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Riparian Community Type Classification of Utah and Southeastern Idaho

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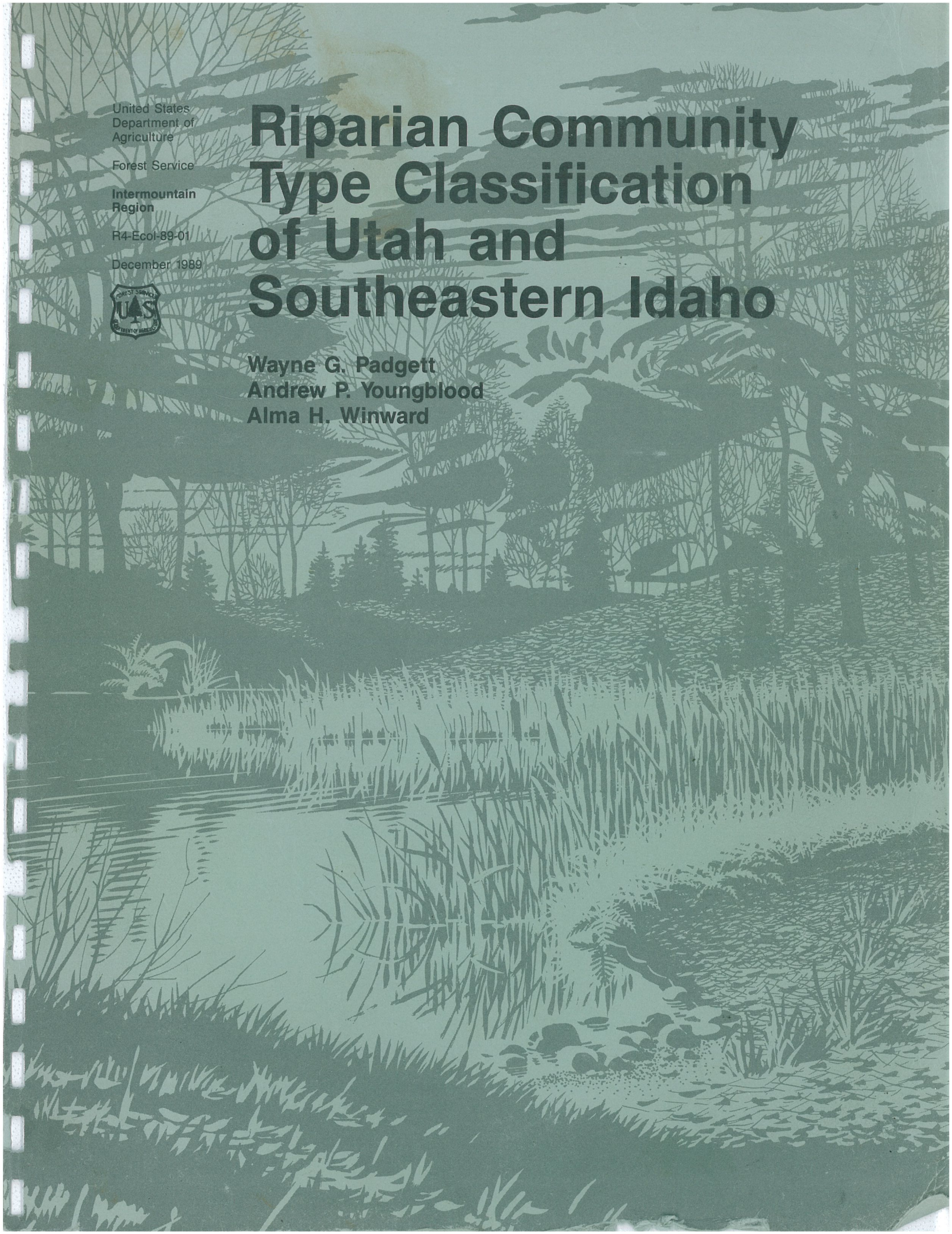

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RESEARCH SUMMARY

A community type classification is presented for riparian ecosystems on U.S. Department of Agriculture, Forest Service lands of Utah and southeastern Idaho. The hierarchical taxonomic classification system is based on the reconnaissance of approximately 600 sample stands. A total of 10 overstory dominance groups and 83 community types are defined and described. A diagnostic key, based on indicator species used in the development of the classification, is provided for field identification of the types. Distribution, vegetation composition, soils, and successional status are discussed. Illustrations and discussions of indicator species are provided for aid in the field determination of community types.

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Riparian Community Type Classification of Utah and Southeastern Idaho

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INTRODUCTION

Field work for this study was done from 1984 to 1986 and includes data from forest habitat type studies by Mauk and Henderson (1984) for northern Utah and by Youngblood and Mauk (1985) for southern Utah. Because of the large area covered during three field seasons, some areas, especially those within the Wilderness boundaries and Wilderness study areas, were not sampled or were sampled at only light to moderate intensities. This study continues the classification of riparian ecosystems in the Intermountain Region and is designed to be compatible with previous work for eastern Idaho and western Wyoming (Youngblood and others 1985a).

The study area (fig. 1) includes lands administered by the U.S. Department of Agriculture, Forest Service, in Utah (Wasatch-Cache, Uinta, Ashley, Manti-LaSal, Fishlake, and Dixie National Forests), as well as portions of the Montpelier, Soda Springs, Pocatello, and Malad Ranger Districts on the Caribou National Forest in southeastern Idaho. A small portion of the Mountain View Ranger District of the Wasatch-Cache National Forest is in southwestern Wyoming, and the eastern portion of the Moab District of the Manti-LaSal National Forest is in western Colorado; these areas are also included in the study. Some of the information is appropriate to portions of adjacent private and public lands but is not intended for widespread use in riparian ecosystems outside Forest System lands.

OBJECTIVES AND SCOPE

This study is part of a continuing effort of vegetation classification within the Intermountain Region of the USDA Forest Service. The objectives of the study were:

1. To develop a riparian community type classification for lands administered by the USDA Forest Service in Utah and southern Idaho.

2. To describe the general physiographic, edaphic, and floristic features of each community type.

3. To describe successional trends for each community type where possible.

4. To provide some management guidelines for community types based on objectives 2 and 3 above.

The study area includes lands administered by seven National Forests, as well as adjacent private and public lands throughout Utah and adjacent portions of Idaho, Wyoming, and Colorado (fig. 1).

There is overlap between this classification and the adjacent riparian community type classification for eastern Idaho and western Wyoming (Youngblood and others 1985a). In addition, this classification includes portions of the aspen community type classifications (Mueggler and Campbell 1986; Mueggler 1988) and the forest habitat type classifications (Youngblood and Mauk 1985; Mauk and Henderson 1984) that represent plant communities or lands within the riparian zone of the study area.

METHODS

Field Methods

Reconnaissance of drainages was made prior to site selection. Notes were made on visually dominant species, and site locations were noted for later sampling. Plot selection was based on "subjective sampling without preconceived bias," as described by Mueller-Dombois and Ellenberg (1974), where plots were selected that reflect the apparent range in environmental and successional conditions within an area and the homogeneity of vegetation. They were not selected with a preconception of placement within a classification system. Sampling was conducted over portions of three field seasons with nearly 600 total plots sampled.

A 50 m^2 (538 ft^2) plot was used in each sampled community, typically with dimensions of 5 by 10 m (16 by 33 ft). Occasionally, long stringer communities were sampled using a 2.5 by 20 m (8 by 66 ft) plot. The 50 m^2 plot size was considered adequate to include most species within a community and small enough that the entire plot could be viewed. Each community was at least twice as large as the plot in order to avoid sampling ecotones.

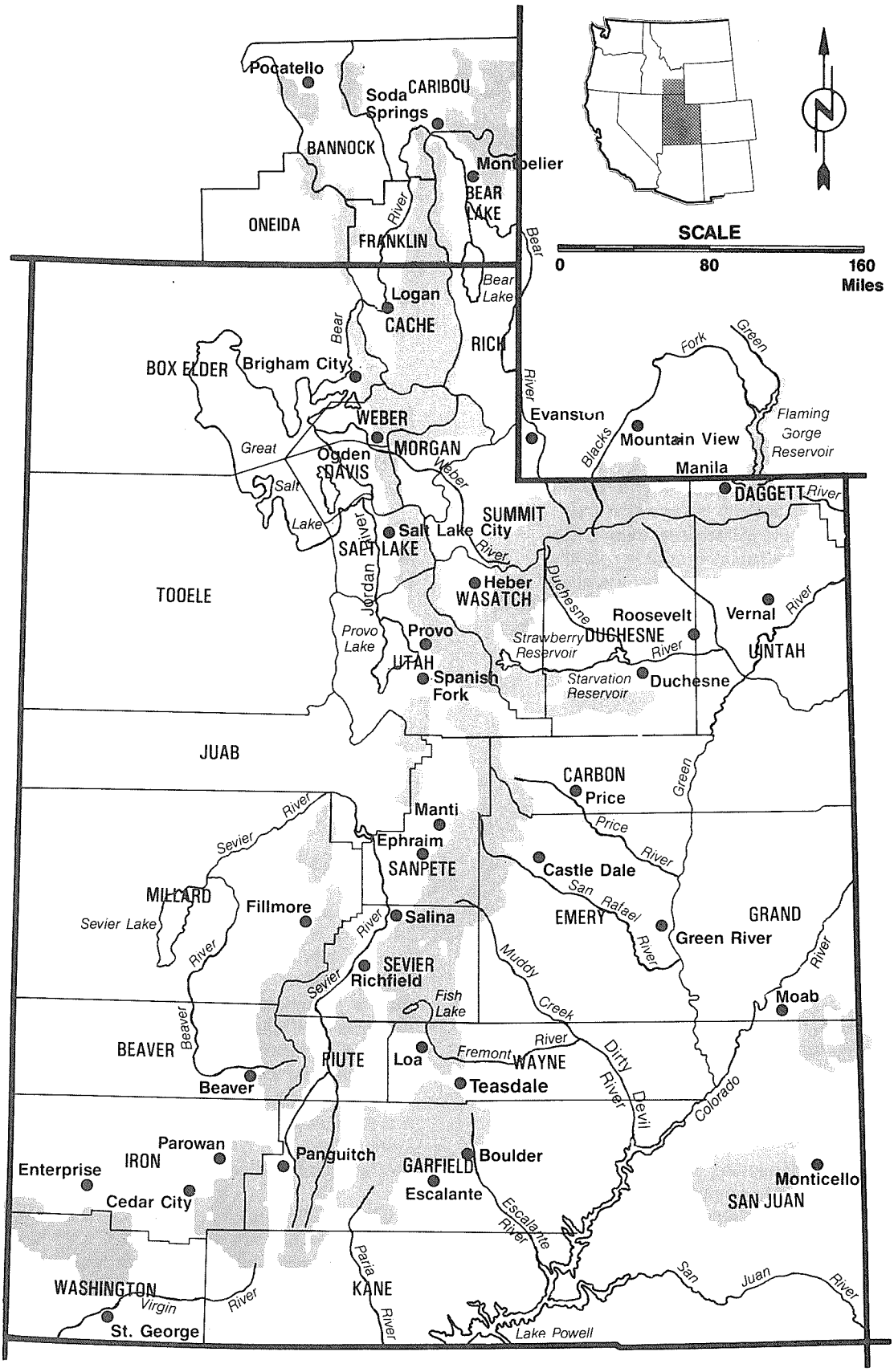


Figure 1.—Area covered by this classification (shaded) showing counties and major towns and rivers.

Ocular estimates of canopy cover for each species within a plot were made to the nearest percent between 1 and 10 percent and to the nearest 5 percent thereafter. Species present within the plot with less than 1 percent cover were noted as "Trace." Other species within the community but not in the plot were noted as "Present" but were not included in the subsequent data analysis. Most plants were identifiable in the field to the species level; those that were not were collected for later determination in the laboratory. Composition data from previous coniferous habitat type studies in Utah were included in our analyses.

A complete soil description was made for most sampled plots using standard pedon description methods (USDA-SCS 1975). In most cases information was collected to classify soils to the family level. A single pedon was assumed to be representative of the vegetation plot sampled, but was not necessarily indicative of soils throughout the community. Most soils, however, were uniform enough to represent at least large portions of those communities.

Soil pits were dug to 1 m (39 in) or to a restrictive layer of stone or cobble. Auger pits were also used in some areas, especially those with deep mollic epipedons and/or organic soils (Histosols). Depth to water table and/or soil saturation was noted when it occurred within the soil pit. Organic soils that were wet or saturated throughout the profile were considered to have a "water table" at the surface, even if the actual water table was below that level.

Other data collected for each plot included aspect, slope, position, configuration, disturbance, and adjacent upland and riparian communities. Elevation was estimated to the nearest contour using U.S. Geological Survey 7.5 and 15-minute quadrangle maps.

Office Methods

Plant specimens that were especially difficult to identify were sent to various herbaria or botanists in Utah for determination or verification. Field data forms were adjusted accordingly.

Soils were classified to the family level using standard pedon description methods (USDA-SCS 1975). Soil temperature regimes were estimated using techniques similar to those described by Tew and others (1986) for the Fishlake National Forest in Utah. Available water-holding capacity was estimated for the top 50 cm (20 in) of mineral soils using guidelines developed by USDA-SCS (1981).

All data were coded and entered on the computer for vegetation, physical, and environmental analyses. Ten percent of all plots sampled were then randomly removed from the data file to be used later in tests of the classification system. These plots were merged with the data file after testing and included in the final revision and description of the riparian community types. Ordinations of undergrowth vegetation alone, as well as both overstory and undergrowth vegetation, were done using detrended correspondence analysis (DCA) as described by Hill and Gauch (1980) and Gauch (1982).

In most cases the herbaceous layer in our riparian communities is a much stronger indicator of environment than overstory shrub and tree species, since the latter commonly occur across a much broader ecological range than do many undergrowth species. The overstory tended to skew the ordination. By eliminating the overstory in the ordination, it was possible to clarify the relationships among undergrowth species and to help determine the role of such undergrowth species in predicting associated environmental characteristics of a given site. As an example, various *Salix* spp. may have associated undergrowths that range from those dominated by true riparian obligates (species that require a constantly high water table), to those dominated by facultative riparian species that also occur in upland situations.

Following the ordination of the communities, a preliminary association table was created using the Axis 1 scores from the undergrowth ordination. This table included both overstory and undergrowth species. Additional association tables were created by separating communities based on structural differences (coniferous trees, deciduous trees, tall willow, short willow, non-willow shrub, and herbaceous-dominated communities), again maintaining the basic order defined by Axis 1 from DCA for the undergrowth. More specific association tables, indicative of structural as well as ecological similarities among communities, were created by separating individual species or species guilds in all layers. This table was used to determine the preliminary community types within the study area. Finally, a test was run on the 10 percent of the plots withheld from analysis (as described above) using the program CLUSTID (Romesburg and Marshall 1984) that compares unknown plots with groups of predetermined makeup (our riparian community types) and determines which community type each unknown plot most closely resembles. Seventy three percent of our test plots were found to have the closest relationship with our defined community types. Thirteen percent of the communities represented unique situations and remained unclassified. Twelve percent of the communities were incorrectly identified, but more than half of these represented closely related types (e.g., community types with similar dominant undergrowths). The remaining two percent represented incidental community types that rarely occurred in the study area. Adjustments were made in the community types based in part on the outcome of this analysis.

A preliminary dichotomous key to riparian community types was developed based on species cover. The key was used to test all plots and necessary revisions,

either in the key or in the community type composition, were made to accommodate these changes. Less than 5 percent of the plots did not fit the classification and are briefly described in the various **Miscellaneous Unclassified Communities** sections.

Descriptions for each riparian community type were prepared, and discussions on vegetation, soils, water table, and geographic, elevational, and physiographic distribution were included. In addition, relationships among adjacent riparian community types and adjacent upland communities were described. Some management suggestions were included where information allowed. This classification, however, should be considered a baseline from which discussion and management of riparian ecosystems can be based. Future studies of wildlife, livestock, stream dynamics, and impacts of various management techniques can be enhanced by the use of this classification.

Taxonomic Considerations

Plant taxonomy follows Welsh and others (1987) for tree, shrub, and forb species, and Cronquist and others (1977) for graminoids. We have used the newer epithets, but because of common usage of a few plant species names, we have included the older names within the key to community types. In addition, because of the vast amount of synonymy, especially in *Salix* spp., table 1 has been prepared to assist the user in comparing our classification to other similar classifications.

Our specimens of *Salix exigua* from northern Utah and southern Idaho, especially Cache and Bear Lake Counties in Utah and Franklin County, Idaho, require additional analysis to distinguish between western extensions of *S. interior* and *Salix exigua* ssp. *melanopsis* taxa. While our plant specimens appear to be taxonomically distinct from *S. exigua* ssp. *exigua,* the more common form known from the study area, there is little apparent ecological basis for separation; all narrow-leaved willows have been combined into *S. exigua* for the present time.

Cornus sericea was previously noted as *C. stolonifera* in eastern Idaho and western Wyoming (Youngblood and others 1985a). Welsh and others (1987), however, stated that our western species is distinct from *C. stolonifera* which occurs in the eastern United States and therefore, following rules of taxonomy, must have a distinct name.

Table 1. Synonymy of common indicator species in the Utah riparian community type classification.

Used in our classification	Common synonymy
Agrostis stolonifera	A. alba
Alnus incana	A. tenuifolia
Betula occidentalis	B. fontinalis
Calamagrostis stricta	C. inexpansa
	C. neglecta
Cornus sericea	C. stolonifera
Glyceria striata	G. elata
Heracleum lanatum	H. sphondyllium
Ligusticum tenuifolium	L. filicinum var. tenuifolium
Polemonium caeruleum	P. occidentale
Potentilla fruticosa	Pentaphylloides florabunda
Rhus aromatica var. trilobata	R. trilobata
Salix lasiandra	S. caudata
	S. pentandra var. caudata
S. boothii	S. myrtillifolia (misapplied)
	S. pseudocordata (in part)
S. planifolia	S. phylicifolia (misapplied)
S. glauca	S. pseudolapponum
S. lutea	S. rigida var. watsonii
S. drummondiana	S. subcoerulea

We have chosen to separate tall and low deciduous tree species in the classification because of structural differences. All *Populus* spp. and *Acer negundo* are included as tall deciduous tree species. *Betula occidentalis* and *Alnus incana* typically reach heights between 3 and 6 m (10 and 20 ft) and are, for this report, considered as low deciduous trees. We also have separated "Tall *Salix*" and "Low *Salix*" species within the classification. Tall *Salix* species include *Salix bebbiana, S. boothii, S. drummondiana, S. exigua, S. geyeriana, S. lasiandra, S. lasiolepis, S. lutea,* and *S. monticola;* low willows, or those typically 1 m (40 in) or less, include *Salix brachycarpa, S. glauca, S. planifolia,* and *S. wolfii.* Occasionally these latter species may reach heights greater than 1 m but are still included as "Low *Salix*" species. Also included with the low willows is *Betula glandulosa* which is low in stature and commonly present, if not dominant, in certain **Salix wolfii community types.**

A small percentage of our plots were dominated by coniferous trees such as *Abies lasiocarpa, Picea engelmannii, P. pungens, Pinus contorta,* and *Pseudotsuga menziesii.* Because of similarities in undergrowths, recognizing differences in ability of these species to tolerate high water table, the overstories were grouped as **Conifer community types.**

Rhus aromatica var. *trilobata* was found as an undergrowth dominant in some communities with overstories dominated by *Populus angustifolia* or *P. acuminata.* While we refer to it as *Rhus aromatica,* it is

used in the stricter sense as the above variety. Similarly, *Artemisia cana* in this classification refers to *A. cana* ssp. *viscidula.*

Some plants presented problems taxonomically when only vegetative materials were present. For this reason some *Aster* and *Erigeron* spp. were combined as *Aster* spp. *Rosa woodsii* and *R. nutkana* were combined as *Rosa* spp. on occasions where flowers or fruit were not available for positive identification. Because of ecological and morphological similarities, *Poa trivialis* and *P. palustris* were combined for purposes of data analysis. These species remain separated in discussions. Similarly, several tall species of bluebells *(Mertensia ciliata, M. franciscana,* and *M. arizonica)* are essentially ecological equivalents separated, in many cases, by plant geography. These species are collectively referred to as "Tall *Mertensia* spp." within the key, yet their identity is maintained, for the most part, within the text.

ECOLOGICAL CONCEPTS AND TERMINOLOGY

Whether one follows the individualistic approach described by Gleason (1939), the Monoclimax of Clements (1936), or the Polyclimax approach suggested by Tansley (1935) and espoused by others (Whittaker 1953; Daubenmire 1952), we are still faced with the need to manage the ecosystems of public and private lands. Classification of plant communities, whether considered real or artificial, allows us the opportunity to group communities with similar floristics, environmental characteristics, and management potentials.

Beals (1969) noted that discrete communities are more common where topography is steep and that communities are more continuous where slopes are gentle. Because of this we would expect that ecotones among communities in broad meadows would be more broad than those occurring adjacent to steeper stream channels. The competitive nature, lifeform, and reproductive patterns (e.g., rhizomatous vs. tufted) also play important roles in species distributions and community patterns.

Community Type Concept

The community type is used as the basic unit of our riparian community classification. We consider communities as being somewhat homogeneous in all layers and differing from contiguous vegetation in either quantitative or qualitative characteristics (Daubenmire 1968). A community type is thus defined as an abstract grouping of all communities (stands) based on floristic and structural similarities in both overstory and undergrowth layers. Some of our riparian communities consist of only a single layer of vegetation; we consider this the overstory and ignore all references to additional strata. Naming the community type follows the frequently used system of a binomial with the dominant overstory species separated from the dominant or most diagnostic indicator of the undergrowth union by a slash (Mueller-Dombois and Ellenberg 1974). Thus, a community characterized by *Salix wolfii* in the overstory, with an undergrowth of *Carex aquatilis* and various mosses, is identified and written as belonging to the **Salix wolfii/Carex aquatilis community type.** In some cases several species were grouped because of apparent similarity in ecological amplitude. Therefore, stands comprised of *Salix drummondiana* or *Salix boothii,* and all combinations of the two, are grouped together. We arbitrarily selected *Salix boothii* to use in the name.

Community types represent the existing structure and composition of communities with no indication of successional status. The community type is a unit of vegetation that has no direct placement within a temporal setting. This is in contrast to the habitat type classification of land (site), in which time is held constant (Steele and others 1983). Habitat type classifications are based on the climax plant community (plant association) and describe the physical characteristics that allow that climax plant community to develop and persist.

Succession and Riparian Ecosystems

The concept of a climax plant community is that of a complex of species adapted to coexistence and to the local environment, capable of reproducing within the community and excluding the establishment of new (especially dominant) species (Oosting 1956), or in other words, a stable, self-perpetuating community. Time is an important factor when discussing succession and the climax plant community because, over geologic time, climates have changed and will continue to change dramatically, resulting in different local environments. Studies of packrat middens on the Abajo Mountains of southeastern Utah (Betancourt 1984) showed that within the last 7,000 to 10,000 years *Picea engelmannii* and *Abies lasiocarpa* once dominated areas now vegetated by pinyon-juniper *(Pinus edulis* and *Juniperus osteosperma)* woodlands, and montane forests *(Pseudotsuga menziesii, Pinus ponderosa,* and *Populus tremuloides).* Potential changes in vegetation over several thousand years are beyond the scope of resource management plans, but one is faced with addressing this issue merely on a philosophical basis when discussing climax. We prefer to think of climax vegetation in terms of a timeframe of several hundred years, during which global climates are relatively stable. Given this definition, we are faced with the additional question of whether riparian communities exist in a climax state. Kovalchik (1987) addressed this issue by describing the **riparian association** as " . . . an assemblage of native vegetation in equilibrium with the environment on specific fluvial surfaces (the vegetative potential of a fluvial

surface)." Kovalchik went on to note that " . . . this potential may change in time with change in the soil and water characteristics of the fluvial surface." This last statement is extremely important because soil and water characteristics commonly change in riparian settings, especially where lateral stream migration and vertical stream cutting occur.

In addition to changing water and soil properties, many riparian communities, especially those in arid portions of the West, have been floristically altered by heavy livestock grazing. In Utah, introduced perennial species have replaced natives in many areas; weedy species (both annual and perennial, native or introduced) have become abundant; and the potential of many riparian ecosystems to support native species in a more natural composition, density, and cover, is nearly, if not completely, obscured.

The Potential Natural Community (PNC) concept is currently gaining popularity with classifiers of plant communities. In general, the PNC is that community which can exist in the absence of disturbance, at a level of equilibrium, with the environment, regardless of the natural status of individual dominant species (i.e., native vs. introduced species). Because our knowledge of the ecology of riparian communities is limited, to classify based on this concept may not always be appropriate. To classify using the PNC concept would eliminate a majority of riparian communities because of the lack of information and knowledge at the present time.

In spite of potential impacts, there are riparian communities in Utah that can be considered ecologically stable communities. Among these are communities in broad, wet meadows (especially those with organic soils that have developed over long periods of time), on seeps with a fairly constant underground flow, and immediately adjacent to well-armored streams or those with fairly constant streamflow.

All sampled communities belonging to the **Carex lasiocarpa** and **Carex limosa community types** could be considered ecologically stable. These communities occur on saturated organic soils, often approaching floating bog status. Little grazing impacts were noted. Some of the communities belonging to the **Carex buxbaumii, Carex aquatilis** (as well as some willow community types with *Carex aquatilis* as the dominant undergrowth), and some communities belonging to the **Carex simulata** or **Carex nebrascensis community types** may also be stable.

Some communities belonging to **Betula occidentalis/Mesic Forb** and **Alnus incana/Mesic Forb community types** appeared very stable, though some may be seral to communities dominated by overstories such as *Picea engelmannii* or *Abies lasiocarpa,* indicating a potential succession toward conifer associations. Some of the coniferous riparian community types resemble climax communities belonging to habitat types previously defined; the **Conifer/Equisetum arvense, Conifer/Actaea rubra,** and the **Conifer/Aconitum columbianum** riparian **community types** include some communities at or near climax. While other communities sampled could be considered plant associations, the defined community types are typically more inclusive with a range in status from early seral onward.

Community Type and Species Distributions

Our analysis included an ordination of communities based on undergrowth species (including strictly herbaceous communities) as well as an ordination based on both overstory and undergrowth. We found that undergrowth species produce a better partition of the environment than overstory species, presumably because most overstory species have a broader ecological amplitude. These findings agree with those of Daubenmire and Daubenmire (1968). Working in the northern Rocky Mountains, the authors suggested that forest overstory and undergrowth " . . . occupy the land independently." They found that not only does the same overstory occur over a variety of undergrowths, but also that the same undergrowth occurs beneath several overstories. Forested overstories were apparently influenced more by macroclimate, while the undergrowths were under the control of microclimate and soils. In Utah's riparian ecosystems studied, undergrowths may change with subtle differences in soil water characteristics. Overstory dominants may be less dependent on available soil water and more indicative of macroenvironmental conditions, especially temperature, though typically it is a combination of factors.

In general, our **Salix exigua community types** occur at lower elevations, especially adjacent to stream channels where they commonly pioneer sand and gravel bars. **Salix geyeriana community types** occur at moderate elevations in broad alluvial valley bottoms, often with fine textured soils. **Salix boothii community types** occur at midelevations, commonly associated with moderately wide valley bottoms. Low growing willow types are common at higher elevations. The **Salix wolfii** and **Salix planifolia community types** occur up to subalpine elevations, while the **Salix glauca/Deschampsia cespitosa community type** typically occurs in alpine settings. Figure 2 shows elevational relationships of some dominant overstory and undergrowth species in our classification.

While we place great emphasis on undergrowth as an indicator of environment, our classification is based on both overstory and undergrowth. The overstory allows the user to describe broad distinctions such as those previously mentioned, while the undergrowth is a "fine-tuning" instrument that describes the soil water environment more clearly. Some species occur over a broad elevational range. This is because species occur at

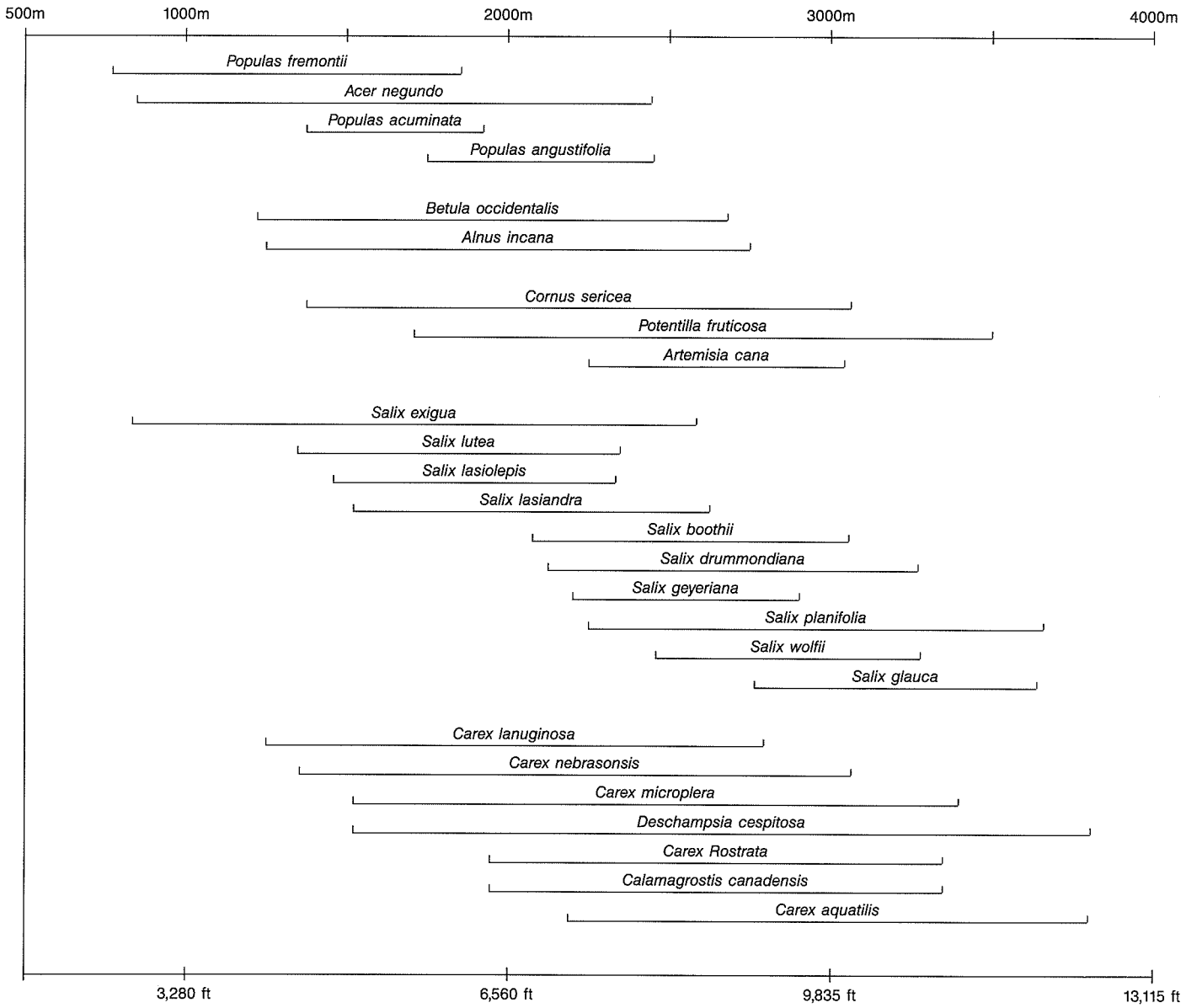


Figure 2.—Elevational distribution of some dominant overstory and undergrowth species in Utah, developed from data published by Welsh and others (1987).

higher elevations at southern latitudes than they do at northern latitudes. Some overstory and undergrowth relationships are more clearly illustrated in Appendix G which groups community types and dominant overstory species by undergrowth dominants.

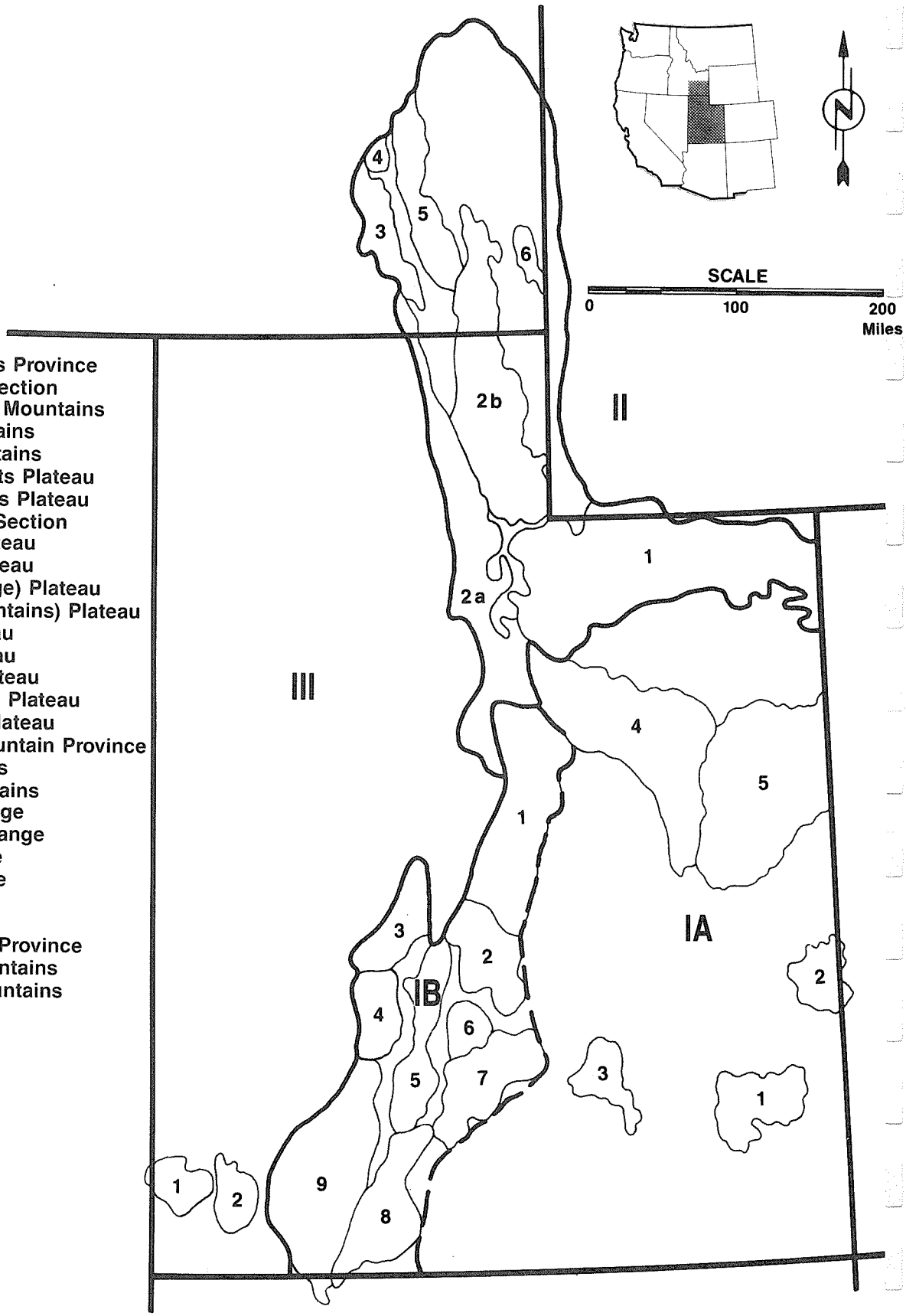
ENVIRONMENTAL SETTING

Physiography and Geology

Included in the study area are portions of three physiographic provinces as described by Fenneman (1931): the Colorado Plateaus Province, the Middle Rocky Mountain Province, and the Basin and Range Province (fig. 3). These physiographic provinces are closely related to the floristic sections as described later in the text.

Colorado Plateaus Province—Distinguishing features of this Province include horizontal formations with high plateaus, typically between 1 525 and 3 355 m (5,000 and 11,000 ft), divided by steep canyons. Two subdivisions of this Province, the High Plateaus and Canyon Lands Sections, exist within the study area.

The High Plateaus Section (fig. 3) is divided into three "strips" by faults that trend north and south. The western portion includes the Markagunt, Tushar, and Pavant Plateaus; the central section includes the Paunsaugunt and Sevier Plateaus; and the Wasatch, Fishlake, Awapa, and Aquarius Plateaus form the eastern section. Of these, only the lava-capped Aquarius Plateau supported glaciers during the



I. Colorado Plateaus Province
  A. Canyonlands Section
    1. Abajo (Blue) Mountains
    2. Lasal Mountains
    3. Henry Mountains
    4. West Tavaputs Plateau
    5. East Tavaputs Plateau
  B. High Plateaus Section
    1. Wasatch Plateau
    2. Fishlake Plateau
    3. Pavant (Range) Plateau
    4. Tushar (Mountains) Plateau
    5. Sevier Plateau
    6. Awapa Plateau
    7. Aquarius Plateau
    8. Paunsaugunt Plateau
    9. Markagunt Plateau

II. Middle Rocky Mountain Province
  1. Uinta Mountains
  2. Wasatch Mountains
    a. Wasatch Range
    b. Bear River Range
  3. Bannock Range
  4. Pocatello Range
  5. Portneuf Range
  6. Pruess Range

III. Basin and Range Province
  1. Bull Valley Mountains
  2. Pine Valley Mountains

Figure 3.—Physiographic Provinces of Utah and southeastern Idaho showing major mountain ranges and plateaus. (Adapted from Cronquist and others, 1972 and Fenneman, 1931.)

Pleistocene. Surface topography includes numerous glacial lakes and ponds and widely scattered volcanic boulders. In contrast, the Awapa Plateau reaches elevations just above 2 745 m (9,000 ft) and has essentially no perennial streams or springs. The Pavant and Tushar Plateaus are a mixture of mountain/plateau topography; in this sense they are least like the other plateaus. The Markagunt and Paunsaugunt Plateaus are similar to one another in their physiography, both having exposures of sandstone cliffs as demonstrated by the Claron or Cedar Breaks Formations and the Kaiparowits Formations of Bryce Canyon National Park and Cedar Breaks National Monument. The Sevier Plateau reaches elevations greater than 3 050 m (10,000 ft).

The Canyonlands Section is characterized by numerous canyons that have developed in the sandstones of an arid environment. Several large rivers flow through this Section: the Colorado, San Juan, and Dolores Rivers flow from the Rocky Mountains; the Price, Fremont, Escalante, and San Rafael Rivers flow from the High Plateaus Section; and the Green River flows through the Uinta Basin and Tavaputs Plateau into the Canyonlands Section. Local uplifts occur within this Section which are characterized by exposed igneous rock. Two uplifts, the LaSal and Abajo Mountains, are included within the study area.

Middle Rocky Mountain Province—The northern portion of the study area occurs in the Middle Rocky Mountain Province and includes the Uinta and Wasatch Mountains. The Uinta Mountains in northeastern Utah are the largest east-west range in the United States (Fenneman 1931) with peaks reaching elevations greater than 3 965 m (13,000 ft). They were characterized by Fenneman as a highly eroded anticline (convex fold). Approximately 5 490 m (18,000 ft) of overlying strata has eroded, exposing acidic Precambrian quartzite at higher elevations. The greatest uplift of the monocline can be seen in the northern portion of the Uinta Mountains where the dip has been estimated to be as high as 45 degrees (Fenneman 1931). Pleistocene glaciation has played a significant role in the formation of the landscape which includes moraines, cirques, and outwash plains.

The Wasatch Mountains in northern Utah and southern Idaho differ from the Uinta Mountains because the former are characterized by fault block uplifting rather than convex folding. The western edge of the Wasatch and Bear River Ranges, that together are included in the Wasatch Mountains, occurs along a fault zone, resulting in an abrupt, uplifted landscape. Active faulting on the western front has been responsible, in part, for the steep V-shaped canyons that occur in this region. The eastern slopes are generally less dramatic in their topography and descend more gradually into the dissected plateaus to the east. Glaciation was most prominent in the higher elevations of the range between Parleys Canyon east of Salt Lake City and south to American Fork Canyon southeast of Provo. Additional mountain ranges that occur within this Section and are included in the study area are the Bannock, Pocatello, Pruess, and Portneuf Ranges in southeastern Idaho.

Basin and Range Province—The Great Basin Section is the only one within the Basin and Range Province that is represented within the study area (fig. 3). While this Section makes up a large portion of the state of Utah, only the Pine Valley and Bull Valley Mountains in the far southwestern portion of the state are included in the study. Both ranges are characterized predominantly by Tertiary intrusive and extrusive volcanic rock with areas of Quaternary basalt flows. Structurally, therefore, they are very different from the adjacent High Plateaus Section of the Colorado Plateaus Province.

Omernik (1986) delineated three ecoregions within the study area that differ somewhat from those physiographic provinces just described. The **Northern Basin and Range Ecoregion** in Utah is essentially the same as the Basin and Range Physiographic Province but excludes the Pine Valley and Bull Valley Mountains.

The **Wasatch and Uinta Mountains Ecoregion** differs from the Middle Rocky Mountain Province in its inclusion of the High Plateaus of central and southern Utah that Fenneman (1931) included in the Colorado Plateaus Province. The **Colorado Plateaus Ecoregion** subsequently differs from the Colorado Plateaus Physiographic Province in the exclusion of the High Plateaus.

Floristic Sections and Vegetation Zones

Four Floristic Sections described by Cronquist and others (1972) dominate the study area, while additional Sections may have limited influence. The Wasatch Mountains, Uinta Mountains, Canyonlands, and Utah Plateaus Floristic Sections are dominant with influences from the Bonneville Basin and Uinta Basin Floristic Sections (fig. 4). In areas where several Floristic Sections occur in proximity, the floras are more diverse. The entire western boundary of both the Wasatch Mountains and Utah Plateaus Floristic Sections are influenced by the Bonneville Basin Floristic Section. The western Uinta Mountains are similar in many ways to the Wasatch Mountains Floristic Section with influence of the Utah Plateaus as well as the Uinta Basin Sections.

The Wasatch Mountains Floristic Section—This Section corresponds with the physiographic province of the same name as described above (Fenneman 1931). Within the Wasatch Mountains, some major species are limited in their distribution. *Pinus contorta* occurs only rarely as an overstory dominant. An exception is in the vicinity of Beaver Creek near the junction of Highway 89 and the Beaver Mountain Ski Area Highway.

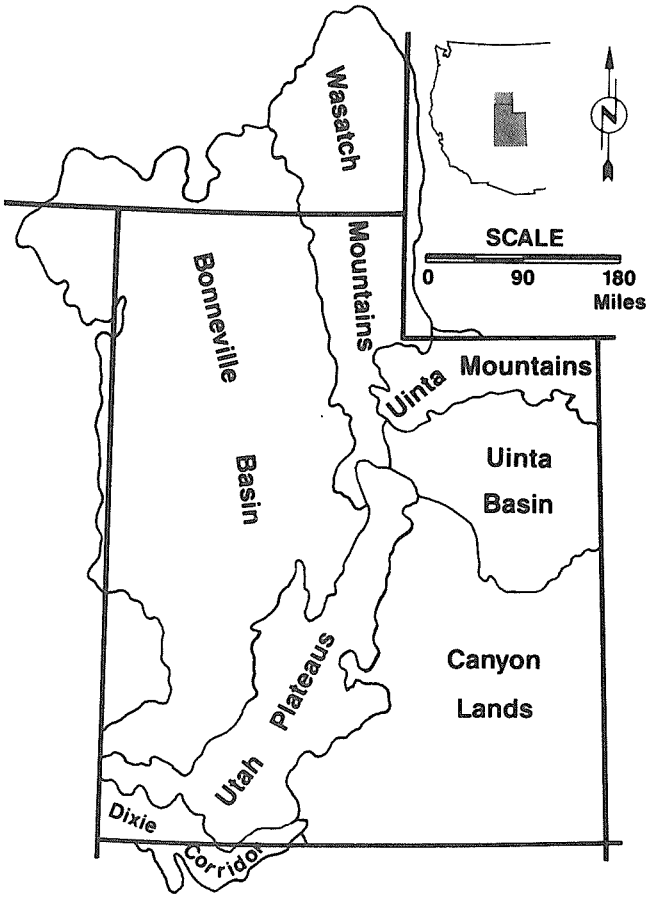


Figure 4.—Floristic sections of Utah and adjacent portions of the study area. (Adapted from Cronquist and others, 1972.)

Quercus gambelii occurs at latitudes generally south of Logan; one small population has been noted near the head of Right Fork above Logan Canyon. The montane zone (Cronquist and others 1972) of this Floristic Section includes communities dominated by *Picea engelmannii, Abies lasiocarpa, Abies concolor,* and *Pseudotsuga menziesii.* Lower elevations are characterized by *Quercus gambelii* (limited in distribution as previously noted) and *Acer grandidentatum.* Soils of the Wasatch and Bear River Ranges are slightly acid to basic which may account for the near absence of acid-loving plants such as members of the Heath Family (Ericacaeae) and Sphagnum mosses.

The Uinta Mountains Floristic Section—This Section occurs within the Middle Rocky Mountain Physiographic Province. Soils are typically acidic, resulting from quartzitic geology and poor drainage. Members of the Ericaceae family as well as other acid-loving plants are common. *Pinus contorta, Abies lasiocarpa,* and *Picea engelmannii* are common in this Floristic Section, while *Pinus ponderosa* occurs at lower elevations near the interface with the **Uinta Basin Floristic Section.** The flora of the Uinta Mountains is unique to Utah in many ways. *Pinus contorta* is abundant in this Section while uncommon elsewhere in the northern Wasatch Range. Within the study area, several sedges (*Carex* spp.) occur only in the Uinta Mountains. These include *Carex lasiocarpa, C. buxbaumii,* and *C. paupercula. Carex limosa* is also more abundant here than elsewhere in the study area. Willows (*Salix* spp.) found predominantly in the Uinta Mountains include *Salix planifolia, S. wolfii,* and *S. geyeriana.*

The Canyonlands Floristic Section—This Section coincides with the southern portion of the Colorado Plateaus Physiographic Province and is considered to be the richest in the Intermountain Region for endemism (Cronquist and others 1972). Much of this area is characterized by *Pinus edulis* and *Juniperus osteosperma* with *Coleogyne ramosissima* at elevations typically below 1 525 m (5,000 ft). The Abajo and LaSal Mountains, where most of the study in this Section occurred, offer some of the highest elevations in the area. The LaSal Mountains are the only areas outside of the Uinta Mountains and Wasatch Mountains Floristic Sections within the study area where *Mertensia ciliata* occurs. Other Tall *Mertensia* spp. (*Mertensia arizonica* and *M. franciscana*) are near ecological equivalents in the remainder of this Floristic Section and within the Utah Plateaus Floristic Section. The Abajo Mountains are less influenced by the Rocky Mountain Flora than are the LaSal Mountains.

The Utah Plateaus Floristic Section—This Section occupies the western portion of the Colorado Plateaus Physiographic Province and the Pine Valley and Bull Valley Mountains in extreme southwestern Utah. Vegetation ranges from *Pinus edulis, Juniperus osteosperma,* and *Artemisia tridentata* at lower elevations to *Picea engelmannii* and *Abies lasiocarpa* at higher elevations. The Pine Valley and Bull Valley Mountains are included in this Section because of large inclusions of *Pinus ponderosa* which is abundant throughout the **Utah Plateaus Floristic Section.** These mountains, however, are influenced by the **Bonneville Basin** and **Dixie Corridor Floristic Sections** (fig. 4), and *Salix lasiolepis,* typically a **Bonneville Basin** species, occurs within the study area as an overstory dominant only in these mountains.

Soils

We define riparian soils as those having higher available water than adjacent uplands and that typically show evidence of water tables within 150 cm (60 in) of the soil surface. This can be in the form of distinct or prominent mottles, as well as actual water tables. Our definition is more liberal than others and allows for the inclusion of soils near the drier end of the moisture gradient. Because our sampling methods do not look at water table changes over time, it is necessary to make inferences about water table patterns from soil characteristics. Several plant communities included in our riparian classification, such as some belonging to the **Populus angustifolia/Rhus aromatica** or **Populus**

angustifolia/Rosa woodsii community types, may not presently occur on riparian soils. For the most part, these are remnant communities that established on sites that were presumably wetter than at present. Through lateral stream migration and downcutting of stream channels, water tables move downward in the profile. In some instances, evidence of high water tables still exist in the form of mottles with high value and chroma reminiscent of fluctuating ground water levels. On other sites there no longer appears to be any such evidence, yet long-lived, deeply rooted or rhizomatous riparian species remain.

In order for a soil to be classified as having an aquic moisture regime at the highest level (suborder), the entire soil must be saturated with standing water, which results in anaerobic conditions for at least a few days each year. The result is typically distinct or prominent mottles with chromas of two or less, or the soil is gleyed with low chromas, often with hues of 2.5Y to 5GY. Soils with water flowing through the profile, as commonly seen in coarse-textured soils immediately adjacent to streams, are not considered aquic at the suborder level because the water is not anaerobic; these soils may be considered aquic, however, at the subgroup level (USDA-SCS 1975).

Within the present soil classification (USDA-SCS 1975), requirements for aquic moisture regimes at the subgroup level do not adequately include situations commonly found in the field. The placement within the Aquic subgroup of a soil classified as a Cryofluvent requires that mottles having a chroma of 2 or less be present within 50 cm (20 in) of the soil surface. It is common to find soils with high water tables that do not fulfill the mottle requirement. In some suborders, however, the mere presence of water in the profile results in an aquic classification. It may be appropriate to reevaluate some of the criteria for this use of moisture regime in the present soil classification system in order to adequately describe the wetness of the soil.

Development of riparian soils is highly variable as indicated by the range of soil orders noted in the study area (Appendix C). Entisols, Inceptisols, Mollisols, and Histosols make up the majority of soils on which our riparian communities occur. While a majority of these soils have developed on alluvium, some colluvial and residual soils were also sampled. These typically occurred in areas where underground flows were shallow, where there was a late snowmelt, or where ground water surfaced. While organic soils were most common at higher elevations where temperatures were cold and water was abundant through ponding and seepage, they were also noted at lower elevations where cold-water seeps occurred.

Most Entisols were classified as Fluvents, which indicates recent and periodic deposition and scouring of fluvial materials. These soils typically occurred immediately adjacent to stream channels within the flood plain zone. Depending on temperature and moisture regimes, these soils most commonly belong to the Cryofluvent, Xerofluvent, or Udifluvent great groups. In addition to the Fluvents, some cold soils with periodic standing water tables at or near the surface were classified as Cryaquents.

Inceptisols were classified at the suborder level as either Aquepts or Ochrepts. Aquepts indicate a standing water table at or near the surface for a period of at least a few days each year, as previously noted. Cryaquepts, Haplaquepts, and Humaquepts were among the classified great groups sampled. Ochrepts represent soils in which some alteration of horizons is noted, but with water tables that are more variable. Cryochrepts and Xerochrepts were the most commonly identified great groups in this suborder and represent those soils with cold (Cryic) temperature regimes and Xeric moisture regimes, respectively.

Mollisols were by far the most common soil order associated with elevated stream terraces, broad meadows, and residual soils on side slopes. Aquolls, Borolls, and Xerolls were represented throughout the study area. Xerolls in our study, though not particularly common, occur at lower elevations where temperature regimes are predominantly frigid and moisture regimes are Xeric. All our Xerolls belonged to the Haploxeroll great group and often were saturated within 1 m (39 in) of the soil surface for some period of time, or had thick mollic epipedons. These soils were particularly common on stream terraces where channels have eroded downward or where soil textures are coarse and have low water retention capabilities. Borolls represent moist and cool to cold Mollisols and were common throughout the study area. These soils in general are not wet enough to be classified as Aquolls, but quite commonly are aquic at the subgroup level of the classification. Cryoborolls and Haploborolls separate out by elevational (temperature) gradient, and many of those sampled had thick mollic epipedons resulting in Cumulic and Pachic subgroup classifications. The wet Mollisols are the Aquolls that, while not as common as the Borolls, are equally broad in their distribution. Cryaquolls occur at high elevations where cryic temperature regimes and wet conditions often result in slow decomposition of organic matter. As a result, many soils had thick, mollic epipedons or had histic epipedons and, in some instances, were intergrades to Terric subgroups of Histosols. This also occurred at lower elevations where Haplaquolls were identified, but in general these soils showed greater levels of organic matter decomposition.

Histosols, while for the most part not extensive, were widely distributed in the study area. They were least common at southern latitudes and quite common in portions of the Uinta Mountains. Levels of decomposition vary greatly and Fibrists, Hemists, and Saprist were all described. Nearly all Histosols were cold and were classified as Borofibrists, Borohemists, and Borosaprists. Sphagnofibrists were noted in the Uinta Mountains,

though whenever there was uncertainty in the composition of mosses, they were described as Borofibrists.

Alfisols were the least common soil order sampled and typically represented mid- or upper-slope situations where late snowmelt occurred and the soils had developed argillic horizons. All were classified as Typic or Aquic Cryoboralfs.

The classification of soils allows us an insight into the developmental processes for sites on which riparian communities occur. Some communities are associated with highly unstable or poorly developed soils, while others occur on very stable soils that have changed little during the timeframe of the community. Barring disturbance to the vegetation, one can also expect to find riparian plant communities that are naturally unstable or those that appear to be highly stable. **Succession and Riparian Ecosystems,** p. 5, has a more detailed discussion. Appendix C shows the substrate features for most riparian community types.

