

Routt National Forest Riparian Vegetation Classification

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EXECUTIVE SUMMARY

In 1993, the Colorado Natural Heritage Program (CNHP) entered into a cost share agreement with the Routt National Forest (Forest) to produce a classification of the riparian vegetation on the Forest. Vegetation and environmental data were collected from 195 plots or transects. Cluster analysis, and to a limited extent, ordination were used to group plots into plant associations. Data from the Forest were compared to data from plant associations described in the literature. Thirty-nine riparian plant associations were identified on the Forest including nine conifer dominated plant associations, two deciduous forest plant associations, eighteen shrub dominated plant associations, and ten herbaceous plant associations. Descriptions of plant association's vegetation and environment are included as are stand tables. Closely related or synonymous plant associations and the geographic range are noted along with information on management, rarity, imperilment, or succession where available. A key to riparian plant associations is presented.

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INTRODUCTION

This study of riparian vegetation on the Routt National Forest (Forest) is part of a larger effort to inventory riparian vegetation statewide in Colorado. The Colorado Natural Heritage Program (CNHP) and The Nature Conservancy are working to develop, through cooperation of state and federal agencies and private organizations, a classification of Colorado vegetation at the plant associations level. The term inventory, as used by CNHP, describes the process of determining which plant associations occur as repeating units on the landscape and their relative abundance, and is not a quantification of the land area occupied by a certain plant association. Thus far, inventories following CNHP methodology have been conducted in the Yampa, San Miguel, Dolores, White, Gunnison, and upper Colorado River watersheds. This project will complement the Routt National Forest's remote sensing project by providing classification of existing riparian vegetation and ground truth points, and is an opportunity to expand upon the previously mentioned work in western Colorado, especially that done by Kittel and Lederer (1993) in the Yampa River basin. The project will also complement a nationwide vegetation classification being developed by The Nature Conservancy's Natural Heritage Programs.

This report consists of descriptions of the plant associations sampled during the two field seasons on the Forest. A key to plant associations from the study area is included. Information gathered from the Forest will be important for understanding montane and other high elevation riparian areas and will be included in the statewide classification. Identification of riparian areas of high ecological significance is valuable for Forest Plan revisions because these areas can be recommended for special management status or used as baseline monitoring sites to evaluate the effects of different management activities. High quality riparian areas can provide specific information for making knowledgeable land use decisions in the short term, between Forest Planning periods.

Forest Service Regional staff participates on an inter-agency Riparian Task Force, composed of state and federal land managers and researchers, and representatives of private organizations, that serves as an advisory board and steering committee for the project. The Task Force provides a vehicle for communication and cooperation across agencies and private organizations in a common effort to understand, protect and manage Colorado's riparian resources.

This classification system will enable land managers to identify riparian plant associations and begin to understand the ecological influences on these associations. This in turn will assist with adjusting management goals and strategies where necessary to achieve management objectives. Sites containing highly significant riparian natural communities (rare plant associations or high quality examples of common associations) have been identified and may be recommended for special management status.

Colorado's Natural Heritage Program

The Colorado Natural Heritage Program is in the latest stage of a seventeen year development. Building on a solid base of biodiversity information, CNHP was relocated from the Division of Parks and Outdoor Recreation into the University of Colorado Museum in the spring of 1992, and then to Colorado State University in the fall of 1994. With an increased staff, the Program is revitalized and updating comprehensive information on the rare or imperiled species and significant ecosystems in Colorado. The multi-disciplinary team of scientists and information managers gather information and incorporate it into the continually updated databases. CNHP is part of an international network of conservation data centers that use the Biological and Conservation Databases (developed by The Nature Conservancy). Concentrating on site-specific data for each element of natural diversity, the accurate status of each element is known. The mapped data illustrate sites that are important to the conservation of Colorado's natural biological diversity. By using the element ranks and the quality of each occurrence, priorities can be established for the protection of the most sensitive sites. It is by having an updated locational database and priority-setting system that CNHP can provide its most effective, proactive land-planning tools.

The information gathered by CNHP is on species and natural communities (plant associations). Each of these significant natural features (species and plant associations) is an **element of natural diversity**, or simply an **element**. Each element is assigned a rank that indicates its relative rarity on a five-point scale (1 = extremely rare; 5 = abundant; Table 1).

The primary criterion for ranking elements is the **number of occurrences**, i.e. the number of known distinct localities or populations. Also of great importance is the number of individuals at each locality or, for highly mobile organisms, the total number of individuals. Other considerations include the **condition of the occurrences**, the number of protected occurrences, and threats. However, the emphasis remains on the number of occurrences such that ranks are an index of known biological rarity. These ranks are assigned both in terms of the element's rarity within Colorado (its State or S-rank) and the **element's rarity over its entire range (its Global or G-rank)**. Taken together, these two ranks give an instant picture of the rarity of the element. Information gathered from the Routt National Forest will be used to update global and state ranks. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species are listed as endangered or threatened, and Natural Heritage rarity ranks should not be interpreted as legal designations.

The spot on the landscape that supports a particular population of a specific species or a specific stand of a given community type is an **element occurrence**. The CNHP has mapped over 5,000 element occurrences in Colorado. Information on the location and quality of these element occurrences is also entered into the computerized Biological and Conservation Databases (BCD). This computer system, developed by The

Nature Conservancy, is utilized by the international network of heritage programs and conservation data centers. All centers utilize the same methodology, allowing a unique, direct comparison of information throughout the area covered.

Table 1. Definition of Natural Heritage state rarity ranks. Global rarity ranks are similar, but refer to a species' rarity throughout its 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 S2N is used.
SU	Status uncertain, often because of low search effort or cryptic nature of the element.
SX	Apparently extirpated from the state.
S?	Some information exists which suggests that the rank may need to be reevaluated.

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 community, the **condition** or naturalness of the habitat, the long-term **viability** of the population or community, and the **defensibility** (ease or difficulty of protecting) the occurrence. Given the intimate relationship between a natural community and its environment, community occurrences are largely ranked in terms of their size and condition.

STUDY AREA DESCRIPTION

The Routt National Forest is located in the northwestern portion of Colorado and is part of the Southern Rocky Mountain and Wyoming Basin Physiographic provinces (Fenneman 1931). The Forest has been strongly affected by glacial activity that occurred during the Pleistocene. The various glacial effects include morainal deposits, glacial debris deposits, scraped, un-weathered bedrock, and the formation of numerous, small basins through glacial drift deposition. Poorly developed soils are common due to the predominance of coarse-textured parent material that is mostly granite, gneiss, and schist (Bunin 1975). The Forest lies within the Northern Parks and Ranges and the North Central Highlands and Rocky Mountain Sections of the Temperate Steppe Regime of Bailey's Ecoregions (Bailey et al. 1994).

The climate of the Forest is generally characterized by long, cold, moist winters, and short, cool, drier summers. The winter weather is dominated by Pacific northwest air masses which result in the majority of the precipitation falling as snow during the six coldest months (Bunin 1975). Precipitation increases with elevation and ranges from about 20 inches in the lower elevations to more than 60 inches in the higher elevations (Colorado Climate Center). The temperatures of the Forest are characterized by wide diurnal and annual ranges. The growing season is short, and freezing temperatures have been recorded for every month. The precipitation that occurs during the late spring and summer months comes from local convective thunderstorms and Gulf of Mexico air masses.

Bunin (1975) described the upland vegetation of the Forest along four elevation zones. The low elevation zone reaches up to 2,300 meters (7,545 feet) elevation and is a shrubland mosaic consisting mostly of Quercus gambelii, Amelanchier alnifolia, Artemisia tridentata, Prunus virginiana, and Symphoricarpos albus. Between 2,300 meters (7,500) and 2,440 meters (8,000 feet) elevation the shrubland dominance diminishes and Populus tremuloides becomes more evident. On the north-facing slopes of this zone, Pseudotsuga menziesii occurs on steep slopes with thin soils. The north-facing slopes also contain Abies lasiocarpa-Picea engelmannii forests. Between 2,440 meters (8,005 feet) and 2,670 meters (8,760 feet) elevation, Populus tremuloides stands are abundant along with Abies lasiocarpa-Picea engelmannii communities and a variety of shrubby and herbaceous growth. Pinus contorta stands dominate the forest up to 2,895 meters (9,500 feet) elevation. In the southern portion of the Forest, Abies lasiocarpa-Picea engelmannii stands are the dominant vegetation in the higher elevational zones (Bunin 1975).

Use of the area by people of European ancestry began in the 1820's, mostly by fur trappers. In 1875, the first ranch in Steamboat Springs was established, and in 1900 the town was incorporated. In 1908 the Routt National Forest was established. Since settlement of the area by European people, there have been three major disturbances; a significant fire and two Engelmann spruce beetle outbreaks. The fire

occurred in 1879 and burned a large portion of the forest between Buffalo and Rabbit Ears Passes. There is still scarce tree reproduction in some of the areas that burned the hottest, and were therefore subject to severe erosion (Bunin 1975). The two spruce beetle outbreaks occurred in 1850 and between 1945-1952. Both outbreaks killed most of the dominant Engelmann spruce trees as well as a significant amount of lodgepole pine. Successful regeneration of the spruce-fir community occurred after each outbreak (Bunin 1975). The spruce kill of 1850 may have provided abnormally high amounts of fuel for the 1879 fire (Wilford 1967 unpublished as cited in Bunin 1975).

Other disturbances on the Routt National Forest include extensive sheep and cattle grazing, increased human recreation, and logging. Sheep grazing began on the Forest in 1907, and as early as 1914, overgrazing by sheep was reported by the Forest supervisor for some areas. However, intensive sheep grazing continued to increase until 1945 when the first steps were taken to reduce the amount of use by sheep. Erosion was a serious problem throughout the forest as a result of overgrazing. Cattle grazing was a less significant source of disturbance due to the amount of terrain on the Forest considered unsuitable for cattle which limited use to lower elevations. Grazing has impacted primarily the deciduous vegetation types of the Forest (Bunin 1975). Moose (*Alces alces*) have been introduced into the area and are expanding their range. This may be a significant source of disturbance to riparian vegetation, particularly willow carrs, through browsing.

Human use of the area has increased significantly in the last several decades. Road building for development and recreational purposes has increased the depth of human intrusion into the Forest. Skiing and snowmobile use are extensive along these roads (Bunin 1975).

METHODS

For the purposes of this project, a riparian area is defined as the land between the riverine aquatic ecosystem and the adjacent upland ecosystem. These areas include strips of vegetation that occur along natural water courses (creeks and rivers), poorly drained overflow areas, and associated natural bodies of water, such as oxbow lakes. Wetlands are those areas that are inundated by surface or ground water with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetation or aquatic life requiring saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds. This classification will focus on streams and wetlands as defined on U.S. Geological Survey 7.5" topographic maps and the Routt National Forest riparian/wetland remote sensing delineations.

Vegetation was examined along perennial, intermittent, and ephemeral streams and isolated wetlands within the boundaries of the Routt National Forest. Vegetation and environmental data were collected from 195 plots or transects.

Representative site selection

The main purpose of the study was to describe the riparian vegetation types that occur on the Forest and the range of variability of these types. Once these types (or plant associations) are identified, efforts can be made to begin to gain an understanding of the ecological processes that influence the vegetation. For this reason a random stratified sampling approach was used. The study area was stratified using variables thought to strongly influence the vegetation. The variables chosen with input from Forest staff were elevation, stream order, and drainage basin. Elevation was used as a surrogate for climatic variables and was divided into following ranges: 7,000-9,000 feet (2,135-2,745 m), 9,000-11,000 feet (2,745-3,355 m) and > 11,000 feet (3,355 m). Stream order was used as a surrogate for the hydrologic regime. The study area was also stratified by major river drainage basins (the Yampa, the North Platte, and Colorado) to get geographic replication. Sampling sites were distributed within the study area in approximately the same proportions as that type of environment occurred on the landscape. For example, if 15% of the streams on the Forest were second order streams at 9,000-11,000 feet (2,745-3,355 m) elevation, that type of environment received approximately 15% of the sampling sites. The relative abundance of plant associations on the Forest may be approximated by the number of stands sampled in each type. Less common environmental situations were sampled more frequently where possible in an attempt to obtain adequate representation.

Color IR (1:40,000) aerial photographs were used in conjunction with field reconnaissance and information from Forest staff to locate relatively undisturbed, representative stream reaches appropriate for sampling. Sites that appeared to have the

greatest variation in vegetation over the smallest area were chosen. This was done in an effort to sample the greatest range of variation with the most efficient use of time and other resources. Sites that appeared to be drastically altered by human activity were rejected because those sites would contribute little to the understanding of the ecological influences on the vegetation. Drastically altered sites are those sites no longer dominated by native vegetation and/or natural ecological processes. Such areas include crop land, hay meadows dominated by exotic species, roadsides, dumping grounds, and livestock holding sites.

By distributing sample sites throughout the study area and collecting information on the physical environment at each site, it is anticipated that composition and structure of the riparian vegetation can be associated with physical environmental factors (such as elevation, stream gradient, etc.), disturbances (flooding), and land use (Jones 1990). This helps to enhance the understanding of the most important factors that influence riparian vegetation.

Vegetation and environmental data collection

Field data were collected so as to be compatible with the Forest Service Ecodata format. This will allow analysis of the data at a local level (Routt National Forest) and also at a regional or larger scale. At each candidate sample site, the field team determined if the site met two criteria for sampling: 1) lack of drastic disturbance; and 2) presence of a relatively homogeneous stand large enough to sample without crossing significant ecotones. If the site was acceptable, both site and stand(s) data were collected for as many as possible of the different riparian plant associations present on the site.

For example, a site might include a .5 - 1 mile reach of stream and within that site there could be several stands of vegetation. Within each stand, data (vegetation and environmental data) were collected to represent that stand. Each stand is an example of a plant association and an element of biodiversity tracked by CNHP. A plant association is defined as existing natural vegetation with definite floristic composition, and uniform physiognomy and habitat. Each stand was also evaluated in terms of quality, condition, viability, and defensibility and ranked in terms of biodiversity significance. Sites with high biodiversity significance may be considered for inclusion as Research Natural Areas, Special Interest Areas or could be utilized as baseline ecological monitoring sites.

During the 1993 field season square or rectangular macro-plots were used to sample vegetation. Sample plots were usually between 100-400 m² in size depending on the physiognomy of vegetation to be sampled. The size and shape of the plot was adjusted to fit within a homogeneous stand of vegetation. Generally 100 m² plots were used to sample graminoid dominated stands, 200 m² plots to sample shrub dominated stands, and 400 m² to sample tree dominated stands. During the 1994 field season the

line-intercept method was used with 20 x 50 centimeters micro-plots to sample vegetation. A transect length of 50 m was used with 16 micro-plots placed at set intervals along the transect. Both methods yield an estimate of biomass and it was felt that using micro-plots increased the accuracy of the cover estimates.

Macro-plots and transects were subjectively located within a homogeneous portion of each community so as to represent the plant association at the site. In some instances, stringer-type sites were so narrow that elongated plots were used. Data collected from individual plots were: plant species present; canopy cover by species and life-form (trees, shrubs, etc.); ground cover of bare soil, litter, wood, gravel, rock, bryophyte, and non-vascular plants; soil description based on one soil pit in each stand location (noted for each horizon are: thickness, texture, color, mottling/gleying, matrix color, coarse fragments, depth to water table, overall thickness, and parent material (if possible)). The hydrologic (including flooding) environment of each plot was characterized by measuring floodplain width, channel width and depth, height and distance of each plot from the bankfull stage (the high water mark), stream gradient, landscape position (point bar, floodplain, old channel, terrace, etc.), wildlife or domestic livestock utilization, disturbance (fire, windthrow, logging, etc.), successional relationships where trends were observed, and adjacent upland communities. Photographs of each site and plot were taken.

Classification

All classification is based on existing vegetation. The riparian classification is a hierarchical arrangement of vegetation units, based on physiognomic type, series, and plant association. The highest level, physiognomic type, includes six categories, depending on the plants dominating the tallest vegetation layer: evergreen trees, deciduous trees, evergreen shrubs, deciduous shrubs, graminoids, and forbs. Physiognomic types can be equated to the wetland class and subclass categories of Cowardin et al. (1979), such as Needle-leaved Evergreen Forested Wetlands and Persistent Emergent Wetlands.

Within each of these physiognomic types, vegetation units are grouped into series according to the dominant species in the tallest vegetation layer. For example, the deciduous shrub category contains alder and various willow dominated types, among others. This level falls under Cowardin's dominance types, and is similar to the riparian dominance types of Montana (Hansen et al. 1988).

Each dominance-ecological type is further subdivided into plant associations. Associations are recognized according to specific groups of species which occur together repeatedly on the landscape and differ substantially in plant species composition from other groups. Plant associations are named after one or two dominant and/or diagnostic plant species in the community, and are distinguished by floristic and structural similarities in both overstory and undergrowth characteristics (Youngblood et

al. 1985, Padgett et al. 1989, Bourgeron and Engelking 1994).

For this report, cluster analysis, comparison with published descriptions of known types, and to a limited extent, ordination were used to group stands into plant associations. Cluster analysis and ordination were used to help develop the classification and form preliminary groups of similar plots, but those results are not the classification itself. Three dendrograms from the cluster analysis are presented, one for forested types, one for shrub types, and one for herbaceous dominated types. Several plots that were transitional between major physiognomic types were analyzed in both types, therefore all plots shown on the dendrogram may not have been placed in that physiognomic type in the final classification. In addition, because of computer program limitations, species with less than 4% cover were not included in the cluster analysis. The final decision on placement of the plots into an association were made subjectively by comparing vegetation and environmental data to the published data. When the data seemed to compare closely to the previously described type, that published name is used. Plant associations not closely similar to previously described types that were sampled with only a few plots are considered tentative plant associations or classified to the series level only. Further data collection and analysis may help to determine the status of these plant associations.

The Western Heritage Task Force of The Nature Conservancy has published a vegetation classification for the western United States (Bourgeron and Engelking 1994). This classification incorporates and updates information from published literature, and from information gathered by Natural Heritage Programs in the western United States. This document is the most comprehensive review of the vegetation data since Johnston's 1987 publication on the plant associations of U.S.F.S. Region 2.

RESULTS

Key to Routt National Forest Riparian Plant Associations

This key is intended to be a general guideline and was developed from data collected at relatively undisturbed sites. Within each plant association there is a certain amount of natural variability (and possibly effects of historic disturbance) that may not be specifically represented in the key. For example, some stands of forested vegetation may not always contain 20% tree cover, although the group of plots representing that plant association usually does contain at least 20% tree cover.

When trying to classify the vegetation at a site several steps should be followed:

1) Use the key to try to get to a specific plant association, 2) see if the description of the plant association (vegetation, environment, range, etc.) corresponds to that at the site being examined, 3) check the stand tables in the appendix to see if the vegetation at the site is similar to sampled stands. If the stand in question does not correspond to any known plant association it is either a type that was not sampled by the CNHP crews or a site that has been at least moderately disturbed by anthropogenic activity.

Because the key was developed from data collected at relatively undisturbed sites keying out disturbed communities will be more difficult. Knowledge of historic conditions (i.e. willows were present in the past) could be used to make assumptions to get through the key. Also comparing the environmental situation at the site to those in the descriptions may help to classify the site. Both of these methods may help narrow down the list of the plant associations that could be at a site but may not lead to a definitive classification.

Key to Groups:

- | | |
|--|---------|
| 1. Tree overstory present, usually with at least 20% cover | 2 |
| 1. Tree overstory absent or less than 20% cover | 3 |
| 2. Coniferous trees dominate the overstory | Group A |
| 2. Deciduous trees (<u>Populus tremuloides</u>) dominate the overstory | Group B |
| 3. Shrubs dominate the overstory, usually with at least 20% cover | 4 |
| 3. Shrubs not dominating the overstory | Group E |

4. Salix species dominate the overstory Group C
4. Other shrub species dominate the overstory Group D

Key to Plant Associations:

Group A: Coniferous Dominated Forests and Woodlands

1. Abies lasiocarpa and/or Picea engelmannii dominate the overstory, Populus angustifolia absent or minor 2
1. Picea pungens or other coniferous trees dominate the overstory 3
2. Alnus incana and/or Salix drummondiana dominate the understory vegetation 4
2. Herbaceous species or Ribes species dominate the understory 5
3. Picea pungens dominant or co-dominant in the overstory, Alnus incana dominates the shrub layer. Picea pungens/Alnus incana p.a.
3. Not as above Unclassified Conifer stands
4. Alnus incana and Salix drummondiana (occasionally other Salix species) present, usually with combined cover > 40%. Abies lasiocarpa/Alnus incana-Salix drummondiana p.a.
4. Not as above 5
5. Ribes species present, usually with at least 20% cover Abies lasiocarpa-Picea engelmannii/Ribes species p.a.
5. Not as above 6
6. Equisetum arvense the dominant herbaceous species Picea engelmannii/Equisetum arvense p.a.
6. Not as above 7
7. Actaea rubra the dominant forb Abies lasiocarpa-Picea engelmannii/Actaea rubra p.a.
7. Not as above 8

8. Mesic forbs, usually including Caltha leptosepala, Cardamine cordifolia, and Senecio triangularis, dominating the understory with combined cover (often > 40%) greater than shrub cover. Abies lasiocarpa/Mertensia ciliata p.a.

8. Graminoids dominate the understory 9

9. Carex aquatilis dominates the understory Picea engelmannii/Carex aquatilis p.a.

9. Not as above 10

10. Calamagrostis canadensis dominates the understory Abies lasiocarpa/Calamagrostis canadensis p.a.

10. Not as above Unclassified Conifer stands

Group B: Deciduous Dominated Woodlands

1. Populus tremuloides dominates the overstory, dense Alnus incana shrub canopy present Populus tremuloides/Alnus incana p.a.
1. Populus tremuloides dominates the overstory, dense mesic forb layer present, shrubs a minor component Populus tremuloides/Mesic forb p.a.

Group C: Willow Dominated Deciduous Shrublands

Generally, willow species on the Routt National Forest are somewhat predictable in their distribution. In higher elevation (usually above 2,745 m [9,000 feet]), open valleys, Salix planifolia is the most dominant species, usually on sites with the water table near the surface most of the summer and highly organic soils. Salix wolfii occurs in similar situations but also occurs at lower elevations (down to 2,440 m [8,000 feet]) than Salix planifolia. Salix brachycarpa also tends to be common at higher at similar elevations as Salix planifolia, but tends to occur in narrower valleys. Salix geyeriana is most common below 2745 m (9,000 feet) and often occurs in beaver influenced systems. Salix boothii is most common from 2,405 to 2,590 m (7,900 to 8,500 feet) and is also often associated with beaver influenced systems. Although these are the most common willows found on Forest, they may occur in environmental situations not sampled and other species may be common.

1. Dominant willows are of low stature (.5-1.5 m), generally subalpine to alpine environments 2
1. Dominant willows are of tall stature (>1.5 m), generally lower subalpine to montane environments 6
2. Salix brachycarpa dominates, occasionally with Salix planifolia co-dominant Salix planifolia-Salix brachycarpa/Mesic forb p.a.
2. Salix wolfii or Salix planifolia dominant 3
3. Salix wolfii dominates the shrub layer, Carex aquatilis dominates the understory Salix wolfii/Carex aquatilis p.a.
3. Not as above 4
4. Salix wolfii dominates the shrub layer, mesic forbs dominate the understory Salix wolfii/Mesic forb p.a.
4. Salix planifolia dominates the shrub layer 5

5. Caltha leptosepala and other mesic forbs dominate the understory with greater cover than mesic graminoids Salix planifolia/Caltha leptosepala p.a.
5. Carex aquatilis dominates the understory Salix planifolia/Carex aquatilis p.a.
6. Salix drummondiana dominates the shrub layer, Calamagrostis canadensis dominates the understory Salix drummondiana-Salix planifolia/Calamagrostis canadensis p.a.
6. Salix geeyeriana and/or Salix monticola dominate the shrub layer 7
7. Salix geeyeriana and Salix monticola co-dominate the shrub layer Salix geeyeriana-Salix monticola/Mesic forb p.a.
7. Salix monticola is of minor importance 8
8. Mesic forbs dominate the understory Salix geeyeriana/Mesic forb p.a.
8. Graminoids dominate the understory 9
9. Carex aquatilis dominates the understory Salix geeyeriana/Carex aquatilis p.a.
9. Not as above 10
10. Carex utriculata dominates the understory Salix geeyeriana/Carex utriculata p.a.
10. Not as above 11
11. Calamagrostis canadensis dominates the understory Salix geeyeriana/Calamagrostis canadensis p.a.
11. Not as above Unclassified Willow stands

Group D: Non-Willow Dominated Deciduous Shrublands

1. Alnus incana dominates the shrub layer 2
1. Other species dominate the shrub layer 5
2. Mesic graminoids dominate the understory, Calamagrostis canadensis usually at least 10% cover, Carex species may co-dominate. Alnus incana/Calamagrostis canadensis p.a.
2. Not as above 3

3. Equisetum arvense dominates the understory Alnus incana/Equisetum arvense p.a.

3. Not as above 4

4. A mixture of mesic forbs dominates the understory Alnus incana/Mesic Forb p.a.

4. Not as above Unclassified Alnus incana stands

5. Pentaphylloides floribunda dominates the shrub layer, Deschampsia cespitosa present in the understory Pentaphylloides floribunda/Deschampsia cespitosa p.a.

5. Not as above 6

6. Betula glandulosa dominates the shrub layer Betula glandulosa Series

6. Not as above Unclassified shrub stands

Group E: Herbaceous Wetlands

1. Carex species and/or Deschampsia cespitosa dominate or co-dominate the vegetation, Eleocharis species minor or absent 2

1. Eleocharis species or forbs dominate the vegetation 9

2. Carex utriculata dominates the vegetation, Carex aquatilis is a minor component Carex utriculata p.a.

2. Other Carex species or Deschampsia cespitosa dominate the vegetation 3

3. Carex aquatilis dominates the vegetation, Carex utriculata and Deschampsia cespitosa present but significantly less abundant than Carex aquatilis Carex aquatilis p.a.

