willow/beaked sedge (*Salix geyeriana/Carex rostrata*) p.a.
(SAGE/CARO) 4 stands (67, 71, 93, GK16)

Synonyms: *Salix geyeriana/Carex rostrata* (Padgett *et al.* 1989, Youngblood *et al.* 1985).

Distribution: Known from central and eastern Idaho and northern Utah (Padgett *et al.* 1989). In Colorado, Johnston (1987) lists this type as *Salix geyeriana-Salix* spp./*Carex utriculata* where it occurs in the Roosevelt and Routt National Forests.

In the Yampa River Basin, this type only occurred in Routt county, in the far eastern portion of the study area. This tall willow plant association occurred adjacent to large and

moderately large stream channels, in swales and overflow channels of active floodplains in wide to moderately wide valley bottoms at elevations between 2070-2450 m (6790-8030 ft).

Soil: Silty clay loam with coarse sand fragments. Gleying evident at about 30 cm.

Vegetation: *Salix geyeriana* dominated the tall willow layer. Other shrubs present were *Alnus incana* spp. *tenuifolia* and *Lonicera involucrata* with less than 10% cover. The understory was characterized by a dense layer of *Carex rostrata. Carex nebrascensis, C. praegracilis, C. aquatilis*, and *Calamagrostis canadensis* were also present in varying amounts. Forb cover was very low.

Adjacent riparian vegetation: Thinleaf alder shrublands, beaked sedge meadows, Colorado blue spruce/alder forests.

Adjacent upland vegetation: Lodgepole forests, big sagebrush scrub.

Succession/management: This type requires a high water table and saturated soils for much of the growing season, and is susceptible to soil compaction by livestock. *Carex rostrata* apparently becomes established (rather than *Carex aquatilis*) when soils are saturated (Padgett *et al.* 1989).

Pacific willow/mesic graminoid (*Salix lasiandra* var. *caudata*/mesic graminoid) p.a.
(SALUC/mf) 6 stands (39, 41, 100, 101, 105, 112)

Synonyms: *Salix exigua-Salix lasiandra* var. *caudata* (CNHP 1993).

Distribution: This plant association has not been report outside of Colorado. In Colorado it is known only from the northwestern corner, in Moffat and Routt counties.

In the Yampa River basin this tall willow plant association occurred on the lower flanks of the Williams Fork Mountains and the Elkhead Mountains, at elevations between 1930 and 2490 m (6330-8160 ft). It was found on immediate stream banks and adjacent floodplains and was associated with abandoned beaver pond areas. Streams with this plant association were usually in narrow to moderately wide, yet shallow, sunny valleys, and was often associated with beaver ponds.

Vegetation: *Salix lasiandra* var. *caudata* and *Salix exigua* co-dominated in the overstory of this tall willow p.a. *Alnus incana* spp. *tenuifolia* and *Ribes aureum* were commonly present. The understory was characterized by a dense layer of introduced grasses, including *Agrostis gigantea, Phleum pratense*, and *Poa pratensis*. Forb cover was sparse and highly variable.

Adjacent riparian vegetation: Coyote willow shrublands.

Adjacent upland vegetation: Piñon-juniper woodlands and big sagebrush scrub.

Succession/management: Often associated with abandoned beaver ponds or steeper reaches below beaver ponds, this early to mid-seral type appears to colonize beaver ponds that have or are being silted in and will eventually be replaced slightly drier site willow types.

Rocky mountain willow/aquatic sedge (*Salix monticola/Carex aquatilis*) p.a.
(SAMO/CAAQ) 2 stands (62, 103)

Synonyms: This type appears to be similar to stands lumped with *Salix boothii* types by Padgett *et al.* (1989) and Youngblood *et al.* (1985). Our stands seem to be have higher canopy coverage of *Salix monticola* and lesser amounts of other willow species.

Distribution: *Salix monticola* is a common and wide spread species, but rarely lends itself to dominate expansive communities. Refer to distributions listed under *Salix boothii* plant associations.

In the Yampa River Basin this appears to be a minor type, occurring in small patches. *Salix monticola* is widespread throughout Colorado, but rarely forms large dominant stands. Our stands occurred at elevations between 2140 and 2880 m (7020-9440 ft), on immediate coarse-textured river banks along narrow valley reaches.

Vegetation: This plant association formed tall, narrow bands of shrubs dominated by *Salix monticola*. *Salix drummondiana* is also expected to occur in similar habitats. Other shrubs included *Cornus sericea* and *Lonicera involucrata*. Herbaceous cover was low due to shading and flooding disturbance.

Adjacent riparian vegetation: Narrowleaf cottonwood/red-osier dogwood forests, thinleaf alder shrublands, Colorado blue spruce/thinleaf alder forests.

Adjacent upland vegetation: Subalpine fir-engelmann spruce forests, Gambel's oak scrub, aspen woodlands.

Succession/management: This type occurs as small patches, and may a seral stage to other, larger tall willow plant associations. More information is needed to determine its successional status.

E. LOW-WILLOW SHRUBLANDS

Low stature willow associations are most abundant in broad subalpine valleys which have high water tables throughout the season. These types are probably very stable associations as the source of the water table is primarily from melting snowfields (Cooper 1990, Windell *et al.* 1986), and soils are often varying depth of accumulated peat.

Planeleaf willow/aquatic sedge (*Salix planifolia* var. *monica/Carex aquatilis*) p.a.

(SAPLM/CAAQ) 2 stands (GK11, GK13)

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).

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 has been reported from Roosevelt, Arapaho, Gunnison, pike, Routt, and Medicine Bow National Forests.

In the Yampa River Basin this type is very abundant throughout the Park Range, the Elkhead Mountains and the Flat Top Mountains. It occurred at elevations above 2760 m (9030 ft) in wide valleys and wet, open subalpine meadows, on broad, gently sloping snowmelt-fed swales and valley bottoms.

Soil: About 60 cm deep peats with strong mineral component. Mottling evident around 20-30 cm. Large angular rocks or gravel layers occurred at depth.

Vegetation: *Salix planifolia* var. *monica* dominated the low willow overstory. *Salix brachycarpa* and *Salix wolfii* were also often present with less than 25% cover, usually confined to steeper slopes and outer edges of wet swales. The understory was characterized

by a dense graminoid layer dominated by *Carex aquatilis*. Other graminoids commonly present in varying amounts included *Deschampsia cespitosa, Calamagrostis canadensis*, and *Agrostis stolonifera. Caltha leptosepala, Pedicularis groenlandica,* and *Osmorhiza depauperata* were among the commonly occurring forbs in this wetland plant association.

Adjacent riparian vegetation: Water sedge meadows, barren-ground willow shrublands.

Adjacent upland vegetation: Subalpine fir-Engelmann spruce forest.

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 evaporation, and can lower the water table, allowing *Salix brachycarpa* or *Salix wolfii* to become established. See also discussion under low-willow subheading, above.

Wolf's willow/mesic forb (*Salix wolfii*/mesic forb) p.a.

(SAWO/MF) 5 stands (50, 72, 80, 85, 89)

Synonyms: *Salix wolfii*/mesic forb (Padgett *et al.* 1989, Youngblood *et al.* 1985); *Salix wolfii/Fragaria virginiana* (Johnston 1987).

Distribution: This type occurs from central and eastern Idaho, western Wyoming (Padgett *et al.* 1989). In Colorado it has been reported from the western slope (Baker 1989).

In the Yampa River Basin this type occurred in the eastern half of the Yampa basin in the upper reaches of the Park range, the Flat Tops, and the Elkhead mountains, at elevations from 2400-2790 m (7870-9150 ft). Wolf's willow/mesic forb plant association was commonly found in broad glaciated or non-glaciated high mountain valleys on well drained slopes and hummocks, usually approximately one meter above the water table.

Soil: Shallow heavy silty clays over gravels and rocks.

Vegetation: *Salix wolfii* formed a low, patchy canopy ranging from 20 to 80% cover. *Salix boothii* and *Salix geyeriana* were often present in small amounts. Graminoid cover averaged approximately 25% cover with highly variable species composition, including *Carex aquatilis, C. hoodii, C. lanuginosa, C. microptera,* and *Calamagrostis canadensis*. Sparse forb cover included *Fragaria virginiana, Galium boreale, Geum macrophyllum, and Heracleum lanatum.*

Adjacent riparian vegetation: Booth's willow/mesic forb shrublands, beaked sedge meadows, thinleaf alder shrublands.

Adjacent upland vegetation: Subalpine fir and Engelmann spruce forests and aspen forests on steep sided valleys, big sagebrush scrub in broad valleys.

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

F. NON-WILLOW DOMINATED SHRUBLANDS

Thinleaf alder-red-osier dogwood (*Alnus incana* spp. *tenuifolia-Cornus sericea*) p.a. (ALIN-COSE) 5 stands (31, 34, 68, 78, GK10)

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

Distribution: This type has been reported from the La Sal mountains and central high plateaus of Utah and eastern Nevada (Padgett *et al.* 1989). In Colorado it has been reported from the Gunnison National Forest (Johnston 1987).

In the Yampa River Basin this p.a. occurred on smaller creeks and upper reaches of the Yampa River in the eastern portion of the watershed (Routt county), at elevations between 2075 and 2300 m (6800-7540 ft). It occurred on narrow, rocky banks and benches of small channels and narrow constricted reaches of larger rivers.

Soil: Sandy loam to sandy clay loam, mottling evident at about 30 cm, gravel or cobbles layers appear at 70-100 cm.

Vegetation: *Alnus incana* spp. *tenuifolia* and *Cornus sericea* dominated a dense tall shrub overstory. Other shrubs commonly present included *Lonicera involucrata, Rubus idaeus, Amelanchier alnifolia,* and *Salix* spp. in minor amounts, although in one stand *Salix bebbiana* was quite abundant. Tree species, if present, were scattered. *Heracleum lanatum, Geum macrophyllum, Rudbeckia laciniata,* and *Aster foliaceus* characterized the rich forb undergrowth. Graminoid cover was usually low.

Adjacent riparian vegetation: Narrowleaf cottonwood-Colorado blue spruce mixed forests, narrowleaf cottonwood/red-osier dogwood forests.

Adjacent upland vegetation: Gambel's oak and serviceberry shrublands, aspen woodlands, engelmann spruce-subalpine fir forests.

Succession/management: Alder and red-osier dogwood appear to be adapted to growing right adjacent to streams, can withstand periodic flooding, and require more aerated ground water that flows through the coarse-textured subsurface soils with which they are commonly associated with (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 the rhizomatous roots may reach the well aerated ground water near the stream.

Thinleaf alder-Geyer willow (*Alnus incana* spp. *tenuifolia-Salix geyeriana*) p.a. (ALIN-SAGE) 2 stands (70, GK15)

Synonyms: Not previously described; however, this type appears to be very similar to the *Alnus incana* spp. *tenuifolia/Equisetum arvense* type described by Padgett *et al.* (1989), Komarkova (1986), and Hess (1981), except that *Salix geyeriana,* present in our stands, appears to be absent in these types.

Distribution: Similar types (listed above) occur in northern and eastern Utah (Padgett *et al.* 1989). In Colorado similar types have been reported from Gunnison and Arapaho National forests (Johnston 1987).

In the Yampa River Basin this p.a. occurred on cobble point bars and islands in moderately wide to wide river valleys at elevations between 2300 and 2450 m (7540-8030 ft)

in the eastern part of the watershed in Routt County.

Soils: Well drained sandy loam over coarser sands, with alternating mottled layers.

Vegetation: *Alnus incana* spp. *tenuifolia* and *Salix geyeriana* dominated the tall shrub overstory along with *Salix ligulifolia,* and *Salix lucida* spp. *caudata.* Herbaceous undergrowth was sparse to abundant, dominated by the introduced grasses *Poa pratensis, Phleum pratense,* and *Agrostis gigantea* due to grazing and flooding disturbance. Forb cover was sparse.

Adjacent riparian vegetation: Coyote willow shrublands, creeping spikerush marshes.

Adjacent upland vegetation: Gambel's oak shrublands, ponderosa pine forests.

Succession/management: The thinleaf alder-Geyer willow p.a. appears to be an unstable p.a., occurring in frequently flooded environments. This type may indicate that the hydrological processes have been altered, and the channel is undergoing adjustment. This p.a. was associated with abandoned or breached beaver dams, and may succeed to a more stable, drier riparian p.a., such as the *Salix geyeriana* p.a. as the water table lowers.

Thinleaf alder/mesic forbs (*Alnus incana* spp. *tenuifolia*/mesic forb) p.a.
(ALIN/mf) 2 stands (88, 28)

Synonyms: *Alnus incana* spp. *tenuifolia*/mesic forb (Padgett *et al.* 1989), *Alnus incana* spp. *tenuifolia/Rudbeckia laciniata* (Cooper & Cottrell 1990).

Distribution: This plant association occurs from southwestern Idaho, the Wasatch, Uinta, La Sal and Abajo Mountains of Utah (Padgett *et al.* 1989). In Colorado this type has previously only been reported from the Front Range (Cooper and Cottrell 1990).

In the Yampa River Basin this p.a. occurred in Routt County, on the northwestern flank of the Elkhead Mountains, at elevations between 2520 and 2600 m (8260-8520 ft), along narrow streams in narrow valleys, on stream benches and banks.

Vegetation: *Alnus incana* spp. *tenuifolia* dominated the overstory, creating an almost closed canopy. Other shrubs included *Lonicera involucrata* and *Salix geyeriana.* A dense rich forb layer characterized the undergrowth, including *Heracleum lanatum, Rudbeckia laciniata,* and *Mertensia ciliata.* Grasses present included *Calamagrostis canadensis* and *Glyceria striata.*

Adjacent riparian vegetation: Booth's willow shrublands.

Adjacent riparian vegetation: Aspen woodlands, lodgepole pine forests.

Succession/management: In Utah, this type appears to be stable sere, and not subject to frequent fluvial scouring and deposition as indicated by the development of mollic epipedons (Padgett *et al.* 1989). More information is needed about soils and flooding intensity and frequency for the Colorado occurrences of this type.

Skunkbrush (*Rhus trilobata*) p.a. (tentative type)
(RHTR) 4 stands (3, 17, 18, 23)

Synonyms: Not previously described. More mesic stands with *Cornus sericea* may be related to *Swida sericea/Distegia involucrata* (Johnston 1987, Komarkova 1986) as they occur in similar habitats.

Distribution: Not reported outside Colorado. In Colorado, similar types described by Komarkova (1986) have been reported from Gunnison and Uncompahgre National Forests.

In the Yampa River Basin it was found at the lower elevations, below about 1740 m (5700 ft, in the western half of the study area in Moffat County. This dense shrub p.a. typically occurred clinging to cliff bottoms and toeslopes in very narrow, rocky river reaches where there was little floodplain development on one or both sides of the river due to bedrock confinement. These shrubs appear to tolerate dry, rocky soils by remaining close to the river, and may have roots that penetrate the water table through cracks in the bedrock substrate, or at least where they can take advantage of summer rainfall.

Soil: Shallow sandy loam or loamy sand over coarse alluvium or bedrock.

Vegetation: The dense narrow shrub layer was dominated by *Rhus trilobata*. In cooler sites *Cornus sericea* was sometimes quite abundant; other shrubs on more xeric sites included *Amelanchier alnifolia, Toxicodendron rydbergii, Betula occidentalis*, and *Clematis ligusticifolia*. The undergrowth was sparse with much litter or bare ground due to shading and thin soils. *Smilacina stellata* occurred in 3 of 4 plots.

Adjacent riparian vegetation: Coyote willow shrubland may occupy a narrow strip within the channel below the skunkbrush type. In wider sections of the river, cottonwood forests or alder-birch shrublands may occur on adjacent floodplains or terraces.

Adjacent upland vegetation: Piñon-juniper woodlands, big sagebrush scrub.

Succession/management: This p.a. appears to be a late-seral riparian shrub association as it occurs just at or above the high water mark of the channel. The dense shrub canopy shows little sign of disturbance. This type may not be an obligate riparian plant association, however, since it may be related other *Rhus trilobata* plant association often found on rock outcrops and scree habitats described by Johnston (1987).

<u>**Silver buffaloberry/giant wild-rye (*Shepherdia argentea-Leymus cinereus*) p.a.**</u> (tentative type)

(SHAR/LECI) 1 stand (35)

Synonyms: May be similar to the *Populus angustifolia/Shepherdia argentea-Cornus sericea* type that Baker (1989) described from the Uncompahgre River. However, this relict stand had no *Populus angustifolia*, and similar small isolated stands on the Little Snake River rarely had *Populus* spp. trees associated with them. Near the Wyoming border, however, cottonwood trees become more frequent, and it may be that historically the p.a. was a cottonwood dominated riparian woodland. More study is needed from Wyoming to verify the relationship of this p.a. to that described previously by Baker.

Distribution: Not reported outside Colorado. See discussion under synonyms, above.

In the Yampa River Basin it was found only along the Little Snake River in the north central portion of the study area in Moffat county at an elevation of 1915 m (6280 ft).

Vegetation: *Shepherdia argentea* dominated the dense, but patchy, tall shrub layer. Associated shrubs included *Artemisia tridentata* and *Chrysothamnus linifolius*. The undergrowth was also patchy with a heavy litter layer between clumps of the large bunch grass *Leymus cinereus*. Few other forbs or graminoids were present.

Adjacent riparian vegetation: Povertyweed and desert saltgrass alkaline meadows, creeping spikerush wetlands.

Adjacent upland vegetation: Big sagebrush, greasewood, and rubber rabbitbrush shrublands.

Succession/management: More information is needed about the historical range of *Sheperdia argentea*, requirements for regeneration, and moisture tolerance/needs. It was probably more widespread, but is now being replaced by Russian olive.

G. HERBACEOUS DOMINATED RIPARIAN WETLANDS

Herbaceous wetland associations rely upon hydrologic processes to maintain their composition. Cycles of flooding and sediment deposition uproot old associations and leave unvegetated sites with substrate types ideal for herbaceous colonization. Also, a braided channel morphology may contribute to the formation and maintenance of wetlands. The felling of trees and shrubs by beavers and the construction of beaver dams contributes to herbaceous and shrub wetland dynamics on many upper tributary basins. These communities are a dynamic mosaic of patch types. For instance, while hydrologic or other processes may convert a particular patch of meadow into shrubland, the work of floods and beavers maintain early-seral wet meadow or beaver pond successional phases (The Nature Conservancy 1992).

Major stresses to herbaceous wetlands occur with changes in base flows, drops in water table levels, and from excessive grazing by wildlife or livestock. At lower elevations, for example, repeated heavy livestock use can turn lush herbaceous areas into bare ground, increasing bank instability and siltation of downstream waters. Natural changes in hydrology may lead to natural succession from riparian meadows to shrubland and from shrublands back to meadows.

Water sedge (*Carex aquatilis*) p.a.

(CAAQ) 2 stands (49, 56)

Synonyms: *Carex aquatilis* (Baker 1984, Padgett *et al.* 1989, Youngblood *et al.* 1985); *Carex aquatilis-Pedicularis groenlandica* (Komarkova 1986); *Carex aquatilis/Carex utriculata (Carex aquatilis* phase) (Johnston 1987). Broader plant associations that encompass our type are the *Carex aquatilis-Carex rostrata* types described by Hess (1981), and Hess and Wasser (1982).

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

In the Yampa Basin this type occurs in the subalpine zone at elevations between 2400 and 3350 m (7850 and 11,000 ft). This p.a. commonly occurred on meadows and seeps associated with broad valley bottoms. Slopes ranged from 0 to 10 percent on even or concave surface topography. Soils were usually deep organic peats, but sometimes were mineral soils.

Soil: Fine silts and deep peats.

Vegetation: *Carex aquatilis* dominated a typically dense graminoid layer. Other

graminoids included *Carex vesicaria, Calamagrostis stricta,* and *Calamagrostis canadensis.* Forb cover was typically sparse, but common associates included *Caltha leptosepala, Pedicularis groenlandica, Fragaria virginiana,* and *Gentianella amarella.*

Adjacent riparian vegetation: Planeleaf willow, Wolf's willow, and barren-ground willow shrublands.

Adjacent upland vegetation: Engelmann spruce-subalpine fir forests.

Succession/management: The *Carex aquatilis* type occurs on soils that are typically wet throughout the growing season, and livestock grazing can often cause hummocking and pitting of the soil (Padgett *et al.* 1989). More information is needed about successional relationships with this and other subalpine graminoid plant associations.

Beaked sedge (*Carex rostrata*) p.a.

(CARO) 6 stands (76, 83, 84, 97, GK12, GK21)

Synonyms: *Carex rostrata* (Padgett *et al.* 1989, Youngblood *et al.* 1985). A broader type, *Carex rostrata-Carex aquatilis* wetland p.a. has been described for north-central Colorado that includes our *Carex rostrata* and *Carex aquatilis* types (Hess and Wasser 1982, Komarkova 1986, Johnston 1987, Hess 1981). See also *Carex aquatilis* p.a. above.

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

In the Yampa Basin the *Carex rostrata* p.a. had a wide elevation range, 2020-2720 m (6620-8920 ft), and occurred in all counties within the study area. It occurred in floodplain swales and abandoned channels, as well as silty stream margins. This is one of the wettest riparian p.a.s found in the Yampa River Basin, as it can have saturated soils all season long, and often is associated with standing water.

Soil: Shallow (0.5 meter) accumulations of clays and silts over cobbles and alluvium.

Vegetation: *Carex rostrata* dominated a dense, continuous graminoid layer. Pure stands occurred occasionally, but *Carex aquatilis* and *Juncus saximontanus* were often present in patches. Forb cover was very low.

Adjacent riparian vegetation: Beaked sedge can occur in conjunction with many different willow and other herbaceous riparian plant associations due to its broad elevational range. Some more common associates were Booth's willow/beaked sedge and coyote willow/mesic graminoid shrublands.

Adjacent upland vegetation: Big sagebrush and Gambel's oak shrublands, subalpine fir-engelmann spruce forests.

Succession/management: *Carex rostrata* appears to occupy the wettest sites, while *Carex aquatilis* occurs in slightly better drained areas. These two species intermix at intermediate habitats, and thus create the confusion in the literature as to whether there are one or two plant associations. We chose to follow Padgett *et al.* (1989) and Youngblood *et al.* (1985) in distinguishing between plant associations which often have different environmental characteristics as well as different species composition. *Carex rostrata* is known to pioneer newly flooded beaver ponds, and form early successional communities (Padgett *et al.* 1989).

Nebraska sedge (*Carex nebrascensis*) p.a.
(CANE) 3 stands (5, 40, 82)

Synonyms: Similar to the *Carex nebrascensis* type described by Padgett *et al.* (1989), Youngblood *et al.* (1985), and Johnston (1987). Ours occurred at somewhat lower elevations, and therefore had different associated species. Notably, ours were lacking the *Deschampsia cespitosa* component, and usually *Salix exigua* was adjacent.

Distribution: Similar types (listed above) are reported from northern and western Wyoming and Eastern Idaho (Johnston 1987), low to mid-elevations of Montana, throughout Utah, and central Oregon (Padgett *et al.* 1989). In Colorado, similar types have been described from cold springs of north-western Colorado (Johnston 1987).

In the Yampa River Basin this type occurred at elevations from 1750 to 2410 m (5740-7900 ft) in Moffat and Routt counties, along low gradient swales and smaller channels within flat floodplains.

Vegetation: *Carex nebrascensis* dominated a dense herbaceous layer. Few shrubs were present. Other graminoids occasionally present included *Juncus balticus* and *Agrostis gigantea.*

Adjacent riparian vegetation: Narrowleaf cottonwood/skunkbrush forests; coyote willow, Pacific willow, and Booth's willow shrublands; beaked sedge and cattail wetlands.

Adjacent upland vegetation: Piñon-juniper woodlands, Gambel's oak, greasewood, and big sagebrush shrublands.

Succession/management: *Carex nebrascensis* is strongly rhizomatous and is a good streambank stabilizer. It is highly palatable to livestock and with it's high underground biomass can withstand moderate to even heavy grazing, although with extreme grazing it can be replaced by *Juncus balticus* or *Poa pratensis* (Padgett *et al.* 1989).

Desert saltgrass meadow (*Distichlis spicata*) p.a. (tentative type)
(DISP) 1 stand (95)

Synonyms: *Distichlis spicata* (Baker 1984); *Distichlis spicata/Elytrigia smithii* or *Distichlis spicata/Sporobolus airoides-Elytrigia smithii* types described by Johnston (1987).

Distribution: This alkaline type is reported from southern Saskatchewan to north-central Oklahoma. In Colorado it is previously reported from northeastern part of the state (Johnston 1987).

In the Yampa River Basin we sampled this type on a small tributary to the Yampa River in Moffat County at an elevation of 2060 m (6750 ft). It is expected to occur throughout the western half of the river basin in moist swales, adjacent to standing water, on small channels and intermittent or ephemeral streams where the soil is alkaline.

Vegetation: *Distichlis spicata* dominated the low graminoid layer. Other species present were *Sporobolus airoides, Juncus balticus,* and *Carex praegracilis.*

Adjacent riparian vegetation: Coyote willow and tamarisk shrublands; bulrush and cattail marshlands in less alkaline areas.

Adjacent upland vegetation: Rubber rabbitbrush and big sagebrush shrublands, piñon-juniper woodlands.

Succession/management: This type can apparently tolerate low to moderate alkaline soils, and appears to be an early-seral colonizing plant association.

Creeping spikerush (*Eleocharis palustris*) p.a. (tentative type)
(ELPA) 1 stand (24)

Synonyms: *Eleocharis palustris* (Padgett *et al.* 1989, Johnston 1987, Youngblood *et al.* 1985).