Climate

The effect of climate on riparian plant communities is more indirect than the effect it has on upland communities. Climate exerts its influence on the development of watersheds and subsequent streamflows. Climatically drier areas, such as those that occur in southwestern Utah, typically have smaller meadows and narrower riparian corridors because of lower peak and average streamflows. The Uinta Mountains, on the other hand, with their colder temperatures and higher levels of precipitation, have broad riparian ecosystems that cover extensive areas in many valley bottoms.

Temperature plays an important role in determining species distributions. While temperature gradients on a local basis are related to elevation, this relationship is affected by latitude; temperatures at southern latitudes for the same elevation are typically warmer than those of more northern latitudes. This is commonly seen in the elevational distribution of community types that occur throughout the study area, such as the **Carex nebrascensis community type** which is typically between 1 920 and 2 320 m (6,300 and 7,600 ft) in northern latitudes and between 2 260 and 2 560 m (7,400 and 8,400 ft) in southern latitudes. Vegetation, cold air drainages, and typically high water tables are important in mediating soil temperatures as well. Where upland soils may have frigid or mesic temperature regimes, riparian soils often have cryic or frigid temperatures.

The Uinta and Wasatch Mountains receive the highest annual precipitation within the study area. The Uinta Mountains receive nearly 90 cm (35 in) or more at the higher elevations; precipitation amounts drop off quickly on the south slope as the Uinta Mountains descend into the Uinta Basin. The **Canyonlands Floristic Section** is generally dry, but the Abajo and LaSal Mountains receive 41 cm (16 in) or more on their peaks. The **Utah Plateaus Floristic Section** varies from north to south, with the Pine Valley and Bull Valley Mountains of southwestern Utah typically receiving 30 cm (12 in) or less precipitation each year. Summer precipitation is the highest on the Wasatch Mountains and on the Wasatch Plateau. These areas typically have large convection storms at the higher elevations. While the Uinta Mountains may receive 20 cm (8 in) or more in the summer months (about 40 percent of the annual precipitation), the Abajo and LaSal Mountains and much of the southern High Plateaus typically receive less. The Pine Valley and Bull Valley Mountains typically have between 10 and 15 cm (4 and 6 in) of precipitation in the summer months.

Not only are the Pine Valley and Bull Valley Mountains the driest portions of the study area, they are also the warmest. At the other extreme, the Uinta Mountains include some of the most wet and cold portions of the study area. For much of the remaining portion of the study area, mean January temperatures range between -9° and -7°C (16° and 20°F) with the higher elevations on the LaSal Mountains averaging slightly colder. Average July temperatures are between 18° and 22°C (64° and 72°F).

Upland Vegetation

Relationships between riparian ecosystems and adjacent upland communities are as yet little understood. As discussed in a previous section (**Community Type and Species Distributions**, p. 6), riparian community types are distributed along elevational as well as moisture gradients within the study area. For example, the **Salix geyeriana community types** are typically associated with uplands dominated by *Artemisia tridentata* ssp. *vaseyana,* while the **Salix planifolia community types** are more typically associated with coniferous forests. Various upland habitat type and community type classifications are available for the study area. Mueggler and Campbell (1986) described *Populus tremuloides* community types for Utah, while Mueggler and Campbell (1982) described those types for the portion of our study area in southeastern Idaho. Mueggler (1988) updated these earlier works with a *Populus tremuloides* community type classification for the entire Intermountain Region of the USDA Forest Service. Mauk and Henderson (1984) described coniferous forest habitat types for northern Utah and adjacent portions of southeastern Idaho. Youngblood and Mauk (1985) described coniferous forest habitat types of southern Utah. Lewis (1970) described some of the alpine communities on the Uinta Mountains, some of which are similar to our high elevation riparian community types for this area. Classifications for sagebrush, pinyon-juniper, oak-maple woodlands, and forb-dominated uplands have not been completed to any great degree for the study area.

CLASSIFICATION

This classification includes communities that occur on sites that range from perennially saturated to those that are marginally riparian. A total of 79 types within 9 dominance groups have been described for the study area; several unclassified communities are discussed as well. Table 2 is a list, by dominance group, of community types, their abbreviations, and abundance. The large number of community types described for Utah reflects the vast floristic, geologic, climatic, and topographic variations that exist across the state. Because of this variability additional types will likely be described in the future.

The term **community type** is used throughout the text and is abbreviated "**c.t.**" to simplify discussions; similarly, **habitat type** is often abbreviated as "**h.t.**" Community type names are abbreviated using two different methods: the first uses the first three letters of the genus and species names, and the second is the more widely recognized method of using the first two letters of the genus and species names. For example, **Carex aquatilis c.t.** becomes **CARAQU c.t.** using the first method and **CAAQ c.t.** using the second. Both abbreviation methods are shown in table 2 and in community type headings within the type descriptions. Because a few c.t.s have the same four-letter abbreviations (**Carex lasiocarpa c.t.** and **Carex lanuginosa c.t.**; **Eleocharis palustris c.t.** and **Eleocharis pauciflora c.t.**), numbers are added to the end of the abbreviated name (**CALA1** and **CALA2**; **ELPA1** and **ELPA2**). The numbers indicate order of community types within the key. Communities dominated by various coniferous tree species are simply abbreviated as **Conifer**. Some undergrowths represent various combinations of mesic forbs or mesic graminoids; these are abbreviated as "**MF**" and "**MG.**" Community types with particularly depauperate undergrowths are described as "**Barren**" and no abbreviations are used.

A key to dominance groups and community types precedes their descriptions. Community types within the key are generally arranged along a wet to dry gradient. A general discussion of each dominance group is provided, followed by detailed descriptions of each community type including distribution, vegetation, soils, and often, successional status and management implications. Following each dominance group is a discussion of miscellaneous unclassified communities belonging to that group.

Dot maps showing the general occurrence of most community types in the study area are provided. The dots indicate the distribution of communities, rather than the number of plots, within a community type. Arrows on some maps indicate known occurrences of the same c.t. beyond the study area boundary. The number of sample stands within a c.t. does not indicate the relative abundance of that type; this is discussed in the **Distribution** sections, as well as in table 2, by describing the type as major, minor, or incidental. A major c.t. is one that covers extensive acreages in at least some drainages. Minor c.t.s may be sporadic throughout the study area but seldom occur as a large unit of vegetation. Incidental c.t.s rarely occur in more than one general vicinity, such as a major drainage, but may extend into our study area from elsewhere.

Users should note that the key is not the classification but rather a tool to assist in using the classification. We have attempted to construct a key with very specific terms that will narrow the ecotones for field identification. In contrast, the type descriptions are generalized to portray modal conditions. In any classification effort, and especially in dynamic systems such as riparian ecosystems, variation is expected within all classified types. The user is cautioned to validate the determination made using the key by checking the written descriptions and supporting appendixes BEFORE leaving the stand or plot.

Table 2. Riparian community types of Utah and adjacent portions of Idaho, Wyoming, and Colorado.

6-Letter; 4-Letter Abbreviation	Community Type	Abundance[1]
	Coniferous Tree-Dominated Community Types	
CONIFER/CORSER; CONIFER/COSE	Conifer/Cornus sericea	i
CONIFER/EQUARV; CONIFER/EQAR	Conifer/Equisetum arvense	m
CONIFER/CALCAN; CONIFER/CACA	Conifer/Calamagrostis canadensis	M
CONIFER/ELEGLA; CONIFER/ELGL	Conifer/Elymus glaucus	m
CONIFER/POTFRU; CONIFER/POFR	Conifer/Potentilla fruticosa	m
CONIFER/DESCES; CONIFER/DECE	Conifer/Deschampsia cespitosa	m
CONIFER/POAPRA; CONIFER/POPR	Conifer/Poa pratensis	m
CONIFER/ACOCOL; CONIFER/ACCO	Conifer/Aconitum columbianum	m
CONIFER/ACTRUB; CONIFER/ACRU	Conifer/Actaea rubra	m
	Tall Deciduous Tree-Dominated Community Types	
POPANG/BETOCC; POAN/BEOC	Populus angustifolia/Betula occidentalis	M
POPANG/ACEGRA; POAN/ACGR	Populus angustifolia/Acer grandidentatum	m
POPANG/CORSER; POAN/COSE	Populus angustifolia/Cornus sericea	M
POPANG/ROSWOO; POAN/ROWO	Populus angustifolia/Rosa woodsii	m
POPANG/RHUARO; POAN/RHAR	Populus angustifolia/Rhus aromatica	m
POPANG/POAPRA; POAN/POPR	Populus angustifolia/Poa pratensis	M
ACENEG/CORSER; ACNE/COSE	Acer negundo/Cornus sericea	m
ACENEG/EQUARV; ACNE/EQAR	Acer negundo/Equisetum arvense	m
	Low Deciduous Tree-Dominated Community Types	
ALNINC/CORSER; ALIN/COSE	Alnus incana/Cornus sericea	m
ALNINC/EQUARV; ALIN/EQAR	Alnus incana/Equisetum arvense	m
ALNINC/MF; ALIN/MF	Alnus incana/Mesic Forb	m
ALNINC/MG; ALIN/MG	Alnus incana/Mesic Graminoid	m
BETOCC/CORSER; BEOC/COSE	Betula occidentalis/Cornus sericea	M
BETOCC/MF; BEOC/MF	Betula occidentalis/Mesic Forb	m
BETOCC/POAPRA; BEOC/POPR	Betula occidentalis/Poa pratensis	M
	Salix boothii-Dominated Community Types	
SALBOO/CARAQU; SABO/CAAQ	Salix boothii/Carex aquatilis	m
SALBOO/CARROS; SABO/CARO	Salix boothii/Carex rostrata	M
SALBOO/CALCAN; SABO/CACA	Salix boothii/Calamagrostis canadensis	m
SALBOO/CARNEB; SABO/CANE	Salix boothii/Carex nebrascensis	i
SALBOO/EQUARV; SABO/EQAR	Salix boothii/Equisetum arvense	i
SALBOO/POAPAL; SABO/POPA	Salix boothii/Poa palustris	i
SALBOO/MF; SABO/MF	Salix boothii/Mesic Forb	M
SALBOO/MG; SABO/MG	Salix boothii/Mesic Graminoid	M
SALBOO/POAPRA SABO/POPR	Salix boothii/Poa pratensis	M
	Salix geyeriana-Dominated Community Types	
SALGEY/CARAQU; SAGE/CAAQ	Salix geyeriana/Carex aquatilis	M
SALGEY/CARROS; SAGE/CARO	Salix geyeriana/Carex rostrata	M
SALGEY/POAPAL; SAGE/POPA	Salix geyeriana/Poa palustris	i
SALGEY/CALCAN; SAGE/CACA	Salix geyeriana/Calamagrostis canadensis	i
SALGEY/DESCES; SAGE/DECE	Salix geyeriana/Deschampsia cespitosa	M
SALGEY/MG; SAGE/MG	Salix geyeriana/Mesic Graminoid	M

Table 2 (Continued)

6-Letter; 4-Letter Abbreviation	Community Type	Abundance[1]
	Salix exigua-Dominated Community Types	
SALEXI/MF; SAEX/MF	Salix exigua/Mesic Forb	m
SALEXI/MG; SAEX/MG	Salix exigua/Mesic Graminoid	m
SALEXI/POAPRA; SAEX/POPR	Salix exigua/Poa pratensis	m
SALEXI/BARREN; SAEX/BARREN	Salix exigua/Barren	m
	Other Tall Willow-Dominated Community Types	
SALLAS/BARREN; SALA/BARREN	Salix lasiolepis/Barren	m
SALBEB/MG; SABE/MG	Salix bebbiana/Mesic Graminoid	m
	Low Willow-Dominated Community Types	
SALWOO/CARAQU; SAWO/CAAQ	Salix wolfii/Carex aquatilis	M
SALWOO/CARROS; SAWO/CARO	Salix wolfii/Carex rostrata	i
SALWOO/MF; SAWO/MF	Salix wolfii/Mesic Forb	M
SALWOO/DESCES; SAWO/DECE	Salix wolfii/Deschampsia cespitosa	M
SALPLA/CARAQU; SAPL/CAAQ	Salix planifolia/Carex aquatilis	M
SALPLA/CALCAN; SAPL/CACA	Salix planifolia/Calamagrostis canadensis	m
SALPLA/DESCES; SAPL/DECE	Salix planifolia/Deschampsia cespitosa	M
SALGLA/DESCES; SAGL/DECE	Salix glauca/Deschampsia cespitosa	M
	Nonwillow Shrub-Dominated Community Types	
CORSER/HERLAN; COSE/HELA	Cornus sericea/Heracleum lanatum	M
POTFRU/DESCES; POFR/DECE	Potentilla fruticosa/Deschampsia cespitosa	M
POTFRU/POAPRA; POFR/POPR	Potentilla fruticosa/Poa pratensis	M
ARTCAN/DESCES; ARCA/DECE	Artemisia cana/Deschampsia cespitosa	m
ARTCAN/FESOVI; ARCA/FEOV	Artemisia cana/Festuca ovina	M
ARTCAN/POAPRA; ARCA/POPR	Artemisia cana/Poa pratensis	M
	Herbaceous Community Types	
TYPLAT; TYLA	Typha latifolia	m
ELEPAL; ELPA1	Eleocharis palustris	m
CARLAS; CALA1	Carex lasiocarpa	M
CARLIM; CALI	Carex limosa	m
CARBUX; CABU	Carex buxbaumii	m
CARSAX; CASA	Carex saxatilis	M
CALLEP; CALE	Caltha leptosepala	m
CARAQU; CAAQ	Carex aquatilis	M
CARROS; CARO	Carex rostrata	M
ELEPAU; ELPA2	Eleocharis pauciflora	i
CARSIM; CASI	Carex simulata	i
CARNEB; CANE	Carex nebrascensis	M
CARMIC; CAMI	Carex microptera	m
CARLAN; CALA2	Carex lanuginosa	m
CALCAN; CACA	Calamagrostis canadensis	M
DESCES; DECE	Deschampsia cespitosa	M
DANINT; DAIN	Danthonia intermedia	M
JUNBAL; JUBA	Juncus balticus	m
POAPRA; POPR	Poa pratensis	M
VERCAL; VECA	Veratrum californicum	M
MERCIL; MECI	Mertensia ciliata	m

[1]M - Major Community Type
m - Minor Community Type
i - Incidental Community Type

Relationship to Previous Classifications

This classification was designed to be an extension of the riparian classification for eastern Idaho and western Wyoming (Youngblood and others 1985a). For the most part, community types that occur in both areas are present on similar environmental settings. Table 3 shows the relationship between these two classification. Discussions are provided in the sections entitled "**Other Studies**" within each community type description where changes in the basic concepts occur.

The U.S. Department of Interior Fish and Wildlife Service classification of wetland habitats (Cowardin and others 1979) is a very broad classification in which our community types could be included. All riparian communities sampled for the Utah study are included in their **Palustrine System**. Four classes/subclasses within their classification are represented by our communities: The **Persistent, Emergent Wetland** includes all our herbaceous community types; the **Broad-leaved, Deciduous Scrub-Shrub Wetland** includes all our communities dominated by *Salix* spp., *Cornus sericea, Potentilla fruticosa,* and *Artemisia cana*; **Broad-leaved, Deciduous Forested Wetlands** include all our **Populus angustifolia, Populus tremuloides,** and **Acer negundo c.t.s**; our **Alnus incana** and **Betula occidentalis c.t.s** may be included in either the **Broad-leaved, Deciduous Forested Wetlands** or the **Deciduous Scrub-Shrub Wetland** classification; and our **Conifer c.t.s** belong to the **Needle-leaved, Evergreen Forested Wetland** class.

Future Directions in Riparian Classification

Research and field work has shown us that stratification of riparian ecosystems is necessary to adequately describe and define these areas. The **Floristic Section** defines, in part, those dominant species that might be expected and, to some degree, the geological characteristics. **Elevation** is important in helping determine the distribution of species along temperature gradients. **Valley bottom width** and **shape,** and the **steepness of side slopes** all play a role in the drainage of cold air; they also help determine the distribution of soil particle sizes and soil water as well as the development of soils. **Stream and valley bottom gradient** are typically a function of the previous factors but also are important in the type of soil water (aerobic vs. anaerobic) and its lateral distribution.

While studies are currently underway that address these factors in detail on the Sawtooth National Forest in Idaho and on USDA Forest System lands in Nevada, only limited data are currently available. Kovalchik (1987) included information in the classification of riparian associations in central Oregon that link the specific associations with landforms. While our approach to the Utah classification did not specifically address this issue, we feel it is important because it helps us begin to understand site potential.

Table 3.—Relationships between the Utah/Southeastern Idaho and the Eastern Idaho/Western Wyoming (Youngblood and others 1985) Riparian Community Type Classifications.

Eastern Idaho and Western Wyoming	Utah and Southeastern Idaho
Picea/Equisetum arvense	Conifer/Equisetum arvense
Picea/Cornus stolonifera	Conifer/Cornus sericea
Picea/Calamagrostis canadensis	Conifer/Calamagrostis canadensis
Picea/Galium triflorum	Conifer/Aconitum columbianum
Conifer/Actaea rubra	
Populus angustifolia/Cornus stolonifera	Populus angustifolia/Cornus sericea
	Betula occidentalis/Cornus sericea
Populus angustifolia/Poa pratensis	Populus angustifolia/Poa pratensis
	Populus angustifolia/Rosa woodsii
	Populus angustifolia/Acer grandidentatum
Cornus stolonifera/Heracleum lanatum	Cornus sericea/Heracleum lanatum
Cornus stolonifera/Galium triflorum	
Artemisia cana/Festuca idahoensis	Artemisia cana/Festuca ovina
Salix boothii/Carex rostrata	Salix boothii/Carex rostrata
	Salix boothii/Carex aquatilis
Salix boothii/Poa pratensi	Salix boothii/Poa pratensis
	Salix boothii/Mesic graminoid
Salix boothii/Smilacina stellata	Salix boothii/Mesic Forb
Salix geyeriana/Mesic Forb (in part)	
Salix geyeriana/Carex rostrata	Salix geyeriana/Carex rostrata
	Salix geyeriana/Carex aquatilis
Salix geyeriana/Poa pratensis	Salix geyeriana/Mesic Graminoid
	Salix geyeriana/Deschampsia cespitosa
Salix wolfii/Mesic Forb	Salix wolfii/Mesic Forb
	Salix wolfii/Deschampsia cespitosa (in pt)
Salix phylicifolia	Salix planifolia/Carex aquatilis
	Salix planifolia/Mesic Forb
	Salix planifolia/Deschampsia cespitosa
Salix lutea	Salix exigua/Mesic Graminoid
	Salix exigua/Poa pratensis
	Salix exigua/Mesic Forb
Salix exigua/Equisetum arvense	
Salix exigua/Poa pratensis	Salix exigua/Poa pratensis
	Salix exigua/Barren
Miscellaneous Carex c.t.s	Carex lanuginosa
Poa pratensis	Poa pratensis
Mesic Forb Meadow	

Key to Riparian Community Types of Utah

READ THESE INSTRUCTIONS FIRST:

1. Use this key for riparian communities within or adjacent tc National Forest lands in Utah and portions of the Manti-LaSal National Forest in Colorado, the Wasatch-Cache National Forest in Wyoming, and the Caribou National Forest in southeastern Idaho.

2. Locate a 50 m^2 sample plot in a representative portion of the stand.

3. Accurately identify and record canopy coverages for all indicator species listed on the field form (app. F). Illustrations of indicator species for this classification are provided in appendix E.

4. Check plot data in the field to verify that the plot is representative of the stand as a whole, using recorded canopy coverage values. If not representative, locate another plot.

5. While in the plot, identify the current Overstory Dominance Group, and then identify the current riparian community type by following the keys literally. Compare the stand's composition and site characteristics with the written descriptions.

6. Remember, the key is not the classification, but only one means of entering the classification. Validate the determination according to the key by using the written description and appendix B.

Note: The "Tall *Salix* spp." referred to in this key include the following species:

Salix bebbiana
Salix boothii
Salix drummondiana
Salix exigua
Salix geyeriana
Salix lasiandra
Salix lasiolepis
Salix lutea
Salix monticola

The "Low *Salix* spp." include:

Salix glauca
Salix planifolia
Salix wolfii

The "Tall Deciduous Trees" include:

Acer negundo
Populus acuminata
Populus angustifolia
Populus fremontii
Populus tremuloides

The "Low Deciduous trees" include:

Alnus incana
Betula occidentalis

Key to Overstory Dominance Groups:

1. Trees dominate the overstory with cover usually exceeding 25 percent (communities with tree seedlings or saplings that resemble shrubs in stature are treated elsewhere) 2

1. Trees not dominating overstory 4

2. Conifers dominate the community, commonly with at least 25 percent cover in the overstory ..... **Group A** (p. 19)

2. Deciduous trees at least 25 percent cover 3

3. *Populus angustifolia, P. acuminata, P. fremontii, P. tremuloides,* or *Acer negundo* dominate the overstory .... **Group B** (p. 20)

3. Not as above. *Alnus incana* and/or *Betula occidentalis* dominate the overstory ..... **Group C** (p. 21)

4. Shrubs dominate the overstory 5

4. Shrubs not dominating the overstory; community dominated by herbaceous species ..... **Group J** (p. 25)

5. *Salix* spp. dominate the overstory commonly with at least 25 percent cover 6

5. Other shrubs dominate the overstory ..... **Group I** (p. 25)

6. Tall *Salix* spp. clearly dominate the overstory, commonly with at least 25 percent cover; low *Salix* spp. occasionally present in varying amounts 7

6. Low *Salix* spp. and/or *Betula glandulosa* dominate the overstory; Tall *Salix* spp. less than 25 percent cover ..... **Group H** (p. 24)

7. *Salix boothii, S. drummondiana,* and/or *S. monticola* dominate the overstory, commonly with at least 25 percent cover. *Salix geyeriana* occasionally codominant ..... **Group D** (p. 22)

7. Not as above 8

8. *Salix geyeriana* dominates the overstory, commonly with at least 25 percent cover ..... **Group F** (p. 23)

8. Not as above 9

9. *Salix exigua, S. lutea,* and/or *S. lasiandra* dominate the overstory, commonly with at least 25 percent cover ..... **Group F** (p. 23)

9. Other Tall *Salix* spp. dominate the overstory ..... **Group G** (p. 24)

Key to Community Types:

Group A. Coniferous Tree-Dominated Community Types

1. *Cornus sericea* [*C. stolonifera*] at least 25 percent cover ..... **Conifer/Cornus sericea c.t.** (p. 28)

1. Not as above 2

2. *Equisetum arvense* at least 25 percent cover ..... **Conifer/Equisetum arvense c.t.** (p. 29)

2. Not as above 3

3. *Calamagrostis canadensis* at least 25 percent cover ..... **Conifer/Calamagrostis canadensis c.t.** (p. 30)

3. Not as above 4

4. *Elymus glaucus at least 5 percent cover* ..... **Conifer/Elymus glaucus c.t.** (p. 31)

4. Not as above 5

5. *Potentilla fruticosa* at least 5 percent cover ..... **Conifer/Potentilla fruticosa c.t.** (p. 32)

5. Not as above 6

6. *Deschampsia cespitosa* at least 5 percent cover ..... **Conifer/Deschampsia cespitosa c.t.** (p. 34)

6. Not as above 7

7. *Poa pratensis* typically present in an open, low growing undergrowth, often with *Taraxacum officinale* and/or *Trifolium* spp. abundant ..... **Conifer/Poa pratensis c.t.** (p. 34)

7. Not as above 8

8. *Aconitum columbianum, Senecio triangularis,* Tall *Mertensia* spp., *Streptopus amplexifolius,* or *Saxifraga odontoloma* at least 5 percent cover, individually or in combination. Combined cover typically greater than 5 percent ..... **Conifer/Aconitum columbianum c.t.** (p. 35)

8. Not as above 9

9. *Actaea rubra, Smilacina stellata,* and/or *Galium triflorum* present ..... **Conifer/Actaea rubra c.t.** (p. 36)

9. Not as above ..... **Miscellaneous Unclassified Coniferous Tree-Dominated Communities** (p. 37)

Group B. Tall Deciduous Tree-Dominated Community Types

1. *Populus tremuloides* the dominant overstory species 2

1. Not as above 4

2. *Veratrum californicum* at least 10 percent cover ..... **Populus tremuloides/Veratrum californicum c.t.** (p. 47)

2. Not as above 3

3. *Poa pratensis* dominates the undergrowth ..... **Populus tremuloides/Poa pratensis c.t.** (p. 47)

3. Not as above ..... **Miscellaneous Unclassified Tall Deciduous Tree-Dominated Communities** (p. 47)

4. *Populus angustifolia, P. acuminata,* and/or *P. fremontii* at least 25 percent cover 5

4. Not as above. *Acer negundo* dominates the overstory 10

5. *Betula occidentalis* at least 25 percent cover ..... **Populus angustifolia/Betula occidentalis c.t.** (p. 38)

5. Not as above 6

6. *Acer grandidentatum* at least 25 percent cover ..... **Populus angustifolia/Acer grandidentatum c.t.** (p. 39)

6. Not as above 7

7. *Cornus sericea* [*C. stolonifera*] and/or *Salix exigua* at least 25 percent cover . . . . . **Populus angustifolia/Cornus sericea c.t.** (p. 40)

7. Not as above 8

8. *Rosa* spp. at least 25 percent cover . . . . . **Populus angustifolia/Rosa woodsii c.t.** (p. 42)

8. Not as above 9

9. *Rhus aromatica* var. *trilobata* [*R. trilobata*] at least 25 percent cover . . . . . **Populus angustifolia/Rhus aromatica c.t.** (p. 43)

9. Not as above. *Poa pratensis* typically present in an open undergrowth . . . . . **Populus angustifolia/Poa pratensis c.t.** (p. 44)

10. *Cornus sericea* [*C. stolonifera*] at least 25 percent cover . . . . . **Acer negundo/Cornus sericea c.t.** (p. 46)

10. Not as above 11

11. *Equisetum arvense* at least 25 percent cover . . . . . **Acer negundo/Equisetum arvense c.t.** (p. 46)

11. Not as above . . . . . **Miscellaneous Unclassified Tall Deciduous Tree-Dominated Communities** (p. 47)

Group C. Low Deciduous Tree-Dominated Community Types

1. *Alnus incana* at least 25 percent cover 2

1. Not as above. *Betula occidentalis* at least 25 percent cover 5

2. *Cornus sericea* [*C. stolonifera*] at least 25 percent cover . . . . . **Alnus incana/Cornus sericea c.t.** (p. 48)

2. Not as above 3

3. *Equisetum arvense* at least 25 percent cover . . . . . **Alnus incana/Equisetum arvense c.t.** (p. 49)

3. Not as above 4

4. Tall *Mertensia* spp., *Heracleum lanatum, Aconitum columbianum, Smilacina stellata, Hydrophyllum fendleri,* or other mesic forbs at least 25 percent cover, individually or together . . . . . **Alnus incana/Mesic Forb c.t.** (p. 50)

4. Not as above. *Agrostis stolonifera, Glyceria* spp., *Poa palustris,* or various *Carex* spp. typically present in an open undergrowth. *Poa pratensis* often present . . . . . **Alnus incana/Mesic Graminoid c.t.** (p. 51)

5. *Cornus sericea* [*C. stolonifera*] at least 25 percent cover . . . . . **Betula occidentalis/Cornus sericea c.t.** (p. 52)

5. Not as above 6

6. *Smilacina stellata, Heracleum lanatum, Aconitum columbianum, Equisetum arvense,* or other mesic forbs at least 25 percent cover either individually or together . . . . . **Betula occidentalis/Mesic Forb c.t.** (p. 53)

6. Not as above 7

7. *Poa pratensis* typically present in an open undergrowth . . . . . **Betula occidentalis/Poa pratensis c.t.** (p. 54)

7. Not as above . . . . . **Miscellaneous Unclassified Low Deciduous Tree-Dominated Communities** (p. 54)

Group D. Salix boothii-Dominated Community Types

1. *Carex aquatilis* and/or *Caltha leptosepala* at least 25 percent cover either together or individually . . . . . **Salix boothii/Carex aquatilis c.t.** (p. 56)

1. Not as above 2

    2. *Carex rostrata* at least 25 percent cover . . . . . **Salix boothii/Carex rostrata c.t.** (p. 57)

    2. Not as above 3

3. *Calamagrostis canadensis* at least 25 percent cover . . . . . **Salix boothii/Calamagrostis canadensis c.t.** (p. 59)

3. Not as above 4

    4. *Carex nebrascensis* at least 25 percent cover . . . . . **Salix boothii/Carex nebrascensis c.t.** (p. 59)

    4. Not as above 5

5. *Equisetum arvense* at least 25 percent cover . . . . . **Salix boothii/Equisetum arvense c.t.** (p. 60)

5. Not as above 6

    6. *Poa palustris* or *P. trivialis* at least 25 percent cover . . . . . **Salix boothii/Poa palustris c.t.** (p. 60)

    6. Not as above 7

7. Tall *Mertensia* spp., *Heracleum lanatum, Smilacina stellata,* and/or *Geranium richardsonii* at least 25 percent cover, together or individually . . . . . **Salix boothii/Mesic Forb c.t.** (p. 60)

7. Not as above 8

    8. *Carex lanuginosa, Juncus balticus, Glyceria striata,* or other mesic graminoid species present in varying amounts. Forb cover usually minor . . . . . **Salix boothii/Mesic Graminoid c.t.** (p. 61)

    8. Not as above 9

9. *Poa pratensis* and/or *Cirsium arvense* typically present in a dry undergrowth . . . . . **Salix boothii/Poa pratensis c.t.** (p. 63)

9. Not as above . . . . . **Miscellaneous Unclassified Willow-Dominated Communities** (p. 86)

Group E. Salix geyeriana-Dominated Community Types

1. *Carex aquatilis* at least 25 percent cover ..... **Salix geyeriana/Carex aquatilis c.t.** (p. 65)

1. Not as above 2

2. *Carex rostrata* at least 25 percent cover ..... **Salix geyeriana/Carex rostrata c.t.** (p. 67)

2. Not as above 3

3. *Poa palustris* or *Poa trivialis* at least 25 percent cover ..... **Salix geyeriana/Poa palustris c.t.** (p. 67)

3. Not as above 4

4. *Calamagrostis canadensis* at least 25 percent cover ..... **Salix geyeriana/Calamagrostis canadensis c.t.** (p. 68)

4. Not as above 5

5. Tall *Mertensia* spp. and/or *Smilacina stellata* at least 25 percent cover ..... **Salix geyeriana/Mesic Forb c.t.** (p. 68)

5. Not as above 6

6. *Deschampsia cespitosa* at least 5 percent cover ..... **Salix geyeriana/Deschampsia cespitosa c.t.** (p. 69)

6. Not as above 7

7. *Poa pratensis, Carex lanuginosa,* and/or *Carex praegracilis* typically present in varying amounts ..... **Salix geyeriana/Mesic Graminoid c.t.** (p. 71)

7. Not as above ..... **Miscellaneous Unclassified Willow-Dominated Communities** (p. 86)

Group F. Salix exigua-Dominated Community Types

1. *Cornus sericea* [*C. stolonifera*] at least 50 percent cover ..... **Cornus sericea/Heracleum lanatum c.t.** (p. 87)

1. Not as above 2

2. *Heracleum lanatum, Smilacina stellata,* Tall *Mertensia* spp., or other mesic forbs at least 25 percent cover, individually or together ..... **Salix exigua/Mesic Forb c.t.** (p. 72)

2. Not as above 3

3. *Carex nebrascensis, C. lanuginosa,* and/or *Juncus balticus* at least 25 percent cover ..... **Salix exigua/Mesic Graminoid c.t.** (p. 73)

3. Not as above 4

4. *Poa pratensis* and/or *Agrostis stolonifera* form a moderate to dense undergrowth, typically with at least 25 percent cover . . . . . **Salix exigua/Poa pratensis c.t.** (p. 74)

4. Not as above 5

5. Little undergrowth vegetation is present with mostly bare ground or litter showing . . . . . **Salix exigua/Barren c.t.** (p. 75)

5. Not as above . . . . . **Miscellaneous Unclassified Willow-Dominated Communities** (p. 86)

Group G. Other Tall Willow-Dominated Community Types

1. *Salix lasiolepis* dominates the overstory with little undergrowth present . . . . . **Salix lasiolepis/Barren c.t.** (p. 76)

1. Not as above 2

2. *Salix bebbiana* dominates the overstory, typically with a dense graminoid undergrowth . . . . . **Salix bebbiana/Mesic Graminoid c.t.** (p. 77)

2. Not as above . . . . . **Miscellaneous Unclassified Willow-Dominated Communities** (p. 86)

Group H. Low Willow-Community Types

1. *Salix wolfii* dominates the overstory 3

1. Not as above 2

2. *Salix planifolia* and/or *Betula glandulosa* dominate the overstory. 6

2. Not as above. *Salix glauca* dominates the overstory with *Artemisia scopulorum, Deschampsia cespitosa,* and *Carex scirpoidea*, typically present in a low-growing herbaceous layer . . . . . **Salix glauca/Deschampsia cespitosa c.t.** (p. 77)

3. *Carex aquatilis* at least 25 percent cover; *Caltha leptosepala* and *C. aquatilis* at least 25 percent cover; or *Carex aquatilis* as the dominant graminoid with high cover of mosses . . . . . **Salix wolfii/Carex aquatilis c.t.** (p. 78)

3. Not as above 4

4. *Carex rostrata* at least 25 percent cover . . . . . **Salix wolfii/Carex rostrata c.t.** (p. 79)

4. Not as above 5

5. Tall *Mertensia* spp., *Smilacina stellata*, and/or other mesic forbs at least 25 percent cover, together or individually or the dominant undergrowth . . . . . **Salix wolfii/Mesic Forb c.t.** (p. 80)

5. Not as above. *Deschampsia cespitosa* present in varying amounts but typically at least 5 percent cover . . . . . **Salix wolfii/Deschampsia cespitosa c.t.** (p. 82)

6. *Carex aquatilis* and/or *C. rostrata* at least 25 percent cover, or *Caltha leptosepala* and *C. aquatilis* 25 percent cover in combination . . . . . **Salix planifolia/Carex aquatilis c.t.** (p. 83)

6. Not as above 7

7. *Calamagrostis canadensis* at least 25 percent cover . . . . . **Salix planifolia/Calamagrostis canadensis c.t.** (p. 84)

7. Not as above 8

8. *Ligusticum tenuifolium* and/or *Deschampsia cespitosa* typically present in varying amounts . . . . . **Salix planifolia/Deschampsia cespitosa c.t.** (p. 84)

8. Not as above . . . . . **Miscellaneous Unclassified Willow-Dominated Communities** (p. 86)

Group I. Nonwillow Shrub-Dominated Community Types

1. *Cornus sericea* [*C. stolonifera*] at least 50 percent cover . . . . . **Cornus sericea/Heracleum lanatum c.t.** (p. 87)

1. Not as above 2

2. *Potentilla fruticosa* dominates the community, typically with at least 25 percent cover 3

2. Not as above. *Artemisia cana* dominates the community, typically with at least 25 percent cover 4

3. *Deschampsia cespitosa* and/or *Polygonum bistortoides* at least 5 percent cover . . . . . **Potentilla fruticosa/Deschampsia cespitosa c.t.** (p. 89)

3. Not as above. *Poa pratensis* and/or *Carex praegracilis* typically present . . . . . **Potentilla fruticosa/Poa pratensis c.t.** (p. 91)

4. *Deschampsia cespitosa* at least 5 percent cover . . . . . **Artemisia cana/Deschampsia cespitosa c.t.** (p. 91)

4. Not as above 5

5. *Festuca ovina* or *Festuca idahoensis* at least 5 percent cover . . . . . **Artemisia cana/Festuca ovina c.t.** (p. 92)

5. Not as above 6

6. *Poa pratensis* and/or *Carex praegracilis* typically present with greater than 25 percent cover . . . . . **Artemisia cana/Poa pratensis c.t.** (p. 93)

6. Not as above . . . . . **Miscellaneous Unclassified Shrub-Dominated Communities** (p. 93)

Group J. Herbaceous Community Types

1. *Eleocharis palustris* dominating a seasonally ponded site . . . . . **Eleocharis palustris c.t.** (p. 94)

1. Not as above 2

2. *Carex lasiocarpa* at least 25 percent cover (Uinta Mountains only) . . . . . **Carex lasiocarpa c.t.** (p. 95)

2. Not as above 3

3. *Carex limosa* at least 25 percent cover ..... **Carex limosa c.t.** (p. 97)

3. Not as above 4

4. *Carex buxbaumii* at least 25 percent cover (Uinta Mountains only) ..... **Carex buxbaumii c.t.** (p. 97)

4. Not as above 5

5. *Carex saxatilis* at least 25 percent cover ..... **Carex saxatilis c.t.** (p. 98)

5. Not as above 6

6. *Caltha leptosepala* and/or *Carex muricata* (Uinta Mountains only) at least 50 percent cover. Cover of *Carex aquatilis* or *C. rostrata* less than 50 percent ..... **Caltha leptosepala c.t.** (p. 100)

6. Not as above 7

7. *Carex aquatilis* at least 25 percent cover ..... **Carex aquatilis c.t.** (p. 101)

7. Not as above 8

8. *Carex rostrata* at least 25 percent cover ..... **Carex rostrata c.t.** (p. 102)

8. Not as above 9

9. *Carex simulata* at least 25 percent cover ..... **Carex simulata c.t.** (p. 104)

9. Not as above 10

10. *Eleocharis pauciflora* at least 25 percent cover ..... **Eleocharis pauciflora c.t.** (p. 104)

10. Not as above 11

11. *Calamagrostis canadensis* at least 25 percent cover ..... **Calamagrostis canadensis c.t.** (p. 105)

11. Not as above 12

12. *Carex nebrascensis* at least 25 percent cover ..... **Carex nebrascensis c.t.** (p. 107)

12. Not as above 13

13. *Carex microptera* at least 25 percent cover ..... **Carex microptera c.t.** (p. 107)

13. Not as above 14

14. *Carex lanuginosa* at least 25 percent cover ..... **Carex lanuginosa c.t.** (p. 108)

14. Not as above 15

15. *Deschampsia cespitosa* at least 25 percent cover ..... **Deschampsia cespitosa c.t.** (p. 109)

15. Not as above 16

16. *Danthonia intermedia* and/or *Agrostis scabra* at least 25 percent cover ..... **Danthonia intermedia c.t.** (p. 110)

16. Not as above 17

17. *Juncus balticus* at least 25 percent cover ..... **Juncus balticus c.t.** (p. 111)

17. Not as above 18

18. *Poa pratensis* typically at least 25 percent cover. Associated forbs often indicative of disturbance ..... **Poa pratensis c.t.** (p. 112)

18. Not as above 19

19. *Veratrum californicum* dominating the overstory ..... **Veratrum californicum c.t.** (p. 114)

19. Not as above 20

20. *Mertensia ciliata* dominating the overstory ..... **Mertensia ciliata c.t.** (p. 114)

20. Not as above ..... **Miscellaneous Unclassified Herb/Graminoid-Dominated Communities** (p. 115)

Descriptions of Dominance Groups and Riparian Community Types

Coniferous Tree-Dominated Community Types

Within our classification we have grouped *Abies lasiocarpa, Picea engelmannii, P. pungens, Pinus contorta,* and *Pseudotsuga menziesii* overstories into **Conifer community types** until additional information is gathered that warrants the separation to the species level. While some wildlife and fisheries management strategies will be similar regardless of overstory species dominance, others such as timber management, will not. Because of these differences we suggest the user consult forest habitat type classifications for Utah (Mauk and Henderson 1984; Youngblood and Mauk 1985) when managing coniferous plant communities. Where possible, our coniferous c.t. descriptions include discussions on relevant habitat types. Our classification includes a broad range of successional stages in community development and, therefore, potential management strategies may differ.

Picea pungens, for the most part, occurs in stream bottoms, but in the Uinta Mountains it also occurs on much drier upland environments. *Pinus contorta* is of major importance as an overstory dominant only in the Uinta Mountains and is found only in minor amounts in the northern Wasatch Mountains; it does not occur elsewhere in the study area.

Pinus contorta var. *murrayana* was shown by Helms and Ratliff (1987) to invade mountain meadows of Yosemite National Park in California. Meadows dominated by *Danthonia intermedia, Aster occidentalis,* and *Trifolium longipes* were more commonly invaded by the pine than were wetter meadows dominated by *Deschampsia cespitosa* and *Carex nebrascensis* or drier meadows with *Lupinus confertus* and *Horkelia fusca*. In the Uinta Mountains *Pinus contorta* var. *latifolia* occurs as a dominant overstory adjacent to meadows with *Danthonia intermedia, Aster foliaceus,* and/or *Erigeron ursinus.* Similar invasion patterns might occur in the Uinta Mountains, though no known research has addressed the issue in this area. Helms (1987) showed that periods of tree invasions on wetter meadow situations were associated with periods of lower precipitation. Helms also showed that invasion on drier meadows was much less influenced by precipitation patterns.

Conifer/Cornus sericea c.t. (CONIFER/CORSER; CONIFER/COSE)

Distribution—CONIFER/COSE appears to be an incidental type that occurs more commonly in eastern Idaho and western Wyoming. In our study area it was sampled only in the Wasatch Mountains Floristic Section below 2 290 m (7,500 ft). It occupies terraces immediately adjacent to stream channels with convex to undulating surface topography. Adjacent upland communities are dominated by *Picea engelmannii, Abies lasiocarpa,* or *Pseudotsuga menziesii.*

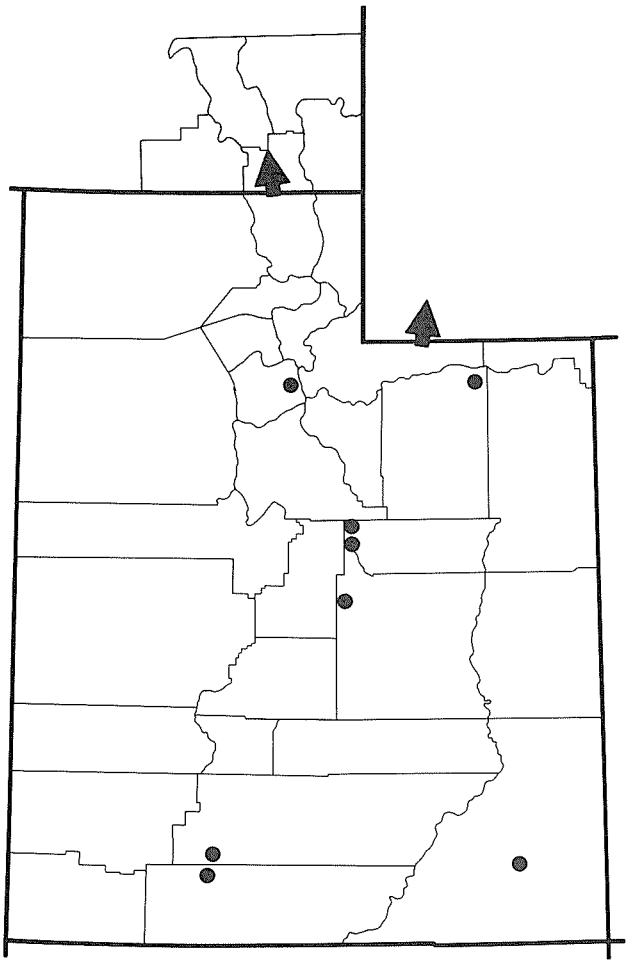
Vegetation—We have defined our **CONIFER/COSE** somewhat broadly to include a range of elevations and communities dominated by *Pseudotsuga menziesii* and *Abies lasiocarpa*. Presence of *Populus angustifolia* or *P. tremuloides* in the community represent early successional remnants as do *Alnus incana* and *Betula occidentalis*. The undergrowth is characterized by dense *Cornus sericea*, while *Ribes inerme, Rubus parviflorus,* or *Amelanchier alnifolia* may also be present. An herbaceous layer may be essentially absent or may include varying amounts of *Elymus glaucus, Actaea rubra,* and *Smilacina stellata.*

Soils—Limited information indicates that our communities occur on similar soils as those described for communities in western Wyoming (Youngblood and others 1985a). Soils have developed from alluvium of various ages but communities typically occur where deposition and scouring are common during high runoff flows. Particle-size classes were loamy-skeletal, and each soil had a thick mollic epipedon. Soil temperature regimes ranged from cryic to frigid, and water tables were not reached within the depth of the soil pit, which was less than 1 m (39 in) because of coarse materials in the pedon.

Succession and Management—Communities belonging to this c.t. have developed on alluvial terraces and represent possible successional changes from deciduous overstories to conifer stands. In each case remnant deciduous trees were present, alluding to the successional status. The tree and shrubs layers of the **CONIFER/COSE c.t.** provide structural diversity for birds and small mammals. Livestock will likely avoid this c.t. because the dense shrub layer is commonly impenetrable. Wild ungulates may use it seasonally for cover.

Other Studies—Youngblood and others (1985a) described the **Picea/Cornus stolonifera** [*C. sericea*] **c.t.** as a major type in eastern Idaho and western Wyoming. Alexander and others (1984) described a similar *Picea pungens/Cornus stolonifera c.t.* for north-central and northwestern New Mexico.

Conifer/Equisetum arvense c.t. (CONIFER/EQUARV; CONIFER/EQAR)



Distribution—CONIFER/EQAR is a minor c.t. found predominantly in the Utah Plateaus Floristic Section but also has sporadic distribution throughout the state. Most of our sampled plots occur in the East Fork Sevier River drainage system on the Dixie National Forest. Elevations ranged from 2 245 to 2 805 m (7,360 to 9,200 ft), typically on stream terraces and seeps. Adjacent uplands often support various *Picea engelmannii*- and *Abies lasiocarpa*-dominated communities, though *Pinus edulis, Juniperus osteosperma,* and *Artemisia tridentata* ssp. *vaseyana* communities were also noted. Riparian communities found in proximity to this c.t. include those dominated by *Carex rostrata* and by *Salix boothii.*

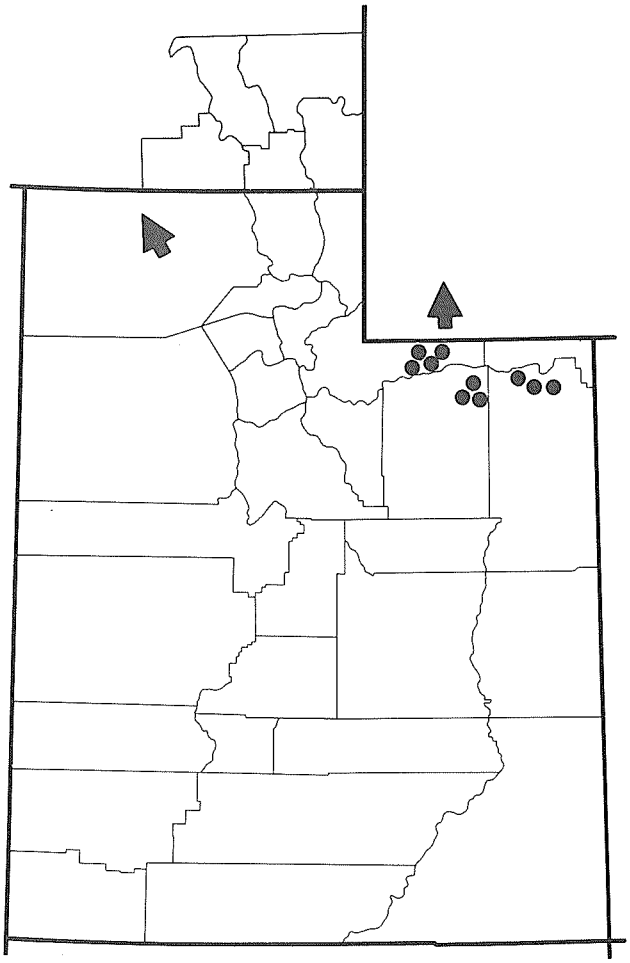
Vegetation—*Picea pungens* or *Picea engelmannii* typically dominate the overstory, though occasionally *Populus tremuloides* and *P. angustifolia* (at lower elevations) persist as codominants. In addition, *Alnus incana* and *Betula occidentalis* may be present. *Lonicera involucrata* and *Rosa* spp. are often present with scattered cover. The herbaceous layer is typically very dense with high cover of *Equisetum arvense* and/or *Carex disperma. Glyceria* spp. are also quite common, while various forbs, including *Geranium richardsonii* and *Smilacina stellata,* are typically present.

Soils—The CONIFER/EQAR c.t. occurs on a variety of soils, though many were wet and/or had a seasonal water table within 50 cm (20 in) of the soil surface. Estimated available water-holding capacity ranged from low to high and soil particle-size classes were loamy-skeletal, sandy-skeletal, and fine-loamy. Soils were classified as Cryofluvents, Cryochrepts, Cryaquolls, and Cryoborolls.

Succession and Management—The **CONIFER/EQAR c.t.** appears to be a late seral to climax sere similar to those found on the **Picea pungens/Equisetum arvense h.t.** (Youngblood and Mauk 1985) and the **Picea engelmannii/Equisetum arvense h.t.** (Mauk and Henderson 1984) which were noted to occur in the study area. Late seral stands have *Populus angustifolia, P. tremuloides,* and/or other deciduous trees present though not reproducing at a significant level. *Abies lasiocarpa,* when present, may indicate either a raised microsite or slightly drier conditions associated with a change in stream channel location. The typically wet soils of this c.t. are easily compacted or displaced. Value for livestock is minimal with the possible exception of shading, while small mammals and birds may value these areas because of their structural diversity. Timber productivity is low to moderate (Youngblood and Mauk 1985; Mauk and Henderson 1984), and low site stability as a result of the soil characteristics is of concern.

Other Studies—Sites supporting the **CONIFER/EQAR c.t.** have been described for Utah (Youngblood and Mauk 1985; Mauk and Henderson 1984), Idaho (Steele and others 1981), western Wyoming (Steel and others 1983), and south-central Montana (Pfister and others 1977). Kovalchik (1987) described a similar **Picea engelmannii/Equisetum arvense-Streptopus association** for central Oregon. The similar **PICEA/EQAR c.t.** has been described by Youngblood and others (1985a) for eastern Idaho and western Wyoming, and also by Norton and others (1981) for western Wyoming. Our treatment is similar to the latter two studies but expands the concept to include other hydrophyllic undergrowths dominated by *Carex disperma.*

Conifer/Calamagrostis canadensis c.t. (CONIFER/CALCAN; CONIFER/CACA)



Distribution—CONIFER/CACA is a major type occurring in the eastern portion of the Uinta Mountains Floristic Section between 2 595 and 3 205 m (8,500 and 10,500 ft) and was not sampled elsewhere in the study area. It occurs on stream terraces and on moist mid and lower slopes with gradients up to 20 percent. Adjacent upland communities include those occurring on the **Picea engelmannii/Vaccinium scoparium, Pinus contorta/ Vaccinium scoparium,** and **Pinus contorta/Juniperus communis habitat types.** The **Calamagrostis canadensis** and **Salix planifolia/Calamagrostis canadensis c.t.s** are common riparian types associated with **CONIFER/CACA.**

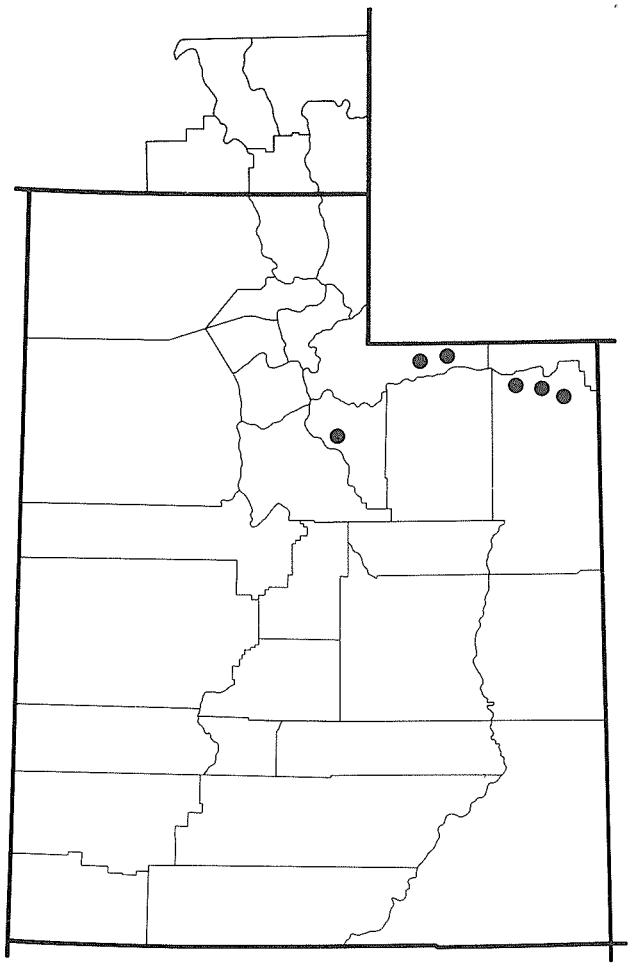
Vegetation—*Pinus contorta* is usually present and commonly dominates the overstory of this c.t., but *Picea engelmannii* or *Abies lasiocarpa* may occasionally dominate the overstory. *Juniperus communis, Potentilla fruticosa, Ribes montigenum,* and *Rosa* spp. may be present but typically have scattered cover. The undergrowth is often characterized by a dense sward of *Calamagrostis canadensis.* Occasionally communities occur which lack a high cover of *Calamagrostis canadensis*, and yet it still remains the dominant undergrowth component; these communities are also included in this type. Other graminoids may include *Trisetum spicatum, Phleum alpinum, Deschampsia cespitosa, Carex atrata,* and *Poa reflexa. Fragaria virginiana, Galium boreale, Erigeron peregrinus, Geranium richardsonii, Polygonum bistortoides,* and *Taraxacum officinale* are among the many forbs likely to occur.