3. Not as above 4

4. Carex utriculata and Carex aquatilis co-dominate the vegetation Carex aquatilis-Carex utriculata p.a.

4. Not as above 5

5. Carex aquatilis and Deschampsia cespitosa co-dominate the vegetation
Deschampsia cespitosa-Carex aquatilis p.a. 6
5. Not as above
6. Deschampsia cespitosa the dominant species, other graminoids clearly less common
Deschampsia cespitosa p.a. 7
6. Not as above
7. Carex scopulorum dominates the vegetation Carex scopulorum-Caltha leptosepala p.a.
7. Not as above 8
8. Carex saxatilis dominates the vegetation Carex saxatilis p.a.
8. Not as above Unclassified Carex dominated stands
9. Eleocharis species dominate the vegetation 10
9. Other graminoids or forbs dominate the vegetation 11
10. Eleocharis quinqueflora dominates the vegetation, or co-dominates with Carex aquatilis
Eleocharis quinqueflora p.a.
10. Eleocharis palustris dominates the vegetation Eleocharis palustris p.a.
11. Calamagrostis canadensis dominates the vegetation Calamagrostis canadensis p.a.
11. Not as above 12
12. Mesic forbs dominate the understory with combined cover much greater than graminoids
Mesic forb stands
12. Not as above Miscellaneous herbaceous stands

Plant associations (p.a.) from the Routt National Forest which appear to be synonymous with previously described plant associations are listed as being very similar. For previously described plant associations, which are similar but not synonymous, it is listed as somewhat similar along with noted differences. In reality, each stand within a group represents a gradient of variation within that plant association. With more information and detailed analysis these groupings may change. In the case of plant associations with data from few stands, if existing types are well described in the literature then the previously published name is used. If the type appears to be undescribed, it is classified as a tentative plant association or to a series level until further information can be gathered. The term plot is used to refer to the area sampled (stand), this could have been done either using the macroplot or transect method.

For each plant association the following are described:

Name: Plant association (p.a.) name, plot number(s) representing the plant association, and the Natural Heritage Program global and state rarity rank (from Bourgeron and Engelking 1994 or from the CNHP database) for plant associations tracked by CNHP (see Table 1 for a brief explanation of the ranking system).

Related Types: Plant associations described in the literature or from other sources are listed and the similarity to the Routt National Forest plant association is briefly discussed.

Distribution: The geographic range from which the plant association has been reported in available literature.

Environment: General environmental setting from published literature is discussed followed by the environmental setting in which the plant association is found on the Routt National Forest.

Vegetation: A general description of the vegetation is provided listing the dominant and/or diagnostic species.

Succession/Management: Information from published literature or from field observations concerning succession or management is provided. Included in this section are general ecology comments and may include information on rarity, research needs, or relationships or differences from other plant associations.

Adjacent Riparian Plant Associations: Plant associations which occurred adjacent to or in a mosaic with the described plant association on the Forest are listed. This is highly variable and dependent on the geomorphology, hydrology, and other environmental factors at the site. It should not be assumed that other associations can not occur with the type.

DISTRIBUTION OF PLANT ASSOCIATIONS BY ELEVATION

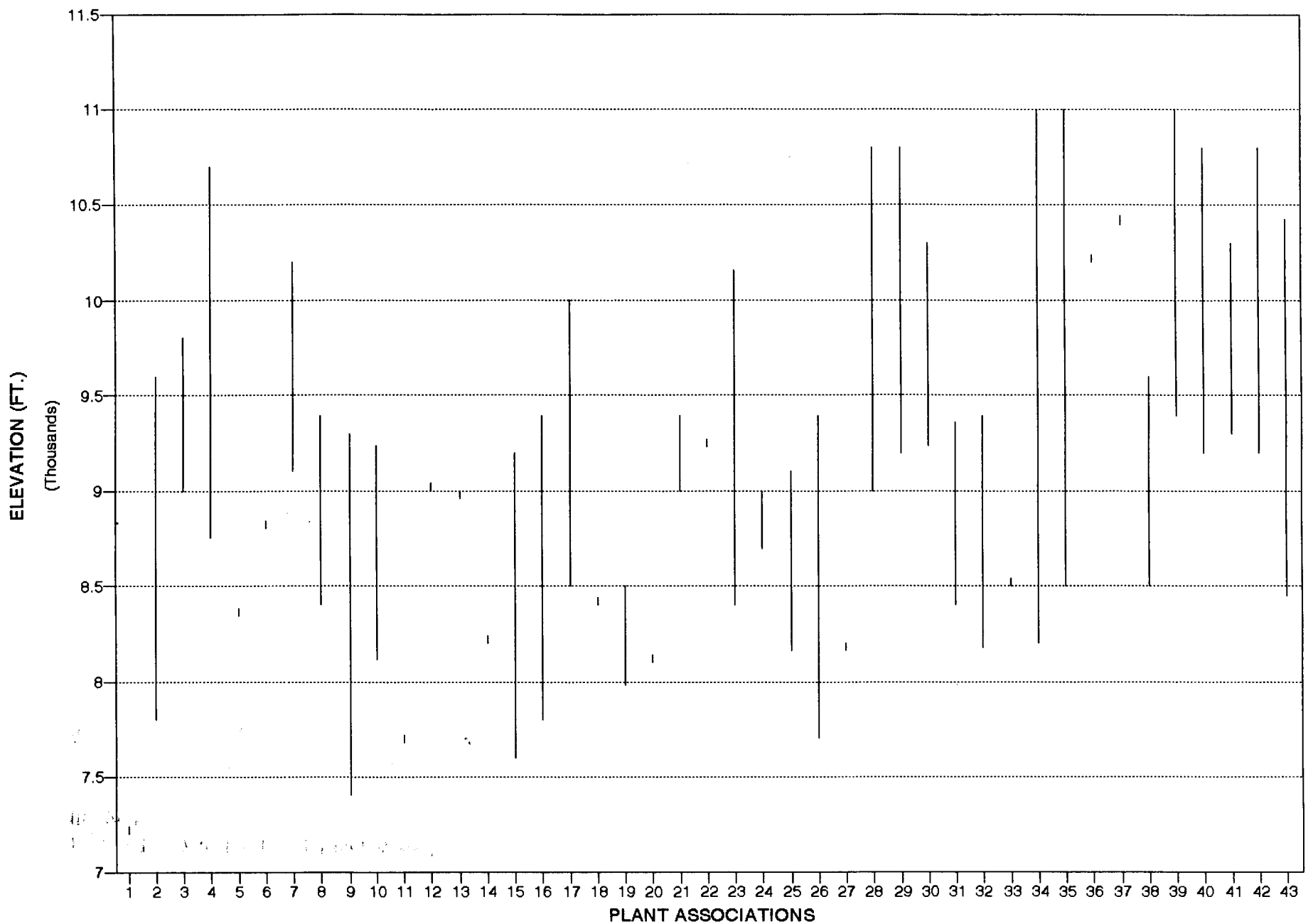
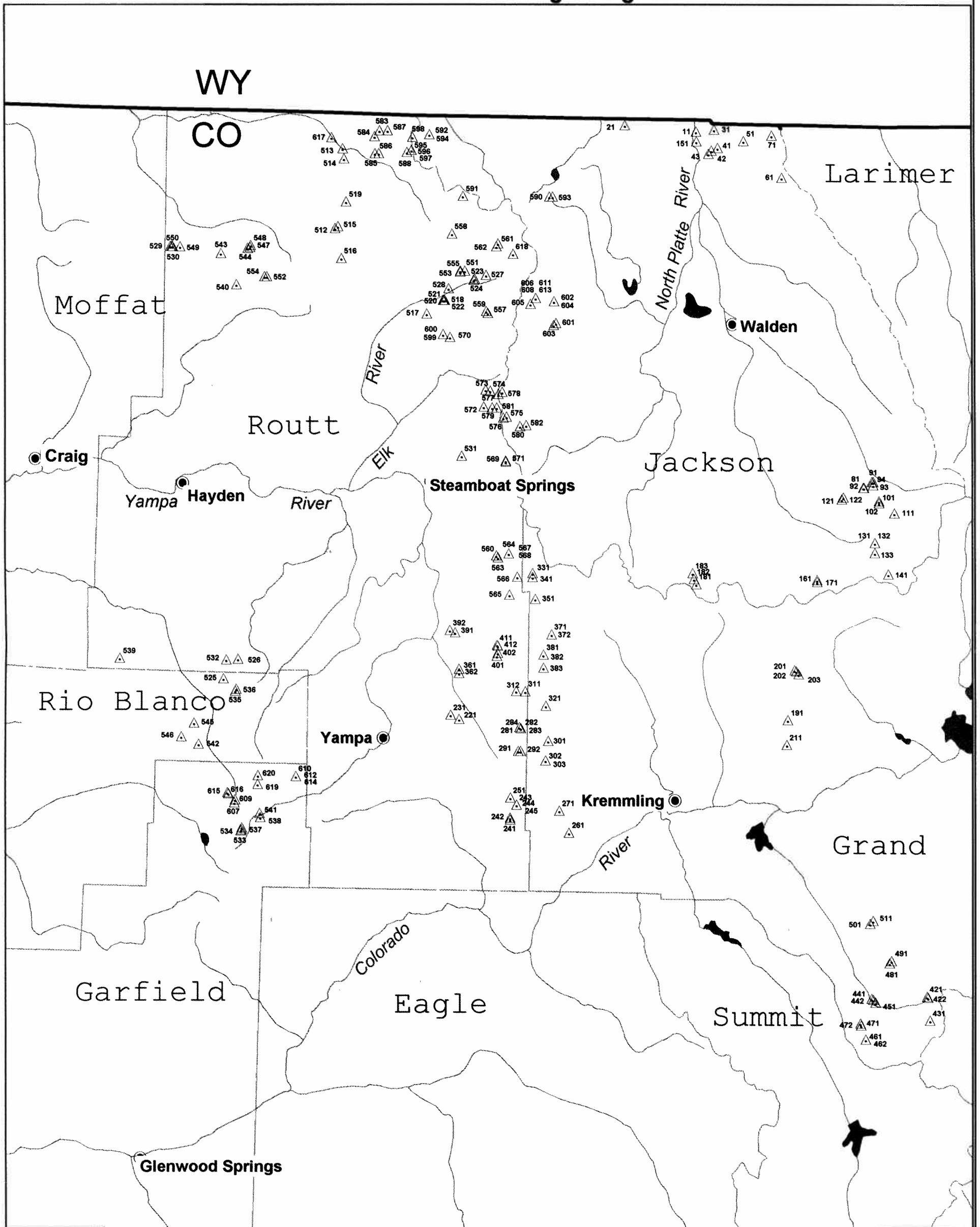


Figure 1. Distribution of Plant Associations by Elevation on the Routt National Forest. Listed in the order that they appear in the text.

1. *Abies lasiocarpa*/*Alnus incana*-*Cornus sericea* p.a.
2. *Abies lasiocarpa*/*Alnus incana*-*Salix drummondiana* p.a.
3. *Abies lasiocarpa*/*Calamagrostis canadensis* p.a.
4. *Abies lasiocarpa*/*Mertensia ciliata* p.a.
5. *Abies lasiocarpa*-*Picea engelmannii*/*Actaea rubra* p.a.
6. *Abies lasiocarpa*-*Picea engelmannii*/*Ribes* spp. p.a.
7. *Picea engelmannii*/*Carex aquatilis* p.a.
8. *Picea engelmannii*/*Equisetum arvense* p.a.
9. *Picea pungens*/*Alnus incana* p.a.
10. Unclassified Conifer Dominated Stands.
11. *Populus balsamifera* Series.
12. *Populus tremuloides*/*Alnus incana* p.a.
13. *Populus tremuloides*/*Mesic forb* p.a.
14. *Alnus incana*/*Equisetum arvense* p.a.
15. *Alnus incana*/*Mesic Forb* p.a.
16. *Alnus incana*/*Mesic Graminoid* p.a.
17. *Betula glandulosa* Series.
18. *Pentaphylloides floribunda*/*Deschampsia cespitosa* p.a.
19. *Salix boothii*/*Carex utriculata* p.a.
20. *Salix boothii*/*Mesic Forb* p.a.
21. *Salix drummondiana*-*Salix planifolia*/*Calamagrostis canadensis* p.a.
22. *Salix geyeriana*/*Calamagrostis canadensis* p.a.
23. *Salix geyeriana*/*Carex aquatilis* p.a.
24. *Salix geyeriana*/*Carex utriculata* p.a.
25. *Salix geyeriana*/*Mesic Forb* p.a.
26. *Salix geyeriana*-*Salix monticola*/*Mesic Forb* p.a.
27. *Salix lucida* ssp. *caudata*/*Mesic graminoid* p.a.
28. *Salix planifolia*/*Caltha leptosepala* p.a.
29. *Salix planifolia*/*Carex aquatilis* p.a.
30. *Salix planifolia*-*Salix brachycarpa*/*Caltha leptosepala* p.a.
31. *Salix wolfii*/*Carex aquatilis* p.a.
32. *Salix wolfii*/*Mesic Forb* p.a.
33. *Calamagrostis canadensis* p.a.
34. *Carex aquatilis* p.a.
35. *Carex aquatilis*-*Carex utriculata* p.a.
36. *Carex saxatilis* p.a.
37. *Carex scopulorum*-*Caltha leptosepala* p.a.
38. *Carex utriculata* p.a.
39. *Deschampsia cespitosa* p.a.
40. *Deschampsia cespitosa*-*Carex aquatilis* p.a.
41. *Eleocharis palustris* p.a.
42. *Eleocharis quinqueflora* p.a.
43. *Mesic Forb* Stands

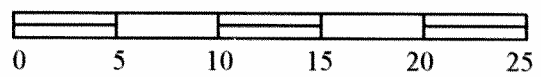
Riparian Sampling Sites, Routt National Forest, Colorado

Colorado Natural Heritage Program



Riparian Sampling Sites

Miles



Evergreen Forests

Abies lasiocarpa Series

Abies lasiocarpa/Alnus incana-Cornus sericea p.a. - plot 617. Heritage rank - GU/SU.

Subalpine fir/thinleaf alder-red-osier dogwood riparian forest

Related Types: This plant association is somewhat similar to the Conifer/Cornus sericea plant association described by Padgett et al. (1989) and the Picea/Cornus stolonifera plant association described by Youngblood et al. (1985).

Distribution: This plant association has been described from eastern Idaho, western Wyoming (Youngblood et al. 1985), and Utah (Padgett et al. 1989).

Environment: This plant association occurs on terraces immediately adjacent to streams with moderate gradients at elevations from 2,010 to 2,285 meters (6,600-7,500 feet) in Utah, Idaho, and western Wyoming (Youngblood et al. 1985, Padgett et al. 1989).

On the Routt National Forest one stand representing this plant association was sampled at 2,195 meters (7,200 feet) elevation adjacent to a low gradient stream. The soil is loamy accumulated on and around exposed boulders. This is very different from the soil descriptions in Padgett et al. (1989).

Vegetation: Abies lasiocarpa is the dominant tree species in this association, although Populus angustifolia may be an important component in some stands (Padgett et al. 1989). Alnus incana and Cornus sericea form a dense shrub canopy. The understory is usually sparsely vegetated.

Succession/Management: The dense shrub layer may prevent livestock access to this plant association, but Cornus sericea tends to decrease with heavy grazing (Kittel and Lederer 1993). The structural diversity created by the shrubs provides habitat for small mammals and birds, and cover for wild ungulates. Deciduous trees within this plant association may represent a slightly earlier successional stage that will change to a conifer overstory (Padgett et al. 1989).

Adjacent Riparian Communities: Unknown

Abies lasiocarpa/Alnus incana-Salix drummondiana p.a. - plots 191, 211, 361, 412, 518, 528, 545, 556, 582, 587, 601, 602, 611. Heritage rank - G3/S3?

Subalpine fir/thinleaf alder-Drummond's willow riparian forest

Related Types: This plant association is very similar to the Picea engelmannii-Abies lasiocarpa/Alnus incana ssp. tenuiflora plant association described by Kittel and Lederer (1993) and the Abies lasiocarpa-Picea engelmannii/Alnus incana ssp. tenuiflora-Lonicera involucrata-Salix drummondiana plant association described by Baker (1989).

Distribution: This plant association has been described from the western slope of Colorado from Rocky Mountain National Park to the San Juan Mountains (Baker 1989, Kittel and Lederer 1993).

Environment: Kittel and Lederer (1993) describe this plant association as occurring in steep, narrow valleys adjacent to the channel in both the Yampa River drainage and the San Miguel/Dolores River drainages in western Colorado.

On the Routt National Forest, this plant association occurs at elevations from 2,380 to 2,925 meters (7,800-9,600 feet) in narrow valleys along high gradient streams where the riparian-upland interface is abrupt. Soils have a loamy or sandy surface horizon and often have a gravel or cobble layer near the surface.

Vegetation: Abies lasiocarpa and Picea engelmannii dominate the overstory and usually form a dense canopy (> 20% cover). Alnus incana usually dominates the shrub layer, often with 50% or greater cover. Salix drummondiana ranges from completely absent to co-dominant in some cases, and Salix geeyeriana may also be common. Salix drummondiana and Salix geeyeriana seem to occupy similar environmental situations under conifer overstories on the Routt National Forest. A wide diversity of forbs and graminoids are common in the understory. The occurrence of this association at the abrupt riparian-upland interface often results in a mixture of mesic species such as Carex species, Heracleum lanatum, or Aconitum columbianum, and more xeric species such as Vaccinium species.

Succession/Management: Baker (1989) notes some elevational influences on the distribution of Alnus incana and Salix drummondiana, and also that this plant association is used heavily by elk in the summer.

Adjacent Riparian Plant Associations: Calamagrostis canadensis, Carex aquatilis, Salix boothii/Carex utriculata, Salix boothii/Mesic forb, Salix geeyeriana/carex aquatilis, Salix planifolia/Caltha leptosepala, Abies lasiocarpa/Mertensia ciliata.

Abies lasiocarpa/Calamagrostis canadensis p.a. - plots 292, 301, 441. Heritage rank G5/SU.

Subalpine fir/bluejoint reedgrass riparian forest

Related Types: This plant association is similar to the Picea/Calamagrostis canadensis plant association described by Youngblood et al. (1985) and the Conifer/Calamagrostis canadensis plant association described by Padgett et al. (1989). However, Padgett et al. (1989) describe the plant association as commonly containing Pinus contorta, yet there was no Pinus contorta in the Routt National Forest stands. It is also very similar to the Abies lasiocarpa-Picea engelmannii/Calamagrostis canadensis plant association reported by Johnston (1987).

Distribution: This common and widely distributed plant association has been described from Montana, western Wyoming, eastern Idaho, and Northern Utah (Youngblood et al. 1985, Johnston 1987, and Padgett et al. 1989). In Colorado, this association has been reported from the Routt, Arapaho, Roosevelt, White River and Gunnison National Forests (Johnston 1987).

Environment: This plant association occurs on moist stream terraces and pond margins on slopes of up to 20% at elevations from 1,830 to 2,775 meters (6,000-9,100 feet) in Wyoming and Montana (Johnston 1987) and at elevation from 2,590 to 3,200 meters (8,500-10,500 feet) in Utah (Padgett et al. 1989). The soils may be saturated during late spring and summer (Johnston 1987).

On the Routt National Forest, this plant association occurs on terraces above narrow, moderate gradient streams at elevations from 2,745 to 2,985 meters (9,000-9,800 feet). This plant association usually occurs in wide valleys. Soils are generally sandy near the surface and have a gravel or cobble layer within 50 centimeters of the surface.

Vegetation: Picea engelmannii is the dominant tree species with most stands also containing significant amounts of Abies lasiocarpa (15-40% combined cover). Lonicera involucrata is common. Calamagrostis canadensis is the dominant graminoid in this plant association (20-30% cover). Equisetum arvense, Streptopus fassettii, Heracleum lanatum and Carex species commonly occur in this plant association.

Succession/Management: Youngblood et al. (1985) state that this is a late seral stage community. Padgett et al. (1989) report that in the Uinta Mountains pinebark beetle kill of Pinus contorta has resulted in the water table raising causing Vaccinium species to be replaced by Calamagrostis canadensis. Hansen et al. (1989) report that grazing during wet times of the year can churn the soil and limit conifer establishment, and that protection of the water source is a major consideration for any management activity.

Adjacent Riparian Plant Associations: Carex utriculata, Salix planifolia-Salix brachycarpa/Caltha leptosepala, Salix drummondiana-Salix planifolia/Calamagrostis canadensis.

Abies lasiocarpa/Mertensia ciliata p.a. - plots 141, 161, 183, 312, 341, 401, 422, 431, 471, 491, 501, 529, 542, 544, 557, 572, 575, 580, 589, 593. Heritage rank - G5/S3?

Subalpine fir/mountain bluebell riparian forest

Related Types: This plant association is very similar to the Abies lasiocarpa-Picea engelmannii/Mertensia ciliata and Abies lasiocarpa-Picea engelmannii/Senecio triangularis plant associations reported by Johnston (1987), the Abies lasiocarpa-Picea engelmannii/Cardamine cordifolia-Mertensia ciliata-Senecio triangularis plant association described by Baker (1989), and the Conifer/Aconitum columbianum plant association described by Padgett et al. (1989).

Distribution: This plant association has been described from Utah (Padgett et al. 1989), northwestern New Mexico and the San Juan and San Isabel National Forests of Colorado (Johnston 1987), as well as from the San Miguel/Dolores River, Colorado River and White River basins Colorado (Kittel and Lederer 1993, Kittel et al. 1994).

Environment: This plant association occurs adjacent to narrow, high gradient streams. The width of the riparian area is usually narrow. It also occurs on seeps with steep, north-facing slopes. It occurs at elevations from 2,440 to 3,200 meters (8,000-10,500 feet) (Johnston 1987, Baker 1989, Kittel et al. 1994).

On the Routt National Forest this plant association occurs on terraces in narrow valleys adjacent to moderate to high gradient streams at elevations from 2,670 to 3,260 meters (8,760-10,700 feet). Soils are sandy or silty loams with a cobble or gravel layer within 40 centimeters of the surface.

Vegetation: Picea engelmannii and Abies lasiocarpa are the dominant tree species in this plant association (usually > 30% combined cover). Alnus incana and Salix drummondiana are common shrub species in this plant association but rarely exceed 20% cover. Calamagrostis canadensis or various Carex species are occasionally present, but never dominate the understory. Mesic forbs are very abundant and usually have greater total cover (typically 20-50% cover) than do the shrubs. Mertensia ciliata is almost always present, but the understory is usually dominated by a mixture of mesic forbs including Mertensia ciliata, Senecio triangularis, Cardamine cordifolia, Micranthes odontoloma, Caltha leptosepala, and Trollius laxus.

Succession/Management: Dominance by Populus tremuloides, Pseudotsuga menziesii, or Pinus contorta may represent earlier seral stages of this type (Padgett et al. 1989). This plant association often occurs as a very narrow band at the riparian upland interface.

Adjacent Riparian Plant Associations: Salix geyeriana/Mesic forb, Salix geyeriana-Salix monticola/Mesic forb, Salix planifolia/Caltha leptosepala, Salix planifolia/Carex aquatilis, Abies lasiocarpa/Alnus incana-Salix drummondiana.

Abies lasiocarpa-Picea engelmannii/Actaea rubra p.a.- plot 527. Heritage rank - G4/SU.

Subalpine fir-Engelmann spruce/baneberry riparian forest

Related Types: This plant association is very similar to the Conifer/Actaea rubra plant association described by Padgett et al. (1989) and the Abies lasiocarpa-Picea engelmannii/Actaea rubra plant association reported by Johnston (1987).

Distribution: This plant association has been described from western Wyoming, southeastern Idaho, and Utah (Johnston 1987, Padgett et al. 1989).

Environment: This plant association occurs on stream terraces immediately adjacent to the channel and extending up the surrounding north-facing lower to midslopes at elevations from 1,830 to 1,745 meters (6,000-9,000 feet) (Johnston 1987).

On the Routt National Forest, one stand representing this plant association was sampled at 2,540 m (8,340 feet) in elevation adjacent to a narrow, moderate gradient stream. The soil contains a shallow loam horizon over a sand and gravel layer.

Vegetation: Abies lasiocarpa and Picea engelmannii are the co-dominant tree species in this plant association. The shrub layer is dominated by Ribes lacustre. Graminoid cover is sparse. Actaea rubra is the dominant forb although there are a variety of mesic to more xeric forbs present.

Succession/Management: This plant association may represent marginal riparian conditions and is a link in the gradual interface between riparian and upland communities and conditions. Padgett et al. (1989) state that this is a climax type and that the presence of Populus tremuloides, Populus angustifolia, or Alnus incana indicates succession from deciduous overstories to one dominated by conifers.

Abies lasiocarpa-Picea engelmannii/Ribes spp. p.a. - plot 604. Heritage rank - GU/SU.

Subalpine fir-Engelmann spruce/currant riparian forest

Related Types: This plant association is very similar to the Abies lasiocarpa-Picea engelmannii/Ribes spp. plant association reported by Johnston (1987).

Distribution: This plant association has been reported from southern Montana, Wyoming, Utah, northern Nevada, and east-central New Mexico. In Colorado, this plant association has been reported on the Gunnison, White River, Pike, and San Juan National Forests (Johnston 1987).

Environment: This plant association occurs on rolling plateaus and moderate to steeper slopes at elevations from 2,560 to 2,955 meters (8,400-9,700 feet) in Wyoming, and at elevations from 2,650 to 3,720 meters (8,700-12,200 feet) in Colorado.

On the Routt National Forest, one stand representing this plant association was sampled at 2,680 meters (8,800 feet) in elevation.

Vegetation: Abies lasiocarpa and Picea engelmannii dominate the overstory of this plant association. Ribes inerme dominates the shrub layer in this stand, although other Ribes species are reported by Johnston (1987). The understory is sparsely vegetated by various forbs.

Succession/Management: Unknown

Picea engelmannii Series

Picea engelmannii/Carex aquatilis p.a. - plots 93, 122. Heritage rank - GU/SU.

Engelmann spruce/water sedge riparian forest

Related Types: This plant association is somewhat similar to the Abies lasiocarpa/Carex aquatilis plant association described by Cooper and Cottrell (1990) and the Picea engelmannii/Caltha leptosepala plant association reported by Johnston (1987).

Distribution: A similar plant association has been described by Cooper and Cottrell (1990) from the northern Colorado Front Range and reported by Johnston (1987) from western Wyoming and northeastern Utah.