Distribution: This plant association has been described from central Oregon, mid to high elevations of Montana, western and central Utah (Padgett *et al.* 1989), and from northern, western, and south-eastern Wyoming (Johnston 1987). In Colorado it is known from the northwest part of the state, the Front Range, and Mesa County (Reid and Bourgeron 1991), and is reported from San Juan National Forest (Johnston 1987).

In the Yampa River Basin the *Eleocharis palustris* p.a. is expected to occur in small patches throughout the basin in low-lying swales, shallow backwater eddies, and silt and sand bars of rivers of all size. This wetland p.a. usually occurs in small patches. Elevational range of this type appears to be 1700-3050 m (5550-10,000 ft) in elevation. We sampled this type on the Yampa river in Moffat county, at an elevation of 1786 m (5855 ft), on a sandbar within the active channel.

Soil: Fresh fine alluvial sands and silt.

Vegetation: *Eleocharis palustris* dominated this narrow stringer wetland p.a. *Populus angustifolia* seedlings and *Scirpus americanus* also occurred there.

Adjacent riparian vegetation: Bulrush marshes, coyote willow shrublands.

Adjacent upland vegetation: Big sagebrush and greasewood shrublands.

Succession/management: *Eleocharis palustris* p.a. occurs well within the active channel, and is inundated annually. This early seral community colonizes backwater eddies and shallow edges of slow moving reaches of small and larger rivers. It is probably an ephemeral community, scoured out each year during high spring flows.

Povertyweed (*Iva axillaris*) p.a.
(IVAX) 3 stands (13, 21, 36)

Synonyms: *Iva axillaris* salt meadow (Baker 1984).

Distribution: Not reported outside Colorado, this type is known from northwestern Moffat County (Reid and Bourgeron 1991).

In the Yampa River Basin this type occurred in the far western sections of the study area, on flat floodplains and terraces of the Green and Yampa Rivers, at elevations below approximately 1840 m (6030 ft). It is expected to occur in the north central portions of the Yampa River basin, along the Little Snake River and along intermittent streams where alkaline conditions prevail.

Vegetation: *Iva axillaris* was the most common forb in this sparsely vegetated p.a. Associated species included *Leymus salina, Distichlis spicata*, and *Chenopodium* spp.

Adjacent riparian vegetation: Rio Grande cottonwood forests.

Adjacent upland vegetation: Piñon-juniper woodlands, greasewood and big sagebrush shrublands.

Succession/management: This plant association appears to be a result of disturbance and alkaline soil conditions. This p.a. appears to be transitional from the moist environs of the riparian zone to the upslope dry/alkaline conditions of the adjacent floodplain, terraces, and toeslopes.

Baltic rush (*Juncus balticus*) p.a.
(JUBA) 2 stands (7, 94)

Synonyms: Johnston (1987) describes two *Juncus balticus (= J. arcticus)* types: *Juncus arcticus/Distichlis spicata* occurs in marshes and meadows in desert valleys and edges of sloughs, while *Juncus arcticus/Carex* spp. occurs with cooler climate, montane species such as *Carex aquatilis*. Our stands appear to be very similar in environment to *Juncus arcticus/Distichlis spicata;* however, our stands lack *Distichlis spicata*, although this species occurred in adjacent communities. The *Juncus arcticus* community type described by Padgett *et al.* (1989), and the *Juncus balticus-Carex* spp. described by Hess (1981) appear to be more similar to Johnston's *Juncus arcticus-Carex* spp. higher elevation type. Because the climatic settings of these two related plant associations are quite different, and their associated species also quite different, we would keep them as separate associations. They may be lumped at a broader scale, such as the series level.

Distribution: The lowland *Juncus* type discussed above has been reported from western Utah (Johnston 1987).

In the Yampa River Basin this wetland p.a. occurred along narrow stream margins and near springs in the western portion of the basin, on smaller tributaries and spring fed creeks. Baltic rush p.a. is expected to occur throughout the basin on smaller streams at elevations between 1950-2150 m (6400-7000 ft).

Vegetation: *Juncus balticus* dominated the low graminoid layer of this narrow stringer p.a. Other graminoids included *Leymus cinereus, Sporobolus airoides*, and *Carex praegracilis*. Common forbs included *Iva axillaris* and *Glycyrrhiza lepidota*. *Salix exigua, Chrysothamnus spp.*, and *Artemisia tridentata* were among the few shrubs that occurred on higher, drier margins of this p.a. Introduced grasses commonly present included *Poa pratensis, Elytrigia repens,* and *Dactylis glomerata.*

Adjacent riparian vegetation: Coyote willow shrublands, desert saltgrass marsh.

Adjacent upland vegetation: Rubber rabbitbrush, greasewood, and sagebrush shrublands, piñon-juniper woodlands.

Succession/management: Occupies wettest the swales and low lying areas at low and mid elevation sites, in frequently inundated but low-disturbance areas. Can occur as a grazing induced type if on a site that could support *Carex rostrata* (Padgett *et al.* 1989).

Scratchgrass (*Muhlenbergia asperifolia*) p.a. (tentative type)
(MUAS) 1 stand (38)

Synonyms: *Muhlenbergia asperifolia* salt meadow, (Baker 1984).

Distribution: Occurs in Utah and northwestern Colorado (Reid and Bourgeron 1991).

In the Yampa River Basin one stand occurred as a narrow stringer along the stream bench of the Little Snake River. This p.a. may occur in low swales and stream benches throughout Moffat county at elevations below 1700 m (5600 ft). This species is more commonly associated with salt-water marshes and roadside ditches.

Vegetation: This sparsely vegetated grassland p.a. had 20% *Muhlenbergia asperifolia* and 10% *Spartina gracilis*. *Bromus tectorum* was also abundant, indicating a disturbed site.

Adjacent riparian vegetation: Bulrush marshes, coyote willow shrublands.

Adjacent upland vegetation: Big sagebrush and greasewood shrublands.

Succession/management: More information is need about the soil conditions and successional status of this type.

Bulrush (*Scirpus americanus*) p.a.
(SCAM) 4 stands (25, 26, 37, 99)

Synonyms: *Scirpus spp./Distichlis spicata* Johnston (1987). Appears to be very similar to the *Scirpus americanus-Carex* spp. p.a. of Bunin (1975) and Johnston (1987); however, these are described from Colorado eastern plains. The associated species component of our stands from the western slope indicates a warmer climatic regime and possibly alkaline soils.

Distribution: The *Scirpus americanus/Carex* spp. type has been reported from central Montana, central Kansas, Saskatchewan, western Utah, and north-central Nebraska (Johnston 1987). In Colorado, this type has been reported from across the northern part of the state (Johnston 1987).

In the Yampa River Basin it was found at elevations below 2150 m (7000 ft) in the eastern portion of the study area in Moffat County. The *Scirpus americanus* type occurred in low-lying swales, abandoned channels, and overflow channels where the water table was at or near the surface, or where spring-time flows became trapped and the site remained wet late into the season. It also occurred on silt and sandbars within the active channel where water velocity was lowest.

Vegetation: *Scirpus americanus* dominated a sparse graminoid layer. Other wetland graminoids included *Spartina gracilis*, *Muhlenbergia asperifolia*, and *Eleocharis palustris*.

Adjacent riparian vegetation: Coyote willow shrublands, creeping spikerush wetlands in similar low-lying areas; cottonwood or box elder forests on higher terraces.

Adjacent upland vegetation: Big sagebrush shrublands, piñon-juniper woodlands.

Succession/management: An early colonizer of constantly wet, non alkaline, nonsaline alluvial silts, marshes and reservoir margins (Johnston 1987).

Alkali bulrush (*Scirpus maritimus*) p.a.(tentative type)
(SCMA) 1 stand (2)

Synonyms: *Scirpus maritima* wetland (Ungar 1974); *Scirpus* spp./*Distichlis spicata* (Johnston 1987).

Distribution: Reported from central Nebraska, north-central Kansas, northwest Utah, west-central North Dakota (Johnston 1987). Not previously reported from Colorado.

In the Yampa River Basin this type occurred on narrow channels and spring fed creeks, wet swales and back-water eddies of larger rivers. Found in the lower elevations of the western portion of the basin in Moffat County at elevations below 1960 m (6430 ft).

Vegetation: *Scirpus maritimus* dominated this sparsely vegetated wetland. Common associated species in lower abundance included *Sporobolus airoides*, *Muhlenbergia asperifolia*, and *Scirpus acutus*. This wetland p.a. was often in standing water.

Adjacent riparian vegetation: *Juncus balticus* wetlands, coyote willow shrublands, Rio Grande cottonwood forests.

Adjacent upland vegetation: Big sagebrush and greasewood shrublands, piñon-juniper woodlands.

Succession/management: An early seral stage that occurs on borders of saline flats,

ponds, and wet depressions, with total salts low (0.3-0.5%, 3000->3500 mg/l dissolved solids), high soil moisture (average 44%), and a pH range of 8.2-8.4 (Johnston 1987). Saline conditions may prohibit invasion of other species and succession to a later-seral stage.

H. MISCELLANEOUS COMMUNITIES

Acer negundo/bare p.a. (tentative type)
(ACNE/bare) 3 stands (10, 20, 98)

Synonyms: It is uncertain at this time whether the native box elder exists along streams and rivers of the western slope. Many box elders of eastern origin were planted by homesteaders and brought in by the railroad. Also, these stands sampled in 1990 were heavily disturbed sites, and thus do not fit the criteria to be included in potential natural riparian plant association classification of the western slope.

Distribution: Highly disturbed type, not reported in the literature.

In the Yampa River Basin this highly degraded type was found in Moffat county on the mainstem of the Yampa and Green rivers, as well as some of their smaller tributaries, on immediate stream banks and upper terraces.

Vegetation: This type is an animal disturbance-induced type. At lower elevations where shading is sparse, livestock are drawn to these shady trees, and consequently all shrub and herbaceous cover is completely obliterated.

Adjacent riparian vegetation: Narrowleaf cottonwood/coyote willow forests, and invasive tamarisk patches.

Adjacent upland vegetation: Piñon-juniper woodlands, big sagebrush scrub.

Succession/management: Lack of any undergrowth indicates a heavy disturbance (grazing/trampling) induced type. More information is needed on the occurrence of the native box elder in Colorado.

Slimstem reedgrass (*Calamagrostis stricta*) p.a. (tentative type)
(CAST) 1 stand (54)

Synonyms: None found.

Distribution: Not previously reported outside Colorado.

In the Yampa River Basin it was found once on upper Elkhead creek just where it leaves California Park in Routt National Forest, on a small isolated island in the creek at an elevation of 2365 m (7750 ft). *Calamagrostis stricta* is known to occur in subalpine willow bogs (Weber 1987).

Vegetation: *Calamagrostis stricta* dominated the low herbaceous layer. A few willows present in small amounts were *Salix wolfii, Salix boothii* and *Salix lucida* var. *caudata.* Other graminoids present included *Poa palustris, Carex rostrata, Carex aquatilis,* and *Carex lanuginosa.* Forb cover was approximately 10% and included *Geum macrophyllum, Mentha arvensis,* and *Pedicularis groenlandica.*

Adjacent riparian vegetation: Booth's willow shrublands.

Adjacent upland vegetation: Aspen woodlands, big sagebrush shrublands.

Succession/Management: More data are needed to determine the status of this plant association and information on the successional trends or status and soil characteristics is also

needed.

Rubber rabbitbrush (*Chrysothamnus* spp.) types (tentative types)
(CHRSPP.) 1 stand (8)

Synonyms: None previously described.

Distribution: Not previously reported outside Colorado.

In the Yampa River Basin it occurred along the Little Snake River on levees and higher mounds in the floodplain in Moffat County at an elevation of 1764 m (5780 ft).

Vegetation: *Chrysothamnus linifolius* dominated the dense shrub layer, along with *Artemisia tridentata* and *Salix exigua*. The undergrowth was dominated by *Glycyrrhiza lepidota, Cardaria latifolia*, and *Elymus trachycaulus*.

Adjacent riparian vegetation: Desert saltgrass marshes.

Adjacent upland vegetation: Big sagebrush and greasewood shrublands.

Succession/management: This p.a. appears to be disturbance-induced. It occurs in riparian areas where the water table has been lowered, and may represent a successional transition from a more mesic riparian p.a. (such as coyote willow shrubland) to a more alkaline or drier shrubland p.a. (such as greasewood shrubland).

Common scouring rush (*Equisetum hyemale*) p.a. (tentative type)
(EQHY) 1 stand (11)

Synonyms: None found.

Distribution: Not previously reported outside Colorado.

Within the Yampa Basin this minor p.a. probably occurs throughout the basin at elevations below 1830 m (6000 ft) on point bars and other depositional surfaces of low-gradient streams, where there is standing water all season long. We sampled one large occurrence at the confluence of the Yampa and Green rivers in Dinosaur National Monument.

Vegetation: This wetland p.a. was dominated by *Equisetum hyemale*. Other wetland graminoids present were *Equisetum arvense, Equisetum variegatum, Carex lanuginosa, Eleocharis palustris, Scirpus americanus*, and *Scirpus maritimus*. *Populus deltoides* spp. *wislizenii* seedlings and *Salix exigua* were among the few scattered woody species present.

Adjacent riparian vegetation: Rio Grande cottonwood forests, coyote willow shrublands.

Adjacent upland vegetation: Piñon-juniper woodlands.

Succession/management: More data are need to determine the successional trend and plant association status of this type. It probably is an early-seral, disturbance induced type, colonizing drying pond margins, or late season drying fluvial deposits.

KEY TO THE SAN MIGUEL/DOLORES RIVER BASIN RIPARIAN PLANT ASSOCIATIONS

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 not dominating 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 (a few willows 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,* or *Pseudotsuga menziesii* 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/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 at least 20% cover individually or together; shrub cover usually less than 20%. . . . . ***Picea engelmannii-Abies lasiocarpa*/mesic forbs p.a.**

4. Well-developed shrub understory of *Salix drummondiana* and *Lonicera involucrata*, often with *Alnus incana* spp. *tenuifolia*, at least 20% cover individually or together. . ***Picea engelmannii-Abies lasiocarpa/Alnus incana* spp. *tenuifolia* p.a.**

3. Pseudotsuga menziesii dominates the overstory 5

5. *Acer glabrum* a dominant shrub understory. . . . . ***Pseudotsuga menziesii/Acer glabrum* p.a.**

5. *Cornus sericea* present. . . . . ***Pseudotsuga menziesii/Cornus sericea* p.a.**

Group B. Mixed Deciduous-Evergreen Forests

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

1. Picea pungens present, may be co-dominant with *Populus angustifolia; Cornus sericea* less than 20% cover, *Alnus incana* spp. *tenuifolia* at least 10% cover. . . . . ***Picea pungens-Populus angustifolia/Alnus incana* spp. *tenuifolia-Lonicera involucrata* p.a.**

Group C. Deciduous Dominated Forests

1. Acer negundo dominates the overstory; *Populus* spp. absent . . . . . ***Acer negundo/Betula occidentalis* p.a.**

1. *Populus angustifolia, P. deltoides*, or *P. acuminata* dominates the overstory, commonly with at least 10% cover 2

2. *Populus deltoides* dominates the overstory; *Rhus trilobata* and/or *Forestiera pubescens* usually present. . . . . ***Populus deltoides* spp. *wislizenii/Rhus trilobata* p.a.**

2. *Populus angustifolia* and/or *Populus acuminata* dominate the overstory 3

3. *Populus angustifolia* and/or *Populus acuminata* dominate the overstory; *Rhus trilobata* and/or *Forestiera pubescens* present. Lower elevation sites, below 6500 ft. . . . . ***Populus angustifolia/Rhus trilobata* p.a.**

3. *Populus angustifolia* and/or *Populus acuminata* dominate the overstory; *Cornus sericea* forms a dense understory. . . . . ***Populus angustifolia/Cornus sericea* p.a.**

Group D. Willow Dominated shrublands

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

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

   2. *Salix brachycarpa* or *Salix wolfii* dominate the low willow cover 3

   2. *Salix planifolia* var. *monica* dominates with at least 30% cover; *Caltha leptosepala* often present. . . . . ***Salix planifolia/Caltha leptosepala* p.a.**

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, *Carex aquatilis* is usually present. . . . . ***Salix wolfii/Carex aquatilis* p.a.**

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

   4. *Salix monticola* and/or *Salix geyeriana*, or *Salix drummondiana* dominant. 5

5. *Salix drummondiana dominant*, often the only willow present along narrow stringer on steep rocky shaded streams. . . . . ***Salix drummondiana* p.a**

5. *Salix monticola* and/or *Salix geyeriana* dominant, usually forming a continuous canopy over wide floodplain areas. . . . . ***.Salix monticola-Salix geyeriana*/mesic forb p.a.**

Group E. Non-Willow Dominated Shrublands

1. *Rhus trilobata* or *Foresteria pubescens* dominates the shrub layer with at least 20% cover 2

1. Not as above 3

   2. *Forestiera pubescens* dominates the shrub layer with at least 50% cover, *Rhus trilobata* less than 50% cover if present . . . . . ***Forestiera pubescens-Salix exigua/Phragmites australis* p.a.**

2. *Rhus trilobata* dominates the shrub layer with at least 50% cover; *Forestiera pubescens* less than 50% cover if present. . . . . ***Rhus trilobata* p.a.**

3. *Betula occidentalis* and *Alnus incana* spp. *tenuifolia* dominated sites have been included with Mixed Deciduous-Evergreen Forest types. See discussion under ***Populus angustifolia-Picea pungens/Alnus incana* spp. *tenuifolia-Cornus sericea p.a.***

Group F. Herbaceous Plant Associations

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

1. Not as above 3

2. *Carex aquatilis* at least 50% cover . . . . . **Carex aquatilis p.a.**

2. *Carex rostrata* at least 50% cover . . . . . **Carex rostrata p.a.**

3. *Eleocharis palustris* at least 10% cover. . . . . **Eleocharis palustris p.a.**

3. Not as above 4

4. *Sporobolus airoides* dominant. . . . . **Sporobolus airoides p.a.**

4. Not as above. . . . .See discussion under Unaweep Seep and Miscellaneous types.

SAN MIGUEL AND DOLORES RIPARIAN PLANT ASSOCIATION DESCRIPTIONS

Stand numbers correspond to those on the San Miguel/Dolores River Basin map (Figure 3) and on the individual plot location maps (Appendix 4). Stand numbers preceded by the letters EO represent observations where only qualitative data was collected. Plots preceded by 92NL or 92GK were collected in 1992. Four letter acronyms (capital letters) for plant association names are used in the constancy tables at the end of the Description section.

A. EVERGREEN FORESTS

Our concept of evergreen (conifer) dominated riparian plant associations is narrower than that described by riparian classifications of Utah and southeastern Idaho (Padgett *et al.* 1989) and eastern Idaho and western Wyoming (Youngblood *et al.* 1985), which can have *Abies* spp., *Picea* spp. and/or *Pseudotsuga menziesii* in the overstory. We feel that elevation and other environmental characteristics of different conifer species warrant splitting them out at the species level.

Channel migration and sediment-deposition serve a key role in regeneration of these associations. As increase sediment deposition over time transforms point bars into terraces, coniferous species begin to increase in abundance within forest stands. Where deciduous species cannot regenerate on terraces above the river, conifers do and can do regenerate, and thus may represent potentially long-lived plant associations. Mature coniferous communities are subject to the cyclical destruction by river channel migration; migrations in river channels provide opportunities for deciduous riparian species to once again gain a foothold (The Nature Conservancy 1992).

Engelmann spruce-Subalpine fir/thinleaf alder (*Picea engelmannii-Abies lasiocarpa/Alnus incana* spp. *tenuifolia*) p.a.
(PIEN-ABLA/ALIN) 2 stands (EO#6, EO#7)

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

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).

Within the San Miguel/Dolores basin, this association occurred on the banks of streams in steep narrow valleys at an elevation of approximately 2450 m (8,000 ft), in the upper reaches of the Dolores watershed, northern Montezuma County, in the San Juan Mountains. Expected to occur at similar elevations on the Uncompahgre Plateau.

Soil: Sandy soils over cobbles.

Vegetation: *Picea engelmannii* and *Abies lasiocarpa* dominated the open tree canopy. *Populus angustifolia* also occurred in wider valleys. *Alnus incana* spp. *tenuifolia* and *Salix drummondiana* dominated the narrow and open shrub layer lining the stream banks. Other

shrubs present included *Salix geyeriana, Salix monticola,* and *Lonicera involucrata.* The herbaceous understory was well developed.

Adjacent riparian vegetation: Thinleaf alder shrublands, subalpine fir-Engelmann spruce forests.

Adjacent upland vegetation: Engelmann spruce and Colorado blue spruce forests, aspen forests.

Succession/management: This appears to be a late-seral, subalpine forest riparian plant association. Padgett *et al.* (1989) suggests this type would eventually become dominated by *Abies lasiocarpa.* See discussion under evergreen forests, above. More information is need about the soil and successional trends of this type.

Engelmann spruce-subalpine fir/mesic forbs (Picea engelmannii-Abies lasiocarpa/mesic forbs) p.a.

(PIEN-ABLA/MF) 4 stands (50, 52, 85, 93)

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 has been 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).

In the San Miguel/Dolores Basin this type occurred on steep narrow streams in subalpine forests above elevations of 2750 m (9000 ft), in narrow to moderately wide valleys in western San Miguel and Dolores counties. The riparian area was usually narrow and confined to immediate river banks within 8-10 meters of the channel and within 1 meter of channel elevation.

Soil: Organic layer (1-6 cm) over shallow (2-20 cm) loams. Parent material consisted of angular boulders or bedrock.

Vegetation: *Picea engelmannii* and *Abies lasiocarpa* dominated the overstory, and a dense cover of forbs dominated the shady, moist understory. *Cardamine cordifolia* lined the wet banks, with *Mertensia ciliata, Osmorhiza depauperata,* and *Heracleum lanatum.* Shrub cover was usually low with *Lonicera involucrata* and *Ribes lacustre* commonly present.

Adjacent riparian vegetation: Thinleaf alder shrublands, subalpine fir-Engelmann spruce forests.

Adjacent upland vegetation: Engelmann spruce-subalpine fir forests, aspen forests.

Succession/management: Padgett *et al.* (1989) describes this type as seral to an *Abies lasiocarpa* dominated sites, and that dominance by *Populus tremulodies, Pseudotsuga menziesii* and or *Pinus contorta* represents earlier seral stages of this type. Also, see discussion under evergreen forests, above.

Colorado blue spruce/thinleaf alder (*Picea pungens/Alnus incana* spp. *tenuifolia*) p.a. (PIPU/ALIN) 2 stands (5, 83)

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 has been 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).

In the San Miguel/Dolores River Basin it occurred on the banks of narrow steep montane to subalpine streams in alluvial and colluvial valley bottoms with northerly aspects, and along narrow reaches in deep canyons of the San Miguel River, from 1860 to 2800 m (6100-9200 ft) in elevation, eastern San Miguel and Dolores counties.

Soil: Loamy sand over gravel and boulders.

Vegetation: *Picea pungens* dominated a dense overstory, with many seedling and saplings in the understory as well. *Alnus incana* spp. *tenuifolia, Lonicera involucrata*, and *Acer glabrum* created a narrow band of shrubs lining the stream bank. Forb and graminoid cover was quite low. Forbs included *Thalictrum fendleri, Galium triflorum, Osmorhiza depauperata*, and *Heracleum lanatum*.

Adjacent riparian vegetation: Alder shrublands, subalpine fir forests.

Adjacent upland vegetation: Colorado blue spruce forest, aspen woodland, piñon-juniper forests, Gambel's oak scrub.

Succession/management: More information is needed about the successional status of *Picea pungens*, however, it appears to be a long-lived, late-seral riparian plant association. See also the discussion under evergreen forests, above.

Colorado blue spruce/red-osier dogwood (*Picea pungens/Cornus sericea*) p.a. (PIPU/COSE) 3 stands (6, 42, 45)

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

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. San Miguel and Montrose counties, 1800-2500 m (6160-8200 ft) in elevation.

Soil: Shallow loam with heavy organic component over lighter colored gravels and cobbles.

Vegetation: Dense stands of *Picea pungens* characterized the overstory of this p.a. *Populus tremuloides* was also occasionally present. *Cornus sericea* formed a dense, almost impenetrable shrub layer. Other shrubs present included *Betula occidentalis, Salix drummondiana, Alnus incana* spp. *tenuifolia,* and *Lonicera involucrata.* Lush herbaceous cover of *Equisetum spp., Carex lanuginosa, Ligusticum porteri, Rudbeckia laciniata,* and *Smilacina stellata* characterized the undergrowth.

Adjacent riparian vegetation: Thinleaf alder, red-osier dogwood, Rocky Mountain willow shrublands.

Adjacent upland vegetation: Aspen and piñon-juniper woodlands, Gambel's oak shrublands.

Succession/management: *Cornus sericea* becomes more abundant on more level sites due to periodic high water tables (Johnston 1987). More information is need about regeneration and successional trends in Colorado blue spruce dominated riparian communities. See also the discussion under evergreen forests above.

B. MIXED DECIDUOUS-EVERGREEN FORESTS

There are two mid to late-seral mixed deciduous-evergreen riparian forest types in the San Miguel/Dolores River basin. Padgett *et al.* (1989) did not describe any mixed conifer-deciduous types. In their conifer/*Cornus sericea* community type deciduous trees (cottonwood, aspen) present were considered remnant, indicating that the conifers were the climax overstory. In all of our stands, however, we found regeneration of both *Picea pungens* and *Populus angustifolia.*

Intact fluvial processes of flooding and deposition allow narrowleaf cottonwood to regenerate, keeping the community in a mid to late-seral stage, while seasonally high water tables and cold-air drainage provide habitat for *Picea pungens.* These mixed deciduous-evergreen plant associations are subject to cyclical destruction by river channel migration; migrations in river channels provide opportunities for deciduous riparian species to once again gain foothold. These montane floodplain environments are a dynamic part of the landscape, and with continued natural processes such as channel migration and flooding, will support a constantly changing patchwork of all age classes and association types (The Nature Conservancy 1992).