Soils—The CONIFER/CACA c.t. typically occurs on loamy-skeletal or clayey-skeletal soils with water tables ranging from near the surface to over 90 cm (35 in) in depth. Soils have developed on alluvium, colluvium, and in some situations where water tables have increased, in residuum. Nearly all soils have an Aquic moisture regime at the subgroup level, and estimated available water-holding capacity ranges from low to high. Soils were classified as Aquic, Pachic, and Typic Cryoborolls, Aquic and Typic Cryochrepts, and Typic Borofibrists.

Succession and Management—Communities belonging to **CONIFER/CACA c.t.** include some occurring on the **Abies lasiocarpa/Calamagrostis canadensis, Abies lasiocarpa/Vaccinium scoparium,** and **Abies lasiocarpa/Vaccinium caespitosa h.t.s** described by Mauk and Henderson (1984) for the Uinta Mountains of northeastern Utah. Water tables of many low-lying areas have increased in the Uinta Mountains because of extensive pine bark beetle (*Dendroctonus ponderosae*) kill of *Pinus contorta*. Evidence of this is seen on several sites that once had conifer overstories and high undergrowth cover of *Vaccinium cespitosum* or *V. scoparium*. Overstories, in many cases, have died, and undergrowths are being invaded by dense swards of *Calamagrostis canadensis* (**Calamagrostis canadensis c.t., Succession and Management**, p. 105). In other situations, only a partial overstory kill has occurred, and a less dramatic increase of *Calamagrostis canadensis* in the undergrowth has taken place. Because the **CONIFER/CACA c.t.** currently covers large areas in the Uinta Mountains, it is very important in understanding the dynamics of riparian ecosystems, especially forested ones, throughout the study area. Additional information may eventually result in the definition of different phases of those habitat types noted above, indicating the temporal changes in environment that allow more mesophytic plants to dominate the sites.

Other Studies—Mauk and Henderson (1984) described a similar **Pinus contorta/Calamagrostis canadensis c.t.** for northern Utah. In addition, the authors described sites in northern Utah that support our **CONIFER/CACA c.t.** as the **Abies lasiocarpa/Calamagrostis canadensis, Abies lasiocarpa/Vaccinium scoparium,** and **Abies lasiocarpa/Vaccinium caespitosa h.t.s.** Similar habitat types have been described by Steele and others (1981; 1983) for central and eastern Idaho and western Wyoming.

Conifer/Elymus glaucus c.t. (CONIFER/ELYGLA; CONIFER/ELGL)



Distribution—CONIFER/ELGL is a minor type sampled in the Uinta Mountains Floristic Section. It occurs between elevations of 2 440 and 3 050 m (8,000 and 10,000 ft) typically on lower slopes and terraces associated with forested uplands. Slopes vary from nearly level to as much as 20 percent. Adjacent communities on wetter sites include those belonging to the **Conifer/Calamagrostis canadensis c.t.** Drier sites usually belong to the **Picea engelmannii/Vaccinium scoparium h.t.**

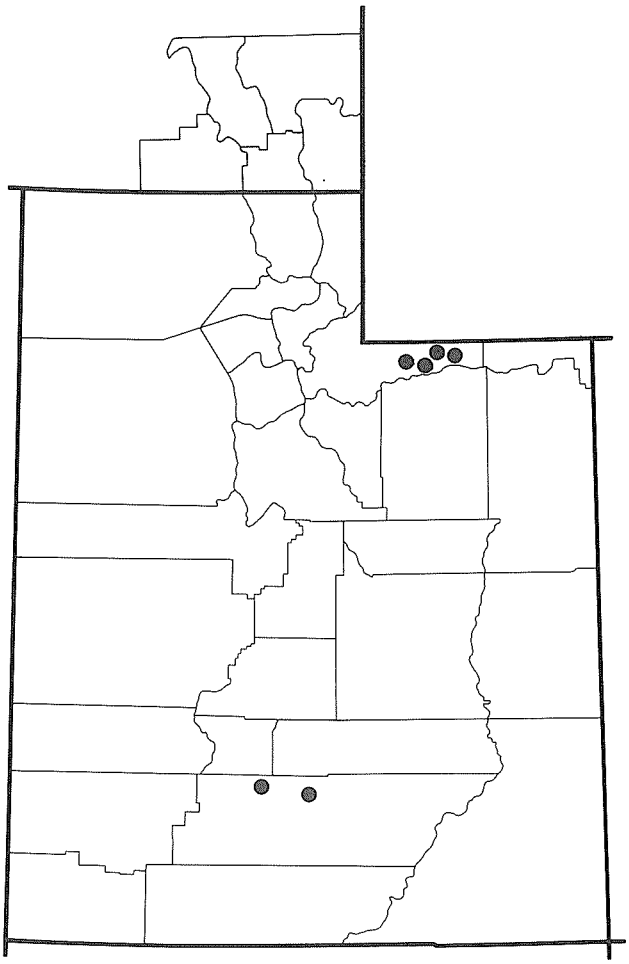
Vegetation—*Picea engelmannii, Picea pungens, Abies lasiocarpa,* and/or *Pinus contorta* typically dominate the overstory of this c.t. *Alnus incana, Rosa* spp., and *Salix boothii* may form a scattered intermediate tree-shrub layer, while *Vaccinium caespitosum* and *V. scoparium* are commonly present in minor amounts in the undergrowth. *Elymus glaucus* is typically a conspicuous component of the herbaceous layer with *Calamagrostis canadensis, Danthonia intermedia, Bromus carinatus,* and *Trisetum spicatum* commonly present in minor amounts. Forb cover is highly variable with *Geranium richardsonii, Caltha leptosepala, Trollius laxus, Osmorhiza occidentale,* and *Aster occidentalis* among those likely to occur.

Soils—Limited information is available for this type, but soils were typically moist to wet within the top 50 cm (20 in). Coarse fragments in the soil usually exceeded 35 percent, while textures of the fines were highly variable. Evidence that soil moisture levels are increasing on many sites in the Uinta Mountains is found in areas where remnant upland species are being replaced by more moisture-loving species and is discussed below in more detail.

Succession and Management—Communities belonging to the **CONIFER/ELGL c.t.** occur on sites that are slightly drier than the **Conifer/Calamagrostis canadensis c.t.** and represent an intergradation to upland situations. Some communities in the Uinta Mountains occur in areas where the pine bark beetle has killed many overstory trees, and sites are in the process of changing from more xeric to more mesic situations. The overstory species are no longer using available soil water and, therefore, are affecting changes in species composition in the plant communities of these areas. The phenomenon of increased available soil water because of the beetle kill in the Uinta Mountains is widespread and is resulting in community type changes throughout the lower slopes where this water is accumulating. Areas that may have supported the **CONIFER/ELGL c.t.** may now support the **Conifer/Calamagrostis canadensis c.t.** Other areas that were considered upland sites may now support the **CONIFER/ELGL c.t.**

Other Studies—The **CONIFER/ELGL c.t.** has not been previously described, but some communities belonging to this type are included in the **Picea engelmannii/Calamagrostis canadensis h.t.** described by Mauk and Henderson (1984) for northern Utah.

Conifer/Potentilla fruticosa c.t. (CONIFER/POTFRU; CONIFER/POFR)



Distribution—The **CONIFER/POFR c.t.** (fig. 5) is a minor type sampled in the Uinta Mountains Floristic Section between elevations of 2 745 and 2 930 m (9,000 and 9,600 ft) and on the Paunsaugunt Plateau east of Bryce Canyon in the southern Utah Plateaus Floristic Section above 2 440 m (8,000 ft). It occurs on broad stream terraces and toe slopes with slopes ranging from 1 to 10 percent. Adjacent uplands are typically dominated by species similar to the overstories in this c.t. including *Pinus contorta* and *Picea pungens. Populus tremuloides* may also dominate the adjacent uplands. Various **Potentilla fruticosa** and **Artemisia cana c.t.s** are commonly associated with **CONIFER/POFR.**

Vegetation—In the Uinta Mountains *Pinus contorta* dominates the overstory, while the undergrowth is characterized by a typically dense cover of *Potentilla fruticosa*. Other shrubs are usually sparse. Herbaceous cover is highly variable but typically contains *Aster occidentalis, Danthonia intermedia, Deschampsia cespitosa, Festuca ovina,* and *Trisetum spicatum*. On the Paunsaugunt Plateau *Picea pungens* dominates the overstory and *Potentilla fruticosa* often forms a more open shrub layer. Graminoids common in these communities include *Poa pratensis, Agrostis stolonifera, Carex lanuginosa,* and *C. praegracilis. Taraxacum officinale* and *Trifolium* spp. are also common. Differences attributed to location may warrant further investigation and possible segregation into separate types. They are combined here because of similarities in site characteristics.

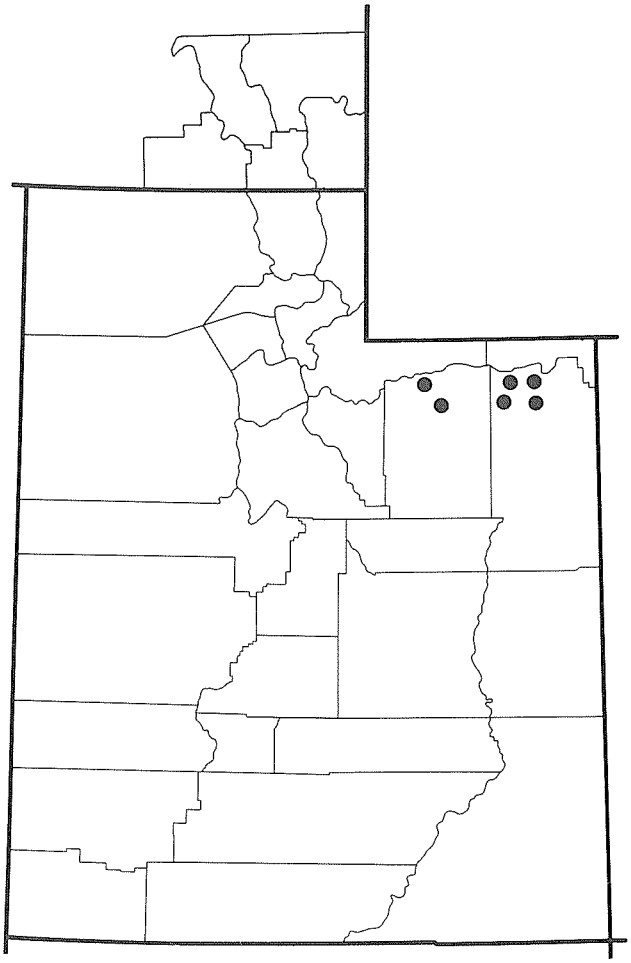
Soils—Soils were classified as Typic, Aquic, or Pachic Cryoborolls. Water tables were seasonally within 50 cm (20 in) of the soil surface as indicated by the presence of standing water or by distinct or prominent mottles. Particle-size classes were fine-loamy or loamy-skeletal with moderate to high estimated available water-holding capacity. Soil characteristics indicate a long period of development and soil stability, though many had developed from alluvial or colluvial deposition.

Succession and Management—The **CONIFER/POFR c.t.** represents relatively stable communities that are transitional to upland situations. It typically has seasonally high water tables but often dries at least in the upper soil profile as the growing season progresses. Open growth pattern of the overstory and gently sloping topography have favored heavy grazing pressure as indicated by the abundance of *Taraxacum officinale, Trifolium repens,* and *Poa pratensis*. Herbaceous potential in this c.t. is high, and activities that promote an increase of graminoids would cause a decline in production of low-growing forbs.

Other Studies—No other studies are known that describe the **CONIFER/POFR c.t.**

Figure 5.—**Conifer/Potentilla fruticosa c.t.** on the north slope of the Uinta Mountains south of Mountain View, Wyoming (2 865 m, 9,400 ft). *Pinus contorta* dominates the overstory while *Potentilla fruticosa* forms a conspicuous shrub layer. *Deschampsia cespitosa, Phleum alpinum,* and *Danthonia intermedia* are minor undergrowth components.

Conifer/Deschampsia cespitosa c.t. (CONIFER/DESCES; CONIFER/DECE)



Distribution—The **CONIFER/DECE c.t.** is a minor type sampled only in the Uinta Mountains Floristic Section between elevations of 2 745 and 3 415 m (9,000 and 11,200 ft). It occurs on stream terraces, on subirrigated slopes, or areas with persistent snowpack. Surface topographies range from smooth to slightly undulating. Adjacent riparian communities include those dominated by *Picea engelmannii* and *Vaccinium myrtillifolium.* At higher elevations, adjacent communities are often subalpine forb communities or Krummholz *Picea engelmannii* communities.

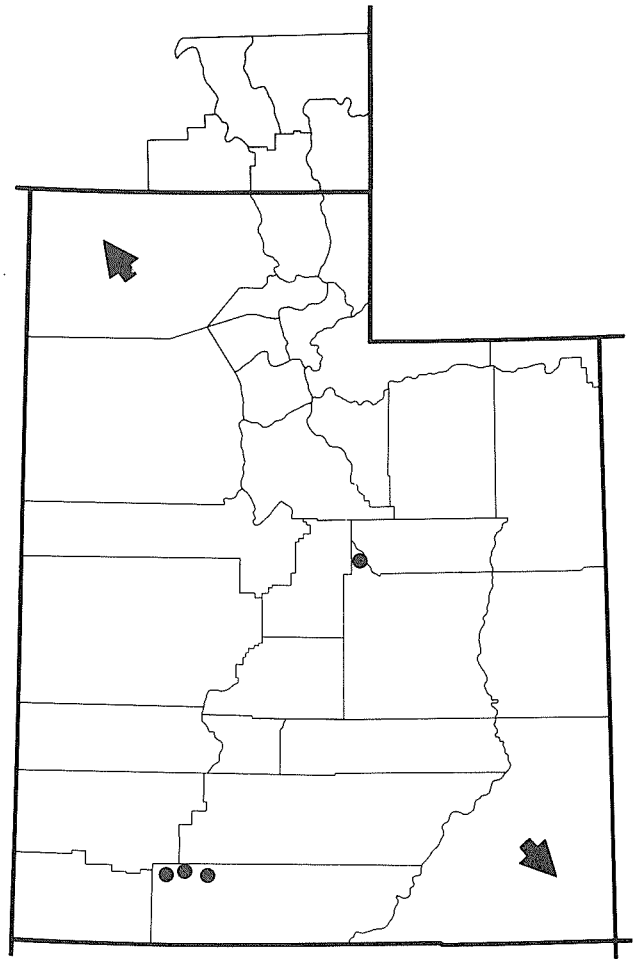
Vegetation—*Picea engelmannii, Pinus contorta,* and/or *Populus tremuloides* dominate the overstory. The undergrowth is characterized by the presence of *Deschampsia cespitosa, Vaccinium cespitosum,* and/or *V. scoparium,* and a dense herbaceous layer. *Carex scirpoidea, C. atrata,* and *Danthonia intermedia* are common graminoids, while forbs include *Caltha leptosepala, Polygonum bistortoides, Sibbaldia procumbens, Antennaria microphylla,* and *Geum rossii.*

Soils—Limited information indicates that soils are commonly fine-textured, often with large cobble and stone present. Water tables are seasonally high.

Succession and Management—This type typically occurs adjacent to meadows where *Deschampsia cespitosa* dominates the herbaceous layer. The overstory is more or less open, and as the tree density and cover increases, a subsequent change in undergrowth is expected. **CONIFER/DECE** includes communities occurring on the **Picea engelmannii/Caltha leptosepala, Picea engelmannii/Vaccinium caespitosum,** or **Picea engelmannii/Vaccinium scoparium h.t.s** described by Mauk and Henderson (1984). Because of the high cover of *Deschampsia cespitosa* in the undergrowth, all communities were included in our **CONIFER/DECE c.t.** Reaction of this c.t. to disturbances is similar to those described by Mauk and Henderson.

Other Studies—The **CONIFER/DECE c.t.** has not been previously described.

Conifer/Poa pratensis c.t. (CONIFER/POAPRA; CONIFER/POPR)



Distribution—CONIFER/POPR is a minor type sampled in the Utah Plateaus Floristic Section and in the Abajo Mountains of the Canyonlands Floristic Section. Elevations range from 2 210 to 2 530 m (7,250 to 8,300 ft). It typically occurs on stream terraces with smooth to gently undulating surface topography. Slopes are typically 3 percent or less. Adjacent riparian communities may belong to the **Poa pratensis** and **Carex nebrascensis c.t.s.** Uplands may be dominated by *Picea pungens, Pseudotsuga menziesii, Pinus ponderosa, Quercus gambelii,* or *Artemisia tridentata* ssp. *vaseyana.*

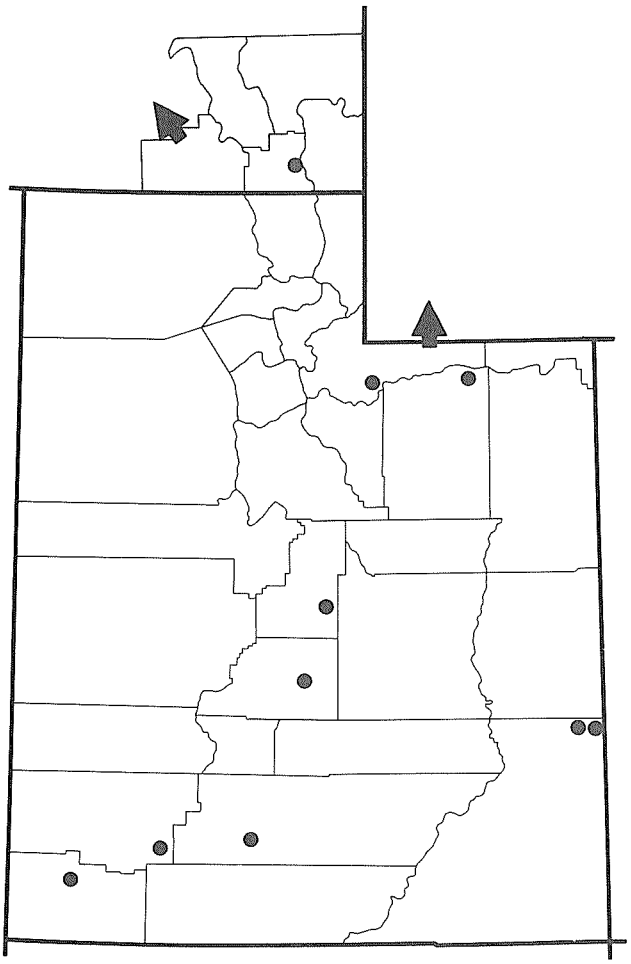
Vegetation—*Picea pungens* or *P. engelmannii* typically dominate the overstory. The open undergrowth is characterized by *Poa pratensis, Taraxacum officinale,* and *Trifolium* spp. Low shrubs such as *Juniperus communis, Potentilla fruticosa,* or *Symphoricarpos oreophilus,* though often present, provide only minor cover.

Soils—Soils were classified as Aquic and Pachic Cryoborolls. Water tables appear to be seasonally within 50 cm (20 in) of the surface as indicated by the presence of standing water or distinct or prominent mottles high in the soil profile. Particle-size classes included loamy-skeletal, coarse-loamy, and fine. Estimated available water-holding capacity ranged from low to high.

Succession and Management—CONIFER/POPR is similar to the **Conifer/Potentilla fruticosa c.t.** and differs predominantly only in the decreased shrub cover. Communities belonging to the **Conifer/Potentilla fruticosa c.t.** on the Paunsaugunt Plateau may more aptly be included in this type. Here, cover of *Potentilla fruticosa* is typically much less when compared to those that occur in the Uinta Mountains. Communities belonging to the **CONIFER/POPR c.t.** have been subjected to heavy grazing pressures as indicated by the abundance of *Poa pratensis* and low forbs such as *Taraxacum officinale.* Compaction of soils by heavy livestock use is possible, especially on sites with wet, fine-textured soils.

Other Studies—Similar communities have been described by Alexander and others (1984) for central New Mexico. Kovalchik (1987) described a **Pinus contorta/Poa pratensis c.t.** for central Oregon.

Conifer/Aconitum columbianum c.t. (CONIFER/ACOCOL; CONIFER/ACCO)



Distribution—This minor type occurs in the Wasatch and Uinta Mountains, in the Utah Plateaus Floristic Sections of central and southern Utah, and in the LaSal Mountains of the Canyonlands Floristic Section. Elevations range from 1 830 to 3 205 m (6,000 to 10,500 ft); communities at higher elevations occur predominantly in southern Utah. **CONIFER/ACCO** occurs on terraces immediately adjacent to streams with slopes to 15 percent. This type also occurs on seeps with moderate to steep, north-facing slopes.

Vegetation—*Abies lasiocarpa* and/or *Picea engelmannii* dominate the overstory; *Pinus contorta, Pseudotsuga menziesii,* or *Populus tremuloides* are locally present as early seral species. *Abies concolor* dominated one community sampled in the Pine Valley Mountains of southwestern Utah, though *Abies lasiocarpa* and *Picea engelmannii* occurred as young trees in the understory. The undergrowth is characterized by sparse graminoid cover and a diverse forb layer with moderate to dense

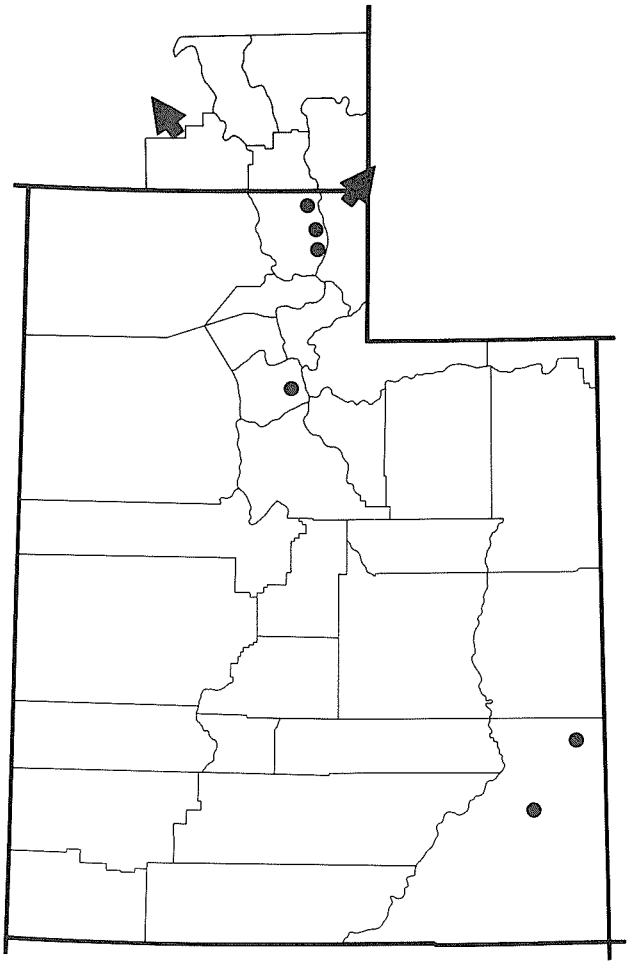
cover. Species indicative of moist to seasonally wet conditions, such as *Aconitum columbianum, Senecio triangularis, Mertensia ciliata, M. arizonica, Delphinium occidentale, Saxifraga odontoloma, Cardamine cordifolia,* and *Streptopus amplexifolius,* are among those present in various combinations. *Pyrola minor, P. secunda, P. asarifolia, Osmorhiza chilensis,* or *O. depauperata* are locally abundant and typically represent drier microsite conditions.

Soils—Limited soils data was collected for communities belonging to this type, though all were very moist to wet with a high accumulation and incorporation of organic matter into the upper horizons. Soils formed predominantly on alluvium, but colluvial and residual soils were also observed.

Succession and Management—The **CONIFER/ACCO c.t.** represents communities at various seral stages belonging, for the most part, to the **Abies lasiocarpa/Aconitum columbianum h.t.** in southern Utah (Youngblood and Mauk 1985) and to the **Abies lasiocarpa/Streptopus amplexifolius** or the **Abies lasiocarpa/Actaea rubra h.t.** in northern Utah (Mauk and Henderson 1984). Dominance by *Pseudotsuga menziesii, Populus tremuloides,* and/or *Pinus contorta* represents earlier seral stages in community development. Herbaceous undergrowth apparently remains rather constant throughout these developmental stages. Some soils are mucky and present limitations on the amount of physical impacts these sites can withstand. Timber management opportunities are best addressed in the appropriate habitat type descriptions noted above. Youngblood and Mauk (1985) noted that communities that occur on the **Abies lasiocarpa/Aconitum columbianum h.t.** may provide quality summer range for both deer and elk.

Other Studies—Youngblood and others (1985b) included some communities belonging to this type in their **Picea/Galium trifolium c.t.** Youngblood and Mauk (1985) described the **Abies lasiocarpa/Aconitum columbianum h.t.** for central and southern Utah. Communities belonging to the **Abies lasiocarpa/Streptopus amplexifolius h.t.**, described by Mauk and Henderson (1984) for northern Utah, are included in our **CONIFER/ACCO**, as are some of the wetter sites in their **Abies lasiocarpa/Actaea rubra h.t.** Steele and others (1981, 1983) described the **Abies lasiocarpa/Streptopus amplexifolius h.t.** for central Idaho and western Wyoming.

Conifer/Actaea rubra c.t.
(CONIFER/ACTRUB; CONIFER/ACRU)



Distribution—This minor type was sampled in the Wasatch Mountains Floristic Section of northern Utah and southeastern Idaho between elevations of 1 830 and 2 410 m (6,000 and 7,900 ft) and in the Abajo and LaSal Mountains of the Canyonlands Floristic Section near 2 745 m (9,000 ft). It occurs on stream terraces and immediately adjacent to stream channels and extends onto moist, north-facing lower to midslopes. It has smooth to gently undulating surface topography with gentle to steep slopes up to 40 percent. Adjacent upland communities may be dominated by *Picea engelmannii, Abies lasiocarpa,* and *Pseudotsuga menziesii.*

Vegetation—The overstory in this c.t. is dominated by *Pseudotsuga menziesii* at lower elevations and *Abies lasiocarpa, Picea engelmannii, P. pungens,* and/or *Populus tremuloides* at higher elevations. A low shrub layer is typically sparse and may include *Ribes montigenum, Lonicera involucrata, Symphoricarpos*

oreophilus, Rosa nutkana, or *Rubus idaeus.* Scattered tall shrubs may occur, especially on drier sites, and may include *Amelanchier alnifolia* or *Prunus virginiana.* The herbaceous layer is characterized by sparse graminoid cover and sparse to dense forb cover. *Smilacina stellata, Actaea rubra, Galium triflorum, Geranium richardsonii,* and *Thalictrum fendleri* are among those commonly noted.

Soils—Soils are highly variable in their development and may be coarse- to fine-textured. Estimated available water-holding capacity ranges from low to moderate. Soils are moist, and water tables may be seasonally within 50 cm (20 in) of the soil surface as indicated by the presence of mottles. Later in the growing season, water tables are generally greater than 1 m (39 in). Soils were classified as Cumulic Cryoborolls and Typic Cryofluvents, both indicating an irregular decrease in organic carbon with depth and development from alluvium.

Succession and Management—The **CONIFER/ACRU c.t.** may represent climax conditions within the **Abies lasiocarpa/Actaea rubra h.t.** described by Mauk and Henderson (1984) for northern Utah or the **Abies lasiocarpa/Aconitum columbianum h.t.** (in part) described by Youngblood and Mauk (1985) for central and southern Utah. The presence of *Populus tremuloides, Populus angustifolia,* or *Alnus incana* indicates succession from a deciduous tree overstory to one dominated by conifers. Mauk and Henderson (1984) noted that, for the **Abies lasiocarpa/Actaea rubra h.t.**, *Abies lasiocarpa* is the indicated climax species, whereas *Pseudotsuga menziesii, Picea engelmannii* or *Populus tremuloides* may locally be seral dominants. **CONIFER/ACRU** represents marginal riparian conditions, and some communities belonging to this type also occur on moderate to steep, north-facing slopes with late snow retention and very moist soil conditions. **CONIFER/ACRU** is included in our classification as a means to link the gradual interface between riparian and upland conditions. Timber management practices can be better addressed by referring to the **Abies lasiocarpa/Actaea rubra h.t.** classification for northern Utah (Mauk and Henderson 1984) and the **Abies lasiocarpa/Aconitum columbianum h.t.** (in part) for southern Utah (Youngblood and Mauk 1985).

Other Studies—Youngblood and others (1985a) described a similar **Picea/Galium triflorum c.t.** for eastern Idaho and western Wyoming that also includes some communities belonging to our **Conifer/Aconitum columbianum c.t.** Youngblood and others (1985b), in their preliminary classification for northern Utah, included some communities belonging to this type in their **Picea/Galium triflorum c.t.** Habitat types that support this c.t. have been described by Mauk and Henderson (1984) for northern Utah (**Abies lasiocarpa/Actea rubra h.t.**) and Youngblood and Mauk (1985) for central and southern Utah (**Abies lasiocarpa/Aconitum columbianum h.t.** in part). Steele and others (1983) described a similar **Picea engelmannii/Galium triflorum h.t.** for western Wyoming; Pfister and others (1977) described a similar type for south-central Montana.

Miscellaneous Unclassified Coniferous Tree-Dominated Communities

One community dominated by *Pinus ponderosa* and *Equisetum arvense* was sampled at lower elevations in the Tushar Mountains. Management practices should be similar to those for the **Conifer/Equisetum arvense c.t.** described on p. 29. In the Uinta Mountains some communities dominated by *Picea engelmannii* and/or *Pinus contorta* and *Vaccinium occidentale* and/or *Salix planifolia* were noted. These were narrow stringer communities along stream, meadow, or lake margins, and they may represent incidental combinations of these overstory and undergrowth species. Other communities dominated by *Vaccinium occidentale* were noted at higher elevations on the south slope of the Uinta Mountains. Conifer communities immediately adjacent to streams with a dense undergrowth of *Cardamine cordifolia* or *Nasturtium officinale* [*Rorippa nasturtium-aquaticum*] occur on the Fishlake Plateau and likely occurs elsewhere in the study area (**Miscellaneous Unclassified Herbaceous Communities,** p. 115). If this wet zone is more extensive, communities might be included in the **Conifer/Aconitum columbianum c.t.** described on p. 35. Other conifer-dominated sites may be identified more correctly using the appropriate habitat type classifications for northern and southern Utah (Mauk and Henderson 1984; Youngblood and Mauk 1985).

Tall Deciduous Tree-Dominated Community Types

Community types belonging to this group occur throughout the study area. Some **Populus angustifolia c.t.s,** though not sampled, occur in the Uinta Mountains Floristic Section while the **Acer negundo c.t.s** do not. Few communities dominated by *Populus tremuloides* were sampled in the study area. Very short type descriptions for the **Populus tremuloides/Veratrum californicum** and **Populus tremuloides/Poa pratensis c.t.s** are based on those of Mueggler (1988). Most aspen communities represent upland situations and are better described by Mueggler and Campbell (1986) or Mueggler (1988).

Three cottonwood species occur in our study area along an elevational gradient from less than 1 220 m (4,000 ft) to more then 2 440 m (8,000 ft). On cooler sites *Populus angustifolia* is the dominant, while *P. fremontii* is more common at lower elevations, especially on lands adjacent to those administered by the USDA Forest Service. *Populus acuminata* occurs at intermediate elevations and is considered to be a hybrid between *P. angustifolia* and *P. fremontii* or other broad-leaved cottonwoods (Goodrich 1983). Because a majority of our sample

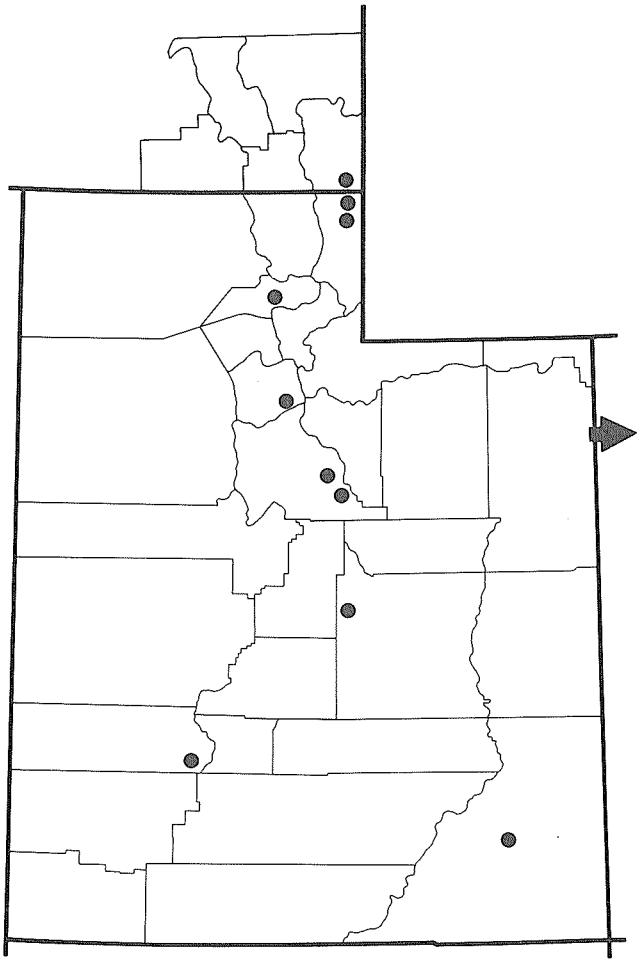
stands were dominated by *Populus angustifolia,* and because of similarity in responses to management, we have grouped overstories dominated by any of these three species into the **Populus angustifolia community types**. Additional sampling at elevations below the forest boundaries would result in distinct **Populus fremontii c.t.s.** While *Acer negundo* may occur at elevations as high as 2 440 m (8,000 ft), our sample stands were typically below 1 985 m (6,500 ft). *Acer negundo* may be a codominant with cottonwood, and in those situations is included in the **Populus angustifolia c.t.s.** Mueggler and Campbell (1986) and Mueggler (1988) described aspen c.t.s in Utah and in the Intermountain Region. Our riparian type descriptions are based on their work. All of the above species are considered to be sprouters (Sampson and Jespersen 1963). Schier and Campbell (1976) noted that while both aspen and cottonwoods sucker from root segments, *Populus angustifolia* and *P. fremontii* were superior in rooting capacity to *P. tremuloides*. The role of fire in aspen stands has been studied in depth, and Debyle and Winokur (1985) have summarized previous work relating to management and ecology of aspen in the western United States. Gruell (1980) noted that fire played an important role in some areas of western Wyoming in maintaining cottonwood (*P. angustifolia*) communities and preventing the invasion of conifers.

Bradley and Smith (1986) studied the recruitment and survival of *Populus deltoides* var. *occidentalis* (a broad-leaved cottonwood) on river flood plains in southern Alberta, Canada and northern Montana. They noted that establishment on point bars correlated most strongly with peak flows higher than 2-year return annual flood. Sediment deposition on point bars following these high flows was shown to provide the moist, bare surface conditions necessary for seed germination. By the end of the first growing season, most cottonwood seedlings extend their taproots 30 to 40 cm (12 to 16 in) and lateral roots up to 60 cm (24 in) (Engstrom 1948; Ware and Penfound 1949). *Populus fremontii* often occurs in coarse alluvium along streams in hot, dry desert environments. It can potentially extend its roots to a depth of 162 cm (64 in) by the end of the first growing season (Fenner and others 1984). This adaptation may be extremely important in the germination and establishment of this low-elevation species. Bradley and Smith (1986) noted that regulating streamflows with dam structures may eventually lead to the elimination of cottonwood stands. Without the periodic high water flows and subsequent sediment deposition, seedling establishment is severely inhibited. The authors suggest that possible management strategies, including occasional man-induced floods, be investigated for their affect on cottonwood seedling establishment.

Acer negundo has not been studied to the extent the various cottonwoods have. Grime (1965) noted it is shade tolerant, and therefore it might succeed cottonwoods where they occur sympatrically. Our limited sampling of communities dominated by *Acer negundo* prevents confirmation of this. *Acer negundo* can establish vegetatively by sprouting.

Blakesley (1987) noted that yellow-bellied sapsucker, dusky flycatcher, black-capped chickadee, house wren, Swainson's thrush, warbling vireo, and yellow warbler were more closely associated with deciduous tree communities than with shrub-dominated community types in the vicinity of Logan Canyon in northern Utah.

Populus angustifolia/Betula occidentalis c.t. (POPANG/BETOCC; POAN/BEOC)



Distribution—The **POAN/BEOC c.t.** is a major type in the Wasatch Mountains Floristic Section, becoming a minor type throughout the remaining portions of the study area. It ranges in elevation from 1 450 to 2 280 m (4,760 to 7,480 ft) with those communities in the southern latitudes typically at the higher elevations. It is most often located on stream terraces and flood plains immediately adjacent to streams. Microtopography is often smooth to gently undulating with slopes between 2 and 5 percent. Adjacent upland communities include

those dominated by *Pseudotsuga menziesii, Pinus ponderosa, Quercus gambelii, Juniperus osteosperma* or *J. scopulorum, Pinus edulis,* and/or *Acer glabrum communities.*

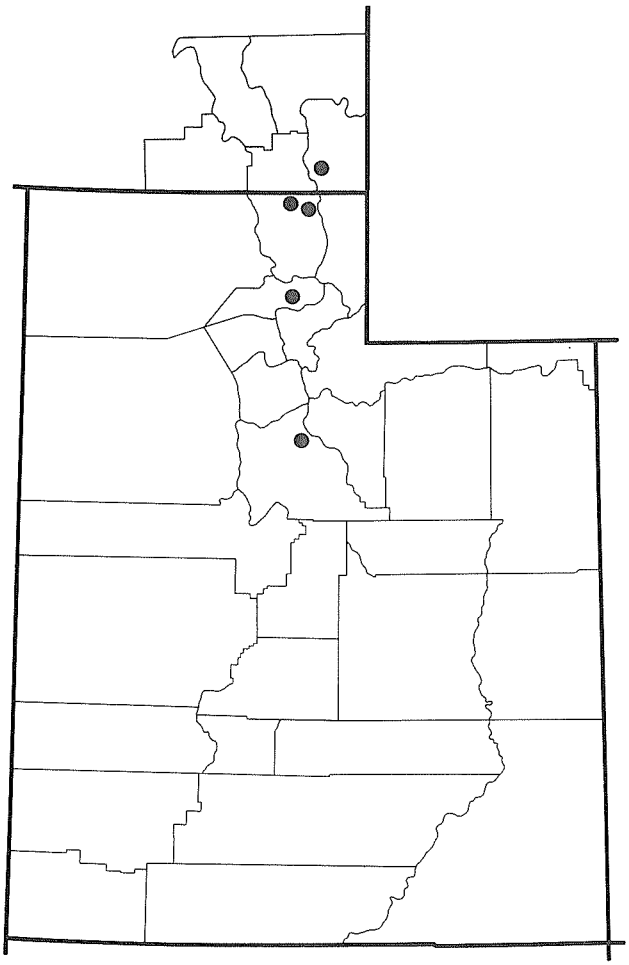
Vegetation—*Populus angustifolia* dominates a tall deciduous tree layer; *Acer negundo* occasionally codominates. *Betula occidentalis* forms a moderate to dense low tree layer with *Alnus incana* and *Acer grandidentatum* as occasional associates. An additional shrub layer of *Cornus sericea* and/or *Rosa* spp. may be present. *Rhus aromatica* was abundant in one sampled community. The herbaceous layer is highly variable and may range from one nearly devoid of vegetation to a dense undergrowth of *Poa pratensis, Osmorhiza chilensis,* and/or *Equisetum arvense.*

Soils—Soils were typically well drained with more than 35 percent coarse fragments, at least in the subsurface horizons. Soils were classified as Typic and Fluvaquentic Haploborolls, Mollic and Aquic Xerofluvents, and Mollic Cryofluvents. Estimated available water-holding capacity ranged from low to moderate. Water tables were rarely within 50 cm (24 in) of the soil surface, and stands were as much as 3 to 4 m (10 to 13 ft) above the stream level.

Succession and Management—Reproduction of *Populus angustifolia*, either through seedling or sucker establishment, is minor or absent. Moderate to heavy livestock grazing, especially during late summer and early fall, often precludes *Populus* regeneration. Livestock grazing, however, is usually limited by the dense low tree and shrub layers. *Pseudotsuga menziesii* or *Picea pungens* occasionally appear as later successional species. This c.t. occurs immediately adjacent to stream channels with water typically available to the deeply rooted dominants throughout the growing season. The presence of *Rhus aromatica* and *Rosa woodsii* indicates a drying trend in the soils and a tendency toward more xeric community types. Communities where *Acer grandidentatum* is abundant indicate succession toward the **Populus angustifolia/Acer grandidentatum c.t.** which is more indicative of upland situations. This c.t. provides high structural diversity for wildlife. *Betula occidentalis* and *Cornus sericea* are important in maintaining streambank stability.

Other Studies—Komarkova (1986) described a similar **Populus angustifolia/Salix exigua-Betula fontinalis** [*B. occidentalis*] **c.t.** for Colorado. Olsen and Gerhart (1982) described a **Populus angustifolia/Betula fontinalis-Ribes c.t.** for Wyoming. Youngblood and others (1985b) described a **Betula occidentalis/Cornus stolonifera [C. sericea] c.t.** that included some communities belonging to this type.

Populus angustifolia/Acer grandidentatum c.t. (POPANG/ACEGRA; POAN/ACGR)



Distribution—The **POAN/ACGR c.t.** is a minor type sampled in the northern Wasatch Mountains Floristic Section. It occurs on stream terraces with gentle to moderate slopes. Elevations ranged from 1 465 to 1 920 m (4,800 to 6,300 ft). Adjacent upland communities include those dominated by *Pseudotsuga menziesii* and *Acer grandidentatum.*

Vegetation—*Populus angustifolia* typically dominates the overstory of this community type with *Acer negundo* often a codominant; *Acer grandidentatum* provides a conspicuous low tree layer. Shrubs, when present, are sparse and may include *Mahonia repens, Pachystyma myrsinites,* or *Symphoricarpos oreophilus.* Herbaceous cover is highly variable, though *Poa pratensis, Elymus glaucus, Smilacina stellata,* and/or *Osmorhiza chilensis* are common. *Poa pratensis* cover may be quite high in some areas.

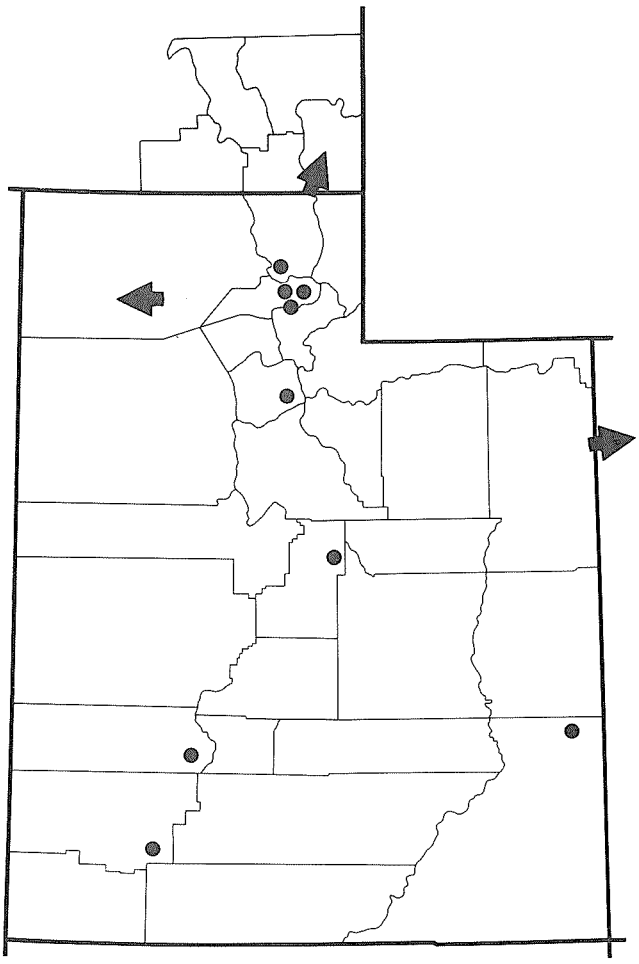
Soils—These communities typically occur on relatively dry soils with greater than 35 percent coarse fragments, at least in the subsurface horizons. Soils were classified

as Cryoborolls, Haploborolls, and Haploxerolls, with no evidence of mottles in the profiles described. Estimated available water-holding capacity ranged from low to high.

Succession and Management—This community type represents a late riparian sere successional to an upland situation. It occurs on stream terraces that have been elevated through stream channel cutting or have become more distant from the channel by means of lateral stream migration. *Populus angustifolia* is not reproducing, and *Pseudotsuga menziesii* and *Abies lasiocarpa* will likely replace the cottonwood overstory. **POAN/ACGR** typically occurs away from active stream channels or on stream terraces that are well above the current level of the channel. Structurally, this c.t. is similar to the **Populus angustifolia/Betula occidentalis c.t.,** though ecologically it represents a very different environmental setting on the landscape as well as being a later seral stage.

Other Studies—This community type has not been previously described.

Populus angustifolia/Cornus sericea c.t. (POPANG/CORSER; POAN/COSE)



Distribution—POAN/COSE (fig. 6) is a major type in the Wasatch Mountains Floristic Section and becomes a minor type in the Utah Plateaus Floristic Section and in the LaSal Mountains of the Canyonlands Floristic Section. While not sampled in the Uinta Mountains, the **Populus angustifolia/Cornus sericea c.t.** was noted in Ashley Gorge west of Grasshopper Flat and is expected to occur elsewhere in this section. This c.t. occurs on stream terraces below 2 135 m (7,000 ft). In southern latitudes it may occur at elevations greater than 2 225 m (7,300 ft). **POAN/COSE** is associated with streams of order 2 to 5. Percent slope ranges from 2 to 6 percent. Adjacent upland communities include those dominated by *Quercus gambelii, Abies concolor, Pseudotsuga menziesii, Pinus ponderosa,* or *P. edulis. Adjacent riparian communities include others dominated by Populus angustifolia, Acer negundo, Salix lutea,* and/or *S. lasiandra.* The **Populus angustifolia/Betula occidentalis c.t.** typically occurs with **POAN/COSE.**

Vegetation—*Populus angustifolia* dominates the overstory of this c.t. *Acer negundo* may rarely codominate. *Cornus sericea* and/or *Salix exigua* form a dense shrub layer with other *Salix* spp. occasionally present in varying amounts. The undergrowth is highly variable with cover ranging from nearly absent to abundant. *Poa pratensis* and *Smilacina stellata* are common, and *Equisetum arvense, Agrostis stolonifera, Elymus glaucus,* and *Taraxacum officinale* may also occur.

Soils—Soils in this c.t. are highly variable, though most had more than 35 percent coarse fragments in subsurface horizons. All soils have developed from alluvium and were classified as Aquic and Mollic Xerofluvents, Aquic Udifluvents, Fluventic Xerochrepts, and Cumulic and Fluvaquentic Haploborolls. Estimated available water-holding capacity was low to moderate. Water tables were typically below the depth of the soil pit which, in may cases, was rather shallow because of the amount of coarse fragments present.

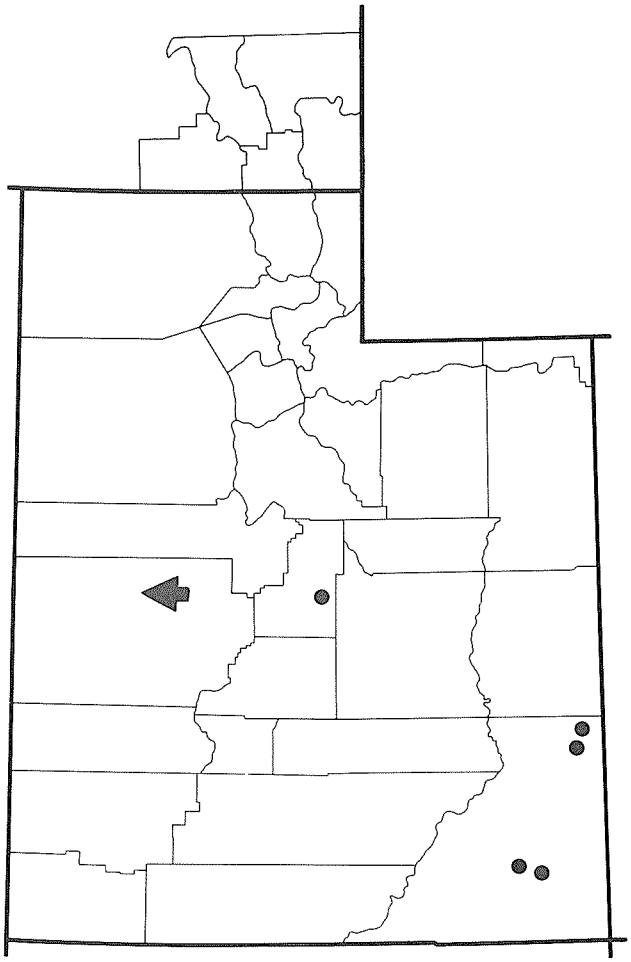
Succession and Management—Because of its proximity to the stream channel, we assume **POAN/COSE** is an early- to mid-seral **Populus angustifolia** type. This c.t. is closely related to the **Populus angustifolia/Betula occidentalis c.t.** but lacks the structural diversity provided by the low tree layer. Both community types occur in similar environments and often adjacent to one another as previously mentioned. The undergrowth dominated by *Salix exigua* has been included in this type because it occurs on similar early successional sites and provides a similar structural diversity. Should the stream channel not change position, this c.t. may be replaced by the **Conifer/Cornus sericea c.t.** If the stream channel moves away from the community, it may be replaced by other **Populus angustifolia community types** with less mesophytic undergrowth. This c.t. provides high structural diversity for wildlife and birds. This type provides shade for stream and river channels, while *Cornus sericea* provides streambank stability because of its strongly rhizomatous rooting nature. Livestock grazing in

Figure 6.—**Populus angustifolia/Cornus serices c.t.** along Beaver Creek east of Huntsville, Utah (1 820 m, 5,960 ft). Mature *Populus angustifolia* dominates the overstory of this streamside community. *Cornus sericea* forms a dense shrub undergrowth with *Ribes inerme* abundant beneath. The herbaceous layer is sparse with scattered *Actaea rubra, Smilacina stellata, Elymus glaucous,* and *Agrostis stolonifera.*

this c.t. is of minor significance because of the typically dense, impenetrable shrub layer. Some communities are subject to periodic flooding and deposition because of the proximity to stream channels.

Other Studies—This c.t. was previously described for eastern Idaho by Youngblood and others (1985a) as the **Populus angustifolia/Cornus stolonifera [Cornus sericea] c.t.** Hess (1981) described a **Populus angustifolia/Salix exigua c.t.** in north-central Colorado that would be included within the description of our **POAN/COSE c.t.**

Populus angustifolia/Rosa woodsii c.t. (POPANG/ROSWOO; POAN/ROWO)



Distribution—POAN/ROWO occurs predominantly in the Abajo and LaSal Mountains of the Canyonlands Floristic Section but was also sampled on the west slope of the Wasatch Plateau. It occupies terraces of order 1 and 2 streams with gentle to moderate slopes and undulating surface topography. Elevations range from 1 890 to 2 195 m (6,200 to 7,200 ft). Adjacent upland communities include those dominated by *Quercus gambelii, Pinus ponderosa* or by *Pinus edulis* and *Juniperus osteosperma.* Adjacent riparian communities may be dominated by *Betula occidentalis, Alnus incana,* or the **Populus angustifolia/Cornus sericea c.t.**

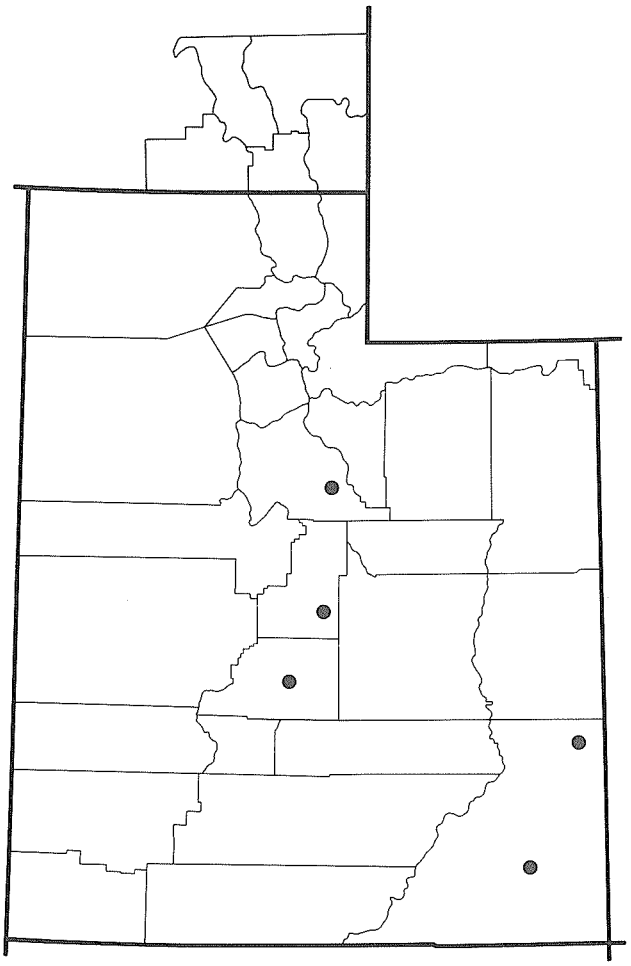
Vegetation—*Populus angustifolia* typically forms a dense overstory in this c.t. *Quercus gambelii* seedlings are often present in minor amounts. *Rosa woodsii* forms a dense shrub layer with *Symphoricarpos oreophilus* commonly present as a minor to codominant component. *Amelanchier alnifolia* may form a tall shrub layer. *Poa pratensis, Taraxacum officinale,* and *Smilacina stellata* occur in a typically sparse herbaceous layer. Other species may include *Clematis ligusticifolia, Agrostis stolonifera, Elymus glaucus,* and *Thalictrum fendleri.*

Soils—Udifluvents, Haploborolls, and Cryoborolls were among the soils sampled in this community type. Soil particle-size classes included those classified as coarse loamy and loamy-skeletal. Estimated available water-holding capacity was low. Water tables were commonly below the depth of the soil pit, and mottles were generally absent.