Environment: This plant association occurs on cold sites along streambanks and terraces at elevation from 2,500 to 2,895 meters (8,200-9,500 feet) in Wyoming and from 2,805 to 3,320 meters (9,200-10,900 feet) in Utah on perpetually saturated soils. On the Colorado Front Range, this association occurs on the margins of subalpine willow carrs and sedge fens (Cooper and Cottrell 1990).

On the Routt National Forest, two stands representing this plant association were sampled with differing environmental conditions. One stand occurs on a saturated, wide meadow with an indirect water source at 2,775 meters (9,100 feet) in elevation. The soil is highly organic. The second stand occurs adjacent to a moderate gradient, narrow stream at 3,110 meters (10,200 feet) in elevation on a sandy clay loam.

Vegetation: Picea engelmannii is the dominant overstory species in this plant association. Shrubs are a minor component. The herbaceous layer is dominated by Carex aquatilis. Few other forb or graminoid species occur in abundance in this association.

Succession/Management: In Colorado, Cooper and Cottrell (1990) describe this association as occurring on unusual environmental situations and uncommon on the Colorado Front Range. This plant association usually occurs in a small patch or linear band along the stream.

Adjacent Riparian Plant Associations: Salix drummondiana-Salix planifolia/Calamagrostis canadensis, Salix geyeriana/Mesic forb, Salix planifolia/Carex aquatilis, Picea engelmannii/Equisetum arvense.

Picea engelmannii/Equisetum arvense p.a. - plots 94, 451, 481, 550. Heritage rank - G5/S2.

Engelmann spruce/scouring rush riparian forest

Related Types: This plant association is very similar to the conifer/Equisetum arvense plant association described by Padgett et al. (1989). It is also somewhat similar to the Picea pungens-Picea engelmannii/Equisetum arvense plant association described by Johnston (1987). Cooper and Cottrell (1990) also describes a Picea engelmannii/Equisetum arvense plant association that is very similar.

Distribution: This plant association has been described from Utah, Montana, Idaho, Western Wyoming (Youngblood et al. 1985, Johnston 1987, Padgett et al. 1989), and Colorado (Johnston 1987, Cooper and Cottrell 1990).

Environment: This plant association occurs on gently sloping stream terraces or seeps on generally north-facing slopes. The water table is high and occasionally the association occurs in standing water (Youngblood et al. 1985, Johnston 1987, and Padgett et al. 1989). It occurs at elevations from 1,890 meters (6,200 feet) in Wyoming to 3,080 meters (10,100 feet) in Colorado (Johnston 1987).

On the Routt National Forest this plant association occurred on low terraces adjacent to streams of low to moderate gradient at elevations from 2,560 to 2,865 meters (8,400-9,400 feet). Soils were sandy with a gravel layer near the surface.

Vegetation: Picea engelmannii is the dominant tree species in this plant association. Alnus incana is usually present with approximately 10% cover. Graminoids are of minor importance. Equisetum arvense is the dominant forb (20-30% cover), although other mesic forbs may be common.

Succession/Management: In Utah, Idaho, and western Wyoming, Padgett et al. (1989) consider this plant association to be a late seral to climax stage community. The soil type and high soil moisture creates low stability for timber use and high potential for soil compaction. It has little grazing value to livestock but supports a wide variety of bird and small mammal species due to the structural complexity (Youngblood et al. 1985, Padgett et al. 1989).

On the Colorado Front Range, Cooper and Cottrell (1990) consider this association more of an early seral type that is dependent on flood disturbance (deposition of sand and silt) to maintain the understory dominance of Equisetum arvense.

Adjacent Riparian Plant Associations: Salix drummondiana-Salix planifolia/Calamagrostis canadensis, Picea engelmannii/Carex aquatilis.

Picea pungens Series

Picea pungens/Alnus incana p.a. - plots 81, 221, 231, 372, 391, 392. Heritage rank - G3/S3.

Colorado Blue spruce/thinleaf alder riparian forest

Related Types: This plant association is very similar to the Picea pungens/Alnus incana spp. tenuiflora plant association described by Kittel and Lederer (1993) and by Baker (1989). Johnston (1987) also reports a similar Picea pungens/Alnus incana plant association.

Distribution: This plant association has been described from western Wyoming, and northern New Mexico (Johnston 1987). In Colorado, it is known from the White River, Gunnison, San Juan, and Routt National Forests (Johnston 1987, Baker 1989) as well as the Yampa and San Miguel/Dolores River basins (Kittel and Lederer 1993).

Environment: This plant association occurs in narrow, steep, valley bottoms with northerly aspects between 1,860 to 2,805 meters (6,100-9,200 feet) in elevation (Baker 1989, Kittel and Lederer 1993). It has also been described on north to northeast facing slopes adjacent to gentle mid-sized creeks to small rivers from 2,135 to 2,590 meters (7,000-8,500 feet) in elevation (Johnston 1987).

On the Routt National Forest, this association occurs adjacent to streams with moderate to high gradients at elevations from 2,255 to 2,835 meters (7,400-9,300 feet). This association was more common below 2,440 meters (8000 feet) elevation. The riparian area width is generally narrow. Soils are sandy, often with a cobble or boulder layer within 50 centimeters of the surface.

Vegetation: Picea pungens is the dominant tree species (10-60% cover) in this plant association, although Populus tremuloides and Abies lasiocarpa may co-dominate. Alnus incana is the dominant shrub species (10-40% cover). Equisetum arvense and Streptopus fassettii are common forb species in this plant association but are usually present in low abundance.

Succession/Management: This appears to be a long-lived, late seral stage riparian plant association due to its occurrence on old point bars. Mature coniferous communities are subject to the cyclical destruction by river channel migration (Kittel and Lederer 1993).

Adjacent Riparian Plant Associations: Salix geyeriana/Carex aquatilis.

Unclassified Conifer Dominated Stands - plots 515, 523, 555, 560, 584

These stands occurred as narrow riparian areas along a forested upland or in areas with highly variable microtopography. This may explain the unusual mixture of Pinus species with the Salix species. These stands are not classified to the plant association level.

Four stands were sampled with an overstory dominated by Pinus contorta and one was dominated by Pinus flexilis. The understories are dominated by various Salix species (Salix boothii, Salix brachycarpa, Salix geeyeriana, or Salix wolfii and mesic forbs or graminoids (see stand tables for more detailed information). Soils have sand, gravel or cobble layers near the surface of the Pinus contorta stands.

These stands may represent cases where stream migration has caused the water table to be near the surface in places where Pinus contorta became established in the past or narrow riparian areas where the riparian-upland interface is abrupt. These stands may be successional to various willow or other plant associations.

Deciduous Forests

Populus balsamifera Series - plot 539. Heritage rank - GU/SU.

Balsam poplar riparian forest

Related Types: This plant association may be somewhat similar to the Populus balsamifera/Cornus sericea plant association reported by Johnston (1987) from Saskatchewan. The shrub and herbaceous layers in this stand are quite different from the type reported in Saskatchewan.

Distribution: A similar plant association has been reported from southern Saskatchewan (Johnston 1987). Populus balsamifera has a limited distribution in Colorado but several similar stands have been observed in Colorado (G. Kittel personal communication).

Environment: This stand occurs at 2,340 meters (7,680 feet) elevation on the Routt National Forest. The soil is a silt loam with mottles present at a depth of 34 centimeters.

Vegetation: Populus balsamifera dominates the overstory with 23% cover. The shrub layer is dominated by Salix drummondiana with 33% cover. The herbaceous layer is dominated by a dense mixture of mesic forbs with Heracleum lanatum, Osmorhiza depauperata, Hydrophyllum fendleri, and Geranium richardsonii being the most common.

Succession/Management: This stand may represent an ecological equivalent to a Populus angustifolia type. This stand is similar to a plot sampled in the Gunnison River Basin except that the stand on the Routt National Forest contained Salix drummondiana instead of Alnus incana in the shrub layer. The forb layer is very similar (G. Kittel - personal communication).

Populus tremuloides Series

Populus tremuloides/Alnus incana p.a. - plot 535. Heritage rank - GU/SU.

Aspen/thinleaf alder riparian forest

Related Types: This stand is very similar to the Populus tremuloides/Alnus incana ssp. tenuifolia plant association described by Kittel et al. (1994), however on the stand sampled on the Routt National Forest there is no Calamagrostis canadensis, while in the plant association described by Kittel et al. (1994) there are significant amounts of Calamagrostis canadensis.

Distribution: This plant association has been described only from the Upper Colorado River Basin (Kittel et al. 1994).

Environment: In the Upper Colorado River Basin, this plant association occurs at elevation from 2,575 to 2,925 meters (8,440-9,600 feet), in narrow valleys along high gradient, first and second order streams (Kittel et al. 1994).

On the Routt National Forest, a single stand representing this plant association was sampled at 2,745 meters (9,000 feet) elevation along a steep, narrow stream.

Vegetation: Populus tremuloides is the dominant tree species in this association. Alnus incana is the dominant shrub species, however, Salix drummondiana is also abundant. Mesic forbs are common in the understory.

Succession/Management: Populus tremuloides woodlands can be self perpetuating climax communities or seral stages to conifer climax communities. It is also a dominant species in both riparian and mesic sites. The impacts of grazing or other disturbances on this plant association are not well known (Kittel et al. 1994).

Populus tremuloides/Mesic forb p.a. - plot 525. Heritage rank - G5/S5.

Aspen/mesic forb riparian forest

Related Types: This plant association is somewhat similar to the Populus tremuloides/Heracleum lanatum plant association described by Hoffman and Alexander (1980) from the Routt National Forest of Colorado, however the mesic forb species were slightly different between the studies. It is also similar to the Populus tremuloides/Ligusticum spp. plant association reported by Johnston (1987).

Distribution: This plant association has been reported from Wyoming in the Medicine Bow National Forest (Johnston 1987). In Colorado it has been described from the White River, Routt, Arapaho, Roosevelt, Uncompahgre, San Juan, and San Isabel National Forests (Johnston 1987).

Environment: This plant association occurs on midslope terraces at elevations from 2,135 to 2,895 meters (7,000-9,500 feet) (Johnston 1987).

On the Routt National Forest, a single stand representing this plant association was sampled at 2,730 meters (8,960 feet) in elevation along a high gradient, very narrow stream. The stand is on a north-facing slope.

Vegetation: Populus tremuloides is the only tree species that occurs in the stand sampled on the Routt National Forest. There are a wide variety of mesic forbs and grasses in this stand, the most abundant being Delphinium barbeyi, Equisetum arvense, Poa pratensis, and Senecio triangularis.

Succession/Management: This association may have been undersampled because many consider this more of an upland type. This plant association provides high quality summer range for big game and sheep, and habitat for many non-game species. This plant association is considered productive for timber harvesting. Erosion is generally not a problem on the high quality sites, and there may be potential for increased streamflow with certain management techniques (Hoffman and Alexander 1980).

Deciduous Shrublands

Alnus incana Series

Alnus incana/Equisetum arvense p.a. - plot 261. Heritage rank - G3/S3.

Thinleaf alder/scouring rush riparian shrubland

Related Types: This plant association is very similar to the Alnus incana/Equisetum arvense plant association described by Padgett et al. (1989), and the Alnus incana ssp. tenuifolia-S. drummondiana/Equisetum arvense plant association reported by Johnston (1987).

Distribution: This plant association has been reported from Utah and southeastern Idaho (Padgett et al. 1989), and in Colorado from the Gunnison National Forest (Johnston 1987).

Environment: Padgett et al., (1989) describe this plant association as occurring adjacent to streams and in meadows at elevation from 1,800 to 2,500 meters (5,900-8,200 feet) in Utah.

On the Routt National Forest one stand representing this plant association was sampled at 2,475 meters (8,250 feet) elevation. The stand occurs on shallow sandy soils with mottles near the surface and a rock layer at 58 centimeters.

Vegetation: Alnus incana dominates the overstory of this plant association, which is usually dense. Several willow species may form a dense lower shrub layer in stands sampled in Utah and Idaho (Padgett et al. 1989). In the stand sampled on the Routt National Forest the understory was clearly dominated by Equisetum arvense. Heracleum lanatum was also present in moderate abundance.

Succession/Management: The dominance of Equisetum arvense in the understory seems to be an indication of recent scouring floods (Cooper and Cottrell 1990). With enough time between scouring floods and some deposition or litter accumulation, it is believed that this type may convert to the Alnus incana/Mesic Forb plant association. Padgett et al. (1989) state that streambank stabilization, stream shading, and bird habitat are values provided by this plant association.

Alnus incana/Mesic Forb p.a. - plots 42, 61, 202, 362, 513, 514, 517, 532, 540, 547, 549, 570, 583. Heritage rank - G3/S3.

Thinleaf alder/mesic forb riparian shrubland

Related Types: This plant association is very similar to the Alnus incana/Mesic Forb plant association described by Padgett et al. (1989). It is somewhat similar to the Alnus incana ssp. tenuifolia-S. drummondiana/Equisetum arvense plant association reported by Johnston (1987) except the stands on the Routt National Forest were clearly dominated by mesic forbs and had minor amounts of Equisetum arvense. Cooper and Cottrell (1990) describe an Alnus incana/Rudbeckia laciniata type that is somewhat similar.

Distribution: This plant association has been described from Utah and southeastern Idaho (Padgett et al. 1989). Johnston (1987) reports a plant association from the Gunnison National Forest that may be similar. Cooper and Cottrell (1990) describe a type from the northern Colorado Front Range that is somewhat similar.

Environment: Padgett et al., (1989) describe this plant association as occurring immediately adjacent to first to third orders streams at elevations from 1,705 to 2,805 meters (5,600-9,200 feet) in Utah and southeastern Idaho.

On the Routt National Forest, this plant association occurs at elevations from 2,315 to 2,805 (7,600-9,200 feet). Stands usually occur on shallow sandy soils with mottles near the surface and a gravel or cobble layer within 50 centimeters of the soil surface.

Vegetation: Alnus incana dominates the overstory of this plant association, which is usually dense. Several willow species, including Salix drummondiana, S. geyeriana, and S. lucida ssp. caudata may be important components of the shrub layer, often with greater than 50% cover. Graminoid cover is usually quite sparse. Forb cover is heavy, often with combined cover greater than 35%, and usually dominated by a mixture of mesic forbs, most commonly Heracleum lanatum, Mertensia ciliata, Aconitum columbianum, or Geranium richardsonii.

Succession/Management: Padgett et al. (1989) state that this type may be a stable community or successional to Picea engelmannii or Abies lasiocarpa dominated types. On the Routt National Forest, this plant association commonly occurs on narrow first order streams in small linear patches. Large continuous stands were less common but occasionally occur along larger stream in areas with a wider floodplain and/or areas with overflow channels.

Adjacent Riparian Plant Associations: Calamagrostis canadensis, Carex utriculata, Alnus incana/Mesic graminoid, Salix monticola/Mesic forb.

Alnus incana/Mesic Graminoid p.a. - plots 11, 597, 598. Heritage rank - G2G3/SU.

Thinleaf alder/mesic graminoid riparian shrubland

Related Types: This plant association is very similar to the Alnus incana/Mesic Graminoid plant association described by Padgett et al. (1989) and Jones (1992). Two (597, 598) of the three stands sampled were somewhat similar to the Alnus incana ssp. tenuifolia-Betula fontinalis/Salix spp. plant association reported by Johnston (1987).

Distribution: This plant association has been described from Utah and southeastern Idaho (Padgett et al. 1989) and from the Medicine Bow National Forest in Wyoming (Jones 1992). Johnston (1987) describes a similar plant association from northeast Colorado, the Arapaho and Roosevelt National Forests, eastern Idaho, northwest Wyoming.

Environment: Padgett et al., (1989) describe this plant association as occurring immediately adjacent to streams of all orders on soils that were developed from alluvium.

On the Routt National Forest this plant association occurs at elevation from 2,375 to 2,855 meters (7,800-9,400 feet). Two of the three stands (597, 598) occur on seeps not associated with a distinct stream channel, on soils with a lot of organic matter. The third stand occurs along the North Platte river and has mineral soils which are gleyed, indicating saturated conditions. This stand is a narrow (about 5 meters wide) band along the channel.

Vegetation: Alnus incana dominates the overstory of this plant association, which is usually dense (> 50% cover). At relatively lower elevations along active stream channels Salix exigua may be an important component of the shrub layer. Graminoid cover is dominated by Calamagrostis canadensis and several Carex species with combined cover usually greater than 40%. Forb cover is sparse along active channels. The stands along the seeps had combined mesic forb cover of 10-30% but graminoid species were significantly more abundant.

Succession/Management: Padgett et al. (1989) state that the presence of mesic forbs in low cover indicates that this type may be a grazing induced sere of the Alnus incana/Mesic Forb plant association although the stands sampled on the Routt National Forest showed no signs of recent disturbance. This type may be valuable for streambank stability (Padgett et al. 1989).

Adjacent Riparian Plant Associations: Calamagrostis canadensis, Carex aquatilis, Carex utriculata, Mesic Forb.

Betula glandulosa Series - plots 242, 282, 381, 462, 586

Bog birch shrubland

Related Types: The Betula glandulosa/Carex scopulorum plant association (Komarkova 1986, as reported by Johnston 1987) may be somewhat similar to the stand from the Routt National Forest, although the understory species are distinctly different.

Distribution: This plant association has not been described in the literature. In addition to the stands sampled on the Routt National Forest, several similar stands have been sampled but remain unclassified from the Gunnison River Basin in Colorado (personal communication with Gwen Kittel - CNHP).

Environment: on the Routt National Forest this type occurs at elevations from 2,590 to 3,050 meters (8,500-10,000 feet). In most cases these stands were associated with Salix planifolia willow carrs and occurred just below the forested uplands in subalpine meadows and willow carrs. This type appears to occur in areas where soils are saturated for a significant part of the growing season with water coming from late melting snow.

Vegetation: Betula glandulosa forms a fairly dense canopy, often with Salix planifolia or S. wolfii in lesser quantities. The understory is dominated by dense mixture of mesic graminoids, such as Carex aquatilis and Deschampsia cespitosa, or a mixture of mesic forbs such as Caltha leptosepala and Ligusticum filicinum.

Succession/Management: These stand are tentatively classified to a Series level at this point because of the limited amount of data available. They might be included as phases of one of the Salix planifolia plant associations, as they usually occur as small patches (< .5 acres but occasionally larger) adjacent to those associations and are very similar in understory composition.

Adjacent Riparian Plant Associations: Deschampsia cespitosa, Eleocharis quinqueflora, Pentaphylloides floribunda/Deschampsia cespitosa, Salix planifolia/Carex aquatilis, Salix wolfii/Mesic forb.

Pentaphylloides floribunda Series

Pentaphylloides floribunda/Deschampsia cespitosa p.a. - plot 241. Heritage rank - G4/SU.

Shrubby cinquefoil/tufted hairgrass riparian shrubland.

Related Types: This plant association is very similar to the Potentilla fruticosa/Deschampsia cespitosa type described by Padgett et al. (1989), Youngblood et al. (1985), and Johnston (1987).

Distribution: This plant association has been reported from Utah and southeastern Idaho (Padgett et al. 1989), and from eastern Idaho and western Wyoming (Youngblood et al. 1985, Johnston 1987).

Environment: Padgett et al. (1989) and Youngblood et al. (1985) describe this plant association as occurring on broad sloping alluvial bottoms and terraces adjacent to streams at elevations from 1,980 to 2,530 meters (6,500-8,300 feet) in eastern Utah and western Wyoming, and at elevations from 1,830 to 2,895 meters (6,000-9,500 feet) in Utah and southeastern Idaho.

On the Routt National Forest one stand representing this plant association was sampled at an elevation of 2,560 meters (8,400 feet) on a terrace above the channel. The soil is a sandy loam over a sand and gravel layer.

Vegetation: Pentaphylloides floribunda dominates the overstory of this plant association (Padgett et al., 1989, Youngblood et al., 1985). In the stand sampled on the Routt National Forest, the understory is dominated by a mixture of graminoids including, Deschampsia cespitosa, Juncus balticus, Poa secunda, and Festuca rubra. Rumex aquaticus and Fragaria virginiana are present in significant quantities possibly indicating moderate disturbance in the past.

Succession/Management: Padgett et al. (1989) indicate that this type may be subject to heavy grazing, which may increase cover of species such as Poa pratensis, Juncus balticus, and Taraxacum officinale. This may eventually lead to a conversion to a Pentaphylloides floribunda/Poa pratensis type.

Adjacent Riparian Plant Associations: Betula glandulosa Series

Salix boothii Series

Salix boothii/Carex utriculata p.a. - plots 244, 516, 519, 521, 522, 524.
Heritage rank - G5/SU.

Booth's willow/beaked sedge riparian shrubland

Related Types: This plant association is very similar to the Salix boothii/Carex rostrata (= C. utriculata) association described by Padgett et al. (1989) and Youngblood et al. (1985).

Distribution: This plant association has been described from Utah and southeastern Idaho (Padgett et al. 1989) and from eastern Idaho and western Wyoming (Youngblood et al. 1985).

Environment: Padgett et al. (1989) describe this association as occurring at elevation from 1,890 to 2,805 meters (6,200-9,200 feet) in Utah on wet streambanks, terraces, and ponded areas around beaver dams that are being filled in with silt.

This plant association occurs on the Routt National Forest in wide riparian areas (usually > 100 meters) at elevations from 2,430 to 2,590 meters (7,980-8,500 feet) on sites influenced by past or present beaver activity. Soils generally contain a lot of organic material or are finer textured in the upper profile with a gravel or cobble layer from 20 to 60 centimeters below the surface.

Vegetation: Salix boothii dominates the shrub overstory (40-91% cover) of this plant association, with Salix geyeriana and/or Salix wolfii often present with significant cover. The graminoid layer is usually dominated by Carex utriculata, but Carex aquatilis and Calamagrostis canadensis may co-dominate. Forbs are of minor importance.

Succession/Management: Padgett et al. (1989) state that this association occurs following beaver pond siltation and as the site becomes drier less hydrophytic species become common. The range of variation in graminoid species cover in the Routt National Forest stands may represent these slightly different successional stages. Padgett et al. (1989) also state that due to the wet nature of the soils that this association is susceptible to trampling and compaction by livestock and heavy machinery.

Adjacent Riparian Plant Associations: Carex aquatilis-Carex utriculata, Alnus incana/Mesic forb, Salix boothii/Mesic forb, Salix wolfii/Mesic forb.

Salix boothii/Mesic Forb p.a. - plots 520, 552, 554. Heritage rank - G3/SU.

Booth's willow/mesic forb riparian shrubland

Related Types: This plant association is very similar to the Salix boothii/Mesic Forb association described by Padgett et al. (1989).

Distribution: This plant association has been reported from Utah and southeastern Idaho (Padgett et al. 1989).

Environment: Padgett et al. (1989) describe this association as occurring at elevations from 1,165 to 3,140 meters (5,300-10,300 feet) on a wide variety of landscape positions.

This plant association occurs on the Routt National Forest at elevations near 2,470 meters (8,100 feet) on sites influenced by past or present beaver activity. This association may occur further from and fairly high above the channel. Soils are generally fine textured and contain organic material in the upper profile with a gravel or cobble layer lower in the profile possibly indicating silted in beaver ponds.

Vegetation: Salix boothii dominates the shrub overstory (20-66% cover) of this plant association. Salix geyeriana is often present with significant cover. The graminoid layer is fairly sparse with Carex utriculata, Carex aquatilis, and Calamagrostis canadensis consistently occurring. Mesic forbs dominate the understory, and may occur as a mixture with no one species consistently dominant, although Heracleum lanatum is important (7-28% cover) in all the stands sampled on the Routt National Forest.

Succession/Management: The stands on the Routt National Forest appear to be more disturbed by grazing than the stands which make up the Salix boothii/Carex utriculata plant association. The environmental setting is also very similar to the Salix boothii/Carex utriculata plant association. It is unclear if grazing increases the dominance of the mesic forbs over the mesic graminoids or if there are subtle environmental differences which contribute to this. Padgett et al. (1989) state that with excessive grazing this type is likely to be replaced by a Salix boothii/Poa pratensis type which may have the characteristic mesic forbs growing in the protection of the shrub bases.

Adjacent Riparian Plant Associations: Salix boothii/Carex utriculata.

Salix drummondiana-Salix planifolia Series

Salix drummondiana-Salix planifolia/Calamagrostis canadensis p.a. - plots 91, 201, 442. Heritage rank - G2/S2.

Drummond's willow-planeleaf willow/bluejoint reedgrass riparian shrubland

Related Types: This plant association is somewhat similar to the Salix drummondiana-Salix monticola/Calamagrostis canadensis-Carex rostrata and the Salix drummondiana-Salix monticola-Salix planifolia-Salix wolfii/Calamagrostis canadensis-Carex rostrata plant associations described by Baker (1989).

Distribution: This plant association has been reported from scattered localities on the west slope of the Rocky Mountains in Colorado, particularly in the Eagle River drainage east of Glenwood Springs (Baker 1989).

Environment: Baker (1989) described this association as occurring in the lower subalpine zone, at elevations from 2,620 to 3,110 meters (8,600-10,200 feet) along moderate-sized streams in relatively broad glaciated valleys in Colorado.

On the Routt National Forest this association occurs at elevations from 2,745 to 2,865 meters (9,000-9,400 feet) associated with beaver influenced or low gradient streams. Soils have a gravel layer within 18 to 67 centimeters of the surface.

Vegetation: Salix drummondiana dominates the shrub overstory (30-70% cover) and Salix planifolia may contribute significant cover. The graminoid layer is dominated by Calamagrostis canadensis (10-40% cover), or a combination of Calamagrostis canadensis, Carex aquatilis, and Carex utriculata. Forb cover is relatively low.

Succession/Management: Only a few stands representing this plant association have been documented. Livestock grazing has probably altered species composition in most remaining stands. Steeper gradient streams in the same elevational range often support subalpine riparian forests dominated by the needle-leaved, evergreens Abies lasiocarpa and Picea engelmannii. These forests can alternate with willow carrs, such as this association, along a single stream (The Nature Conservancy 1994). On the Routt National Forest one stand was noted as receiving heavy moose browsing and another heavy cattle and elk use.

Adjacent Riparian Plant Associations: Carex utriculata, Alnus incana/Mesic forb, Salix geyeriana/mesic forb, Abies lasiocarpa/Calamagrostis canadensis.