Narrowleaf cottonwood-Colorado blue spruce/thinleaf alder-red-osier dogwood (*Populus angustifolia-Picea pungens/Alnus incana* spp. *tenuifolia-Cornus sericea*) p.a.

(POAN-PIPU/ALIN-COSE) 13 stands (7-15, 46, 47, EO#1, EO#3)

Synonyms: *Populus angustifolia-(Picea pungens)/Alnus incana* spp. *tenuifolia-Cornus sericea* (Baker 1989). Our plots often had higher *Betula occidentalis* cover than described by Baker because 1) we sampled smaller plots than Baker (50 m^2 vs. 1000 m^2), and 2) we often placed plots along convex stream banks adjacent to the water where *Betula* and *Alnus* tend to grow in thick bands.

Distribution: From eastern Idaho and western Wyoming to southern Utah (Baker 1989). Within Colorado it has been reported from the White River Plateau, the Gunnison and Uncompahgre National Forests (Hess and Wasser 1982, DeVelice *et al.* 1984, and Komarkova 1986, as cited by Baker 1989).

In the San Miguel/Dolores River Basin it occurred along river banks and floodplains of the San Miguel River from the Norwood bridge to Sawpit and along narrow reaches of the Dolores and West Dolores rivers. From 2015 to 2500 m (6600 to 8200 ft) in elevation in narrow to wide valleys (10-450 m). Stream gradient was 2%-12%.

Soil: Shallow sandy to silty loams over approximately 0.5 meter thick sands, often stratified with finer textures from sedimentary events. Cobbles at 0.5 to 1 meter depth. Boulders often occurred at the surface.

Vegetation: *Populus angustifolia* dominated the overstory of this p.a. *Picea pungens* was always present, ranging from 1% to 30% cover. Other trees often present were *Pseudotsuga menziesii, Populus tremuloides*, or *Quercus gambelii. Cornus sericea* dominated the dense shrub layer, although on immediate river banks *Alnus incana* spp. *tenuifolia* and *Betula occidentalis* occurred in a thick band. We could almost split this birch and alder shrub band into a separate association, as it often occurred in narrow portions of the canyon without a tree overstory; however, we often found *Picea pungens* or *Populus angustifolia* seedlings within this band. Birch and alder also occurred within the mixed forest on the floodplain behind stream banks. Other shrubs commonly present in the understory were *Lonicera involucrata, Amelanchier alnifolia* and *Symphoricarpos rotundifolius. Heracleum lanatum, Rudbeckia laciniata*, and *Smilacina stellata* were common and abundant forbs. Graminoid cover was sparse.

Adjacent riparian vegetation: *Salix exigua* and *Salix ligulifolia* stands on point bars and small islands. On the West Dolores *Salix monticola* willow carrs occurred in low, open areas adjacent to the narrowleaf cottonwood-Colorado blue spruce/thinleaf alder-red-osier dogwood p.a.

Adjacent upland vegetation: Piñon-juniper woodlands, Gambel's oak scrub, aspen woodlands, and conifer forests including Douglas-fir, Colorado blue spruce and ponderosa pine.

Succession/management: It is thought to be a late-seral type. With flooding, channel migration, deposition, and scouring, the community will not reach climax stage. Also see discussion under the mixed deciduous-evergreen subheading, above.

Colorado blue spruce-narrowleaf cottonwood/thinleaf alder-black twinberry (*Picea pungens-Populus angustifolia/Alnus incana* spp. *tenuifolia-Lonicera involucrata*) p.a.
(PIPU-POAN/ALIN-LOIN) 6 stands (18, 36, 37, 82, EO#5, EO#10)

Synonyms: *Picea pungens-Populus angustifolia/Alnus incana* spp. *tenuifolia-Lonicera involucrata* (Baker 1989).

Distribution: Not reported outside of Colorado. Known only from west-central and southwestern Colorado (Baker 1989).

In the San Miguel/Dolores River Basin this type occurred on narrow terraces and benches adjacent to the channel in narrow to moderately wide valleys, usually 1-2 meters above the

high water line. Between 2370 and 2620 m (7780-8600 ft) in elevation in eastern San Miguel and Dolores counties.

Soil: Highly stratified soils due to depositional events. Shallow loamy sand and silt over 0.5 meters of loam or sandy clay with alternating dark and light bands. Gravel and cobble alluvial parent material was within one meter of the surface. Depth to water table averaged approximately 45 cm, varying from 0 to greater than 77 cm.

Vegetation: This mixed deciduous-evergreen p.a. is distinguished from the narrowleaf cottonwood-Colorado blue spruce/thinleaf alder-red-osier dogwood p.a. by lack of *Cornus sericea* and higher abundance of *Picea pungens*. *Populus angustifolia* and *Picea pungens* codominate the overstory (plots from this type did not adequately represent the overall percentage of the dominant tree species; thus the constancy and average cover for this p.a. do not reflect the importance of *Picea*). *Alnus incana* spp. *tenuifolia* was abundant, usually lining the river banks, while *Lonicera involucrata* was a constant understory shrub component within the floodplain forest. Other tree species present in minor amounts included *Populus tremuloides* and *Pseudotsuga menziesii*. Other shrub species present were *Salix ligulifolia, Salix drummondiana, Salix monticola, Rosa woodsii* and *Symphoricarpos rotundifolius*. The herbaceous layer was dominated by forbs including *Smilacina stellata, Equisetum arvense, Equisetum hyemale, Heracleum lanatum, Geranium richardsonii*, and *Rudbeckia laciniata*. Graminoid cover was sparse, and included *Poa pratensis* and *Bromus ciliatus*.

Adjacent riparian vegetation: Coyote willow, Rocky Mountain willow-Geyer's willow shrublands.

Adjacent upland vegetation: Engelmann spruce-subalpine fir and Douglas-fir forests; aspen and piñon-juniper woodlands; Gambel's oak scrub on south-facing slopes.

Succession/management: More information is needed about these mixed deciduous-evergreen riparian forests. They may be a late-seral plant association subject to frequent flooding and deposition. Also see discussion under mixed-deciduous forests, above.

C. DECIDUOUS FORESTS

Plant associations dominated by cottonwoods are often not considered climax riparian types. Where cottonwood communities become separated from the current fluvial processes of seasonal water tables and semi-annual flooding, either by channel down cutting or by terrace development, they will eventually succeed to non-riparian shrub or other upland plant communities. However, within the active channel and its current floodplain, cottonwood forests are subjected to a successional cycle described well elsewhere (Bradley and Smith 1986, McBride and Strahan 1984, Akashi 1988, and others).

Snowmelt runoff in the spring can produce heavy flows that erode the outside bend. As a result, the river channel moves, and cottonwood seedlings take hold on the newly-deposited point bars. In the absence of large floods in subsequent years, seedlings gain a strong foothold from which they trap sediment from smaller flows. After a few years, enough sediment is trapped to begin to form riverside terraces, elevating the young forest community

above the river channel. In its new elevated position, absent excessive browsing, fire, and agricultural conversion, the community can grow into a mature riparian forest. At the same time, meandering river channels continually create oxbows and other geomorphic formations resulting in a constantly changing patchwork of all age classes and association types (The Nature Conservancy 1992).

Box elder[1]/river birch (*Acer negundo*[1]/*Betula occidentalis*) p.a.
(ACNE/BEOC) 4 stands (61, 62, 63, 64)

Synonyms: Not previously reported.

Distribution: Currently known only from one locality in Colorado. It is expected to occur in similar environments in southwestern Colorado and southeastern Utah. In the San Miguel/Dolores River Basin it occurred on La Sal creek, a tributary of the Dolores River in western Montrose county, draining the La Sal mountains, Utah. Found below 1860 m (6100 ft) in elevation on immediate river banks within 2 meters of the channel in a narrow, sandstone box-canyon.

Soil: Shallow to deep (up to 1.5 m) sand or loam over cobbles.

Vegetation: *Acer negundo*[1] and *Betula occidentalis* dominated the tree and shrub canopy respectively, with the shrubs *Forestiera pubescens, Salix exigua*, and *Clematis ligusticifolia* often present. Forbs and graminoids were sparse; in some plots *Poa pratensis, Equisetum hyemale* and *Phalaroides arundinacea* had high cover.

Adjacent riparian vegetation: Coyote willow shrublands.

Adjacent upland vegetation: Piñon-juniper woodlands.

Succession/management: More information is needed about box elder and birch regeneration and long-term needs.

Narrowleaf cottonwood/red-osier dogwood (*Populus angustifolia/Cornus sericea*) p.a.
(POAN/COSE) 7 Stands (40, 41, 43, 70, 80, 81, EO#2)

Synonyms: Similar to *Populus angustifolia/Cornus sericea* (Padgett el al. 1989, Youngblood *et al.* 1985); *Populus angustifolia/Amelanchier alnifolia/Smilacina stellata, (Crataegus rivularis-Cornus sericea* phase) (Hess and Wasser 1982, Johnston 1987), however our stands have a strong *Salix boothii* and *Salix lasiandra* var. *caudata* component, although these may represent earlier seral stages.

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 1989). In Colorado, it is also known from the White River National Forest (Johnston 1987).

In the San Miguel/Dolores River Basin it occurred on floodplains and river benches in wide to moderately wide valleys on larger streams in northern Montezuma and southern Dolores counties, or southerly facing small streams in narrower canyons draining the

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[1]Box elder (*Acer negundo*) taxonomy is under review as to whether the occurrences on the western slope are members of the native western race (*Acer negundo* ssp. *interius*), the introduced eastern race (*Acer negundo* ssp. *violaceus*), or a hybrid between the two.

Uncompahgre Plateau, central Montrose county, 2165-2415 m (7100-7900 ft) in elevation. Best examples of this p.a. were found on the main stem of the Dolores River above Stoner.

Soil: Stratified layers of loam, silty clay, sand, and cobbles with alternating light and dark color, indicating that depositional events have created this substrate, rather than in-place soil development. Overall depth up to 1 meter.

Vegetation: *Populus angustifolia* dominated an open tree canopy. *Cornus sericea* formed an impenetrable shrub layer. This p.a. was distinguished from mixed *Populus-Picea* by the absence of *Picea pungens*. Other trees present in minor amounts included *Populus tremuloides*, and *Pseudotsuga menziesii*. Other shrubs occasionally present included *Alnus incana* spp. *tenuifolia, Quercus gambelii, Amelanchier alnifolia, Salix ligulifolia*, and *Betula occidentalis*. *Alnus* and *Betula* were generally confined to the bank edge, while the willow species occurred throughout the stand. Forb cover was lush, and included *Smilacina stellata,* and *Heracleum lanatum*. Graminoid cover was low, consisting mainly of *Equisetum spp.*

Adjacent riparian vegetation: Coyote willow shrublands, narrowleaf cottonwood-Colorado blue spruce forests.

Adjacent upland vegetation: Gambel's oak shrubland, piñon-juniper and ponderosa pine forests, Engelmann spruce-subalpine fir forests.

Succession/management: Our stands appear to be late-seral, mature cottonwood forests. Eroding banks on the outside bend of meanders had mature tree roots exposed and occasionally 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. Mid-seral stands had a mix of *Salix boothii* and *Salix lasiandra* var. *caudata.*

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 need about the long-term maintenance and response to grazing impacts. *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 (1989) proposes that his similar type may be considered early to mid-seral due to it's proximity to the channel. If the channel remains in place, it may be replaced by a Conifer/*Cornus sericea* type, and if the channel moves away it may be replaced by another *Populus angustifolia* dominated type, with a less mesic undergrowth.

Narrowleaf cottonwood/skunkbrush (*Populus angustifolia/Rhus trilobata*) p.a.
(POAN/RHTR) 14 stands (20, 21, 23, 24, 25, 26, 28, 29, 30, 31, 38, 92NL28, 92GK30, 92GK32)

Synonyms: *Populus angustifolia/Rhus aromatica* var. *trilobata* Padgett *et al.* 1989.

Distribution: Reported from the central high plateaus and the Abajo and La Sal Mountains in Utah (Padgett *et al.* 1989). Previously not reported in Colorado.

In the San Miguel/Dolores River Basin it occurred on immediate river banks, floodplains and terraces in narrow to medium-wide sandstone canyons between 1500 and 1850 m (5000 and 6100 ft) in elevation in northwestern Montrose County and southwestern Mesa County. On the San Miguel River near Uravan, this p.a. intermixes with the *Populus deltoides spp. wislizenii/Rhus trilobata* p.a. Stands generally occurred within 1 meter of the high water mark, as well as on higher terraces (up to 3 m).

Soil: Fine sandy loams, clay loams and silty clay loams.

Vegetation: Overstory dominated by *Populus angustifolia* or *Populus acuminata*. Other trees occasionally present were *Acer negundo** and *Quercus gambelii*. The shrub layer was dominated by *Rhus trilobata*. Other characteristic shrubs included *Forestiera pubescens, Clematis ligusticifolia, Berberis fendleri, Rosa woodsii, Crataegus rivularis*, and at higher elevations *Cornus sericea*. The herbaceous layer was usually sparse, with *Poa pratensis* a common grass, and *Smilacina stellata* and *Melilotus officinale* common forbs.

Adjacent riparian vegetation: Coyote willow shrublands, Rio grande cottonwood/skunkbrush forests at the lower elevational limit where the two cottonwood species overlap.

Adjacent upland vegetation: Piñon-juniper forests, big sagebrush and rubber rabbit brush shrublands, and Gambel's oak 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 to the exclusion of 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).

Rio Grande cottonwood/skunkbrush (*Populus deltoides* ssp. *wislizenii/Rhus trilobata*) p.a. (PODE/RHTR) 1 mature stand (92NL29) and 2 early seral stands (1, 2)

Synonyms: *Populus deltoides ssp. wislizenii/Rhus trilobata* (Baker 1984, Keammerer *et al.* 1974, and Johnston 1987).

Distribution: This plant association has not been well documented outside of Colorado, but is likely to occur in eastern Utah and possibly in northwestern New Mexico (Graham 1937, Campbell and Dick-Peddie 1964). In Colorado this type has been reported from the Colorado River from about Silt to Palisade, and on the San Miguel River between Vancorum and Uravan.

In the San Miguel/Dolores River Basin it occurred on the San Miguel River near Uravan, 1370 to 1680 m (4,500-5,500 ft) elevation. The early seral stands occur on point bars and other depositional surfaces within the main channel. Mature stands on floodplains can be far from the channel and high above channel elevation, as the older trees have deep enough roots to reach the water table as the active channel becomes more distant.

Soil: Deep stratified sandy loam with cobbles; fresh alluvial sand and gravels on point bars.

Vegetation: In early seral stands, *Populus deltoides ssp. wislizenii* seedlings were often very dense, and *Salix exigua* was usually present. Graminoids and forbs varied from sparse to dense, and included *Juncus balticus, Eleocharis palustris, Phalaroides arundinacea, Melilotus officinale* and *Aster brachyactis*. Mature stands had a *Populus deltoides* ssp. *wislizenii* tree overstory and a shrub layer of *Rhus trilobata, Forestiera pubescens*, or both. The herbaceous layer consisted of species adapted to well-drained sandy sites, such as *Elymus trachycaulus, Poa pratensis*, and *Elymus canadensis*.

Adjacent riparian vegetation: Coyote willow shrublands; narrowleaf cottonwood/skunkbrush forests at the upper elevational limit.

Adjacent upland vegetation: Piñon-juniper woodlands, Gambel's oak shrubland.

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 early 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).

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 sexually reproduce under a mature canopy.

D. TALL-STATURE WILLOW SHRUBLANDS

Deciduous shrublands are highly dependent upon hydrologic conditions and substrate types and textures. Willow carrs (shrublands) along these rivers require nearly saturated soil conditions during the growing season. As hydrologic conditions change, or if there is excessive elk or cattle browsing, shrublands may be converted to other, less mesic, associations. Alien species and conversion to agricultural use (clearing) also threaten riparian shrublands (see also discussion under Herbaceous Communities, below). Additionally, because beavers play a significant role in the dynamic conversion of patches from shrublands to wet meadows and back to shrublands, threats to the natural role of beavers in these communities present serious threats to the communities themselves (The Nature Conservancy 1992).

Drummond's willow/mesic forb (*Salix drummondiana*/mesic forb) p.a. (tentative type) (SADR/mf) 1 stand (54)

Synonyms: *Salix drummondiana/Mertensia ciliata* (Cooper and Cottrell 1990). Similar to the following types; however, ours are more narrowly defined by dominance by only *Salix drummondiana*: *Salix drummondiana-Salix monticola/Calamagrostis canadensis-Carex*

rostrata (Baker 1989); *Salix monticola*/mesic forb (Padgett *et al.* 1989); *Salix drummondiana-Salix monticola* (Phillips 1977).

Distribution: This p.a. occurs in Idaho and Utah (Baker 1989, Padgett *et al.* 1989). In Colorado it has been reported from the Front Range (Cooper and Cottrell 1990) and in the Gunnison and Uncompahgre National Forests (Komarkova 1986, as cited in Baker 1989).

In the San Miguel/Dolores River Basin, although only one stand was sampled, it was observed along narrow rocky steep streams, at elevations between 2750-3200 m (9,000-10,500 ft) in narrow valleys in the San Juan Mountains, eastern San Miguel and Dolores counties.

Soil: Silty clay loam over coarse weathered granite.

Vegetation: Dense stand of *Salix drummondiana* on a rocky hillslope down to stream edge. Dense forb layer with *Mertensia ciliata, Heracleum lanatum*, and *Delphinium barbeyi.*

Adjacent riparian vegetation: Rocky mountain willow shrublands, subalpine fir forests.

Adjacent upland vegetation: Engelmann spruce-subalpine fir conifer forest.

Succession/management: This narrow shrub association appears to tolerate flooding, and is early-seral, colonizing the bolder-strewn steep 1st order streams.

<u>Coyote willow/mesic graminoids (*Salix exigua*/mesic graminoids) p.a.</u>
(SAEX/MG) 10 stands (3, 27, 32, 33, 60, 68, 69, 74, 76, 78)

Synonyms: *Salix exigua*/barren (Padgett *et al.* 1989); *Salix exigua/Equisetum arvense* and *Salix exigua/Poa pratensis* (Youngblood *et al.* 1985, Cooper and Cottrell 1990); *Salix exigua-Salix* spp./*Poa pratensis* (Johnston 1987).

Distribution: This plant association is known from central and eastern Idaho, western and southeastern Wyoming (Youngblood et al 1985, Olsen and Gerhart 1982, as cited in Padgett *et al.* 1989), is wide spread throughout Utah, Arizona and New Mexico (Padgett *et al.* 1989, Szaro 1989). In Colorado, this type is reported from the eastern plains and the Colorado Front Range (Bunin 1985, Cooper and Cottrell 1990), and is expected to occur throughout the state.

In the San Miguel/Dolores River Basin, this plant association occurred throughout the basin, and was more common below 2000 m (6500 ft) in elevation in the western portion of the basin, and often occurred right at the channel edge, on cobble bars, sand islands, and river banks, but also occurred along overflow channels up to 30 meters away from the main channel. It appeared to be an early seral community, pioneering cobble point bars and unstable banks.

Soil: Fresh alluvium, thin layers of sandy loam over cobbles at channel edges and point bars. Deeper loamy sand over gravels along overflow channels and floodplain depressions.

Vegetation: *Salix exigua* dominated this shrubby community with 10-90% cover. Other shrubs present included *Salix monticola, Clematis ligusticifolia, Cornus sericea* and *Rosa woodsii.* Often *Populus angustifolia, Populus deltoides ssp. wislizenii* and/or *Acer negundo** seedlings were present. Frequently disturbed channel margins had low, weedy herbaceous cover, including *Melilotus officinale, Glycyrrhiza lepidota, Poa pratensis*, and *Agrostis stolonifera.* Less frequently disturbed areas such as backflow channels had a more dense herbaceous layer, including *Carex nebrascensis, Eleocharis palustris, Juncus balticus, Phalaroides arundinacea* and *Equisetum arvense.*

Adjacent riparian vegetation: Narrowleaf cottonwood/skunkbrush and Rio Grande cottonwood/skunkbrush forests, "yellow willow"-red-osier dogwood shrublands, creeping spike-rush wetlands.

Adjacent upland vegetation: Piñon-juniper woodlands, big sagebrush, rubber rabbit brush and greasewood shrublands, Gambel's oak scrub, ponderosa pine.

Succession/management: This p.a. is tolerant of flooding, and is one of the first pioneering types on freshly deposited alluvial surfaces. This early seral community is a common type that stabilizes banks and channel edges throughout the basin.

Rocky Mountain willow-Geyer's willow/mesic forb (*Salix monticola-Salix geyeriana*/mesic forb) p.a.

(SAMO-SAGE/MF) 12 stands (16, 19, 35, 48, 49, 53, 84, 86, 88, 92NL27, EO#8, EO#9)

Synonyms: Similar to *Salix geyeriana-Salix spp./Calamagrostis canadensis* (Johnston 1987); however, our stands lacked the *Calamagrostis* undergrowth; *Salix geyeriana*/mesic forb (Youngblood 1985 and Padgett *et al.* 1989), except ours had *Salix monticola* instead of *Salix boothii*; *Salix monticola/Calamagrostis canadensis* (Cooper and Cottrell 1990), (again ours lacked a *Calamagrostis* undergrowth); *Salix drummondiana-Salix monticola/Calamagrostis canadensis-Carex rostrata* (Baker 1989), but our stands had a different undergrowth component. This difference appears to be because none of Baker's samples of this type occurred within the San Miguel and Dolores rivers drainage.

Distribution: Similar types (listed above) occur from eastern Idaho, northwestern and north-central Wyoming (Johnston 1987) into Utah. In Colorado, similar types have been reported from the Colorado Front Range (Cooper and Cottrell 1990), the Routt, Arapaho, Gunnison and Medicine Bow National Forests.

In the San Miguel/Dolores River drainage it occurs primarily in eastern San Miguel and Dolores counties on river banks and floodplains of broader valley reaches in the San Juan Mountains, 2350-3000 m (7700-9800 ft) in elevation. The water table was usually within .5 m of the surface.

Soil: Shallow silt and silty clay loams (less than 0.5 meter) over gravels and cobbles. Some stands occurred on deeper clay loams of filled in beaver ponds.

Vegetation: *Salix monticola* and *Salix geyeriana* were codominant in this dense willow carr p.a. (in one stand only *S. monticola* was present, and in another, only *S. geyeriana* was present). Other associated *Salix* species were *Salix bebbiana* and *Salix brachycarpa*. Other shrubs included *Lonicera involucrata, Ribes inerme,* and *Alnus incana* spp. *tenuifolia*. The herbaceous layer was sparse directly under the willow canopy but dense between willow patches. Total graminoid cover was highly variable and included *Carex aquatilis, Bromus ciliatus* and *Poa pratensis*. Some of the more consistent forbs were *Geranium richardsonii, Thalictrum fendleri, Smilacina stellata* and *Equisetum arvense*. Wettest occurrences of the p.a., along overflow channels or floodplain depressions, had a greater abundance and richness of forbs and graminoid species, such as *Carex lanuginosa, Juncus balticus*, and *Carex aquatilis.*

Adjacent riparian vegetation: Beaked sedge meadow, Colorado blue spruce-narrowleaf cottonwood/thinleaf alder-black twinberry woodland.

Adjacent upland vegetation: Engelmann spruce-subalpine fir, Douglas-fir and Colorado blue spruce forests, aspen woodlands, Gambel's oak scrub.

Succession/management: *Salix geyeriana* willow carrs seem to require a water table no deeper that about 1 meter (Padgett *et al.* 1989). These willow carrs are commonly, but not always, associated with beaver ponds, which can maintain a higher water table than would be present otherwise. Where they occur on first and second order streams they may be fairly stable late-seral associations. Along lower order streams subject to flooding and channel adjustments, or where associated with beaver ponds, this plant association may be subject to a shorter successional cycle. More research is needed to understand the successional sequence of willow cars dependent on beaver-maintained high water tables.

E. LOW-STATURE WILLOW SHRUBLANDS

Low stature willow associations are most abundant in broad subalpine valleys which have high water tables throughout the season. These types are probably very stable associations as the source of the water table is primarily from melting snowfields (Cooper 1990, Windell *et al.* 1986), and soils are often varying depth of accumulated peat.

Barren-ground willow/mesic forb (*Salix brachycarpa/mesic forb*) p.a.

(SABR/MF) 2 stands (55, 92)

Synonyms: Similar to *Salix planifolia-Salix wolfii/Caltha leptosepala-Carex aquatilis* (Baker 1989), our stands had much higher amounts 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 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).

In the San Miguel/Dolores River Basin it occurs on well drained hummocks, streambanks and slopes in subalpine valleys between 3000 and 3400 m (10,000 and 11,000 ft) elevation in the uppermost reaches of the San Miguel and Dolores rivers within the Lizard Head Wilderness Area, eastern San Miguel and Dolores counties. This p.a. often occurred around the fringes of wetter depressions with *Salix planifolia.* Channel width was narrow, stream gradient highly variable (1-14%).

Soil: Peat and fine silts over boulders.