Succession and Management—The **POAN/ROWO c.t.** is similar in many respects to the **Populus angustifolia/Rhus aromatica (POAN/RHAR) c.t.** In areas where *Rhus aromatica* is common on adjacent uplands (especially in southeastern Utah), **POAN/RHAR** may replace the **POAN/ROWO c.t.** The presence of *Quercus gambelii* and *Symphoricarpos oreophilus* in some sampled communities indicates a tendency toward drier upland situations. This community type provides structural diversity not found in the **Populus angustifolia/Poa pratensis c.t.** but is environmentally very similar. This diversity in vertical structure provides habitat for many birds and small mammals that feed on the fruits of *Rosa* spp.; deer may browse on young twigs and foliage (Sampson and Jespersen 1963). Livestock grazing may be of some importance in communities with moderate shrub and herbaceous cover. The **POAN/ROWO c.t.** is perhaps more important, however, for providing shade for deer as well as livestock.

Other Studies—The **POAN/ROWO c.t.** has not been previously described.

Populus angustifolia/Rhus aromatica c.t. (POPANG/RHUARO; POAN/RHAR)



Distribution—POAN/RHAR is a minor type in the Utah Plateaus Floristic Section and in the Abajo and LaSal Mountains of the Canyonlands Floristic Section. It typically occurs on old stream terraces and benches between elevations of 1 585 and 2 115 m (5,200 and 6,600 ft). Stream order is 2 or greater and slopes are up to 4 percent. Uplands are often dominated by *Pinus edulis* and *Juniperus osteosperma* or other dry shrubland species.

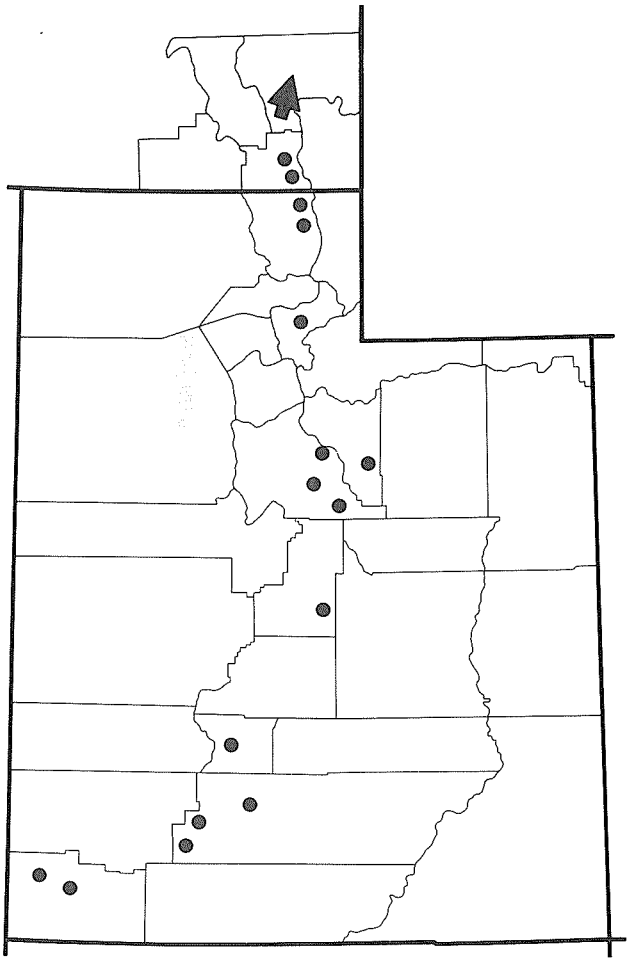
Vegetation—The overstory of this c.t. is dominated by *Populus angustifolia* or *P. acuminata*. Other trees are typically absent, though *Betula occidentalis* occurred in one community and *Quercus gambelii* seedlings were in two. *Rhus aromatica* forms a dense shrub layer that is often impenetrable. *Poa pratensis* often occupies any open areas, while *Clematis ligusticifolia* and *Cynoglossum officinale* may be present in minor amounts.

Soils—Soils were classified as Mollic Xerofluvents, Cumulic and Entic Haploxerolls, and Fluventic Xerochrepts, indicating a xeric moisture regime in all communities sampled. Estimated available water-holding capacity ranged from low to moderate, and water tables were estimated at greater than 1 m for all communities sampled. No mottles were encountered. Particle-size classes for this c.t. were variable, though most were loamy-skeletal or sandy-skeletal at least in the subsurface horizons.

Succession and Management—Structurally and environmentally this c.t. is similar to the **Populus angustifolia/Rosa woodsii c.t.,** though **POAN/RHAR** commonly occurs at lower elevations. The **POAN/RHAR c.t.** represents a later successional riparian sere often on slightly drier soils where these two types occur in proximity. This community type is only considered to be riparian because of the continued presence of *Populus* spp. on sites no longer amenable to the germination and establishment of new individuals of *Populus*. There also appeared to be no reproduction of the *Populus* spp. in these communities by sucker establishment. This may be related, in part, to livestock browsing and trampling. Undergrowth as well as soil characteristics indicate this type to be early successional to an upland site, and the presence of *Quercus gambelii* in some communities may indicate a trend toward an oak overstory. Sampson and Jespersen (1963) noted that *Rhus trilobata* [*R. aromatica*] in California is considered only fair to poor browse for deer and poor to useless for livestock of all kinds. They mentioned, however, that in areas with limited amounts of more desirable feed it might be browsed more heavily. *Rhus* was also noted by these authors as a sprouting species which is capable of colonizing relatively large areas and perhaps responding with increased cover following fire. The older cottonwood trees in this c.t. provide habitat for cavity-dependent species. Livestock grazing is typically not significant in this c.t. because of the dense shrub layer which does not allow for easy access and movement.

Other Studies—This community type has not been previously described.

Populus angustifolia/Poa pratensis c.t. (POPANG/POAPRA; POAN/POPR)



Distribution—POAN/POPR (fig. 7) is a major c.t. occurring throughout most of the study area. It occurs at elevations between 1 170 and 2 450 m (3,840 and 8,040 ft) on stream terraces with slopes of 1 to 6 percent. Stream order ranges from intermittent to order 4. Adjacent upland communities may be dominated by *Acer grandidentatum, Juniperus scopulorum, Quercus gambelii, Artemisia tridentata* ssp. *vaseyana, Pinus ponderosa, Pinus edulis* (or *P. monophylla*), and/or *Juniperus osteosperma*. Adjacent riparian communities may be dominated by *Cornus sericea, Salix exigua, Salix lasiolepis, Betula occidentalis,* and other **Populus angustifolia community types.**

Vegetation—*Populus angustifolia, P. acuminata,* and/or *P. fremontii* dominate the overstory of this c.t. *Acer negundo* or *Fraxinus velutinus* may occasionally be present as codominants. *Juniperus scopulorum* is commonly present with as much as 10 to 20 percent cover. *Rosa* spp., *Symphoricarpos oreophilus,* and *Juniperus communis* are often present, though their cover is typically minor. Cover of *Poa pratensis* is typically high but may be minor or absent in communities with little or no undergrowth. *Agrostis stolonifera, Elymus glaucus,* and *Bromus tectorum* are among the other graminoids that may be present. Forbs may include *Taraxacum officinale, Clematis ligusticifolia, Cynoglossum officinale,* and *Smilacina stellata.*

Soils—Soils are highly variable, though many were classified at the family level as sandy, sandy-skeletal, or loamy-skeletal at least in the subsurface horizons. Rarely was a water table present within the depth of the soil pit (typically limited by coarse fragments), and only occasionally was there evidence (mottles) of a seasonally high water table. Estimated available water-holding capacity ranged from low to high with a mean of 0.10. Soils belonged to the Fluvent, Ochrept, and Boroll suborders.

Succession and Management—The **POAN/POPR c.t.** represents several possible seral stages in community development throughout the elevational ranges of the various cottonwood species. Early successional communities typically have numerous young trees. These communities may have a very dense undergrowth, or they may have a sparse undergrowth because of recent fluvial deposition. More common perhaps are the communities that have few, if any, young trees and a dense to sparse undergrowth. Undergrowth of these communities is likely determined by the water-holding capacity of the soils and past grazing levels by livestock and wildlife species. Those communities that have more xeric surface soils typically have lower herbaceous cover or high cover of species such as *Bromus tectorum. Poa pratensis* and *Smilacina stellata* may occur on more mesic sites. Livestock grazing can have a significant impact on communities of this c.t. because of its typically open undergrowth. Grazing may reduce palatable forbs and increase cover of weedy species. **POAN/POPR** is commonly used by livestock for shading and is nearly always adjacent to flowing water. Because of the often heavy use of this c.t., streambanks may be degraded and reproduction of *Populus* may be hampered. This c.t. provides structural diversity for wildlife and birds and shading for adjacent stream channels.

Other Studies—Youngblood and others (1985a) described a similar **POAN/POPR c.t.** for eastern Idaho and western Wyoming. Youngblood and others (1985b) described a broader **POAN/POPR c.t.** in their preliminary classification for northern Utah that included communities belonging to our **Populus angustifolia/Rosa woodsii, Populus angustifolia/Betula occidentalis,** and **Populus angustifolia/Acer grandidentatum c.t.s.**

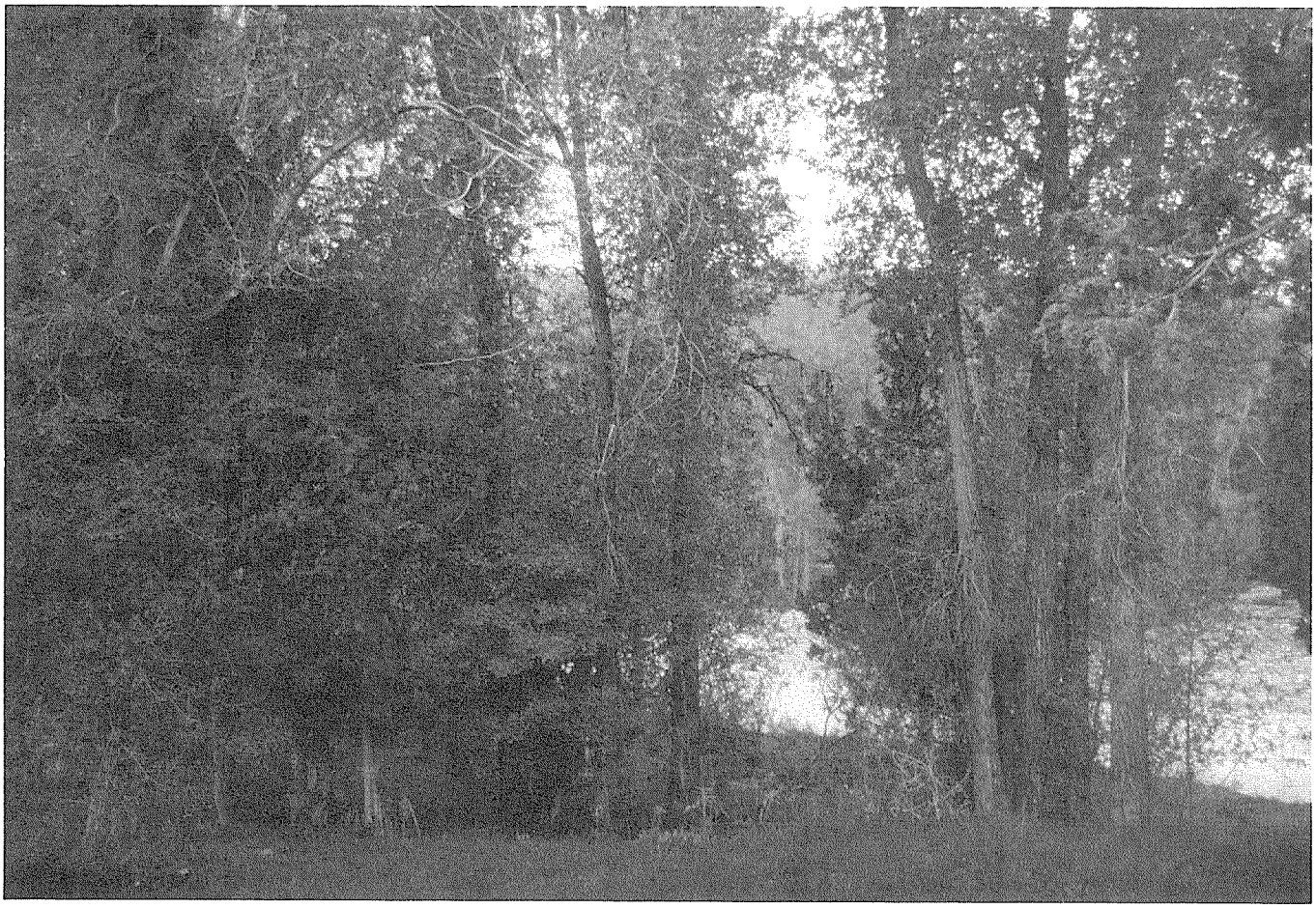
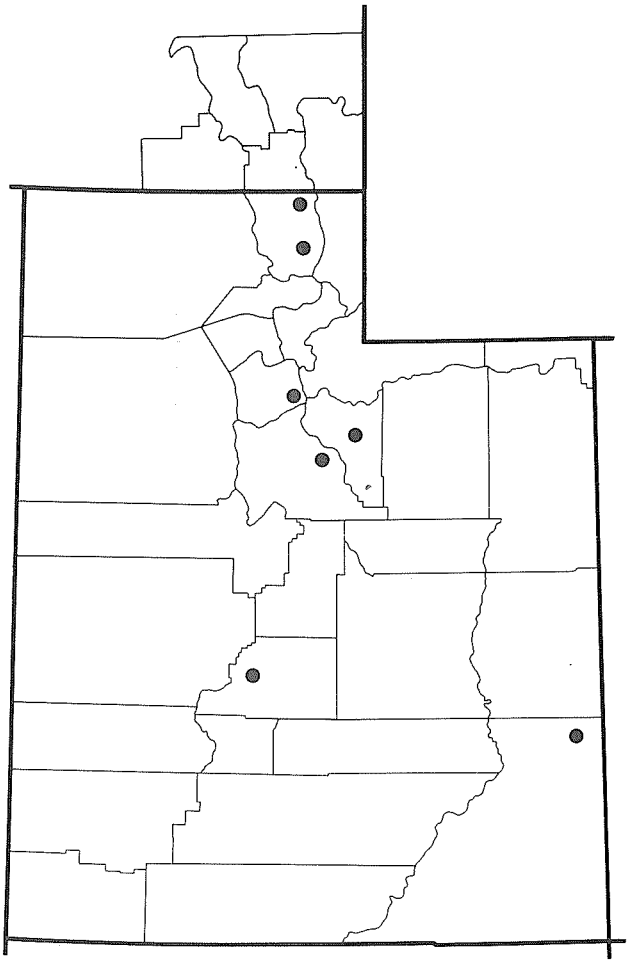


Figure 7.—**Populus angustifolia/Poa pratensis c.t.** adjacent to Twelvemile Creek east of Mayfield, Utah (1 975 m, 6,480 ft). Mixed-age *Populus angustifolia* dominate the tree layer with *Poa pratensis* the dominant graminoid. *Taraxacum officinale, Cynoglossum officinale,* and *Poa bulbosa* are minor components of the herbaceous layer.

Acer negundo/Cornus sericea c.t. (ACENEG/CORSER; ACNE/COSE)



Distribution—ACNE/COSE occurs in the Wasatch Mountains Floristic Section as a minor type and in the Utah Plateaus Floristic Section and in the LaSal Mountains of the Canyonlands Floristic Section as an incidental type. It typically occurs below 1 985 m (6,500 ft) in elevation on benches and terraces immediately adjacent to streams of order 2 or greater. Slopes are generally 2 to 3 percent with a few communities occurring on steeper slopes. Adjacent upland communities may be dominated by *Abies lasiocarpa, Acer glabrum, Quercus gambelii, Artemisia tridentata* ssp. *vaseyana,* or *Pinus edulis* and *Juniperus osteosperma*. Riparian communities associated with this c.t. may include those dominated by *Populus angustifolia, Salix exigua,* or others dominated by *Acer negundo.*

Vegetation—*Acer negundo* dominates the overstory of this c.t. *Betula occidentalis, Alnus incana,* or *Acer grandidentatum* occasionally form a dense low tree layer. *Fraxinus americanus* was codominant in the overstory of one community sampled along the Logan River in northern Utah. Cover of *Cornus sericea* is usually greater than 25 percent, and *Salix lutea* or *S. exigua* are occasionally present. *Rosa* spp., *Ribes inerme,* and *Symphoricarpos oreophilus* may also be present, usually with minor cover. The herbaceous layer is highly variable with *Smilacina stellata* and *Poa pratensis* commonly occurring; *Heracleum lanatum, Osmorhiza chilensis, Arctium lappa,* and *Taraxacum officinale* are also likely to occur.

Soils—A majority of the soils were classified as Mollisols (Haploborolls, Cryoborolls, Haploxerolls, and Haplaquolls) with a few Entisols and Inceptisols. Particle-size classes included sandy, fine-loamy and coarse-loamy to loamy-skeletal, and sandy-skeletal. Estimated available water-holding capacity of those communities sampled ranged from low to high. Depth to water table was as high as 21 cm (8 in) below the surface but, in many cases, was below the depth of the soil pit. These latter soils often had mottles within 1 m (39 in) of the surface, indicating a seasonally high water table.

Succession and Management—The **ACNE/COSE c.t.** appears to be a relatively stable type that will likely persist until stream channels meander away from the existing community or until the channel cuts deeper, resulting in a more xeric environment. Limited data suggest the occurrence of a climax c.t. dominated by *Acer negundo* and *Smilacina stellata* may result from this "drying" of the habitat. **ACNE/COSE** is a stable type, however, and conversion is likely to be very slow. This c.t. provides structural diversity for birds and small mammals. Blakesley (1987) noted a strong correlation between the occurrence of yellow warbler and song sparrow with the **ACNE/COSE c.t.** in Logan Canyon in northern Utah. *Cornus sericea* should provide streambank stability because of its strongly rhizomatous rooting nature. *Acer negundo*, while not rhizomatous, has strong roots that provide site stability.

Other Studies—The **ACNE/COSE c.t.** has not been previously described.

Acer negundo/Equisetum arvense c.t. (ACENEG/EQUARV; ACNE/EQAR)

Distribution—ACNE/EQAR is a minor type represented by only a few plots in the Wasatch Mountains Floristic Section. It occurs on stream terraces below 1 830 m (6,000 ft) with slopes 3 percent or less. Adjacent uplands may be dominated by *Quercus gambelii* or other lowland tree and shrub communities.

Vegetation—*Acer negundo* dominates the overstory of this c.t. with *Equisetum arvense* forming a dense, and often continuous, undergrowth. Shrubs and graminoids

are usually sparse with *Smilacina stellata, Mentha arvensis, Agrostis stolonifera, Elymus glaucus,* and *Poa pratensis* among those likely to occur.

Soils—Limited data indicate that soils are coarse-loamy or fine-loamy. Water tables are seasonally within 1 m of the surface as indicated by the presence of distinct or prominent mottles. Estimated available water-holding capacity ranged from low to moderate.

Succession and Management—Though only a few plots were sampled, the occurrence of *Smilacina stellata* in this c.t., as is found in the **Acer negundo/Cornus sericea c.t.,** indicates succession toward a stable community dominated by *Acer negundo* and *Smilacina steliata.* It is assumed that following a drying of these communities *Equisetum arvense* would decrease in cover, while *Smilacina stellata,* without grazing pressures, would increase. Again, these are only assumptions based on limited information. Sites supporting the **ACNE/EQAR c.t.** typically have wet soils that are easily compacted or displaced. *Equisetum arvense* is strongly rhizomatous and provides stability to streambanks and surface soil.

Other Studies—The **ACNE/EQAR c.t.** has not been previously described.

Populus tremuloides/Veratrum californicum c.t. (POPTRE/VERCAL; POTR/VECA)

This rarely encountered type was sampled in Utah on the north slope of the Uinta Mountains and in the Wasatch Range east of Salt Lake City. Most communities belonging to this type occur between 2 135 and 2 440 m (7,000 and 8,000 ft) on very moist sites. The overstory is dominated by *Populus tremuloides* and shrubs, such as *Salix scouleriana, Rosa woodsii* and/or *Symphoricarpos oreophilus,* may be present with minor cover. *Veratrum californicum* is prominent in the herbaceous layer with *Mertensia arizonica, Senecio serra, Valeriana occidentalis* and *Rudbeckia occidentalis* likely associated. Graminoids are not typically abundant.

Populus tremuloides/Poa pratensis c.t. (POPTRE/POPR; POTR/POPR)

POTR/POPR is not common but was sampled in the Bear River Range, the Uinta Mountains, the Markagunt Plateau, and the Abajo Mountains. This type typically occurs on stream terraces, flat to gently sloping benches, and on lower slopes between elevations of 2 135 and 2 745 m (7,000 and 9,000 ft). The vegetation indicates past heavy grazing with a reduced diversity of the herbaceous layer. *Abies lasiocarpa* or *Picea engelmannii* may be present in the overstory, while low shrubs such as *Symphoricarpos oreophilus, Rosa woodsii,* and *Mahonia* [*Berberis*] *repens* are occasionally present with minor cover. The undergrowth is characterized by low growing forbs such as *Taraxacum officinale* and *Achillea millefolium,* and grasses such as *Poa pratensis.*

Miscellaneous Unclassified Tall Deciduous Tree-Dominated Communities

Populus tremuloides dominated some additional communities sampled in the study area. Two *Populus tremuloides* communities in the northern portion of the study area were dominated by *Cornus sericea* in the undergrowth. With further sampling a type named after these species might be described. Two communities with undergrowths dominated by *Equisetum arvense* and either *Deschampsia cespitosa* or *Poa pratensis* were sampled on the Wasatch Plateau and in the Abajo Mountains, respectively. An additional *Populus tremuloides* community with a dense shrub layer of *Salix boothii* and an herbaceous undergrowth of *Heracleum lanatum, Smilacina stellata,* and *Urtica dioica* was sampled in the Wasatch Mountains.

Some communities with overstories dominated by *Fraxinus velutinus* were sampled in the southwestern portion of Utah on the Pine Valley District of the Dixie National Forest. Except for the different overstory dominant, these communities resembled various cottonwood c.t.s including the **Populus angustifolia/Betula occidentalis c.t.** and the **Populus angustifolia/Rhus aromatica c.t.** It is suggested that, when encountered, communities dominated by *Fraxinus velutinus* be treated similarly to those dominated by the various cottonwoods and that management suggestions also apply. *Fraxinus americanus* was noted in portions of Logan Canyon and should be treated in a similar manner.

Also in Logan Canyon and elsewhere in the state, *Salix fragilis* (a tree species) has been introduced and now covers large areas from lower forest canyons into the adjacent populated valleys. Because of its tall, nearly complete, overstory it provides abundant wildlife habitat, and recreation use is typically high (camping, picnicking, etc.). In fact, many campground and picnic areas have been established where this willow occurs. Its branches are extremely fragile and break easily during rain and wind storms as well as under pressure from snowfall. Structurally, these communities are similar to those dominated by *Populus angustifolia* and, where necessary, should be treated like those belonging to cottonwood c.t.s.

One newly developed bar community dominated by young *Populus angustifolia* as well as by various *Salix* spp., *Agrostis stolonifera, Poa palustris,* and *Trifolium hybridum* was sampled along the Cub River in southern Idaho; a **Populus angustifolia/Bar c.t.** might be described with further sampling.

Low Deciduous Tree-Dominated Community Types

Alnus incana and *Betula occidentalis* have been variously described as shrubs or trees, and they often behave as either lifeform. Because *Alnus incana* may vary from 1 to 10 m (3 to 33 ft) and *Betula occidentalis* is typically between 3 and 6 m (10 to 20 ft) we are treating them as low deciduous trees. Sampson and Jespersen (1963) noted *Betula occidentalis* as a nonsprouting species, while *Alnus incana,* like other species of alder, is expected to sprout. Because of this difference, management should consider the impact of treatments that affect top removal. Huenneke (1987) noted that *Alnus incana* ssp. *rugosa* (ours belongs to this same subspecies) in central New York State does not have rhizomes or horizontal roots from which it can spread. Rather, Huenneke noted that while this species is capable of producing root suckers and offsets, these typically occur near the parent clump. *Alnus incana* has also been noted to fix nitrogen (Daly 1966) which is likely to be advantageous when it occurs on young, nutrient-poor substrates.

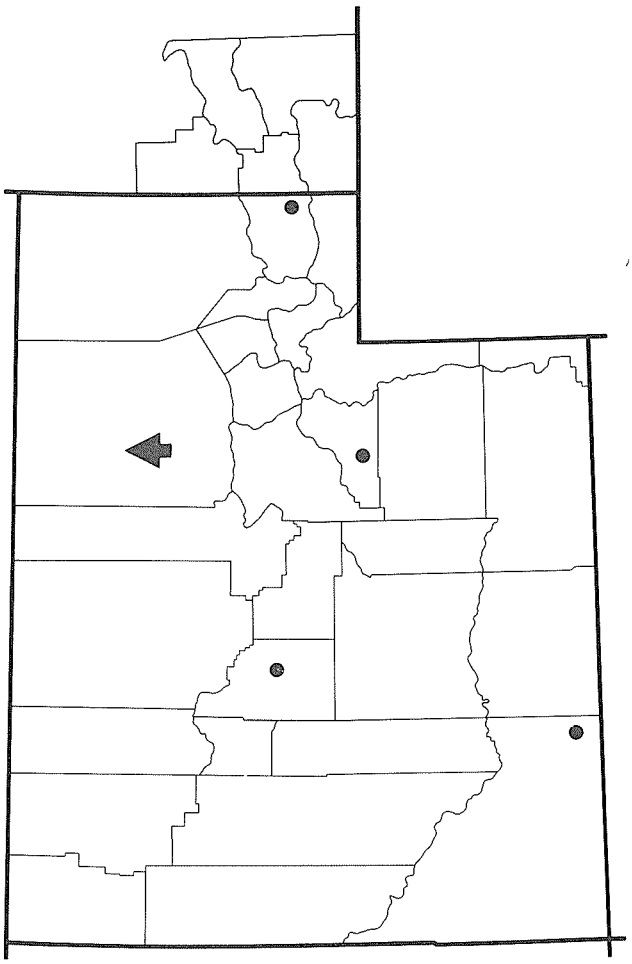
Both *Alnus incana* and *Betula occidentalis* typically occupy sites immediately adjacent to streams and rivers where aerated water flows through the soil profile. Because of this, soils are typically not included in the aquic moisture regime at the soil suborder level as this level of classification requires soil water to be anaerobic. Personal observations indicate that *Alnus incana* typically occupies colder sites than *Betula occidentalis.* Medina (1986) noted similar site requirements for *Alnus oblongifolia,* a like species in southwestern New Mexico.

Preliminary classifications for northern Utah (Youngblood and others 1985b) and southern Utah (Padgett and Youngblood 1986) did not distinguish different **Alnus c.t.s** and **Betula c.t.s** because of limited sampling. Type descriptions that follow are the result of additional sampling throughout the study area and represent different environmental characteristics and, quite often, management practices.

The preliminary classification for northern Utah and southern Idaho described an **Alnus incana/Ribes hudsonianum c.t.** similar to that described by Youngblood and others (1985a) for eastern Idaho and western Wyoming. Communities belonging to this type, however, rarely had *Ribes hudsonianum* as a dominant undergrowth associate. The southern Utah preliminary report simply described the **Alnus incana c.t.** Both of the above preliminary types included a variety of dominant undergrowths; the community type names in this final report reflect these differences.

The preliminary classification for northern portion of the study area included a **Betula occidentalis/Cornus stolonifera** [*sericea*] **c.t.** In this area *Cornus sericea* is the most common undergrowth component, though a few communities with undergrowths dominated by herbaceous species were also sampled. In the southern Utah preliminary report Padgett and Youngblood (1986) described a more general **Betula occidentalis c.t.,** which also included a variety of undergrowths. This final report includes several **Betula occidentalis c.t.s** that describe the variability of undergrowth associates.

Alnus incana/Cornus sericea c.t. (ALNINC/CORSER; ALIN/COSE)



Distribution—The **ALIN/COSE c.t.** is a minor type scattered throughout the study area. Elevation ranged from 1 740 to 2 195 m (5,700 to 7,200 ft). It occurs immediately adjacent to streams of order 2 to 4 that are subject to seasonal fluvial scouring and deposition. Surface topography is typically undulating and slopes are often 2 percent or less. Adjacent upland communities may be dominated by *Pinus ponderosa, Quercus gambelii,* or *Artemisia tridentata* ssp. *vaseyana,* among others.

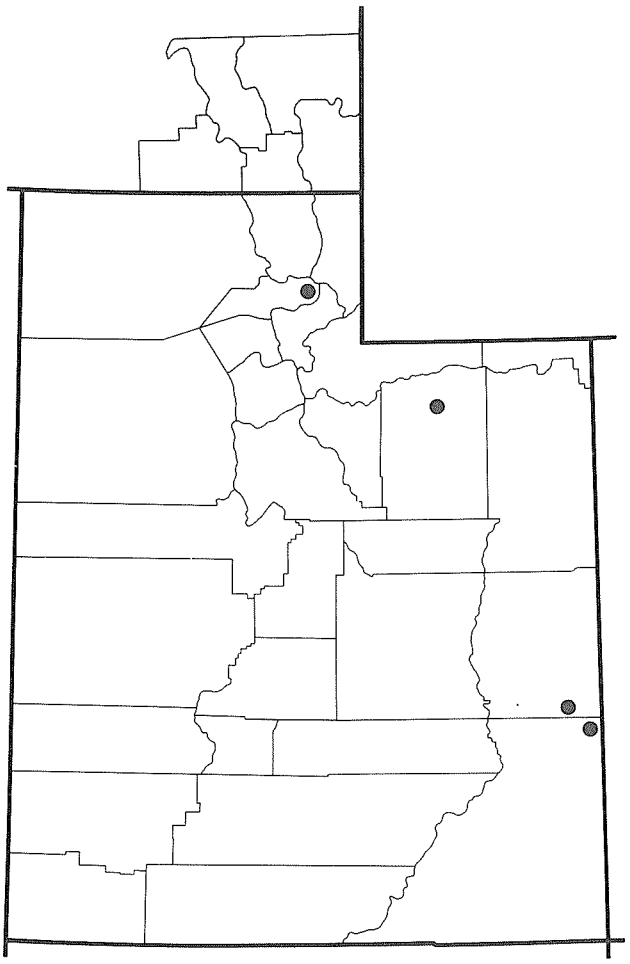
Vegetation—*Alnus incana* dominates the low tree overstory of this c.t. *Betula occidentalis* may occasionally be present as a codominant. *Cornus sericea* forms a dense shrub layer with *Salix lutea, Lonicera involucrata, Rosa* spp., and *Ribes inerme* present in some communities. The herbaceous layer is usually sparse with *Smilacina stellata, Heracleum lanatum, Tall Mertensia* spp., and *Agrostis stolonifera* among those likely to occur.

Soils—All soils sampled were formed by fluvial deposition and scouring and had more than 35 percent coarse fragments at least in the subsurface horizons. Estimated available water-holding capacity ranged from low to moderate. Water tables were closely related to the height of the community above the water level of adjacent streams. Soils were classified as Aquic Cryofluvents, Typic Udifluvents, Mollic Xerofluvents, and Typic and Aquic Cryoborolls.

Succession and Management—At lower elevations, this c.t. is replaced by the **Betula occidentalis/Cornus sericea c.t.,** and in some areas these two community types grade into one another with both *Alnus incana* and *Betula occidentalis* present in the overstory. *Alnus incana* and *Cornus sericea* (as well as *Betula occidentalis*) are well adapted to growing immediately adjacent to streams. They appear to withstand periodic flooding and seem to require the more aerated ground water that flows through the coarse-textured subsurface soils with which they are commonly associated. Because of their rooting structure, these species are capable of holding coarse streambank materials in place and can act as filters for upland water and soil movement into channel systems. Livestock grazing is limited because of the dense undergrowth of this c.t. The low tree/shrub layers provide structural diversity for birds while providing shade to the adjacent streams.

Other Studies—The **ALIN/COSE c.t.** has not been previously described.

Alnus incana/Equisetum arvense c.t. (ALNINC/EQAR; ALIN/EQAR)



Distribution—The **ALIN/EQAR c.t.** is a minor type throughout the study area. It occurs adjacent to streams and in meadows between elevations of 1 800 and 2 500 m (5,900 and 8,200 ft). Adjacent upland communities may be dominated by *Populus tremuloides, Artemisia tridentata* ssp. *vaseyana, Pinus ponderosa, Picea engelmannii,* or *Quercus gambelii.* Associated riparian communities may be dominated by *Salix exigua* or *Carex rostrata,* among others.

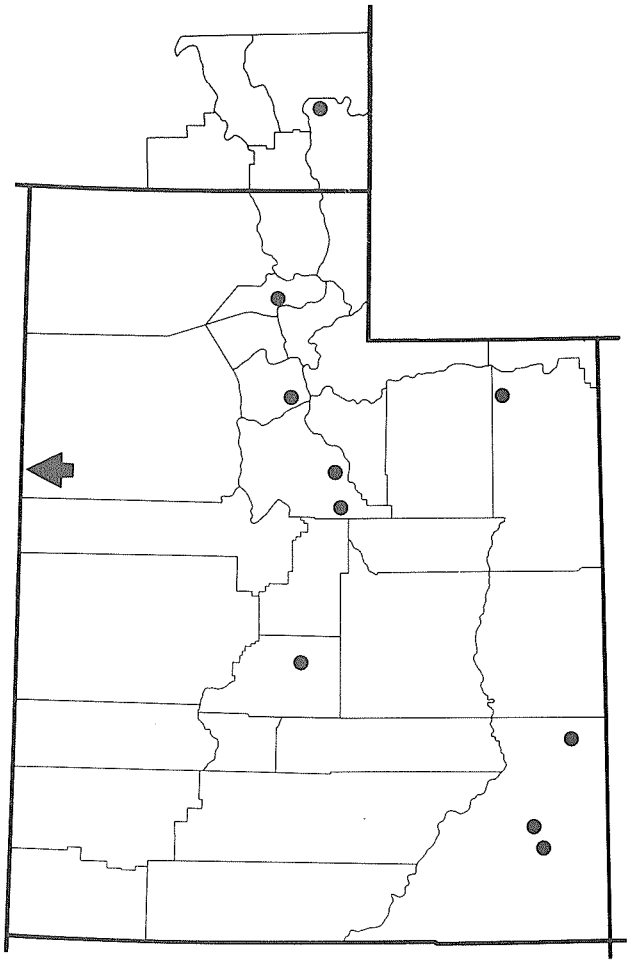
Vegetation—The overstory is dominated by *Alnus incana; Salix lutea, S. exigua, S. lasiandra,* or *S. boothii* commonly dominate a tall shrub layer. *Ribes inerme, Rosa* spp., and *Lonicera involucrata* may be present in varying amounts, and *Cornus sericea,* if present, typically provides only minor cover. The undergrowth is characterized by a dense cover of *Equisetum arvense* with *Agrostis stolonifera, Poa pratensis, Carex lanuginosa, C. rostrata, Mentha arvensis,* or *Smilacina stellata* also likely to occur. Other herbaceous species may be locally abundant.

Soils—Soils developed from alluvium and were classified as Cumulic and Pachic Cryoborolls and Typic Cryofluvents, indicating variable horizon development. Water tables were typically between 50 and 100 cm (20 and 39 in) below the soil surface. Subsurface horizons typically had more than 35 percent coarse fragments with estimated water-holding capacity ranging from low to moderate. These coarse-textured soils allow water to move freely through the subsoil, providing highly oxygenated water that appears necessary for establishment and optimal survival of *Alnus incana.*

Succession and Management—Livestock grazing is somewhat inhibited by the tall shrub layer, though it may occur in more open communities. Opportunities to manage for birds exist because of the structural diversity. Stream shading and streambank stabilization are also important contributions which this community type provides.

Other Studies—The **ALIN/EQAR c.t.** has not been previously described.

Alnus incana/Mesic Forb c.t. (ALNINC/MF; ALIN/MF)



Distribution—The **ALIN/MF c.t.** is a minor type in the Wasatch Mountains, Uinta Mountains, and Canyonlands Floristic Sections and on the Wasatch Plateau of the Utah Plateaus Floristic Section. It occupies streambanks and terraces immediately adjacent to stream channels of order 1 to 3. Elevation ranges from 1 710 to 2 805 m (5,600 to 9,200 ft). Adjacent upland communities are commonly dominated by *Quercus gambelii* or *Pinus edulis* and *Juniperus osteosperma,* but may be dominated by *Abies lasiocarpa* at higher elevations. Adjacent riparian communities may include those belonging to the **Populus angustifolia/Rosa woodsii** or **Conifer/Equisetum arvense c.t.**

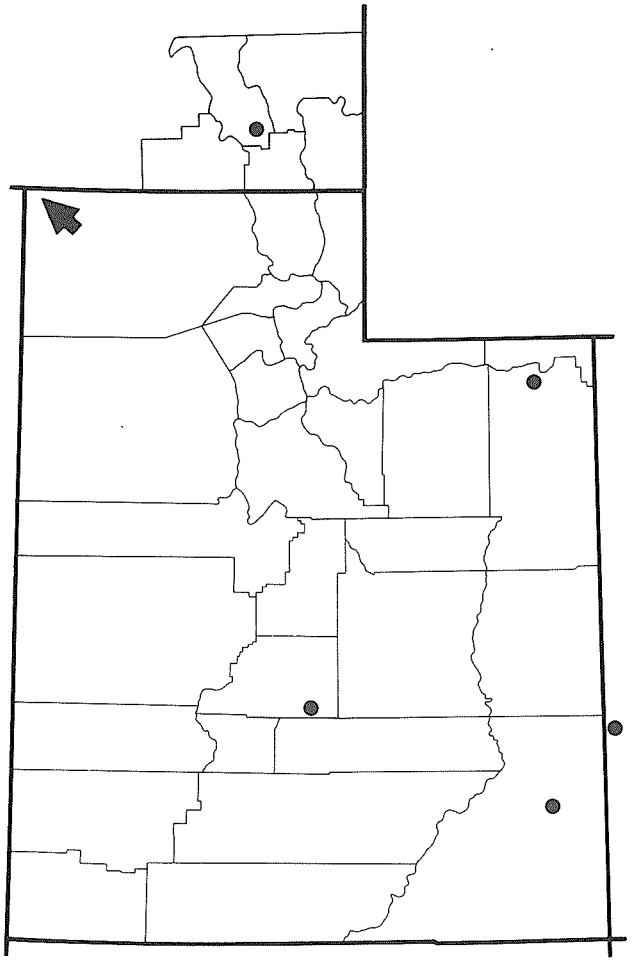
Vegetation—*Alnus incana* dominates the low tree overstory. The undergrowth is characterized by a dense forb layer dominated by *Heracleum lanatum, Aconitum columbianum,* Tall *Mertensia* spp., *Hydrophyllum fendleri,* and/or *Smilacina stellata.* In addition, *Geranium richardsonii, Actaea rubra,* and *Urtica dioica,* among others, may also be locally abundant. *Salix* spp. are not typically present, though cover may be high. A low shrub layer is often present and may include *Lonicera involucrata, Ribes inerme, Rosa* spp., and/or *Symphoricarpos oreophilus. Cornus sericea,* when present, is a minor component. Common graminoids include *Agrostis stolonifera, Poa pratensis,* and *Elymus glaucus,* among others, sometimes with combined cover greater than 50 percent.

Soils—Cryoborolls and Cryofluvents were the most common soil great groups classified for the **ALIN/MF c.t.** Soil particle-size classes were typically sandy-skeletal or loamy-skeletal, at least in the subsurface horizons, often with 50 percent or more coarse fragments. Estimated available water-holding capacity was commonly low. Water table measurements were restricted by the high percent coarse fragments in the subsurface horizons, although mottles were typically within 25 cm (10 in) of the surface indicating a seasonally high water table. For those soils where a water table could be measured, the mean depth was 48 cm (19 in).

Succession and Management—Communities belonging to this c.t. appear to be less subjected to fluvial scouring and deposition than the **Alnus incana/Cornus sericea c.t.** as is indicated by the development of mollic epipedons and the establishment of a dense forb layer. Because of typically open undergrowth, this c.t. is more likely to be impacted by livestock grazing, in some cases resulting in a conversion to the **Alnus incana/Mesic Graminoid c.t.** Stabilization of streambanks is likely to be less than in those Alder c.t.s with shrub-dominated undergrowth because of roots. These communities may exist as stable seres, or they may be replaced by communities dominated by *Abies lasiocarpa* or *Picea engelmannii. Acer negundo* may also succeed those dominated by *Alnus incana,* especially as sites become more xeric.

Other Studies—The **ALIN/MF c.t.** has not been previously described.

Alnus incana/Mesic Graminoid c.t. (ALNINC/MG; ALIN/MG)



Distribution—The highly variable **ALIN/MG c.t.** occurs as a minor type in the central Utah Plateaus and the Uinta Mountains Floristic Sections, and in the Abajo Mountains of the Canyonlands Floristic Section. Elevations range from 1 710 to 2 745 m (5,600 to 9,000 ft). It occupies sites immediately adjacent to streams of nearly all orders. Upland communities may be dominated by *Quercus gambelii, Artemisia tridentata* ssp. *vaseyana, Pinus edulis* and *Juniperus osteosperma, Pinus ponderosa, P. contorta,* and/or *Populus tremuloides.*

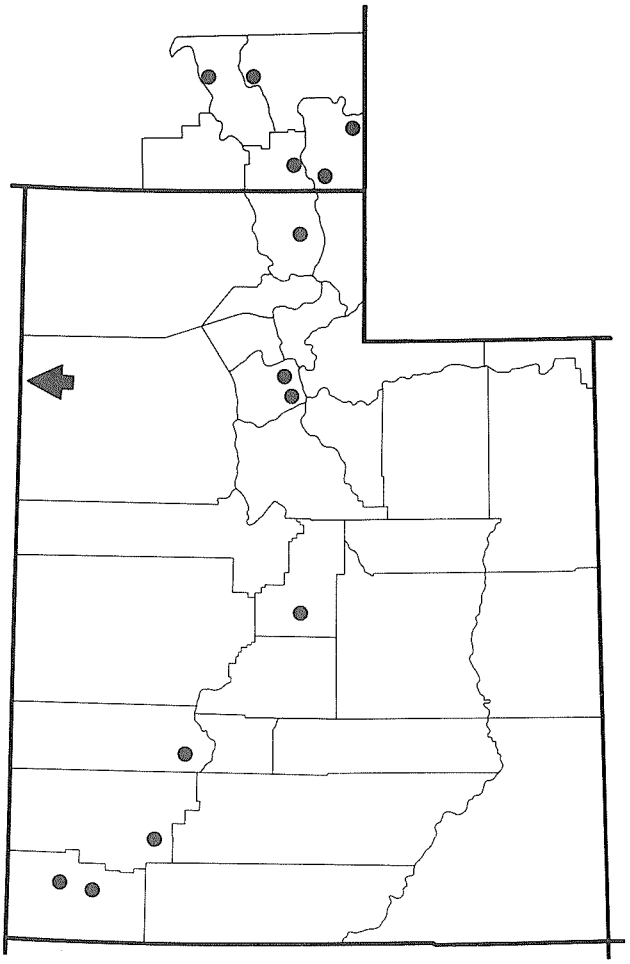
Vegetation—*Alnus incana* dominates a low tree overstory. *Betula occidentalis* is likely to occur in communities at lower elevations where these species overlap. The undergrowth is open, and shrubs are typically sparse and/or low. *Salix lasiandra* and/or *S. lutea* may be among the willows likely to occur. The herbaceous layer is highly variable with minor to nearly continuous cover of graminoids; percent cover of mesic forbs is low. *Poa pratensis* and *Agrostis stolonifera* are among the graminoids with highest constancy; others include *Poa palustris, Glyceria striata, Calamagrostis canadensis, Elymus glaucus, Carex aquatilis,* and *C. rostrata.* Forb cover is typically sparse with *Geranium richardsonii* and *Taraxacum officinale* among those most likely to occur. Additional forbs may include *Trifolium* spp., *Thalictrum fendleri, Equisetum arvense,* and *Cirsium* spp.

Soils—Soils were developed from alluvium and were classified as Cryofluvents, Cryochrepts, Cryoborolls, and Haploxerolls. Subsurface horizons typically had more than 35 percent coarse fragments, and estimated available water-holding capacity ranged from low to high. Water tables were often within 1 m (39 in) of the soil surface with a mean depth of 51 cm (20 in).

Succession and Management—As with the other **Alnus incana c.t.s, ALIN/MG** occurs immediately adjacent to stream channels and, therefore, provides stability to streambanks and shade for the stream channel. *Heracleum lanatum,* Tall *Mertensia* spp., *Smilacina stellata,* among others, occur with a low percent cover and may indicate that **ALIN/MG** is a grazing-induced sere of the **Alnus incana/Mesic Forb c.t.**

Other Studies—Kauffman and others (1983) described a similar **Alnus incana/Poa pratensis community** in northeastern Oregon.

Betula occidentalis/Cornus sericea c.t. (BETOCC/CORSER; BEOC/COSE)



Distribution—BEOC/COSE is a major c.t. in the Wasatch Mountains Floristic Section and the west slope of the Utah Plateaus Floristic Section, including the Pine Valley Mountains. It typically occurs below 1 985 m (6,500 ft) but has been sampled above 2 290 m (7,500 ft). It occupies streambanks and terraces immediately adjacent to streams typically of order 2 or greater. Percent slope is commonly 2 to 4 percent, and surface topography is often undulating. Adjacent upland communities may be dominated by *Pseudotsuga menziesii, Pinus ponderosa, P. edulis* and *Juniperus osteosperma,* or *Quercus gambelii.*

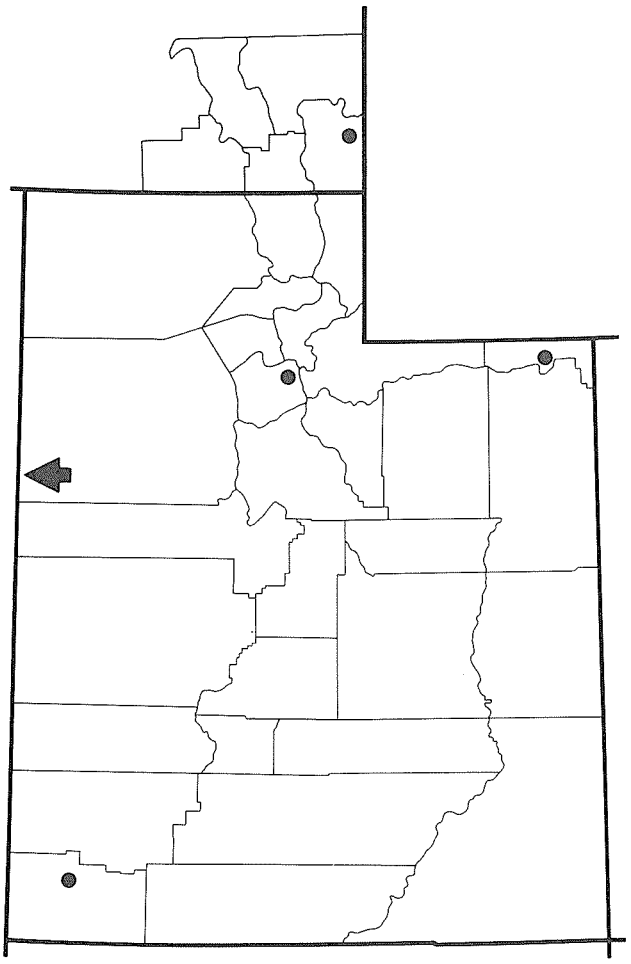
Vegetation—*Betula occidentalis* forms a low tree overstory with *Alnus incana* occasionally present in minor amounts. This type is characterized by a dense shrub undergrowth dominated by *Cornus sericea,* often with a mixture of tall willows (*Salix lutea, S. exigua, S. lasiolepis,* among others). *Rosa* spp. and *Ribes lacustre* may form a low shrub layer. The herbaceous layer varies inversely with shrub cover. *Equisetum hyemale, E. laevigatum,* and/or *E. arvense* are commonly present. *Smilacina stellata, Urtica dioica, Heracleum lanatum, Actaea rubra,* and *Galium triflorum* are often associated. The typically sparse graminoid layer may include *Glyceria striata, Poa palustris, P. trivialis, P. pratensis,* or *Elymus glaucus.*

Soils—Soils associated with this c.t. were formed on alluvium. They were coarse to fine-textured in the surface horizons and typically had more than 35 percent coarse fragments, at least in the subsurface horizons. Estimated available water-holding capacity in the top 50 cm (24 in) of the soil ranged from low to high. Water tables were typically below the depth of the soil pit, which was often limited by the high percent of coarse materials, but was measured as high as 38 cm (15 in) below the surface. A majority of the soils were classified as Cryoborolls and Haploborolls, but Cryaquents, Udifluvents, and Xerofluvents were also classified.

Succession and Management—*Pseudotsuga menziesii, Picea pungens,* and *Abies lasiocarpa* were among the conifers present in minor amounts in some communities of this c.t.; they may result in the eventual replacement of the **BEOC/COSE c.t.** with the **Conifer/Cornus sericea c.t.** In some communities *Populus tremuloides, P. angustifolia,* or *Acer negundo* may indicate succession toward communities dominated by these species with an undergrowth of *Cornus sericea.* The **BEOC/COSE c.t.** is very important in stabilizing streambanks because of the dense rooting nature of *Cornus sericea* and *Betula occidentalis.* Because they are located adjacent to streams, communities of this c.t. are commonly subjected to periodic scouring and deposition. The dense nature of *Cornus* stems acts to slow the movement of water flow over the community during high runoff, resulting in an increased deposition rate and a reduced impact of scouring. This c.t also provides shade for streams and rivers and helps to create overhang habitat that is beneficial for fish. Use of these communities by livestock and wild ungulates is expected to be rather small because of the dense undergrowth. Birds have been noted to use these communities, and the dense overstory/undergrowth should provide nesting and perching habitat for several species.