Salix geyeriana Series

Salix geyeriana/Calamagrostis canadensis p.a. - plot 591. Heritage rank - G5/S2.

Geyer's willow/bluejoint reedgrass riparian shrubland

Related Types: This plant association is very similar to the Salix geyeriana/Calamagrostis canadensis plant association described by Padgett et al., (1989), Youngblood et al., (1985), and Cooper and Cottrell (1990), and to the Salix geyeriana-Salix spp./Calamagrostis canadensis plant association reported by Johnston (1987).

Distribution: This plant association has been reported from Utah and southeastern Wyoming (Padgett et al. 1989), eastern Idaho and western Wyoming (Youngblood et al. 1985), the northern Colorado Front Range (Cooper and Cottrell 1990), and the Bighorn, Roosevelt, Arapaho, Gunnison, Medicine Bow, and Routt national Forests (Johnston 1987).

Environment: Cooper and Cottrell (1990) describe this association as occurring in the Laramie River drainage in Colorado at elevations from 2,430 to 2,750 meters (7,980-10,300 feet).

Only one stand representing this plant association was sampled on the Routt National Forest. This stand is at an elevation of 2,815 meters (9230 feet) on a partially filled in beaver pond not associated with a distinct channel. The microtopography is undulating, which is consistent with descriptions of this plant association from Utah (Padgett et al. 1989).

Vegetation: In the stand sampled on the Routt National Forest Salix geyeriana dominates the shrub overstory, with S. monticola and Alnus incana also contributing significant cover. The graminoid layer is clearly dominated by Calamagrostis canadensis, which is consistent with published descriptions of this plant association (Padgett et al. 1989, Youngblood et al. 1985). Forb cover is relatively low.

Succession/Management: Field notes from the Routt National Forest site indicate that Pinus contorta is beginning to invade the site. Padgett et al., (1989) suggest that in Utah and southeast Idaho, this may indicate a conversion to their Conifer/Calamagrostis canadensis type over a long time period.

Salix geyeriana/Carex aquatilis p.a. - plots 31, 371, 606, 612. Heritage rank - G3?/SU.

Geyer's willow/water sedge riparian shrubland

Related Types: This plant association is very similar to the Salix geyeriana/Carex aquatilis plant association described by Padgett et al. (1989).

Distribution: This plant association has been reported from Utah and southeastern Wyoming (Padgett et al. 1989).

Environment: Padgett et al. (1989) describe the association as occurring on seeps and in broad meadows at elevations from 2,590 to 2,895 meters (8,500-9,500 feet) in Utah and southeastern Idaho. Soils were described as developing on alluvium or in place with an organic layer at the surface and with the water table within 35 centimeters of the surface.

On the Routt National Forest this plant association occurs at elevations from 2,560 to 3,100 meters (8,400 to 10,160 feet). Soils were loamy with the water table within 55 centimeters of the surface.

Vegetation: Salix geyeriana dominates the shrub overstory (12-80% cover). Other Salix species may contribute 5-16% cover. The graminoid layer is clearly dominated by Carex aquatilis (18-28% cover), but Carex utriculata, Calamagrostis canadensis or other mesic graminoids may contribute significant cover. Forb cover is generally minor relative to the total graminoid cover although one stand (606) had 25% cover of Equisetum arvense and 14% cover of Senecio triangularis.

Succession/Management: Padgett et al. (1989) state that in the Uinta Mountains of Utah, browsing by moose or other ungulates may result in hedged shrub layer. They also note that because of the normally wet soils excessive ungulate use or heavy machinery may cause soil compaction, although livestock grazing seemed to be limited to the drier edges.

Adjacent Riparian Plant Associations: Carex aquatilis, Abies lasiocarpa/Alnus incana-Salix drummondiana, Picea pungens/Alnus incana.

Salix geyeriana/Carex utriculata p.a. - plots 71, 271, 536. Heritage rank - G5/S2.

Geyer's willow/beaked sedge riparian shrubland

Related Types: This plant association is very similar to the Salix geyeriana/Carex rostrata plant association described by Padgett et al. (1989), Youngblood et al. (1985), and Jones (1992).

Distribution: This plant association has been described from Utah and southeastern Wyoming (Padgett et al. 1989), eastern Idaho and western Wyoming (Youngblood et al. 1985), and from the Medicine Bow National Forest (Jones 1992).

Environment: Padgett et al. (1989) describe the association as occurring in meadows and on stream terraces on broad valley bottoms at elevations from 2,440 to 2,745 meters (8,000-9,000 feet) in Utah and southeastern Idaho. Soils commonly have organic horizons, and mottling in the mineral soils.

On the Routt National Forest this association occurs at elevations from 2,650 to 2,745 meters (8,700-9,000 feet). Mottling or gleying occurs in the soils of two of the three stands sampled. All three stands are in beaver influenced systems.

Vegetation: Salix geyeriana dominates the shrub overstory (20-40% cover). Other Salix species may contribute 10-25% cover. The graminoid layer is dominated by Carex utriculata (20-60% cover), but C. aquatilis or other mesic graminoids may contribute significant cover. Forb cover is generally minor but one stand did have significant cover of a mixture of mesic forbs.

Succession/Management: Padgett et al, (1989) suggest that the only difference between this type and the Salix geyeriana/Carex aquatilis type is in which sedge species establishes first (usually C. utriculata on permanently flooded sites). Heavy machinery may impact the soils. This plant association provides excellent streambank stability because of the rooting nature of Carex utriculata.

Adjacent Riparian Plant Associations: Populus tremuloides/Alnus incana.

Salix geyeriana/Mesic Forb p.a. - plots 92, 531, 551, 558, 559. Heritage rank - G3/SU.

Geyer's willow/mesic forb riparian shrubland

Related Types: This plant association is very similar to the Salix geyeriana/Mesic Forb plant association described by Padgett et al. (1989) and Youngblood et al. (1985).

Distribution: This plant association has been described from Utah and southeastern Idaho (Padgett et al. 1989) and from eastern Idaho and western Wyoming (Youngblood et al. 1985).

Environment: Padgett et al (1989) describe this association as occurring at elevations from 2,620 to 3,050 meters (8,600-10,000 feet) in meadows and broad valley bottoms in Utah and southeastern Idaho.

On the Routt National Forest this plant associations occurs at elevations from 2,485 to 2,775 meters (8,160-9,100 feet). It generally occurs in wide valleys and on soils with a gravel or cobble layer 10 to 28 centimeters below the surface.

Vegetation: Salix geyeriana clearly dominates the shrub overstory (20-75% cover) of this plant association, although other willows and/or Alnus incana also contribute significant cover. The graminoid layer is usually fairly sparse. The forb layer is fairly dense with a variety of mesic forbs co-dominating, usually including Mertensia ciliata, Senecio triangularis, and Heracleum lanatum with combined cover greater than 35%.

Succession/Management: Padgett et al. (1989) suggest that heavy grazing may result in a conversion to a Salix geyeriana/Poa pratensis type which is more prone to bank sloughing because of the sparse rooting nature of the dominant understory species.

Adjacent Riparian Plant Associations: Salix boothii/Mesic forb, Salix drummondiana-Salix planifolia/Calamagrostis canadensis, Salix lucida ssp. caudata/Mesic graminoid, Abies lasiocarpa/Mertensia ciliata.

Salix geyeriana-Salix monticola/Mesic Forb p.a. - plots 41, 43, 151, 530, 546.
Heritage rank - GU/SU.

Geyer's willow-mountain willow/mesic forb riparian shrubland

Related Types: Baker (1989) describes a Salix geyeriana-Salix monticola/Calamagrostis canadensis-Carex aquatilis-Carex rostrata plant association and Johnston (1987) reports a Salix geyeriana-Salix spp./Calamagrostis canadensis plant association that are somewhat similar to this plant association. The stands in the Routt National Forest were dominated by mesic forbs rather than the mesic graminoids reported by the authors mentioned above.

Distribution: Baker (1989) and Johnston (1987) report a somewhat similar type as common in the Colorado Rocky Mountains and in western Wyoming.

Environment: This plant association occurs on the Routt National Forest at elevations from 2,435 to 2,865 meters (7,700-9,400 feet). Soils are relatively fine textured and have mottling in the soil profile within 35 centimeters of the surface indicating elevated water tables for some part of the year.

Vegetation: Salix monticola (30-86% cover) and/or Salix geyeriana dominate the shrub overstory of this plant association, although occasionally Salix geyeriana is of minor importance or absent altogether (0-40% cover). The graminoid layer is usually fairly sparse but contains significant amounts of Poa pratensis or various Carices. The forb layer is fairly dense with a variety of mesic forbs co-dominating, most commonly Mertensia ciliata, Senecio triangularis, and/or Heracleum lanatum with combined cover of 20-45%. Weedy species, such as Poa pratensis and Urtica dioica were more common in disturbed stands.

Succession/Management: This plant association differs from the Salix geyeriana/Mesic Forb plant association in that Salix monticola is always present with significant cover or with even greater cover than Salix geyeriana. It is not known if this is due to environmental differences or if this is a different successional stage of the Salix geyeriana/Mesic forb association.

Adjacent Riparian Plant Associations: Carex aquatilis, Eleocharis quinqueflora, Alnus incana/Mesic forb, Salix planifolia/Carex aquatilis.

Salix lucida ssp. caudata Series

Salix lucida ssp. caudata/Mesic graminoid p.a. - plot 553. Heritage rank - GU/SU.

Shining willow riparian shrubland

Related Types: The Salix lasiandra var. caudata (= S. lucida ssp. caudata)/Mesic graminoid (Kittel and Lederer 1993) and the Salix lucida ssp. caudata-Salix monticola/Calamagrostis canadensis-Equisetum arvense (Jankovsky-Jones 1994) plant associations are very similar to the stand from the Routt National Forest.

Distribution: Kittel and Lederer (1993) described this plant association from the Yampa River basin and Jankovsky-Jones (1994) describes this plant association from the roaring Fork River basin in western Colorado.

Environment: Kittel and Lederer (1993) describe this association as occurring at elevations from 1,930 to 2,485 meters (6,330-8,160 feet) on streambanks and floodplains associated with beaver ponds.

The only stand representing this plant association sampled on the Routt National Forest was associated with a beaver pond at an elevation of 2,485 meters (8,160 feet).

Vegetation: Salix lucida ssp. caudata dominates the overstory. Pinus contorta, Salix boothii, Salix geyeriana and Alnus incana also contribute significant cover. The understory is dominated by a mixture of mesic graminoids including Calamagrostis canadensis and several Carex species. Forbs are a minor component.

Succession/Management: Stands described by Kittel and Lederer (1993) had high cover of exotic grasses possibly indicating more disturbed conditions. They also state that this type is often associated with beaver ponds or steeper reaches below beaver ponds and it is an early to mid successional type that may be eventually replaced by drier site willows.

Adjacent Riparian Plant Associations: Carex aquatilis-Carex utriculata, Salix boothii/Mesic forb.

Salix planifolia Series

Salix planifolia/Caltha leptosepala p.a. - plots 181, 421, 533, 534, 538, 562, 563, 565, 579, 588, 610, 615, 619. Heritage rank - GU/SU

Planeleaf willow/marsh marigold riparian shrubland

Related Types: This association is very similar to the Salix planifolia/Psychrophila leptosepala (= Caltha leptosepala) plant association described by Cooper and Cottrell (1990), and to the Salix phylicifolia ssp. planifolia/Caltha leptosepala association reported by Johnston (1987).

Distribution: This association has been reported from the White River and Gunnison National Forests in Colorado (Johnston 1987), and from the northern Front Range of Colorado (Cooper and Cottrell 1990).

Environment: Johnston (1987) reports this association as occurring at elevations from 2,865 to 3,640 meters (9,400-11,950 feet) in a wide variety of landscape positions.

On the Routt National Forest this association occurs at elevations from 2,745 to 3,290 meters (9,000-10,800 feet) in wide valley bottoms. Soils have an organic layer of various thickness at the surface, and generally have a gravel or cobble layer within 20 to 50 centimeters of the surface. The water table is usually near the surface throughout the growing season and may be perched by a clay horizon.

Vegetation: Salix planifolia dominates the shrub overstory (30-100% cover). The graminoid layer is usually sparse but occasionally may have various mesic species present with significant cover. Forb cover is usually very dense with Caltha leptosepala, Senecio triangularis, Cardamine cordifolia, and Mertensia ciliata commonly occurring with greater than 40% combined cover. Caltha leptosepala is almost always present, but may not always be the dominant forb. The understory of this plant association is clearly forb dominated, while the Salix planifolia/Carex aquatilis association is dominated by mesic graminoids with mesic forbs occasionally co-dominating.

Succession/Management: It is not clear what environmental or successional factors separate this association from the Salix planifolia/Carex aquatilis association. Padgett et al. (1989) described Caltha leptosepala and Carex aquatilis as having very similar environmental requirements. The stands sampled on the Routt National Forest were generally closer to the stream channel and along higher gradient streams than the Salix planifolia/Carex aquatilis stands.

Adjacent Riparian Plant Associations: Carex aquatilis-Carex utriculata, Mesic forb, Salix planifolia/Carex aquatilis, Salix planifolia-Salix brachycarpa/Caltha leptosepala, Abies lasiocarpa/Mertensia ciliata.

Salix planifolia/Carex aquatilis p.a. - plots 101, 121, 171, 182, 281, 311, 321, 351, 461, 472, 566, 567, 590, 600, 607, 614, 616. Heritage rank - G4G5/S4S5.

Planeleaf willow/water sedge riparian shrubland

Related Types: This association is very similar to the Salix planifolia/Carex aquatilis association described by Padgett et al. (1989) and Youngblood et al. (1985), Kittel et al. (1994), and to the Salix phylicifolia ssp. planifolia/Carex aquatilis association reported by Johnston (1987). Several stands that were sampled on the Routt National Forest were similar to Baker's (1989) Salix planifolia-Salix wolfii/Caltha leptosepala-Carex aquatilis association in that Salix wolfii was a important component of the shrub overstory, although Caltha leptosepala was not an important component of these stands.

Distribution: This association has been described from Utah and southeastern Idaho (Padgett et al. 1989), from eastern Idaho and western Wyoming (Youngblood et al. 1985), in Montana (Hansen et al. 1988), and from the West Slope in Colorado (Kittel et al. 1994, Baker 1989, Johnston 1987).

Environment: In Colorado, Kittel et al., (1994) describe this association as occurring in wide valleys and wet, open subalpine meadows on gently sloping snow melt fed swales at elevations above 2,745 meters (9,000 feet).

On the Routt National Forest this association occurs at elevations from 2,805 to 3,290 meters (9,200-10,800 feet) in wide valley bottoms along low gradient streams or on seeps. Soils have an organic layer of varied thickness at the surface, and generally have a gravel or cobble layer within 20 to 50 centimeters of the surface. The water table is usually near the surface throughout the growing season and may be perched by a clay horizon lower in the profile.

Vegetation: Salix planifolia dominates the shrub overstory (20-90% cover) with Salix wolfii occasionally present with significant cover. The graminoid layer is dense and is usually dominated by Carex aquatilis (> 20% cover), although Carex utriculata or Calamagrostis canadensis may co-dominant with Carex aquatilis. Forb cover can be dense with Caltha leptosepala, Aster foliaceus, Ligusticum filicinum, and Senecio triangularis commonly occurring. This plant association is usually dominated by the graminoids mentioned above, although forb cover may be nearly equal to the graminoid cover. The Salix planifolia/Caltha leptosepala association is heavily dominated by mesic forbs with relatively little graminoid cover.

Succession/Management: Padgett et al (1989) describe this association as a stable type and state that wildlife use was also often noted but was not heavy.

Adjacent Riparian Plant Associations: Carex aquatilis, Carex aquatilis-Carex utriculata, Carex utriculata, Deschampsia cespitosa-Carex aquatilis, Eleocharis palustris, Betula glandulosa Series, Salix planifolia/Caltha leptosepala.

Salix planifolia-Salix brachycarpa/Caltha leptosepala p.a. - plots 291, 303, 541.
Heritage rank - G4/S4.

Planeleaf willow-barrenground willow/marsh marigold riparian shrubland

Related Types: This association is very similar to the Salix brachycarpa-Salix planifolia/Caltha leptosepala-Carex aquatilis association described by Baker (1989), and somewhat similar to the Salix phylicifolia ssp. planifolia/Caltha leptosepala association reported by Johnston (1987).

Distribution: This association has been described from the West Slope of Colorado (Baker 1989).

Environment: Baker (1989) describes this association as occurring in small, narrow valleys near treeline in western Colorado.

On the Routt National Forest this association occurs at elevations from 2,815 to 3,140 meters (9,240-10,300 feet) in narrow valley bottoms. Two of the three stands sampled have sandy soils and mottles present in the upper profile.

Vegetation: Salix planifolia (3-30% cover) and Salix brachycarpa (10-60% cover) dominate the shrub overstory. Salix brachycarpa was completely dominant in one stand but Salix planifolia was also present in low cover. The graminoid layer is diverse with several Carices usually common. Forb cover is usually fairly dense (combined cover usually > 40%) with Caltha leptosepala a characteristic species. Other mesic forbs may be present in significant quantities, including Ligusticum filicinum, Senecio triangularis, and Mertensia ciliata.

Succession/Management: Baker (1989) describes this plant association as occurring in narrow valleys near treeline. The Salix planifolia/Caltha leptosepala association, which rarely contains Salix brachycarpa, occurs more commonly in wide valleys on the Routt National Forest.

Adjacent Riparian Plant Associations: Carex utriculata, Salix planifolia/Caltha leptosepala, Abies lasiocarpa/Calamagrostis canadensis.

Salix wolfii Series

Salix wolfii/Carex aquatilis p.a. - plots 331, 511, 512. Heritage rank - G4/S4.

Wolf willow/water sedge riparian shrubland

Related Types: This association is very similar to the Salix wolfii/Carex aquatilis association described by Padgett et al. (1989), Youngblood et al. (1985), Kittel et al. (1994), and to the Salix wolfii/Carex aquatilis association reported by Johnston (1987).

Distribution: This association has been reported from Utah and southeastern Idaho (Padgett et al. 1989), from eastern Idaho and western Wyoming (Youngblood et al. 1985), in Montana (Hansen et al. 1988), and from the Western Slope in Colorado (Kittel et al. 1994).

Environment: Kittel et al. (1994) describe this association as occurring on saturated peat bogs, mesic swales and hummocks within glaciated basins above 2,800 meters (9,180 feet) in Colorado.

On the Routt National Forest, this association occurs at elevations from 2,560 to 2,855 meters (8,400-9,360 feet) in wide valley bottoms along low gradient streams. Soils are highly variable with stands occurring on peat and also on mineral soils.

Vegetation: Salix wolfii dominates the shrub layer (20-70% cover) in this association. The graminoid layer is dense and usually dominated by Carex aquatilis (15-30% cover). Carex utriculata or Caltha leptosepala may co-dominate with Carex aquatilis. Forb cover can be very dense.

Succession/Management: Padgett et al. (1989) state that because of the wet soils, this association may be susceptible to impact from grazing or heavy machinery. They also note that if this type begins to dry out it may succeed to a Salix wolfii/Mesic Forb or Salix wolfii/Deschampsia cespitosa plant association.

Adjacent Riparian Plant Associations: Deschampsia cespitosa, Salix planifolia/Caltha leptosepala.

Salix wolfii/Mesic Forb p.a. - plots 133, 245, 383, 543, 585. Heritage rank - G3/S3.

Wolf willow riparian shrubland

Related Types: This association is very similar to the Salix wolfii/ Mesic Forb association described by Padgett et al. (1989) and Youngblood et al. (1985), and to the Salix wolfii/Fragaria virginiana association reported by Johnston (1987).

Distribution: This association has been described from Utah and southeastern Idaho (Padgett et al. 1989) and from eastern Idaho and western Wyoming (Youngblood et al. 1985).

Environment: Padgett et al. (1989) and Youngblood et al. (1985) described this association as occurring at elevations from 1,890 to 2,620 meters (6,200-8,600 feet) in Utah, eastern Idaho, and western Wyoming. The association often occurs on first or second order streams in meadows and on stream terraces in moderate to broad valleys.

On the Routt National Forest, this association occurs at elevations from 2,495 to 2,865 meters (8,180-9,400 feet) in moderate to wide valley bottoms along low gradient streams. Soils generally have high organic matter in the upper profile, are loamy to sandy textured, and a gravel layer within 60 centimeters of the surface.

Vegetation: Salix wolfii dominates the shrub layer (30-70% cover) in this plant association. Salix planifolia and Salix boothii occasionally co-dominate. The graminoid layer is diverse but rarely contains more than 20% cover. Characteristic species include Calamagrostis canadensis, Deschampsia cespitosa, and various Carices. Forbs dominate the understory in this association with combined cover of 30 to 60%. No one forb species is consistently dominant, but Fragaria virginiana is usually present with 3 to 10% cover.

Succession/Management: Four of the five stands sampled on the Routt National forest were grazed by cows or sheep and the other stand had substantial impact from recreational use. Many of the species in the forb layer of this association are considered increasers or weedy species, including Taraxacum officinale and Fragaria virginiana. It is possible that this association may be a disturbance induced phase of the Salix wolfii/Carex aquatilis plant association, but further research would be needed to determine this.

Adjacent Riparian Plant Associations: Carex aquatilis-Carex utriculata, Carex utriculata, Deschampsia cespitosa, Betula glandulosa Series, Salix boothii/Carex utriculata.

Graminoid Dominated Stands

Calamagrostis canadensis Series

Calamagrostis canadensis p.a. - plots 548, 603. Heritage rank - G4/S4.

Bluejoint reedgrass herbaceous wetland

Related types: This plant association is very similar to the Calamagrostis canadensis association described by Padgett et al. (1989) in Utah and southeastern Idaho, and by Kittel et al. (1994) in the White and Colorado River Basins in Colorado.

Distribution: This plant association has been described from Utah, Idaho, Montana, northern Wyoming, and Colorado (Padgett et al. 1989, Kittel et al. 1994).

Environment: This association occurs adjacent to small streams and moist forest openings, and in broad glaciated valleys on a slightly undulating, low gradient surface topography at elevations from 2,745 to 2,985 meters (9,000-9,800 feet) (Padgett et al. 1989, Kittel et al. 1994).

On the Routt National Forest, this association occurs in openings in moist forests and silted in beaver ponds at elevations around 2,590 meters (8,500 feet).

Vegetation: Calamagrostis canadensis dominates the herbaceous layer (17-31% cover) in this plant association. Other common species include Carex utriculata, Senecio triangularis, and Equisetum arvense.

Succession/Management: Calamagrostis canadensis is only moderately palatable and grazing animals are likely to seek out more palatable species (Welsh et. al. 1987). At one site (plot 603) it was noted that Equisetum arvense and Carex species were colonizing recently eroded banks and Calamagrostis canadensis occurs on the stable banks of an older channel.

Carex aquatilis Series

Carex aquatilis p.a. - plots 21, 251, 411, 599, 609, 613, 620. Heritage rank - G5/S5.

Water sedge herbaceous wetland

Related Types: This plant association is very similar to the Carex aquatilis-Carex utriculata association reported by Johnston (1987) except that Carex utriculata is less abundant. Similar Carex aquatilis plant associations are also described by Padgett et al. (1989), and by Kittel et al. (1994) in the White and Colorado River Basins of Colorado. The Carex aquatilis/Pedicularis groenlandica plant association described by Cooper and Cottrell (1990) is also somewhat similar to this plant association.

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

Environment: This association is reported to occur on low-sloping benches, valley bottoms, broad glaciated meadows, and depressions near seeps or low gradient streams at elevations from 2,500 to 3,355 meters (8,200-11,000 feet) (Johnston 1987, Kittel et al. 1994).

On the Routt National Forest, this plant association occupies valley bottoms and meadows adjacent to seeps or low gradient streams at elevations from 2,650 to 3,355 meters (8,700-11,000 feet). It is often associated with beaver influenced systems. The texture in the upper soil profile in several stands is silty loam or clay loam.

Vegetation: Carex aquatilis dominates (17-70% cover) this plant association. Carex utriculata, Deschampsia cespitosa, and Salix planifolia are other species which commonly occur in this plant association with low cover.

Succession/Management: Although Carex aquatilis and Carex utriculata seem to be very similar in regard to environmental conditions such as moisture regimes and elevations. Carex utriculata seems to be capable of occupying sites that are more inundated than Carex aquatilis (Padgett et al. 1989).

Adjacent Riparian Plant Associations: Carex aquatilis-Carex utriculata, Carex utriculata, Deschampsia cespitosa, Eleocharis quinqueflora, Salix geyeriana/carex aquatilis, Salix planifolia/Carex aquatilis, Salix planifolia/Mesic forb.

Carex aquatilis-Carex utriculata p.a. - plots 243, 537. Heritage rank - G3G4/S3S4.

Water sedge-beaked sedge herbaceous wetland

Related Types: This plant association is somewhat similar to both the Carex aquatilis and Carex utriculata plant associations described by Kittel and Lederer (1993), Kittel et al. (1994) on the White, Colorado, Yampa, and San Miguel/Dolores River Basins of Colorado. It is also very similar to the Carex aquatilis/Carex utriculata association described by Johnston (1987).

Distribution: This plant association has been reported from western Wyoming, eastern Idaho, northeastern Utah, and Colorado (Padgett et al. 1989, Youngblood et al. 1985, Johnston 1987). In Colorado, it has been reported from the Roosevelt, Arapaho, White River, Gunnison, and Routt National Forests, as well as Rocky Mountain National Park (Johnston 1987) and from the several river basins on the Western Slope of Colorado (Kittel and Lederer 1993, Kittel et al. 1994).

Environment: This plant association occurs on marshy areas of valley bottoms and depressions adjacent to low gradient streams or seeps at elevations from 2,590 to 3,355 meters (8,500-11,000 feet) (Johnston 1987).

On the Routt National Forest, this association occurs on moderately wide marshy areas adjacent to low gradient, small streams at elevations from 2,590 to 3,260 meters (8,500-10,700 feet). It is often associated with beaver influenced systems.

Vegetation: Carex aquatilis and Carex utriculata co-dominate (46-70% combined cover) this plant association. Various graminoid and forb species are interspersed scarcely throughout the stands.