Vegetation: *Salix brachycarpa* occurred in almost pure stands on hummocks and well drained slopes within the valley floor. *Salix planifolia* occurred as pure stands in lower, poorly drained areas, and the two species intermixed at the ecotone between these micro-sites. Forb growth of *Ligusticum porteri, Senecio triangularis, Geranium richardsonii,* among others created a moderately dense herbaceous understory. Boulders were often covered with lichens and mosses.

Adjacent riparian vegetation: Planeleaf willow and Wolf's willow shrublands, water sedge meadows.

Adjacent upland vegetation: Engelmann spruce-subalpine fir forests.

Succession/management: This type occurs on slightly drier locations that the planeleaf willow types. Can be heavily grazed by sheep, which may alter the species composition. It appears stable, but little is known about the successional trends or status.

Planeleaf willow/marsh marigold (*Salix planifolia* var. *monica/Caltha leptosepala*) p.a. (SAPLM/CALE) 3 stands (56, 57, 89)

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

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 through out the high country of Colorado and has been reported form Roosevelt, Arapaho, Gunnison, pike, Routt, and Medicine National Forests.

In the San Miguel/Dolores River Basin it occurs on wet sites in broad glaciated snowmelt valleys above 3200 m (10,500 ft) in elevation along narrow stream channels, eastern San Miguel and northwestern Dolores counties. Low willow cover may extend for many meters across the broad valley floor, as the moisture is predominantly from melting snow patches, so the p.a. is not confined to a narrow strip along the channel.

Soil: Deep peats on top of glacial till or colluvium from landslides.

Vegetation: The shrub layer was dominated by dense, low stature *Salix planifolia* var. *monica*. Other willows often present in lesser amounts were *Salix monticola* and *Salix wolfii*. The canopy of willows was dense enough that the herbaceous understory was not well developed except in openings between patches of willows. Common graminoids included *Carex aquatilis* and *Calamagrostis canadensis*; common forbs included *Caltha leptosepala, Senecio triangularis* and *Mertensia ciliata*.

Adjacent riparian vegetation: Water sedge and beaked sedge meadows, barren-ground willow shrubland.

Adjacent upland vegetation: Engelmann spruce-subalpine fir forests.

Succession/management: This plant associations 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 evaporation, and can lower the water table, allowing *Salix brachycarpa* or *Salix wolfii* to become established.

Wolf's willow/aquatic sedge (*Salix wolfii/Carex aquatilis*) p.a. (SAWO/CAAQ) 1 stand (90)

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 has been reported from the western slope (Baker 1989).

In the San Miguel/Dolores River Basin it occurred in mesic swales and hummocks within glaciated basins above 3000 m (10,000 ft) in elevation, eastern San Miguel County.

Soil: Shallow heavy silty clays over gravels and rocks.

Vegetation: This low-stature willow community was 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 occurred. *Caltha leptosepala* and *Carex aquatilis* were abundant in the herbaceous layer.

Adjacent riparian vegetation: Water sedge meadow, *Salix planifolia, Salix brachycarpa* shrublands.

Adjacent upland vegetation: Engelmann spruce-subalpine fir forests.

Succession/management: *Carex aquatilis* is well suited to wet, organic soils at these elevations. Succession would be very slow (Padgett *et al.* 1989).

F. NON-WILLOW DOMINATED SHRUBLANDS

Wild privet-coyote willow/common reed (*Forestiera pubescens-Salix exigua/Phragmites australis*) p.a. (tentative type)
(FOPU-SAEX/PHAU) 2 stands (67, EO#4)

Synonyms: Not previously described.

Distribution: Similar types have not been described in the literature. Only known occurrence is on the Dolores River, CO.

In the San Miguel Dolores/River Basin it occurs on the Dolores River below 1700 m (5,500 ft) in elevation on riverbanks and natural levees of the Dolores River, in western San Miguel and Dolores counties. About 3 meters above channel elevation, this type formed a narrow but continuous band for many river miles.

Soil: Deep silty clays over clay loam and sandy loam.

Vegetation: *Rhus trilobata, Forestiera pubescens*, and *Salix exigua* dominated the shrub layer. *Phragmites australis*, a tall erect grass, occurred as a codominant among tall shrubs. *Artemisia tridentata* often bordered the upland side of the narrow strip of riparian vegetation.

Adjacent riparian vegetation: Creeping spike-rush wetland, coyote willow shrubland.

Adjacent upland vegetation: Big sagebrush shrubland.

Succession/management: Appears to be a flood-tolerant association along stream margins. *Forestiera pubescens* usually occupied sightly higher ground than the *Salix exigua* and *Phragmites*. Probably not grazed due to such dense shrub cover. More research is needed to determine the establishment needs, long-term stability, and ecology of this unique plant association.

Skunkbrush (*Rhus trilobata*) p.a. (Tentative type)
(RHTR) 3 stands (39, 77, 92GK31)

Synonyms: Not previously described. More mesic stands with *Cornus sericea* may be related to *Swida sericea/Distegia involucrata* (Johnston 1987 and Komarkova 1986) as they occur in similar habitats.

Distribution: Not reported outside Colorado. In Colorado, similar types described by Komarkova (1986) have been reported from Gunnison and Uncompahgre National Forests.

In the San Miguel/Dolores River Basin this plant association occurred as a narrow band between the high water line and the upland dry slopes, 1550-2000 m (5100-6500 ft) in elevation, on rocky well drained benches in moderately wide valleys and along narrow reaches of larger rivers in south central and western Montrose and western San Miguel counties.

Soil: Shallow sandy loam or loamy sand over coarse alluvium or bedrock.

Vegetation: *Rhus trilobata* dominated the dense shrub layer. *Salix ligulifolia* was commonly present in high amounts. In more mesic areas, *Cornus sericea* was quite thick. Other shrubs present in lesser amounts included *Berberis fendleri, Salix exigua* and *Rosa woodsii*. Graminoids included *Carex nebrascensis, Bromus inermis, Juncus balticus, Phalaroides arundinacea*, and *Poa pratensis*. The sparse forb layer included *Glycyrrhiza lepidota, Prunella vulgaris*, and *Taraxacum officinale*.

Adjacent riparian vegetation: Coyote willow shrubland, narrowleaf cottonwood/skunkbrush forests.

Adjacent upland vegetation: Piñon-juniper and ponderosa pine woodlands, Gambel's oak scrub.

Succession/management: This p.a. appears to be a late-seral riparian shrub association as it occurs just at or above the high water mark of the channel. The dense shrub canopy shows little sign of disturbance. This type may not be an obligate riparian plant association, however, since it may be related other *Rhus trilobata* rock outcrop and scree types described by Johnston (1987).

G. HERBACEOUS PLANT ASSOCIATIONS

Herbaceous wetland associations rely upon hydrologic processes to maintain their composition. Cycles of flooding and sediment deposition uproot old associations and leave unvegetated sites with substrate types ideal for herbaceous colonization. Also, a braided channel morphology may contribute to the formation and maintenance of wetlands. The felling of trees and shrubs by beavers and the construction of beaver dams contributes to herbaceous and shrub wetland dynamics on many upper tributary basins. These communities are a dynamic mosaic of patch types. For instance, while hydrologic or other processes may convert a particular patch of meadow into shrubland, the work of floods and beavers maintain early-seral wet meadow or beaver pond successional phases (The Nature Conservancy 1992).

Major stresses to herbaceous wetlands occur with changes in base flows, drops in water table levels, and from excessive grazing by wildlife or livestock. At lower elevations, for example, repeated heavy livestock use can turn lush herbaceous areas into bare ground, increasing bank instability and siltation of downstream waters. Natural changes in hydrology may lead to natural succession from riparian meadows to shrubland and from shrublands back to meadows.

Water sedge (*Carex aquatilis*) p.a.

(CAAQ) 2 stands (58, 91)

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

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

In the San Miguel/Dolores River Basin it occurred in snow-melt fed swales and slopes in broad glaciated valleys above 3000 m (10,000 ft) in elevation, San Juan Mountains, eastern San Miguel and Dolores counties.

Soil: Fine silts and deep peats.

Vegetation: A dense rhizomatous sward of *Carex aquatilis*, usually accompanied by one or two grass species such as *Calamagrostis canadensis* or *Hordeum glaucum,* and an occasional forb such as *Pedicularis groenlandica,* characterized this p.a.

Adjacent riparian vegetation: Planeleaf willow, Wolf's willow, and Rocky Mountain willow-Geyer's willow shrublands.

Adjacent upland vegetation: Engelmann spruce-subalpine fir forest, krummholz, alpine forb meadows and willow shrublands.

Succession/management: The *Carex aquatilis* type occurs on soils that are typically wet throughout the growing season, and livestock grazing can often cause hummocking and pitting of the soil (Padgett *et al.* 1989). More information is needed about successional relationships of this and other subalpine graminoid plant associations.

Beaked sedge (*Carex rostrata*) p.a.

(CARO) 3 stands (17, 34, 87)

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

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

In the San Miguel/Dolores River Basin this common type occurred in a wide variety of settings, from narrow to wide valleys, from standing water to sites that become relatively dry late in the growing season, 1800-3200 m (6000-10,500 ft) in elevation along low-gradient streams, eastern San Miguel and Dolores counties. Stands sampled were in swales, overflow channels and abandoned silted-in beaver ponds between 2350 and 2950 m (7700 and 9700 ft) in elevation. These shallow depressions are usually inundated each year in spring and

receive fine sediments, and are very wet, with the water table usually within 0.5 m of the surface.

Soil: Shallow (0.5 meter) accumulations of clays and silts over cobbles and alluvium.

Vegetation: This open herbaceous p.a. was dominated by nearly pure stands of *Carex rostrata*, with varying associated *Carex* species, especially *Carex aquatilis* and *Carex nebrascensis*. Willow carrs were often adjacent, and a few scattered individual willows occurred, particularly *Salix planifolia* at higher elevations and *Salix monticola* at lower elevations. Forbs were quite scarce.

Adjacent riparian vegetation: Planeleaf willow and Rocky mountain willow-Geyer's willow shrublands.

Adjacent upland vegetation: Engelmann spruce-subalpine fir, Douglas-fir, and Colorado blue spruce forest, aspen woodlands, Gambel's oak scrub.

Succession/management: *Carex rostrata* appears to occupy the wettest sites, while *Carex aquatilis* occurs in slightly better drained areas. These two species intermix at intermediate habitats, and thus create the confusion in the literature as to whether there are one or two plant associations. We chose to follow Padgett *et al.*'s (1989) and Youngblood *et al.*'s (1985) lead in distinguishing between plant associations which often have different environmental characteristics as well as different species composition. *Carex rostrata* is known to pioneer newly flooded beaver ponds, and from early successional communities (Padgett *et al.* 1989).

Creeping spike-rush (*Eleocharis palustris*) p.a. (tentative type)
(ELPA) 1 stand (65).

Synonyms: *Eleocharis palustris* (Padgett *et al.* 1989, Johnston 1987, Youngblood *et al.* 1985, Kovalchik 1987).

Distribution: This plant association has been described from central oregon, mid to high elevations of Montana, western and central Utah (Padgett *et al.* 1989), and from northern, western, and south-eastern Wyoming (Johnston 1987). In Colorado it is known from the northwest part of the state, the Front Range, and Mesa County (Reid and Bourgeron 1991), and is reported from San Juan National Forest (Johnston 1987).

In the San Miguel/Dolores River Basin this p.a. is expected to occur throughout the basin on wet sand bars and on finer substrates in backwater areas within the channel at low elevations. This type often occurs as small, narrow stringer patches.

Soil: Fresh fine alluvial sands and silt.

Vegetation: Although sampled only once, this type was observed throughout the basin, and is well described in the literature. *Eleocharis palustris, Phalaroides arundinacea, Juncus balticus*, and *Scirpus americanus* commonly were abundant on this type of site, along with introduced species such as *Melilotus officinale* and *Bromus inermis*.

Adjacent riparian vegetation: Coyote willow shrubland, beaked sedge meadow.

Adjacent upland vegetation: Piñon-juniper woodland.

Succession/management: *Eleocharis palustris* p.a. occurs well within the active channel, and is inundated annually. This early seral community colonizes backwater eddies and shallow edges of slow moving reaches of small and larger rivers. It is probably an ephemeral community, scoured out each year during high spring flows.

Alkali saccaton (*Sporobolus airoides*) p.a. (tentative type)
(SPAI) 1 stand (22)

Synonyms: *Sporobolus airoides* (Baker 1984); *Sporobolus airoides/Agropyron smithii* (Johnston 1987).

Distribution: From north-western New Mexico, northern Oklahoma, southern Kansas (Johnston 1987). In Colorado, it is reported from the Comanche and Cimarron National Grasslands (Johnston 1987), South Park, and southeastern Colorado along the Arkansas River (Reid and Bourgeron 1991). Occurs on floodplain depressions (Johnston 1987).

In the San Miguel/Dolores River Basin one small stand was found on Tabeguache Creek, draining the Uncompahgre Plateau in central Montrose County, near its confluence with Spring Creek. On the sandy stream bank at 1584 m (5300 ft) elevation.

Soil: Shallow sandy clay loam stratified with sand and gravel layers in between boulders.

Vegetation: Dense narrow patch of *Sporobolus airoides* lined and overhung the stream bank. Other graminoids present were *Schizachyium scoparium* and *Carex emoryi.* The few sparse woody species included *Populus angustifolia, Fraxinus anomala, Rhus trilobata, Amelanchier alnifolia,* and *Salix exigua.* Forb cover was low.

Adjacent riparian vegetation: *Populus angustifolia/Rhus trilobata* forests, coyote willow shrublands.

Adjacent upland vegetation: Piñon-juniper woodlands.

Succession/management: An early-seral community on floodplains and depressions of moderate salinity (Aldous and Shantz 1924, as cited in Johnston 1987). Sharp increases in salinity will cause reductions in *Sporobolus airoides.* With no change in salinity, this type will form hummocks that accumulate sand and gradually lose salinity and moisture, followed by invasion by other grasses (Ungar 1974, as cited in Johnston 1987).

H. MISCELLANEOUS PLANT ASSOCIATIONS

Douglas fir/Rocky Mountain maple (*Pseudotsuga menziesii/Acer glabrum*) p.a. (tentative type)
(PSME/ACGL) 1 stand (51)

Synonyms: *Pseudotsuga menziesii/Acer glabrum* Johnston 1987. Occurs on steep slopes from SE Idaho to SE New Mexico. Not considered riparian.

Distribution: Occurs in north and northwestern Wyoming, southeastern Idaho, and northern Utah. Known from northeastern Colorado above 6500', and from White River National Forest, CO (Johnston 1987).

In the San Miguel/River Basin one stand sampled on a very steep (46%) intermittent gully above South Fork San Miguel River. The hillside was quite mesic with many seeps, supporting a dense aspen woodland with thick forb cover undergrowth.

Soil: Thin sandy loam over loose sedimentary boulders and bedrock.

Vegetation: *Pseudotsuga menziesii* and *Populus tremuloides* dominated the overstory. Several typical riparian shrubs occurred along the steep and eroding gully banks, including *Acer glabrum, Salix exigua,* and *Lonicera involucrata.* Forb cover was low but mesic, including *Mertensia ciliata, Cardamine cordifolia,* and *Heracleum lanatum.*

Adjacent riparian vegetation: None.

Adjacent upland vegetation: Aspen woodlands.

Succession/management: Moist, northerly aspects, often on steep slopes (Johnston 1987). Apparently an incidental type found in steep draws, not considered an obligate riparian plant association.

Douglas fir/red-osier dogwood (*Pseudotsuga menziesii/Cornus sericea*) p.a. (tentative type)

(PSME/COSE) 1 stand (66)

Synonyms: Similar to Conifer/*Cornus sericea* (Padgett *et al.* 1989), our stand had no *Abies lasiocarpa.*

Distribution: Similar types (listed above) have been reported from eastern Idaho and western Wyoming, and considered an incidental type in the Wasatch region of central Utah (Padgett *et al.* 1989).

In the San Miguel/Dolores River Basin one stand was sampled on upper Paradox Creek where it drains the La Sal National Forest and enters Paradox Valley. Elevation approximately 1720 m (5640 ft), on a steep rocky narrow creek.

Vegetation: *Alnus incana* spp. *tenuifolia* and *Cornus sericea* lined the creek bed. *Pseudotsuga menziesii* dominated the north facing canyon wall and creek edge. Undergrowth was very sparse, with small pockets of *Equisetum* spp.

Adjacent riparian vegetation: None.

Adjacent upland vegetation: Douglas-fir forests, piñon-juniper woodlands.

Succession/management: This community appeared to be an overlap of a north-facing steep slope stand of Douglas fir coming right to the stream edge were *Cornus sericea* was growing.

Unaweep Seep Non-riparian Wetlands

Four stands of unique wetland vegetation were sampled at Unaweep Seep: *Celtis reticulata/Clematis ligusticifolia* (stand 71), *Eleocharis palustris-Phragmites australis* (stand 72) and *Eleocharis palustris-Scirpus validus*[2] (stand 73), and *Alnus incana* spp. *tenuifolia/Eupatorium maculatum* (stand 75). This fourth type was similar to *Alnus incana* spp. *tenuifolia*/mesic forb types (Padgett *et al.* 1989); however, the dense forb undergrowth was dominated by a rare forb known only from Unaweep Seep.

Unclassified stands

Two stands (4 and 59) had *Populus* spp. overstories but were heavily disturbed and had a high percentage of introduced species, and were thus not classified. Two stands (44 and 79) were dominated by unidentified *Carex* species, and were left unclassified.

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[2]Two bulrush species, *Scirpus acutus* and *Scirpus validus,* may have been confused, as they are difficult to distinguish in the field. We called all specimens found in the San Miguel/Dolores River basin *S. acutus,* except for those seen at Unaweep Seep, where previous research had identified the population as *S. validus.*

Table 5. Yampa Basin Coniferous Forest plant association constancy (CONS) and average percent cover values (COV, t = trace) values for important plant species. Full names for plant association acronyms are listed at the end of table.

	PIEC-ABLA/ALIN		PIEN-ABLA/LOIN		PIPU/ALIN	
	CONS	AVE	CONS	AVE	CONS	AVE
Trees						
Abies lasiocarpa	100	7	100	20	33	t
Picea engelmannii	83	12	100	34	0	0
Picea pungens	17	t	0	0	100	21
Pinus contorta	17	3	0	0	0	0
Willows						
Salix boothii	17	t	0	0	0	0
Salix drummondiana	50	7	20	t	33	1
Salix geyeriana	17	5	0	0	33	1
Salix lasiandra var. caudata	17	t	0	0	0	0
Salix monticola	33	t	20	t	0	0
Shrubs						
Alnus incana	100	48	60	9	100	67
Amelanchier alnifolia	17	t	20	t	33	t
Cornus sericea	0	0	0	0	33	1
Lonicera involucrata	100	13	100	8	33	t
Ribes inerme	50	2	0	0	33	t
Ribes lacustre	17	t	40	6	0	0
Ribes montigenum	0	0	20	2	33	t
Rosa woodsii	17	t	0	0	67	1
Rubus idaeus	67	t	60	t	33	1
Vaccinium myrtillus	17	t	40	2	0	0
Vaccinium scoparium	17	t	60	6	0	0
Graminoids						
Agropyron dasystachyum (=Elymus lanceolatus)	17	t	0	0	0	0
Agrostis gigantea	17	2	0	0	33	1
Agrostis spp.	17	t	0	0	0	0
Bromus tectorum	33	t	0	0	0	0
Calamagrostis canadensis	67	1	60	t	33	3
Calamagrostis stricta	17	t	0	0	0	0
Carex aquatilis	0	0	20	t	33	1
Carex spp.	17	t	20	t	33	3
Carex hoodii	50	t	0	0	0	0
Carex lenticularis	17	t	0	0	0	0
Carex microptera	17	t	0	0	0	0
Carex praegracilis	17	t	0	0	0	0
Carex rostrata	33	t	0	0	0	0
Cinna latifolia	17	t	20	t	67	4
Deschampsia cespitosa	17	t	0	0	0	0
Elymus glaucus	67	1	20	t	33	t
Elytrigia repens	0	0	0	0	33	3
Elymus trachycaulus	17	t	0	0	0	0
Glyceria striata	0	0	0	0	67	1
Juncus balticus	0	0	20	t	0	0
Phleum pratense	17	t	0	0	33	t
Poa palustris	33	1	0	0	67	1
Poa pratensis	17	t	0	0	33	1
Forbs						
Achillea millefolium	67	t	20	t	33	t
Aconitum columbianum	50	t	60	5	33	3
Actaea rubra	17	t	60	t	33	t
Aster foliaceus	50	2	0	0	33	t
Caltha leptosepala	17	t	40	1	0	0
Cardamine cordifolia	50	t	80	t	0	0

Table 5. Continued.

	ABLA-PIEN/ALIN		PIEN-ABLA/LOIN		PIPU/ALIN	
	CONS	AVE	CONS	AVE	CONS	AVE
Forbs, continued						
Cirsium species	33	t	0	0	0	0
Delphinium barbeyi	0	0	0	0	33	10
Epilobium angustifolium	67	t	20	2	33	t
Epilobium species	0	0	0	0	33	t
Fragaria virginiana	67	t	60	t	100	t
Galium boreale	33	t	20	t	67	t
Geranium richardsonii	83	t	60	1	100	2
Geum macrophyllum	83	t	0	0	100	t
Heracleum lanatum	83	3	60	1	67	4
Mentha arvensis	33	t	0	0	33	t
Mertencia ciliata	83	t	100	1	67	4
Micranthes odontoloma	17	t	60	t	33	3
Osmorhiza depauperata	50	t	100	t	100	4
Pyrola americana	50	2	60	5	0	0
Rubus parviflorus	33	2	0	0	33	1
Rudbeckia laciniata	33	t	0	0	33	1
Senecio triangularis	33	t	80	t	67	4
Smilacina racemosa	17	t	0	0	33	1
Smilacina stellata	33	t	40	t	67	1
Solidago canadensis	0	0	0	0	33	t
Solidago giganta var. serotina	17	t	0	0	0	0
Stellaria jamesii (=Pseudostellaria jamesiana)	0	0	0	0	33	1
Streptopus amplexifolius	67	t	60	3	0	0
Taraxacum officinale	83	t	0	0	67	t
Thalictrum fendleri	50	t	40	t	67	4
Urtica dioica ssp gracilis	17	t	0	0	0	0
Vicia americana	0	0	0	0	33	t
Horsetails						
Equisetum arvense	100	8	100	9	100	12
Equisetum hyemale	0	0	0	0	33	t

ABLA-PIEN/ALIN *Picea engelmannii-Abies lasiocarpa/Alnus incana* p.a.
PIEN-ABLA/LOIN *Picea englemannii-Abies lasiocarpa/Lonicera involucrata* p.a.
PIPU/ALIN *Pinus pungens/Alnus incana* p.a.

Table 6. Yampa Basin Mixed Deciduous-Evergreen Forest plant association constancy (CONS) and average percent cover (COV, t = trace) values for important plant species.

Populus angustifolia-Picea pungens/Alnus incana-Cornus sericea	CONS	COV
Trees		
Abies lasiocarpa	29	5
Picea pungens	71	8
Populus angustifolia	100	40
Willows		
Salix lasiandra var. caudata	14	1
Salix ligulifolia	29	2
Shrubs		
Alnus incana	57	18
Amelanchier alnifolia	86	2
Cornus sericea	100	42
Crataegus rivularis	14	t
Lonicera involucrata	71	1
Ribes inerme	43	t
Ribes lacustre	14	t
Rosa woodsii	71	2
Rubus idaeus	43	t
Graminoids		
Agropyron dasystachyum (=Elymus laceolatus)	14	1
Agrostis gigantea	43	t
Carex species	43	t
Carex lanuginosa	29	t
Carex praegracilis	14	t
Dactylis glomerata	43	3
Elymus glaucus	57	t
Elytrigia repens	14	t
Phalaris arundinacea	14	t
Phleum pratense	57	t
Poa palustris	14	t
Poa pratensis	57	1
Forbs		
Achillea millefolium var. alpicola	43	t
Aconitum columbianum	57	t
Actaea rubra	57	5
Aster foliaceus	29	t
Cirsium arvense	14	t
Cirsium spp.	29	t
Fragaria virginiana	71	3
Galium boreale	29	t
Geranium richardsonii	100	7
Geum macrophyllum	29	t
Heracleum lanatum	57	2
Humulus lupulus	14	t
Ligusticum porteri	57	3
Mertencia ciliata	57	t
Osmorhiza depauperata	100	2
Pyrola americana	14	1
Pyrola asarifolia	14	3
Rudbeckia laciniata	100	11
Sidalcea candida	29	t
Smilacina stellata	86	6
Solidago giganta var. serotina	43	6
Solidago nana	14	1
Streptopus amplexifolius	14	t
Taraxacum officinale	86	4
Thalictrum fendleri	57	t
Trifolium hybridum	14	t
Vicia americana	29	2
Viola canadensis	29	2
Horsetails		
Equisetum arvense	71	3
Equisetum hyemale	29	t
Equisetum laevigatum	29	t

Table 7. Yampa Basin Deciduous Forest plant association constancy (CONS) and average percent cover (COV, t = trace) values for important plant species. Plant association full names are listed at end of table.