Other Studies—Youngblood and others (1985b), in their preliminary classification for northern Utah, described a broader **BEOC/COSE c.t.** that included some communities belonging to our **Populus angustifolia/Betula occidentalis c.t.** and other **Betula occidentalis c.t.s.**

Betula occidentalis/Mesic Forb c.t. (BETOCC/MF; BEOC/MF)



Distribution—The **BEOC/MF c.t.** is a minor type throughout the study area, though it was not sampled in southeastern Utah. Elevations ranged from 1 830 to 2 135 m (6,000 to 7,000 ft). This type occurs along order 1 and 2 streams or near intermittent channels. Percent slope ranges from 1 to 6 percent with most communities having slopes of 3 percent or less. Surface topography is commonly undulating. Adjacent upland communities include those dominated by *Pinus ponderosa, Pinus edulis* with *Juniperus osteosperma* and/or *J. scopulorum,* and/or *Quercus gambelii.*

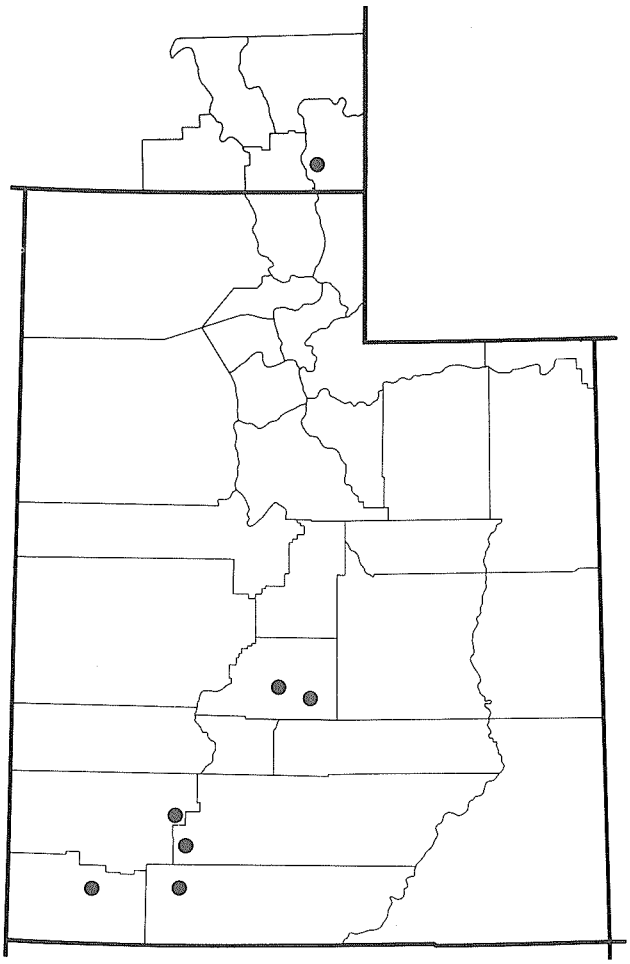
Vegetation—*Betula occidentalis* dominates a low tree overstory with *Alnus incana* and various *Salix* spp. occasionally present in varying amounts. Coniferous and deciduous trees were present in minor amounts in some stands of this type. Forbs dominate the undergrowth and include *Smilacina stellata, Heracleum lanatum, Aconitum columbianum, Equisetum arvense,* and *Geranium richardsonii;* numerous other forbs may also occur. *Poa pratensis, Agrostis stolonifera, Elymus glaucus,* and/or *Carex microptera* are typically present in varying amounts. Shrubs are common, though the undergrowth is more open than the **Betula occidentalis/Cornus sericea c.t.** *Rosa* spp., *Ribes aureum,* and *Lonicera involucrata* are among those likely to occur.

Soils—A majority of the soils formed in alluvium and were classified as Cryoborolls, Haploborolls, and Xerofluvents. Soil particle-size classes were variable, though most were coarse-textured and/or had more than 35 percent coarse fragments in the subsurface horizons. Water tables were usually below the soil pit depth, often limited by the amount of coarse fragments in the subsurface horizons. Mottles were common, however, within 50 cm (20 in) of the soil surface, indicating a seasonally high water table.

Succession and Management—The **BEOC/MF c.t.** differs from the **Betula occidentalis/Cornus sericea c.t.** in its lack of the dense layer of *Cornus sericea.* The undergrowth is more open and may indicate areas in which *Cornus sericea* never had the opportunity to become established. The presence of *Pinus ponderosa, Picea engelmannii,* and *Populus tremuloides,* among others, indicates a possible successional trend toward coniferous tree-dominated communities. Because of the open undergrowth, livestock grazing is more likely in this type than in the **Betula occidentalis/Cornus sericea c.t.**; this often results in a greater impact to streambanks. In addition, the lack of the rooting structure of *Cornus* in the **BEOC/MF c.t.** also results in lower levels of streambank stabilization. This type provides structural diversity for nesting and perching of birds and provides stream shading.

Other Studies—The **BEOC/MF c.t.** has not been previously described.

Betula occidentalis/Poa pratensis c.t. (BETOCC/POPR; BEOC/POPR)



Distribution—The **BEOC/POPR c.t.** (fig. 8) is a major type occurring predominantly in the south-central Utah Plateaus Floristic Section, including the Pine Valley and Bull Valley Mountains of southwestern Utah. It was also sampled on the Bear River Range of the northern Wasatch Mountains Floristic Section. Elevations range from 1 830 to 2 380 m (6,000 to 7,800 ft). Slopes on most sites are 3 percent or less. Surface topography is commonly undulating. Adjacent upland communities included those dominated by *Pinus ponderosa, Pinus edulis* (with *Juniperus osteosperma* and/or *J. scopulorum*), and/or *Quercus gambelii.*

Vegetation—*Betula occidentalis* dominates a low tree overstory with *Salix boothii, S. lasiolepis,* and/or *S. bebbiana* occasionally present as minor to codominant associates. *Alnus incana,* when present, is clearly subordinate. *Juniperus scopulorum* was present in several sampled stands. Shrubs are common and *Rosa woodsii, Lonicera involucrata, Ribes aureum,* and *R. inerme* are among those likely to occur. The open undergrowth is commonly dominated by *Poa pratensis. Glyceria striata, Agrostis stolonifera, Juncus balticus, Carex lanuginosa, C. rostrata,* and/or *C. nebrascensis* are likely to be present in varying amounts. Tall forbs are inconspicuous, while low-growing species such as *Trifolium* spp. and *Taraxacum officinale* may have very high cover. Other weedy species such as *Cirsium arvense* may also be conspicuous.

Soils—Soil development was highly variable, though all were alluvial. Soils were classified as Aquic and Mollic Xerofluvents, Cumulic Cryaquolls, and Aquic and Cumulic Haploborolls. Most particle-size classes were coarse-textured and/or had more than 35 percent coarse fragments in at least the subsurface horizons. Estimated available water-holding capacity ranged from low to high. Depth to water table was usually below the depth of the soil pit but was measured as high as 17 cm (7 in) below the surface.

Succession and Management—The **BEOC/POPR c.t.** differs from the **Betula occidentalis/Mesic forb (BEOC/MF) c.t.** in its lack of dense forb cover. The undergrowth is more open and indicates heavy levels of past grazing intensities, and in most situations we consider **BEOC/POPR** a grazing-induced sere of the **BEOC/MF.** Because of the open structure of the community, livestock are more likely to graze and seek shade in this type than the **Betula occidentalis/Cornus sericea c.t.** The result is a risk to streambank stability because of the effects of trampling. Structural diversity in the **BEOC/POPR c.t.** is less than any of the other **Betula occidentalis c.t.s**, though it is still capable of providing shade for adjacent stream channels.

Other Studies—The **BEOC/POPR c.t.** has not been previously described.

Miscellaneous Unclassified Low Deciduous Tree-Dominated Communities

One community with an overstory dominated by *Alnus incana* had an undergrowth uncharacteristic of other **Alnus incana c.t.s**. *Carex rostrata, Poa palustris,* and *Glyceria striata* dominated a dense graminoid layer in an area that had been a very old beaver pond. Following siltation the *Alnus* had remained, and undergrowths have likely evolved slowly from an unvegetated situation to one dominated by *Carex rostrata* and *Glyceria striata;* it currently is being succeeded by *Poa palustris.* This situation, while not common, may occur elsewhere in the study area.

Figure 8.—**Betula occidentalis/Poa pratensis c.t.** along St. Charles Creek west of St. Charles, Idaho (1 940 m, 6,360 ft). *Betula occidentalis* and *Salix bebbiana* dominate the low tree-tall shrub overstory. *Poa pratensis, Agrostis stolonifera,* and *Juncus balticus* are the dominant graminoids. *Taraxacum officinale, Medicago lupulina, Achillea millefolium,* and *Trifolium repens* are abundant forbs.

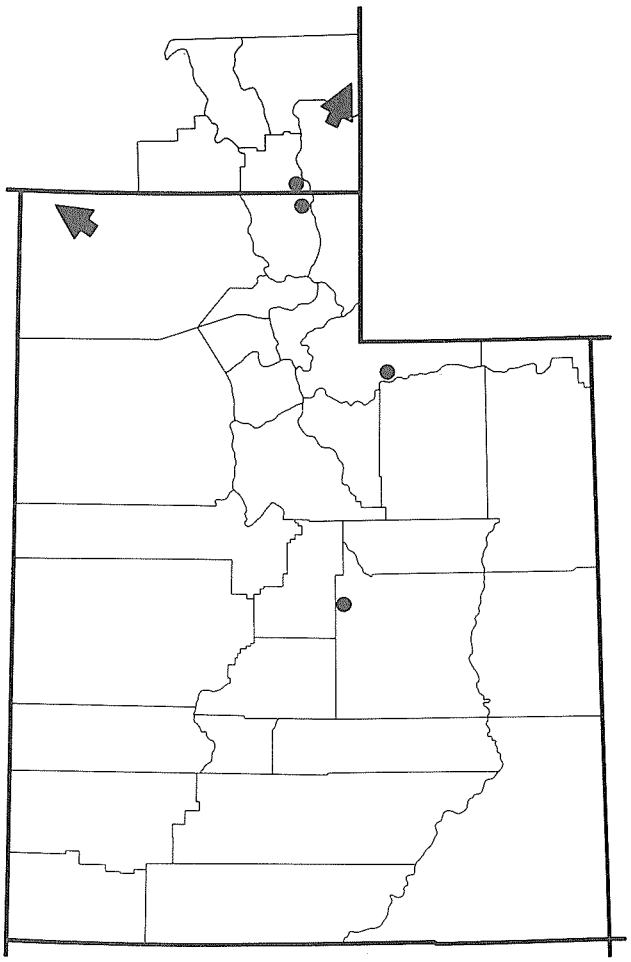
Salix boothii-Dominated Community Types

The **Salix boothii community types** occur throughout the study area with only limited distribution in the Canyonlands Floristic Section. Our concept of this group has changed somewhat from that of Youngblood and others (1985a). Overstory dominance may include cover of *Salix boothii, S. drummondiana,* and/or *S. monticola. Salix monticola* appears structurally and vegetatively similar to *S. boothii* and was so seldom encountered that communities dominated by this species are included in this group. In addition, our concept of this dominance group now includes communities in which *Salix geyeriana* may be present in significant amounts. In the eastern Idaho, western Wyoming classification of Youngblood and others (1985a), any community with at least 25 percent cover of *Salix geyeriana* was placed in the dominance group of that name. We now feel, however, that there are significant structural differences when cover of *Salix boothii* is 25 percent or more. **Salix geyeriana c.t.s** typically have an open corridor aspect, while **Salix boothii c.t.s** are more often closed and less easily accessible by large ungulates. We have otherwise maintained those concepts for the undergrowth component, as described by Youngblood and others (1985a) with the following exceptions. We have separated communities that would be described by their **Salix boothii/Carex rostrata c.t.** into two distinct types—the **Salix boothii/Carex aquatilis** and the **Salix boothii/Carex rostrata c.t.s.** Additional sampling has shown different site characteristics as well as differences in palatability of undergrowth dominants.

Communities previously described as the **Salix boothii/Smilacina stellata c.t.** are essentially identical to our **Salix boothii/Mesic forb c.t.** We have chosen the latter name to de-emphasize the importance of any one undergrowth dominant and to more generally describe undergrowth characteristics. With additional sampling, some environmental differences among communities with different forb undergrowths may become evident, and new types could be defined. While we do not have sufficient data to separate these now, undergrowths dominated by Tall *Mertensia* spp., *Smilacina stellata,* or *Heracleum lanatum* may eventually describe different c.t.s.

Blakesley (1987) noted that the calliope hummingbird, broad-tailed hummingbird, willow flycatcher, MacGillivray's warbler, black-headed grosbeak, evening grosbeak, and dark-eyed junco were closely associated with willow-dominated community types in the vicinity of Logan Canyon in northern Utah. Our **Salix boothii/Carex rostrata, Salix boothii/Equisetum arvensis,** and **Salix boothii/Mesic Forb c.t.s** were among the types with which these bird species were associated.

Salix boothii/Carex aquatilis c.t. (SALBOO/CARAQU; SABO/CAAQ)



Distribution—SABO/CAAQ is a minor type that occurs in the Wasatch Mountains Floristic Section, the Utah Plateaus Floristic Section, and the northwest slope of the Uinta Mountains. It was sampled between elevations of 2 255 and 2 685 m (7,400 and 8,800 ft) with lower elevation communities typically in the northern latitudes. **SABO/CAAQ** occurs on seeps and on stream terraces with continually high water tables. Valley bottoms are moderate to broad with uplands vegetated by *Abies lasiocarpa, Picea engelmannii, Pinus contorta,* and/or *Populus tremuloides.* Adjacent riparian communities include those belonging to the **Salix wolfii/Carex aquatilis, Carex aquatilis,** and **Carex rostrata c.t.s.**

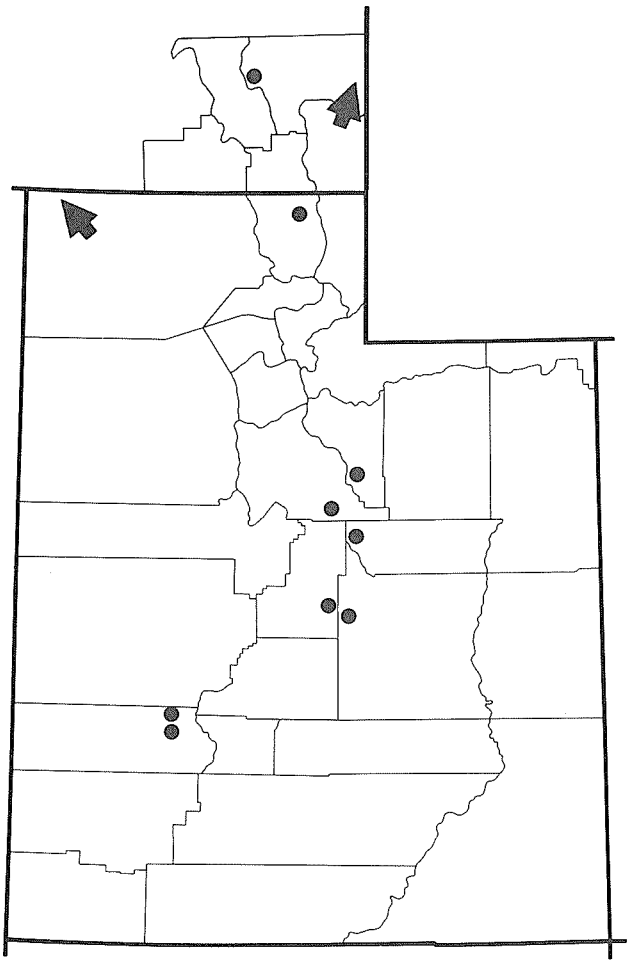
Vegetation—*Salix boothii, S. drummondiana,* and/or *S. monticola* (Wasatch Plateau) may dominate the tall willow layer. *Salix geyeriana* may also be present, while *S. wolfii* may occasionally form a dense, low shrub layer. *Lonicera involucrata, Betula glandulosa,* or *Ribes inerme,* may also be present. The undergrowth is characterized by an herbaceous layer of *Carex aquatilis* and/or *Caltha leptosepala.* Moss is usually abundant. *Deschampsia cespitosa* and *Carex rostrata* are often present in minor amounts, while additional forbs may include *Geranium richardsonii, Polemonium caeruleum, Saxifraga odontoloma,* and/or *Geum macrophyllym.*

Soils—Organic and/or wet soils are characteristic of this c.t. Many soils were classified as Histosols (Fibrists, Hemists, and Saprists). Mineral soils had organic surface horizons or thickened mollic epipedons. Soils were typically saturated at or near the surface with a mean depth to water table of 9 cm (4 in). Particle-size classes for mineral soils included fine, clayey-skeletal, and fine-loamy. Estimated available water-holding capacity was high.

Succession and Management—Communities belonging to the **SABO/CAAQ c.t.** appear to develop differently than those of the **Salix boothii/Carex rostrata c.t.** with which these communities were previously included. **SABO/CAAQ** appears to develop on habitats where soils are perpetually wet through subirrigation (seepy soils) and where soil temperatures remain cool throughout the growing season. In contrast, communities belonging to the **Salix boothii/Carex rostrata c.t.** appear to develop on ponded sites, such as areas behind beaver dams (**Salix boothii/Carex rostrata c.t., Succession and Management,** p. 57), rather than subirrigated, seepy sites, and tend to have less build-up of organic material. Communities belonging to the **SABO/CAAQ c.t.** appear, for the most part, to be stable because of the wet, organic nature of the soils.

Other Studies—Communities belonging to our **SABO/CAAQ c.t.** were included in the **Salix boothii/Carex rostrata c.t.** described for eastern Idaho and western Wyoming (Youngblood and others 1985a) and for northern Utah (Youngblood and others 1985b). Other authors, including Norton and others (1981), Tuhy and Jensen (1982), Mutz and Graham (1982), and Mutz and Queiroz (1983), have described c.t.s in Idaho and western Wyoming similar to ours.

Salix boothii/Carex rostrata c.t. (SALBOO/CARROS; SABO/CARO)



Distribution—SABO/CARO c.t. (fig. 9) is a major type on the Wasatch Plateau of the Utah Plateaus Floristic Section and in the Wasatch Mountains Floristic Section. It occurs over a broad elevational range and was sampled between 1 890 and 2 805 m (6,200 and 9,200 ft). It appears restricted to wet streambanks, terraces, and ponded areas behind beaver dams that are beginning to silt in. Slopes range from 1 to 3 percent, and surface topography is smooth to undulating. Valley bottoms are generally moderate to broad with uplands dominated by *Abies lasiocarpa, Picea engelmannii, Populus tremuloides, Pinus flexilis, Quercus gambelii,* or *Artemisia tridentata* ssp. *vaseyana.*

Vegetation—The tall willow layer in this community type is dominated by *Salix boothii. Salix drummondiana* or *S. geyeriana* are occasionally codominants. The undergrowth is characterized by a dense graminoid layer of *Carex rostrata* and/or *Glyceria striata;* others likely to occur include *Carex aquatilis, C. lanuginosa,* and *C. nebrascensis,* usually with less than 20 percent cover. In addition, *Calamagrostis canadensis, C. stricta, Poa palustris,* or *Deschampsia cespitosa* may also be present in varying amounts. Forb cover is generally sparse and may include *Mentha arvensis, Veronica americana,* and *Equisetum arvense.*

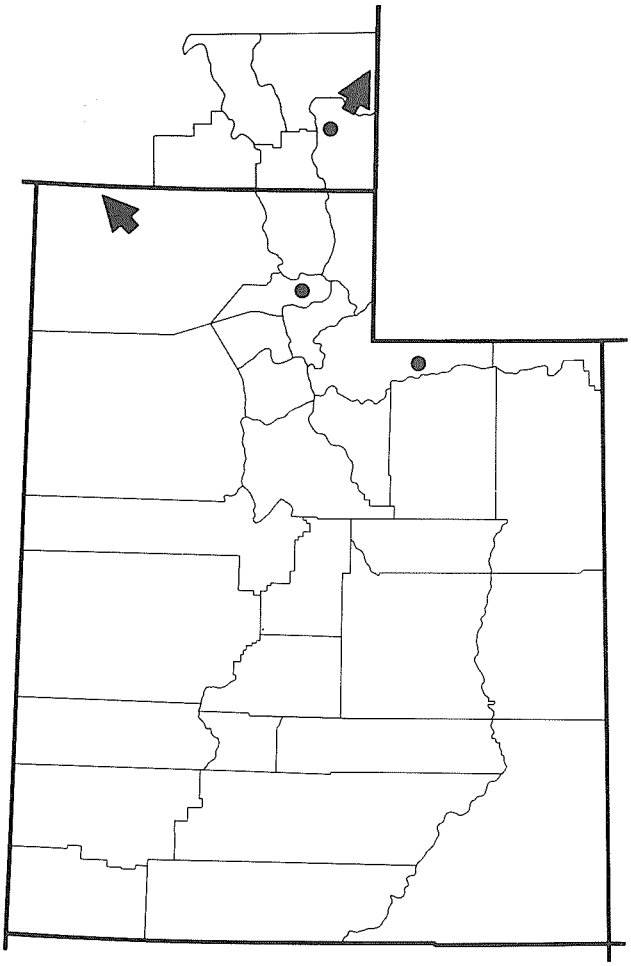
Soils—Soils appear to have developed, for the most part, through the accumulation of fine materials on ponded or previously ponded sites. Nearly all soils were classified as Cumulic and Histic Cryaquolls with only one Humic Cryaquept sampled. Organic horizons, when present, were shallow. Compare this to the typically organic soils of the **Salix boothii/Carex aquatilis c.t.** described above (p. 56). Soil particle-size classes were usually fine-loamy or fine at least in the surface horizons. Estimated available water-holding capacity ranged from moderate to high. Mean depth to water table was 29 cm (11 in) and ranged from the surface to over 80 cm (32 in) in depth.

Succession and Management—The **SABO/CARO c.t.** is a common type to occur following beaver pond siltation (**Soils** above). One theory on the development of this c.t. is that, prior to the establishment of the beaver pond, a *Salix boothii*-dominated community exists. Following the establishment of a beaver dam, the area becomes flooded, and most undergrowth is eliminated; *Salix boothii* is able to maintain itself, though sometimes only under stress. *Carex rostrata* and/or *Glyceria striata,* capable of growing under permanently or prolonged ponding, will colonize these sites and, as further siltation occurs, become strongly established. Eventually, as the site becomes drier through increased siltation or stream channel realignment, *Carex rostrata, Glyceria striata,* and *Salix boothii* will become more robust. Through continued drying the undergrowth will eventually be replaced by less hydrophyllic species. The presence of dead conifers in some plots, presumably killed by increased water tables, confirms this theory at least in part. Other pathways may also be possible but have not yet been explored. The wet nature of the soils of this c.t. make it highly susceptible to trampling and compaction by livestock and heavy machinery. Rarely, however, were livestock noted in this type.

Other Studies—A more broadly defined **SABO/CARO c.t.** that includes our **Salix boothii/Carex aquatilis c.t.** has been defined for eastern Idaho and western Wyoming by Youngblood and others (1985a) and for northern Utah by Youngblood and others (1985b). Others authors (Norton and others 1981; Mutz and Graham 1982; Mutz and Queiroz 1983) have described similar **SABO/CARO c.t.** for eastern Idaho and western Wyoming, while Tuhy and Jensen (1982) described a more broadly defined **Salix/Carex rostrata c.t.** for central Idaho.

Figure 9.—**Salix boothii/Carex rostrata c.t.** above Joe's Valley Reservoir west of Castle Dale, Utah (2 270 m, 7,440 ft). *Salix boothii* forms an open shrub overstory while *Carex rostrata* forms a dense graminoid mat. *Juncus balticus, Carex nebrascensis,* and *Equisetum arvense* are minor herbaceous components.

Salix boothii/Calamagrostis canadensis c.t. (SALBOO/CALCAN; SABO/CACA)



Distribution—This minor c.t. occurs in the northwestern Uinta Mountains, becoming rare in the Wasatch Mountains Floristic Section. It was not sampled elsewhere in the study area. The **SABO/CACA c.t.** occurs above 2 745 m (9,000 ft) in the Uinta Mountains but is below 2 135 m (7,000 ft) in the Wasatch and Bear River Ranges. It is in moderate to broad valley bottoms adjacent to stream channels, typically with slightly undulating surface topography and slopes of 1 to 3 percent. Adjacent uplands are dominated by *Pinus contorta, Populus tremuloides,* or *Picea engelmannii.*

Vegetation—*Salix boothii* and/or *S. drummondiana* dominate the overstory. *Salix geyeriana* is occasionally a codominant. Low shrubs such as *Lonicera involucrata* and *Ribes inerme* are commonly present, especially near the bases of the willows. The undergrowth is characterized by a dense graminoid layer dominated by *Calamagrostis canadensis.* Other graminoid species, while commonly present, usually have low cover. Total forb cover in this c.t. is highly variable (from less than 25 to over 80 percent) and may include *Smilacina stellata, Thalictrum fendleri, Mertensia ciliata, Geum macrophyllum,* as well as several others.

Soils—Soils sampled in this c.t. include Aquic and Pachic Cryoborolls and Typic and Cumulic Cryaquolls. All subsurface horizons sampled had more than 35 percent coarse fragments. Water tables ranged from near the surface to more than 60 cm (24 in) and estimated water-holding capacity ranged from low to high.

Succession and Management—Overstory cover in this c.t. is typically very dense, though in many cases it does not impede livestock movement. In the Uinta Mountains there were signs of moose utilization in this type for cover and browse. **SABO/CACA** is ecologically similar to some communities belonging to the **Salix boothii/Mesic Forb c.t.** (p. 60); they may occur on similar sites and include many of the same herbaceous species.

Other Studies—Youngblood and others (1985a) described a **SABO/CACA c.t.** in eastern Idaho and western Wyoming that is very similar to ours. Mutz and Queiroz (1983) noted the occurrence of a similar type in the Centennial Mountains of eastern Idaho. Tuhy and Jensen (1982) described a broader **Salix/CACA c.t.** for central Idaho.

Salix boothii/Carex nebrascensis c.t. (SALBOO/CARNEB; SABO/CANE)

Distribution—**SABO/CANE** is an incidental type sampled only along the East Fork Sevier River drainage of southern Utah (Utah Plateaus Floristic Section) and on the Malad Range east of Malad City in southern Idaho (Wasatch Mountains Floristic Section). This is a minor c.t. in the Centennial Mountains of eastern Idaho (Youngblood and others 1985a).

Vegetation—*Salix boothii* dominates the overstory in this c.t. and is characterized by a dense graminoid layer of *Carex nebrascensis.* Other graminoid species noted in these communities include *Glyceria striata, Carex rostrata, Carex simulata,* and *Juncus balticus.* Forbs include *Mentha arvensis, Veronica americana,* and *Polemonium caeruleum.*

Soils—Soils were classified as Histic Cryaquoll and Lithic Borosaprist. High water tables and organic matter build-up were noted in both communities sampled.

Succession and Management—Communities belonging to this c.t. are similar in many respects to the **Salix exigua/Mesic graminoid c.t.** of the High Plateaus of central and southern Utah. It is not clear why there is not more of the **SABO/CANE c.t.** in the study area, since both overstory and undergrowth dominants are common.

It may be more prominent at lower elevations outside Forest Service boundaries. There may be some relationship to the relatively high palatability of *Carex nebrascensis* which may have resulted in past heavy use of communities belonging to this type and a subsequent elimination of *Salix boothii* and/or *Carex nebrascensis* from areas where it once occurred in greater abundance.

Other Studies—Youngblood and others (1985a) described the **SABO/CANE c.t.** for the Centennial Mountains of eastern Idaho.

Salix boothii/Equisetum arvense c.t. (SALBOO/EQUARV; SABO/EQAR)

Distribution—This incidental type was sampled only on the southern Bear River Range east of Logan and on the southwest slope of the Uinta Mountains north of Duchesne. It is a major type in western Wyoming on the Greys River drainage and in the Centennial Mountains of eastern Idaho (Youngblood and others 1985a). It was sampled between 1 830 and 2 380 m (6,000 and 7,800 ft).

Vegetation—*Salix boothii* dominates the overstory with a dense, nearly continuous undergrowth of *Equisetum arvense. Poa palustris, Carex lanuginosa,* and *Carex rostrata* may be present in varying amounts.

Soils—Soils were classified as Typic Cryaquolls and Pachic Cryoborolls with water tables seasonally near the surface. Particle-size classes were fine-loamy, coarse-loamy, and loamy-skeletal.

Succession and Management—In one community sampled, *Picea pungens* was becoming a dominant overstory species indicating a possible successional trend toward our **Conifer/Equisetum arvense c.t.** Although data is limited, physical impacts may be similar to those for the **Conifer/Equisetum arvense c.t.**

Other Studies—The **SABO/EQAR c.t.** was previously described by Youngblood and others (1985a) for eastern Idaho and western Wyoming.

Salix boothii/Poa palustris c.t. (SALBOO/POAPAL; SABO/POPA)

Distribution—This incidental type was sampled only in the southern Wasatch Mountains at 2 320 m (7,600 ft). It occurred on an alluvial terrace below Currant Creek Dam immediately adjacent to the stream channel. **SABO/POPA** was considered a minor type in the Caribou Range of eastern Idaho.

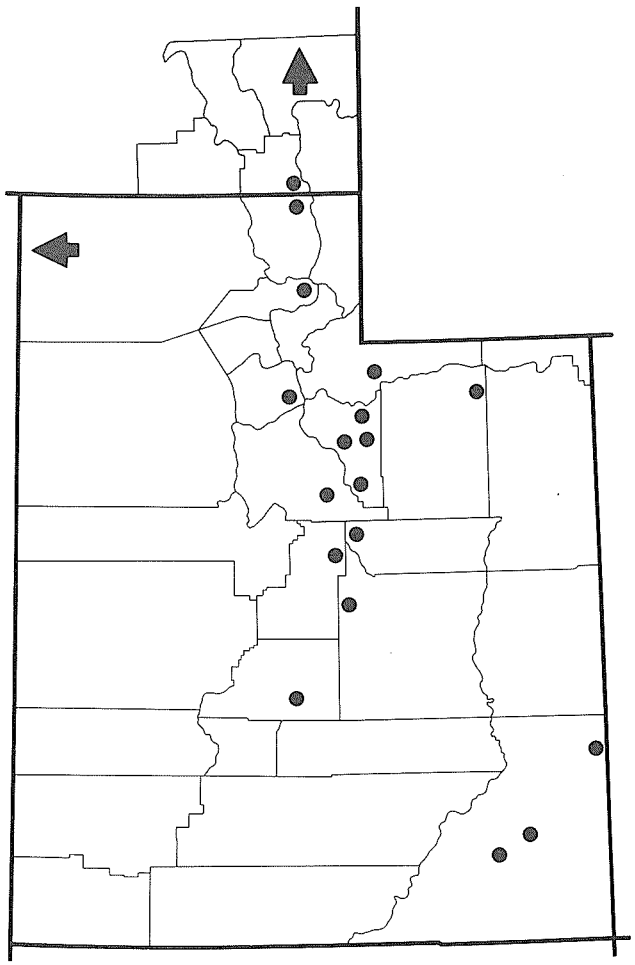
Vegetation—*Salix boothii* dominated a dense overstory layer; *Poa palustris* was the dominant undergrowth graminoid. *Carex rostrata* was present in minor amounts, while *Smilacina stellata* was a codominant. Other species present included *Cirsium arvense, Mertensia ciliata,* and *Aster foliaceus.*

Soils—The soil was classified as a Typic Cryaquoll, intergrading to an Aquic Cryoboroll. Surface soil textures were silty clay loams and sandy clay loams that were deposited over sandy-skeletal particle-size classes. Soils were saturated late in the growing season at 65 cm (26 in).

Succession and Management—Although data is limited, the similarities between these communities and those belonging to the **Salix boothii/Mesic Forb c.t.** suggest they will respond similarly to disturbance.

Other Studies—Youngblood and others (1985a) described a similar **SABO/POPA c.t.** for eastern Idaho.

Salix boothii/Mesic Forb c.t. (SALBOO/MF; SABO/MF)



Distribution—This major c.t. is one of the most common **Salix boothii c.t.s** in the study area. It occurs in all floristic sections and over a broad range of elevations between 1 615 and 3 140 m (5,300 and 10,300 ft) with most communities between 2 440 and 3 050 m (8,000 and 10,000 ft). Communities belonging to the **SABO/MF c.t.** occupy a variety of positions on the landscape, including stream benches, meadows, and seeps; they occur in narrow to broad valley bottoms. Adjacent upland communities are dominated by species representative of the range in elevation on which this c.t occurs. *Abies lasiocarpa, Picea engelmannii, Populus tremuloides,* and *Artemisia tridentata* ssp. *vaseyana* are among the upland dominants. Adjacent riparian communities include a similar range of dominant species.

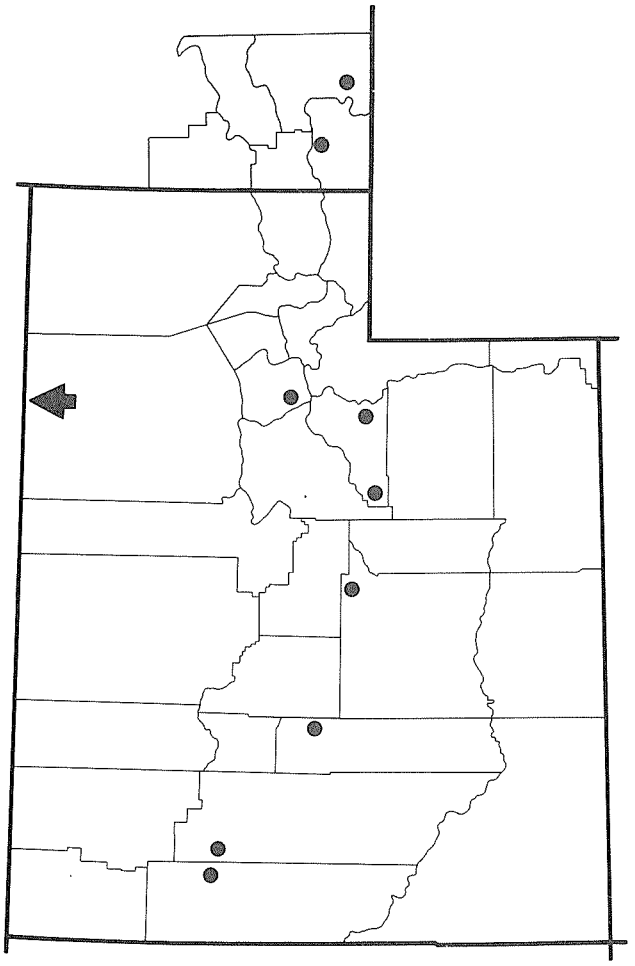
Vegetation—*Salix boothii* and/or *S. drummondiana* dominate or codominate the overstory of the c.t. *Salix geyeriana* may codominate with one or both of the above species. A low shrub layer of *Lonicera involucrata* and/or *Ribes inerme* is common. The undergrowth is characterized by a dense layer of forbs such as *Heracleum lanatum,* Tall *Mertensia* spp. (*Mertensia ciliata* in the LaSal, Uinta, and Wasatch Mountains; *Mertensia franciscana* and *M. arizonica* on the High Plateaus and Abajo Mountains), *Smilacina stellata, Hydrophyllum fendleri,* and *Aconitum columbianum. Thalictrum fendleri, Urtica dioica,* and *Rudbeckia occidentalis* may be locally abundant. Additional forbs common in this type, but with typically low percent cover, include *Fragaria virginiana, Geranium richardsonii,* and *Polemonium caeruleum.* Graminoid cover is highly variable though typically less than 10 to 20 percent; it is typically more abundant in the open interspaces between shrubs. *Carex microptera* and *Poa pratensis* have the highest constancy in this type with numerous other graminoids present in minor amounts.

Soils—Many soils were classified as Aquic, Cumulic, and Pachic Cryoborolls and as Histic, Cumulic and Typic Cryaquolls indicating moist, if not wet, environments with a continual incorporation of organic materials into the soil. Additional soils included those classified as Cryaquepts, Cryochrepts, and Haploborolls. Water tables were highly variable, but most soils had mottles within 50 cm (20 in) of the soil surface, indicating a seasonally high water table. Estimated available water-holding capacity was typically moderate, but ranged from low to high. Soil particle-size classes were highly variable.

Succession and Management—The mesic conditions associated with the **SABO/MF c.t.** appear optimal for the growth of *Salix boothii* and *S. drummondiana.* These species do not appear to grow well where the soils are permanently saturated throughout (as in **Salix boothii/Carex rostrata** and **Salix boothii/Carex aquatilis c.t.s**) or where they are dry through most of the growing season (as in some communities belonging to the **Salix boothii/Poa pratensis c.t.**). Other willows, such as *Salix planifolia,* appear better adapted to permanently saturated conditions. Some communities belonging to the **SABO/MF c.t.** are similar to those of the **Salix boothii/Calamagrostis canadensis c.t.** Herbaceous undergrowths may be similar but lack the dense graminoid layer described for the latter type. While the distribution of *Calamagrostis canadensis* as an undergrowth dominant is restricted in the study area to the Uinta Mountains and Wasatch Mountains Floristic Sections, the various forbs that dominate the undergrowth occur throughout the study area. This is, perhaps, the most common of all willow community types in the study area. Through excessive grazing levels, this type is likely to be replaced by the **Salix boothii/Poa pratensis c.t.** which often has remnant forbs indicative of the **SABO/MF c.t.** growing in the protection of the shrub bases.

Other Studies—Youngblood and others (1985a, 1985b) described a similar **Salix boothii/Smilacina stellata c.t.** for eastern Idaho and western Wyoming, and for northern Utah, respectively. Our treatment, while being similar, includes communities in which *Salix geyeriana* codominates and chooses not to emphasize any particular species in the undergrowth but rather the concept of a dense mesic forb layer. Similar c.t.s with different names have been described by Norton and others (1981) for western Wyoming and by Mutz and Queiroz (1983) for eastern Idaho.

Salix boothii/Mesic Graminoid c.t. (SALBOO/MG; SABO/MG)



Distribution—SABO/MG (fig. 10) is a major type sampled in the Wasatch Mountains, the Uinta Mountains, and the Utah Plateaus Floristic Sections. It occurs predominantly on moist stream terraces and streambanks between elevations of 2 045 and 2 990 m (6,700 and 9,800 ft), with higher elevation communities usually in southern latitudes. Slopes range from 1 to 8 percent, and surface topography is highly variable. Adjacent riparian communities include those belonging to the **Carex rostrata** and **Carex lanuginosa c.t.s** and various **Potentilla fruticosa** and **Salix geyeriana c.t.s.** Upland communities are representative of the broad elevational gradient and latitudinal distribution that this type covers and include those dominated by *Pinus ponderosa, Pinus contorta, Artemisia tridentata* ssp. *vaseyana, Artemisia nova, Abies lasiocarpa,* and *Populus tremuloides.*

Vegetation—This broadly defined c.t. includes communities with overstories dominated by *Salix boothii, S. drummondiana,* and/or *S. monticola. Salix geyeriana* may be a codominant, though rarely was this the case. *Salix lasiandra, S. exigua,* or *S. brachycarpa* may be present in minor amounts. The undergrowth is characterized by sparse or low-growing forb cover and sparse to dense graminoid cover. Graminoids common to this type may include *Carex lanuginosa, C. microptera, Juncus balticus, Glyceria striata, Agrostis stolonifera,* and *Deschampsia cespitosa. Poa pratensis,* when present, is usually a minor component. Also likely to be present in minor amounts, especially when herbaceous cover is sparse, are *Calamagrostis canadensis, Carex rostrata,* and *Poa palustris.* These communities will probably develop into other, previously described types. Forbs may include *Mentha arvensis, Veronica americana, Mimulus guttatus, Ranunculus cymbalaria,* and small *Epilobium* spp.

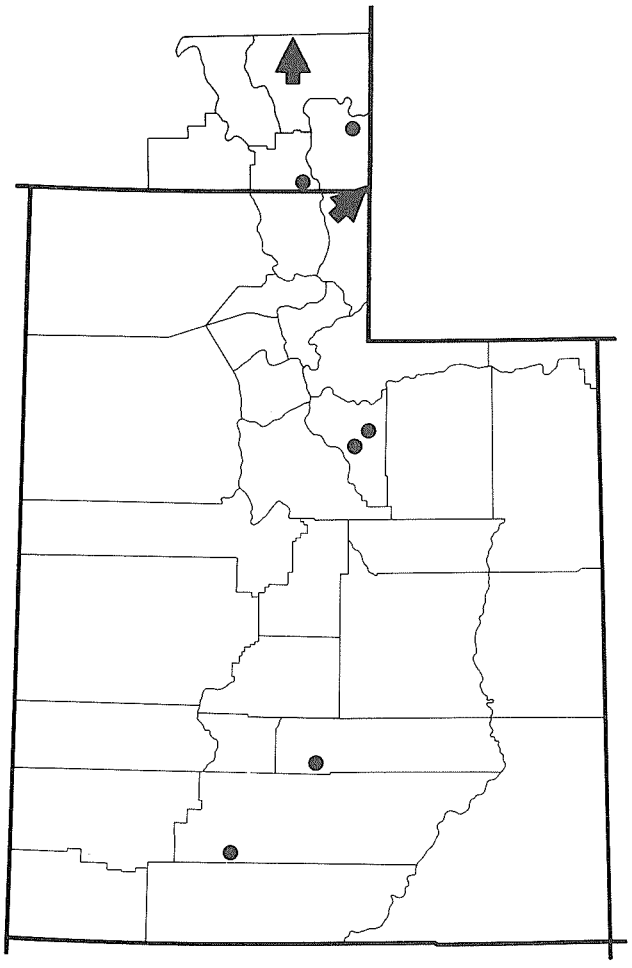
Soils—Most soils have developed from alluvium, and many were classified as Typic, Cumulic, and Histic Cryaquolls and Aquic or Cumulic Cryoborolls. Also sampled were Aquic Cryofluvents and Typic Borosaprists. Family particle-size classes of mineral soils were fine-loamy and sandy-skeletal, and estimated available water-holding capacity was moderate to high. Depth to water table ranged from the surface to 80 cm (31 in) with a mean of 39 cm (15 in).

Figure 10.—**Salix boothii/Mesic Graminoid c.t.** on a seep near Indian Creek east of Spring City, Utah (2 780 m, 9,120 ft). *Salix boothii* and *S. monticola* dominate the tall willow overstory with *S. brachycarpa* a minor low willow component. *Carex lanuginosa* is the dominant graminoid while *Caltha leptosepala* and *Carex rostrata* are minor undergrowth species.

Succession and Management—This type, as noted in **Vegetation** above, is a broadly defined type and includes early- to mid-seral communities. Several sampled communities previously belonged to other c.t.s, such as the **Salix boothii/Calamagrostis canadensis, Salix boothii/Poa pratensis,** or **Salix boothii/Carex rostrata c.t.s.** Because of recent fluvial deposition, however, communities no longer had sufficient undergrowth cover to appropriately be identified as such. These communities may return to previous c.t. status, but they more likely will become drier because alluvial deposition has raised soil surfaces above the original water table level. Other communities sampled represent stable situations where undergrowths are dominated by one or more mesic graminoids such as *Carex lanuginosa* or *Glyceria striata.* Additional sampling may eventually result in the identification of new community types described by these individual undergrowths, but because only one, or at the most a few, communities were sampled from each, they have been grouped into this "Mesic Graminoid" type.

Other Studies—The **SABO/MG c.t.** has not been previously described.

Salix boothii/Poa pratensis c.t. (SALBOO/POAPRA; SABO/POPR)



Distribution—The **SABO/POPR c.t.** (fig. 11) is a major type with widespread distribution in the Wasatch Mountains and the Utah Plateaus Floristic Sections. It was sampled between elevations of 1 940 and 2 995 m (6,360 and 9,820 ft) with most communities occurring below 2 590 m (8,500 ft). **SABO/POPR** commonly occurs on terraces adjacent to order 2 or 3 streams, usually well above stream levels, in moderately broad valley bottoms. Adjacent uplands may be dominated by *Populus tremuloides, Pinus contorta, Artemisia tridentata* ssp. *vaseyana,* or *Artemisia nova,* among others. Adjacent riparian communities include those belonging to the **Artemisia cana/Poa pratensis** and **Populus angustifolia/Cornus sericea c.t.s.**

Vegetation—*Salix boothii* and/or *S. drummondiana* dominate a tall willow overstory. *Salix geyeriana* and *S. lasiandra* may be present or codominant. Low shrubs are common, typically within the basal area of the willows, and may include *Ribes inerme, R. lacustre, Lonicera involucrata,* and *Rosa* spp. The undergrowth is characterized by species representative of disturbance and/or dry surface conditions. *Poa pratensis, Cirsium arvense* (as well as other *Cirsium* spp.), and *Rudbeckia occidentalis* are among those that commonly dominate. Species indicative of the **Salix boothii/Mesic Forb c.t.,** such as *Mertensia ciliata, Smilacina stellata, Heracleum lanatum,* and others are often present but only in minor amounts.

Soils—Most soils in this c.t. developed in alluvium and were classified as Aquic, Pachic, and Cumulic Cryoborolls and Typic Cryaquolls. This indicates relatively stable conditions and an accumulation of organic material into surface and subsurface mineral horizons. Depth to water table ranged from 23 cm (9 in) to over 1 m (39 in) below the surface. Soil particle-size classes were highly variable as was estimated available water-holding capacity.

Succession and Management—The **SABO/POPR c.t.** appears to be a disturbance-induced sere related to the **Salix boothii/Mesic Forb (SABO/MF) c.t.**; similarities in position on the landscape, the soils, and the occurrence of undergrowth species suggest this to be the case. With heavy grazing levels, cover of palatable forbs dominating the **SABO/MF c.t.** is reduced, and less palatable forbs are more abundant. *Poa pratensis,* which tolerates heavy grazing levels, also tends to increase, resulting in a change from the **SABO/MF** to the **SABO/POPR c.t.** In communities with more open overstories, grazing levels are likely to be much higher and, therefore, the impacts to herbaceous vegetation are often greater. Species dominating the **SABO/POPR c.t.** generally are not effective stabilizers of streambanks because of their shallow or sparse rooting systems.

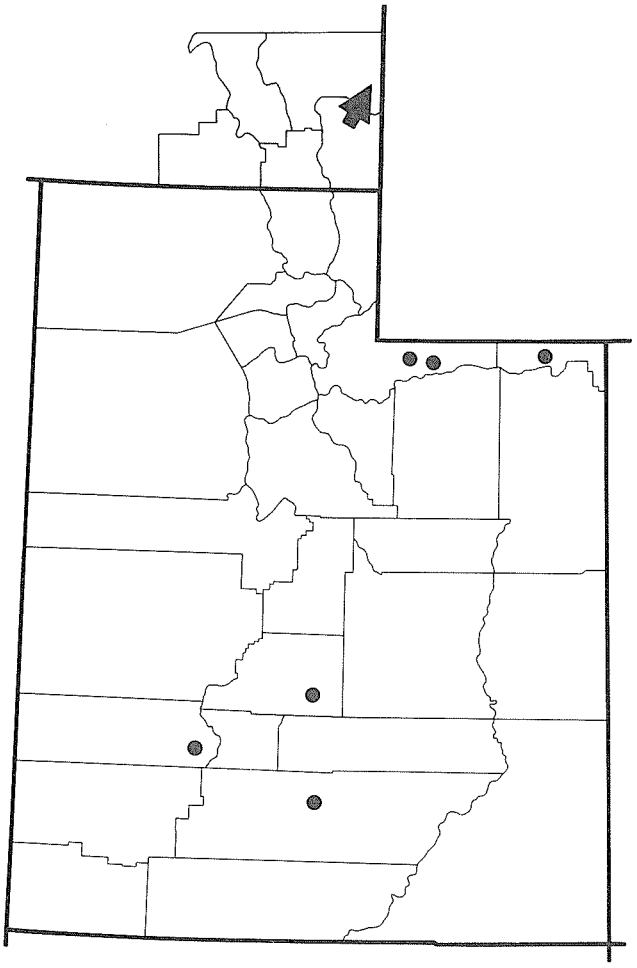
Other Studies—Youngblood and others (1985a) described a similar **SABO/POPR c.t.** for eastern Idaho and western Wyoming. Broader types of this name were described by Norton and others (1981) for the Greys River drainage of western Wyoming and by Mutz and Queiroz (1983) for the Centennial Mountains of eastern Idaho.

Figure 11.—**Salix boothii/Poa pratensis c.t.** near Station Creek southwest of Teasdale, Utah (2 635 m, 8,640 ft). *Salix boothii* and *S. geyeriana* codominate the tall willow overstory while *Ribes inerme* is conspicuous as a low shrub component. *Poa pratensis* is the dominant graminoid with *Agrostis stolonifera* a minor component.

Salix geyeriana-Dominated Community Types

Our concept of the **Salix geyeriana c.t.s** is more narrowly defined than that described by Youngblood and others (1985a). Our types are clearly dominated by *Salix geyeriana,* while cover of other willows is minor. When *Salix geyeriana* grows as the single overstory dominant, there typically exists an open, corridor-like structure between individual willow plants. Undergrowths, when not heavily impacted by grazing, are typically dense which is likely attributable to favorable moisture levels and the amount of light allowed to reach the ground through the open overstory. Communities dominated by *Salix geyeriana* are notably absent from the Canyonlands Floristic Section but occur with varying distribution through the remaining portions of the study area. While able to occupy wet to relatively dry sites, *Salix geyeriana* rarely occurs on sites with water tables deeper than 1 m (39 in). Even the **Salix geyeriana/Poa pratensis c.t.** had a mean water table depth of 67 cm (26 in) as opposed to the **Salix boothii/Poa pratensis c.t.** which often had water tables greater than 1 m. With the exception of the **Salix geyeriana/Mesic Forb c.t.**, nearly all communities in this group occur on fine-textured soils, often belonging to fine-loamy, fine, and clayey-skeletal particle-size classes.

Salix geyeriana/Carex aquatilis c.t. (SALGEY/CARAQU; SAGE/CAAQ)



Distribution—SAGE/CAAQ c.t. (fig. 12) is a major type on the north slope of the Uinta Mountains and also occurs sporadically through the southern Utah Plateaus Floristic Section. It occurs predominantly between elevations of 2 600 and 2 900 m (8,500 and 9,500 ft). **SAGE/CAAQ** occupies seeps and sites in very broad meadows. Adjacent uplands typically have gentle to moderate slopes and are dominated by *Abies lasiocarpa, Picea engelmannii, Pinus contorta,* and/or *Populus tremuloides.* Associated riparian communities include those belonging to **Salix planifolia/Carex aquatilis, Carex aquatilis, Poa pratensis,** and **Artemisia cana/Poa pratensis c.t.s.**

Vegetation—*Salix geyeriana* dominates a typically open overstory. *Salix boothii* and *S. bebbiana* may occasionally be present in minor amounts. Low willows, including *Salix wolfii* and *S. planifolia,* may be locally abundant forming a low shrub layer. In some communities in the Uinta Mountains, heavy browsing by moose has left the willows hedged and low in appearance. The undergrowth is characterized by a dense graminoid layer dominated by *Carex aquatilis. Carex rostrata* may occasionally codominate. Other graminoids such as *Deschampsia cespitosa, Calamagrostis canadensis,* and *Phleum alpinum* are among those likely to occur. Forb cover is generally very low in stature and scattered. *Geum macrophyllum* typically grows on the somewhat higher ground adjacent to the willow bases. Other forbs may include *Thalictrum fendleri, Polemonium caeruleum, Galium trifidum,* and *Caltha leptosepala.*

Soils—Soils have developed on alluvium or in place, and all had an accumulation of organic material at the surface. Soils were classified as Thapto-Histic, Histic and Cumulic Cryaquolls, or as Borosaprists. Water tables were typically within 35 cm (14 in) of the surface, and organic soils were saturated throughout. Particle-size classes for mineral soils were fine-loamy, loamy-skeletal, and fine.

Succession and Management—Communities belonging to the **SAGE/CAAQ c.t.** are a result of the high-elevation, wet habitats where *Carex aquatilis* appears to thrive. The organic buildup in the soils is indicative of these cold, wet environments associated with broad, open valley bottoms typical of the north slope of the Uinta Mountains and found scattered on the Fishlake and Markagunt Plateaus. The widely spaced *Salix geyeriana* allows for easy movement of wildlife and livestock through the communities, though livestock grazing appears to be limited to the dryer extremes of this c.t. In the Uinta Mountains, as previously noted, browsing by moose and other wild ungulates is common, resulting in a strongly hedged shrub layer sometimes similar in physiognomy to low willow-dominated c.t.s. Because soils in this type are often wet to near the surface, they may be strongly impacted by large ungulates or heavy machinery. Compaction of the upper soil profiles reduces infiltration which, in turn, may result in reduced water storage on the site.

Other Studies—Communities belonging to the **SAGE/CAAQ c.t.** were previously included in the more broadly defined **Salix geyeriana/Carex rostrata c.t.** described by Youngblood and others (1985a) for eastern Idaho.