Succession/Management: The relative proportion of Carex aquatilis and Carex utriculata varies from site to site most likely due to differing water tables. On drier sites, Carex aquatilis tends to be more abundant while on wetter sites, Carex utriculata dominates (Johnston 1987). Small microtopographic differences may allow both species to co-dominate.

Adjacent Riparian Plant Associations: Carex aquatilis, Carex utriculata, Salix boothii/Carex utriculata, Salix planifolia/Caltha leptosepala, Salix wolfii/Mesic forb.

Carex saxatilis Series

Carex saxatilis p.a. - plot 284. Heritage rank - G3/SU.

Rock sedge herbaceous wetland

Related Types: This plant association is very similar to the Carex saxatilis association described by Padgett et al. (1989) in Utah and southeastern Idaho,

Distribution: This plant association has been described from Utah and reported from Montana (Padgett et al. 1989).

Environment: This plant association occurs on at elevations from 2,745 to 3,205 meters (9,000-10,500 feet) in Utah (Padgett et al. 1989).

Only one stand representing this plant association was sampled on the Routt National Forest. This stand was at an elevation of 3,050 meters (10,000 feet) on a seep in a wide meadow. The soil is highly organic, which is consistent with descriptions of this plant association from Utah (Padgett et al. 1989).

Vegetation: Carex saxatilis dominates the herbaceous layer (40% cover) in this plant association. Carex aquatilis, Eleocharis quinqueflora, and Deschampsia cespitosa are also abundant with 10-20% cover. Caltha leptosepala dominates the forb component with 10% cover.

Succession/Management: Padgett et al. (1989) state that Carex saxatilis appears to be more palatable than Carex utriculata but less palatable than Carex aquatilis which grows on similar sites. Use of heavy machinery on this plant association should be avoided because of the organic, wet soils.

Adjacent Riparian Plant Associations: Eleocharis quinqueflora, Betula glandulosa Series, Salix planifolia/Carex aquatilis.

Carex scopulorum Series

Carex scopulorum-Caltha leptosepala p.a. - plot 581. Heritage rank - G4/S3S4.

Rock sedge-marsh marigold herbaceous wetland

Related Types: This plant association is very similar to the Carex scopulorum-Caltha leptosepala association described by Johnston (1987).

Distribution: This plant association has been described from the Shoshone National Forest in Wyoming, and the Arapaho, Roosevelt, San Juan, White River, and Gunnison National Forests in Colorado (Johnston 1987).

Environment: This association occupies marshy areas adjacent to streams or melting snow fields that are level to gently sloping at elevations from 3,260 to 4,025 meters (10,700-13,200 feet). Soils are poorly drained but not highly organic (Johnston 1987).

On the Routt National Forest, one stand representing this plant association was sampled at an elevation of 3,170 meters (10,400 feet) in a rivulet at the headwaters of a creek. Soils are loamy near the surface with mottles present.

Vegetation: Carex scopulorum dominates the herbaceous layer of this plant association. Caltha leptosepala, Ligusticum filicinum, Deschampsia cespitosa, and Agrostis thurberiana commonly occur in this plant association.

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

Adjacent Riparian Plant Associations: Deschampsia cespitosa.

Carex utriculata Series

Carex utriculata p.a. - plots 51, 111, 131, 203, 302, 596. Heritage rank - G5/S3.

Beaked sedge herbaceous wetland

Related Types: This plant association is very similar to the Carex utriculata plant association described by Kittel and Lederer (1993) and Kittel et al. (1994) in the White, Colorado, Yampa, and San Miguel/Dolores River Basins of Colorado. It is also somewhat similar to the Carex aquatilis/Carex utriculata association reported by Johnston (1987).

Distribution: This is a common community throughout the western U.S. reported from central and eastern Oregon, central and eastern Idaho, Utah, western Wyoming, and western and central Montana (Padgett et al. 1989). In Colorado, this plant association has been described by Kittel and Lederer (1993) and Kittel et al. (1994) from the White, Colorado, Yampa, and San Miguel/Dolores River basins. Mixed communities dominated by Carex utriculata and Carex aquatilis have been reported as one plant association from all National Forests in Colorado, and from Rocky Mountain National Park (Johnston 1987).

Environment: This plant association occurs on flat saturated floodplains, backwater areas, sinkholes, and adjacent beaver ponds at elevations from 2,620 to 2,925 meters (8,600-9,600 feet) in Utah and southeast Idaho (Padgett et al. 1989).

On the Routt National Forest, this association occurs on narrow to broad marshy areas adjacent to seeps or low gradient streams at elevations from 2,590 to 2,925 meters (8,500 to 9,600 feet). Soils are generally silty clays to clays. The water table is usually near the surface for most of the growing season.

Vegetation: Carex utriculata dominates the herbaceous layer (10-90% cover) in this plant association. Other plant species commonly occurring in this plant association are Juncus balticus, Carex aquatilis, and Deschampsia cespitosa. In some ponded wetlands Carex utriculata formed a monotypic stand with few other species present.

Succession/Management: Carex utriculata tends to dominate wetter sites, while Carex aquatilis dominates the slightly more well drained areas (Kittel and Lederer 1993). Carex utriculata is known to be a pioneer on newly flooded beaver ponds. It also appears to be less palatable than other common sedges of similar environments (Padgett et al. 1989).

Adjacent Riparian Plant Associations: Carex aquatilis, Carex aquatilis-Carex utriculata, Deschampsia cespitosa, Alnus incana/Mesic forb, Salix drummondiana-Salix planifolia/Calamagrostis canadensis, Salix planifolia-Salix brachycarpa/Caltha leptosepala, Salix wolfii/Mesic forb, Abies lasiocarpa/calamagrostis canadensis.

Deschampsia cespitosa Series

Deschampsia cespitosa p.a. - plots 132, 382, 571, 573. Heritage rank - GU/SU.

Tufted hairgrass herbaceous wetland

Related Types: This association is also very similar to the Deschampsia cespitosa association described by Padgett et al. (1989) in Utah and southeastern Idaho. The Deschampsia cespitosa/Carex spp. association reported by Johnston (1987), and Kittel et al. (1994) is also very similar.

Distribution: This is a widespread plant association in the West, and has been described from eastern and central Idaho, western Wyoming, Utah, Oregon, Washington, and Colorado (Padgett et al. 1989, Johnston 1987, Kittel et al. 1994).

Environment: This plant association has been reported from sites with well-drained ridges and hummocks at elevations above 2,895 meters (9,500 feet), and from meadows and stream terraces in moderate to broad valley bottoms at elevations from 2,895 to 3,385 meters (9,500-11,000 feet).

On the Routt National Forest, this association occurs at elevations from 2,865 to 3,385 meters (9,400-11,000 feet) on sites with a moderately high water table (indicated by the presence of mottles or gleying in the soil). It dominates wet, high elevation meadows and generally occurs on sites with environmental conditions similar to the Carex aquatilis and Carex utriculata plant associations, but with a slightly lower water table. Mottles and/or gleying were present below 17 centimeters in three of the four stands sampled.

Vegetation: Deschampsia cespitosa dominates the herbaceous layer (17-70% cover) in this plant association. Carex aquatilis, C. utriculata, and Phleum alpinum are other species which commonly occur in this plant association but are of minor importance compared to the Deschampsia cespitosa.

Succession/Management: Deschampsia cespitosa is a palatable species and may receive heavy grazing pressure from livestock. Its presence and the low abundance of increaser species such as Poa pratensis may indicate low levels of disturbance. In the Intermountain West, it is thought that this association may have occupied more xeric environments, but its distribution in drier conditions is limited by intense grazing pressure, possibly explaining why it is now found in more mesic conditions (Padgett et al. 1989).

Adjacent Riparian Plant Associations: Carex aquatilis, Carex aquatilis-Carex utriculata, Carex scopulorum, Carex utriculata, Deschampsia cespitosa-Carex aquatilis, Betula glandulosa Series, Salix wolfii/Mesic forb.

Deschampsia cespitosa-Carex aquatilis p.a. - plots 102, 574, 576, 577. Heritage rank - GU/SU

Tufted hairgrass-water sedge herbaceous wetland

Related Types: This plant association is somewhat similar to the Deschampsia cespitosa-Carex spp. plant association described by Kittel et al. (1994) and the Deschampsia cespitosa-Carex species plant association reported by Johnston (1987). However, Carex aquatilis was not indicated as the dominant Carex species by either author.

Distribution: This plant association has been described from western Montana, eastern Wyoming, eastern Oregon, eastern Idaho, Northern Utah, and Colorado in Rocky Mountain National Park, the Gunnison National Forest, the Flat Top Plateau, and the White and Colorado River Basins (Johnston 1987, Kittel et al. 1994).

Environment: This plant association occurs on wet, high elevation meadows and valley bottoms which are flooded by spring snowmelt at elevations above 1,830 meters (6,000 feet) in Montana and above 2,745 meters (9,000 feet) in Colorado (Johnston 1987). It has also been reported on well drained ridges and hummocks at elevations above 2,895 meters (9500 feet) in Colorado (Kittel et al. 1994).

On the Routt National Forest, this plant association occurs on subalpine meadows next to low to moderate gradient streams at elevations from 2,805 to 3,295 meters (9,200-10,800 feet). Soils in the upper profile were usually silt loams.

Vegetation: Deschampsia cespitosa (13-40% cover) and Carex aquatilis (18-50% cover) co-dominate the herbaceous layer in this plant association. Caltha leptosepala and Ranunculus alismifolius are forb species which commonly occur in this plant association. Several Carex species are commonly present in this association, although in lower abundance.

Succession/Management: Presence of this community without an abundance of increaser species such as Poa pratensis, Juncus balticus, and Taraxacum officinale may indicate non-disturbance conditions according to Padgett et al. (1989). Poa pratensis may replace Deschampsia cespitosa as disturbance levels in the habitat increase. This plant association is susceptible to heavy grazing due to the high palatability of Deschampsia cespitosa. There is also potential for damage to the plant association through vehicle use because of the high moisture in the soil (Padgett et al. 1989).

Adjacent Riparian Plant Associations: Carex aquatilis, Carex aquatilis-Carex utriculata, Carex utriculata, Mesic forb, Salix planifolia/Carex aquatilis.

Eleocharis palustris Series

Eleocharis palustris p.a. - plots 564, 569. Heritage rank - G5/S3S4.

Creeping spikerush herbaceous wetland

Related Types: This plant association is somewhat similar to the Eleocharis palustris-Carex species plant association reported by Johnston (1987) and the Eleocharis palustris association described by Padgett et al. (1989) in Utah and southeastern Idaho.

Distribution: This is a common plant association throughout the west ranging from central and eastern Oregon, high elevations of Montana, west-central Utah (Padgett et al. 1989), and Wyoming (Johnston 1987). It has been described in the northwest and Front Range portions of Colorado as well as the San Juan National Forest (Johnston 1987), and the Yampa River basin (Kittel and Lederer 1993).

Environment: This community occurs in small patches and is associated with small to moderate sized ponds and edges of larger standing bodies of water (Padgett et al. 1989), as well as backwater eddies and sandbars of varying sized rivers (Kittel and Lederer 1993).

On the Routt National Forest, this association occurs on marshy meadows adjacent to beaver ponds or seeps at elevations from 2,835 to 3,140 meters (9,300-10,300 feet). Soils textures in the upper profile are silts to silt loams.

Vegetation: Eleocharis palustris is the dominant graminoid species (20-22% cover) in this plant association. This is a small, patchy wetland that is interspersed with few additional species.

Succession/Management: Kittel and Lederer (1993) describe this as being an early seral stage plant association as does Padgett et al. (1989) who state that it may be replaced by Carex utriculata as siltation occurs.

Adjacent Riparian Plant Associations: Deschampsia cespitosa, Salix planifolia/Caltha leptosepala, Salix planifolia/Carex aquatilis.

Eleocharis quinqueflora Series

Eleocharis quinqueflora p.a. - plots 283, 402, 568, 578, 595, 608, 618. Heritage rank - G4/SU.

Spikerush herbaceous wetland

Related Types: This plant association is similar to the Carex aquatilis-Carex utriculata plant association Eleocharis quinqueflora phase described by Johnston (1987), and the Eleocharis quinqueflora plant association described by Padgett et al. (1989). This association is also very similar to the Eleocharis quinqueflora plant association described by Kittel et al. (1994).

Distribution: This plant association has been described from the Routt and Gunnison National Forests of Colorado, and from northeastern Utah (Johnston 1987, Briggs and MacMahon 1983), as well as central Oregon, western and north central Montana, and Yellowstone National Park (Padgett et al. 1989). It has also been described from the White and Colorado River Basins of Colorado (Kittel et al. 1994).

Environment: Johnston (1987) reports this plant association as a phase of the Carex aquatilis-Carex utriculata association on the wettest sites where the water table is at the soil surface.

On the Routt National Forest, this plant association occurs on high elevation meadows associated with seeps at elevations from 2,805 to 3,290 meters (9,200-10,800 feet). Soils are highly organic.

Vegetation: Eleocharis quinqueflora dominates the herbaceous layer (16-50% cover) in this variable plant association. Carex aquatilis may be co-dominant. Deschampsia cespitosa and Caltha leptosepala commonly occur in this plant association.

Succession/Management: In this plant association, Carex aquatilis may be a codominant species with highly reduced production which would indicate suboptimal conditions for its growth (Padgett et al. 1989). Eleocharis quinqueflora is not common as a dominant in plant communities in Utah (Padgett et al. 1989). Both Padgett et al. (1989) and Johnston (1987) describe this association as closely aligned to the Carex species associations and other authors may have included it in those associations. This may explain why there are few reports of this type.

Adjacent Riparian Plant Associations: Carex aquatilis, Carex utriculata, eleocharis palustris, Betula glandulosa Series, Salix planifolia/Carex aquatilis, Abies lasiocarpa/Mertensia ciliata.

Forb Dominated Stands

Mesic Forb Stands - plots 526, 561, 592, 594, 605

Related Types: Plot 561 is very similar to the Trollius albiflorus-Ligusticum filicinum/Erigeron peregrinus plant association reported by Johnston (1987). Plot 605 is somewhat similar to the Saxifraga odontoloma/Deschampsia cespitosa plant association reported by Johnston (1987). Plot 592 is somewhat similar to the Mertensia ciliata plant association described by Youngblood et al. (1985) and the Mertensia ciliata/Deschampsia cespitosa plant association reported by Johnston (1987). Plots 526 and 594 do not compare to published descriptions.

Distribution: The Trollius albiflorus-Ligusticum filicinum/Erigeron peregrinus and Saxifraga odontoloma/Deschampsia cespitosa plant associations have been reported from the Arapaho and Roosevelt National Forests of Colorado (Johnston 1987). The Mertensia ciliata/Deschampsia cespitosa plant association has been reported from the Gunnison, Arapaho and Roosevelt National Forests in Colorado and from western Wyoming (Youngblood et al. 1985).

Succession/Management: Unknown

Adjacent Riparian Plant Associations: Carex aquatilis, Deschampsia cespitosa, Salix planifolia/Caltha leptosepala.

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APPENDICES

Appendix 1. Stand Tables for Plant Associations on the Routt National Forest.

Species acronyms and covers are listed down the columns. Plot numbers are listed across the top row. Species included in the stand tables are those that occur in the majority of the plots, those contributing significant cover (at least 3-10%) in at least one plot, and/or diagnostic plants. Stand tables for plant associations with numerous plots should provide some indication of the range of variability of the vegetation within that plant association.

Canopy cover by plot for selected species in the Abies lasiocarpa/Alnus incana-Cornus sericea p.a.

PLOT	
SPECIES	617
ABILA2	10
ABILAS	21
PICENG	8
POPANG	14
ALNINC	42
CORSER	53
RUDLAC	11
SALDRU	7

Canopy cover by plot for selected species in the Abies lasiocarpa/Alnus incana-Salix drummondiana p.a.

PLOTS													
SPECIES	191	211	361	412	518	528	545	556	582	587	601	602	611
ABILA1	0	3	10	1	0	9	3	0	0	5	1	1	0
ABILA2	0	10	20	3	0	0	5	2	6	4	4	8	5
ABILAS	0	10	10	10	0	8	6	35	0	11	0	6	2
PICEN1	3	0	0	0	3	0	0	0	3	1	4	10	3
PICEN2	10	3	10	3	0	0	5	0	6	17	15	0	9
PICENG	40	3	0	30	0	82	7	0	7	10	19	16	7
PINCO1	0	0	0	0	18	0	0	0	0	0	0	0	0
PINCO2	0	0	0	0	30	0	0	0	0	0	0	0	0
ALNINC	30	60	70	40	47	76	28	51	60	41	11	6	1
SALDRU	10	3	0	0	5	0	0	0	0	0	13	14	1
SALGEY	0	0	0	0	13	0	16	0	0	9	3	30	24
CALCAN	3	0	0	0	0	0	5	0	3	1	8	11	1
CARAQU	10	0	0	3	0	0	0	0	0	1	0	10	11
EQUARV	10	0	0	0	0	0	12	9	0	3	3	3	11
HERLAN	0	0	3	3	0	0	10	0	16	4	1	1	0
MERCIL	0	0	0	10	0	0	0	4	11	6	3	1	0
SENTRI	0	0	0	3	0	0	0	4	9	2	0	5	1

Canopy cover by plot for selected species in the Abies lasiocarpa/Calamagrostis canadensis p.a.

	PLOTS		
SPECIES	292	301	441
ABILAS	0	3	0
ABILAS1	1	1	0
ABILAS2	20	10	0
PICEN1	1	1	1
PICEN2	20	20	3
PICENG	20	10	10
ALNINC	0	3	10
LONINV	3	3	3
VACMYR	0	10	0
CALCAN	30	20	20
CARUTR	10	0	20
CARCOR	3	3	1
EQUARV	3	10	3
LIGFIL	10	1	0
LIGPOR	10	0	0
MERCIL	10	1	1
MICODO	10	3	0
SENTRI	20	10	0
STRFAS	3	10	1

Canopy cover by plot for selected species in the *Abies lasiocarpa*/*Mertensia ciliata* p.a.

	PLOTS																			
SPECIES	141	161	183	312	341	401	422	431	471	491	501	529	542	544	557	572	575	580	589	593
ABILA1	1	1	3	1	3	1	3	1	1	1	10	4	2	0	10	1	1	1	3	3
ABILA2	3	1	10	0	0	3	0	3	3	3	0	2	1	0	13	14	0	7	0	10
ABILAS	1	20	3	0	0	10	0	3	10	3	3	5	29	34	7	0	0	1	8	52
PICEN1	3	1	10	1	3	0	3	10	1	1	1	0	2	0	1	0	1	3	0	1
PICEN2	10	10	10	10	3	20	3	10	10	10	1	17	0	0	4	1	4	10	2	2
PICENG	20	20	1	3	10	30	20	30	30	30	50	20	32	15	54	6	4	26	20	28
ALNINC	0	20	0	0	0	0	0	0	0	10	0	7	0	0	0	0	0	19	2	24
LONINV	1	3	3	1	3	1	0	1	10	3	10	2	6	0	3	1	0	1	2	1
SALDRU	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
SALPLA	0	0	0	0	3	0	3	1	3	0	0	0	0	0	0	0	0	0	0	0
VACSPP	1	1	1	20	10	20	30	30	21	11	4	0	1	0	3	10	0	10	1	24
CALCAN	1	0	0	10	10	0	0	10	0	1	1	1	1	4	2	0	0	4	0	4
CARAQU	10	0	0	10	3	10	0	1	10	0	0	0	0	0	0	0	1	0	0	1
CALLEP	10	0	0	20	1	10	0	20	1	0	0	0	0	0	1	1	11	0	0	0
CARCOR	1	10	1	1	0	3	3	1	3	10	3	11	1	5	0	1	0	2	5	1
EQUARV	0	1	0	0	0	1	0	0	3	10	3	15	1	8	0	0	0	1	0	0
ERIPER	0	0	0	0	10	10	3	3	1	0	0	0	0	2	2	5	0	0	1	0
LIGFIL	0	0	0	10	1	3	0	0	0	0	0	0	0	0	4	3	6	1	0	0
MERCIL	0	3	3	1	1	1	3	1	1	3	1	6	3	0	5	2	0	1	5	0
MICODO	0	1	1	1	0	1	0	1	3	0	3	10	0	1	0	0	2	1	4	0
OXYFEN	0	1	1	1	0	1	1	1	1	1	0	3	0	0	2	0	6	2	6	6
SENTRI	1	10	1	3	3	10	20	10	3	3	3	10	0	1	5	1	8	6	6	3
STRFAS	1	1	3	1	1	3	0	0	1	10	1	9	0	2	5	0	0	6	1	3
TROLAX	0	0	1	20	20	10	1	10	3	0	0	0	0	0	2	2	5	2	0	0

Canopy cover by plot for selected species in the Abies lasiocarpa-Picea engelmannii/Actaea rubra p.a.

PLOT	
SPECIES	527
ABILA1	4
ABILAS	12
PICEN1	4
PICEN2	17
ACTRUB	13
ARNMOL	14
HERLAN	7
STRFAS	10

Canopy cover by plot for selected species in the Abies lasiocarpa-Picea engelmannii/Ribes species p.a.

PLOT	
SPECIES	604
ABILAS	11
ABILA2	15
ABILA1	12
PICENG	39
PICEN2	6
RIBINE	22
VACSCO	6
ARNCOR	4
ERIPER	3

Canopy cover by plot for selected species in the Picea engelmannii/Carex aquatilis p.a.

	PLOTS	
SPECIES	93	122
ABILA1	0	3
ABILA2	0	3
PICEN1	1	3
PICEN2	10	10
PICENG	10	0
CALCAN	0	3
CARAQU	80	10
ACOCOL	0	3
CARCOR	3	1
EQUARV	3	0
MICODO	1	3

Canopy cover by plot for selected species in the *Picea engelmannii*/*Equisteum arvense* p.a.

	PLOTS			
SPECIES	94	451	481	550
ABILAS	0	0	0	6
ABILA2	0	0	3	0
ABILA1	0	3	3	0
PICENG	20	40	3	10
PICEN2	3	3	3	0
PICEN1	1	3	3	0
ALNINC	1	10	10	10
SALGEY	20	0	0	0
CALCAN	20	1	1	7
EQUARV	30	30	20	19
GERRIC	0	0	10	16
MERCIL	1	0	3	11
MICODO	0	0	10	1
SENTRI	1	1	10	9

Canopy cover by plot for selected species in the *Picea pungens*/*Alnus incana* p.a.

	PLOTS					
SPECIES	81	221	231	372	391	392
POPTRE	0	0	10	0	0	0
PICPUN	10	20	10	50	60	10
PICPU1	3	1	0	1	0	0
PICPU2	0	2	0	3	1	0
ABILAS	20	0	0	0	0	10
ABILA2	3	3	3	0	0	0
ALNINC	40	20	20	40	10	30
CORSER	0	0	0	0	3	10
LONINV	3	0	1	0	3	3
RIBLAC	20	0	0	0	0	0
SALDRU	0	0	3	0	0	10
ELYGLA	0	0	3	3	0	0
ACTRUB	0	0	3	0	3	0
EQUARV	1	20	10	0	10	3
MERCIL	10	0	0	0	0	3
SENTRI	0	0	10	3	0	0
STRFAS	3	0	0	0	10	0

Canopy cover by plot for selected species in the Unclassified Conifer group.

	PLOTS				
SPECIES	515	523	555	560	584
PINCON	25	33	74	33	0
PINFLE	0	0	0	0	25
ALNINC	0	16	9	0	0
BETGLA	10	0	0	0	0
LONINV	0	0	0	5	3
SALBOO	29	17	11	0	27
SALBRA	0	0	0	0	40
SALGEY	0	37	18	0	5
SALWOL	48	16	0	0	0
CALCAN	17	9	3	1	13
CARAQU	3	7	1	11	0
ASTFOL	0	0	0	0	9
CARCOR	6	2	1	1	3
CONSCO	0	1	1	0	5
EQUARV	1	1	5	1	6
ERIPER	1	2	1	9	0
FRAVIR	1	0	0	1	14
GERRIC	0	1	0	0	11
LIGFIL	0	0	1	5	0
SENTRI	1	0	0	3	4
TROLAX	0	0	0	4	0

Canopy cover by plot for selected species in the Populus balsamifera Series.

	PLOT
SPECIES	539
POPBAL	23
LONINV	3
RUBIDA	7
SALDRU	33
SYMROT	9
POAPRA	6
EQUARV	5
GERRIC	8
HERLAN	19
HYDFEN	8
MAIAMP	5
OSMDEP	8
URTGRA	10

Canopy cover by plot for selected species in the Populus tremuloides/Alnus incana p.a.

	PLOT
SPECIES	535
POPTRE	19
ALNINC	32
SALDRU	22
EQUARV	7
HERLAN	14
MERCIL	10
SENTRI	5
TAROFF	6

Canopy cover by plot for selected species in the Populus tremuloides/Mesic forb p.a.

	PLOT
SPECIES	525
POPTRE	17
CARUTR	6
GLYELA	6
POAPRA	11
DELBAR	10
EPI SP	5
EQUARV	13
ERISP	7
GERRIC	5
HERLAN	3
MICODO	4
SENTRI	12
THAFEN	4

Canopy cover by plot for selected species in the Alnus incana/Equisetum arvense p.a.

	PLOT
SPECIES	261
ALNINC	60
LONINV	3
RIBINE	3
ROSWOO	3
SALGEY	3
SALLUC	3
SALMON	3
EQUARV	50
HERLAN	10

Canopy cover by plot for selected species in the *Alnus incana*/Mesic forb p.a.