	PODE/RHTR		POAN/AMAL		POAN/SAEX		POAN/COSE	
	CONS	COV	CONS	COV	CONS	COV	CONS	COV
Trees								
Acer negundo	0	0	0	0	0	0	0	0
Picea pungens	0	0	0	0	0	0	0	0
Populus x acuminata	33	7	0	0	0	0	0	0
Populus angustifolia	33	13	100	40	100	25	100	37
Populus deltoides spp. Wislizenii	100	27	0	0	0	0	0	0
Willows								
Salix boothii	0	0	0	0	0	0	17	t
Salix drummondiana	0	0	0	0	0	0	0	0
Salix exigua	0	0	0	0	50	5	17	t
Salix geyeriana	0	0	0	0	0	0	17	t
Salix lasiandra var. caudata	0	0	0	0	100	15	67	10
Salix ligulifolia	0	0	0	0	0	0	67	6
Shrubs								
Alnus incana	0	0	0	0	50	2	83	9
Amelanchier alnifolia	0	0	100	10	0	0	17	t
Chrysothamnus linifolius	33	7	0	0	0	0	0	0
Cornus sericea	0	0	50	t	0	0	100	63
Crataegus rivularis	0	0	100	10	0	0	0	0
Lonicera involucrata	0	0	0	0	0	0	33	5
Rhus trilobata	67	t	0	0	0	0	0	0
Ribes aureum	0	0	50	2	0	0	0	0
Ribes inerme	0	0	0	0	0	0	33	3
Ribes lacustre	0	0	0	0	0	0	0	0
Ribes montigenum	0	0	0	0	0	0	0	0
Rosa woodsii	33	1	100	15	0	0	83	9
Rubus idaeus	0	0	0	0	0	0	17	t
Shepherdia argentea	0	0	0	0	0	0	0	0
Symphoricarpos occidentalis	33	10	0	0	0	0	0	0
Graminoids								
Agropyron dasystachyum(=Elymus lanceolatus)	0	0	0	0	0	0	0	0
Agrostis gigantea	0	0	50	t	100	3	50	3
Agrostis stolonifera	0	0	0	0	0	0	17	t
Bromus inermis	67	7	0	0	50	t	17	2
Bromus tectorum	0	0	0	0	0	0	0	0
Calamagrostis canadensis	0	0	0	0	0	0	33	t
Carex spp.	0	0	0	0	0	0	0	0
Carex hoodii	0	0	0	0	0	0	0	0
Carex lanuginosa	0	0	0	0	0	0	17	2
Carex lenticularis	0	0	0	0	0	0	0	0
Carex microptera	0	0	0	0	0	0	0	0
Carex norvegica var. stevenii	0	0	0	0	0	0	0	0
Carex occidentalis	0	0	0	0	0	0	0	0
Carex praegracilis	0	0	50	2	50	t	17	t
Carex rostrata	0	0	0	0	0	0	0	0
Carex vesicaria	0	0	0	0	0	0	0	0
Dactylis glomerata	0	0	50	15	0	0	0	0
Distichlis spicata	33	7	0	0	0	0	0	0
Elymus glaucus	0	0	50	t	50	13	33	1
Elymus species	0	0	0	0	0	0	0	0
Elytrigia repens	100	11	50	t	50	13	0	0
Elymus trachycaulus	33	t	0	0	0	0	0	0
Glyceria grandis	0	0	0	0	0	0	0	0
Glyceria striata	0	0	0	0	0	0	17	t
Hordeum jubatum	33	t	0	0	0	0	0	0
Juncus balticus	33	1	0	0	50	2	0	0
Juncus saximontanus	0	0	0	0	0	0	0	0
Leymus cinereus	0	0	0	0	0	0	0	0

Table 7. Continued.

	PODE/RHTR		POAN/AMAL		POAN/SAEX		POAN/COSE	
	CONS	COV	CONS	COV	CONS	COV	CONS	COV
Graminoids, continued.								
Phalaris arundinacea	0	0	100	3	50	25	0	0
Phleum pratense	0	0	100	t	100	25	33	t
Poa species	0	0	0	0	0	0	0	0
Poa palustris	0	0	50	2	50	13	33	1
Poa pratensis	67	1	50	t	100	18	17	t
Rush species	0	0	0	0	0	0	0	0
Scirpus americana	0	0	0	0	0	0	0	0
Scirpus maritimus	0	0	0	0	0	0	0	0
Forbs								
Achillea millefolium var. alpicola	0	0	50	t	50	13	0	0
Aconitum columbianum	0	0	0	0	0	0	17	t
Actaea rubra	0	0	0	0	0	0	50	5
Ammammia robusta	0	0	0	0	0	0	0	0
Aster foliaceus	0	0	50	t	50	13	17	t
Barbarea vulgaris	0	0	0	0	0	0	17	t
Cardamine cordifolia	0	0	50	t	50	13	0	0
Chenopodium fremontii	33	13	0	0	0	0	0	0
Cirsium arvense	0	0	50	t	100	13	0	0
Cirsium species	0	0	0	0	0	0	33	t
Clematis ligusticifolia	67	8	0	0	0	0	0	0
Conyza canadensis	33	1	0	0	0	0	0	0
Epilobium species	0	0	0	0	0	0	0	0
Fragaria virginiana	0	0	0	0	0	0	17	t
Galium boreale	0	0	50	5	50	13	0	0
Geranium richardsonii	0	0	50	t	50	13	67	5
Geum macrophyllum	0	0	50	t	50	13	50	t
Heracleum lanatum	0	0	50	t	50	13	67	4
Humulus lupulus	0	0	0	0	0	0	17	2
Iva axillaris	67	4	0	0	0	0	0	0
Ligusticum porteri	0	0	50	2	50	13	17	2
Melilotus alba	0	0	0	0	0	0	0	0
Melilotus officinalis	0	0	50	t	100	14	0	0
Mentha arvensis	0	0	50	t	50	13	0	0
Mertencia ciliata	0	0	0	0	0	0	33	t
Micranthes odontoloma	0	0	0	0	0	0	0	0
Nasturtium officinale	0	0	0	0	0	0	0	0
Osmorhiza depauperata	0	0	0	0	0	0	33	2
Potentilla anserina	0	0	0	0	0	0	0	0
Potentilla gracilis	0	0	50	t	50	13	0	0
Pyrola asarifolia	0	0	0	0	0	0	17	3
Rudbeckia laciniata	0	0	0	0	50	t	83	7
Sidalcea candida	0	0	50	t	50	13	0	0
Smilacina racemosa	0	0	0	0	0	0	0	0
Smilacina stellata	0	0	100	t	50	25	83	4
Solidago canadensis	33	t	50	t	100	23	17	t
Solidago giganta var. serotina	0	0	0	0	0	0	67	5
Solidago nana	0	0	0	0	0	0	17	2
Stellaria jamesii (=Pseudostellaria jamesiana)	0	0	0	0	50	5	0	0
Taraxacum officinale	0	0	100	t	100	25	83	2
Thalictrum fendleri	0	0	50	2	50	13	33	t
Trifolium species	0	0	0	0	50	t	0	0
Trifolium hybridum	0	0	50	2	50	13	33	t
Trifolium pratense	0	0	50	t	50	13	0	0
Urtica dioica ssp. gracilis	0	0	0	0	0	0	17	t
Vicia americana	0	0	100	2	50	25	50	2
Viola canadensis	0	0	50	2	50	13	0	0
Horsetails								
Equisetum arvense	0	0	50	t	50	13	83	1
Equisetum hyemale	0	0	50	t	100	13	17	t
Equisetum laevigatum	33	1	0	0	0	0	17	t

Table 7. Continued.

	POAN/ALIN		POAN-ACNE/COSE		ACNE/bare	
	CONS	COV	CONS	COV	CONS	COV
Trees						
Acer negundo	0	0	100	30	100	73
Picea pungens	0	0	0	0	0	0
Populus x acuminata	0	0	0	0	0	0
Populus angustifolia	100	25	100	32	0	0
Populus deltoides spp. Wislizenii	0	0	0	0	0	0
Willows						
Salix boothii	0	0	0	0	0	0
Salix drummondiana	50	8	0	0	0	0
Salix exigua	25	3	0	0	0	0
Salix geyeriana	25	t	0	0	0	0
Salix lucida ssp caudata	50	3	13	3	0	0
Salix lutea	50	3	0	0	0	0
Shrubs						
Alnus incana	100	35	0	0	0	0
Amelanchier alnifolia	25	t	38	t	33	t
Chrysothamnus linifolius	0	0	0	0	0	0
Cornus sericea	25	3	100	54	0	0
Crataegus rivularis	0	0	63	2	0	0
Lonicera involucrata	50	3	0	0	33	1
Rhus trilobata	0	0	0	0	0	0
Ribes aureum	0	0	13	t	0	0
Ribes inerme	25	3	13	t	0	0
Ribes lacustre	0	0	0	0	0	0
Ribes montigenum	25	t	0	0	0	0
Rosa woodsii	0	0	63	t	0	0
Rubus idaeus	25	5	0	0	0	0
Shepherdia argentea	0	0	0	0	33	3
Symphoricarpos occidentalis	0	0	0	0	33	7
Graminoids						
Agropyron dasystachyum(=Elymus lanceolatus)	0	0	0	0	33	1
Agrostis gigantea	75	18	38	4	33	t
Agrostis stolonifera	25	t	38	4	0	0
Bromus inermis	25	t	38	14	0	0
Bromus tectorum	0	0	0	0	33	t
Calamagrostis canadensis	25	t	0	0	0	0
Carex species	25	t	13	3	0	0
Carex hoodii	25	t	13	t	0	0
Carex lanuginosa	0	0	13	t	0	0
Carex lenticularis	0	0	0	0	0	0
Carex microptera	25	t	13	t	0	0
Carex norvegica var. stevenii	25	t	0	0	0	0
Carex occidentalis	50	3	0	0	0	0
Carex praegracilis	0	0	0	0	33	7
Carex rostrata	25	t	0	0	0	0
Carex vesicaria	25	t	0	0	0	0
Dactylis glomerata	0	0	38	t	0	0
Distichlis spicata	0	0	0	0	0	0
Elymus glaucus	0	0	13	t	0	0
Elymus species	0	0	13	1	33	t
Elytrigia repens	0	0	25	1	33	7
Elymus trachycaulus	25	t	13	1	0	0
Glyceria grandis	75	1	0	0	0	0
Glyceria striata	0	0	0	0	33	1
Hordeum jubatum	0	0	0	0	0	0
Juncus balticus	0	0	0	0	0	0
Juncus saximontanus	25	t	0	0	0	0
Leymus cinereus	0	0	0	0	33	t
Phalaris arundinacea	0	0	88	5	0	0
Phleum pratense	50	t	63	2	0	0
Poa species	0	0	25	4	0	0

Table 7. Continued

	POAN/ALIN		POAN-ACNE/COSE		ACNE/bare	
	CONS	COV	CONS	COV	CONS	COV
Graminoids, continued						
Poa palustris	25	3	25	t	0	0
Poa pratensis	75	2	63	3	67	1
Juncus spp.	0	0	13	1	0	0
Scirpus americana	25	t	0	0	0	0
Scirpus maritimus	0	0	0	0	0	0
Forbs						
Achillea millefolium	25	t	0	0	33	t
Aconitum columbianum	0	0	0	0	0	0
Actaea rubra	25	t	0	0	0	0
Ammammia robusta	0	0	13	3	0	0
Aster foliaceus	50	2	0	0	0	0
Barbarea vulgaris	50	t	0	0	0	0
Cardamine cordifolia	0	0	13	t	0	0
Chenopodium fremontii	0	0	0	0	33	t
Cirsium arvense	25	t	25	t	0	0
Cirsium species	50	t	75	8	33	t
Clematis ligusticifolia	0	0	0	0	0	0
Conyza canadensis	25	t	0	0	0	0
Epilobium species	0	0	13	t	33	t
Fragaria virginiana	25	t	0	0	0	0
Galium boreale	50	t	13	t	0	0
Geranium richardsonii	75	1	0	0	0	0
Geum macrophyllum	50	t	25	t	33	t
Heracleum lanatum	25	t	13	t	33	t
Humulus lupulus	0	0	13	t	33	t
Iva axillaris	0	0	0	0	0	0
Ligusticum porteri	0	0	0	0	0	0
Melilotus alba	25	10	0	0	0	0
Melilotus officinalis	25	t	13	t	0	0
Mentha arvensis	50	t	25	t	0	0
Mertencia ciliata	25	t	0	0	0	0
Micranthes odontoloma	0	0	0	0	33	1
Nasturtium officinale	0	0	0	0	33	1
Osmorhiza depauperata	25	t	0	0	33	3
Potentilla anserina	50	t	0	0	0	0
Potentilla gracilis	25	t	0	0	0	0
Pyrola asarifolia	25	t	0	0	0	0
Rudbeckia laciniata	50	t	38	3	33	t
Sidalcea candida	50	t	0	0	0	0
Smilacina racemosa	0	0	38	3	0	0
Smilacina stellata	25	t	50	t	33	t
Solidago canadensis	25	t	0	0	0	0
Solidago giganta var. serotina	25	t	63	13	0	0
Solidago nana	0	0	0	0	0	0
Stellaria jamesii(=Pseudostellaria jamesiana)	0	0	0	0	0	0
Taraxacum officinale	100	5	75	6	0	0
Thalictrum fendleri	0	0	0	0	0	0
Trifolium species	25	t	0	0	0	0
Trifolium hybridum	0	0	13	t	0	0
Trifolium pratense	25	t	0	0	33	7
Urtica dioica ssp gracilis	25	t	38	t	33	t
Vicia americana	75	1	0	0	0	0
Viola canadensis	0	0	0	0	0	0
Horsetails						
Equisetum arvense	75	t	0	0	0	0
Equisetum hyemale	0	0	0	0	0	0
Equisetum laevigatum	25	t	13	t	0	0

Table 7. Continued.

PODE/RHTR	*Populus deltoides/Rhus trilobata*
POAN/AMAL	*Populus angustifolia/Amelanchier alnifolia*
POAN/SAEX	*Populus angustifolia/Salix exigua*
POAN/COSE	*Populus angustifolia/Cornus sericea*
POAN/ALIN	*Populus angustifolia/Alnus incana*
POAN-ACNE/COSE	*Populus angustifolia-Acer negundo/Cornus sericea*
ACNE/bare	*Populus angustifolia*/bare ground

Table 8. Yampa Basin Tall-Stature Willow Shrubland plant association constancy (CONS) and average percent cover (AVE, t = trace) values for important plant species. Plant association full names are listed at the end of table.

	SABO/MF		SABO/CAROS		SAMO/CAAQ		SAGE/CARO	
	CONS	AVE	CONS	AVE	CONS	AVE	CONS	AVE
Trees								
Abies lasiocarpa	0	0	0	0	50	t	0	0
Picea engelmannii	10	t	0	0	0	0	0	0
Pinus contorta	0	0	0	0	0	0	25	t
Willows								
Salix boothii	100	58	67	30	0	0	25	t
Salix drummondiana	0	0	33	1	50	5	0	0
Salix geyeriana	50	4	67	14	0	0	100	58
Salix lasiandra var. caudata	20	1	0	0	0	0	0	0
Salix ligulifolia	0	0	0	0	0	0	25	t
Salix monticola	0	0	0	0	100	75	0	0
Salix planifolia var. monica	10	t	0	0	0	0	0	0
Salix planifolia var. planifolia	0	0	100	14	0	0	0	0
Salix serissima	0	0	33	10	0	0	0	0
Salix wolfii	50	5	0	0	0	0	0	0
Shrubs								
Alnus incana	10	t	0	0	0	0	50	3
Artemisia tridentata	10	t	0	0	0	0	0	0
Cornus sericea	10	7	0	0	50	5	0	0
Lonicera involucrata	0	0	100	5	50	2	50	t
Potentilla fruticosa	20	2	0	0	0	0	0	0
Ribes aureum	0	0	0	0	0	0	25	t
Ribes inerme	20	t	67	1	50	2	25	t
Rosa woodsii	0	0	100	5	50	5	0	0
Rubus idaeus	10	t	0	0	50	2	0	0
Vaccinium myrtillus	10	t	0	0	0	0	0	0
Graminoids								
Agrostis gigantea	40	5	33	10	50	t	25	5
Agrostis stolonifera	10	2	0	0	50	5	25	t
Bromus inermis	10	t	0	0	0	0	0	0
Bromus tectorum	20	t	0	0	50	t	0	0
Calamagrostis canadensis	10	8	33	3	0	0	50	13
Calamagrostis stricta	10	t	100	5	0	0	25	3
Carex aquatilis	10	1	67	13	50	10	75	2
Carex hoodii	30	2	0	0	0	0	0	0
Carex lanuginosa	30	1	33	t	0	0	25	t
Carex microptera	0	0	0	0	50	2	25	t
Carex nebrascensis	10	t	33	7	0	0	25	3
Carex norvegica	10	t	0	0	0	0	0	0
Carex occidentalis	0	0	0	0	0	0	25	3
Carex praegracilis	0	0	0	0	0	0	25	5
Carex rostrata	20	2	100	53	0	0	100	36
Carex spp.	30	t	0	0	0	0	25	t
Dactylis glomerata	10	t	0	0	0	0	0	0
Deschampsia cespitosa	0	0	0	0	50	5	0	0
Elymus glaucus	0	0	0	0	50	t	25	t
Elymus repens (=Elytrigia repens)	40	1	0	0	0	0	0	0
Elymus trachycaulus	10	t	0	0	0	0	0	0
Glyceria grandis	10	t	33	3	0	0	0	0
Glyceria striata	20	t	0	0	0	0	50	t
Juncus balticus	20	4	33	1	0	0	25	t
Juncus saximontanus	10	t	0	0	0	0	25	t
Phalaroides arundinacea	0	0	0	0	50	t	25	t
Phleum alpinum	10	1	0	0	0	0	0	0
Phleum pratense	60	3	33	1	100	t	50	t
Poa palustris	40	4	0	0	50	t	50	3

Table 8. Continued.

	SABO/MF		SABO/CAROS		SAMO/CAAQ		SAGE/CARO	
	CONS	AVE	CONS	AVE	CONS	AVE	CONS	AVE
Graminoids, continued								
Poa pratensis	60	8	67	27	0	0	50	t
Poa sp.	20	1	0	0	0	0	0	0
Forbs								
Achillea millefolium	70	1	0	0	50	t	25	t
Aconitum columbianum	10	t	0	0	50	t	0	0
Actaea rubra	10	t	0	0	0	0	0	0
Aster foliaceous	40	1	0	0	0	0	25	t
Caltha leptocepala	0	0	0	0	50	2	0	0
Cardamine cardifolia	10	t	0	0	0	0	25	t
Cardaria pubescens	10	2	0	0	0	0	0	0
Chenopodium fremontii	10	t	0	0	0	0	0	0
Cirsium arvense	30	t	0	0	0	0	0	0
Cirsium sp.	30	2	33	t	50	2	50	t
Epilobium angustifolia	10	t	33	t	0	0	0	0
Epilobium sp.	10	t	100	5	50	t	25	t
Frageria virginiana	80	9	33	7	50	t	25	t
Galium boreale	50	2	0	0	50	t	25	t
Geranium richardsonii	60	t	33	3	100	t	25	t
Geum macrophyllum	70	t	67	4	50	t	100	1
Heracleum lanatum	20	t	0	0	100	2	25	t
Iva axillaris	10	t	0	0	0	0	0	0
Ligusticum porteri	10	t	33	t	0	0	25	t
Mentha arvense	30	t	0	0	0	0	75	t
Mertensia ciliata	20	t	0	0	0	0	25	t
Micranthes odontoloma	10	t	0	0	0	0	0	0
Potentilla anserina	10	t	0	0	0	0	25	t
Potentilla gracilis	20	t	0	0	0	0	0	0
Pyrola americana	10	1	0	0	0	0	0	0
Rudbeckia laciniata	40	1	0	0	0	0	0	0
Senecio canus	20	3	0	0	0	0	0	0
Senecio triangularis	0	0	0	0	50	t	25	t
Sidalcea candida	30	3	0	0	50	t	50	t
Smilacina stellata	50	3	33	t	50	2	50	t
Solidago canadensis	50	t	0	0	50	t	0	0
Solidago gigantea var. serotina	10	1	0	0	50	5	0	0
Taraxacum officinale	80	6	33	3	100	t	50	t
Thalictrum fendleri	40	t	0	0	50	t	25	t
Trifolium sp.	0	0	33	3	0	0	0	0
Trifolium hybridum	10	1	0	0	0	0	25	t
Trifolium pratense	10	7	0	0	0	0	0	0
Urtica dioica ssp. gracilis	10	1	0	0	0	0	0	0
Vicia americana	80	2	33	t	100	t	25	t
Horsetails								
Equisetum arvense	50	t	0	0	100	5	50	3
Equisetum hyemalis	20	t	0	0	50	t	25	t

(table continues on next page)

Table 8. Continued.

	SAEX/MG CONS	SAEX/MG AVE	SALA/MG CONS	SALA/MG AVE
Trees				
Acer negundo	10	t	0	0
Willows				
Salix boothii	10	t	33	7
Salix exigua	100	64	33	5
Salix lasiandra var. caudata	30	3	33	13
Salix ligulifolia	20	1	33	22
Salix planifolia var. monica	0	0	33	t
Shrubs				
Alnus incana	20	3	50	7
Amelanchier alnifolia	0	0	33	t
Artemisia tridentata	20	t	0	0
Chrysothamnus viscidiflorus	10	2	0	0
Cornus sericea	40	4	17	t
Crataegus rivularis	20	t	0	0
Lonicera involucrata	0	0	17	t
Rhus trilobata	10	t	0	0
Ribes aureum	40	t	33	t
Ribes inerme	0	0	17	t
Ribes montigenum	0	0	33	18
Rosa woodsii	30	t	17	t
Rubus idaeus	0	0	17	t
Graminoids				
Agrostis gigantea	90	11	50	10
Bromus inerme	30	t	0	0
Bromus secalinus	0	0	17	2
Bromus tectorum	10	t	0	0
Calamagrostis canadensis	0	0	17	t
Carex hoodii	40	t	50	2
Carex microptera	10	6	0	0
Carex nebrascensis	0	0	17	t
Carex rostrata	0	0	17	t
Dactylis glomerata	0	0	33	t
Eleocharis palustris	10	4	17	t
Elymus repens	30	t	17	t
Elymus trachycaulus	10	t	33	1
Glyceria grandis	10	t	0	0
Glyceria striata	20	t	50	6
Hordeum jubatum	30	1	0	0
Juncus balticus	10	t	17	t
Juncus saximontanus	10	t	0	0
Leymus cinereus	10	t	0	0
Muhlenbergia asperifolia	10	2	0	0
Pascopyrum smithii	10	t	0	0
Phalaroides arundinacea	20	t	0	0
Phleum pratense	30	t	33	1
Phragmites australis	10	5	0	0
Poa pratensis	30	1	17	2
Poa sp.	20	t	17	t
Juncus spp.	10	t	0	0
Scirpus americanus	10	t	0	0
Spartina gracilis	10	t	0	0
Typha latifolia	0	0	17	t
Forbs				
Achillea millefolium	0	0	33	t
Ammannia robusta	0	0	17	t
Aster foliaceous	0	0	17	t
Barbarea vulgaris	0	0	17	t
Cardaria pubescens	30	t	0	0

Table 8. Continued.

	SAEX/MG CONS	SAEX/MG AVE	SALA/MG CONS	SALA/MG AVE
Forbs, continued				
Cirsium arvense	30	1	33	3
Cirsium spp.	40	t	17	t
Clematis ligusticifolia	30	t	0	0
Conyza canadensis	20	t	17	t
Frageria virginiana	0	0	33	t
Galium boreale	0	0	17	t
Geranium richardsonii	20	t	17	t
Geum macrophyllum	10	t	33	t
Glycyrrhiza lepidota	50	3	0	0
Heracleum lanatum	0	0	17	t
Humus lupulus	0	0	17	t
Iva axillaris	10	t	0	0
Lepidium latifolium	10	t	0	0
Melilotus albus	30	2	0	0
Melilotus officinale	30	2	17	t
Mentha arvense	10	t	17	t
Nasturtium officinale	0	0	17	t
Osmorhiza depauperata	0	0	17	t
Potentilla anserina	30	t	50	t
Rudbeckia laciniata	10	t	50	t
Smilacina stellata	10	t	33	t
Solidago gigantea	30	1	33	2
Stellaria jamesii(=Pseudostellaria jamesii)	0	0	17	3
Taraxacum officinale	20	t	50	7
Trifolium pratense	0	0	17	t
Urtica dioica ssp. gracilis	0	0	17	t
Veronica catenata	0	0	17	t
Horsetails				
Equisetum arvense	30	t	33	t
Equisetum hyemale	0	0	17	2
Equisetum laevigata	20	t	0	0

SABO/MF *Salix boothii*/mesic forbs
SABO/CAROS *Salix boothii/Carex rostrata*
SAMO/CAAQ *Salix monticola/Carex aquatilis*
SAGE/CARO *Salix geyeriana/Carex rostrata*Table. 4 continued.
SAEX/MG *Salix exigua*/mesic graminoids
SALA/MG *Salix lasiandra* var. *caudata*/mesic graminoids

Table 9. Yampa Basin Low-Stature Willow shrubland plant association constancy (CONS) and average percent cover (AVE, t =trace) values for important plant species. Plant association full names are listed at the end of the table.