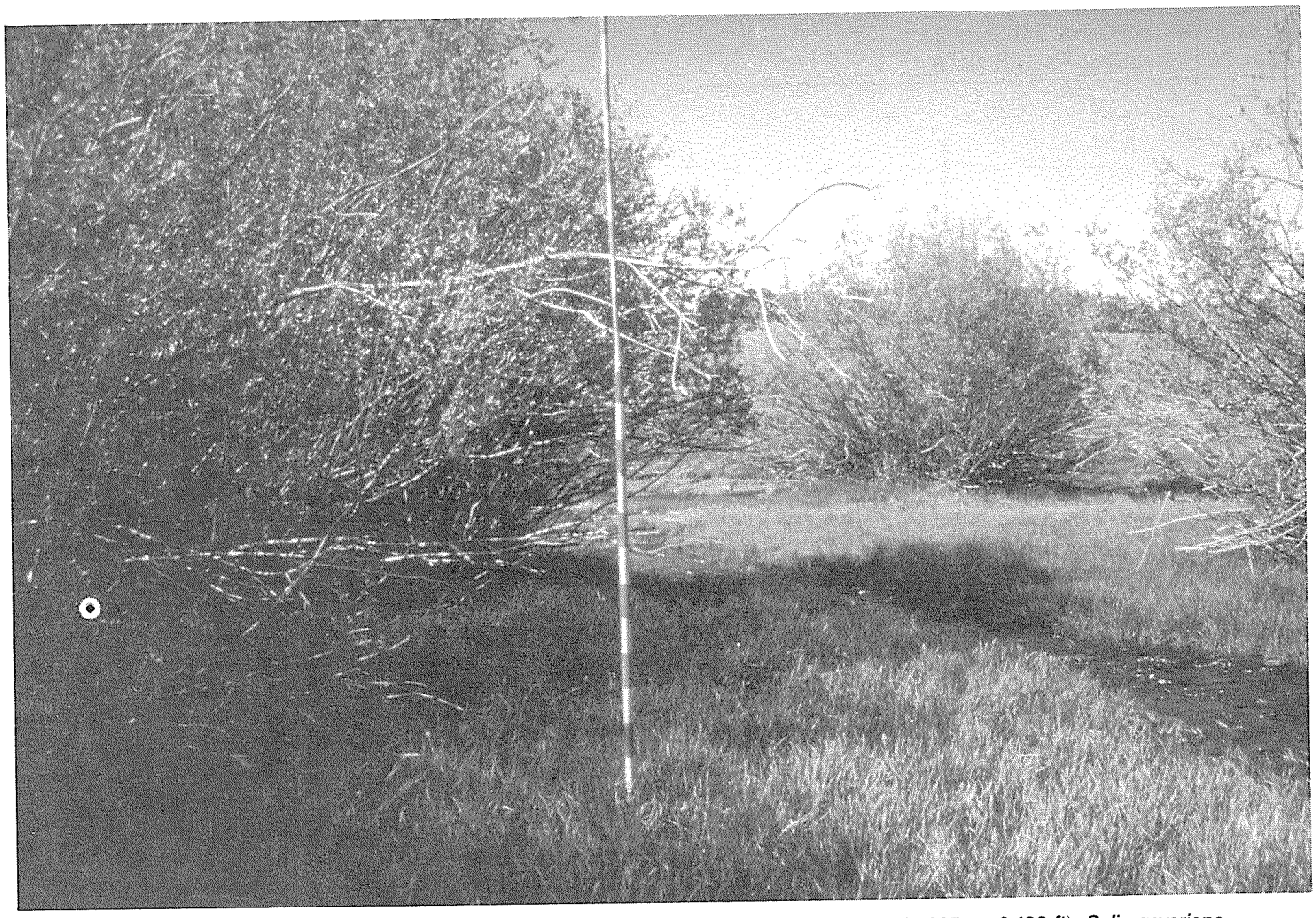
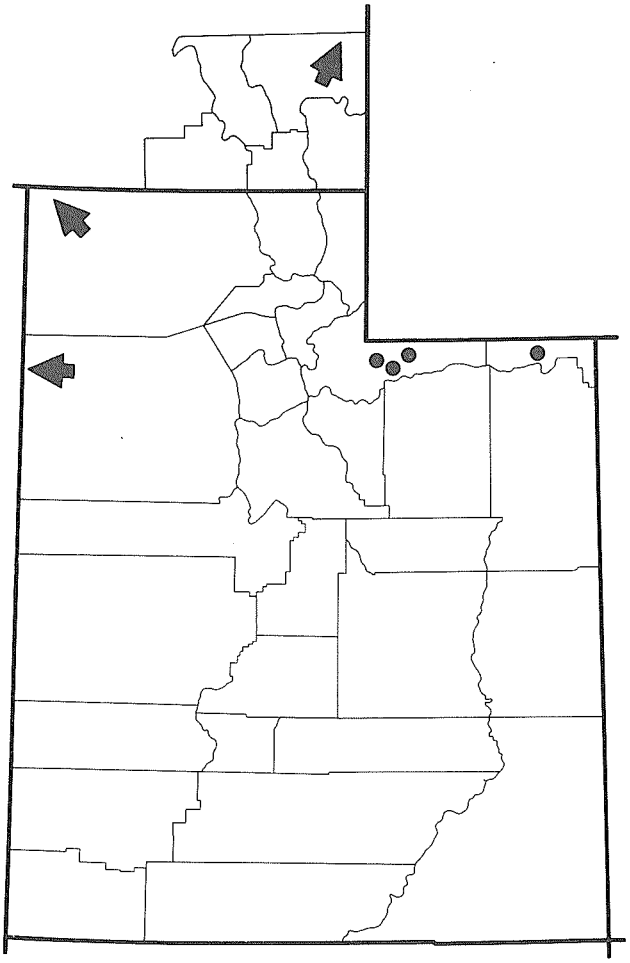


Figure 12.—**Salix geyeriana/Carex aquatilis c.t.** on Right Fork U.M. Creek north of Loa, Utah (2 865 m, 9,400 ft). *Salix geyeriana* dominates the overstory with a typical scattered physiognomy. *Carex aquatilis* is the dominant graminoid; other herbaceous species are minor components.

Salix geyeriana/Carex rostrata c.t. (SALGEY/CARROS; SAGE/CARO)



Distribution—The **SAGE/CARO c.t.** is a major type sampled only on the north slope of the Uinta Mountains. It occurs in meadows and on stream terraces of broad valley bottoms formed by Quaternary glacial morains. Elevations ranged from 2 440 to 2 745 m (8,000 and 9,000 ft) with slopes typically 0 to 1 percent. Surface microtopography is usually hummocky as a result of the irregular buildup of organic material. Adjacent uplands typically have moderate slopes and are dominated by *Populus tremuloides, Picea engelmannii, Pinus contorta,* or *Artemisia tridentata* ssp. *vaseyana.* Adjacent riparian communities may include those belonging to **Salix planifolia/Carex aquatilis, Salix geyeriana/Deschampsia cespitosa, Deschampsia cespitosa,** and **Carex rostrata c.t.s.**

Vegetation—*Salix geyeriana* dominates the tall shrub layer. Other tall willows, such as *Salix boothii* or *S. drummondiana,* are often present in minor amounts. Low shrubs such as *Salix planifolia* and *Betula glandulosa* may be locally abundant. *Carex aquatilis* and *Calamagrostis canadensis* are commonly present in varying amounts, but the dense undergrowth is clearly dominated by *Carex rostrata.* Species diversity is typically poor, and *Geum macrophyllum, Polemonium caeruleum, Calamagrostis stricta,* and *Deschampsia cespitosa* may be present only in trace amounts.

Soils—Organic horizons were common in at least the surface tiers of most soils sampled. Soils were classified as Histic Cryaquepts and Cryaquolls, Terric and Typic Borohemists, while on the "dry" extreme, Pachic Cryoborolls were noted. Organic soils or soils with organic surface horizons were typically saturated throughout. Mineral soils often had mottles at the surface or the top of the mineral horizons, indicating seasonally saturated conditions (Aquic moisture regime).

Succession and Management—Communities belonging to the **SAGE/CARO c.t.** are closely related to the **Salix geyeriana/Carex aquatilis c.t.**; they occur on similar habitats and have similar physiognomy. The only basic difference between these two types may be the result of which species, *Carex rostrata* or *C. aquatilis,* was able to establish itself first. We believe, however, that *Carex rostrata* will pioneer a site that is permanently flooded, such as areas ponded by beaver activity, more easily and earlier than *C. aquatilis* and should, therefore, be separated as a distinct c.t. While grazing is not common in communities belonging to these two c.t.s, *Carex rostrata* and *C. aquatilis* have different palatabilities to livestock and to wild ungulates (*Carex aquatilis* being more palatable) and should be managed differently. The organic soils commonly associated with the **SAGE/CARO c.t.** can be strongly impacted by the use of heavy machinery. Where this c.t. occurs adjacent to stream channels, streambank stability is very good because of the extremely dense nature of roots and rhizomes of *Carex rostrata.*

Other Studies—A broader type that includes our **Salix geyeriana/Carex aquatilis c.t.** was described by Youngblood and others (1985a) for eastern Idaho. Mutz and Queiroz (1983) described similar communities in the Centennial Mountains of eastern Idaho and along the South Fork of the Salmon River in central Idaho. Tuhy and Jensen (1982) included communities similar to those of our **SAGE/CARO** in their even broader **SALIX/CARO c.t.** in central Idaho which included various *Salix* spp. in the overstory.

Salix geyeriana/Poa palustris c.t. (SALGEY/POAPAL; SAGE/POPA)

Distribution—This incidental type was sampled only in the eastern portion of the north slope of the Uinta Mountains. This c.t. occurs at approximately 2 440 m (8,000 ft) in a broad meadow with gentle slopes and

nearly smooth surface topography. It is more common in the Centennial Mountains of northeastern Idaho. Adjacent uplands are dominated by *Pinus contorta,* while adjacent riparian communities may belong to our **Deschampsia cespitosa c.t.**

Vegetation—*Salix geyeriana* dominates the overgrowth in this c.t. with a dense graminoid layer of *Poa palustris. Deschampsia cespitosa* and *Antennaria microphylla* are among other herbaceous species present.

Soils—Soils were deep and fine-textured, belonging to the fine particle-size class. The water table was greater than 1 m (39 in) but was seasonally near the surface as noted by the presence of prominent mottles.

Succession and Management—The community sampled appeared to be early successional with willows less than 1 m (39 in) tall. The area appears highly productive for livestock grazing and has received heavy cattle grazing in the past. This may result in soil compaction, especially since surface soils are very fine-textured. Willows may also be hedged depending on the season of grazing. *Poa palustris* is a naturalized species that, because of its stoloniferous and competitive nature, may have replaced native species such as *Deschampsia cespitosa.* It will likely remain a dominant species for a long period in communities where it has established.

Other Studies—Youngblood and others (1985a) and Mutz and Queiroz (1983) described the **SAGE/POPA c.t.** for the Centennial Mountains of northeastern Idaho.

Salix geyeriana/Calamagrostis canadensis c.t. (SALGEY/CALCAN; SAGE/CACA)

Distribution—**SAGE/CACA** is an incidental type sampled only on the north slope of the Uinta Mountains. It occurs between 2 745 and 3 050 m (9,000 and 10,000 ft). Those communities sampled occurred immediately adjacent to streams in broad valley bottoms. Slopes are 2 percent or less, and surface topography is slightly undulating. Adjacent uplands include those dominated by *Pinus contorta* and/or *Picea engelmannii.* This type, also incidental in eastern Idaho and western Wyoming, occurs more commonly in central Idaho and north central Colorado.

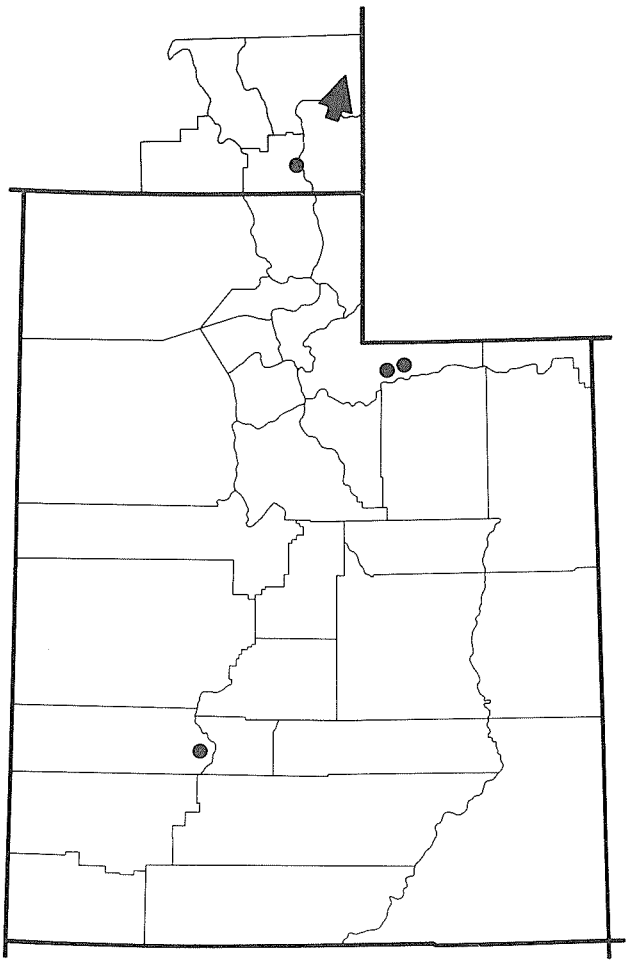
Vegetation—*Salix geyeriana* dominates the overstory with *Salix planifolia* typically present in minor amounts. The undergrowth is characterized by a dense layer of *Calamagrostis canadensis.* A variety of other graminoids may be present with varying cover; *Carex aquatilis, Phleum alpinum,* and *Carex microptera* are among those likely to occur. Forb cover is highly variable and may include *Mertensia ciliata, Ligusticum tenuifolium,* and *Antennaria microphylla.*

Soils—Limited information indicates that these communities occur on sites with seasonally high water tables. Soils are commonly fine-textured. Sampled communities occurred on silty clay loams and sandy clay loams. Subsurface horizons may have more than 35 percent coarse fragments.

Succession and Management—Species composition indicates the **SAGE/CACA c.t.** is very similar to the **Salix geyeriana/Mesic Forb c.t.** The presence of *Pinus contorta* in communities belonging to this type suggests a possible conversion to the **Conifer/Calamagrostis canadensis c.t.**; this is not expected to occur over a short period of time, however, and management should emphasize current species status.

Other Studies—Youngblood and others (1985a) described the **SAGE/CACA c.t.** as an incidental type in the Centennial Mountains of eastern Idaho, while Tuhy and Jensen (1982) described a similar type for central Idaho. Hess and Wasser (1982) described similar communities in north central Colorado.

Salix geyeriana/Mesic Forb c.t. (SALGEY/MF; SAGE/MF)



Distribution—SAGE/MF is a major c.t. in the northeast portion of the Uinta Mountains and is a minor type in the southern Utah Plateaus Floristic Section. It was sampled between 2 625 and 3 050 m (8,600 and 10,000 ft) and typically occurs in meadows and on stream terraces in broad valley bottoms. Slopes are typically 2 percent or less with slightly undulating surface topography. Adjacent uplands are typically dominated by *Pinus contorta, Picea engelmannii, P. pungens,* and/or *Populus tremuloides.*

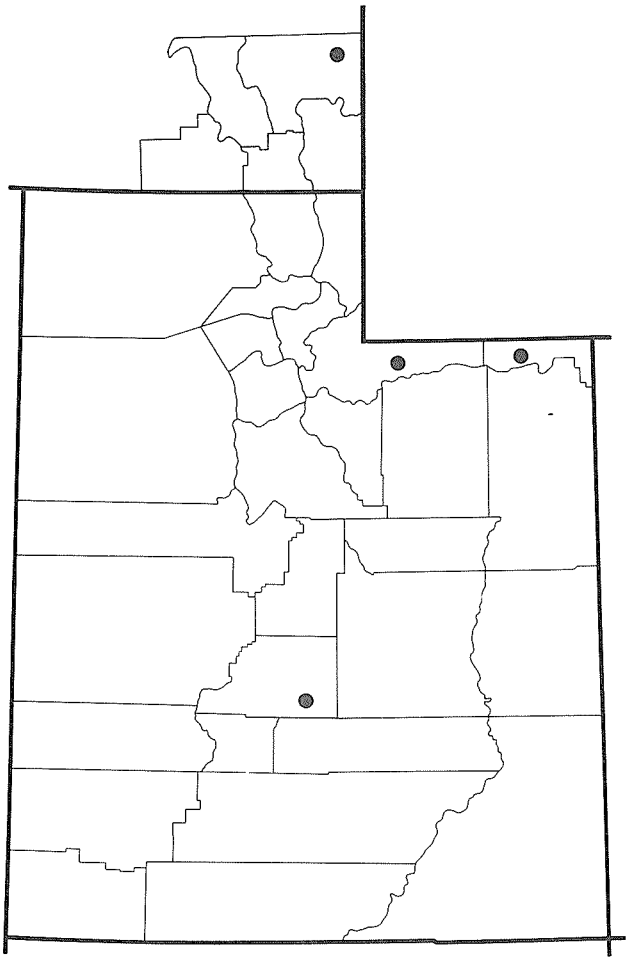
Vegetation—*Salix geyeriana* dominates an open willow overstory with *Salix boothii* occasionally present in minor amounts. Low shrubs such as *Ribes inerme, R. aureum,* or *Rosa* spp. may be present, typically within the basal area of the willows. The undergrowth is characterized by the dominance of Tall *Mertensia* spp. *(Mertensia ciliata* or *M. arizonica)* and/or *Smilacina stellata.* Other graminoids may include *Carex microptera, C. rostrata,* and *Phleum alpinum* though usually in minor amounts. Forbs may include *Fragaria virginiana, Geum macrophyllum,* and *Thalictrum fendleri,* among others.

Soils—Soils were classified predominantly as Aquic, Pachic, or Cumulic Cryoborolls or Cumulic Cryaquolls. Particle-size classes included sandy, clayey-skeletal, or loamy-skeletal. Water tables appeared to be seasonally within 50 cm (20 in) of the surface as evidenced by the presence of mottles or actual water table; many soils, however, dried as the growing season progressed.

Succession and Management—Communities belonging to the **SAGE/MF c.t.** appear similar to the **Salix geyeriana/Deschampsia cespitosa** and **Salix geyeriana/Calamagrostis canadensis c.t.s. SAGE/MF** appears much drier than the **Salix geyeriana/Carex aquatilis** and the **Salix geyeriana/Carex rostrata c.t.s.** In some areas it is possible that **SAGE/MF** replaces either of these types, but the general lack of organic surface soils indicates this type may be more closely related to the **Salix geyeriana/Deschampsia cespitosa c.t.** Most communities belonging to the **SAGE/MF c.t.** have the typical open-corridor physiognomy. Some, however, appear much more closed and are physiognomically similar to **Salix boothii** community types. In communities with corridors, livestock grazing can be important. Impacts from heavy grazing may result in the succession toward the **Salix geyeriana/Poa pratensis c.t.** There is an inherently high potential for bank sloughing because of the sparse rooting nature of the dominant undergrowth species which may be accelerated by the physical impacts of livestock.

Other Studies—The **SAGE/MF c.t.** has been previously described by Youngblood and others (1985a) for eastern Idaho and western Wyoming. Jensen and Tuhy (1982) described a somewhat similar mesic forb undergrowth with *Salix geyeriana* dominating the overstory on the north slope of the Uinta Mountains.

Salix geyeriana/Deschampsia cespitosa c.t. (SALGEY/DESCES; SAGE/DECE)



Distribution—The **SAGE/DECE c.t.** (fig. 13) is a major type in the Wasatch Mountains, the Uinta Mountains, and the Utah Plateaus Floristic Sections. Elevations range from 1 950 to 2 835 m (6,400 to 9,300 ft). It occurs in broad valley bottoms and in meadows with slopes typically less than 3 percent. Surface topography is smooth to gently undulating. Adjacent riparian communities include those belonging to the **Salix geyeriana/Poa pratensis, Poa pratensis,** and **Artemisia cana c.t.s** on drier sites, the **Potentilla fruticosa/Deschampsia cespitosa** and **Deschampsia cespitosa c.t.s** on similar sites, and the **Carex rostrata c.t.** on wetter sites. Adjacent uplands are typically dominated by *Artemisia tridentata* ssp. *vaseyana* and occasionally by *Pinus contorta.*

Vegetation—*Salix geyeriana* dominates the overstory with other willows typically absent or only as minor components. The undergrowth is characterized by a dense graminoid layer that includes varying amounts of

Figure 13.—**Salix geyeriana/Deschampsia cespitosa c.t.** adjacent to the Henry's Fork River south of Mountain View, Wyoming (2 820 m, 9,240 ft). *Salix geyeriana* dominates the tall willow overstory. *Poa pratensis, Deschampsia cespitosa,* and *Agropyron trachycaulum* are the dominant graminoids. *Aster foliaceus* is also abundant in the herbaceous layer.

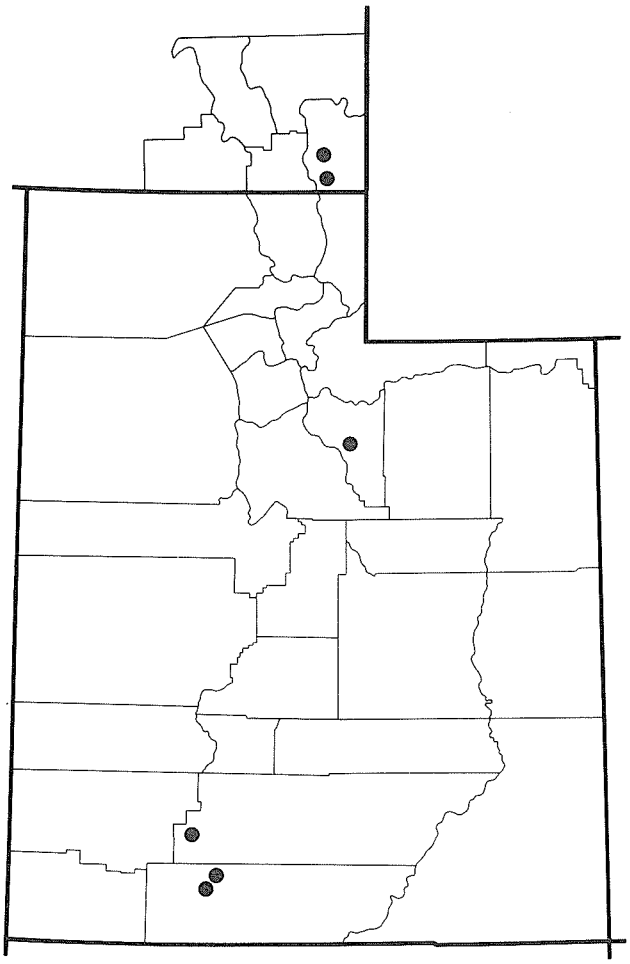
Deschampsia cespitosa, ranging from 5 percent to nearly 50 percent cover. *Carex microptera, Juncus balticus,* and *Poa pratensis* are among other graminoids that may occur in the undergrowth. Forb cover is highly variable but typically includes *Taraxacum officinale* and *Geum macrophyllum. Aster foliaceus, A. occidentalis,* and *Fragaria virginiana* are also likely to occur.

Soils—Soils varied in their development. Those with thick mollic epipedons or argillic horizons indicate long-term development, while development was much less on other sites. Nearly all soils, however, were fine-textured and belonged to fine or clayey-skeletal particle-size classes. Water tables were typically within 40 to 50 cm (16 to 20 in) of the soil surface.

Succession and Management—The **SAGE/DECE c.t.** does not differ significantly from the **Salix geyeriana/Mesic Graminoid c.t.** Site characteristics may be similar, but separating these two allows us to address the issue of disturbance caused by past grazing. In many communities belonging to the **SAGE/DECE c.t.,** the presence of *Poa pratensis, Juncus balticus,* and *Taraxacum officinale* indicates heavy grazing impacts and a likely conversion to the **Salix geyeriana/Mesic Graminoid c.t.** As a result, total forage production may decrease.

Other Studies—Similar communities have been described by Jensen and Tuhy (1982) for the north slope of the Uinta Mountains.

Salix geyeriana/Mesic Graminoid c.t.
(SALGEY/MG; SAGE/MG)



Distribution—SAGE/MG (fig. 14) occurs as a major type on the Paunsaugunt and Markagunt Plateaus of the Utah Plateaus Floristic Section and in the Caribou and Bear River Ranges of the Wasatch Mountains Floristic Section. Elevations range from 1 980 to 2 530 m (6,500 to 8,300 ft) with lower elevation communities occurring in the northern portion of the study area. **SAGE/MG** is associated with stream terraces in broad valley bottoms developed from Quaternary alluvium and morainal outwash materials. Adjacent uplands may be dominated by *Picea pungens, Pinus contorta, Populus tremuloides,* or *Artemisia tridentata* ssp. *vaseyana.* Adjacent riparian communities often include those belonging to the **Poa pratensis c.t.**

Vegetation—SAGE/MG is dominated by *Salix geyeriana* with its typically open nature. The undergrowth is characterized by a dense graminoid layer in which *Poa pratensis, Carex microptera, C. lanuginosa, C. praegracilis,* and/or *Juncus balticus* may be dominant. Additional species may include *Geum macrophyllum, Fragaria virginiana,* and *Trifolium spp.,* as well as numerous others.

Soils—Most soils were classified as Typic and Pachic Cryoborolls, Typic Cryaquolls, and Typic Borosaprists. Surface soil textures were mostly fine-textured and included silt loams, silty clay loams, or clay loams. Rarely was there more than 35 percent coarse fragments in the sampled profiles. Estimated available water-holding capacity was moderate to high. Water tables ranged from the surface to over 1 m (39 in) with a mean of 56 cm (22 in).

Succession and Management—We have grouped a variety of graminoid-dominated undergrowth layers in the **SAGE/MG,** because environmental characteristics were not significantly different in those communities sampled. Some appeared to be more moist than others, but vegetatively nearly all communities contained significant cover of *Poa pratensis* or *Carex praegracilis; Carex lanuginosa* and *Juncus balticus* had the next highest constancy of graminoids, but cover was typically less than that of *Poa pratensis.* We consider those communities with undergrowths dominated by *Carex lanuginosa* to represent better condition situations. Undergrowths dominated by *Poa pratensis, Juncus balticus,* and/or *Carex praegracilis* are considered to be disturbance-induced, probably as a result of past heavy grazing in communities once dominated by *Deschampsia cespitosa.* This c.t., with its open physiognomy and dense herbaceous layer, provides easy access for livestock grazing; evidence of recent grazing was present in nearly all communities included in this type. Streambank stability may be fairly good in communities with fine-textured soils and densely rooted undergrowth species such as *Carex praegracilis, Carex lanuginosa,* or *Juncus balticus.* Where *Poa pratensis* dominates the undergrowth, soil-holding capabilities are less because of shallow rooting structure.

Other Studies—Youngblood and others (1985a) described a similar **Salix geyeriana/Poa pratensis c.t.** for eastern Idaho. We have chosen not to emphasize any single species as an undergrowth dominant as described above.

Salix exigua-Dominated Community Types

This group represents a broad variety of community types, some quite common throughout the study area and others important only on a localized basis. While none of these types were sampled in the Uinta Mountains Floristic Section, some **Salix exigua** types might be expected to occur at lower elevations adjacent to streams. The **Salix exigua c.t.s** are widespread and may cover large areas. Included in the **Salix exigua c.t.s** are communities dominated by *Salix exigua, S. lutea,* and *S. lasiandra.* While the latter two species may occur as overstory dominants, they were sampled

Figure 14.—**Salix geyeriana/Mesic Graminoid c.t.** along Co-op Creek near Strawberry Reservoir southeast of Heber, Utah (2 320 m, 7,600 ft). *Salix geyeriana* forms a typical open-corridor overstory with *Carex lanuginosa* the dominant undergrowth graminoid. *Juncus balticus* and *Carex rostrata* are conspicuous components of the herbaceous layer while forb cover is minor.

infrequently and were commonly codominant with *Salix exigua*. Brunsfeld and Johnson (1985) noted that these three species are typically associated with the low-elevation zone, although *Salix lasiandra* may occur at mid elevations. Brunsfeld and Johnson also noted that different subspecies of *Salix exigua* have different elevational distributions; *Salix exigua* ssp. *melanopsis,* which occurs in the northern portion of the study, is considered a mid-elevational species. Because *Salix lasiandra* and *S. lutea,* like *S. exigua* typically pioneer newly developed bars, we feel these overstories can be treated as part of the same species group. Unlike most other willows, *Salix exigua* can send up individual stems from a complex underground root system, making it an excellent woody species for stabilizing streambanks and riparian soils.

Salix exigua/Mesic Forb c.t. (SALEXI/MF; SAEX/MF)

Distribution—SAEX/MF, though sampled infrequently, appears to be a minor type in the southern Idaho portion of the Wasatch Mountains Floristic Section with one plot sampled on the eastern, mid-elevation of the Aquarius Plateau in south-central Utah. It occurs on streambanks and terraces in narrow to moderately broad valley bottoms. Surface topography is slightly undulating and slopes are generally 3 percent or less. Uplands may be dominated by *Abies lasiocarpa, Picea engelmannii,* and *Populus tremuloides.*

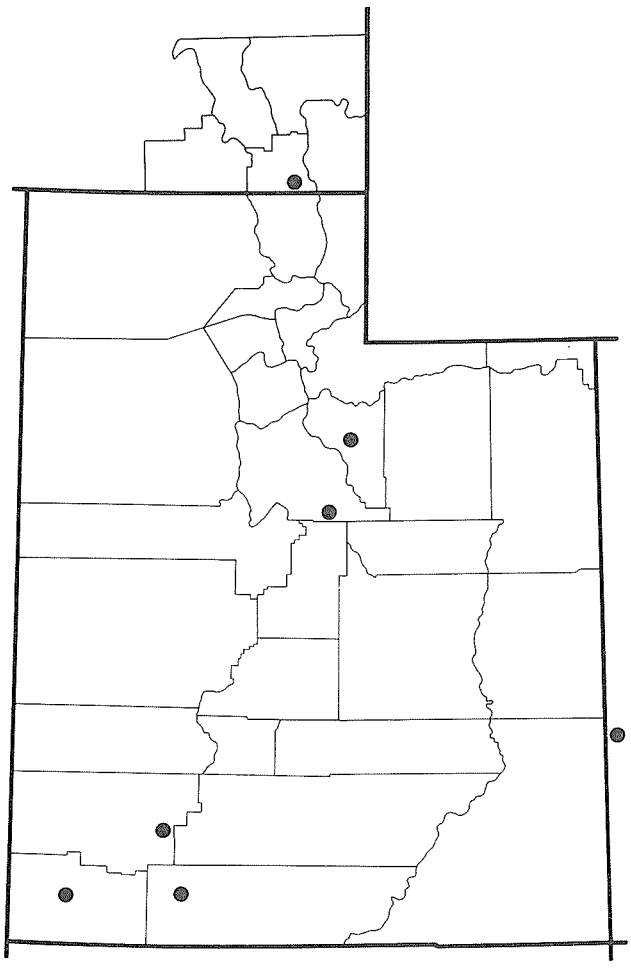
Vegetation—*Salix exigua* typically dominates the overstory in this c.t. with *Rosa woodsii* and *Ribes inerme* common as a low shrub layer. Forbs form a dense undergrowth layer and may include *Heracleum lanatum, Smilacina stellata, Urtica dioica,* Tall *Mertensia* spp. (*Mertensia ciliata* in the northern portion of the study area and *M. arizonica* on the High Plateaus), *Senecio serra,* and *Thalictrum fendleri,* among others. Graminoid cover is highly variable, ranging from nearly absent to over 50 percent; *Poa pratensis, Elymus glaucus, Calamagrostis canadensis,* and *Agrostis stolonifera* are among those likely to occur. Communities dominated by *Salix lasiandra* or *S. lutea,* with a dense forb layer, were not sampled but are expected to occur.

Soils—All sampled soils developed on alluvium and included Typic Cryochrepts and Aquic and Cumulic Cryoborolls. Particle-size classes were variable, and estimated available water-holding capacity ranged from low to high. Depth to water table ranged from 42 cm (17 in) to greater than 1 m (39 in).

Succession and Management—Because *Salix exigua* is a colonizing species with distinct growth patterns (growing not from a single basal crown and forming clumps but rather from an extensive network of rootstocks that give rise to individual stems), it has the ability to stabilize areas that have previously been denuded. The **SAEX/MF c.t.** appears to be a later seral stage in the development of sand and gravel bar communities. Stable soils have developed, and associated species indicate long periods of stability with a lack of heavy grazing levels in the past. **SAEX/MF** appears to be associated more with the subalpine or Douglas-fir zone, while other **Salix exigua c.t.s** are more common at lower elevations.

Other Studies—The **SAEX/MF c.t.** has not been previously described.

Salix exigua/Mesic Graminoid c.t. (SALEXI/MG; SAEX/MG)



Distribution—The **SAEX/MG c.t.** is a minor type that occurs throughout most of the study area. Elevations range from 1 830 to 2 350 m (6,000 to 7,700 ft). It occurs on stream terraces and in meadows associated with stream channels. Percent slope is typically very gentle and surface topography is highly variable. Adjacent upland communities include those dominated by *Pinus ponderosa* or *P. edulis.* Adjacent riparian communities include those belonging to the **Carex nebrascensis, Carex rostrata,** or **Eleocharis palustris c.t.s** on wetter sites and the **Poa pratensis c.t.** on slightly drier sites.

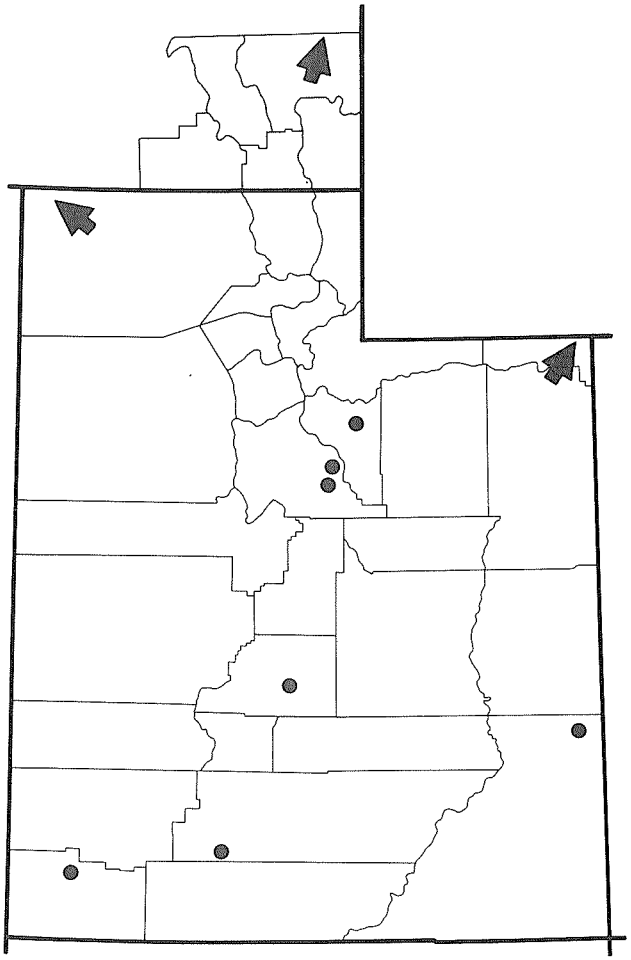
Vegetation—*Salix lasiandra* and/or *S. exigua* dominate the overstory of this c.t. *Salix lutea, S. boothii,* and/or *S. lasiolepis* (southwest Utah only) may occasionally codominate. Other shrubs are typically minor components of this c.t., but the presence of *Alnus incana* or *Betula occidentalis* may indicate succession toward c.t.s dominated by low deciduous trees. The undergrowth is characterized by moderate to dense cover of *Carex nebrascensis, Juncus balticus, Carex lanuginosa,* and/or *Agrostis stolonifera.* Forb cover is typically sparse but may include *Mentha arvensis, Veronica americana, Geum macrophyllum,* or *Equisetum arvense.*

Soils—Water tables ranged from the surface to over 1 m (39 in) below the surface with a mean of 53 cm (21 in). Distinct or prominent mottles were common within 50 cm (20 in) of the surface, indicating a seasonally high water table. Soils indicated a broad range of development, from the well-developed Terric Borohemists, Cumulic Haploborolls, Typic Cryaquolls, and Pachic Cryoborolls to the less-developed Aquic Cryofluvents and Fluvaquentic Haploxerolls. Nearly all soils developed on alluvial depositions of varying ages. Particle-size classes were highly variable, with estimated available water-holding capacity ranging from low to moderate.

Succession and Management—In most situations the **SAEX/MG c.t.** is considered an early successional type pioneering sand and gravel bars but may be persistent as indicated by communities occurring in the vicinity of Pine Valley in the Pine Valley Mountains of southwestern Utah. This type appears in general to be wetter than other **Salix exigua c.t.s**, and the environment is likely to be more favorable for the establishment of rhizomatous sedges. This results in greater soil-holding abilities and ultimately improved streambank stabilizing characteristics. *Salix lasiandra,* a typical dominant or codominant in this type, appears similar in many ways to *Salix exigua* in its ability to pioneer and stabilize newly established bars. It does not, however, appear to occur as commonly at lower elevations outside of the study area. Should the sites become drier and/or grazing levels increase, this type might be replaced by the **Salix exigua/Poa pratensis c.t.** or possibly the **Salix exigua/Barren c.t.** Similar sites at higher elevations may support the **Salix exigua/Mesic Forb c.t.**

Other Studies—The **SAEX/MG c.t.** has not been previously described.

Salix exigua/Poa pratensis c.t. (SALEXI/POAPRA; SAEX/POPR)



Distribution—The **SAEX/POPR c.t.** is a widespread, minor c.t. that occurs throughout the study area. It is common, especially below 2 135 m (7,000 ft). **SAEX/POPR** occurs in broad to narrow valley bottoms and becomes a major type below Forest Service boundaries. It commonly occurs immediately adjacent to streams, generally of order 2 or 3, though it was also sampled in a meadow. Adjacent upland communities are indicative of the relatively low elevation of these communities and may be dominated by *Pinus ponderosa, Quercus gambelii, Artemisia tridentata* ssp. *tridentata,* or more commonly *Pinus edulis* and *Juniperus osteosperma.*

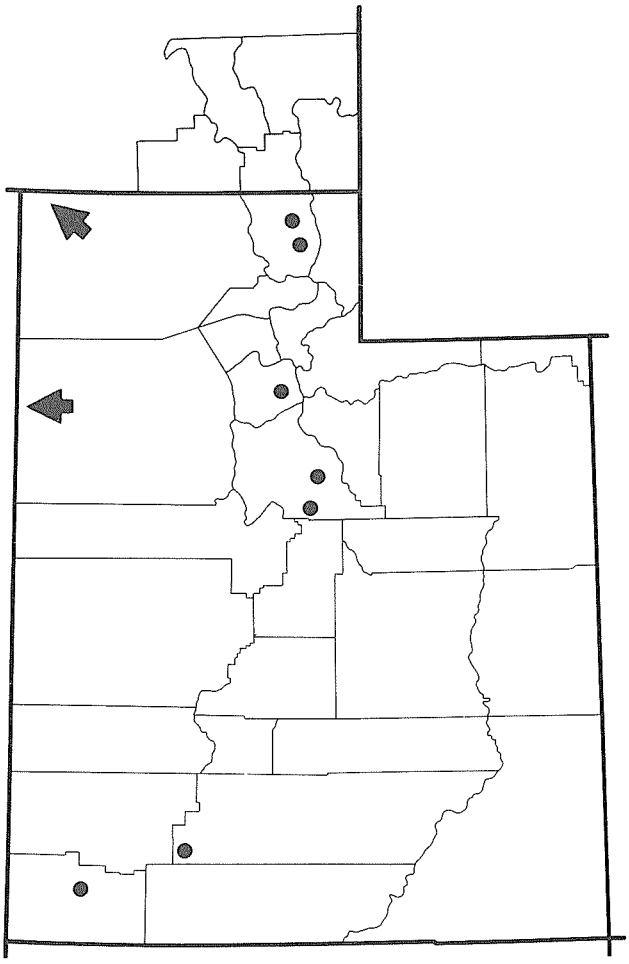
Vegetation—*Salix exigua* dominates the overstory with *S. lasiandra, S. lutea, S. lasiolepis* (southwest Utah), or *S. boothii* occasionally minor components. A low shrub layer may be present with *Rosa* spp., *Ribes aureum,* or scattered *Cornus sericea* among those that might occur. The undergrowth is characterized by a moderate to dense graminoid layer that may include *Poa pratensis* or *Bromus tectorum. Juncus balticus* may be present in minor amounts. Forb cover is usually minor with *Taraxacum officinale* and *Equisetum arvense* among those likely to occur.

Soils—Soils vary greatly in their development, though all were formed on alluvium. Soils were classified as Fluvents, Aquepts, Aquolls, Borolls, and Xerolls. Because of their moderate elevation, most soils were considered to have a frigid soil temperature regime. Particle-size classes were also highly variable, including fine, coarse-loamy, loamy-skeletal, and sandy-skeletal. Estimated available water-holding capacity was typically low to moderate.

Succession and Management—This c.t. appears to be a sere developed either from an increase in graminoids following the establishment of the **Salix exigua/Barren c.t.,** or a grazing-induced type related to the **Salix exigua/Mesic Forb c.t.** or the **Salix exigua/Mesic Graminoid c.t.** In either case there generally appears to be ample forage in the undergrowth which, in most situations, can be easily accessed by livestock. These communities are typically adjacent to stream channels and, while the undergrowth species may not have a strong ability to stabilize streambanks, the willows are very strong colonizers and tend to slow water movement over the community and allow an increased deposition of soil particles rather than continued scouring.

Other Studies—Youngblood and others (1985a) described a broader **SAEX/POPR c.t.** for eastern Idaho and western Wyoming that would include portions of our **SAEX/POPR** as well as our **Salix exigua/Barren c.t.** Because of the increased grazing capabilities and successional differences between these two types, we have separated their **SAEX/POPR c.t.** into distinct types. Norton and others (1981) described a type in western Wyoming similar to that of Youngblood and others, while Olsen and Gerhart (1982) described communities similar to ours for southeastern Wyoming as did Padgett (1982) for eastern Oregon.

Salix exigua/Barren c.t. (SALEXI/BARREN; SAEX/BARREN)



Distribution—This widespread minor c.t. occurs throughout the study area and may be a more common, major type on lands adjacent to those managed by the Forest Service. It was sampled most often below 1 680 m (5,500 ft) but occurred as high as 2 060 m (6,760 ft). It is commonly associated with streambanks, but it also occurs away from streams on sites with little undergrowth. Adjacent upland communities may include those dominated by *Quercus gambelii,* or *Pinus edulis* and *Juniperus osteosperma.*

Vegetation—*Salix exigua, S. lasiandra,* or *S. lutea* dominate the overstory of an otherwise depauperate community. *Cornus sericea, Ribes inerme,* or *Rosa* spp. may be present in the shrub layer but generally have low cover values. The undergrowth is open with predominantly bare ground, rock, or leaf litter and only scattered herbaceous species. Graminoids are generally absent.

Soils—Soils were highly variable in this c.t. ranging from highly stable Cumulic Haplaquolls and Aquic Cryoborolls to early developmental Typic Udifluvents. All had developed on alluvium of varying ages. Estimated available water-holding capacity ranged from low to high, and particle-size classes included fine-loamy and sandy-skeletal. Water tables ranged from near the surface to over 1 m (39 in).

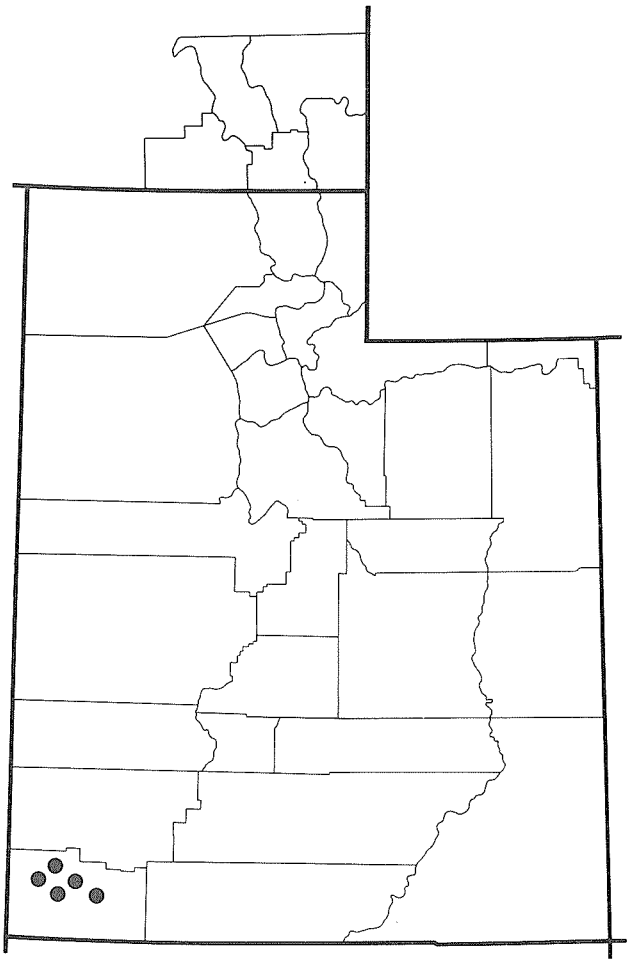
Succession and Management—The **SAEX/BARREN c.t.** is an early successional type that has had little undergrowth development. Some communities sampled appear to have rather xeric surface soils which inhibits the establishment of herbaceous species, while others were very wet but have not had sufficient time for establishment. Succession in this c.t., without outside disturbance, will likely lead toward the **Salix exigua/Mesic Forb** or the **Salix exigua/Mesic Graminoid c.t.** in more moist situations, while drier areas may develop into the **Salix exigua/Poa pratensis c.t.** There is essentially no herbaceous livestock forage available in this type. *Salix* spp. provide stability of streambanks as well as stream shading.

Other Studies—Tuhy and Jensen (1982) described a similar type with no diagnostic undergrowth for central Idaho.

Other Tall Willow-Dominated Community Types

Salix lasiolepis and *S. bebbiana* are the only other tall willows for which community types have been named. *Salix lasiolepis,* a Great Basin species, occurs as an overstory dominant in our study area only in the Pine Valley and Bull Valley Mountains of southwestern Utah. This species seems well adapted to warm and dry climates and appears to require only a seasonally high water table. *Salix bebbiana,* unlike *S. lasiolepis,* typically occurs at higher elevations on sites that are more moist. While *Salix bebbiana* is more common in south-central and southeastern Utah, it is widespread in its distribution. *Salix bebbiana,* however, seldom occurs in large enough patches to form distinct communities.

Salix lasiolepis/Barren c.t. (SALLAS/BARREN; SALA/BARREN)



Distribution—The **SALA/BARREN c.t.** is a minor type that typically forms stringer communities along drainages in the southwestern portion of the Utah Plateaus Floristic Section. It was sampled only in the Pine Valley and Bull Valley Mountains but is also expected to occur in the eastern portion of the Great Basin, west of the study area. Elevations range from 1 680 to 2 045 m (5,500 to 6,700 ft). Adjacent uplands may be dominated by *Pinus edulis* and *Juniperus osteosperma, Quercus gambelii,* or *Artemisia tridentata* ssp. *vaseyana.*

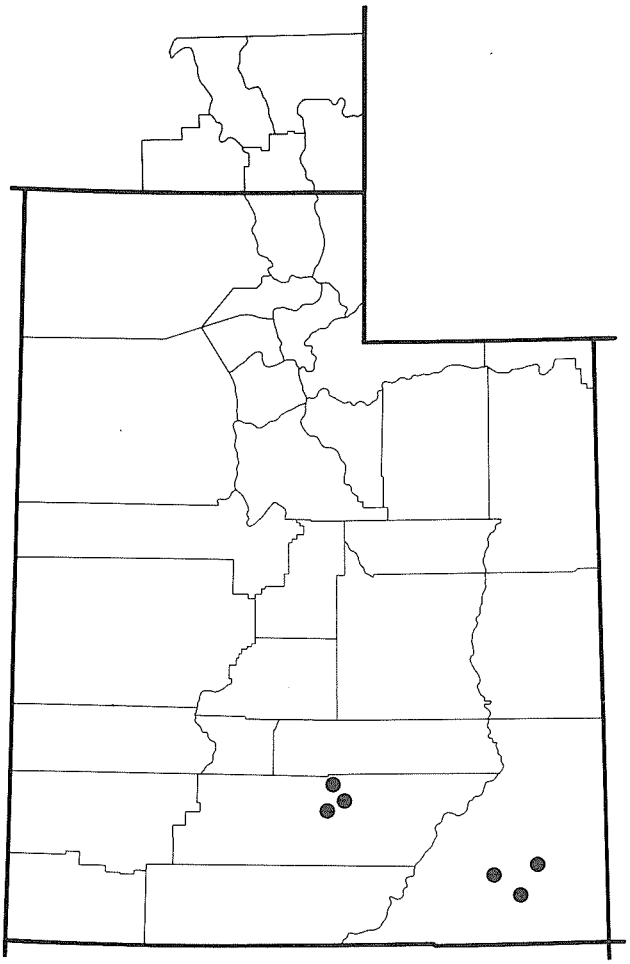
Vegetation—*Salix lasiolepis* dominates a dense overstory. *Ribes aureum* and/or *Rosa* spp. typically form a low shrub layer near the base of the willows. The undergrowth is typically depauperate with *Bromus tectorum* commonly present in minor amounts. *Clematis ligusticifolia, Poa pratensis,* and *Taraxacum officinale* may also be present, though cover is usually very sparse. Bare ground and/or leaf litter from the willow overstory are characteristic of this type.

Soils—All soils developed on alluvium and had xeric moisture regimes. They were classified as Xerofluvents, Xerochrepts, and Haploxerolls, indicating the range in soil development. Particle-size classes were typically sandy-skeletal, and estimated available water-holding capacity was low. Water tables were rarely reached within the depth of the soil pit, and mottles were not evident because of the coarse soil textures.

Succession and Management—Little is known about the successional status of this type. It appears to occur where soils are coarse-textured and water is available at least early in the growing season. The depauperate undergrowth is likely indicative of the xeric surface soil conditions or grazing pressures on an ecosystem that is barely able to support livestock. Communities belonging to the **SALA/BARREN c.t.** are likely to be very important to wildlife in the area because, in many instances, these are the only riparian communities in stream bottoms. Sampson and Jespersen (1963) noted that *Salix lasiolepis* in California was browsed "avidly" by deer, and that some livestock use may also occur in the summer and early fall. Research needs to address the relationships of wildlife to this riparian ecosystem.

Other Studies—The **SALA/BARREN c.t.** has not been previously described.

Salix bebbiana/Mesic Graminoid c.t. (SALBEB/MG; SABE/MG)



Distribution—SABE/MG is a minor type sampled on the Aquarius Plateau of the Utah Plateaus Floristic Section and in the Abajo Mountains of the Canyonlands Floristic Section. It appears to be more or less restricted to the Canyonlands and adjacent Floristic Sections. It occupies broad meadows, alluvial terraces, and sub-irrigated lower slopes. Elevations range from 2 105 to 2 805 m (6,900 to 9,200 ft) with most communities above 2 440 m (8,000 ft). Adjacent streams may range from intermittent to order 2 in size, and slopes may range from 2 to 5 percent. *Pinus ponderosa, Populus tremuloides,* or *Quercus gambelii* are among those likely to dominate the adjacent uplands.

Vegetation—*Salix bebbiana* commonly forms a dense overstory. *Salix boothii* or *S. lutea* are occasionally present in minor to moderate amounts. A low shrub layer of *Ribes inerme, Rosa* spp., and/or *Symphoricarpos oreophilus* is typically present in or near the base of the *Salix* plants. The undergrowth is, for the most part, characterized by graminoids and low-growing forbs. *Poa pratensis* occurred in all communities sampled, while *Taraxacum officinale* and *Trifolium* spp. were also common. Other graminoids such as *Carex nebrascensis, C. praegracilis,* and *Juncus balticus* may be present or even dominate the undergrowth. *Actaea rubra, Aconitum columbianum,* and *Geranium richardsonii* are among the forbs that might occur.

Soils—Soils developed, for the most part, on alluvium. Nearly all soils were classified as Aquic, Pachic, or Cumulic Cryoborolls, indicating stable sites with long-term accumulation of organic materials in the profiles. Water tables were nearly always below the depth of the soil pit; the depth of the soil pit typically was restricted by the presence of usually more than 50 percent coarse fragments by volume. Estimated available water-holding capacity ranged from low to high.

Succession and Management—Little is know about the successional status of communities belonging to the **SABE/MG c.t.**, but some communities belonging to this type, such as those with undergrowths dominated by *Carex nebrascensis,* are felt to be stable. The occurrence of *Picea engelmannii* and/or *P. pungens* in some communities indicates a possible successional trend toward c.t.s dominated by these species. While willow overstories are typically dense in communities belonging to this c.t., adjacent communities are commonly graminoid meadows and are often subject to very heavy livestock grazing. This may eliminate the possible expansion of this c.t. because *Salix bebbiana* seedlings may be unable to establish. Most communities lacked willow regeneration, and many willows were hedged, indicating persistent browsing.

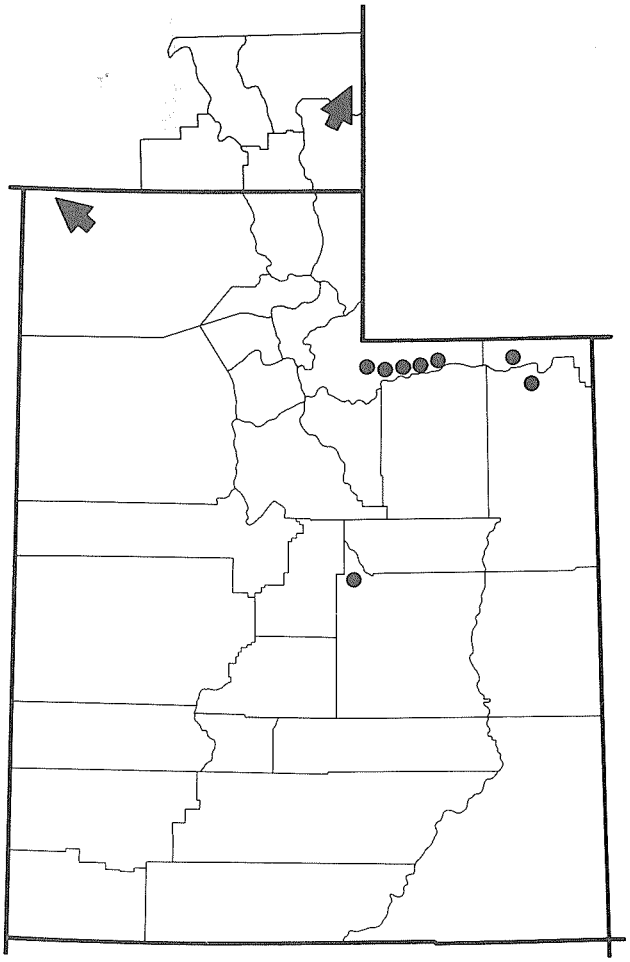
Other Studies—The **SABE/MG c.t.** has not been previously described.