	PLOTS												
SPECIES	42	61	202	362	514	513	517	532	540	547	549	570	583
PICENG	0	0	0	0	0	0	0	2	7	0	0	0	13
POPANG	0	0	0	0	0	0	0	0	0	0	0	8	0
ALNINC	70	70	80	60	97	41	32	23	62	10	36	48	65
LONINV	1	10	3	0	2	8	0	0	0	0	1	0	0
RIBLAC	1	20	0	0	1	0	0	0	0	0	0	0	0
SALBOO	0	0	0	0	0	22	22	0	0	0	0	3	0
SALDRU	0	3	3	0	0	0	0	0	0	0	11	0	0
SALGEY	1	0	0	0	0	16	18	1	0	0	0	6	0
CALCAN	0	0	0	3	2	1	2	5	4	6	3	0	2
CARAQU	0	0	3	0	2	3	1	3	5	1	2	1	0
CARUTR	0	0	0	0	3	2	1	6	0	1	6	0	0
ACOCOL	0	1	0	3	11	6	0	14	0	0	0	0	4
CARCOR	0	0	3	0	0	0	6	3	0	1	2	0	3
EQUARV	0	1	3	1	1	2	4	3	14	14	3	5	5
GERRIC	0	0	1	1	0	10	13	0	8	3	6	1	0
HERLAN	3	3	1	70	10	7	15	19	1	0	0	0	5
MERCIL	10	10	1	3	4	1	2	6	5	4	1	0	5
MITPEN	0	1	0	0	0	0	3	1	6	3	1	0	2
RUDLAC	3	0	0	10	13	7	0	0	0	0	0	0	0
SENTRI	0	1	1	1	0	2	5	3	9	5	1	1	4
TAROFF	1	0	1	0	2	13	3	0	1	1	4	1	1
URTGRA	10	0	0	0	0	0	0	1	0	0	0	0	0

Canopy cover by plot for selected species in the *Alnus incana*/Mesic graminoid p.a.

	PLOTS		
SPECIES	11	597	598
ALNINC	60	56	83
SALEXI	10	0	0
CARAQU	0	1	20
CALCAN	20	36	10
CAR SP	20	3	0
CARUTR	0	3	32
GLYELA	0	6	0
CALLEP	0	7	14
CARCOR	0	2	8
MERCIL	0	1	11
MICOOO	0	3	6
VIOMAC	0	4	11

Canopy cover by plot for selected species in the *Betula glandulosa* Series.

	PLOTS				
SPECIES	242	282	381	462	586
BETGLA	80	40	40	30	40
SALBRA	0	10	0	0	0
SALPLA	0	10	10	20	0
SALWOL	1	0	0	3	21
PENFLO	1	0	3	10	10
BROCAN	0	0	0	1	8
CALCAN	0	0	0	30	0
CARAQU	3	0	10	10	0
CARUTR	0	0	0	10	0
DESCES	1	10	3	0	6
POAPRA	3	0	30	0	5
ASTER	0	0	0	0	14
CALLEP	0	10	10	0	0
GALSEP	1	0	0	0	13
EPIANG	10	0	0	0	0
ERIPER	0	20	0	0	0
FRAVIR	3	0	1	1	25
LIGFIL	3	10	10	0	11
PER SP	0	0	20	0	0
POLBIS	0	0	0	0	7
TAROFF	1	1	0	1	12

Canopy cover by plot for selected species in the Pentaphylloides floribunda/Deschampsia cespitosa p.a.

	PLOT
SPECIES	241
PENFLO	30
BROPOR	3
DESCES	10
FESRUB	20
JUNBAL	10
POASEC	30
FRAVIR	10
RUMAQU	10

Canopy cover by plot for selected species in the Salix boothii/Carex utriculata p.a.

	PLOTS					
SPECIES	244	516	519	521	522	524
SALBOO	60	59	91	55	45	40
SALGEY	0	17	15	6	6	25
SALWOL	3	6	0	0	0	16
SALPLA	0	0	0	0	7	0
SALDRU	0	0	4	0	6	0
CALCAN	0	1	6	7	13	5
CARAQU	3	2	0	12	7	6
CARUTR	3	19	25	12	10	9
MERCIL	3	1	0	5	0	2

Canopy cover by plot for selected species in the Salix boothii/Mesic forb p.a.

	PLOTS		
SPECIES	520	552	554
SALBOO	66	56	66
SALGEY	34	20	0
CALCAN	6	3	8
CARAQU	7	0	3
CARUTR	1	1	10
ASTER	0	0	10
GERRIC	0	8	1
HERLAN	10	28	7
MERCIL	1	0	4

Canopy cover by plot for selected species in the Salix drummondiana-Salix planifolia/Calamagrostis canadensis p.a.

	PLOTS		
SPECIES	91	201	442
SALDRU	30	70	60
SALPLA	20	0	1
CALCAN	20	10	40
CARAQU	30	10	10
CARUTR	0	10	30
GLYSTR	0	10	0
GEUMAC	1	3	1
HERLAN	3	1	1

Canopy cover by plot for selected species in the Salix geyeriana/Calamagrostis canadensis p.a.

	PLOT
SPECIES	591
ALNINC	12
SALGEY	47
SALMON	9
CALCAN	41
CARMAC	8
TORPAU	7
GEUMAC	6

Canopy cover by plot for selected species in the Salix geyeriana/Carex aquatilis p.a.

	PLOTS			
SPECIES	31	371	606	612
SALBOO	10	0	1	0
SALGEY	40	80	25	12
SALMON	0	0	16	0
SALPLA	3	0	1	6
CALCAN	0	10	12	0
CARAQU	20	20	18	28
CARLIM	0	0	0	16
CARNEU	0	0	13	0
CARUTR	0	10	0	14
LUZPAR	1	0	4	3
CARCOR	1	3	6	1
EQUARV	0	1	25	0
GEUMAC	1	1	0	10
SENTRI	0	3	14	2

Canopy cover by plot for selected species in the Salix geyeriana/Carex utriculata p.a.

	PLOTS		
SPECIES	71	271	536
SALDRU	0	0	10
SALGEY	40	20	34
SALMON	0	20	17
SALPLA	3	0	12
SALWOL	10	0	0
BROCAN	0	1	16
CARAQU	0	20	6
CARUTR	60	20	58
ACOCOL	0	1	24
CARCOR	0	1	16
EQUARV	0	0	31
MICODO	0	0	10
SENTRI	0	1	12

Canopy cover by plot for selected species in the Salix geyeriana/Mesic forb p.a.

	PLOTS				
SPECIES	92	531	551	558	559
ALNINC	0	0	50	30	15
SALDRU	0	18	0	0	0
SALGEY	40	67	68	69	75
SALMON	0	0	0	0	20
SALPLA	10	3	1	0	1
ALOPRA	20	0	0	0	0
FESRUB	20	0	0	0	0
ACOCOL	0	0	1	2	5
ANTCOR	10	0	0	0	0
CARCOR	0	2	0	18	7
CASSUL	10	0	0	0	0
ERISPE	0	0	0	2	8
FRAVIR	0	1	5	0	1
GERRIC	0	6	4	3	2
HERLAN	0	22	6	2	28
MERCIL	1	34	1	3	6
OXYFEN	10	0	2	4	2
SENTRI	0	7	2	8	9

Canopy cover by plot for selected species in the Salix geyeriana-Salix monticola/Mesic forb p.a.

SPECIES	PLOTS				
	41	43	151	530	546
ALNINC	20	0	0	0	0
RIBINE	10	0	10	1	0
SALGEY	40	40	10	0	0
SALMON	20	50	30	86	81
CALCAN	1	0	0	4	0
CARAQU	0	0	0	1	7
CARUTR	10	0	0	4	0
POAPRA	10	0	10	1	1
ANGAMP	10	3	0	0	0
CALLEP	0	0	0	0	8
EQUARV	0	0	0	2	5
HERLAN	10	10	1	14	1
MAISTE	1	0	10	0	0
MERCIL	3	3	0	4	2
RUDLAC	10	0	0	0	0
SENTRI	1	0	0	9	3
URTGRA	1	10	1	0	0
LONINV	0	1	1	7	0

Canopy cover by plot for selected species in the Salix lucida var. caudata/Mesic graminoid p.a.

	PLOT
SPECIES	553
PINCON	13
ALNINC	10
SALBOO	12
SALGEY	9
SALLUC	25
CALCAN	8
CARAQU	6
CARCAN	5

Canopy cover by plot for selected species in the *Salix planifolia*/*Caltha leptosepala* p.a.

	PLOTS												
SPECIES	181	421	533	534	538	562	563	565	579	588	610	615	619
SALBRA	0	0	12	0	0	0	0	0	0	0	0	0	0
SALLUL	10	0	0	0	0	0	0	0	0	0	0	0	0
SALPLA	50	30	34	48	98	82	73	83	29	56	65	48	56
CALCAN	0	0	0	2	2	1	0	0	0	4	0	2	0
CARAQU	1	1	1	2	9	12	3	4	0	26	6	2	10
CARJON	0	0	6	2	0	0	0	0	0	6	1	0	3
CARUTR	0	0	0	0	3	0	9	1	0	6	10	2	5
DESCES	0	1	6	7	1	3	0	0	4	10	0	0	1
POAPRA	10	0	2	1	0	0	3	0	0	1	0	1	0
ACOCOL	20	10	1	1	4	0	0	6	0	0	0	1	1
CALLEP	1	10	16	24	1	15	1	38	5	11	6	3	11
ERIPER	0	1	9	2	0	1	0	0	7	0	0	0	0
FRAVIR	0	0	0	0	1	0	4	2	0	10	1	1	0
LIGFIL	0	0	0	0	0	7	3	9	12	0	0	0	0
MERCIL	10	10	0	1	4	3	6	1	0	0	0	1	1
MICODO	0	3	0	0	0	3	0	8	0	3	0	4	3
PEDGRO	0	0	0	1	1	1	0	8	0	2	11	0	5
SENTRI	20	30	1	1	5	4	3	11	3	7	1	10	6
TROLAX	0	10	5	3	0	10	0	10	6	2	0	0	0

Canopy cover by plot for selected species in the *Salix planifolia*/*Carex aquatilis* p.a.

	PLOTS																
SPECIES	101	121	171	182	281	311	321	351	461	472	566	567	590	600	607	614	616
BETGLA	0	0	0	0	0	0	0	20	1	1	0	0	0	0	0	0	0
SALDRU	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0
SALPLA	70	60	40	40	80	60	30	50	30	70	49	42	48	91	58	32	21
SALWOL	20	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0
CALCAN	0	0	0	0	0	20	0	3	1	10	20	2	5	23	10	6	0
CARAQU	20	50	40	20	10	30	50	60	50	10	4	25	1	25	7	38	23
CARUTR	20	0	30	30	0	1	10	10	30	0	3	0	11	0	0	16	11
DESCES	1	0	0	0	3	1	3	3	0	0	0	5	0	0	14	0	5
POAREF	0	0	0	0	10	3	0	1	1	0	0	0	0	0	0	0	0
TRIWOL	0	0	0	0	20	0	0	0	1	1	2	2	0	0	0	0	8
ASTFOL	0	0	0	0	0	0	0	0	1	10	0	0	1	2	0	0	0
CALLEP	1	3	0	0	10	20	40	10	0	0	5	19	0	4	3	0	7
CARCOR	1	10	1	1	0	1	0	0	0	1	0	0	0	3	4	3	1
CONSCO	0	0	0	0	0	0	10	3	1	3	0	0	1	0	1	0	0
ERIPER	0	0	0	0	30	0	0	0	0	0	0	3	0	0	0	0	0
LIGFIL	0	0	0	0	0	3	20	3	0	0	0	1	1	8	0	0	0
MICODO	0	20	0	0	0	0	0	0	0	1	0	0	0	3	2	0	15
SENTRI	0	3	1	3	1	10	1	3	0	0	6	1	1	16	4	4	5

Canopy cover by plot for selected species in the Salix brachycarpa-Salix planifolia/Mesic forb p.a.

	PLOTS		
SPECIES	291	303	541
SALBRA	10	50	59
SALMON	10	0	0
SALPLA	10	30	3
CARAQU	20	10	0
CARAUR	1	10	0
CARMIC	10	1	0
ACOCOL	3	3	2
CALLEP	10	20	0
CARCOR	0	0	14
HERLAN	10	0	0
LIGBIG	0	10	0
LIGFIL	10	40	0
MERCIL	1	0	16
RUMAQU	0	10	0
SENTRI	3	3	7
SOLMUL	0	10	0

Canopy cover by plot for selected species in the Salix wolfii/Carex aquatilis p.a.

	PLOTS		
SPECIES	331	511	512
BETGLA	0	10	0
SALWOL	70	60	21
DESCES	0	3	0
CARAQU	20	30	13
CARUTR	0	0	19
ASTFOL	1	20	0
CALLEP	20	0	2
FRAVIR	20	3	0
GEUMAC	1	20	0
LIGFIL	10	0	0
POLBIS	20	0	0

Canopy cover by plot for selected species in the Salix wolfii/Mesic forb p.a.

	PLOTS				
SPECIES	133	245	383	543	585
SALBOO	0	3	0	36	18
SALPLA	30	0	20	0	0
SALGEY	0	0	0	0	20
SALWOL	30	70	50	43	50
CALCAN	10	0	0	1	1
CARAQU	3	3	0	5	1
CARUTR	0	0	3	4	1
DESCES	1	3	3	0	0
ACHLAN	1	1	3	2	1
ASTFOL	0	3	3	0	0
CALLEP	1	0	10	1	1
CARCOR	3	1	0	1	0
FRAVIR	3	3	10	4	12
GALSEP	0	0	1	0	6
GERRIC	10	0	0	1	3
GEUMAC	1	1	3	1	1
HERLAN	0	0	0	1	3
LIGFIL	0	0	10	0	1
TAROFF	1	1	1	6	3
THAFEN	0	3	0	1	0

Canopy cover by plot for selected species in the Calamagrostis canadensis p.a.

	PLOTS	
SPECIES	548	603
CALCAN	31	17
CARAQU	4	0
CARMIC	16	0
CARUTR	6	7
ASTFOL	0	10
EQUARV	7	7
SENTRI	7	3

Canopy cover by plot for selected species in the Carex aquatilis p.a.

	PLOTS						
SPECIES	21	251	411	599	609	613	620
SALGEY	0	10	0	0	0	0	0
AGRGIG	0	0	10	0	0	0	0
CARAQU	70	70	40	21	22	17	27
CARJON	0	0	0	0	12	13	0
CARUTR	1	20	0	2	2	8	0
DESCES	0	3	10	7	6	1	7
CALLEP	0	0	1	6	12	0	2

Canopy cover by plot for selected species in the Carex aquatilis-Carex utriculata p.a.

	PLOTS	
SPECIES	243	537
CARAQU	40	28
CARUTR	30	18
DESCES	20	0

Canopy cover by plot for selected species in the Carex saxatilis p.a.

	PLOT
SPECIES	284
CARAQU	20
CARSAX	40
DESCES	10
ELEQUI	20
CALLEP	10

Canopy cover by plot for selected species in the Carex scopulorum-Caltha leptosepala p.a.

	PLOT
SPECIES	581
AGRTHU	10
CARSCO	34
DESCES	24
CALLEP	10
LIGFIL	23

Canopy cover by plot for selected species in the Carex utriculata p.a.

	PLOTS					
SPECIES	51	111	131	203	302	596
CARAQU	0	3	0	0	10	4
CARUTR	60	40	90	80	70	10
JUNBAL	20	0	0	0	0	1
CALLEP	1	0	3	0	0	9
PEDGRO	1	0	1	1	0	7

Canopy cover by plot for selected species in the Deschampsia cespitosa p.a.

	PLOTS			
SPECIES	132	382	571	573
CARAQU	1	0	10	4
CARILL	8	0	0	0
CARUTR	0	20	0	0
DESCES	41	70	50	17
ANENAR	0	0	0	13
ARNMOL	0	0	0	20
CALLEP	16	0	1	11
ERIPER	0	0	0	11
LIGFIL	1	0	0	26

Canopy cover by plot for selected species in the Deschampsia cespitosa-Carex aquatilis p.a.

	PLOTS			
SPECIES	102	574	576	577
DESCES	40	31	13	13
CARAQU	50	35	25	18
CARILL	0	6	8	5
ELEQUI	0	0	9	0
CALLEP	1	8	45	14
ERIPER	0	4	2	8
LIGFIL	0	38	8	23
TROLAX	0	1	2	11

Canopy cover by plot for selected species in the Eleocharis palustris p.a.

	PLOTS	
SPECIES	564	569
CARAQU	7	0
CARUTR	1	1
ELEPAL	20	22

Canopy cover by plot for selected species in the *Eleocharis quinqueflora* p.a.

	PLOTS					
SPECIES	283	568	578	595	608	618
CARAQU	10	8	29	20	2	31
CARCAN	1	0	5	0	0	0
CARILL	0	0	1	16	0	0
CARJON	0	0	0	26	0	0
CARSCO	0	0	10	0	0	0
DESCES	1	8	1	0	1	1
ELEQUI	40	16	21	38	26	51
CALLEP	1	6	4	13	1	1
PEDGRO	1	1	1	10	1	2
SENTRI	0	0	0	7	0	0

Canopy cover by plot for selected species in the mesic forb group.

	PLOTS				
SPECIES	526	561	592	594	605
SALDRU	0	0	5	3	0
SALPLA	10	0	0	0	0
CARAQU	0	11	1	0	0
DESCES	0	8	10	6	7
JUNDRU	0	7	1	0	2
ARMOL	1	4	4	1	13
ASTER	0	0	8	0	0
CALLEP	0	14	0	0	0
CARCOR	11	0	1	8	0
EPISP	7	3	1	1	0
EQUARV	14	0	7	3	0
ERIPER	7	11	0	1	0
GERRIC	8	0	1	1	0
LIGFIL	0	25	2	0	0
MERCIL	2	0	6	1	6
MICODO	6	3	1	1	9
OXYFEN	1	0	3	4	0
PRUVUL	0	0	7	3	0
SENTRI	13	0	8	1	0
TAROFF	1	0	9	1	0
TROLAX	0	10	0	0	0

Appendix 2. List of Scientific Names Used in Plant Association Descriptions Cross Referenced with SCS
Common Names

Abies lasiocarpa - subalpine fir
Aconitum columbianum - Columbian monkshood
Actaea rubra - red baneberry
Agrostis thurberiana - Thurber's bentgrass
Alnus incana ssp. *tenuifolia* - thinleaf alder
Aster foliaceus var. *foliaceus* - alpine leafybract aster
Calamagrostis canadensis - bluejoint reedgrass
Caltha leptosepala ssp. *leptosepala* - white marshmarigold
Cardamine cordifolia - heartleaf bittercress
Carex aquatilis var. *aquatilis* - water sedge
Carex saxatilis var. *saxatilis* - russet sedge
Carex scopulorum - mountain sedge
Carex utriculata - Northwest Territory sedge
Cornus sericea - red osier dogwood
Delphinium barbeyi - tall larkspur
Deschampsia cespitosa ssp. *cespitosa* - tufted hairgrass
Eleocharis palustris - common spikerush
Eleocharis quinqueflora - fewflower spikerush
Equisetum arvense - field horsetail
Festuca rubra - red fescue
Fragaria virginiana ssp. *glauca* - Virginia strawberry
Geranium richardsonii - Richardson's geranium
Heracleum lanatum - cow parsnip
Hydrophyllum fendleri - Fendler's waterleaf
Juncus balticus var. *montanus* - mountain rush
Ligusticum tenuifolium - Idaho licoriceroot
Lonicera involucrata var. *involucrata* - twinberry honeysuckle
Mertensia ciliata - mountain bluebells
Osmorhiza depauperata - bluntseed sweetroot
Phleum alpinum - alpine timothy
Picea engelmannii - Engelmann spruce
Pinus contorta - lodgepole pine
Poa pratensis - Kentucky bluegrass
Populus angustifolia - narrowleaf cottonwood
Populus balsamifera - balsam poplar
Populus tremuloides - quaking aspen
Ribes lacustre - prickly currant
Salix boothii - Booth's willow
Salix brachycarpa - barreground willow
Salix drummondiana - Drummond's willow
Salix exigua - sandbar willow
Salix geyeriana - Geyer's willow
Salix lucida ssp. *caudata* - greenleaf willow
Salix monticola - park willow
Salix planifolia - diamondleaf willow
Salix wolfii - Wolf's willow
Saxifraga odontoloma - brook saxifrage
Senecio triangularis - arrowleaf groundsel
Streptopus fassettii - tubercle twistedstalk
Trollius laxus ssp. *albiflorus* - American globeflower

Appendix 3. Species List and Acronyms Used in Stand Tables

Sp. Code	Kartesz (SCS) Name	Weber Name
ABILA1	<i>Abies lasiocarpa</i> (Hook.) Nutt.--seedlings*	
ABILA2	<i>Abies lasiocarpa</i> (Hook.) Nutt.--saplings**	
ABILAS	<i>Abies lasiocarpa</i> (Hook.) Nutt.--young & mature trees*	
ACEGLA	<i>Acer glabrum</i> Torr.*	
ACHLAN	<i>Achillea millefolium</i> L. var. <i>occidentalis</i> DC.	<i>Achillea lanulosa</i> Nuttall
ACOCOL	<i>Aconitum columbianum</i> Nutt.*	
ACTRUB	<i>Actaea rubra</i> (Ait.) Willd. ssp. <i>arguta</i> (Nutt.) Hulten*	
ADOMOS	<i>Adoxa moschatellina</i> L.*	
AGR SP	<i>Agrostis</i> sp.*	
AGREXA	<i>Agrostis exarata</i> Trin.*	
AGRGIG	<i>Agrostis gigantea</i> Roth*	
AGRHUM	<i>Agrostis humilis</i> Vasey*	
AGRIDA	<i>Agrostis idahoensis</i> Nash*	
AGRSCA	<i>Agrostis scabra</i> Willd.*	
AGRSTO	<i>Agrostis stolonifera</i> L.*	
AGRTHU	<i>Agrostis thurberiana</i> A.S. Hitchc.*	
AGRVAR	<i>Agrostis variabilis</i> Rydb.*	
ALLBRE	<i>Allium brevistylum</i> S. Wats.*	
ALNINC	<i>Alnus incana</i> ssp. <i>tenuifolia</i> (Nutt.) Breitung*	
ALO SP	<i>Alopecurus</i> sp.*	
ALOA EQ	<i>Alopecurus aequalis</i> Sobol.*	
ALOPRA	<i>Alopecurus pratensis</i> L.*	
ALSIN	Alsinaceae	
AMEALN	<i>Amelanchier alnifolia</i> (Nutt.) Nutt. ex M. Roemer*	
ANAMAR	<i>Anaphalis margaritacea</i> (L.) Benth. & Hook. f.*	
AND SP	<i>Androsace</i> sp.	
ANDFIL	<i>Androsace filiformis</i> Retz.*	
ANDSEP	<i>Androsace septentrionalis</i> L.*	
ANENAR	<i>Anemone narcissiflorum</i> ssp. <i>zephyra</i> (A.Nels.) Hultén	<i>Anemonastrum narcissiflorum</i> (L.) Holub ssp. <i>zephyrum</i> (A. Nelson) W.A. Weber
ANGAMP	<i>Angelica ampla</i> A. Nels.*	
ANGGRA	<i>Angelica grayi</i> (Coul. & Rose) Coult. & Rose*	
ANGPIN	<i>Angelica pinnata</i> S. Wats.*	
ANTCOR	<i>Antennaria corymbosa</i> E. Nels.*	
ANTELE	<i>Zigadenus elegans</i> ssp. <i>elegans</i> Pursh	<i>Anticlea elegans</i> (Pursh) Rydberg
APIAC	Apiaceae	
AQU SP	<i>Aquilegia</i> sp.*	
AQUCOE	<i>Aquilegia coerulea</i> James*	
ARA SP	<i>Arabis</i> sp.	
ARCADE	<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	<i>Arctostaphylos adenotricha</i> (Fernald & Macbride) Löve et al.
AREFEN	<i>Arenaria fendleri</i> var. <i>fendleri</i> Gray	<i>Eremogone fendleri</i> (A. Gray) Ikonnikov
ARGANS	<i>Argentina anserina</i> (L.) Rydberg	<i>Argentina anserina</i> (L.) Rydberg var. <i>concolor</i> Rydberg
ARI SP	<i>Aristida</i> sp.	
ARN SP	<i>Arnica</i> sp.	
ARNCHA	<i>Arnica chamissonis</i> Less.*	
ARNCOR	<i>Arnica cordifolia</i> Hook.*	
ARNLAT	<i>Arnica latifolia</i> Bong.*	
ARNMOL	<i>Arnica mollis</i> Hook.*	
ARNPAR	<i>Arnica parryi</i> Gray*	
ARRELA	<i>Arrhenatherum elatius</i> (L.) J. & K. Presl	<i>Arrhenatherum elatius</i> (L.) P. Beavois ex J. & K. Presl
ARTLUD	<i>Artemisia ludoviciana</i> ssp. <i>ludoviciana</i> Nutt.*	
ASTALP	<i>Aster alpinus</i> L. var. <i>vierhapperi</i> (Onno) Cronq.	
ASTASC	<i>Aster ascendens</i> Lindl.	<i>Virgulaster ascendens</i>
ASTER	Asteraceae	
ASTFOL	<i>Aster foliaceus</i> var. <i>foliaceus</i> Lindl. ex DC.*	
ATHFIL	<i>Athyrium filix-femina</i> (L.) Roth ex Mertens ssp.	
AZAALB	<i>Rhododendron albiflorum</i> Hook.	<i>Azaleastrum albiflorum</i> (Hook.) Rydb.
BETGLA	<i>Betula glandulosa</i> Michx.*	
BISVIV	<i>Polygonum viviparum</i> L.	<i>Bistorta vivipara</i> (L.) S. Gray
BOEDRU	<i>Arabis drummondii</i> Gray	<i>Boechera drummondii</i> (A. Gray) Löve & Löve
BROBUL	<i>Melica bulbosa</i> Geyer ex Porter & Coult.	<i>Bromelica bulbosa</i> (Geyer ex Porter & Coulter) W.A. Weber
BROCAN	<i>Bromus canadensis</i> Michx.	<i>Bromopsis canadensis</i> (Michaux) Holub. subsp. <i>richardsonii</i> (Link) Tselev.
BROCAR	<i>Bromus carinatus</i> Hook. & Arn.	<i>Ceratochloa carinata</i> (Hook. & Arn.) Tutin
BROINE	<i>Bromus inermis</i> ssp. <i>inermis</i> var. <i>inermis</i> Leyss.	<i>Bromopsis inermis</i> (Leysser) Holub
BROLAN	<i>Bromus lanatipes</i> (Shear) Rydb.	<i>Bromopsis lanatipes</i> (Shear) Holub
BROPOR	<i>Bromus anomalus</i> Rupr. ex Fourn.	<i>Bromopsis porteri</i> (Coulter) Holub
BROPUM	<i>Bromus inermis</i> Leyss. ssp. <i>pumpellianus</i> (Scribn.) Wagnon var. <i>coloradensis</i> (Vasey ex Beal) Kart	<i>Bromopsis pumpelliana</i> (Scribner) Holub
BROSPE	<i>Melica spectabilis</i> Scribn.	<i>Bromelica spectabilis</i> (Scribn.) W.A. Weber