	SAWO/MF		SAPL/CAAQ	
	CONS	AVE	CONS	AVE
Trees				
Pinus contorta	20	t	0	0
Willows				
Salix bebbiana	20	10	0	0
Salix boothii	60	9	0	0
Salix geyeriana	40	8	0	0
Salix lasiandra var. caudata	20	t	0	0
Salix ligulifolia	20	t	0	0
Salix planifolia var. monica	20	t	100	65
Salix wolfii	80	40	0	0
Shrubs				
Cornus sericea	20	6	0	0
Loniceria involucrata	20	t	0	0
Potentilla fructosa	80	1	0	0
Vaccinium myrtillus	20	t	0	0
Graminoids				
Agrostis stolonifera	0	0	50	t
Bromus tectorum	40	t	0	0
Calamagrostis canadensis	60	7	50	5
Carex aquatilis	40	3	100	15
Carex spp.	0	0	50	10
Carex hoodii	40	4	0	0
Carex lanuginosa	20	4	0	0
Carex microptera	20	2	50	2
Carex norvegica	20	4	0	0
Carex prageacilis	20	t	0	0
carex rostrata	40	7	0	0
Deschampsia cespitosa	20	t	50	5
Elymus glaucus	20	t	0	0
Elymus trachycaulus	40	t	0	0
Glyceria grandis	20	t	0	0
Glyceria striata	60	t	0	0
Phleum alpinum	0	0	50	t
Phleum pratense	40	t	0	0
Poa palustris	60	3	0	0
Poa pratensis	40	t	50	t
Scirpus maritimus	20	t	0	0
Achillea millefolium var alpicola	40	t	0	0
Aconitum columbianum	20	t	50	t
Aster foliaceus	80	3	0	0
Caltha leptosepala	20	t	50	15
Cardamine cordifolia	40	t	50	t
Cardaria pubescens	20	t	0	0
Chenopodium fremontii	20	t	0	0
Cirsium species	40	t	0	0
Epilobium angustifolium	20	t	50	t
Epilobium species	20	t	50	2
Fragaria virginiana	80	t	50	t
Galium boreale	40	t	0	0
Geranium richardsonii	80	2	0	0
Geum macrophyllum	60	t	50	t
Heracleum lanatum	60	t	0	0
Ligusticum porteri	20	t	50	t
Mentha arvensis	20	t	0	0
Mertencia ciliata	40	t	0	0
Mimulus glabratus	20	t	0	0
Osmorhiza depauperata	0	0	50	t

Table 9. Continued

	SAWO/MF CONS	SAWO/MF AVE	SAPL/CAAQ CONS	SAPL/CAAQ AVE
Forbs, continued				
Potentilla anserina	20	t	0	0
Potentilla gracilis	20	t	0	0
Pyrola americana	20	t	0	0
Senecio triangularis	20	t	50	2
Smilacina stellata	60	t	50	t
Solidago nana	20	t	0	0
Taraxacum officinale	80	t	50	t
Thalictrum fendleri	20	t	0	0
Vicia americana	60	t	0	0
Horestails				
Equisetum arvense	80	1	50	t

SAWO/MF *Salix wolfii*/mesic forbs
SAPL/CAAQ *Salix planifolia* var. *monica*/*Carex aquatilis*

Table 10. Yampa Basin Non-Willow Shrublands plant association constancy (CONS) and average percent cover (AVE t = trace) values for importatnt plant species. Full names of plant associations are listed at the end of the table.

	ALIN-COSE		ALIN-SAGE		ALIN/MF		RHTI	
	CONS	AVE	CONS	AVE	CONS	AVE	CONS	AVE
Trees								
Picea pungens	20	t	0	0	50	t	0	0
Populus angustifolia	60	2	0	0	0	0	25	t
Populus tremuloides	0	0	0	0	50	10	0	0
Willows								
Salix boothii	0	0	50	2	0	0	0	0
Salix drummondiana	20	t	0	0	0	0	0	0
Salix exigua	20	t	50	5	0	0	25	t
Salix geyeriana	0	0	100	20	50	2	0	0
Salix lasiandra var. caudata	20	4	50	5	0	0	0	0
Salix ligilifolia	40	3	50	15	0	0	0	0
Shrubs								
Alnus incana	100	52	100	55	100	70	0	0
Amelanchier alnifolia	40	t	50	t	0	0	25	t
Artemisia tridentata	0	0	0	0	0	0	50	t
Chrysothamnus viscidiflorus	0	0	0	0	0	0	25	t
Cornus sericea	100	27	0	0	0	0	25	3
Juniperus osteosperma	0	0	0	0	0	0	25	3
Lonicera involucrata	20	t	50	t	100	t	0	0
Rhus trilobata	0	0	0	0	0	0	100	59
Ribes aureum	0	0	0	0	0	0	50	10
Ribes inerme	60	2	0	0	50	2	0	0
Rosa woodsii	80	3	50	2	0	0	75	4
Rubus idaeus	40	4	0	0	0	0	0	0
Graminoids								
Agrostis gigantea	80	5	50	t	0	0	0	0
Agrostis species	0	0	50	10	0	0	0	0
Agrostis stolonifera	0	0	50	2	0	0	0	0
Bromus inermis	0	0	0	0	0	0	25	t
Bromus tectorum	0	0	0	0	0	0	25	t
Calamagrostis canadensis	40	t	100	2	50	5	0	0
Calamagrostis stricta	20	2	0	0	0	0	0	0
Carex hoodii	0	0	0	0	100	t	0	0
Carex lanuginosa	20	t	50	2	0	0	0	0
Carex nebrascensis	20	t	0	0	0	0	0	0
Carex rostrata	20	t	100	2	0	0	0	0
Elymus glaucus	40	t	0	0	50	2	0	0
Elytrigia repens	20	t	0	0	0	0	25	t
Elymus trachycaulus	0	0	0	0	0	0	25	t
Glyceria striata	20	t	0	0	50	2	0	0
Phalaris arundinacea	40	5	50	2	0	0	0	0
Phleum alPinum	0	0	50	t	0	0	0	0
Phleum pratense	80	2	50	10	50	t	0	0
Poa palustris	60	1	50	2	50	2	0	0
Poa pratensis	40	14	100	35	0	0	0	0
Forbs								
Achillea millefolium var alpicola	40	t	0	0	50	t	0	0
Aconitum columbianum	20	t	0	0	100	5	0	0
Actaea rubra	20	t	0	0	50	t	0	0
Aster foliaceus	20	t	0	0	50	2	0	0
Barbarea vulgaris	0	0	50	5	0	0	0	0
Cardamine cordifolia	20	t	50	t	50	5	0	0
Cardaria pubescens	0	0	0	0	0	0	25	3
Cirsium arvense	40	t	50	5	0	0	0	0
Clematis ligusticifolia	0	0	0	0	0	0	75	18
Epilobium angustifolium	0	0	0	0	50	t	0	0

Table 10. Continued.

	ALIN-COSE		ALIN-SAGE		ALIN/MF		RHTI	
	CONS	AVE	CONS	AVE	CONS	AVE	CONS	AVE
Epilobium species	0	0	50	t	0	0	0	0
Fragaria virginiana	20	t	50	5	50	t	0	0
Geranium richardsonii	60	t	0	0	100	2	0	0
Geum macrophyllum	80	t	100	5	50	t	0	0
Glycyrrhiza lepidota	0	0	0	0	0	0	25	t
Heracleum lanatum	20	4	50	t	100	5	0	0
Iva axillaris	0	0	0	0	0	0	25	t
Lepidium latifolium	0	0	0	0	0	0	25	5
Ligusticum porteri	20	t	50	t	50	t	0	0
Mentha arvensis	40	t	50	5	50	2	0	0
Mertencia ciliata	0	0	0	0	100	t	0	0
Micranthes odontoloma	0	0	0	0	50	2	0	0
Osmorhiza depauperata	20	t	0	0	50	2	0	0
Potentilla anserina	0	0	50	t	0	0	0	0
Rubus parviflorus	0	0	0	0	50	t	0	0
Rudbeckia laciniata	100	2	0	0	0	0	0	0
Senecio triangularis	0	0	0	0	100	2	0	0
Sidalcea candida	20	t	0	0	0	0	0	0
Smilacina stellata	60	t	50	t	0	0	75	3
Solidago giganta var serotina	40	2	0	0	0	0	0	0
Streptopus amplexifolius	0	0	0	0	100	5	0	0
Taraxacum officinale	80	t	100	t	100	t	0	0
Thalictrum fendleri	20	t	0	0	100	t	0	0
Trifolium hybridum	40	t	0	0	0	0	0	0
Urtica dioica ssp gracilis	40	t	0	0	50	t	0	0
Horsetails								
Equisetum arvense	80	2	100	5	100	2	0	0
Equisetum hyemale	20	t	0	0	0	0	0	0
Equisetum laevigatum	0	0	0	0	0	0	25	t

ALIN-COSE *Alnus incana-Cornus sericea*
ALIN-SAGE *Alnus incana-Salix geyeriana*
ALIN/MF *Alnus incana/mesic forbs*
RHTI *Rhus trilobata*

Table 11. Yampa Basin Herbaceous plant association constancy (CONS) and average percent cover (AVE, t = trace) values for important plant species. Full plant association names appear at end of table.

	CARROS		CARAQU		CARNEB		SCIAME	
	CONS	COV	CONS	COV	CONS	COV	CONS	COV
Trees								
Pinus contorta	17	t	0	0	0	0	0	0
Willows								
Salix bebbiana	0	0	0	0	0	0	0	0
Salix boothii	33	2	0	0	0	0	0	0
Salix drummondiana	33	7	0	0	0	0	0	0
Salix exigua	0	0	0	0	33	3	25	t
Salix geyeriana	0	0	0	0	0	0	0	0
Salix lasiandra var. caudata	0	0	0	0	0	0	0	0
Salix ligilifolia	33	t	0	0	0	0	0	0
Salix monticola	33	1	0	0	0	0	0	0
Salix planifolia var. planifolia	0	0	0	0	0	0	0	0
Salix serrisima	0	0	0	0	0	0	0	0
Salix wolfii	0	0	0	0	0	0	0	0
Shrubs								
Alnus incana	33	3	0	0	0	0	0	0
Cornus sericea	17	t	0	0	0	0	0	0
Lonicera involucrata	17	t	0	0	0	0	0	0
Potentilla fruticosa	0	0	50	t	0	0	0	0
Rosa woodsii	0	0	0	0	0	0	0	0
Rubus idaeus	0	0	0	0	0	0	0	0
Graminoids								
Agrostis gigantea	83	10	0	0	67	4	50	t
Calamagrostis canadensis	17	2	50	2	0	0	0	0
Calamagrostis stricta	17	t	50	t	0	0	0	0
Carex aquatilis	17	8	100	60	0	0	0	0
Carex species	17	t	0	0	33	10	0	0
Carex hoodii	0	0	0	0	0	0	0	0
Carex lanuginosa	33	t	0	0	0	0	0	0
Carex microptera	33	t	0	0	0	0	0	0
Carex nebrascensis	17	2	0	0	100	67	0	0
Carex praegracilis	33	t	0	0	33	10	0	0
Carex rostrata	100	67	0	0	0	0	0	0
Carex vesicaria	0	0	50	25	0	0	0	0
Deschampsia cespitosa	17	t	0	0	0	0	0	0
Distichlis spicata	0	0	0	0	0	0	25	t
Eleocharis palustris	17	t	0	0	0	0	50	11
Elymus glaucus	0	0	0	0	0	0	0	0
Elytrigia repens	0	0	0	0	0	0	25	5
Elymus trachycaulus	0	0	0	0	0	0	0	0
Glyceria grandis	17	t	0	0	0	0	0	0
Glyceria striata	33	2	0	0	0	0	0	0
Hordeum jubatum	17	t	0	0	0	0	100	t
Juncus balticus	0	0	0	0	33	1	25	t
Juncus saximontanus	33	13	0	0	0	0	0	0
Muhlenbergia asperifolia	0	0	0	0	0	0	75	t
Phalaris arundinacea	17	7	0	0	33	3	0	0
Phleum pratense	0	0	50	t	0	0	0	0
Poa palustris	17	t	50	t	0	0	0	0
Poa pratensis	33	8	0	0	67	t	0	0
Scirpus americana	0	0	0	0	0	0	100	30
Spartina gracilis	0	0	0	0	0	0	25	15
Typha latifolia	0	0	0	0	33	3	0	0
Achillea millefolium var. alpicola	0	0	0	0	0	0	0	0
Aconitum columbianum	17	t	0	0	0	0	0	0
Aster foliaceus	0	0	50	t	0	0	0	0
Barbarea vulgaris	17	t	0	0	0	0	0	0
Caltha leptosepala	0	0	50	15	0	0	0	0

Table 11. Continued.

	CARROS		CARAQU		CARNEB		SCIAME	
	CONS	COV	CONS	COV	CONS	COV	CONS	COV
Forbs, continued								
Cardamine cordifolia	0	0	0	0	0	0	0	0
Cirsium species	17	t	0	0	33	t	50	t
Epilobium angustifolium	0	0	50	t	0	0	0	0
Epilobium spp.	0	0	0	0	33	t	0	0
Fragaria virginiana	0	0	50	15	0	0	0	0
Geranium richardsonii	17	t	0	0	0	0	0	0
Geum macrophyllum	67	t	50	t	0	0	0	0
Glycyrrhiza lepidota	0	0	0	0	0	0	50	t
Heracleum lanatum	17	t	0	0	0	0	0	0
Ligusticum porteri	33	t	0	0	0	0	0	0
Melilotus alba	0	0	0	0	0	0	25	t
Mentha arvensis	33	t	0	0	67	7	0	0
Mertencia ciliata	17	t	0	0	0	0	0	0
Mimulus glabratus	0	0	0	0	33	3	0	0
Nasturtium officinale	0	0	0	0	33	7	0	0
Potentilla anserina	0	0	0	0	0	0	25	t
Potentilla gracilis	0	0	50	5	0	0	0	0
Rudbeckia laciniata	0	0	0	0	0	0	0	0
Senecio triangularis	0	0	50	t	0	0	0	0
Sidalcea candida	17	t	0	0	0	0	0	0
Smilacina stellata	17	t	0	0	0	0	0	0
Solidago giganta var. serotina	0	0	0	0	0	0	0	0
Taraxacum officinale	17	t	50	t	0	0	25	t
Thalictrum fendleri	17	t	50	t	0	0	0	0
Trifolium species	0	0	0	0	0	0	25	t
Trifolium hybridum	17	t	0	0	33	t	0	0
Urtica dioica ssp. gracilis	0	0	0	0	0	0	0	0
Veronica catenata	0	0	0	0	33	7	0	0
Equisetum arvense	33	t	50	2	33	3	0	0

(table contines on next page)

Table 11. Continued.

	JUNBAL		IVAAXI	
	CONS	AVE	CONS	AVE
Willows				
Salix exigua	50	t	0	0
Shrubs				
Artemisia tridentata	100	5	33	1
Chrysothamnus linifolius	0	0	33	3
Chrysothamnus nauseosus	50	2	0	0
Chrysothamnus viscidiflorus	50	15	0	0
Graminoids				
Carex praegracilis	50	2	0	0
Dactylis glomerata	50	t	0	0
Distichlis spicata	0	0	33	3
Elytrigia repens	50	15	33	3
Hordeum jubatum	0	0	33	t
Juncus balticus	100	20	33	t
Leymus cinereus	100	5	0	0
Muhlenbergia asperifolia	0	0	33	3
Pascopyrum smithii	0	0	33	7
Poa pratensis	50	5	33	3
Forbs				
Achillea millefolium var alpicola	50	t	0	0
Cirsium arvense	50	2	33	t
Glycyrrhiza lepidota	50	2	67	1
Iva axillaris	50	t	100	13
Melilotus officinalis	0	0	33	t
Solidago giganta var serotina	50	t	0	0
Equisetum laevigatum	0	0	67	4

CARROS	*Carex rostrata*	SCIAME	*Scirpus americana*
CARAQU	*Cares aquatilis*	JUNBAL	*Juncus balticus*
CARNEB	*Carex nebrascensis*	IVAAXI	*Iva axillaris*

Table 12. San Miguel/Dolores Basin Evergreen Forest plant association constancy (CONS) and average percent cover (AVE, t = trace) for important plant species. Association full names are listed at end of the table.

	PIEN-ABLA/MF		PIPU/ALIN		PIPU/COSE	
	CONS	AVE	CONS	AVE	CONS	AVE
Trees						
Abies lasiocarpa	100	23	50	25	0	0
Picea engelmannii	100	33	0	0	0	0
Picea pungens	0	0	100	30	67	13
Populus tremuloides	25	t	0	0	33	1
Willows						
Salix bebbiana	0	0	0	0	33	1
Salix drummondiana	0	0	0	0	33	7
Salix exigua	0	0	50	t	0	0
Salix geyeriana	25	3	0	0	0	0
Salix ligulifolia	0	0	50	t	0	0
Salix monticola	0	0	0	0	33	10
Shrubs						
Acer glabrum	0	0	50	5	0	0
Alnus incana ssp. tenuifolia	0	0	100	50	33	1
Amelanchier alnifolia	0	0	0	0	33	t
Berberis fendleri	0	0	0	0	33	t
Betula occidentalis	0	0	0	0	67	27
Clematis ligusticifolia	0	0	50	2	33	t
Cornus sericea	0	0	50	2	100	21
Lonicera involucrata	100	7	100	3	67	2
Rhus trilobata	0	0	50	t	0	0
Ribes coloradense	25	3	0	0	0	0
Ribes lacustre	50	6	50	2	0	0
Rosa woodsii	0	0	50	2	33	t
Symphoricarpos rotundifolius	0	0	0	0	33	1
Graminoids						
Elytrigia repens	0	0	0	0	33	t
Agrostis stolonifera	0	0	50	2	33	1
Bromus ciliatus	75	1	0	0	33	t
Carex lanuginosa	0	0	0	0	33	10
Carex species	25	t	50	t	33	t
Dactylis glomerata	0	0	0	0	33	t
Eleocharis palustris	0	0	50	t	0	0
Glyceria striata	0	0	50	t	33	1
Juncus balticus	0	0	50	2	0	0
Poa pratensis	25	t	0	0	67	1
unknown grasses	0	0	50	t	33	t
Forbs						
Asteraceae species	50	2	50	t	33	t
Cardamine cordifolia	100	18	0	0	67	t
Cirsium species	0	0	0	0	67	4
Delphinium barbeyi	0	0	50	2	0	0
Fragaria species	0	0	50	t	0	0
Galium triflorum	25	t	50	2	33	t
Geranium richardsonii	75	2	50	5	67	1
Heracleum lanatum	75	2	50	t	67	2
Ligusticum porteri	50	1	0	0	33	1
Mertensia ciliata	75	8	0	0	0	0
Osmorhiza depauperata	75	2	50	2	33	1
Oxypolis fendleri	50	8	0	0	33	t
Prunella vulgaris	0	0	50	t	100	1
Rudbeckia laciniata	0	0	50	t	67	4
Senecio triangularis	50	2	0	0	0	0
Smilacina stellata	0	0	50	t	67	t

Table 12. Continued.

	PIEN-ABLA/MF		PIPU/ALIN		PIPU/COSE	
	CONS	AVE	CONS	AVE	CONS	AVE
Forbs, continued.						
Taraxacum officinale	50	t	100	1	67	t
Thalictrum fendleri	25	t	50	5	0	0
Thalictrum species	25	t	0	0	33	1
Tragopogon species	0	0	50	t	33	t
Vicia americana	0	0	0	0	33	t
Horsetails						
Equisetum arvense	25	t	100	2	100	14
Equisetum hyemale	0	0	0	0	67	4

PIEN-ABLA/MF *Picea engelmannii-Abies lasiocarpa*/mesic forbs
PIPU/ALIN *Picea pungens/Alnus incana*
PIPU/COSE *Picea pungens/Cornus sericea*

Table 13. San Miguel/Dolores Basin Mixed Deciduous-Evergreen Forest plant association constancy (CONS) and average percent cover (AVE, t = trace) values for important plant species. Association full names are listed at the end of the table.

	POAN-PIPU/ALIN-COSE		PIPU-POAN/ALIN-LOIN	
	CONS	AVE	CONS	AVE
Trees				
Picea pungens	82	7	100	6
Populus angustifolia	100	7	75	35
Populus tremuloides	9	t	50	3
Pseudotsuga menziesii	9	t	50	1
Quercus gambelii	9	t	0	0
Willow				
Salix bebbiana	0	0	25	t
Salix drummondiana	9	t	25	3
Salix exigua	27	3	0	0
Salix ligulifolia	36	2	50	13
Salix monticola	9	t	25	t
Shrubs				
Alnus incana ssp. tenuifolia	82	32	75	16
Amelanchier alnifolia	9	t	50	1
Berberis fendleri	9	t	0	0
Betula occidentalis	73	42	0	0
Clematis ligusticifolia	9	t	0	0
Cornus sericea	36	9	50	3
Lonicera involucrata	73	7	100	18
Mahonia repens	0	0	25	t
Prunus virginiana	0	0	25	t
Rhus trilobata	9	t	0	0
Ribes inerme	18	t	50	1
Rosa woodsii	64	1	75	1
Symphoricarpos rotundifolius	18	t	100	4
Graminoids				
Agrostis stolonifera	18	t	0	0
Bromus ciliatus	9	t	0	0
Carex lanuginosa	9	t	0	0
Carex species	18	t	25	t
Dactylis glomerata	0	0	25	10
Eleocharis palustris	9	t	0	0
Glyceria striata	9	t	0	0
Juncus balticus	27	t	25	t
Phalaris arundinacea	9	t	0	0
Poa pratensis	73	3	50	t
Forbs				
Asteraceae species	18	t	25	t
Cardamine cordifolia	9	t	50	t
Cirsium species	36	t	50	1
Fragaria species	9	t	25	t
Galium triflorum	36	t	50	3
Geranium richardsonii	18	t	100	2
Heracleum lanatum	36	1	75	6
Ligusticum porteri	9	t	25	t
Mertensia ciliata	18	t	25	t
Osmorhiza depauperata	9	t	75	t
Oxypolis fendleri	0	0	50	t
Prunella vulgaris	9	t	0	0
Rudbeckia laciniata	27	t	75	6
Smilacina stellata	82	7	100	10
Taraxacum officinale	55	t	100	3
Thalictrum fendleri	27	t	50	3
Thalictrum species	9	t	50	1
unknown forbs	27	t	50	3
Vicia americana	18	t	50	1

Table 13. Continued

	POAN-PIPU/ALIN-COSE		PIPU-POAN/ALIN-LOIN	
	CONS	AVE	CONS	AVE
Horsetails				
Equisetum arvense	55	2	75	4
Equisetum hyemale	18	3	75	1

POAN-PIPU/ALIN-COSE *Populus angustifolia-Picea pungens/Alnus incna-Cornus sericea*

PIPU-POAN/ALIN-LOIN *Picea pungens-Populus angustifolia /Alnus incana-Loniceria involucrata*

Table 14. San Miguel/Dolores River Basin Deciduous Forest plant association constancy (CONS) and average percent cover (AVE, t = trace) values for important plant species. Associations full names appear at end of the table.

	ACNE/BEOC		POAN/COSE		POAN/RHTR		PODE/RHTR	
	CONS	AVE	CONS	AVE	CONS	AVE	CONS	AVE
Trees								
Acer negundo	100	41	17	t	7	t	0	0
Juniperus osteosperma	0	0	0	0	7	t	0	0
Populus x acuminata	0	0	0	0	7	4	0	0
Populus angustifolia	0	0	100	27	86	27	7	1
Populus deltoides ssp. wislizenii	0	0	0	0	0	0	21	19
Populus tremuloides	0	0	17	t	0	0	0	0
Pseudotsuga menziesii	0	0	17	3	0	0	0	0
Quercus gambelii	0	0	50	2	29	3	0	0
Willows								
Salix exigua	75	9	33	t	36	5	14	8
Salix ligulifolia	0	0	50	7	7	t	14	t
Salix monticola	25	t	0	0	0	0	0	0
Shrubs								
Acer glabrum	0	0	33	2	0	0	0	0
Alnus incana ssp. tenuifolia	0	0	50	6	0	0	0	0
Amelanchier alnifolia	0	0	50	4	0	0	0	0
Amelanchier utahensis	0	0	0	0	7	t	0	0
Artemisia tridentata	25	t	0	0	36	2	0	0
Berberis fendleri	0	0	0	0	21	3	0	0
Betula occidentalis	75	40	17	2	7	t	0	0
Chrysothamnus viscidiflorus	0	0	0	0	7	t	0	0
Clematis ligusticifolia	75	4	17	t	79	6	7	t
Cornus sericea	0	0	100	32	21	1	0	0
Crataegus rivularis	0	0	17	3	14	t	0	0
Forestiera pubescens	50	8	0	0	50	15	7	10
Lonicera involucrata	0	0	33	8	0	0	0	0
Mahonia repens	0	0	0	0	7	4	0	0
Pachistima myrsinites	0	0	33	2	0	0	0	0
Prunus virginiana	0	0	17	t	0	0	0	0
Rhus trilobata	0	0	0	0	86	33	7	1
Rosa woodsii	50	3	67	4	43	4	0	0
Shepherdia argentea	0	0	0	0	14	3	0	0
Symphoricarpos rotundifolius	0	0	50	2	7	t	0	0
Toxicodendron rydbergii	0	0	17	2	21	t	7	1
Graminoids								
Elytrigia repens	25	3	0	0	0	0	0	0
Agrostis stolonifera	25	t	0	0	7	t	0	0
Carex lanuginosa	0	0	0	0	7	t	0	0
Carex species	25	t	50	1	7	t	0	0
Eleocharis palustris	0	0	0	0	21	t	14	t
Juncus balticus	25	t	0	0	14	t	14	8
Phalaris arundinacea	50	t	0	0	0	0	14	4
Phleum pratense	0	0	17	t	0	0	0	0
Poa pratensis	75	4	67	t	79	6	21	5
unknown grasses	50	1	33	t	29	t	0	0
Forbs								
Aster foliaceus	0	0	0	0	7	t	0	0
Asteraceae species	0	0	17	t	7	t	0	0
Aster glaucodes	0	0	0	0	0	0	14	10
Cirsium species	0	0	17	t	14	t	0	0
Galium triflorum	0	0	50	t	0	0	0	0
Geranium richardsonii	0	0	17	t	0	0	0	0
Glycyrrhiza lepidota	25	t	0	0	14	t	0	0
Heracleum lanatum	0	0	50	7	0	0	0	0
Ligusticum porteri	0	0	33	t	0	0	0	0
Lupinus species	0	0	33	2	0	0	0	0

Table 14. Continued.