Low Willow-Dominated Community Types

For the most part, low-growing willows such as *Salix wolfii, S. planifolia* var. *monica, S. glauca,* and *S. brachycarpa* occur at moderately high to high elevations (fig. 2, p. 7). Community types of this group are most common in the northern portion of the study area including the Wasatch Mountains, the Uinta Mountains, and the northern portion of the Utah Plateaus Floristic Sections. A few communities dominated by the tall *Salix planifolia* var. *planifolia,* however, were sampled as far south as the Fishlake Plateau near the central portion of Utah. The **Salix glauca/Deschampsia cespitosa c.t.** was sampled only in the Uinta Mountains but may also occur at higher elevations in the Wasatch Mountains. No community types dominated by *Salix brachycarpa* have been described in the study area, though it can be expected to occur, especially on calcareous soils (Goodrich 1987), as an overstory dominant. Strong structural and environmental similarities occur among c.t.s in this group with similar undergrowths. Brunsfeld and

Johnson (1985) noted that *Carex aquatilis* and *Carex rostrata* in north-central Idaho were the most constant and abundant associates with these willows at the lower portion of their High Elevation Zone. Management practices for the **Salix wolfii/Carex aquatilis** and **Salix planifolia/Carex aquatilis c.t.s,** for example, should be very similar, and one may wish to group these and other like types for the purpose of management.

Salix wolfii/Carex aquatilis c.t. (SALWOO/CARAQU; SAWO/CAAQ)



Distribution—SAWO/CAAQ (fig. 15) is a major type on the north slope of the Uinta Mountains. It was also sampled on the south slope of the Uinta Mountains near the Trout Creek Guard Station and in Scad Valley on the Wasatch Plateau. It occurs between 2 595 and 3 020 m (8,500 and 9,900 ft). It occupies meadows, alluvial terraces, and seeps associated with broad valley bottoms. Slopes range from 1 to 20 percent, and surface topography is smooth to slightly undulating. Adjacent upland communities may be dominated by *Picea engelmannii, Pinus contorta, Abies lasiocarpa, Populus tremuloides,* or *Artemisia tridentata* ssp. *vaseyana.* Riparian communities commonly associated with this c.t. include those belonging to the **Carex aquatilis, Carex lanuginosa, Deschampsia cespitosa, Caltha leptosepala c.t.s,** and other **Salix wolfii c.t.s.**

Vegetation—*Salix wolfii* dominates a typically dense low willow overstory. Tall willows such as *Salix boothi* or *S. geyeriana* may occasionally be present with less than 25 percent cover. *Potentilla fruticosa, Lonicera involucrata,* and/or *Betula glandulosa* may be present with minor cover and are usually growing beneath the cover of *Salix wolfii.* The undergrowth is characterized by water-loving species such as *Carex aquatilis* and/or *Caltha leptosepala;* moss cover is commonly quite high. Other common graminoids include *Deschampsia cespitosa, Phleum alpinum,* and *Juncus balticus; Carex interior* and *C. lanuginosa* were present with relatively high cover in a few plots. Forb cover, other than that of *Caltha leptosepala,* is usually sparse. *Geum macrophyllum, Ligusticum tenuifolium, Fragaria virginiana, Polemonium caeruleum,* and *Swertia perennis* are among the many forbs that may occur.

Soils—Soils were cold and wet, and many were organic or had histic epipedons. Soils were classified as Histosols, Histic and Typic Cryaquolls, or Humic and Histic Cryaquepts. Water tables ranged from the surface to over 1 m (39 in) in depth, though most were less than 35 cm (14 in) deep. Mean water table depth was 22 cm (9 in) and those soils that had water tables below 50 cm (20 in) had mottles at or near the surface, indicating a seasonally high water table. Some organic soils had mineral subsurface horizons (Terric Borohemists and Borosaprists) that were often clayey, thus acting to perch the water tables.

Succession and Management—The **SAWO/CAAQ c.t.** appears to be a stable type occupying large expanses in wet meadow complexes. *Caltha leptosepala* appears to have similar environmental requirements as *Carex aquatilis* and both species often occur together. Soils are wet and easily impacted by heavy equipment and livestock. Sheep may browse the willows, but cattle are more likely to go into wet areas. *Carex aquatilis* is palatable to cattle and grazing will likely occur. Browsing by wild ungulates was noted in a few communities and may be of importance as both moose and deer were noted in the vicinity of the **SAWO/CAAQ c.t.** in the Uinta Mountains. Should the environments where this c.t. occurs become drier, there would likely be a succession toward the **Salix wolfii/Mesic Forb** or the **Salix wolfii/Deschampsia cespitosa c.t.s.**

Other Studies—Our **SAWO/CAAQ c.t.** includes portions of the **Salix wolfii/Carex rostrata c.t.** described by Youngblood and others for eastern Idaho and western Wyoming. Our type is similar to the **Salix wolfii-Betula glandulosa/Carex rostrata-Carex aquatilis c.t.** described by Mutz and Queiroz (1983) for central Idaho and the

Figure 15.—**Salix wolfii/Carex aquatilis c.t.** near Whitney Reservoir south of Evanston, Wyoming (2 855 m, 9,360 ft). *Salix wolfii* dominates the low-growing willow overstory with a dense graminoid undergrowth of *Carex aquatilis. Geum macrophyllum* and *Achillea millefolim* are minor forb components on slightly drier microsites within the community.

Salix wolfii/Swertia perennis c.t.s described by Norton and others (1981) for the Greys River drainage of western Wyoming. Jensen and Tuhy (1982) described a broad **Carex rostrata** undergrowth group and a **Swertia perennis** undergrowth group with a **Salix wolfii** overstory that includes communities belonging to our **SAWO/CAAQ c.t.** for the Uinta Mountains. Mattson (1984) described sites in Yellowstone National Park with communities similar to ours as the **Salix wolfii/Carex aquatilis h.t.**.

Salix wolfii/Carex rostrata c.t. (SALWOO/CARROS; SAWO/CARO)

Distribution—This incidental type was sampled only on the north slope of the Uinta Mountains. Elevations range from 2 745 to 2 960 m (8,000 to 9,700 ft). **SAWO/CARO** is typically associated with broad valley bottom and seeps. Adjacent riparian communities include others dominated by *Salix wolfii* and those belonging to the **Deschampsia cespitosa c.t.** Uplands are dominated by *Pinus contorta, Picea engelmannii,* and/or *Populus tremuloides.*

Vegetation—*Salix wolfii* typically dominates this c.t. with at least 25 percent cover. *Salix planifolia* and/or *S. geyeriana* may be locally evident. Communities in which *Salix geyeriana* clearly dominates, however, are classified as the **Salix geyeriana/Carex rostrata c.t.** The undergrowth is variable but is dominated by *C. rostrata,* typically with lesser amounts of *C. aquatilis* and/or *Calamagrostis canadensis.* Forb cover is variable but may include *Erigeron peregrinus, Polemonium caeruleum, Pedicularis groenlandica,* and/or *Swertia perennis.*

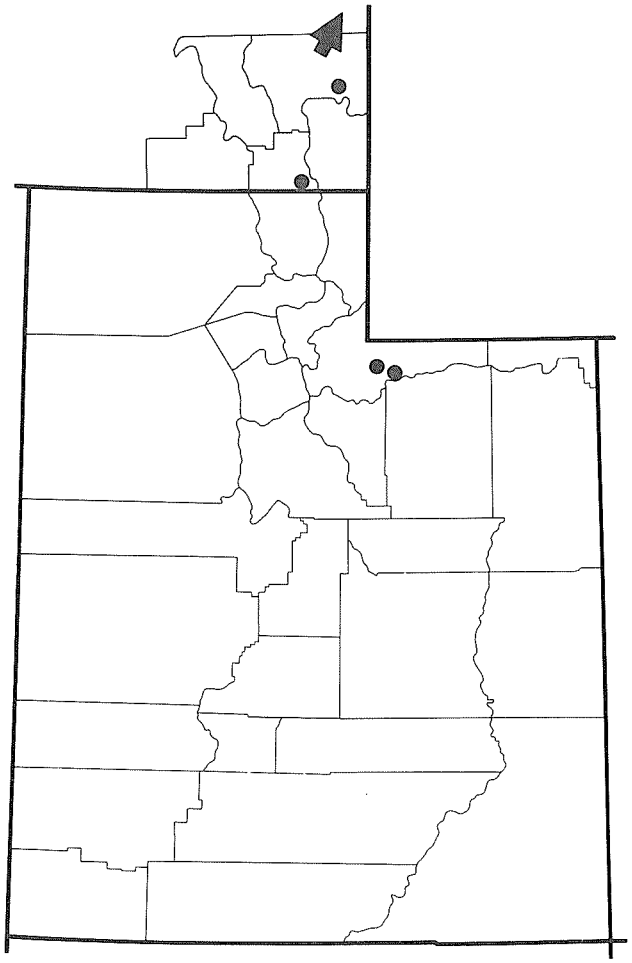
Soils—Soils were organic to mineral, with fine-loamy to fine particle-size classes in the mineral horizons. Water tables were typically near the surface.

Succession and Management—The **Salix wolfii/Carex rostrata c.t.** is a major type in eastern Idaho and western Wyoming but was sampled only a few times on the north slope of the Uinta Mountains. Those

communities sampled represented, for the most part, intergrades to other c.t.s. One community was closely allied to the **Salix wolfii/Carex aquatilis c.t.** with organic soils and a codominance of *Carex aquatilis.* A second community occurred on mineral soils and was an intergrade to the **Salix wolfii/Calamagrostis canadensis c.t.** described by Youngblood and others (1985a) for eastern Idaho. Management should be similar to that for the **Salix wolfii/Carex aquatilis c.t.,** except that *Carex rostrata* is not as palatable as *C. aquatilis* and, therefore, livestock impacts may be less.

Other Studies—Youngblood and others (1985a) described a similar **SAWO/CARO c.t.** for eastern Idaho and western Wyoming. Norton and others (1981) described a broader **SAWO/CARO c.t.** for western Wyoming that would include our **Salix wolfii/Carex aquatilis c.t.** Tuhy and Jensen (1982) described a **Salix/Carex rostrata c.t.** for central Idaho that would include our **SAWO/CARO c.t.** Jensen and Tuhy (1982) described a broad **Carex rostrata** undergrowth group with a **Salix wolfii** overstory group for the north slope of the Uinta Mountains that includes communities belonging to our **SAWO/CARO c.t.**

Salix wolfii/Mesic Forb c.t. (SALWOO/MF; SAWO/MF)



Distribution—SAWO/MF (fig. 16) is a major type on the north slope of the Uinta Mountains above 2 805 m (9,200 ft); it becomes a minor type in the Wasatch Mountains Floristic Section in southern Idaho where it occurs between 2 290 and 2 440 m (7,500 and 8,000 ft). It is associated with broad meadows and stream terraces of moderate to broad valley bottoms. *Abies lasiocarpa, Picea engelmannii,* and *Artemisia tridentata* ssp. *vaseyana* are among the adjacent upland dominants. The **Salix wolfii/Carex aquatilis c.t.** commonly occurs on wetter habitats in proximity to the **SAWO/MF c.t.**

Vegetation—*Salix wolfii* forms a dense low willow overstory. *Potentilla fruticosa* or *Ribes inerme* are occasionally present with sparse cover. The undergrowth is characterized by a dense forb layer of *Mertensia ciliata, Polemonium caeruleum,* and/or *Smilacina stellata.* Other forbs, such as *Geum macrophyllum* and *Fragaria virginiana,* are commonly minor components. Graminoid cover is variable with *Carex microptera* often present.

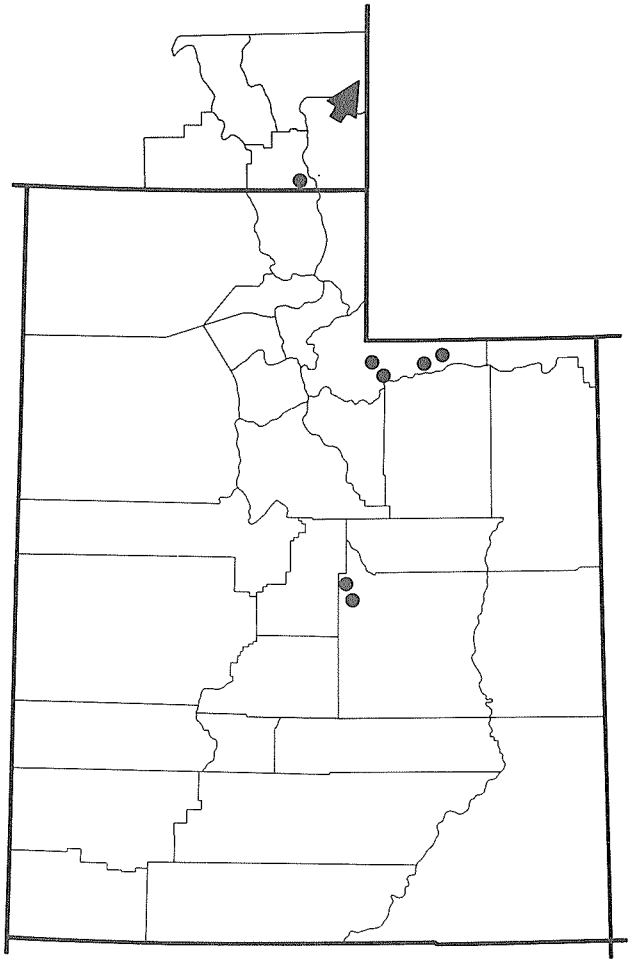
Soils—Soils developed in alluvium and were classified as Aquic and Cumulic Cryoborolls and Cumulic Cryaquolls. Those communities with thick mollic epipedons indicate a stability of the site with a continuing incorporation of organic materials in the pedons. Surface soil textures were loams, silt loams, clay loams, and clays. There were occasionally more than 35 percent coarse fragments, at least in subsurface horizons. Estimated available water-holding capacity ranged from moderate to high, and depth to water table ranged from 5 to 80 cm (2 to 32 in) with a mean of 52 cm (20 in).

Succession and Management—Because of soil characteristics and lush undergrowth of forbs, the **SAWO/MF c.t.** appears to be a stable type. The presence of *Polemonium caeruleum* in this and the **Salix wolfii/Carex aquatilis (SAWO/CAAQ) c.t.** may indicate a relationship between the two types. However, succession from the **SAWO/CAAQ** to the **SAWO/MF c.t.** would be slow to occur. Communities belonging to this type are successionally closer to the **Salix wolfii/Deschampsia cespitosa c.t.** because of their similar soil and water features; in some cases they could possibly be combined for management purposes. Livestock grazing is commonly impeded by the dense overstory of *Salix wolfii,* while wild ungulates may commonly browse communities belonging to the **SAWO/MF c.t.** (Youngblood and others 1985a).

Other Studies—Youngblood and others (1985a) described a similar **SAWO/MF c.t.** for eastern Idaho and western Wyoming. Mutz and Queiroz (1983) described a similar **Salix wolfii/Mesic Forb c.t.** for the Centennial Mountains of eastern Idaho. Jensen and Tuhy (1982) described a somewhat similar **Mesic Forb** undergrowth group with a **Salix wolfii** overstory for the north slope of the Uinta Mountains.

Figure 16.—**Salix wolfii/Mesic Forb c.t.** near Whitney Reservoir south of Evanston, Wyoming (2 830 m, 9,280 ft). *Salix wolfii* forms a very dense low willow overstory. *Polemonium caeruleum* and *Mertensia ciliata* occur as dominant forbs beneath the willow overstory. Graminoids are sparse.

Salix wolfii/Deschampsia cespitosa c.t. (SALWOO/DESCES; SAWO/DECE)



Distribution—The **SAWO/DECE c.t.** is a major type on the north slope of the Uinta Mountains. It was also sampled on the Wasatch Plateau in central Utah and the Bear River Range of southern Idaho. **SAWO/DECE** occurs between elevations of 2 440 and 2 865 m (8,000 and 9,400 ft). It is typically in meadows and on alluvial terraces associated with broad mountain valley bottoms. Adjacent upland communities may be dominated by *Pinus contorta, Populus tremuloides,* or *Artemisia tridentata* ssp. *vaseyana.* Adjacent riparian communities include those belonging to **Artemisia cana, Deschampsia cespitosa,** and **Carex aquatilis c.t.s.**

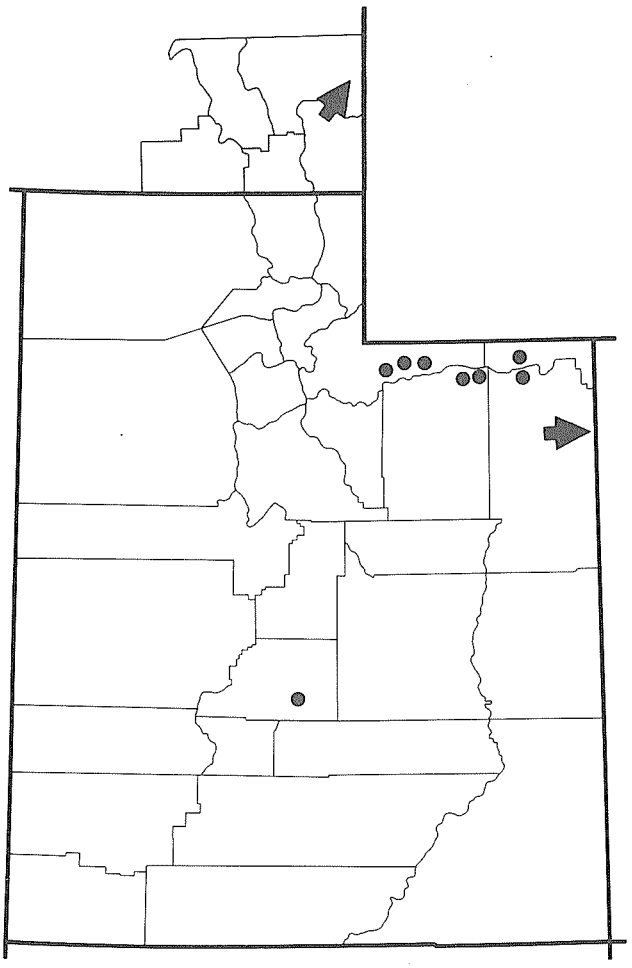
Vegetation—*Salix wolfii* dominates a typically dense low willow overstory with *Potentilla fruticosa* commonly present and scattered within the canopy. The undergrowth is characterized by the presence of *Deschampsia cespitosa,* sometimes with minor cover, and a variety of other graminoids and forbs. Among those graminoids commonly present, usually with low percent cover, are *Phleum alpinum, Danthonia intermedia, Agrostis scabra, Trisetum spicatum, Carex microptera,* and *C. aquatilis. Fragaria virginiana, Aster occidentalis, Galium boreale, Taraxacum officinale,* and *Trifolium* spp. are some of the common forbs that typically occur in the undergrowth, often with greater cover than the graminoids.

Soils—Soils were commonly classified as Cumulic, Pachic, and Aquic Cryoborolls. Depth to water tables ranged from the surface to over 1 m (39 in) with a mean of 55 cm (22 in); all had distinct or prominent mottles within 40 cm (16 in) of the surface. Soil particle-size classes ranged from fine-loamy to clayey-skeletal and fine to clayey over loamy-skeletal. Surface soil textures were typically loams and clay loams, while estimated available water-holding capacity ranged from moderate to high.

Succession and Management—The **SAWO/DECE c.t.** represents the driest of the **Salix wolfii c.t.s** sampled in the study area, though environmentally it is very similar to the **Salix wolfii/Mesic Forb c.t.** While communities belonging to the **SAWO/DECE c.t.** have moderately high water tables, they appear to dry in the upper horizons to a much greater extent than other **Salix wolfii c.t.s.** These communities are also more likely to occur on soils with greater than 35 percent coarse fragments in the subsurface horizons. The dense, low willow overstory may impede livestock use, but because these communities occur on relatively dry sites, they are subject to heavy grazing pressures; the occurrence of species such as *Taraxacum officinale* and *Trifolium* spp., as well as typically low cover of *Deschampsia cespitosa,* attests to the likelihood of this. While use of this c.t. by wild ungulates was not noted, it is expected to be used like other **Salix wolfii c.t.s.**

Other Studies—Youngblood and others (1985a) described a similar type for western Wyoming that occasionally had higher cover of *Deschampsia cespitosa.*

Salix planifolia/Carex aquatilis c.t. (SALPLA/CARAQU; SAPL/CAAQ)



Distribution—The **SAPL/CAAQ c.t.** is a major type in the Uinta Mountain Floristic Section. It occurs in the north and south-central Uinta Mountains and extends to the southeastern Uinta Mountains. It was also sampled on the Fishlake Plateau of south-central Utah. Elevations are greater than 2 745 m (9,000 ft) and extend above 3 355 m (11,000 ft). This type covers expansive areas in the Uinta Mountains and is one of the more dominant c.t.s in its elevation range. **SAPL/CAAQ** is associated with broad valley bottoms and wet, open subalpine slopes of 0 to 6 percent. The **Picea engelmannii/Vaccinium scoparium** and the **Pinus contorta/Vaccinium scoparium h.t.s** (Mauk and Henderson 1984) are commonly adjacent to areas on which this c.t. occurs, while at higher elevations alpine grass and forb communities may abut. Adjacent riparian communities may include those belonging to the **Carex aquatilis, Carex saxatilis, Carex lasiocarpa, Deschampsia cespitosa,** and **Salix geyeriana/Calamagrostis canadensis c.t.s.**

Vegetation—*Salix planifolia* dominates the low willow overstory. *Salix wolfii, Betula glandulosa,* and/or *Potentilla fruticosa* may occasionally be present with less than 25 percent cover. The undergrowth is characterized by a typically dense graminoid layer dominated by *Carex aquatilis, Caltha leptosepala,* and/or *Carex rostrata.* Other graminoids are present in varying amounts and include *Deschampsia cespitosa, Calamagrostis canadensis, Agrostis scabra, A. humilis,* and *Carex canescens. Galium trifidum, Pedicularis groenlandica, Ligusticum tenuifolium,* and *Sedum rhodanthum* are among the commonly occurring forbs in the **SAPL/CAAQ c.t.** with cover ranging from a trace to over 25 percent. Moss is also a common component of these wet communities.

Soils—These high elevation communities occur on soils with water tables almost always at or near the surface. Soils had histic epipedons and were classified as Borofibrists, Borohemists, and Borosaprists or as Histic Cryaquepts and Histic Cryaquolls. Mineral subsurface horizons were commonly clayey and act to perch water tables, making the soil environment better adapted to the accumulation of organic materials.

Succession and Management—Communities belonging to the **SAPL/CAAQ c.t.** are stable and are linked very closely to the high elevation and wet organic soils on which they occur. Any succession toward other **Salix planifolia c.t.s** would be an extremely slow process following a drying trend and subsequent decomposition of organic materials. *Carex aquatilis* is especially well-suited to the wet, organic soils noted for this c.t. and appears to optimally express itself at elevations where this type occurs (**Carex aquatilis c.t., Succession and Management**, p. 101). Only one community with an undergrowth dominated by *Carex rostrata* was sampled. While we prefer to segregate these two species because of their differences in palatability and, possibly, site potential, we have included this community here because of its wet nature. Additional sampling will likely result in the description of a **Salix planifolia/Carex rostrata c.t.** Signs of use by elk, beaver, and domestic sheep were noted in communities belonging to this type, but it did not appear to be extensive; more utilization was noted on adjacent, drier habitats. Some wildlife trails occurred in these communities, indicating their use at least as corridors for movement through the expansive valley bottoms and meadows where the c.t. typically occurs.

Other Studies—The **SAPL/CAAQ c.t.** has previously been described by Lewis (1970) for the Uinta Mountains. Winn and others (1982) also described a similar **Salix phylicifolia [S. planifolia]/Carex aquatilis riparian type** that they further divided into different phases based on the relative abundance of forbs in the undergrowth. Mattson (1984) described sites in Yellowstone National Park with similar communities as the **Salix phylicifolia [S. planifolia]/Carex aquatilis h.t.** Similar types have also been variously described for northwestern Wyoming by Terwilliger and others (1979) and in Colorado by Wasser and Hess (1982). Jensen and Tuhy (1982) described **Carex rostrata** and **Swertia perennis** undergrowth

for the north slope of the Uinta Mountains that include communities belonging to our **SAPL/CAAQ c.t.** Youngblood and others (1985a) described a similar **Salix planifolia c.t.** as a minor type on the Yellowstone Plateau and the Centennial Mountains of eastern Idaho.

Salix planifolia/Calamagrostis canadensis c.t. (SALPLA/CALCAN; SAPL/CACA)

Distribution—SAPL/CACA is a minor type sampled only in the Uinta Mountains Floristic Section. It is, perhaps, more common in portions of Wyoming where it also occurs. This c.t. was sampled between 3 050 and 3 355 m (10,000 and 11,000 ft) but can be expected to occur at elevations down to 2 745 m (9,000 ft). It occurs in meadows and adjacent to order 1 streams in narrow to broad valley bottoms. The gently sloping uplands are commonly dominated by *Pinus contorta* or *Picea engelmannii.*

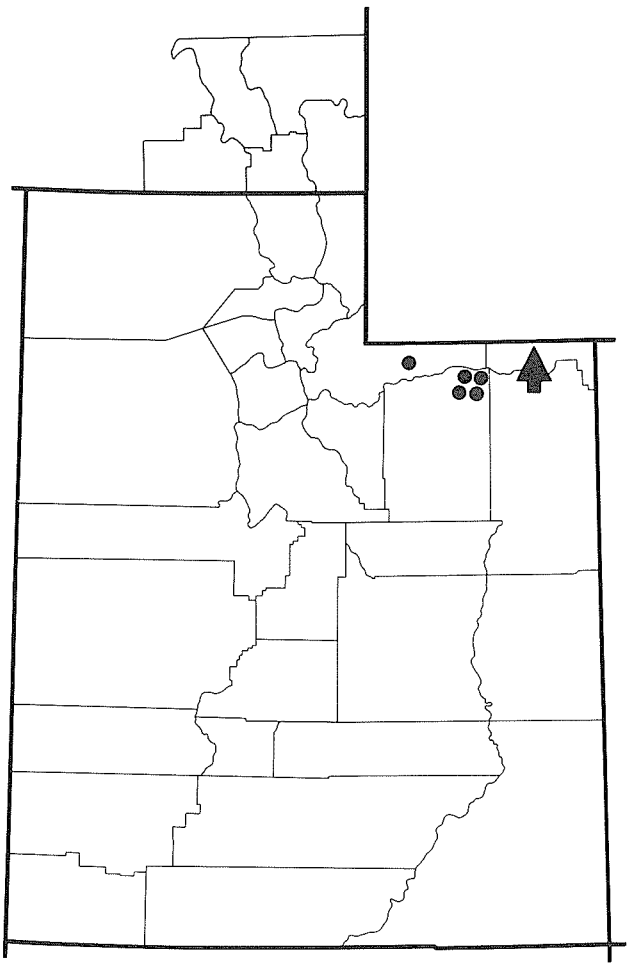
Vegetation—*Salix planifolia* dominates a low willow overstory. *Calamagrostis canadensis* typically forms a dense undergrowth. *Mertensia ciliata* is commonly associated with this c.t. and may be a codominant undergrowth species. *Deschampsia cespitosa, Phleum alpinum, Poa alpina, P. reflexa, Carex illota,* and *C. aquatilis* are among the graminoids that commonly occur with only scattered cover. Forbs likely to occur include *Ligusticum tenuifolium* and *Sedum rhodanthum.*

Soils—Limited sampling indicates this c.t. can occur on a variety of soils from Histosols associated with meadows to coarse-textured Mollisols adjacent to stream channels. Water tables appeared to be relatively close to the surface throughout the growing season. More sampling of communities belonging to this type needs to be done before adequate correlations can be made.

Succession and Management—Because limited information is available for communities belonging to the **SAPL/CACA c.t.**, few inferences to successional status can be made. It appears similar in some respects to the **Calamagrostis canadensis c.t.** (p. 105) but offers greater structural diversity for wildlife. It occurs on sites that are better drained than the **Salix planifolia/Carex aquatilis c.t.** and may represent an ecotonal community to the **Conifer/Calamagrostis canadensis c.t.**

Other Studies—A similar **SAPL/CACA c.t.** was described for the Bighorn National Forest of Wyoming by Olsen and Gerhart (1982). Winn and others (1982) described a similar **Salix phylicifolia [S. planifolia]/Calamagrostis canadensis-Carex canescens-Mertensia ciliata riparian type** for high elevations in this same general location in the Uinta Mountains.

Salix planifolia/Deschampsia cespitosa c.t. (SALPLA/DESCES; SAPL/DECE)



Distribution—SAPL/DECE (fig. 17) is a major type on the south slope of the Uinta Mountains, especially near the upper reaches of the Whiterocks River drainage. It was also sampled on the north slope of the Uinta Mountains but did not appear to be as extensive. **SAPL/DECE** may also extend into the High Uintas Wilderness Area to the west but was not sampled. Elevations range from 2 745 to 3 415 m (9,000 to 11,200 ft). It typically occurs on seeps and in meadows associated with broad valley bottoms. Alpine forb and grassland communities, as well as those dominated by *Picea engelmannii* and/or *Pinus contorta,* are typically associated with the **SAPL/DECE c.t.**

Vegetation—*Salix planifolia* dominates a low willow overstory. *Betula glandulosa* and *Potentilla fruticosa* are rarely codominants. *Salix glauca* is occasionally present and typically represents a transition to communities in which it dominates at higher elevations. The undergrowth is generally dense and low-growing and includes

Figure 17.—**Salix planifolia/Deschampsia cespitosa c.t.** near Cepeta Lake north of Roosevelt, Utah (3 390 m, 11,120 ft). *Salix planifola* dominates the low willow overstory. *Carex nigricans* is the dominant graminoid with *Juncus drummondiana* conspicuous; *Deschampsia cespitosa* is a minor undergrowth component.

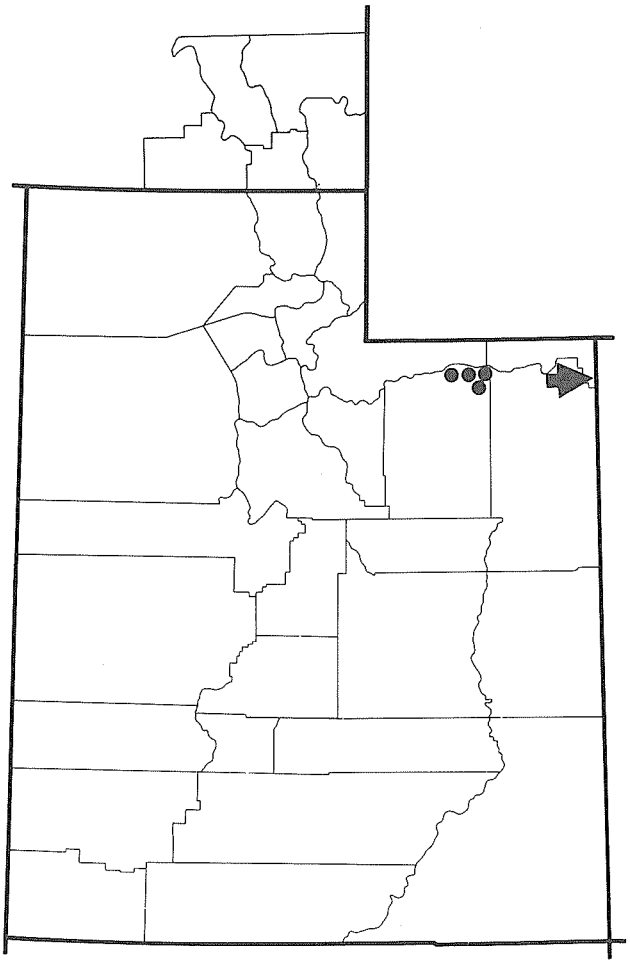
Ligusticum tenuifolium, Caltha leptosepala, Polygonum bistortoides, and *Sedum rhodanthum. Erigeron peregrinus* is commonly present with scattered cover. Graminoid cover is low to moderate and may include *Deschampsia cespitosa, Danthonia intermedia, Phleum alpinum,* and *Juncus drummondii.*

Soils—Soils were highly variable and included those classified as Aquic Cryoborolls, Histic Cryaquepts, Aquic Cryochrepts, and Terric Borohemists. Particle-size class was most often loamy-skeletal. Soils were seasonally wet with water tables generally deeper than those of the **Salix planifolia/Carex aquatilis c.t.** Soils, however, remain moist throughout the growing season.

Succession and Management—This appears to be the driest **Salix planifolia c.t.** and is likely to be grazed by livestock (mostly sheep in the areas where it occurs) and wild ungulates. Because it occurs in broad valley bottoms and has a low overstory physiognomy, movement by both livestock and wildlife is rarely impeded. The ecological relationship of this to other **Salix planifolia c.t.s** is not completely understood. It does not appear likely that this type has resulted from a succession from the **Salix planifolia/Carex aquatilis c.t. SAPL/DECE** probably represents a stable situation in which vegetation composition is likely influenced by grazing levels.

Other Studies—Jensen and Tuhy (1982) described a similar *Salix phylicifolia* [*S. planifolia*] overstory with a *Deschampsia cespitosa* undergrowth for the north slope of the Uinta Mountains. A similar **Salix planifolia/Deschampsia cespitosa c.t.** was described by Hess (1981) and by Wasser and Hess (1982) for north-central Wyoming.

Salix glauca/Deschampsia cespitosa c.t. (SALGLA/DESCES; SAGL/DECE)



Distribution—SAGL/DECE is a major type sampled only on the south slope of the Uinta Mountains. Elevations are near 3 355 m (11,000 ft) and above. While sampling was limited, this type is believed to be distributed throughout the upper subalpine and alpine zones of the Uinta Mountains and may also occur at high elevations in the Wasatch Mountains. **SAGL/DECE** typically occurs on convex, well drained open sites with slopes ranging from 5 to over 20 percent. Adjacent communities may include alpine grass-forb communities with *Picea engelmannii* communities adjacent at lower elevations. Adjacent Krummholz communities occur at the interface with the true alpine.

Vegetation—*Salix glauca* dominates the low willow layer. Scattered *Picea engelmannii* were noted in a few communities belonging to this type but are not likely to become dominant. The undergrowth is highly variable with herbaceous cover much greater in those communities with a more open overstory; *Geum rossii, Artemisia scopulorum,* and/or *Danthonia intermedia* may dominate these communities. In communities with dense overstories the herbaceous layer is typically sparse. *Artemisia scopulorum, Polygonum bistortoides, Carex scirpoidia, Trisetum spicatum, Festuca ovina* var. *breviflora,* and *Deschampsia cespitosa* are among the species that were noted in all communities belonging to this c.t.

Soils—Soils have developed in place on moderate to steep, convex slopes; all appear to be well drained. Soil development is variable and includes those classified as Typic Cryochrepts and Typic and Aquic Cryoborolls. Soil water is usually from late snow melt and runoff. All communities occurred on rocky mineral soils (loamy-skeletal particle-size classes) typical of the glaciated high elevations of the Uinta Mountains. Some had mollic epipedons indicative of the incorporation of organic material into the pedon, while more were classified as Inceptisols with only minor development of diagnostic horizons.

Succession and Management—The **SAGL/DECE c.t.** occupies slightly drier positions on the landscape than community types dominated by *Salix planifolia.* Whereas the **SAGL/DECE c.t.** typically occurs on convex slopes that are well drained and rocky, the **Salix planifolia c.t.s** typically occupy adjacent concave positions or positions which remain wet for longer periods during the growing season. Little is known about its successional trends or status, though many of the high elevation areas in the Uinta Mountains have been heavily grazed by sheep. While these communities are considered to be relatively stable, they are not necessarily representative of natural species compositions.

Other Studies—Terwilliger and others (1979), Hess (1981), and Wasser and Hess (1982) described similar **Salix pseudolapponum [S. glauca]/Deschampsia cespitosa h.t.s** for central Colorado.

Miscellaneous Unclassified Willow-Dominated Communities

Because of the widespread distribution of the various *Salix* spp. and the diversity of environmental conditions and past uses, several willow communities did not fit our classified c.t.s. One community dominated by *Salix fragilis* was sampled along the Logan River of the Bear River Range. *Alnus incana* was also present in the overstory, and a dense undergrowth was dominated by *Heracleum lanatum* and *Smilacina stellata* as well as other tall forbs. This community is similar to the **Alnus incana/Mesic Forb c.t.,** and management practices should follow those suggested for this type. Also in the Bear River Range near Franklin Basin, one community with a dense *Salix wolfii* overstory had an undergrowth dominated by a variety of forbs, though not those indicative of **Salix wolfii/Mesic Forb c.t. (SAWO/MF);** *Carex microptera* was also common in the undergrowth.

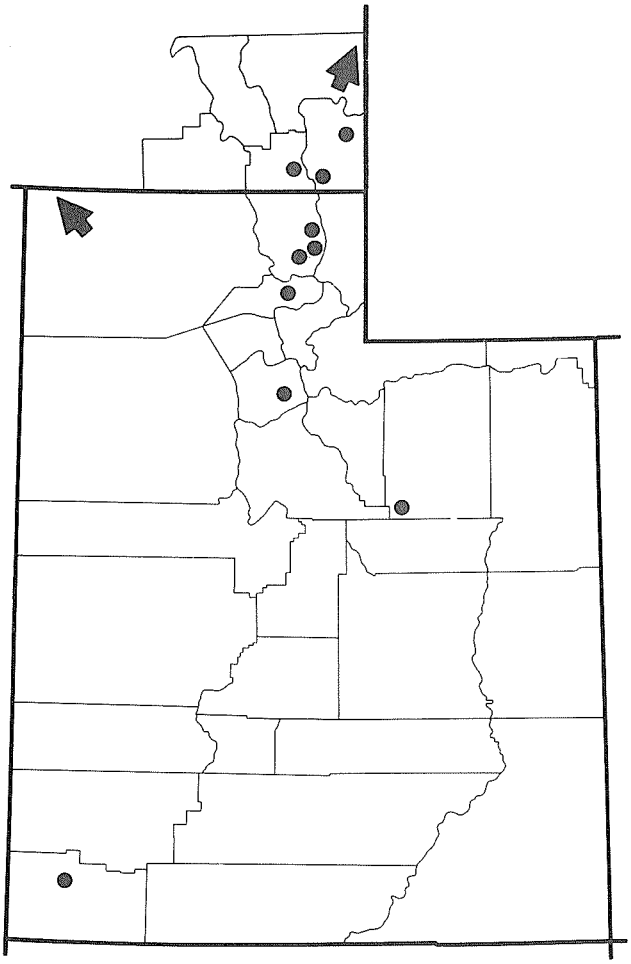
This community seemed to most resemble the **SAWO/MF c.t.** and management should be similar. Some communities dominated by *Salix boothii* or *S. drummondiana* do not fit the c.t.s described for the **Salix boothii dominance type.** In some instances they do not have sufficient cover of the appropriate graminoids or forbs necessary for their inclusion. For purposes of management, we would suggest user discretion in the placement of these miscellaneous communities in the classification. If site characteristics are the most important aspect for management, then the inclusion of communities into c.t.s with similar environmental settings is suggested. If undergrowth production is important it may be necessary to create a c.t. description based on production potential and/or current production levels. In the Uinta Mountains one community with an overstory dominated by *Salix glauca* and an undergrowth dominated by *Mertensia ciliata* was sampled. This community occurred on a steep, rocky, ephemeral stream site and was unlike either the **Salix glauca/Deschampsia ciliata** or the **Salix planifolia/Calamagrostis canadensis c.t.** Further sampling may result in the description of an additional **Salix glauca type.**

Nonwillow Shrub-Dominated Community Types

Communities dominated by *Cornus sericea* or *Artemisia cana* were sampled predominantly in the Utah Plateaus and the Wasatch Mountains Floristic Sections, while those dominated by *Potentilla fruticosa* were sampled throughout the study area. *Artemisia cana* does not occur in San Juan County and, therefore, not in the Abajo or LaSal Mountains of the Canyonlands Floristic Section. Communities dominated by other shrubs were sampled but not frequently enough to describe community types (**Miscellaneous Unclassified Shrub Communities**, p. 93). While *Cornus sericea* typically occurs on coarse-textured soils immediately adjacent to active stream channels or those that have in the recent past been active, *Artemisia cana* and *Potentilla fruticosa* more commonly dominate in broad valley bottoms and gently sloping toe slopes with fine-textured soils.

Sampson and Jespersen (1963) described *Artemisia cana* and *Cornus sericea* as strongly sprouting species, while they stated that *Potentilla fruticosa* was not. Chadde (1988), however, noted that *P. fruticosa* sprouted vigorously following an autumn burn in northern Yellowstone National Park. Because **Artemisia cana c.t.s** often cover extensive areas, the use of fire as a "control" method could likely result in a more dense cover of this sagebrush species. Additional information on the response of *Potentilla fruticosa* to fire will be necessary to determine what conditions are necessary to kill this species with fire. *Cornus sericea* normally reproduces by sprouting and is considered advantageous to stream channel stabilization.

Cornus sericea/Heracleum lanatum c.t. (CORSER/HERLAN; COSE/HELA)



Distribution—The **COSE/HELA c.t.** (fig. 18) is a major type in the Wasatch Mountains Floristic Section of northern Utah and southern Idaho, becoming a minor type in the southwestern portion of Utah. It was not sampled in the Uinta Mountains or Canyonlands and only rarely in the Utah Plateaus Floristic Sections. **COSE/HELA** typically occurs below 2 135 m (7,000 ft) immediately adjacent to streams of order 2 or greater. Slopes are commonly 2 to 3 percent though may be as much as 6 percent. Adjacent upland communities may be dominated by *Pseudotsuga menziesii, Quercus gambelii, Acer glabrum,* and/or *Artemisia tridentata* ssp. *vaseyana.* Associated riparian communities may include **Betula occidentalis, Salix exigua,** or other low-elevation community types.

Vegetation—*Cornus sericea* forms a dense shrub layer with at least 50 percent cover. *Salix exigua, S. lutea,* or other tall *Salix* spp. may be codominants. *Ribes aureum, R. hudsonianum, R. lacustre, R. inerme* and/or *Rosa*

Figure 18.—**Cornus sericea/Heracleum lanatum c.t.** adjacent to South Fork Wolf Creek northwest of Huntsville, Utah (1 950 m, 6,400 ft). *Cornus sericea* forms a dense shrub layer up with *Pachystima myrsinites* as a low shrub component. *Senecio serra, Mertensia ciliata, Chlorocrambe hastata,* and *Urtica dioica* form a conspicuous forb layer in the undergrowth. Graminoids cover is minor.

spp. may be intermixed with the tall shrub layer forming a nearly closed canopy. The undergrowth is highly variable, though *Heracleum lanatum* and *Urtica dioica* are nearly always present in at least minor amounts. *Poa pratensis, Elymus glaucus,* and *Glyceria striata* may also be present as well as *Geum macrophyllum, Galium triflorum, Geranium richardsonii, Smilacina stellata,* and *Senecio serra.*

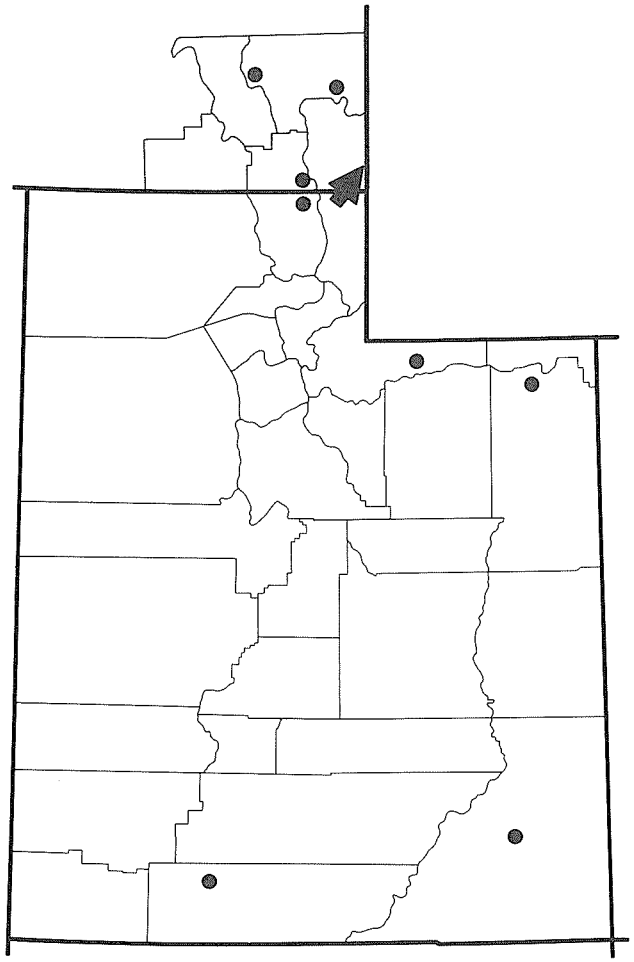
Soils—Many soils were classified as Aquic and Cumulic Cryoborolls and Cumulic and Fluvaquentic Haploborolls. Aquic Udifluvents, Dystric Cryochrepts, and Cumulic Cryaquolls were also noted. Mollisols on the flood plain often had a thin depositional layer overlying the A1 horizon. The development of a Mollic epipedon indicates that, even though communities belonging to the **COSE/HELA c.t.** occur adjacent to stream channels, many are stable enough for the incorporation of organic material. Many sites on which this c.t. occurs are currently elevated above the annual flood plain to a degree that no longer allows annual fluvial action to take place. Estimated available water-holding capacity was typically low to moderate, and water table depths ranged from 40 cm (16 in) to over 1 m (39 in).

Succession and Management—The **COSE/HELA c.t.** is an early successional type that colonizes stream bars and adjacent areas. Typically a combination of stream order and slope influence the establishment of this c.t. Areas with a gentle gradient and stream size of order 3 or more are environmentally similar to smaller order streams along steeper gradients. Both might result in the deposition of large rocky material as well as a movement of highly aerated water through the coarse soils. These two factors seem to be important in the establishment of the **COSE/HELA c.t.** Livestock movement through this c.t. is limited because of the dense shrub layer, and little forage is available for grazing. Sampson and Jesperson (1963) rated *Cornus sericea* as fair to poor browse for deer, but Chadde (1988) noted that it receives much wildlife use, especially on drier sites, and can be decreased by browsing animals. Most classes of livestock will not browse this species unless other feed is unavailable. The *Cornus* provides streambank stability because of its strongly rhizomatous nature, while stems appear to slow down water

movement through the community during high water flow. Some stream shading is provided adjacent to streambanks.

Other Studies—Youngblood and others (1985a) described two community types dominated by *Cornus sericea* [*C. stolonifera*]—the **Cornus stolonifera/Heracleum lanatum c.t.** and the **Cornus stolonifera/Galium triflorum c.t.** Our **COSE/HELA** is a more broadly defined type that includes communities that would fall into either of the latter two. We found that there was little reason in Utah and adjacent areas to separate these types based on undergrowth. Within central Idaho, somewhat similar communities have been described by Tuhy and Jensen (1982) for the Salmon and Middle Fork Salmon Rivers.

Potentilla fruticosa/Deschampsia cespitosa c.t. (POTFRU/DESCES; POFR/DECE)



Distribution—POFR/DECE (fig. 19) is a major type covering large areas in the Uinta Mountains and portions of the southern Utah Plateaus Floristic Sections (especially the East Fork Sevier River drainage of the Paunsaugunt Plateau). It was sampled between 1 830 and 2 900 m (6,000 and 9,500 ft) on broad meadows and terraces adjacent to streams; lower elevation communities occur in southern Idaho. Adjacent upland communities are dominated by *Artemisia tridentata* ssp. *vaseyana, Populus tremuloides, Picea pungens, Pinus contorta,* and/or *Pinus ponderosa.* Associated riparian communities include those dominated by *Salix wolfii, S. geyeriana, S. boothii, Carex nebrascensis,* and/or *C. aquatilis.*

Vegetation—*Potentilla fruticosa* dominates a low shrub overstory with *Artemisia cana, Betula glandulosa,* or *Salix wolfii* occasionally present in minor amounts. The undergrowth is characterized by a dense graminoid layer that includes *Deschampsia cespitosa, Carex microptera, Carex praegracilis, Juncus balticus,* and *Poa pratensis,* among others. Cover of *Deschampsia cespitosa* need not be dominant; its presence with at least 5 percent cover is indicative of environmental characteristics and community potential. Forb cover is highly variable with *Taraxacum officinale, Fragaria virginiana, Polygonum bistortoides* (wet extremes), and/or *Geum macrophyllum* likely to occur.

Soils—A majority of the soils were classified as Cryoborolls and Cryaquolls, often with thick mollic epipedons indicative of long-term soil development. One soil was classified as an Aquic Cryoboralf which means soils were in place long enough for an argillic horizon to form. Soils were typically fine-textured even when there were more than 35 percent coarse fragments and were classified as fine, silty, fine-loamy, clayey-skeletal, and loamy-skeletal at the soil family level. Depth to water table at the time of sampling ranged from 7 cm (3 in) to over 1 m (39 in); many had mottles within 30 cm (12 in) of the soil surface.

Succession and Management—This type is highly productive and typically occupies stable sites that can dry out as the growing season progresses. The **POFR/DECE c.t.** may be subjected to heavy grazing pressures, and the cover of *Deschampsia cespitosa* may be relatively low. A corresponding increase in *Poa pratensis, Juncus balticus,* and *Taraxacum officinale* can occur, leading eventually to a conversion to the **Potentilla fruticosa/Poa pratensis c.t.**

Other Studies—The **POFR/DECE c.t.** was described in western Wyoming and eastern Idaho by Youngblood and others (1985a). Mutz and Graham (1982) also described a more broadly defined **POFR/DECE c.t.** for western Wyoming.

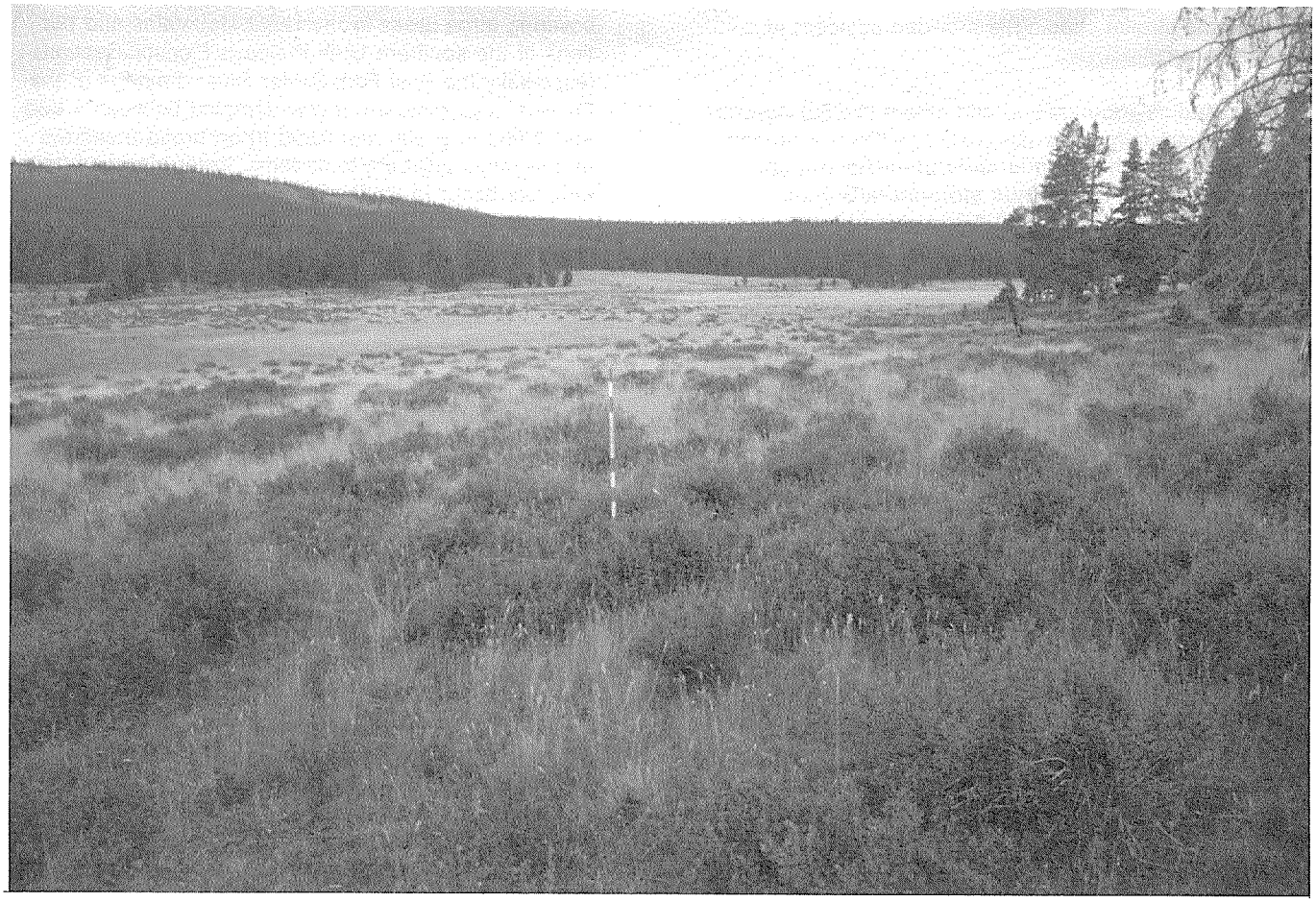
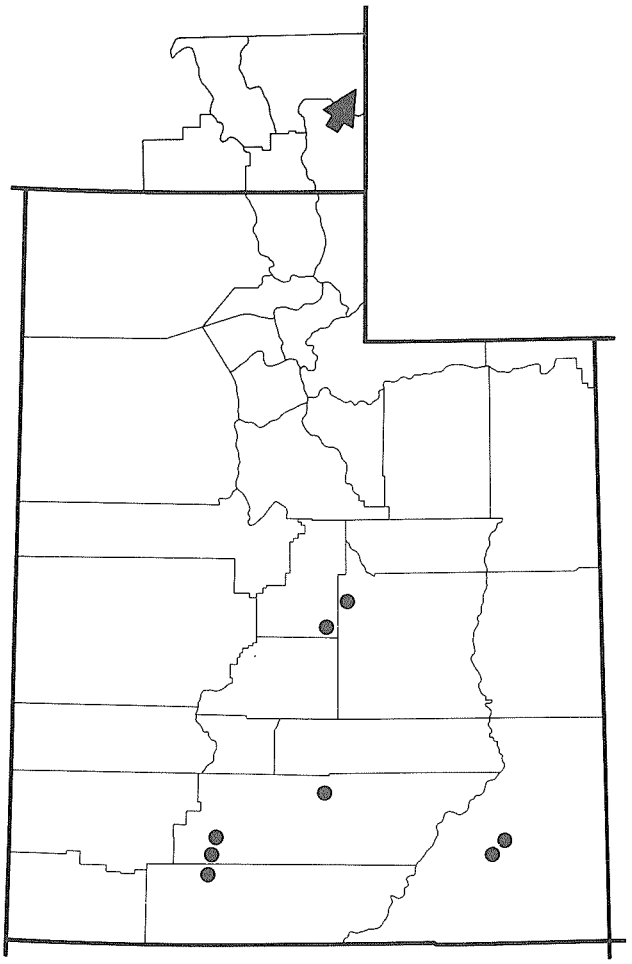


Figure 19.—**Potentilla fruticosa/Deschampsia cespitosa c.t.** in Bullocks Park south of Mountain View, Wyoming (2 900 m, 9,500 ft). *Potentilla fruticosa* is the dominant species in the low shrub overstory. *Deschampsia cespitosa, Danthonia intermedia, Phleum alpinum,* and *Juncus hallii* combine to form a dense graminoid component of the herbaceous undergrowth. *Aster occidentalis* and *Potentilla gracilis* are conspicuous forbs.