CALBUL	Calypso bulbosa (L.) Oakes*	
CALCAN	Calamagrostis canadensis (Michx.) Beauv.*	
CALLEP	Caltha leptosepala ssp. leptosepala var. leptosepala DC.	Psychrophila leptosepala (DeCandolle) W.A. Weber
CALSCO	Calamagrostis scopulorum M.E. Jones*	
ALVER	Callitriche palustris L.	Callitriche verna L. emend Lönnroth
CAMPAR	Campanula parryi Gray*	
CAMROT	Campanula rotundifolia L.*	
CAR SP	Carex sp.*	
CARAQU	Carex aquatilis Wahlenb. var. aquatilis*	Carex aquatilis Wahl. subsp. aquatilis
CARATH	Carex athrostachya Olney*	
CARAUR	Carex aurea Nutt.*	
CARBRE	Cardamine breweri S. Wats.*	
CARBUX	Carex buxbaumii Wahlenb.*	
CARCAN	Carex canescens L.*	
CARCOR	Cardamine cordifolia Gray*	
CARDEW	Carex deweyana Schwein.*	
CARDIS	Carex disperma Dewey*	
CAREBE	Carex ebenea Rydb.*	
CARFOE	Carex foenea Willd.*	
CARGEY	Carex geyeri Boott*	
CARHAS	Carex hassei Bailey*	
CARILL	Carex illota Bailey*	
CARINT	Carex interior Bailey*	
CARJON	Carex jonesii Bailey*	
CARLAC	Carex bipartita All.	Carex lachenalii Schkuhr
CARLIM	Carex limosa L.*	
CARMAC	Carex macloviana d'Urv.*	
CARMAG	Carex magellanica Lam. ssp. irrigua (Smith) Hult.*	
CARMIC	Carex microptera Mackenzie*	
CARNEB	Carex nebrascensis Dewey*	
CARNEU	Carex neurophora Mackenzie*	
CARNIG	Carex nigricans C.A. Mey.*	
CARNOR	Carex norvegica ssp. norvegica Retz.*	
CARNOV	Carex nova Bailey*	
CARPEN	Carex inops Bailey ssp. heliophila (Mackenzie) Crins	Carex pensylvanica Lamarck ssp. heliophila (Mackenzie) W.A. Weber
CARPRA	Carex praegracilis W. Boott*	
CARRAY	Carex raynoldsii Dewey*	
CARSAX	Carex saxatilis L. var. saxatilis	Carex saxatilis L. ssp. laxa (Traut.) Kalela
CARSCO	Carex scopulorum Holm*	
CARUTR	Carex utriculata Boott*	
CAS SP	Castilleja sp.	
CASMIN	Castilleja miniata Dougl. ex Hook.*	
CASRHE	Castilleja rhexifolia Rydb.*	
CASSUL	Castilleja sulphurea Rydb.*	
CER SP	Cerastium sp.*	
CHADOU	Chaenactis douglasii (Hook.) Hook. & Arn.*	
CHASUB	Epilobium latifolium L.	Chamerion subdentatum (Rydb.) Love & Love
CHLTRI	Hieracium triste var. triste Hulten	Chlorocrepis tristis (Willd. ex Sprengel) Löve & Löve ssp. gracilis (Hooker) W.A. Weber
CICDOU	Cicuta douglasii (D.C.) Coult. & Rose.*	
CINLAT	Cinna latifolia (Trev. ex Goepf) Griseb*	
CIR SP	Cirsium sp.*	
CIRALP	Circaea alpina ssp. alpina L.	
CIRARV	Cirsium arvense (L.) Scop.*	
CIRCOL	Cirsium tioganum var. coloradense (Rydb.) Dorn	Cirsium coloradense (Rydb.) Cockerell
CIREAT	Cirsium eatonii (Gray) B.L. Robins*	
CIRHES	Cirsium scopulorum (Greene) Cockerell ex Daniels	Cirsium hesperium (Eastw.) Petrak
CIRPAR	Cirsium parryi (Gray) Petrak*	
CIRVUL	Cirsium vulgare (Savi) Ten.*	
COLLIN	Collomia linearis Nutt.*	
CONSCO	Conioselinum scopulorum (Gray) Coult. & Rose*	
COR SP	Corallorrhiza sp.*	
CORSER	Cornus sericea L.	Swida sericea (L.) Holub
CORTRI	Corallorrhiza trifida Chatelain*	
CRUCHA	Montia chamissoi (Ledeb. ex Spreng.) Greene	Crunocallis chamissoi (Ledeb. ex Spreng.) Rydb.
CYSFRA	Cystopteris fragilis (L.) Bernh.*	
DACGLO	Dactylis glomerata L.*	
DANINT	Danthonia intermedia Vasey*	
DELBAR	Delphinium barbeyi (Huth) Huth*	
DES SP	Descurainia sp.*	
DESCES	Deschampsia cespitosa (L.) Beauv. ssp. cespitosa*	
ESINC	Descurainia incana (Bernh. ex Fisch. & C.A. Mey.) Dorn*	
DODPUL	Dodecatheon pulchellum (Raf.) Merr.*	
DRAALB	Draba albertina Greene*	

DUGHOO	Dugaldia hoopesii (Gray) Rydb.*	
ELE SP	Eleocharis sp.*	
ELEPAL	Eleocharis palustris (L.) Roemer & J.A. Schultes*	
ELEQUI	Eleocharis quinqueflora (F.X. Hartman) Schwarz*	
ELYELY	Elymus elymoides (Raf) Swezey*	
ELYGLA	Elymus glaucus Buckl.*	
ELYREP	Elytrigia repens (L.) Desv. ex B.D. Jackson*	
ELYTRA	Elymus trachycaulus (Link) Gould ex Shinners*	
EPI SP	Epilobium sp.*	
EPIANG	Epilobium angustifolium (L.) Scopoli ssp. circumvagum Mosquin	Chamerion danielsii D. Löve
EPICIL	Epilobium ciliatum Rafinesque ssp. ciliatum*	
EPIHAL	Epilobium halleanum Hausskn.*	
EPIHOR	Epilobium hornemannii Reichenb.*	
EPIILAC	Epilobium lactiflorum Hausskn.*	
EPIPAL	Epilobium palustre L.	E. palustre L. var. grammadophyllum Hausskn.
EPISAX	Epilobium saximontanum Hausskn.*	
EQU SP	Equisetum sp.*	
EQUARV	Equisetum arvense L.*	
EQUPra	Equisetum pratense Ehrh.*	
ERI SP	Erigeron sp.*	
ERiang	Eriophorum angustifolium Honckeney*	
ERICOU	Erigeron coulteri Porter*	
ERIELA	Erigeron elatior (Gray) Greene*	
ERIEXI	Erigeron eximius Greene*	
ERIPER	Erigeron peregrinus (Banks ex Pursh) Greene ssp. callianthemus (Greene) Cronq.*	
ERISPE	Erigeron speciosus (Lindl.) D.C. var. speciosus (Lindl.) DC.	
ERISUB	Erigeron subtrinervis Rydb. ex Porter & Britt.*	
ERYCHE	Erysimum cheiranthoides L.*	
ERYGRA	Erythronium grandiflorum Pursh*	
EUCENG	Aster engelmannii (D.C. Eat.) Gray	Eucephalus engelmannii (D.C. Eat.) Green
FABAC	Fabaceae	
FESBRA	Festuca brachyphylla ssp. coloradensis Frederiksen*	
FESIDA	Festuca idahoensis Elmer*	
FESRUB	Festuca rubra L.*	
FESTHU	Festuca thurberi Vasey*	
FRASPE	Frasera speciosa Dougl. ex Griseb.*	
FRIVES	Fragaria vesca ssp. bracteata (Heller) Standt*	
FRAVIR	Fragaria virginiana Duchesne ssp. glauca (S. Wats.) Staudt	Fragaria virginiana P. Miller subsp. glauca (S. Watson) Staudt
GAL SP	Galium sp.*	
GALBIF	Galium bifolium S. Wats.*	
GALMEX	Galium mexicanum Kunth ssp. asperrimum (Gray) Dempster*	
GALSEP	Galium boreale L.	Galium septentrionale Roemer & Schultes
GALSPU	Galium spurium L.*	
GALTFD	Galium trifidum ssp. subbiflorum (Wieg.) Piper*	
GALTRI	Galium triflorum Michx.*	
GAUHUM	Gaultheria humifusa (Graham) Rydb.*	
GENACU	Gentianella amarella ssp. acuta (Michx.) J. Gillett	Gentianella acuta (Michx.) Hiitonen
GENBAR	Gentianopsis barbellata (Engelm.) Iltis	
GENHET	Gentianella amarella ssp. heterosepala (Engelm.) J. Gillett	Gentianella heterosepala (Engelm.) Holub
GENTHE	Gentianopsis thermalis (Kuntze) Iltis*	
GERRIC	Geranium richardsonii Fisch. & Trautv.*	
GERVIS	Geranium viscosissimum var. nervosum (Rydb.) C.L. Hitchc.	Geranium viscosissimum Fischer & Meyer ssp. nervosum (Rydb.) W.A. Weber
GEUALE	Geum aleppicum Jacq.	Geum aleppicum Jacq. ssp. strictum (Aiton) Clausen
GEUMAC	Geum macrophyllum Willd. var. perincisum (Rydb.) Raup*	
GEURIV	Geum rivale L.*	
GEUTRI	Geum triflorum var. triflorum Pursh	Erythrocoma triflora (Pursh) Greene
GLY SP	Glyceria sp.*	
GLYELA	Glyceria elata (Nash ex Rydb.) M.E. Jones*	
GLYSTR	Glyceria striata (Lam.) A.S. Hitchc. var. stricta (Scribn.) Fern.	
GOOBL	Goodyera oblongifolia Raf.*	
HACFLO	Hackelia floribunda (Lehm) I.M. Johnston*	
HERLAN	Heracleum maximum Bartr.	Heracleum sphondylium L. ssp. montanum (Schleicher ex Gaudin) Briquet
HEHIR	Hierochloa hirta (Schrank) Borbas ssp. arctica (J. Presl) G. Weim.*	
HIPVAR	Equisetum variegatum var. variegatum Schleich. ex Hippochaete variegata (Schleicher) Bruhin	

HOR SP	F. Weber & D.M.H. Mohr Hordeum sp.	Critesion brachyantherum (Nevski) Barkworth & Dewey
HORBRA	Hordeum brachyantherum Nevski	Critesion jubatum (L.) Nevski
HORJUB	Hordeum jubatum L. ssp. jubatum	
HYDFEN	Hydrophyllum fendleri (Gray) Heller*	Hypericum formosum Humboldt, Bonpland, & Kunth
HYPFOR	Hypericum scouleri Hook. ssp. nortoniae (M.E. Jones) J. Gillett	
IRIMIS	Iris missouriensis Nutt.*	
JUN SP	Juniperus sp.*	Juncus ater Rydberg
JUNBAL	Juncus balticus Willd. var. montanus Englm.	
JUNCOM	Juniperus communis L.*	
JUNCON	Juncus confusus Coville*	
JUNDRU	Juncus drummondii E. Mey*	
JUNENS	Juncus ensifolius Wikstr.*	
JUNFIL	Juncus filiformis L.*	
JUNLON	Juncus longistylis Torr.*	
JUNMER	Juncus mertensianus Bong.*	
JUNSAX	Juncus saximontanus A. Nels.*	
JUNTRA	Juncus tracyi Rydb.*	
KALMIC	Kalmia microphylla (Hook.) Heller*	
LAC SP	Lactuca sp.*	
LEP SP	Lepidium sp.*	
LEYCIN	Leymus cinereus Scribn.*	
LIG SP	Ligusticum sp.	Ligularia amplexens (Gray) W.A. Weber
LIGAMP	Senecio amplexens var. amplexens Gray	Ligularia bigelovii (A. Gray) W.A. Weber var. hallii (A. Gray) W.A. Weber
LIGBIG	Senecio bigelovii var. hallii Gray	Ligusticum filicinum S. Wats. var. tenuifolium (S. Wats.) Mathias & Constance
LIGFIL	Ligusticum tenuifolium S. Wats.	
LIGPOR	Ligusticum porteri Coult. & Rose*	Ligularia pudica (Greene) W.A. Weber
LIGPUD	Senecio pudicus Greene	Limnorchis sp.
LIM SP	Platanthera sp.	Limnorchis hyperborea (L.) Rydb.
LIMHYP	Platanthera hyperborea var. hyperborea (L.) Lindl.	Linnaea borealis L. ssp. americana (Forbes) Hultén ex Clausen
LINBOR	Linnaea borealis ssp. longiflora (Torr.) Hultén	Listera cordata (L.) R. Br. ssp. nephrophylla (Rydberg) A. & D. Löve
LISCOR	Listera cordata (L.) R. Br. var. nephrophylla (Rydberg) Hultén	
LOM SP	Lomatium sp.	
LOMDIS	Lomatium dissectum (Nutt.) Mathias & Constance var. multifidum (Nutt.) Mathias & Constance*	Distegia involucrata (Banks ex Sprengel) Cockerell
LOINIV	Lonicera involucrata var. involucrata Banks ex Sprengel	
LUPARG	Lupinus argenteus Pursh*	L. comosa E. Mey.
LUZCON	Luzula congesta (Thuill.) Lej.	
LUZPAR	Luzula parviflora (Ehrh.) Desv.*	
LUZSPI	Luzula spicata (L.) DC.	
LYCANN	Lycopodium annotinum L.*	
LYSOBT	Platanthera obtusata (Banks ex Pursh) Lindl.	Lysiella obtusata (Banks ex Pursh) Rydb.
MAIRAC	Maianthemum racemosum ssp. amplexicaule (Nutt.) LaFrankie	Maianthemum amplexicaule (Nutt.) W.A. Weber
MAISTE	Maianthemum stellatum (L.) Link*	
MENARV	Mentha arvensis L.*	
MERCIL	Mertensia ciliata (James ex Torr.) G. Don*	Micranthes odontoloma (Piper) Heller
MICODO	Saxifraga odontoloma Piper	Micranthes oregana (T.J. Howell) Small
MICORE	Saxifraga oregana J.T. Howell	
MIMGUT	Mimulus guttatus DC.*	
MIMLEW	Mimulus lewisii Pursh*	
MIMMOS	Mimulus moschatus Dougl. ex Lindl.*	
MITPEN	Mitella pentandra Hook.*	
MITSTA	Mitella stauropetala var. stenopetala Piper*	
MOELAT	Moehringia lateriflora (L.) Fenzl*	
MONUNI	Moneses uniflora (L.) Gray*	
MUHAND	Muhlenbergia andina (Nutt.) A.S. Hitchc.*	
MYOCUP	Myosurus cupulatus S. Wats.*	
NOCMON	Thlaspi montanum var. montanum L.	Noccaea montana (L.) F.G. Mey.
OREPYG	Lewisia pygmaea (Gray) B.L. Robins.	Oreobroma pygmaea (Gray) T.J. Howell
ORTSEC	Orthilla secunda (L.) House*	
OSM SP	Osmorhiza sp.	
OSMCHI	Osmorhiza chilensis Hook. & Arn.*	
OSMDEP	Osmorhiza depauperata Phil.*	
OSMOCC	Osmorhiza occidentalis (Nutt. ex Torr. & Gray) Torr*	
OXYDIG	Oxyria digyna (L.) Hill*	
OXYFEN	Oxypolis fendleri (Gray) Heller*	Packera dimorphophylla (Greene) Weber & Löve ssp. dimorphophylla
PACDIM	Senecio dimorphophyllus var. dimorphophyllus Greene	

PARFIM	<i>Parnassia fimbriata</i> Koenig*	
PASSMI	<i>Pascopyrum smithii</i> (Rydb.) A. Love*	
PAXMYR	<i>Paxistima myrsinites</i> (Pursh) Raf.*	
PEDBRA	<i>Pedicularis bracteosa</i> Benth in Hooker ssp. <i>paysoniana</i> (Pennell) Cronq.*	
EDCAN	<i>Pedicularis canadensis</i> ssp. <i>fluviatilis</i> (Heller) W.A. Weber*	
PEDGRO	<i>Pedicularis groenlandica</i> Retz.*	
PEDPAR	<i>Pedicularis parryi</i> ssp. <i>parryi</i> Gray*	
PEDRAC	<i>Pedicularis racemosa</i> Dougl. ex Benth. ssp. <i>alba</i> Pennell*	
PEN SP	<i>Penstemon</i> sp.* Schmidel	
PENCON	<i>Penstemon procerus</i> var. <i>procerus</i> Dougl. ex Graham	<i>Penstemon confertus</i> Douglas in Lindl. ssp. <i>procerus</i> (Douglas ex R. Graham) D. Clark
PENFLO	<i>Pentaphylloides floribunda</i> (Pursh) A. Love*	
PENRYD	<i>Penstemon rydbergii</i> A. Nels.	
PER SP	<i>Polygonum</i> sp.	<i>Persicaria</i> sp.
PETSAG	<i>Petasites sagittatus</i> (Banks ex Pursh) A. Gray*	
PHAHAS	<i>Phacelia hastata</i> Douglas ex Lehmann*	
PHAHET	<i>Phacelia heterophylla</i> Pursh*	
PHLALP	<i>Phleum alpinum</i> L.	<i>Phleum commutatum</i> Gaudin
PHLPRA	<i>Phleum pratense</i> L.*	
PICEN1	<i>Picea engelmannii</i> Parry ex Engelm.--seedlings*	
PICEN2	<i>Picea engelmannii</i> Parry ex Engelm.--saplings*	
PICENG	<i>Picea engelmannii</i> Parry ex Engelm.--young & mature trees*	
PICPU1	<i>Picea pungens</i> Engelm.--seedlings*	
PICPU2	<i>Picea pungens</i> Engelm.--saplings*	
PICPUN	<i>Picea pungens</i> Engelm.--young & mature trees*	
PINCO1	<i>Pinus contorta</i> Dougl. ex Loud--seedlings*	
PINCO2	<i>Pinus contorta</i> Dougl. ex Loud--saplings*	
PINCON	<i>Pinus contorta</i> Dougl. ex Loud--young & mature trees*	
PINFLE	<i>Pinus flexilis</i> James*	
PINPON	<i>Pinus ponderosa</i> var. <i>scopulorum</i> Engelm.--young and mature trees*	
PLADIL	<i>Platanthera dilatata</i> (Pursh) Lindl. ex Beck var. <i>albiflora</i> (Cham.) Ledeb.	<i>Limnorchis dilatata</i> (Pursh) Hook. ssp. <i>albiflora</i> (Cham.) A. Löve & Simon
PLAER1	<i>Plantago eriopoda</i> Torr.*	
PLALAN	<i>Plantago lanceolata</i> L.*	
PLASPA	<i>Platanthera sparsiflora</i> (S. Wats.) Schlechter*	<i>Limnorchis ensifolia</i> Rydberg
PLASTR	<i>Platanthera stricta</i> Lindl.	<i>Limnorchis stricta</i> (Lindl.) Rydberg
PLATWE	<i>Plantago tweedyi</i> Gray*	
PNE SP	<i>Gentiana</i> sp.	<i>Pneumonanthe</i> sp.
PNEAFF	<i>Gentiana affinis</i> Griseb.	<i>Pneumonanthe affinis</i> (Griseb.) W.A. Weber
PNEPAR	<i>Gentiana parryi</i> Engelm.	<i>Pneumonanthe parryi</i> (Engelm.) Green
POA SP	<i>Poa</i> sp.*	
POAARC	<i>Poa arctica</i> R. Br.*	
POACE	Poaceae	
POAJUN	<i>Poa secunda</i> J. Presl	<i>Poa juncifolia</i> Scrib.
POALEP	<i>Poa leptocoma</i> Trin.*	
POAPAL	<i>Poa palustris</i> L.*	
POAPRA	<i>Poa pratensis</i> L.*	
POAREF	<i>Poa reflexa</i> Vaesy & Scribn. ex Vasey*	
PODEAS	<i>Podistera eastwoodiae</i> (Coul. & Rose) Mathias & Constance*	
POL SP	<i>Polemonium</i> sp.*	
POLBIS	<i>Polygonum bistortoides</i> Pursh	<i>Bistorta bistortoides</i> (Pursh) Small
POLCAE	<i>Polemonium occidentale</i> ssp. <i>occidentale</i> Greene	<i>Polemonium caeruleum</i> L. ssp. <i>amygdalium</i> (Wherry) Munz
POLDOU	<i>Polygonum douglasii</i> Greene*	
POLFOL	<i>Polemonium foliosissimum</i> Gray*	
POLPUL	<i>Polemonium pulcherrimum</i> Hook ssp. <i>delicatum</i> (Rydb.) Brand*	
POLRAM	<i>Polygonum ramosissimum</i> Michx.*	
POLVIS	<i>Polemonium viscosum</i> Nutt.*	
POPAN1	<i>Populus angustifolia</i> James--seedlings*	
POPAN2	<i>Populus angustifolia</i> James--saplings*	
POPANG	<i>Populus angustifolia</i> James--young & mature trees*	
POPBAL	<i>Populus balsamifera</i> L.*	
POPTR1	<i>Populus tremuloides</i> (seedling)	
POPTR2	<i>Populus tremuloides</i> (sapling)	
POPTRE	<i>Populus tremuloides</i> Michx.*	
POT SP	<i>Potentilla</i> sp.*	
POTDIV	<i>Potentilla diversifolia</i> Lehm.*	
POTGRA	<i>Potentilla gracilis</i> Dougl. ex Hook.*	
POTGRX	<i>Potentilla gracilis</i> hybrid	

POTPLA	Potentilla plattensis Nutt.*	
POTPUL	Potentilla pulcherrima Lehm.*	
POTSPX	Potentilla sp. hybrid	
PRIPAR	Primula parryi Gray*	
PRUVIR	Prunus virginiana var. melanocarpa (A. Nels.) Sarg.	Padus virginiana (L.) P. Miller ssp. melanocarpa (A. Nelson) W.A. Weber
PRUVUL	Prunella vulgaris L.*	
PSEMON	Pseudocymopterus montanus (Gray) Coult. & Rose*	
PYRCHL	Pyrola chlorantha Sw.*	
PYRMIN	Pyrola minor L.*	
PYRROT	Pyrola asarifolia Michx. ssp. asarifolia	Pyrola rotundifolia ssp. asarifolia (Michx.) Love
RAN SP	Ranunculus sp.*	
RANABO	Ranunculus abortivus var. abortivus L.	Ranunculus abortivus L. ssp. acrolasius (Fern.) Kapoor & A. & D. Löve
RANACR	Ranunculus acriformis Gray*	
RANALI	Ranunculus alismifolius var. montanus S. Wats.*	
RANESC	Ranunculus eschscholtzii Schlecht.*	
RANINA	Ranunculus inamoenus Greene*	
RANMAC	Ranunculus macounii Britt.*	
RANREP	Ranunculus repens L.*	
RANUNC	Ranunculus uncinatus D. Don ex G. Don*	
RIB SP	Ribes sp.*	
RIBCOL	Ribes coloradense Coville*	
RIBINE	Ribes inerme Rydb.*	
RIBLAC	Ribes lacustre (Pers.) Poir.*	
RIBMON	Ribes montigenum McClatchie*	
RIBWOL	Ribes wolfii Rothrock*	
RORPAL	Rorippa palustris (L.) Bess. spp. hispida (Desv.) Jonsell*	
RORTER	Rorippa teres (Michx.) R. Stuckey*	
ROSWOO	Rosa woodsii Lindl.*	
RUB SP	Rubus sp.*	
RUBIDA	Rubus idaeus L. ssp. strigosus (Michx.) Focke	Rubus idaeus ssp. melanolasius (Dieck) Focke
RUBPAR	Rubus parviflorus var. parviflorus Nutt.	Rubacer parviflorum (Nuttall) Rydberg
RUDLAC	Rudbeckia laciniata var. ampla (A. Nels.) Cronq.	Rudbeckia ampla A. Nelson
RUMAQU	Rumex aquaticus L. var. fenestratus (Greene) Dorn	Rumex aquaticus L. ssp. occidentalis (S. Wats.) Hultén
RUMCRI	Rumex crispus L.*	
RUMDEN	Rumex densiflorus Osterhout*	
RUMSAL	Rumex salicifolius Weinm. var. mexicanus (Meisn.) C.L. Hitchc.	Rumex triangulivalvis (Danser) Rechinger
SAL SP	Salix sp.*	
SALBEB	Salix bebbiana Sarg.*	
SALBOO	Salix boothii Dorn*	
SALBRA	Salix brachycarpa Nutt.*	
SALDRU	Salix drummondiana Barratt ex Hook*	
SALEXI	Salix exigua Nutt.	Salix exigua Nutt. ssp. exigua
SALGEY	Salix geyeriana Anderss*	
SALIC	Salicaceae	
SALLUC	Salix lucida Muhlenberg ssp. caudata (Nutt.) E. Murr.*	
SALLUL	Salix lucida Muhlenberg ssp. lasiandra (Benth.) E. Murr.*	
SALMON	Salix monticola Bebb*	
SALPLA	Salix planifolia Pursh*	
SALSCO	Salix scouleriana Barrett ex Hook*	
SALWOL	Salix wolfii Bebb*	
SAMRAC	Sambucus racemosa ssp. pubens var. microbotrys (Rydb.) Kearney & Peebles	Sambucus microbotrys Rydb.
SCIPAL	Scirpus pallidus (Britt.) Fern.*	
SCROP	Scrophulariaceae	
SEDINT	Sedum integrifolium ssp. integrifolium (Raf.) A. Nels.	Rhodiola integrifolia Rafinesque
SEDRHO	Sedum rhodanthum Gray	Clementsia rhodantha (A. Gray) Rose
SENCRA	Senecio crassulus Gray*	
SENERE	Senecio eremophilus Richards. var. kingii (Rydb.) Greenm.	Senecio eremophilus Richards. ssp. kingii (Rydb.) G.W. & G.R. Dougl.
SENINT	Senecio integerrimus Nutt.*	
SENERE	Senecio serra var. serra Hook.*	
SENTRI	Senecio triangularis Hook.*	
SIBPRO	Sibbaldia procumbens L.*	
SIDCAN	Sidalcea candida Gray*	
SIDNEO	Sidalcea neomexicana Gray*	
SIS SP	Sisymbrium sp.*	
SISLOE	Sisymbrium loeselii L.*	
SISMON	Sisyrinchium montanum Greene*	
SOL SP	Solidago sp.*	