	ACNE/BEOC		POAN/COSE		POAN/RHTR		PODE/RHTR	
	CONS	AVE	CONS	AVE	CONS	AVE	CONS	AVE
Forbs, continued								
Melilotus officinalis	0	0	0	0	57	1	14	1
Osmorhiza depauperata	0	0	50	2	0	0	0	0
Prunella vulgaris	0	0	0	0	14	t	0	0
Rudbeckia laciniata	0	0	33	1	14	t	0	0
Smilacina stellata	0	0	67	2	21	t	0	0
Solidago canadensis	0	0	0	0	7	t	0	0
Taraxacum officinale	0	0	50	1	57	t	0	0
Thalictrum species	0	0	33	2	0	0	0	0
Thlaspi montanum	0	0	50	1	14	t	0	0
unknown forbs	25	t	0	0	36	t	7	t
Vicia americana	0	0	50	2	21	t	0	0
Horsetails								
Equisetum arvense	0	0	83	2	29	t	7	t
Equisetum hyemale	50	3	67	t	0	0	0	0

ACNE/BEOC *Acer negundo/Betula occidentalis*
POAN/COSE *Populus angustifolia/Cornus sericea*
POAN/RHTR *Populus angustifolia/Rhus trilobata*
PODE/RHTR *Populus angustifolia* ssp. *wislizenii/Rhus trilobata*

Table 15. San Miguel/Dolores Tall-Willow Shrubland plant association constancy (CONS) and average percent cover (AVE, t = trace) values for important plant species. Plant association full names appear at the end of the table (p.a. represented by one plot are not included).

	SAEX/MG		SAMO-SAGE/MF	
	CONS	AVE	CONS	AVE
Trees				
Acer negundo	20	2	0	0
Picea engelmannii	0	0	10	t
Picea pungens	0	0	10	t
Populus angustifolia	20	t	0	0
Populus deltoides ssp. wislizenii	10	1	0	0
Willows				
Salix bebbiana	0	0	20	1
Salix brachycarpa	0	0	10	1
Salix exigua	100	48	0	0
Salix geyeriana	0	0	80	34
Salix ligulifolia	10	t	0	0
Salix monticola	20	t	90	43
Salix planifolia	0	0	10	t
Salix species	0	0	30	8
Salix wolfii	0	0	10	2
Shrubs				
Alnus incana ssp. tenuifolia	10	1	20	2
Betula occidentalis	10	2	0	0
Clematis ligusticifolia	60	8	0	0
Cornus sericea	30	t	0	0
Forestiera pubescens	20	t	0	0
Lonicera involucrata	0	0	60	4
Rhus trilobata	20	t	0	0
Ribes inerme	0	0	50	2
Rosa woodsii	50	11	30	t
Toxicodendron rydbergii	30	1	0	0
Graminoids				
Elytrigia repens	0	0	20	t
Agrostis stolonifera	30	2	20	t
Bromus ciliatus	0	0	40	t
Bromus inermis	10	t	0	0
Carex aquatilis	10	t	30	3
Carex emoryi	10	t	0	0
Carex lanuginosa	0	0	20	2
Carex nebrascensis	10	t	0	0
Carex rostrata	10	t	0	0
Carex species	40	3	10	t
Dactylis glomerata	10	t	20	t
Eleocharis palustris	30	2	0	0
Glyceria striata	10	t	0	0
Holcus lanatus	10	t	0	0
Juncus balticus	20	1	20	8
Phalaris arundinacea	10	3	0	0
Phleum pratense	10	t	20	1
Phragmites australis	20	t	0	0
Poa pratensis	40	t	40	3
Scirpus validus	20	t	0	0
Forbs				
Asteraceae species	10	t	40	2
Aster glaucodes	10	t	0	0
Cardamine cordifolia	0	0	40	t
Cirsium species	40	t	60	t
Eupatorium maculatum	10	t	0	0
Fragaria species	0	0	50	1
Galium triflorum	0	0	10	t
Geranium richardsonii	0	0	80	4

Table 15. Continued

	SAEX/MG		SAMO-SAGE/MF	
	CONS	AVE	CONS	AVE
Forbs, continued				
Glycyrrhiza lepidota	30	1	0	0
Heracleum lanatum	0	0	50	t
Ligusticum porteri	0	0	30	t
Melilotus officinalis	60	4	0	0
Mertensia ciliata	0	0	50	2
Oxypolis fendleri	0	0	30	t
Prunella vulgaris	10	t	10	t
Rudbeckia laciniata	10	t	20	t
Senecio triangularis	0	0	10	t
Smilacina stellata	10	t	60	2
Solidago canadensis	10	1	10	t
Taraxacum officinale	20	t	70	4
Thalictrum fendleri	0	0	60	1
Thalictrum species	0	0	10	t
Tragopogon species	0	0	30	t
Vicia americana	20	t	40	t
Horestails				
Equisetum arvense	60	3	70	3
Equisetum hyemale	10	t	10	t

SAEX/MG *Salix exigua*/mesic graminoid
SAMO-SAGE/MF *Salix monticola-Salix geyeriana*/mesic forbs

Table 16. San Miguel/Dolores Basin Low-Willow Shrubland plant association constancy (CONS) and average percent cover (AVE, t = trace) values for important plant species. Plant association full names are listed at end of the table (p.a represented by one plot are not included).

	SABR/MF		SAPL/CALE	
	CONS	AVE	CONS	AVE
Trees				
Picea engelmannii	50	t	0	0
Willows				
Salix brachycarpa	100	45	0	0
Salix monticola	50	2	33	13
Salix planifolia var. monica	50	5	100	67
Salix wolfii	50	35	67	4
Graminoids				
Bromus ciliatus	50	t	0	0
Calamagrostis canadensis	50	t	33	1
Carex aquatilis	0	0	67	14
Carex sp.	0	0	67	11
Poa pratensis	100	1	33	t
Forbs				
Asteraceae species	50	2	0	0
Caltha leptosepala	0	0	100	14
Cardamine cordifolia	0	0	33	1
Geranium richardsonii	100	3	67	1
Ligusticum porteri	100	12	0	0
Mertensia ciliata	100	1	67	2
Oxypolis fendleri	0	0	33	t
Senecio triangularis	100	3	33	3
Taraxacum officinale	50	2	67	t
Thalictrum fendleri	0	0	33	7

SABR/MF *Salix brachycarpa*/mesic forbs
SAPL/CALE *Salix planifolia* var. *monica*/*Caltha leptosepala*

Table 17. San Miguel/Dolores Basin Non-Willow Shrubland plant association constancy (CONS) and average percent cover (AVE, t = trace) values for important plant species (p.a represented by one plot are not included).

	Rhus trilobata	
	CONS	AVE
Willows		
Salix exigua	100	10
Salix ligulifolia	100	10
Shrubs		
Acer glabrum	33	t
Alnus incana ssp. tenuifolia	33	t
Berberis fendleri	67	1
Betula occidentalis	33	t
Chrysothamnus viscidiflorus	33	3
Clematis ligusticifolia	67	1
Cornus sericea	67	7
Rhus trilobata	100	31
Rosa woodsii	100	2
Toxicodendron rydbergii	33	1
Graminoids		
Bromus inermis	33	3
Carex lanuginosa	33	t
Carex nebrascensis	33	1
Carex species	33	1
Dactylis glomerata	33	t
Juncus balticus	67	1
Phalaris arundinacea	67	1
Poa pratensis	100	2
Forbs		
Aster foliaceus	33	1
Asteraceae species	33	t
Glycyrrhiza lepidota	33	1
Prunella vulgaris	33	3
Smilacina stellata	33	t
Taraxacum officinale	100	4
Thlaspi montanum	33	1
Tragopogon species	33	t
Horestails		
Equisetum arvense	67	t

Table 18. San Miguel/Dolores River Basin Herbaceous plant association constancy (CONS) and average percent cover (AVE, t = trace) values for important plant species (p.a represented by one plot are not included).

	Carex aquatilis		*Carex rostrata*	
	CONS	AVE	CONS	AVE
Willows				
Salix drummondiana	0	0	33	1
Salix geyeriana	0	0	33	t
Salix ligulifolia	0	0	33	1
Salix monticola	0	0	67	7
Salix planifolia var. monica	0	0	33	11
Graminoids				
Calamagrostis canadensis	50	10	0	0
Carex aquatilis	100	60	33	7
Carex lanuginosa	0	0	33	t
Carex nebrascensis	0	0	33	7
Carex rostrata	0	0	100	70
Carex sp.	0	0	33	t
Glyceria striata	0	0	33	t
Hordeum murinum ssp. glaucum	50	15	0	0
Juncus balticus	0	0	33	1
Poa pratensis	50	2	33	t
Scirpus microcarpus	0	0	33	3
Forbs				
Asteraceae species	0	0	33	1
Cardamine cordifolia	50	t	0	0
Cirsium species	0	0	33	t
Oxypolis fendleri	0	0	33	t
Rudbeckia laciniata	0	0	33	t
Senecio triangularis	0	0	33	t
Taraxacum officinale	50	t	0	0
Horsetails				
Equisetum arvense	0	0	33	1
Equisetum hyemale	0	0	33	t

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Appendix 1. Proposed Ecologically-Significant Riparian Areas of the Yampa River and San Miguel/Dolores River Basins (see Methods for ecological-site definition).

Yampa River Basin Proposed Ecologically-Significant Riparian Areas.

1. Yampa River at Morgan Bottoms (in and around the Mt. Harris and Hayden area) harbors good and excellent occurrences of a globally rare riparian deciduous forest, the narrowleaf cottonwood-box elder/red-osier dogwood (*Populus angustifolia-Acer negundo/Cornus sericea*) p.a. (plots 9,27, GK02-GK05).

2. On the upper reaches of the Yampa River mainstem, near the town of Yampa, is a large, high quality occurrence of the Booth's willow/beaked sedge (*Salix boothii/Carex rostrata*) p.a. (plots GK17, GK18, GK19). This site also has a population of the rare autumn willow (*Salix serissima*).

3. The East Fork of the Williams Fork River harbors one of the best examples of a high quality, long continuous stretch (4 miles) of narrowleaf cottonwood-Colorado blue spruce/red-osier dogwood (*Populus angustifolia-Picea pungens/Cornus sericea*) p.a. (plots 104, GK06, GK07).

4. Elk River from Christina Wildlife area north to the Moon Hill bridge supports a large, although fragmented, good to excellent condition example of the narrowleaf cottonwood/red-osier dogwood (*Populus angustifolia/Cornus sericea*) p.a. (plot 45, GK09).

5. Lower reaches of the South Fork of Slater Creek and the main stem of Slater Creek have large and excellent condition occurrences of a Booth's willow/mesic forb (*Salix boothii*/mesic forb) p.a. (plot 52).

6. Morrison Creek, about 5 km south of the Silver Creek confluence, supports a mosaic of both high quality and poorer condition occurrences of Booth's willow/mesic forb (*Salix boothii*/mesic forb) p.a. (plot GK14), Geyer willow/beaked sedge (*Salix geyeriana/Carex rostrata*) p.a. (plot GK 16), and thinleaf alder-Geyer willow (*Alnus incana* spp. *tenuifolia-Salix geyeriana*) p.a. (plot GK15).

7. Fourmile Creek, a tributary to the Little Snake River, harbors a fairly large, but slightly degraded, example of the Pacific willow/mesic forb (*Salix lasiandra* var. *caudata*/ mesic forb) p.a. (plot 39).

8. Upper reaches of the South Fork of Slater Creek drain the north flank of the Elkhead Mountains and has an excellent example of an Engelmann spruce-subalpine fir/black twinberry (*Picea engelmannii-Abies lasiocarpa/Lonicera*

involucrata) p.a (plot 48) along the narrow, steep-sided reaches, and an aquatic sedge (*Carex aquatilis*) wet meadow p.a. (plot 49) in low lying swales.

9. Sawmill Creek drains the south flank of the Elkhead Mountains, and supports an excellent example of a Colorado blue spruce/thinleaf alder (*Picea pungens/Alnus incana* spp. *tenuifolia*) p.a. (plot GK01).

10. Little Snake River at Lone Mountain supports a small but good condition example of the skunkbrush (*Rhus trilobata*) riparian shrubland p.a. (plot 17).

11. Sandbars of the Yampa River near Maybell have small but good quality examples of the bulrush (*Scirpus americana*) wetland p.a. (plot 25).

<u>San Miguel/Dolores River Basin Proposed Ecologically-Significant Riparian Areas.</u>

1. Just above Uravan, the San Miguel River harbors good to excellent examples of the Rio Grande cottonwood/skunkbrush (*Populus deltoides* spp. *wislizenii/Rhus trilobata*) (plots 1, 2, NL29). This site also contains stands of the narrowleaf cottonwood/skunkbrush p.a. (plot GK32).

2. Along Tabeguache Creek, a tributary to the San Miguel River that drains the Uncompahgre Plateau, there are excellent examples of the narrowleaf cottonwood/skunkbrush (*Populus angustifolia/Rhus trilobata*) p.a. (plots 20, 21, 23-26).

3. In the roadless canyon of the San Miguel River above the confluence with Horsefly creek is a good example of the Colorado blue spruce/red-osier dogwood (*<u>Picea pungens/Cornus sericea</u>*) p.a. (plot 6).

4. San Miguel River mainstem, from the upper reaches of the roadless canyon, past the Norwood bridge to town of Sawpit has pockets of high quality examples of the globally rare narrowleaf cottonwood-Colorado blue spruce/thinleaf alder-red osier dogwood (*Populus angustifolia-Picea pungens/Alnus incana* spp. *tenuifolia-Cornus sericea*) p.a. (plots 7-15).

5. The mainstem of the San Miguel River above Lime and the South Fork of the San Miguel River from Society Turn to just below Ophir Loop harbors large and small patches of a globally rare riparian forest, Colorado blue spruce-narrowleaf cottonwood/thin leaf alder-black twinberry (*Picea pungens-Populus angustifolia/Alnus incana* spp. *tenuifolia-Lonicera involucrata*) p.a. (plot EO#5, 18). Rocky Mountain willow-Geyer willow/mesic forb (*Salix*

monticola-Salix geyeriana/mesic forb) also occurs around beaver ponds along this stretch of the river (plots 16,19).

6. La Sal Creek, a tributary to the Dolores River in a largely roadless canyon, harbors an outstanding high-quality occurrence of the box elder/river birch (*Acer negundo/Betula occidentalis*) p.a. (plots 61-64). This is the only known occurrence of this plant association.

7. The Dolores River mainstem, below the Dolores Canyon, supports an excellent example of the wild privet-coyote willow/common reed (*Foresteria pubescens-Salix exigua/Phragmites australis*) riparian shrubland lining the banks for many miles (plot 67).

8. Dolores River at Scotch Creek harbors one river mile of the best condition occurrence of *Picea pungens-Populus angustifolia/Lonicera involucrata.*

9. The West Dolores River mainstem near Dunton (near Cold Creek) contains a large and good condition rocky mountain willow-Geyer willow/mesic forb (*Salix monticola-Salix geyeriana*/mesic forb) willow carr (plot NL27).

10. West Dolores River near the confluence with Dry Creek harbors an excellent occurrence of a Colorado blue spruce-narrowleaf cottonwood/black twinberry (*Picea pungens-Populus angustifolia/Alnus incana* spp. *tenuifolia-Lonicera involucrata*) p.a. (plot 82).

11. The Dolores River mainstem, above Stoner, supports a small but excellent condition occurrence of a narrowleaf cottonwood/red-osier dogwood (*Populus angustifolia/Cornus sericea*) p.a. (plot 80, 81).

12. A branch of Bilk Creek, within the Lizard Head Wilderness Area, contains a high quality mosaic of two common subalpine and alpine associations: barren ground willow/mesic forb (*Salix brachycarpa*/mesic forb) and planeleaf willow/marsh marigold (*Salix planifolia/Caltha leptosepala*) (plots 55, 56).

13. Bilk Creek, in the upper San Miguel River watershed, has an unusually large occurrence of more common p.a., Drummond's willow/mesic forb (*Salix drummondiana*/mesic forb) (plot 54).

14. Snow Spur Creek, a small tributary to the upper reaches of the Dolores River, drains a subalpine valley containing excellent examples of Wolf's willow/aquatic sedge (*Salix wolfii/Carex aquatilis*) low willow carr and aquatic sedge (*Carex aquatilis*) wet meadow p.a. (plots 90, 91, respectively).

Appendix 2A. Yampa River Basin riparian plant species scientific (based on Kartesz & Kartesz 1988, except for *Salix* spp., which are based on Dorn 1977) and common names.

Scientific Name	Common Name
Trees	
Abies lasiocarpa	subalpine fir
Acer negundo	box elder
Juniperus osteosperma	Utah juniper
Picea engelmannii	Engelmann spruce
Picea pungens	Colorado blue spruce
Pinus contorta	lodgepole pine
Populus angustifolia	narrowleaf cottonwood
Populus deltoides ssp. wislizenii	Rio grande cottonwood
Populus tremuloides	quaking aspen
Populus x acuminata	lanceleaf cottonwood (hybrid of *P. deltoides* and *P. angustifolia*)
Quercus gambelii	Gambel's oak
Willows	
Salix bebbiana	Bebb's willow
Salix boothii	Booth's willow
Salix brachycarpa	barren-ground willow
Salix drummondiana	Drummond's willow
Salix exigua	coyote willow, sandbar willow
Salix geyeriana	Geyer's willow
Salix lasiandra var. caudata	Pacific willow, whiplash willow
Salix ligulifolia	"yellow willow"
Salix monticola	rocky mountain willow
Salix planifolia var. monica	plainleaf willow, planeleaf willow
Salix planifolia var. planifolia	plainleaf willow, planeleaf willow
Salix scouleriana	Scouler's willow
Salix serissima	autumn willow
Salix wolfii	wolf's willow
Shrubs	
Acer glabrum	Rocky Mountain maple
Alnus incana	thinleaf alder
Amelanchier alnifolia	serviceberry, shadbush
Artemisia tridentata	big sagebrush
Betula glandulosa	bog birch
Chrysothamnus linifolius	spreading rabbitbrush
Chrysothamnus nauseosus	rubber rabbitbrush
Chrysothamnus viscidiflorus	viscid rabbitbrush
Chrysothamnus spp.	rabbitbrush

Appendix 2A. Yampa River Basin plant species, continued.

Shrubs, continued.	
Cornus sericea	red-osier dogwood
Crataegus rivularis	river hawthorn
Lonicera involucrata	black twinberry, bush honeysuckle
Mahonia repens	Oregon grape, creeping mahonia
Pachistima myrsinites	mountain lover
Potentilla fruticosa	shrubby cinquefoil
Prunus virginiana	chokecherry
Rhus trilobata	skunkbrush
Ribes aureum	golden currant
Ribes inerme	whitestem gooseberry
Ribes lacustre	black swamp gooseberry
Ribes leptanthum	trumpet gooseberry
Ribes montigenum	gooseberry currant
Ribes spp.	gooseberry
Rosa woodsii	woods rose
Rubus idaeus	red raspberry
Sambucus racemosa	red elderberry
Shepherdia argentea	silver buffaloberry
Sorbus scopulina	rock mountain-ash
Symphoricarpos longiflorus	long-flower snowberry
Symphoricarpos occidentalis	wolfberry
Symphoricarpos oreophilus	mountain snowberry
Tamarix ramosissima	tamarisk, salt cedar
Vaccinium myrtillus	dwarf bilberry, blueberry
Vaccinium scoparium	grouseberry
Graminoids	
Agropyron cristatum	crested wheatgrass
Agrostis exarata	spike bentgrass
Agrostis gigantea	redtop
Agrostis stolonifera	redtop
Agrostis spp.	bentgrass species
Beckmannia syzigachne	American sloughgrass
Bromus carinatus	mountain brome
Bromus ciliatus	fringed brome
Bromus inermis	smooth brome
Bromus lanatipes	brome grass
Bromus secalinus	rye chess
Bromus tectorum	cheatgrass
Calamagrostis canadensis	bluejoint reedgrass
Calamagrostis stricta	slimstem reedgrass

Appendix 2A. Yampa River Basin plant species, continued.

Graminoids, continued.	
Calamagrostis spp.	reedgrass species
Carex aquatilis	water sedge
Carex aurea	golden sedge
Carex deweyana	sedge
Carex disperma	softleaved sedge
Carex geyeri	elk sedge
Carex hoodii	sedge
Carex lanuginosa	woolly sedge
Carex lasiocarpa	slender sedge
Carex lenticularis	sedge
Carex microptera	small-wing sedge
Carex nebrascensis	Nebraska sedge
Carex norvegica var stevenii	Scandinavian sedge
Carex occidentalis	western sedge
Carex praegracilis	blackcreeper sedge
Carex rostrata	beaked sedge
Carex vesicaria	blister sedge
Carex spp.	sedge species
Catabrosa aquatica	brookgrass
Cinna latifolia	drooping woodreed
Dactylis glomerata	orchard grass
Danthonia californica	California oatgrass
Danthonia spicata	oneside oatgrass
Deschampsia cespitosa	tufted hairgrass
Distichlis spicata	desert salt-grass
Eleocharis palustris	creeping spikerush
Eleocharis spp.	spikerush species
Elymus canadensis	Canada wildrye
Elymus glaucus	blue wildrye
Elymus lanceolatus ssp. lanceolatus	thickspike wheatgrass
Elymus trachycaulus	slender wheatgrass
Elymus virginicus	Virginia wildrye
Elymus x critesion	wildrye
Elymus spp.	wildrye
Elytrigia repens	quackgrass
Festuca arundinacea	tall fescue
Festuca thurberi	thurber fescue
Glyceria elata	mannagrass
Glyceria grandis	American mannagrass
Glyceria striata	fowl mannagrass
Glyceria spp.	mannagrass

Appendix 2A. Yampa River Basin plant species, continued.

Graminoids, continued.	
Hordeum brachyantherum	meadow barley
Hordeum jubatum	foxtail barley
Juncus balticus	baltic rush, wiregrass
Juncus bufonius	toad rush
Juncus compressus	rush
Juncus confusus	rush
Juncus longistylis	longstyle rush
Juncus saximontanus	rush
Juncus torreyi	Torrey rush
Juncus tracyi	rush
Juncus spp.	rush
Leymus cinereus	Great Basin wildrye
Leymus salina	Salina wildrye
Lophopyrum elongatum	slender wheatgrass
Luzula multiflora ssp. congesta	hairy woodrush
Luzula parviflora	millet woodrush
Muhlenbergia asperifolia	scratchgrass
Oryzopsis spp.	ricegrass species
Pascopyrum smithii	western wheatgrass
Phalaris arundinacea	reed canarygrass
Phleum alpinum	alpine timothy
Phleum pratense	timothy
Phragmites australis	common reed
Poa arida	bluegrass
Poa compressa	Canada bluegrass
Poa palustris	fowl bluegrass
Poa pratensis	Kentucky bluegrass
Poa spp.	bluegrass species
Polypogon monspeliensis	rabbitfoot grass
Puccinellia nuttalliana	nuttall alkaligrass
Scirpus acutus	hardstem bulrush
Scirpus americana	olney threesquare, bulrush
Scirpus maritimus	alkali bulrush
Scirpus pallidus	bulrush
Spartina gracilis	alkali cordgrass
Sporobolus airoides	alkali saccaton
Stipa viridula	green needlegrass
Triglochin palustris	marsh arrowgrass
Trisetum wolfii	wolf trisetum
Typha latifolia	broad-leaved cattail

Appendix 2A. Yampa River Basin plant species, continued.

Forbs

Achillea millefolium var. alpicola	yarrow
Aconitum columbianum	monkshood
Acroptilon repens	Russian knapweed
Actaea rubra	baneberry
Allium spp.	onion species
Ammannia robusta	loosestrife
Anaphalis margaritacea	pearly everlasting
Antennaria spp.	pussytoes
Apocynum cannabinum	dogbane
Aquilegia caerulea	Colorado columbine
Arabis glabra	tower mustard
Arabis hirsuta	hairy rockcress
Arctium minus	burdock
Arnica cordifolia	heartleaf arnica
Arnica latifolia	broadleaf arnica
Arnica mollis	hairy arnica
Artemisia biennis	biennial wormwood
Artemisia ludoviciana	Louisiana wormwood
Asclepias speciosa	showy milkweed
Aster ascendens	aster
Aster bracteolatus	Eaton's aster
Aster foliaceus	leafybract aster
Aster hesperius	Siskiyou aster
Aster spp.	aster
Astragalus spp.	milkvetch species
Atriplex argentea	silver orach
Atriplex heterosperma	two-seed orach
Barbarea vulgaris	wintercress
Brachyactis ciliata	aster
Barbarea orthoceras	wintercress
Caltha leptosepala	marsh marigold
Campanula rotundifolia	harebell, bluebells of Scotland
Cardamine breweri	Brewer's bittercress
Cardamine cordifolia	heartleaf bittercress
Cardaria chalapensis	whitetop
Cardaria pubescens	hairy whitetop
Cardaria spp.	whitetop
Caryophyllaceae spp.	pink family species
Castilleja flava	yellow paintbrush
Castilleja miniata	scarlet paintbrush
Castilleja minor	paintbrush

Appendix 2A. Yampa River Basin plant species, continued.

Forbs, continued.

Castilleja rhexifolia	rhexia-leaved paintbrush
Castilleja sulphurea	paintbrush
Castilleja spp.	paintbrush species
Centaurium calycosum	Buckley's centaury
Cerastium fontanum	mouse-ear chickweed
Chenopodium berlandieri	goosefoot
Chenopodium fremontii	Fremont's goosefoot
Chenopodium gigantospermum	goosefoot
Chenopodium glaucum	oakleaf goosefoot
Chenopodium leptophyllum	narrowleaf goosefoot
Chenopodium rubrum	red goosefoot
Chenopodium spp.	goosefoot species
Cicuta douglasii	water hemlock
Cirsium arvense	Canada thistle
Cirsium centaureae	fringed thistle
Cirsium ownbeyi	Ownbey thistle
Cirsium spp.	thistle species
Cirsium vulgare	bull thistle
Clematis ligusticifolia	white virgins-bower
Collomia linearis	collomia
Conioselinum scopulorum	hemlock-parsley
Convolvulus arvensis	bindweed
Conyza canadensis	horseweed
Corallorhiza maculata	spotted coralroot
Corydalis aurea	goldensmoke, golden corydalis
Cynoglossum officinale	houndstongue
Cystopteris fragilis	brittle-fern
Cystopteris spp.	fern
Delphinium ramosum	fern
Descurainia californica	California tansymustard
Descurainia richardsonii	Richardson tansymustard
Dodecatheon pulchellum	pretty shooting-star
Dugaldia hoopesii	orange sneezeweed
Delphinium barbeyi	Barbey larkspur
Epilobium angustifolium	fireweed
Epilobium ciliatum	northern willow-herb
Epilobium saximontanum	Rocky Mountain willow-herb
Epilobium spp.	willow-herb species
Erigeron coulteri	Coulter daisy
Erigeron elatior	tall daisy
Erigeron eximius	splendid daisy

Appendix 2A. Yampa River Basin plant species, continued.

Forbs, continued.	
Erigeron peregrinus	wandering daisy
Erigeron speciosus	showy daisy
Erigeron subtrinervis	daisy
Erigeron spp.	daisy
Eupatorium maculatum	joe-pye weed
Euthamia occidentalis	western goldenrod
Epilobium hornemannii	willow-herb
Epilobium lactiflorum	willow-herb
Fragaria virginiana	mountain strawberry
Frasera speciosa	green gentian, monument plant
Galium boreale	northern bedstraw
Galium spurium	cleavers
Galium trifidum	small bedstraw
Galium triflorum	sweet-scented bedstraw
Gentianella amarella	northern gentian
Gentianopsis thermalis	meadow gentian
Geranium richardsonii	Richardson geranium
Geum macrophyllum	large-leaved avens
Glaux maritima	sea milkwort
Glycyrrhiza lepidota	licorice
Grindelia fastigiata	erect gumweed
Hackelia floribunda	showy stickseed
Halimolobos virgata	strictweed
Haplopappus parryi	aster
Helenium autumnale	common sneezeweed
Heliomeris multiflora	showy goldeneye
Heracleum lanatum	cow parsnip
Hesperis matronalis	dame's violet, sweet rocket
Humulus lupulus	hops
Hypericum scouleri	St. Johnswort
Iva axillaris	povertyweed
Ipomopsis aggregata	scarlet gilia
Iris missouriensis	Missouri iris
Kochia scoparia var. pubescens	summer-cypress
Lactuca serriola	prickly lettuce
Lactuca tatarica	blue lettuce
Lepidium latifolium	peppergrass
Leucanthemum vulgare	ox-eye daisy
Ligusticum filicinum	fernleaf ligusticum
Ligusticum porteri	lovage, osha
Listera cordata	heart-leaved twayblade

Appendix 2A. Yampa River Basin plant species, continued.

Forbs, continued.	
Lithospermum multiflorum	pretty stoneseed, puccoon
Lomatium dissectum	giant lomatium
Lupinus argenteus	silvery lupine
Lupinus spp.	lupine species
Lysimachia ciliata	fringed loosestrife
Lotus tenuis	slender trefoil
Medicago lupulina	black medick
Medicago sativa	alfalfa
Melilotus alba	white sweet-clover
Melilotus officinalis	yellow sweet-clover
Mentha arvensis	field mint
Mertensia ciliata	mountain bluebell, chiming bells
Micranthes odontoloma	brook saxifrage, foamflower
Mimulus glabratus	glabrous monkey-flower
Mitella pentandra	fivestar miterwort
Moehringia lateriflora	Moehringia's chickweed
Monarda fistulosa	beebalm, horsemint
Mimulus moschatus	musk monkeyflower
Montia chamissoi	water spring-beauty
Nasturtium officinale	water cress
Oenothera spp.	evening primrose species
Orthilia secunda	one-sided wintergreen
Osmorhiza depauperata	blunt-fruit sweet cicely
Osmorhiza occidentalis	western sweet cicely
Oxypolis fendleri	fendler cowbane
Ozmorhiza chilensis	sweet cicely
Parnassia fimbriata	fringed grass-of-parnassus
Pedicularis groenlandica	elephant-head, elephantella
Pedicularis procera	gray lousewort
Pedicularis racemosa	leafy lousewort, parrotbeak
Penstemon spp.	penstemon species
Perideridia gairdneri	false yarrow
Plantago lanceolata	english plantain
Plantago major	broadleaf plantain, common plantain
Platanthera stricta	slender bog-orchid
Platanthera spp.	bog-orchid species
Polemonium foliosissimum	leafy jacob's ladder
Polemonium occidentale	blue jacob's ladder
Polemonium pulcherrimum	pretty jacob's ladder
Polygonum amphibium var. emersum	water smartweed
Potentilla anserina	common silverweed

Appendix 2A. Yampa River Basin plant species, continued.

Forbs, continued.

Potentilla diversifolia	wedge-leaf cinquefoil
Potentilla gracilis	slender cinquefoil
Potentilla norvegica	rough cinquefoil
Potentilla pulcherrima	cinquefoil
Potentilla spp.	cinquefoil
Prunella vulgaris	heal-all
Pseudostellaria jamesiana	tuber starwort
Pteridium aquilinum	bracken fern
Pyrola americana	swamp wintergreen, liverleaf wintergreen
Pyrola minor	lesser wintergreen
Ranunculus spp.	buttercup species
Ranunculus uncinatus	buttercup
Rorippa teres	yellowcress
Rubus parviflorus	thimbleberry
Rudbeckia laciniata	cutleaf coneflower
Rumex aquaticus	western dock
Rumex crispus	curly dock
Rumex triangulivalvis	beach dock
Ranunculus cymbalaria	marsh buttercup
Ranunculus macounii	Macoun buttercup
Rorippa palustris spp. hispida	yellowcress
Salicornia europaea	annual samphire
Salsola australis	Russian thistle, tumbleweed
Saxifraga spp.	saxifrage species
Scutellaria galericulata	skullcap
Sedum rhodanthum	queen's crown, pink stonecrop
Senecio bigelovii	bigelow groundsel
Senecio canus	gray groundsel
Senecio eremophilus	desert groundsel
Senecio pseudaureas	groundsel
Senecio serra	saw groundsel
Senecio triangularis	arrowleaf groundsel
Sidalcea candida	checker mallow
Sidalcea neomexicana	checker mallow
Sidalcea spp.	checker mallow
Sium suave	hemlock water-parsnip
Smilacina racemosa	false solomon-seal
Smilacina stellata	false solomon-seal
Solidago canadensis	canada goldenrod
Solidago gigantea var. serotina	giant goldenrod

Appendix 2A. Yampa River Basin plant species, continued.

Forbs, continued.

Solidago nana	dwarf goldenrod
Sonchus arvensis ssp. uliginosus	field sow-thistle
Stachys palustris	marsh betony
Stellaria longifolia	long-stalked starwort
Stellaria obtusa	starwort
Streptopus amplexifolius	clasping twisted-stalk
Suaeda calceoliformis	broom seepweed
Swertia perennis	star gentian
Taraxacum officinale	dandelion
Thalictrum fendleri	fendler meadowrue
Thalictrum sparsiflorum	montane meadowrue
Thelypodium integrifolium	mustard
Thermopsis rhombifolia	golden pea, golden banner
Thlaspi arvense	candytuft
Thlaspi montanum	candytuft
Tithymalis uralensis	spurge
Toxicodendron rydbergii	poison ivy
Tragopogon dubius	oyster-plant, salsify
Trifolium hybridum	alsike clover
Trifolium longipes var. brachypus	Rydberg clover
Trifolium pratense	red clover
Trifolium repens	white clover, dutch white clover
Trifolium species	clover species
Trillium ovatum	wake-robin
Trollius laxus	globeflower
Urtica dioica ssp. gracilis	stinging nettle
Valeriana edulis	valerian
Valeriana occidentalis	valerian
Veratrum tenuipetalum	false hellebore
Verbascum thapsus	woolly mullein
Veronica americana	American brooklime
Veronica catenata	speedwell
Veronica serpyllifolia	thyme-leaf speedwell
Veronica wormskjoldii	Wormskjold speedwell
Vicia americana	American vetch
Viola adunca	blue violet
Viola canadensis	canada violet
Viola epipsila	violet
Viola praemorsa	nuttall violet
Viola spp.	violet species
Xanthium strumarium	cocklebur

Appendix 2A. Yampa River Basin plant species, continued.

Horsetails

Equisetum arvense	meadow horsetail
Equisetum hyemale	common scouringrush
Equisetum laevigatum	smooth scouringrush
Equisetum variegatum	variegated scouringrush
Equisetum spp.	scouringrush, horsetail species

Appendix 2B. San Miguel/Dolores River Basin plant species scientific (based on Kartez and Kartez 1988, except for *Salix* spp., which are based on Dorn 1977) and common names.

Scientfic name	Common name
Trees	
Abies lasiocarpa	subalpine fir
Acer negundo	box elder
Celtis laevigata var. reticulata	hackberry
Fraxinus anomala	single-leaf ash
Juniperus osteosperma	Utah juniper
Juniperus scopulorum	Rocky Mountain juniper
Juniperus spp.	juniper species
Picea engelmannii	Engelmann spruce
Picea pungens	Colorado blue spruce
Pinus edulis	pinyon pine
Pinus ponderosa	ponderosa pine
Populus angustifolia	narrowleaf cottonwood
Populus deltoides ssp. wislizenii	Rio Grande cottonwood
Populus tremuloides	quaking aspen
Populus x acuminata	hybrid between P.deltoides and P. angustifolia
Pseudotsuga menziesii	Douglas-fir
Quercus gambelii	Gambel's oak
Salix gooddingii	black willow
Ulmus pumila	Siberian elm
Willows	
Salix bebbiana	Bebb's willow
Salix brachycarpa	barren-ground willow
Salix drummondiana	Drummond's willow
Salix exigua	coyote willow, sandbar willow
Salix geyeriana	Geyer's willow
Salix ligulifolia	"yellow willow"
Salix lasiandra var. lasiandra	Pacific willow, whiplash willow
Salix lutea	yellow willow
Salix monticola	Rocky Mountain willow
Salix planifolia	plainleaf willow, planeleaf will
Salix wolfii	Wolf's willow
Salix spp.	willow species
Shrubs	
Acer glabrum	Rocky Mountain maple
Alnus incana ssp. tenuifolia	thinleaf alder
Amelanchier alnifolia	serviceberry, shadbush
Amelanchier utahensis	Utah serviceberry
Artemisia tridentata	big sagebrush
Berberis fendleri	Fendler barberry

Appendix 2B. San Miguel/Dolores River Basin plant species, continued.

Shrubs, continued.	
Betula occidentalis	water birch, river birch
Chrysothamnus linifolius	spreading rabbitbrush
Chrysothamnus nauseosus	rubber rabbitbrush
Chrysothamnus spp.	rabbitbrush species
Chrysothamnus viscidiflorus	viscid rabbitbrush
Clematis ligusticifolia	white virgins-bower
Clematis spp.	virgins-bower species
Cornus sericea	red-osier dogwood
Crataegus rivularis	river hawthorn
Forestiera pubescens	desert olive, wild privet
Gutierrezia sarothrae	broom snakeweed
Humulus lupulus	hops
Juniperus communis	common juniper
Lonicera involucrata	black twinberry, bush honeysuckl
Mahonia repens	Oregon grape, creeping mahonia
Pachistima myrsinites	mountain lover
Potentilla fruticosa	shrubby cinquefoil
Prunus virginiana	chokecherry
Rhus trilobata	skunkbrush
Ribes aureum	golden currant
Ribes cereum	wax currant
Ribes coloradense	Colorado currant
Ribes inerme	whitestem gooseberry
Ribes lacustre	swamp black gooseberry
Ribes montigenum	gooseberry currant
Rosa woodsii	woods rose
Rubus discolor	Himalayan blackberry
Rubus idaeus	red raspberry
Rubus spp.	raspberry species
Sambucus racemosa var. microbotrys	red elderberry
Shepherdia argentea	silver buffaloberry
Symphoricarpos rotundifolius	snowberry
Tamarix ramosissima	tamarisk, salt cedar
Toxicodendron rydbergii	poison ivy
Vaccinium myrtillus	dwarf bilberry, blueberry
Graminoids	
Agropyron spp.	wheatgrass species
Agrostis exarata	spike bentgrass
Agrostis gigantea	redtop
Agrostis scabra	ticklegrass
Agrostis stolonifera	redtop

Appendix 2B. San Miguel/Dolores River Basin plant species, continued.

Graminoids, continued.	
Agrostis spp.	bentgrass species
Bromus ciliatus	fringed brome
Bromus inermis	smooth brome
Bromus japonicus	Japanese chess
Bromus lanatipes	brome grass
Bromus tectorum	cheatgrass
Bromus spp.	brome species
Calamagrostis canadensis	bluejoint reedgrass
Carex aquatilis	water sedge
Carex aurea	golden sedge
Carex bella	beautiful sedge
Carex capillaris	hair sedge
Carex emoryi	sedge
Carex foenea	sedge
Carex geyeri	elk sedge
Carex interior	inland sedge
Carex lanuginosa	woolly sedge
Carex microptera	small-wing sedge
Carex nebrascensis	Nebraska sedge
Carex norvegica	Scandinavian sedge
Carex parryana	sedge
Carex rostrata	beaked sedge
Carex spp.	sedge species
Dactylis glomerata	orchard grass
Deschampsia cespitosa	tufted hairgrass
Distichlis spicata var. stricta	desert saltgrass
Eleocharis palustris	creeping spikerush
Elymus canadensis	Canada wildrye
Elymus elymoides	squirreltail
Elymus glaucus	blue wildrye
Elymus lanceolatus ssp. lanceolatus	thickspike wheatgrass
Elymus trachycaulus	slender wheatgrass
Elytrigia repens	quackgrass
Festuca arundinacea	tall fescue
Festuca brachyphylla ssp. coloradensis	fescue
Festuca pratensis	meadow fescue
Festuca thurberi	Thurber fescue
Glyceria striata	fowl mannagrass
Holcus lanatus	Yorkshirefog velvetgrass
Hordeum jubatum	foxtail barley
Hordeum murinum ssp. glaucum	rabbit barley

Appendix 2B. San Miguel/Dolores River Basin plant species, continued.

Graminoids, continued.	
Juncus articulatus	jointed rush
Juncus balticus	baltic sedge, wiregrass
Juncus saximontanus	rush
Juncus tenuis	poverty rush
Juncus tracyi	Tracy's rush
Juncus spp.	rush species
Leymus cinereus	Great Basin wildrye
Luzula parviflora	millet woodrush
Muhlenbergia asperifolia	scratchgrass
Muhlenbergia racemosa	green muhly
Oryzopsis hymenoides	Indian ricegrass
Oryzopsis micrantha	littleseed ricegrass
Panicum virgatum	switchgrass
Pascopyrum smithii	western wheatgrass
Phalaris arundinacea	reed canarygrass
Phleum pratense	timothy
Phragmites australis	common reed
Poa alpina	alpine bluegrass
Poa fendlerana	muttongrass
Poa leptocoma	bluegrass
Poa pratensis	Kentucky bluegrass
Poa spp.	bluegrass species
Schizachyrium scoparium	little bluestem
Scirpus validus	softstem bulrush
Scirpus americanus	Olney threesquare, bulrush
Scirpus microcarpus	panicled bulrush
Scirpus pallidus	bulrush
Scirpus tabernaemontanii	bulrush
Sphenopholis obtusata	prairie wedgegrass
Sporobolus airoides	alkali saccaton
Trisetum spicatum var. majus	spike trisetum
Typha latifolia	broad-leaved cattail
Forbs	
Achillea millefolium	yarrow
Aconitum columbianum	monkshood
Actaea rubra	baneberry
Allium geyeri	Geyer onion
Angelica grayi	angelica
Angelica spp.	angelica
Antennaria parvifolia	common pussytoes
Antennaria species	pussytoes spp.

Appendix 2B. San Miguel/Dolores River Basin plant species, continued.

Forbs, continued.

Apiaceae spp.	parsley family species
Apocynum cannabinum	dogbane
Apocynum x floribundum	dogbane
Aquilegia coerulea	Colorado columbine
Aquilegia elegantula	elegant columbine
Arctium minus	burdock
Arnica cordifolia	heartleaf arnica
Arnica mollis	hairy arnica
Artemisia ludoviciana	Louisiana wormwood
Asclepias speciosa	showy milkweed
Asparagus officinalis	asparagus
Aster foliaceus	leafybract aster
Aster glaucodes	blueleaf aster
Aster laevis	smooth aster
Asteraceae spp.	sunflower family species
Astragalus wingatanus	Fort Wingate milkvetch
Barbarea spp.	wintercress species
Bidens frondosa	devil's beggarticks
Brachyactis ciliata	aster
Brassicaceae spp.	mustard family species
Brickellia grandiflora	tasselflower
Caltha leptosepala	marsh marigold
Calystegia sepium ssp. americana	hedge bindweed
Cardamine cordifolia	heartleaf bittercress
Castilleja miniata	scarlet paintbrush
Castilleja rhexiifolia	rhexia-leaved paintbrush
Castilleja sulphurea	paintbrush
Cerastium fontanum	mouse-ear chickweed
Chenopodium spp.	goosefoot species
Cicuta douglasii	water hemlock
Cirsium parryi	Parry thistle
Cirsium spp.	thistle species
Conioselinum scopulorum	hemlock-parsley
Corallorhiza striata	spotted coralroot
Cymopteris bulbosus	onion spring-parsley
Delphinium barbeyi	Barbey larkspur
Delphinium spp.	larkspur species
Descurainia spp.	tansymustard species
Disporum trachycarpum	bellwort
Draba aurea	golden draba
Draba cana	draba

Appendix 2B. San Miguel/Dolores River Basin plant species, continued.

Forbs, continued.	
Draba spectabilis	splendid draba
Draba spp.	draba species
Dugaldia hoopesii	orange sneezeweed
Epilobium angustifolium	fireweed
Epilobium hornemannii	willow-herb
Epilobium spp.	willow-herb species
Epipactis gigantea	helleborine
Erigeron concinnus var. concinnus	daisy
Erigeron coulteri	Coulter daisy
Erigeron divergens	spreading daisy
Erigeron engelmannii	Engelmann daisy
Erigeron eximius	daisy
Erigeron speciosus	Oregon daisy, showy daisy
Erigeron spp.	daisy species
Erodium cicutarium	storksbill
Eupatorium maculatum	Joe-Pye weed
Fabaceae spp.	pea family, legume family specie
Fragaria vesca ssp. americana	starvling strawberry
Fragaria virginiana	mountain strawberry
Fragaria spp.	wild strawberry species
Frasera speciosa	green gentian, monument plant
Galium boreale	northern bedstraw
Galium coloradoense	bedstraw
Galium triflorum	sweet-scented bedstraw
Galium spp.	bedstraw species
Gaura coccinea	scarlet gaura
Gentiana affinis	Rocky Mountain gentian
Gentianaceae spp.	gentian family species
Gentianella amarella ssp. acuta	northern gentian
Geranium richardsonii	Richardson geranium
Geranium spp.	geranium species
Geum aleppicum	erect avens
Geum macrophyllum	large-leaved avens
Glycyrrhiza lepidota	licorice
Hedysarum boreale	northern sweetvetch
Helianthus rigidus	sunflower
Heracleum lanatum	cow parsnip
Heterotheca villosa	hairy goldenaster
Hydrophyllum fendleri	Fendler waterleaf
Hypericum scouleri ssp. nortoniae	St. Johnswort
Ipomopsis aggregata	scarlet gilia

Appendix 2B. San Miguel/Dolores River Basin plant species, continued.

Forbs, continued.

Lactuca spp.	wild lettuce species
Lesquerella rectipes	Colorado bladderpod
Leucanthemum vulgare	ox-eye daisy
Ligusticum porteri	lovage, osha
Lupinus bakeri ssp. amplus	lupine
Lupinus spp.	lupine species
Medicago lupulina	black medick
Medicago sativa	alfalfa
Melilotus alba	white sweet-clover
Melilotus officinalis	yellow sweet-clover
Mentha arvensis	field mint
Mertensia ciliata	mountain bluebell, chiming bells
Mertensia franciscana	Flagstaff bluebell
Mertensia spp.	bluebell species
Mimulus guttatus	common monkey-flower
Mitella pentandra	fivestar miterwort
Mitella stauropetala var. stenopetala	smallflower miterwort
Moehringia lateriflora	Moehringa's chickweed
Moehringia macrophylla	Moehringa'a chickweed
Monarda fistulosa	beebalm, horsemint
Moneses uniflora	one-flowered wintergreen
Nasturtium officinale	water cress
Nepeta cataria	catnip
Oenothera elata	Hooker evening primrose
Osmorhiza depauperata	blunt-fruit sweet cicely
Oxypolis fendleri	Fendler cowbane
Pastinaca sativa	parsnip
Pedicularis groenlandica	elephant-head, elephantella
Pedicularis procera	Gray lousewort
Pedicularis racemosa	leafy lousewort, parrotbeak
Penstemon whippleanus	Whipple penstemon
Plantago lanceolata	English plantain
Plantago major	common plantain, broadleaf plant
Platanthera stricta	slender bog-orchid
Podistera eastwoodiae	umbell
Polemonium foliosissimum	leafy Jacob's ladder
Polemonium viscosum	viscid Jacob's ladder
Polemonium spp.	Jacob's ladder species
Polygonum bistortoides	American bistort
Potentilla anserina	common silverweed
Potentilla gracilis	slender cinquefoil

Appendix 2B. San Miguel/Dolores River Basin plant species, continued.

Forbs, continued.	
Potentilla pulcherrima	cinquefoil
Potentilla spp.	cinquefoil species
Prunella vulgaris	heal-all
Pseudocymopteris montanus	mountain parsley
Pseudostellaria jamesiana	tuber starwort
Pyrola americana	swamp wintergreen, liverleaf win
Pyrola minor	lesser wintergreen
Pyrola spp.	wintergreen species
Ranunculus acriformis	sharp buttercup
Ranunculus cymbalaria	marsh buttercup
Ranunculus macounii	Macoun buttercup
Ranunculus ranunculinus	little buttercup
Ranunculus uncinatus	buttercup
Ranunculus spp.	buttercup species
Rorippa palustris	yellowcress
Rorippa spp.	yellowcress species
Rudbeckia laciniata	cutleaf coneflower
Rumex crispus	curly dock
Saxifraga odontoloba	brook saxifrage, foamflower
Scutellaria galericulata	skullcap
Sedum integrifolium	king's crown, roseroot
Sedum rhodanthum	queen's crown, pink stonecrop
Senecio bigelovii	Bigelow groundsel
Senecio crassulus	thick groundsel
Senecio dimorphophyllus	different groundsel
Senecio integerrimus	gauge plant
Senecio neomexicanus var. mutabilis	groundsel
Senecio serra	saw groundsel
Senecio streptanthifolius	manyface groundsel
Senecio triangularis	arrowleaf groundsel
Senecio spp.	groundsel species
Silene menziesii	Menzies campion
Sisymbrium altissimum	Jim Hill mustard
Smilacina racemosa	false solomon-seal
Smilacina stellata	false solomon-seal
Solidago altissima	tall goldenrod
Solidago canadensis	Canada goldenrod
Solidago spp.	goldenrod species
Stellaria longifolia	long-leaved starwort
Stellaria longipes	long-stalked starwort
Stellaria spp.	starwort

Appendix 2B. San Miguel/Dolores River Basin plant species, continued.

Forbs, continued.	
Streptopus amplexifolius	clasping twisted-stalk
Swertia perennis	star gentian
Taraxacum officinale	dandelion
Tetraneuris ivesiana	aster
Thalictrum fendleri	Fendler meadowrue
Thalictrum species	meadowrue species
Thermopsis rhombifolia var. montana	golden pea, golden banner
Thlaspi montanum	candytuft
Tragopogon spp.	oyster plant, salsify species
Trifolium pratense	red clover
Trifolium repens	white clover, white Dutch clover
Trifolium spp.	clover species
Urtica dioica ssp. gracilis	stinging nettle
Valeriana acutiloba var. acutiloba	valeriana
Veratrum californicum	false hellebore
Verbascum thapsus	woolly mullein
Veronica americana	American brooklime
Veronica catenata	speedwell
Veronica wormskjoldii	Wormskjold speedwell
Vicia americana	American vetch
Viola canadensis	Canada violet
Viola spp.	violet species
Horsetails	
Equisetum arvense	meadow horsetail
Equisetum hyemale	common scouringrush
Equisetum laevigatum	smooth scouringrush
Equisetum variegatum	variegated scouringrush