SOLCAN	<i>Solidago canadensis</i> L.*	
SOLMUL	<i>Solidago multiradiata</i> var. <i>scopulorum</i> Gray*	
SOLSPA	<i>Solidago spathulata</i> D.C.*	
SORSCO	<i>Sorbus scopulina</i> Greene*	
SPAMIN	<i>Sparganium nutans</i> L.	<i>Sparganium minimum</i> Wallroth
SPIROM	<i>Spiranthes romanzoffiana</i> Cham.*	
STECAL	<i>Stellaria calycantha</i> (Ledeb.) Bong.*	
STELON	<i>Stellaria longipes</i> Goldie*	
STEOBT	<i>Stellaria obtusa</i> Engelm.*	
STEUMB	<i>Stellaria umbellata</i> Turcz. ex Kar. & Kir.*	
STIVIR	<i>Stipa viridula</i> Trin.*	
STRFAS	<i>Streptopus amplexifolius</i> var. <i>chalazatus</i> Fassett	<i>Streptopus fassettii</i> A. & D. Löve
SWEPER	<i>Swertia perennis</i> L.*	
SYMORE	<i>Symphoricarpos oreophilus</i> A. Gray	<i>Symphoricarpos rotundifolius</i> A. Gray
SYMROT	<i>Symphoricarpos rotundifolius</i> Gray*	
TAROFF	<i>Taraxacum officinale</i> G.H. Weber ex Wiggers*	
THA SP	<i>Thalictrum</i> sp.*	
THAALP	<i>Thalictrum alpinum</i> L.*	
THAFEN	<i>Thalictrum fendleri</i> Engelm. ex Gray*	
THASPA	<i>Thalictrum sparsiflorum</i> Turcz. ex Fisch. & C.A. Mey.*	
TORPAU	<i>Torreyochloa pallida</i> (Torr.) Church var. <i>pauciflora</i> (J. Presl) J.I. Davis	<i>Torreyochloa pauciflora</i> (J. Presl) Church
TRADUB	<i>Tragopogon dubius</i> Scop.	<i>Tragopogon dubius</i> Scop. ssp. <i>major</i> (Jacq.) Voll.
TRAPRA	<i>Tragopogon pratensis</i> L.*	
TRI SP	<i>Trifolium</i> sp.*	
TRIHVB	<i>Trifolium hybridum</i> L.*	
TRILON	<i>Trifolium longipes</i> ssp. <i>pygmaeum</i> (Gray) J. Gillett	<i>Trifolium rusbyi</i> Greene ssp. <i>rusbyi</i>
TRIOVA	<i>Trillium ovatum</i> Pursh*	
TRIPRA	<i>Trifolium pratense</i> L.*	
TRIREF	<i>Trifolium longipes</i> ssp. <i>reflexum</i> (A. Nels.) J. Gillett	<i>Trifolium rusbyi</i> Greene ssp. <i>relixum</i> (A. Nelson) Heller & Zohary
TRIREP	<i>Trifolium repens</i> L.*	
TRISPI	<i>Trisetum spicatum</i> (L.) Richter	<i>Trisetum spicatum</i> (L.) Richter ssp. <i>congdonii</i>
TRIWOL	<i>Trisetum wolfii</i> Vasey*	
TROLAX	<i>Trollius laxus</i> Salisbury ssp. <i>albiflorus</i> (Gray) A.D. Löve & Kapoor	<i>Trollius albiflorus</i> (A. Gray) Rydberg
UNKNO	Unknown species	
URTGRA	<i>Urtica dioica</i> ssp. <i>gracilis</i> (Ait.) Seland.	<i>Urtica gracilis</i> Aiton ssp. <i>gracilis</i>
VAC SP	<i>Vaccinium</i> sp.	
VACCES	<i>Vaccinium cespitosum</i> Michx.*	
VACMYR	<i>Vaccinium myrtilus</i> var. <i>oreophilum</i> (Rydb.) Dorn	<i>Vaccinium myrtilus</i> L. ssp. <i>oreophilum</i> (Rydberg) Löve et al.
VACSCO	<i>Vaccinium scoparium</i> Leib. ex Coville*	
VAHATR	<i>Vahlodea atropurpurea</i> (Wahlenb.) Fries ex Hartman	<i>Vahlodea atropurpurea</i> (Wahlenb.) Fries <i>latifolia</i> (Hook.) Porsild
VALCAP	<i>Valeriana acutiloba</i> var. <i>acutiloba</i> Rydb.	<i>Valeriana capitata</i> Pallas ex Link ssp. <i>acutiloba</i> (Rydberg) F.G. Meyer
VALOCC	<i>Valeriana occidentalis</i> Heller*	
VER SP	<i>Veronica</i> sp.	
VERAME	<i>Veronica americana</i> Schwein. ex Benth.*	
VERSER	<i>Veronica serpyllifolia</i> L. ssp. <i>humifusa</i> (Dickson) Syme	<i>Veronicastrum serpyllifolium</i> L. <i>humifusum</i> (Dickson) W.A. Weber
VERTEN	<i>Veratrum tenuipetalum</i> Heller*	
VERWOR	<i>Veronica wormskjoldii</i> Roemer & J.A. Schultes	<i>Veronica nutans</i> Bong. (Weber says <i>V. w.</i> misreported)
VIC SP	<i>Vicia</i> sp.	
VICAME	<i>Vicia americana</i> Muhl. ex Willd.*	
VIO SP	<i>Viola</i> sp.*	
VIOADU	<i>Viola adunca</i> Sm.*	
VIOCAN	<i>Viola canadensis</i> L. var. <i>scopulorum</i> Gray	<i>Viola scopulorum</i> (A. Gray) Greene
VIOLAB	<i>Viola labradorica</i> Schrank	NOT = WW's <i>V. labradorica</i> (see notes)
VIOMAC	<i>Viola macloskeyi</i> Lloyd ssp. <i>pallens</i> (Banks ex DC.) M.S. Baker	
VIOREN	<i>Viola renifolia</i> Gray	<i>Viola renifolia</i> A. Gray var. <i>brainerdii</i> (Greene) C.L. Hitchcock

Appendix 4. Number of Occurrences of Each Species from a Possible 195 Plots

	SPECIES	OCCURRENCES
1	ABILA1	47
2	ABILA2	41
3	ABILAS	41
4	ACEGLA	2
5	ACHLAN	87
6	ACOCOL	77
7	ACTRUB	12
8	ADOMOS	1
9	AGOAUR	5
10	AGR SP	4
11	AGREXA	12
12	AGRGIG	5
13	AGRHUM	1
14	AGRIDA	15
15	AGRSCA	10
16	AGRSTO	8
17	AGRTHU	12
18	AGRVAR	4
19	ALLBRE	3
20	ALNINC	66
21	ALO SP	1
22	ALOEQ	2
23	ALOPRA	2
24	ALSIN	3
25	AMEALN	4
26	ANAMAR	12
27	AND SP	3
28	ANDFIL	9
29	ANDSEP	3
30	ANENAR	3
31	ANGAMP	6
32	ANGGRA	2
33	ANGPIN	2
34	ANTCOR	17
35	ANTELE	1
36	APIAC	3
37	AQU SP	1
38	AQUCOE	2
39	ARA SP	1
40	ARCADE	2
41	AREFEN	1
42	ARGANS	2
43	ARI SP	1
44	ARN SP	1
45	ARNCHA	2
46	ARNCOR	32
47	ARNLAT	2
48	ARNMOL	38
49	ARNPAR	1
50	ARRELA	1
51	ARTLUD	1
52	ASTALP	2
53	ASTASC	3
54	ASTER	33
55	ASTFOL	27
56	ATHFIL	1
57	AZAALB	2
58	BETGLA	21
59	BISVIV	12
60	BOEDRU	1
61	BROBUL	1
62	BROCAN	29
63	BROCAR	3
64	BROINE	8
65	BROLAN	7
66	BROPOR	6
67	BROPUM	4
68	BROSPE	2
69	CALBUL	1
70	CALCAN	98
71	CALLEP	83
72	CALSCO	1
73	CALVER	1
74	CAMPAR	2

75	CAMROT	2
76	CAR SP	19
77	CARAQU	129
78	CARATH	3
79	CARAUR	10
80	CARBRE	3
81	CARBUX	1
82	CARCAN	19
83	CARCOR	111
84	CARDEW	2
85	CARDIS	16
86	CAREBE	3
87	CARFOE	3
88	CARGEY	2
89	CARHAS	3
90	CARILL	12
91	CARINT	2
92	CARJON	12
93	CARLAC	1
94	CARLIM	2
95	CARMAC	3
96	CARMAG	2
97	CARMIC	51
98	CARNEB	1
99	CARNEU	3
100	CARNIG	11
101	CARNOR	8
102	CARNOV	4
103	CARPEN	3
104	CARPRA	1
105	CARRAY	1
106	CARSAX	1
107	CARSCO	7
108	CARUTR	90
109	CAS SP	1
110	CASMIN	3
111	CASRHE	7
112	CASSUL	37
113	CER SP	11
114	CHADOU	28
115	CHASUB	2
116	CHLTRI	4
117	CICDOU	6
118	CINLAT	2
119	CIR SP	5
120	CIRALP	2
121	CIRARV	7
122	CIRCOL	8
123	CIREAT	6
124	CIRHES	1
125	CIRPAR	1
126	CIRVUL	2
127	COLLIN	1
128	CONSCO	46
129	COR SP	1
130	CORSER	6
131	CORTRI	4
132	CRUCHA	2
133	CYSFRA	2
134	DACGLO	2
135	DANINT	6
136	DELBAR	3
137	DES SP	7
138	DESCES	78
139	DESINC	2
140	DODPUL	3
141	DRAALB	3
142	DUGHOO	5
143	ELE SP	3
144	ELEPAL	3
145	ELEQUI	14
146	ELYELY	2
147	ELYGLA	20
148	ELYREP	6
149	ELYTRA	4
150	EPI SP	82
151	EPIANG	37

152	EPICIL	1
153	EPIHAL	5
154	EPIHOR	5
155	EPILAC	5
156	EPIPAL	2
157	EPISAX	23
158	EQU SP	1
159	EQUARV	92
160	EQUORA	2
161	ERI SP	15
162	ERIANQ	1
163	ERICOU	6
164	ERIELA	6
165	ERIEXI	1
166	ERIPER	42
167	ERISPE	10
168	ERISUB	4
169	ERYCHE	1
170	ERYGRA	6
171	EUCENG	1
172	FABAC	2
173	FESBRA	3
174	FESIDA	1
175	FESRUB	3
176	FESTHU	2
177	FRASPE	2
178	FRAVES	3
179	FRAVIR	96
180	GAL SP	3
181	GALBIF	32
182	GALMEX	1
183	GALSEP	34
184	GALSPU	1
185	GALTFD	14
186	GALTRI	46
187	GAUHUM	7
188	GENACU	8
189	GENBAR	3
190	GENHET	1
191	GENTHE	16
192	GERRIC	83
193	GERVIS	4
194	GEUALE	1
195	GEUMAC	85
196	GEURIV	1
197	GEUTRI	10
198	GLY SP	1
199	GLYELA	22
200	GLYSTR	15
201	GOOBL	2
202	HACFLO	2
203	HERLAN	72
204	HIEHIR	4
205	HIPVAR	1
206	HOR SP	1
207	HORBRA	5
208	HORJUB	1
209	HYDFEN	5
210	HYPFOR	1
211	IRIMIS	3
212	JUN SP	12
213	JUNBAL	17
214	JUNCOM	5
215	JUNCON	2
216	JUNDRU	51
217	JUNENS	3
218	JUNFIL	1
219	JUNLON	3
220	JUNMER	19
221	JUNSAX	6
222	JUNTRA	11
223	KALMIC	5
224	LAC SP	1
225	LEP SP	1
226	LEYCIN	1
227	LIG SP	1
228	LIGAMP	1

229	LIGBIG	9
230	LIGFIL	47
231	LIGPOR	15
232	LIGPUD	2
233	LIM SP	1
234	LIMHYP	8
235	LINBOR	4
236	LISCOR	8
237	LOM SP	1
238	LOMDIS	1
239	LOINV	65
240	LUPARG	3
241	LUZCOM	14
242	LUZPAR	66
243	LUZSPI	1
244	LYCANN	2
245	LYSOBT	3
246	MAIRAC	3
247	MAI STE	26
248	MENARV	11
249	MERCIL	122
250	MICODO	70
251	MICORE	3
252	MIMGUT	13
253	MIMLEW	1
254	MIMMOS	1
255	MITPEN	66
256	MITSTA	3
257	MOELAT	1
258	MONUNI	5
259	MUHAND	1
260	MYOCUP	1
261	NOCMON	12
262	OREPYG	1
263	ORTSEC	31
264	OSM SP	9
265	OSMCHI	4
266	OSMDEP	35
267	OSMOCC	1
268	OXYDIG	1
269	OXYFEN	88
270	PACDIM	8
271	PARFIM	9
272	PASSMI	2
273	PAXMYR	4
274	PEDBRA	5
275	PEDCAN	1
276	PEDGRO	85
277	PEDPAR	4
278	PEDRAC	2
279	PEN SP	1
280	PENCON	2
281	PENFLO	24
282	PENRYD	8
283	PER SP	1
284	PETSAG	1
285	PHAHAS	1
286	PHAHET	1
287	PHLALP	67
288	PHLPRA	16
289	PICEN1	49
290	PICEN2	46
291	PICENG	51
292	PICPU1	5
293	PICPU2	6
294	PICPUN	9
295	PINCO1	9
296	PINCO2	6
297	PINCON	18
298	PINFLE	1
299	PINPON	1
300	PLADIL	38
301	PLAERI	1
302	PLALAN	1
303	PLASPA	1
304	PLASTR	1
305	PLATWE	13

306	PNE SP	2
307	PNEAFF	1
308	PNEPAR	8
309	POA SP	10
310	POAARC	8
311	POACE	4
312	POALEP	4
313	POAPAL	3
314	POAPRA	69
315	POAREF	24
316	POASEC	1
317	PODEAS	4
318	POL SP	4
319	POLBIS	16
320	POLCAE	10
321	POLDOU	1
322	POLFOL	2
323	POLPUL	5
324	POLVIS	1
325	POPAN1	6
326	POPAN2	2
327	POPANG	2
328	POPBAL	1
329	POPTR1	3
330	POPTR2	2
331	POPTRE	8
332	POT SP	5
333	POTDIV	6
334	POTGRA	6
335	POTGRX	1
336	POTPLA	3
337	POTPUL	3
338	POTSPX	11
339	PRIPAR	4
340	PRUVIR	1
341	PRUVUL	19
342	PSEMON	4
343	PYRCHL	2
344	PYRMIN	21
345	PYRROT	18
346	RAN SP	2
347	RANABO	1
348	RANACR	2
349	RANALI	17
350	RANESC	2
351	RANINA	4
352	RANMAC	8
353	RANREP	3
354	RANUNC	5
355	RIB SP	1
356	RIBCOL	4
357	RIBINE	13
358	RIBLAC	22
359	RIBMON	9
360	RIBWOL	1
361	RORPAL	1
362	RORTER	3
363	ROSWOO	21
364	RUB SP	1
365	RUBIDA	21
366	RUBPAR	2
367	RUDLAC	10
368	RUMAQU	9
369	RUMCRI	4
370	RUMDEN	5
371	RUMSAL	1
372	SAL SP	2
373	SALBEB	2
374	SALBOO	29
375	SALBRA	10
376	SALDRU	32
377	SALEXI	3
378	SALGEY	49
379	SALIC	1
380	SALLUC	16
381	SALLUL	1
382	SALMON	32

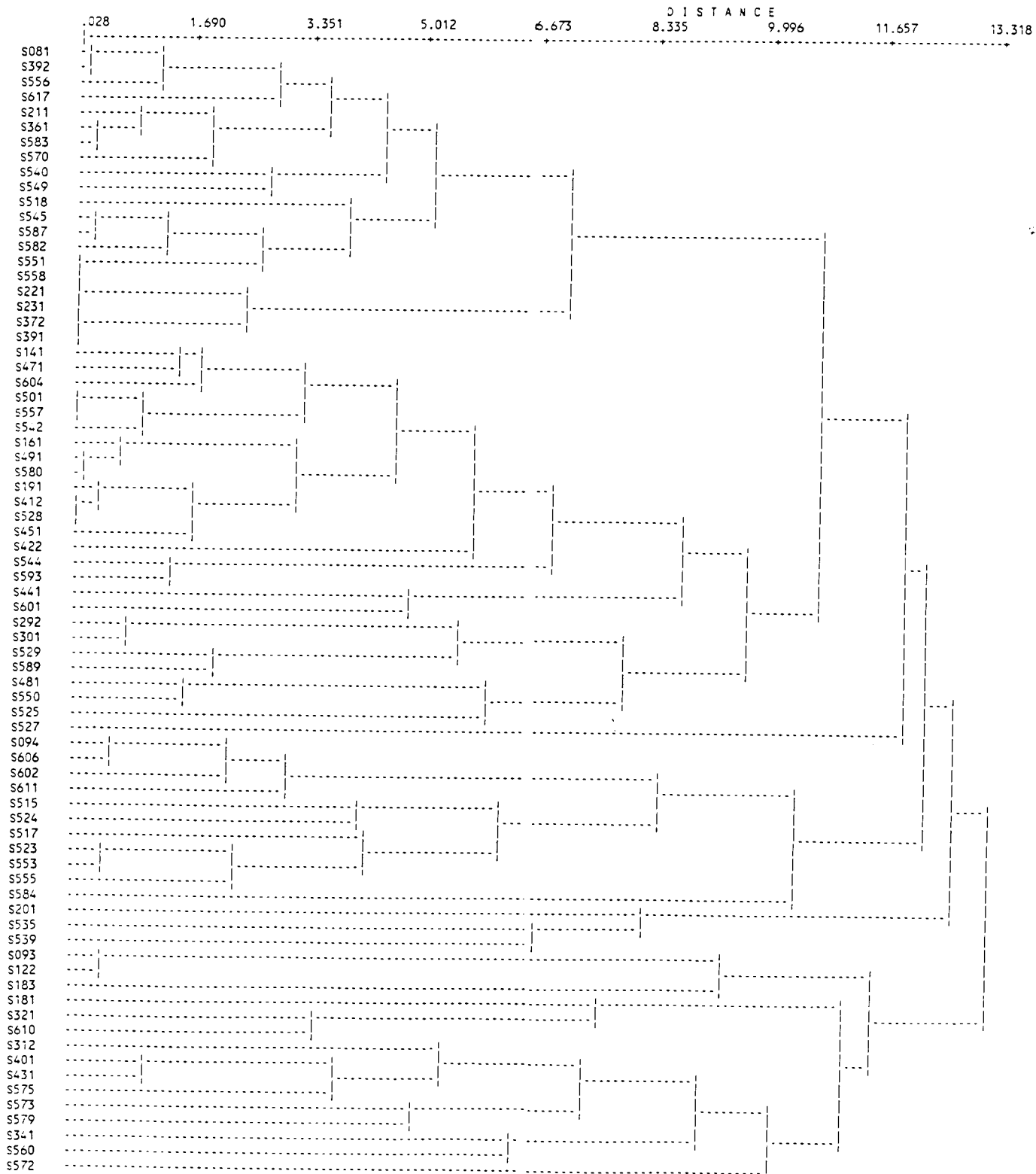
383	SALPLA	78
384	SALSCO	1
385	SALWOL	28
386	SAMRAC	5
387	SCIPAL	1
388	SCROP	1
389	SEDINT	1
390	SEDRHO	57
391	SENCRA	4
392	SENERE	1
393	SENINT	1
394	SENER	7
395	SENTRI	134
396	SIBPRO	13
397	SIDCAN	7
398	SIDNEO	1
399	SIS SP	1
400	SISLOE	2
401	SISMON	1
402	SOL SP	2
403	SOLCAN	5
404	SOLMUL	2
405	SOLSPA	1
406	SORSCO	3
407	SPAMIN	1
408	SPIROM	5
409	STECAL	8
410	STELON	8
411	STEOBT	2
412	STEUMB	10
413	STIVIR	2
414	STRFAS	45
415	SWEPER	20
416	SYMORE	2
417	SYMROT	1
418	TAROFF	97
419	THA SP	4
420	THAALP	3
421	THAFEN	25
422	THASPA	14
423	TORPAU	4
424	TRADUB	1
425	TRAPRA	1
426	TRI SP	6
427	TRIHVB	6
428	TRILON	4
429	TRIOVA	2
430	TRIPRA	1
431	TRIREF	1
432	TRIREP	9
433	TRISPI	4
434	TRIWOL	25
435	TROLAX	36
436	URTGRA	15
437	VAC SP	2
438	VACCES	4
439	VACMYR	21
440	VACSCO	23
441	VAHATR	4
442	VALCAP	2
443	VALOCC	8
444	VER SP	3
445	VERAME	24
446	VERSER	1
447	VERTEN	17
448	VERWOR	63
449	VIC SP	2
450	VICAME	24
451	VIO SP	12
452	VIOADU	4
453	VIOCAN	8
454	VIOLAB	2
455	VIOMAC	41
456	VIOREN	3

Cluster Analysis Dendrograms for forest, Shrubland, and Herbaceous Stands

ROUTT N.F. DATA--1993 AND 1994
 PLOTS CLASSIFIED AS FORESTED ONLY
 ALL SPP WITH GREATER THAN 3% COVER
 TRANSFORMED WITH GENERAL RELATIVIZATION BY PLOT

CLUSTER ANALYSIS, $2W/(A+B)$ DISTANCE GROUP AVERAGE

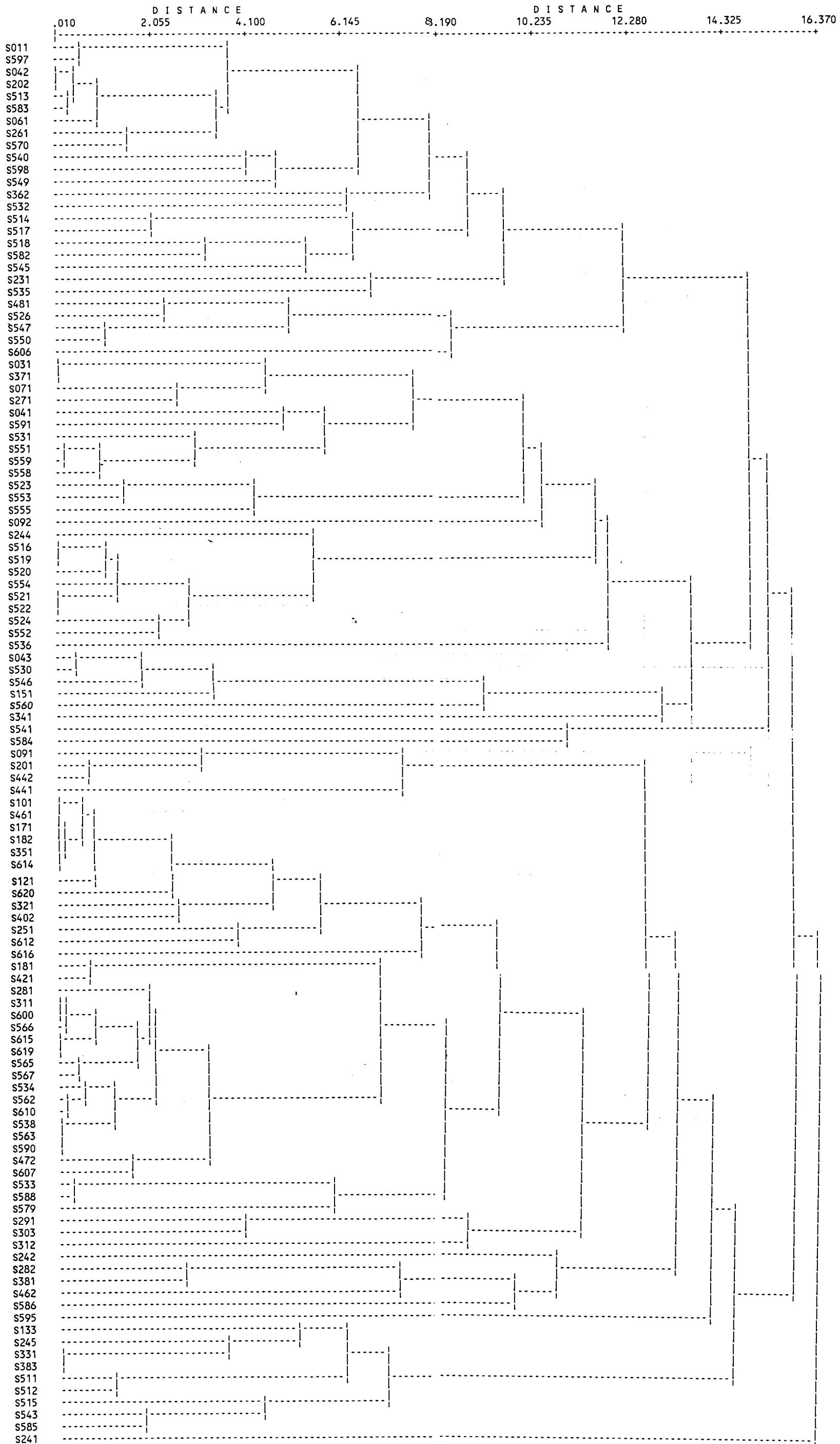
Percent chaining = 7.70



ROUTT NF SHRUB PLOTS
SPP WITH >3% COVER ONLY
COVER TRANSFORMED USING GENERAL RELATIVIZATION BY PLOT

CLUSTER ANALYSIS, 2W/(A+B) DISTANCE GROUP AVERAGE

Percent chaining = 7.23



OUT OF HERB PLOTS

PP WITH >3% COVER

TRANSFORMED USING GENERAL RELATIVIZATION BY PLOT

CLUSTER ANALYSIS, 2W/(A+B) DISTANCE GROUP AVERAGE

Percent chaining = 12.13