Potentilla fruticosa/Poa pratensis c.t. (POTFRU/POAPRA; POFR/POPR)



Distribution—The **POFR/POPR c.t.** is a major type in the central and southern portions of the Utah Plateaus Floristic Section and also in the Abajo and Wasatch Mountains. **POFR/POPR** occurs on broad meadows and stream terraces between elevations 2 410 to 3 050 m (7,900 to 10,000 ft). Adjacent uplands typically were gently sloping and/or had open vegetation dominated by *Picea engelmannii, Populus tremuloides,* and/or *Pinus ponderosa.* Associated riparian communities included those belonging to the **Conifer/Potentilla fruticosa, Potentilla fruticosa/Deschampsia cespitosa, Deschampsia cespitosa, Poa pratensis,** and **Juncus balticus c.t.s.**

Vegetation—*Potentilla fruticosa* dominates a low shrub overstory with the occasional occurrence of *Artemisia cana* or *Symphoricarpos oreophilus.* The undergrowth is highly variable but usually indicative of past heavy grazing levels. *Poa pratensis* cover may be quite high. *Taraxacum officinale, Trifolium repens, T. longipes, Erigeron flagellaris,* and/or *Juncus balticus* may dominate the herbaceous layer. *Festuca ovina* and *Stipa lettermanii* were rarely encountered.

Soils—Nearly all soils were classified as Cryoborolls (Typic, Aquic, Pachic, and Calcic Pachic), though one Inceptisol (an Aquic Cryochrept) was also sampled. Particle-size classes were typically fine or fine-loamy, though some were classified as loamy-skeletal. Water tables were generally below the depth of the soil pit at the time of sampling, but mottles were common within 30 to 50 cm (12 to 20 in) of the soil surface, indicating a seasonally high water table.

Succession and Management—**POFR/POPR** represents a grazing-induced type similar in many respects to the **Potentilla fruticosa/Deschampsia cespitosa (POFR/DECE) c.t.**; the presence of *Poa pratensis, Taraxacum officinale,* and *Trifolium longipes* or *T. repens* with high percent cover indicate this to be the case. In addition, soil characteristics are similar between these two c.t.s with **POFR/DECE** having slightly more moist conditions in some communities. Communities in which *Festuca ovina* and *Stipa lettermanii* occur may indicate succession toward dryer conditions similar to those found in the **Potentilla fruticosa/Festuca idahoensis c.t.** described by Youngblood and others (1985a) in eastern Idaho and western Wyoming. Though not sampled in our area, communities similar to the **Potentilla fruticosa/Festuca idahoensis c.t.** occur on the Fishlake National Forest. Because undergrowth species are rather shallow-rooted, little streambank stability is provided by communities belonging to this type. The loamy soils are easily sloughed into the stream channels either through stream action or livestock movement near the channel edge. Special attention to streambank stability may be necessary in some areas where fisheries habitat are of major concern. Management for a narrow strip of buffering c.t.s along each side of the stream, such as the **Carex aquatilis, Carex nebrascensis,** or **Carex rostrata c.t.s**, would help promote stability.

Other Studies—The **POFR/POPR c.t.** was previously described for the east slope of the Wyoming Range in Wyoming and the Centennial Mountains of eastern Idaho by Youngblood and others (1985a); it was proposed for western Wyoming by Mutz and Queiroz (1983).

Artemisia cana/Deschampsia cespitosa c.t. (ARTCAN/DESCES; ARCA/DECE)

Distribution—ARCA/DECE is a minor type sampled in the Utah Plateaus (Fishlake Plateau) and Wasatch Mountains (Bear River Range) Floristic Sections. It occurs at elevations between 2 105 and 2 805 m (6,900 and 9,200 ft) in broad meadows associated with *Artemisia tridentata* ssp. *vaseyana* uplands. Adjacent riparian communities included those belonging to the **Carex nebrascensis** and other **Artemisia cana c.t.s.**

Vegetation—*Artemisia cana* forms a low shrub canopy with *Deschampsia cespitosa, Carex scirpoidea,* and/or

Juncus balticus forming a dense undergrowth. *Poa pratensis, Carex praegracilis, Polygonum bistortoides,* and *Potentilla gracilis,* may also occur in the herbaceous layer.

Soils—Limited information indicates that these soils are very stable with the development of Mollic epipedons (Aquic Cryoborolls) or argillic horizons (Udollic Ochraqualf). Estimated available water-holding capacity was high with very fine or fine soil particle-size classes. Distinct or prominent mottles were present within 25 cm (10 in) of the surface, indicating a seasonally high water table.

Succession and Management—The presence of *Deschampsia cespitosa* indicates moist conditions, at least seasonally, as described in **Soils** above. This type appears to be a stable sere replaced by the **Artemisia cana/Poa pratensis c.t.** under heavy grazing pressures (**Artemisia cana/Poa pratensis c.t.**, p. 93). Communities belonging to **ARCA/DECE** typically provide good livestock forage and occur on gently sloping meadows that allow easy access for grazing. Streambank stability in this c.t. is variable, depending on the species dominating the undergrowth. Stability is very low in communities dominated by *Deschampsia cespitosa,* whereas communities with high cover of *Juncus balticus* and/or *Carex praegracilis,* both strongly rhizomatous species, have much greater potential to hold streambanks in place.

Other Studies—The **ARCA/DECE c.t.** has not been previously described.

Artemisia cana/Festuca ovina c.t. (ARTCAN/FESOVI; ARCA/FEOV)

Distribution—The **ARCA/FEOV** (fig. 20) is a major type on the Fishlake and Wasatch Plateaus of the Utah Plateaus Floristic Section and may also occur in the Uinta Mountains Floristic Section. It occurs on broad meadows between 2 805 and 3 265 m (9,200 and 10,700 ft). It is likely to occur elsewhere in the study area but was not sampled.

Figure 20.—**Artemisia cana/Festuca ovina c.t.** near Right Fork U.M. Creek north of Loa, Utah (2 870 m, 9,400 ft). *Artemisia cana* ssp. *viscidula* dominates the low shrub overstory while *Potentilla fruticosa* is a minor component. *Festuca ovina* is the dominant graminoid with *Juncus balticus* a conspicuous associate. *Taraxacum officinale* is abundant with *Aster, Geum triflorum,* and *Achillea millefolium* throughout the community.

Vegetation—*Artemisia cana* dominates the low shrub overstory. *Festuca ovina* is present in varying amounts with *Juncus balticus* and/or *Poa pratensis* locally abundant. *Taraxacum officinale, Aster* spp., and *Achillea millefolium* are commonly present. *Festuca ovina* is considered taxonomically equivalent to *F. idahoensis* by Welsh and others (1987), and as such, is treated as the same in describing the undergrowth of this type.

Soils—Surface soil particle-size class was typically fine-loamy. One community was sandy-skeletal in the subsurface horizons with greater than 50 percent coarse fragments. No evidence of high water table was noted in the top 50 cm (20 in), though the coarse nature of the soils made it difficult to see mottles.

Succession and Management—**ARCA/FEOV** may be a stable, late successional *Artemisia cana* sere that can, through heavy grazing pressures, be converted to the **Artemisia cana/Poa pratensis c.t. ARCA/FEOV** represents the interface between riparian and upland situations. It is included in our classification because *Artemisia cana* can occur on truly riparian sites and typically has water table levels that are higher than surrounding upland types.

Other Studies—The **ARCA/FEOV c.t.** is similar to the **Artemisia cana/Festuca idahoensis c.t.** described in western Wyoming and eastern Idaho (Youngblood and others 1985). Schlatterer (1972) also described an **Artemisia cana/Festuca idahoensis c.t.** for central Idaho, while Mueggler and Stewart (1980) recognized similar communities in southwestern Montana.

Artemisia cana/Poa pratensis c.t. (ARTCAN/POPR; ARCA/POPR)

Distribution—**ARCA/POPR** is a major type in the Utah Plateaus, Uinta Mountains, and southern Wasatch Mountains Floristic Sections and commonly occurs as expansive areas on Forest Service and adjacent public and private lands. This c.t. was sampled in a narrow elevation range between 2 290 and 2 350 m (7,500 and 7,700 ft). It occurs on gently sloping, broad meadows and elevated terraces adjacent to streams. Upland communities are usually dominated by *Artemisia tridentata* ssp. *vaseyana* and/or *Populus tremuloides* with associated riparian communities dominated by *Salix boothii* and *Carex nebrascensis,* among others.

Vegetation—*Artemisia cana* dominates a low shrub overstory; other shrubs are rare. The undergrowth is characterized by dense a graminoid layer of *Poa pratensis* and/or *Carex praegracilis. Stipa nelsonii, S. lettermanii, Taraxacum officinale, Smilacina stellata, Cirsium* spp., *Fragaria virginiana,* and/or *Trifolium* spp. may also be present in varying amounts.

Soils—Soils were classified as Pachic Cryoborolls and Cumulic Cryaquolls, indicating stable conditions and an accumulation of organic materials deep within the soil profile. Surface particle-size classes were fine-loamy or fine, and estimated available water-holding capacity was moderate to high. Water tables were highly variable. Most soils had mottles within 50 cm (20 in) of the surface, indicating a seasonally high water table.

Succession and Management—Communities belonging to this type, as previously noted, occur on broad, gently sloping meadows and stream terraces. Because of this they are often subjected to heavy livestock grazing pressure and are commonly dominated by increaser and invader species. Similarities between the **ARCA/POPR c.t.** and our **Artemisia cana/Festuca ovina** and **Artemisia cana/Deschampsia cespitosa c.t.s** indicate this to be a grazing-induced sere.

Other Studies—Youngblood and others (1985a) described a similar **ARCA/POPR c.t.** as a minor type in eastern Idaho and western Wyoming.

Miscellaneous Unclassified Shrub-Dominated Communities

Several communities dominated by various shrubs were sampled infrequently and were, therefore, not classified. In the Wasatch Mountains a few communities dominated by *Ribes hudsonianum* were sampled. These communities occurred immediately adjacent to streams within the subalpine fir-Engelmann spruce zone. *Lonicera involucrata, Actaea rubra,* and *Geranium richardsonii* were among the associated species in these communities. Similar communities were included in the **Alnus incana/Ribes hudsonianum c.t.** in eastern Idaho and western Wyoming (Youngblood and others 1985a). In the Uinta Mountains, communities dominated by *Ledum glandulosum,* with a dense mat of moss and little additional undergrowth, occurred on sphagnum seeps. Communities dominated by *Vaccinium occidentale* also occur in the Uinta Mountains. These were typically adjacent to lake and stream margins above 2 745 m (9,000 ft) on wet, mossy soils. *Carex aquatilis* and *Pedicularis groenlandica* were often present in the undergrowth. Mattson (1984) described a similar **Vaccinium occidentale/Carex aquatilis h.t.** for Yellowstone National Park in northwestern Wyoming, and our communities may be a southern extension of this type. *Salix planifolia* is also commonly present in these communities, and until further data collection warrants, these may be managed like the **Salix planifolia/Carex aquatilis c.t.** Other communities in which *Salix planifolia* and/or *Vaccinium occidentale* dominate were described by Winn and others (1983) for the Shale Creek drainage on the south slope of the Uinta Mountains near the upper Uinta River watershed.

Herbaceous Community Types

Herbaceous communities occur throughout the study area—sometimes in combination with woody communities though quite often not. Communities dominated by various grasses, forbs, or grass-likes are included in this dominance group and represent a broad environmental spectrum, from perennially saturated or ponded sites to those that are only wet very early in the growing season. Some community types are restricted to certain geographic portions of the study area. For example, the **Carex lasiocarpa** and **Carex buxbaumii c.t.s** only occur in the Uinta Mountains. Many of our herbaceous types grade into one another and distinctions are not always clear. This is typically because many of the meadows in the areas where they occur have gradually changing environments rather than distinct or abrupt environmental boundaries. The user is urged to use discretion in delineating these sometimes broad ecotonal communities.

Typha latifolia c.t. (TYPLAT; TYLA)

Distribution—TYLA is a minor type sampled infrequently in the Wasatch Mountains Floristic Section below 1 710 m (5,600 ft). Because most USDA Forest Service lands in Utah are above this elevation, this c.t. is of more importance on adjacent public and private lands. The **TYLA c.t.** occurs on wet, typically ponded sites or on sites with slow-moving water. Adjacent upland communities are indicative of the lower elevations and include those dominated by *Pseudotsuga menziesii, Cercocarpus ledifolius,* or *Artemisia tridentata* spp. *vaseyana.*

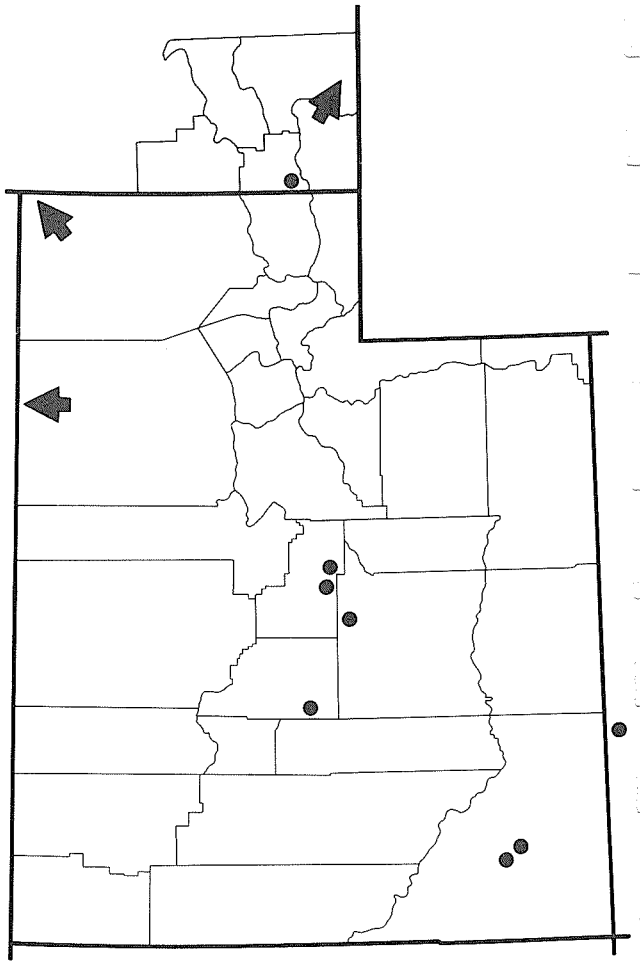
Vegetation—*Typha latifolia* dominates a nearly monospecific community; graminoids such as *Eleocharis palustris, Glyceria grandis, G. striata,* and *Phalaris arundinacea* are among those likely to occur with minor cover. On sites where water levels draw down, forbs such as *Mentha arvensis, Veronica americana,* and *Polygonum amphibium* were noted.

Soils—Because all sites were either saturated or had standing water, complete soil descriptions were not made. Each site, however, had an accumulation and incorporation of organic matter into surface horizons, and soils were estimated to be Cumulic or Histic Haplaquolls. Mineral soils were fine-textured and included silt loams, silty clay loams, and sandy clay loams, at least in the upper horizons.

Succession and Management—The **TYLA c.t.** is an early successional wetland community at lower elevations in the study area, and *Typha latifolia* is one of the most ubiquitous lowland marsh and wetland species throughout the western states. It is able to withstand prolonged periods of flooding but requires some period of bare soil exposure for germination and establishment. Because seed production is extremely high, *Typha latifolia* is capable of rapid colonization on wet mineral soils (Hansen and others 1988) but will persist for long periods. Numerous wildlife species, especially waterfowl, use the **TYLA c.t.** for nesting, cover, and food.

Other Studies—Hansen and others (1988) described a similar **Typha latifolia dominance type** for Montana.

Eleocharis palustris c.t. (ELEPAL; ELPA1)



Distribution—This minor type is expected to occur throughout the study area. Elevations range from 2 225 to 3 020 m (7,300 to 9,900 ft). **ELPA1** is associated with small- to moderate-sized ponds and edges of larger lakes and reservoirs. The **Carex rostrata c.t.** may occur on sites with shallower standing water, while **Deschampsia cespitosa, Carex microptera,** and **Poa pratensis c.t.s** are among those likely to occur adjacent

to the ponded sites. Adjacent uplands may be dominated by *Artemisia tridentata* ssp. *vaseyana, Pinus ponderosa, Populus tremuloides, Picea pungens,* or *Abies lasiocarpa.*

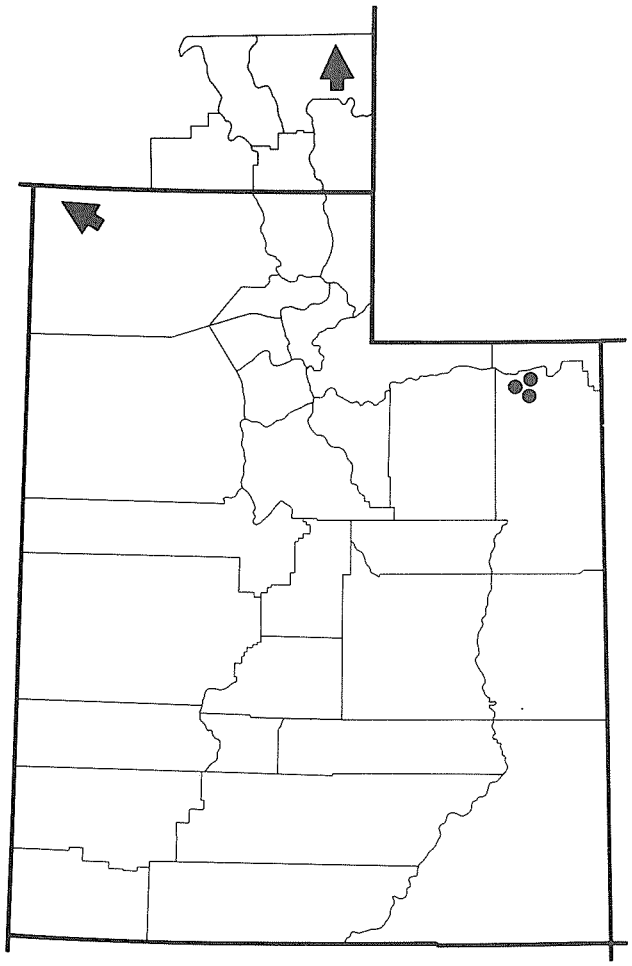
Vegetation—*Eleocharis palustris* forms a scattered to dense overstory often with few additional species present; *Eleocharis acicularis* and *Alopecuris aequalis* are among those likely to occur. On the wetter extreme of this type, *Hipperus vulgarus, Utricularia vulgaris, Potamogeton* spp., and *Ranunculus aquatilis* may be present. At the drier end, *Juncus balticus, Hordeum brachyantherum,* and *Poa pratensis* may occur.

Soils—This c.t occurs on mineral soils with fine-loamy to fine particle-size classes or on organic soils. They are commonly ponded throughout much of the growing season, and soils have developed, for the most part, from pond siltation. Soils were classified as Aeric Humic and Histic Cryaquepts, Typic Cryaquolls, and Aquic and Argic Pachic Cryoborolls. One soil was a Typic Borosaprist. Estimated available water-holding capacity was moderate to high but appears, in most cases, to be inconsequential because of the standing water.

Succession and Management—Because communities belonging to the **ELPA1 c.t.** can occur on sites that are only ponded seasonally, it is included within our classification. Sites with deeper water are discussed in a later section (**Wetland Communities**, p. 116). *Eleocharis palustris* is an early successional species on these ponded sites, and as continued siltation occurs, it may eventually be replaced by the **Carex rostrata c.t.** The often light-colored soils indicate an early developmental stage as well as an early stage of organic matter incorporation into the mineral soil.

Other Studies—Youngblood and others (1985a) briefly described similar communities dominated by this type for eastern Idaho and western Wyoming. Hansen and others (1988) described an **Eleocharis palustris dominance type** throughout Montana. Kovalchik (1987) described a similar **Eleocharis palustris association** for central Oregon.

Carex lasiocarpa c.t. (CARLAS; CALA1)



Distribution—CALA1 (fig. 21) is a major type with distribution limited to the Sims Peak Potholes region on the south slope of the Uinta Mountains. It appears to be more common in western Montana on similar and drier sites (Hansen and others 1988). It occupies organic mat soils between 2 900 and 2 990 m (9,500 and 9,800 ft) in an area where glaciation left a series of ponds that have been replaced by sphagnum bogs. Adjacent uplands typically belong to the **Pinus contorta/Vaccinium scoparium h.t.**, while **Carex rostrata, Carex limosa,** and **Carex saxatilis c.t.s** are among the associated riparian types.

Vegetation—Communities have very low species diversity and are clearly dominated by *Carex lasiocarpa. Carex rostrata* is usually present in minor amounts with *C. aquatilis* or *C. canescens* occasionally present on slightly raised microsites. No forbs or grasses were noted in this type.

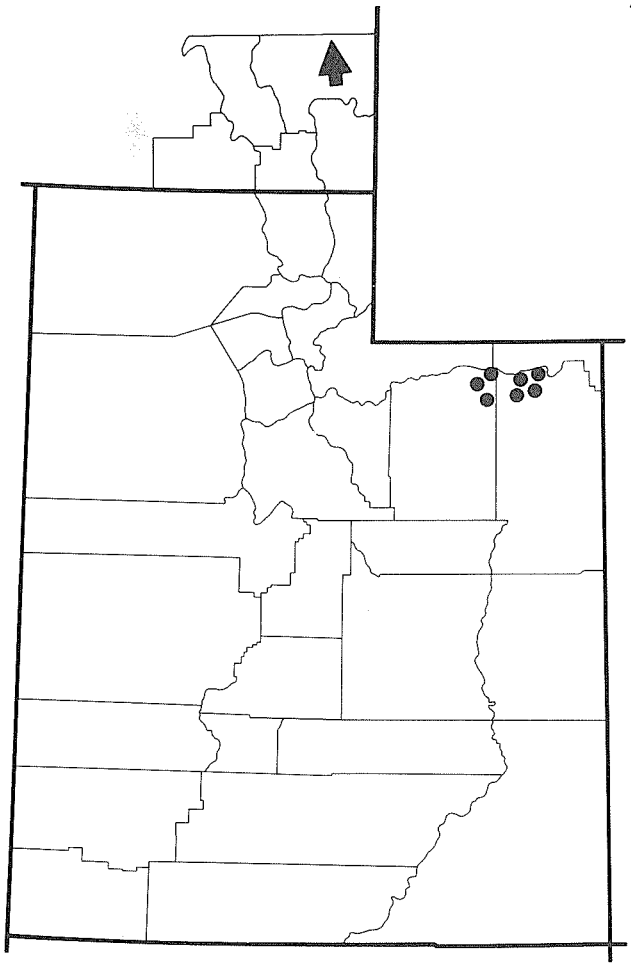
Figure 21.—**Carex lasiocarpa c.t.** in the Sims Peak Potholes area north of Vernal, Utah (2 950 m, 9,680 ft). *Carex lasiocarpa* dominates this boggy meadow community. *Carex rostrata,* the only other species occurring, is a minor component.

Soils—Soils are organic and were classified as Borofibrists, Borohemists, or Borosaprists. While not classified as Hydric subgroups (floating bogs), all communities occurred on soils that might be considered as intergrades to this type and felt highly unstable when one walked across them. Water tables were at or, more typically, above the surface and probably remained as such throughout the growing season.

Succession and Management—Numerous wildlife trails occurred in communities belonging to this c.t. and elk were seen walking through one. It is not known whether *Carex lasiocarpa* is palatable to wildlife species, but it has low palatability for livestock (Hermann 1970), and no utilization was noted. Because of the unique nature of these and other communities, the area in which they occur is currently being considered as a candidate Research Natural Area. Mechanical interference in this c.t. should be avoided because of the fragile nature of the wet, organic soils. Livestock are naturally dissuaded from using this area because of its extremely wet nature.

Other Studies—Kovalchik (1987) described a similar **Carex lasiocarpa** association for central Oregon, and Hansen and others (1988) described the **Carex lasiocarpa dominance type** for western and central Montana.

Carex limosa c.t. (CARLIM; CALI)



Distribution—CALI is a minor type scattered throughout the south slope of the Uinta Mountains and possibly extends to the north and western portions of this Floristic Section. Elevations range from 2 930 to 3 235 m (9,600 to 10,600 ft). It occurs on organic meadow soils, occasionally as floating mats, in moderate to broad valley bottoms. Adjacent riparian communities include those belonging to the **Salix planifolia/Carex aquatilis, Carex aquatilis, Carex rostrata,** and **Carex lasiocarpa c.t.s.** Adjacent uplands are typically dominated by *Pinus contorta* or *Picea engelmannii* and occur on the **Pinus contorta/Vaccinium scoparium** or **Picea engelmannii/Vaccinium scoparium h.t.s.**

Vegetation—*Carex limosa* dominates communities belonging to this type; *Carex aquatilis* and *Eleocharis pauciflora* are often present and occasionally codominants. *Eriophorum scheuchzeri, Scirpus caespitosus,* and *Pedicularis groenlandica* are among the common associates though typically with minor cover. A dense layer of moss may occur in some communities.

Soils—Most soils were classified as Typic or Hydric Borofibrists (floating bogs), indicating very little decomposition of organic matter. *Carex limosa* is strongly rhizomatous and, when combined with mosses, helps maintain the fibric nature of these organic soils. Soils were saturated to the surface, while the Hydric Borofibrists had a water layer typically between 50 and 60 cm (20 and 24 in) below the surface.

Succession and Management—CALI appears closely related to the **Carex aquatilis c.t.** with which it is commonly associated. In the Uinta Mountains *Carex aquatilis,* though less productive and robust, is common in the **CALI c.t.** Communities belonging to this type, however, often occur on organic soils that are much less decomposed than those associated with the **Carex aquatilis c.t. CALI** is considered a stable, long-lived c.t but, should the areas become slightly drier or more decomposed, *Carex aquatilis* may become more competitive thus resulting in a very slow change to the **Carex aquatilis c.t.**

Other Studies—Hansen and others (1988) described a rare **Carex limosa dominance type** occurring on similar floating organic mats in western Montana.

Carex buxbaumii c.t. (CARBUX; CABU)

Distribution—This minor type is scattered throughout the Uinta Mountains Floristic Section on wet, organic meadows. Elevations range from 2 960 to 3 205 m (9,700 to 10,500 ft). This type occurs in moderately broad valley bottoms with gently sloping adjacent uplands, typically belonging to the **Pinus contorta/Vaccinium scoparium** or **Picea engelmannii/Vaccinium scoparium h.t.s.** The **CABU c.t.** is often interspersed with communities belonging to the **Carex rostrata** or **Salix planifolia/Carex aquatilis c.t.s.**

Vegetation—*Carex buxbaumii* cover is 25 percent or greater; *Carex aquatilis* and/or *C. saxatilis* are present and occasionally are codominants. *Deschampsia cespitosa, Caltha leptosepala, Pedicularis groenlandica,* and *Ligusticum tenuifolium* are among the common associates typically present with minor cover.

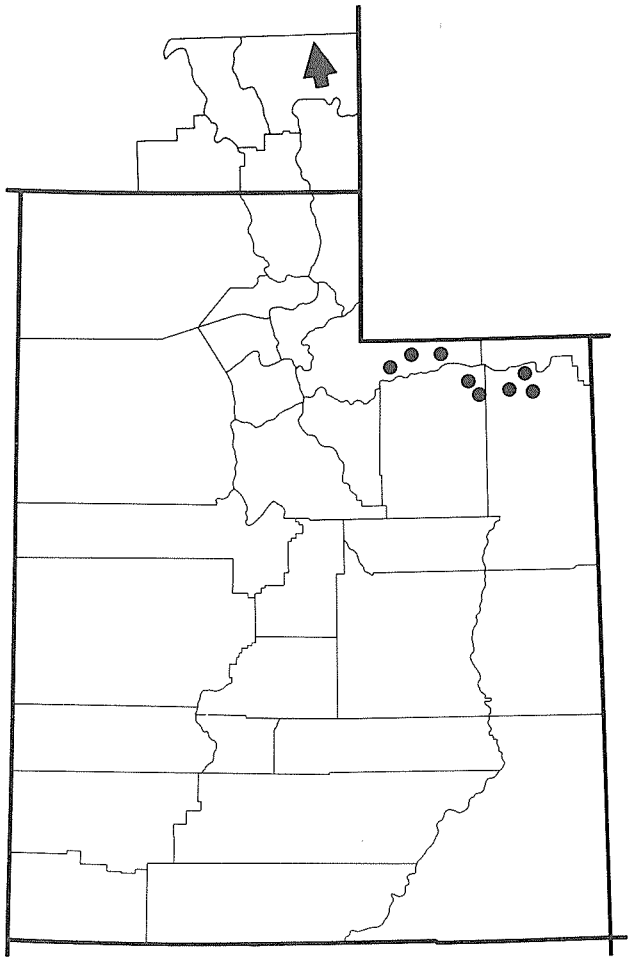
Soils—Additional information is necessary to determine relationships between soils and vegetation. Limited information, however, indicates this c.t. occurs on organic soils that are saturated to the surface throughout the growing season. Soils were classified as Typic Borofibrists, Terric Borosaprists, and Histic Cryaquepts.

Succession and Management—The **CABU c.t.** is

related to the **Carex aquatilis c.t.** Whether *Carex aquatilis* or *C. buxbaumii* become established on a site may be more a matter of opportunism than competition, but more information is needed on this type. One community in which *Scirpus caespitosus* dominated was included in this type because of the presence of *Carex buxbaumii* and the lack of additional plots dominated by the former species. *Scirpus caespitosus*-dominated communities will likely be described as a distinct type once more plots are sampled. *Carex buxbaumii* appeared to occur on more highly decomposed organic soils than did *Scirpus caespitosus.* The wet nature of this type is a natural deterrent to livestock grazing, and most communities appear to be stabie and in good ecological condition.

Other Studies—A similar **Carex buxbaumii dominance type** has been described for Montana by Hansen and others (1988), Mattson (1984), and Pierce and Johnson (1986).

Carex saxatilis c.t. (CARSAX; CASA)



Distribution—**CASA** (fig. 22) is a major type in the Uinta Mountains Floristic Section. Elevations range from 2 745 to 3 205 m (9,000 to 10,500 ft). It occurs in narrow to broad mountain meadows, typically on organic substrates, with smooth to concave surface topography. Adjacent uplands are gently sloping and may be dominated by *Pinus contorta, Picea engelmannii,* or *Populus tremuloides;* the **Pinus contorta/Vaccinium scoparium h.t.** is the most common upland type associated with this c.t. Adjacent riparian communities include those belonging to the **Carex rostrata** and the **Carex lasiocarpa c.t.s,** on wetter sites, the **Salix planifolia/Carex aquatilis** and the **Carex aquatilis c.t.s** on similar or slightly drier sites, and the **Deschampsia cespitosa c.t.** on drier sites.

Vegetation—*Carex saxatilis* dominates a typically dense graminoid community; *Carex aquatilis* is commonly present and often a codominant. *Pedicularis groenlandica* and *Caltha leptosepala* are also present in most communities, but cover is typically minor. *Deschampsia cespitosa, Carex rostrata, C. canescens,* and *Eriophorum scheuchzeri* may also be present, but again, often with only scattered occurrence.

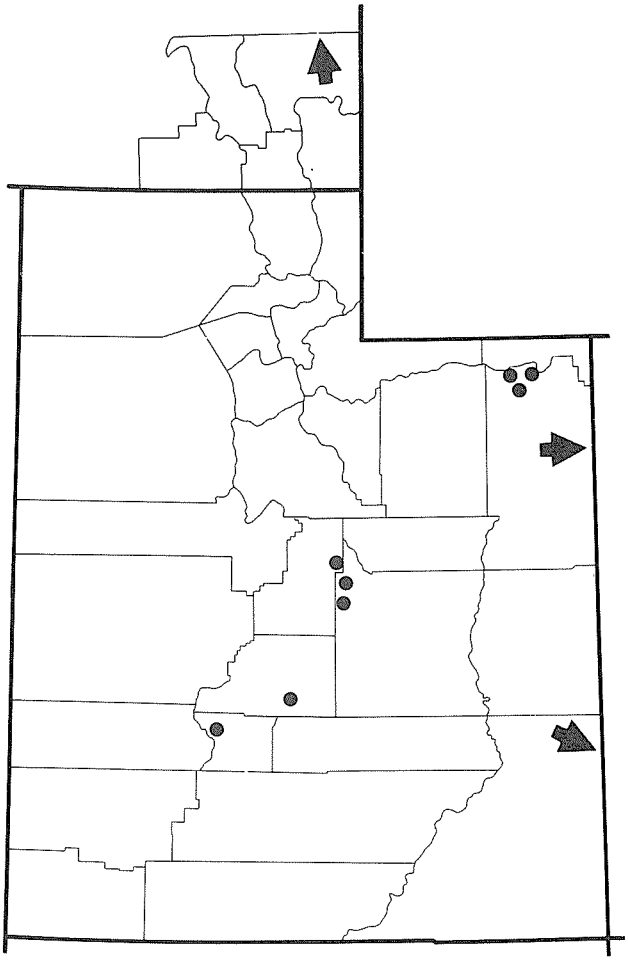
Soils—All soils had a histic epipedon, and most were classified as Borohemists and Borosaprists; others with thin histic epipedons were classified as Histic Cryaquepts and Histic Cryaquolls. Many of the Histosols belonged to Terric subgroups, thus indicating an intergradation to mineral soils. Organic decomposition, for the most part, is greater in the soils of the **CASA c.t.** than for the **Carex limosa** and **Carex lasiocarpa c.t.s.** Soils are typically saturated to the surface, though some had water tables well below the surface, indicating a tolerance for seasonal drying in the upper horizons.

Succession and Management—The environment on which the **CASA c.t.** occurs appears similar to that of the **Carex aquatilis c.t.** The dominance of one species over the other may be more opportunistic, though little is known of the autecology of *Carex saxatilis* (**Carex aquatilis c.t., Succession and Management**, p. 101). These two types are, in the very least, closely allied with both grading into one another. Some cattle and elk use was noted in communities belonging to this type. While the palatability of *Carex saxatilis* is not known, it appears to be somewhat more palatable than *Carex rostrata* yet not as palatable as *C. aquatilis.* **CASA** appears to be a stable c.t. with species compositions only slightly impacted by past livestock grazing. Use of heavy machinery on this c.t should be avoided because of the organic, wet soils.

Other Studies—Lewis (1970) previously described **Carex saxatilis** communities for the Uinta Mountains. Hansen and others (1988) described a similar **Carex saxatilis dominance type** at high elevations in western Montana.

Figure 22.—**Carex saxatilis c.t.** on the north slope of the Uinta Mountains south of Mountain View, Wyoming (3 020 m, 9,900 ft). *Carex saxatilis* dominates this wet meadow community with only scattered *Carex athrostachya;* forbs are inconspicuous.

***Caltha leptosepala* c.t.**
(CALLEP; CALE)



Distribution—The **CALE c.t.** is a minor type in the Uinta Mountains and Utah Plateaus Floristic Section. It typically occurs between 2 745 and 3 110 m (9,000 and 10,200 ft), but it is expected at both lower and higher elevations. This type typically occupies seeps and wet, subirrigated meadows. It may be associated with narrow forest openings to broad valley bottoms with slopes of 3 to 10 percent. Adjacent riparian communities include those belonging to the **Carex rostrata, Carex microptera, Deschampsia cespitosa,** and **Calamagrostis canadensis c.t.s.** Adjacent uplands may be dominated by *Abies lasiocarpa, Pinus contorta,* or *Populus tremuloides.*

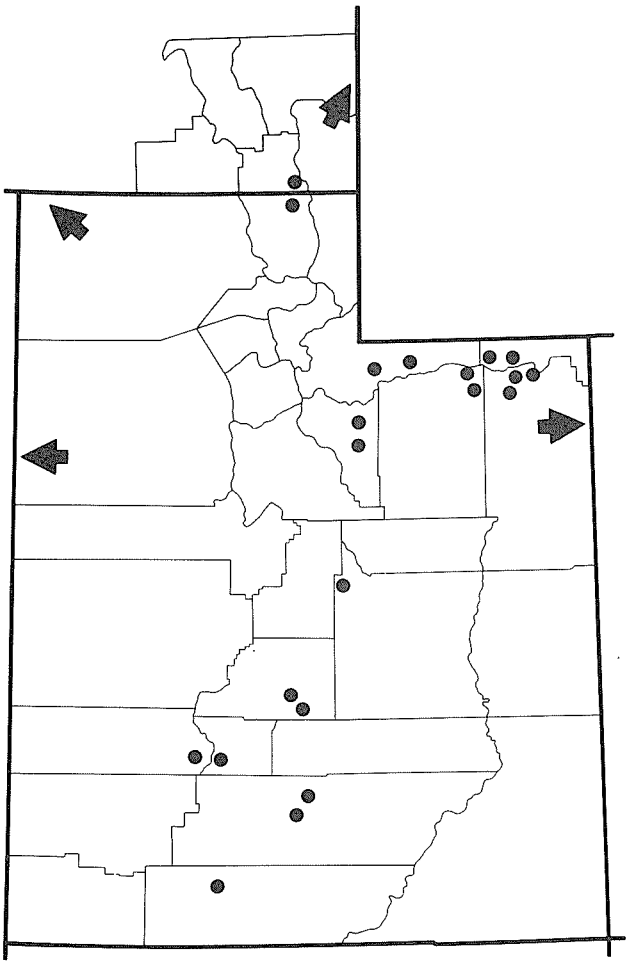
Vegetation—These diverse communities typically have a mixture of graminoids, usually sedges, with a dense, conspicuous layer of *Caltha leptosepala. Carex aquatilis* or *C. rostrata* are among the most common associates. *Carex simulata, C. muricata,* and *C. lanuginosa* are occasionally major community components. *Deschampsia cespitosa,* while commonly present, was a codominant in only one sampled community. Forb cover, other than that of *Caltha leptosepala,* usually includes *Pedicularis groenlandica, Parnassia fibriata, Polygonum bistortoides,* and *Equisetum arvense.* Communities dominated by *Carex muricata* commonly have a dense cover of *Caltha leptosepala* associated and, because only a few of these were sampled, were included in the **CALE c.t.**

Soils—The **CALE c.t.** typically occurred on soils with shallow Histic epipedons, ranging from 15 to 45 cm (6 to 18 in) thick. They were classified as Histic Cryaquepts, Terric Borohemists, and Terric and Lithic Borosaprists. One Typic Cryaquept had an organic horizon 4 cm (1.5 in) thick. Soils were always saturated at the surface, commonly from underground seeps or subsurface flows. Particle-size classes were fine-loamy, fine, and clayey-skeletal. Estimated available water-holding capacity was moderate to high.

Succession and Management—Caltha leptosepala appears to be well suited to seeps or areas with a continual addition of fresh water. *Carex muricata* seems to be similarly suited, as previously noted, and communities dominated by this sedge are, for the time being, included in the **Caltha leptosepala c.t.** These communities are considered to be stable and receive little domestic livestock use, probably because of the wet environment. Elk or deer use is likely in communities associated with forest openings. The relationship of this to other riparian communities can only be speculated. The presence of *Carex aquatilis, C. rostrata,* and *Deschampsia cespitosa* in some communities, however, indicates that these species are, at least, capable of doing well on environments favorable to *Caltha leptosepala.* Many riparian species have overlapping environmental tolerances, thus making it difficult to separate c.t.s. This suggests that, to a large degree, opportunism may be responsible for the development of one c.t. over another.

Other Studies—Ellison (1954) noted the occurrence of communities dominated by *Caltha leptosepala* on the Wasatch Plateau of central Utah. Komarkova (1976) described a similar **Caltha leptosepala/Sedum rhodanthum plant association** for north-central Colorado. Hansen and others (1988) described the **Caltha leptosepala dominance type** as a rare to minor type in western and central Montana.

***Carex aquatilis* c.t.**
(CARAQU; CAAQ)



Distribution—CAAQ is a major type throughout most of the study area. It occurs, for the most part, between 2 440 and 3 355 m (8,000 and 11,000 ft) with a few communities belonging to this type as high as 3 390 m (11,120 ft). **CAAQ** commonly occurs on meadows and seeps associated with broad valley bottoms but may also occur in more narrowly confined areas. Slopes range from 0 to 10 percent, and surface topography is commonly smooth to concave. Adjacent riparian communities include those belonging to the **Carex rostrata** and **Carex lasiocarpa c.t.s** on wetter habitats, the **Salix boothii/Carex aquatilis, Salix wolfii/Carex aquatilis,** and **Salix planifolia/Carex aquatilis c.t.s** on similar habitats, and the **Deschampsia cespitosa, Artemisia cana/Deschampsia cespitosa,** and **Juncus balticus c.t.s** on drier habitats. Adjacent uplands may be dominated by *Picea engelmannii, Abies lasiocarpa, Pinus contorta, Populus tremuloides,* or *Artemisia tridentata* ssp. *vaseyana.*

Vegetation—*Carex aquatilis* dominates a typically dense graminoid layer, though some communities with moderate cover are included here if *Carex aquatilis* is the dominant herbaceous species. *Deschampsia cespitosa* and moss are common associates, though cover is highly variable for each. *Carex rostrata* may be present with cover rarely exceeding 15 percent. In addition, some communities had moderate cover of *Calamagrostis stricta, C. canadensis, Carex lanuginosa, C. microptera, C. nebrascensis, Eleocharis pauciflora,* and/or *Juncus balticus.* Forb cover is usually sparse but may include *Pedicularis groenlandica, Caltha leptosepala,* and *Polemonium caeruleum.*

Soils—Most soils had histic epipedons, though some occur on wet mineral soils. Organic soils were classified as Borofibrists, Borohemists, and Borosaprists; mineral soils included Histic, Cumulic, and Typic Cryaquolls, and rarely, Aquic Cryoborolls. Water tables were generally at or above the surface when sampled, with a mean depth of 5 cm (2 in). Particle-size classes for mineral soils and Terric subgroups of Histosols ranged from clayey-skeletal to loamy-skeletal and fine-loamy. Estimated available water-holding capacity for these mineral soils ranged from low to high.

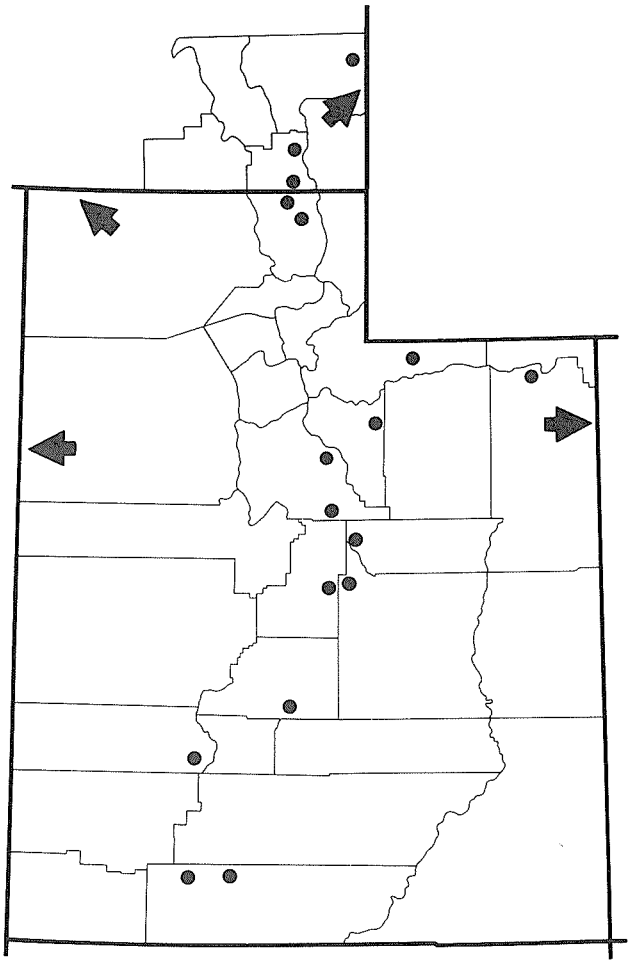
Succession and Management—Much discussion has taken place concerning the ecological status of *Carex aquatilis* communities versus those dominated by *Carex rostrata.* Because of similarities in moisture regime of areas on which these two and other *Carex* spp. occur, more information clearly needs to be obtained. Some field observations, however, are beginning to show some distinct differences where *Carex aquatilis* occurs in relation to *Carex rostrata,* even though the latter species is occasionally a component in the **CAAQ c.t.**

A group of herbaceous community types occur in which *Carex aquatilis* dominates or is a major associate. These include the **Carex aquatilis, Carex limosa, Carex buxbaumii, Carex saxatilis, Eleocharis pauciflora,** and **Caltha leptosepala c.t.s** (note that **Carex limosa, Carex buxbaumii,** and **Carex saxatilis c.t.s** were sampled only in the Uinta Mountains). Each of these c.t.s occur on well-developed Histosols, or they have Histic epipedons not quite thick enough to be classified as Histosols but belong to Histic subgroups of mineral soils. This is in direct contrast to the **Carex rostrata c.t.** which may, or may not, occur on organic soil and more typically occurs on mineral soils (**Carex rostrata c.t., Succession and Management**, p. 103). The effect of flooding on *Carex rostrata* and *C. aquatilis* was studied in northern Sweden (Sjoberg and Danell 1983). Mean depths to water were increased from 0 to 5 cm (2 in) deep prior to treatment, to 30-60 cm (12 to 24 in) deep following flooding. A significant decrease in the number of shoots of *Carex rostrata* was noted; while *C. aquatilis* shoots also decreased, it was not statistically significant. *Carex rostrata,* however, appears to be more of a pioneering species than *C. aquatilis* and is capable of growing in deeper standing water. The relationships among these c.t.s are, as of yet, not clearly understood, and in many

instances the establishment of one species over another appears opportunistic. Because the environment on which the **CAAQ c.t.** occurs is usually wet throughout the growing season, this community type may receive only limited grazing. *Carex aquatilis* is palatable to cattle, and while it is quite resistant to grazing, livestock will often cause an increase in the hummocking and pitting of associated soils. Communities belonging to the **Carex aquatilis c.t.** appear to be more resistant to decreasing levels of water than the other c.t.s in this group. In fact, *Carex aquatilis* appears less productive on sites that are constantly wet, such as floating bogs, and produces greater herbage on organic or mineral soils with slightly drier conditions. The differences in moisture levels among the various c.t.s are extremely subtle, and more precise measurements may be necessary to sort out the optimal requirements of dominant species in this discussion.

Other Studies—Lewis (1970) described **Carex aquatilis** communities for the Uinta Mountains of northeastern Utah. Jensen and Tuhy (1982) described a broad **Carex rostrata** undergrowth group that included communities belonging to our **Carex aquatilis c.t.** for the north slope of the Uinta Mountains. Winn and others (1982) also described various riparian types dominated or codominated by *Carex aquatilis.* Mattson (1984) described a **Carex aquatilis Series** for Yellowstone National Park which included several **Carex aquatilis h.t.s.** Other **Carex aquatilis** types have been described for Colorado (Komarkova 1976; Wasser and Hess 1982), Wyoming (Terwilliger and others 1979; Youngblood and others 1985a), and for eastern Idaho (Youngblood and others 1985a). Hansen and others (1988) described a similar **Carex aquatilis dominance type** for mid to high elevations in Montana.

Carex rostrata c.t. (CARROS; CARO)



Distribution—CARO (fig. 23) is a major type throughout most of the study area. It was not, however, sampled in the Canyonlands Floristic Section or the Pine Valley or Bull Valley Mountains of the Utah Plateaus Floristic Section. It has a broad elevational range but is most common between 1 830 and 2 990 m (6,000 and 9,800 ft). It occurs in narrow to broad valley bottoms on meadows, seeps, and stream terraces and is commonly associated with ponds that have silted in. It can occur in standing water or on sites that become relatively dry during the latter part of the growing season. Surface topography is typically smooth to concave and with slopes ranging from 0 to 10 percent. Adjacent riparian communities include those belonging to the **Carex nebrascensis, Juncus balticus, Deschampsia cespitosa,** and **Poa pratensis c.t.s** on slightly to much drier environments and the **Carex aquatilis c.t.** on similar sites. Adjacent upland communities are indicative of the wide elevational gradient in which the **CARO c.t.** occurs. *Artemisia tridentata* ssp. *vaseyana, Populus tremuloides, Abies*

Figure 23.—**Carex rostrata c.t.** in a forest opening near China Meadows south of Mountain View, Wyoming (2 985 m, 9,780 ft). *Carex rostrata* dominates this community with standing water to 35 cm (14 in.) deep.

lasiocarpa, Pinus contorta, Picea engelmannii, and *Picea pungens* are among those likely to dominate.

Vegetation—The **CARO c.t.** typically has low species diversity. It often has only one or two species occurring in communities at the wet extreme and often has less than 10 species at the driest extreme. *Carex rostrata* clearly dominates the community, forming a dense graminoid layer, or in those communities with standing water throughout the growing season, forming a more scattered graminoid layer. *Agrostis stolonifera, Deschampsia cespitosa,* and *Poa pratensis* may occur on slightly drier microsites, and *Carex aquatilis* or *C. nebrascensis* may be conspicuous, especially where they dominate adjacent community types. Forb cover is usually very sparse, and moss cover can be very high.

Soils—A majority of soils were classified as Histic and Cumulic Cryaquolls or as Typic and Sapric Borohemists, Typic Borosaprists, and Hemic Borofibrists. Water tables were almost always at or above the soil surface. Mineral soils typically belonged to fine-loamy or fine particle-size classes. Estimated available water-holding capacity was moderate to high.

Succession and Management—While commonly occurring on organic soils, *Carex rostrata* is equally capable of establishing, and perhaps more likely to establish, on mineral soils with continually high water levels. The soils may be more anaerobic than those of the **Carex aquatilis c.t.**, but this is merely speculation. *Carex rostrata* is one of the species most likely to pioneer newly flooded beaver ponds and often forms an early successional c.t. Evidence of previous beaver activity is common in communities bèlonging to this type. *Carex rostrata* appears to have a lower palatability, at least seasonally, than other sedges such as *Carex nebrascensis* or *C. aquatilis; Carex rostrata* will usually be left untouched or only used to a small degree when in proximity to these other species. Only a few sampled communities had transitory use by cattle or sheep.

Other Studies—Several authors have described broader **Carex rostrata** types that include our **Carex aquatilis c.t.** for western Wyoming (Norton and others 1981; Mutz and Graham 1982) and north-central Colorado (Hess and Wasser 1982; Komarkova 1982). Mutz and Quieroz (1983) described a **CARO c.t.** similar to ours for the Centennial Mountains of eastern Idaho,

while similar communities have also been described for central Utah (Kerr and Henderson 1979), central Idaho (Schlatterer 1972; Tuhy and Jensen 1982), and central and eastern Oregon (Seyer 1979; Padgett 1982; Kovalchik 1987). Mattson (1984) described a **Carex rostrata Series** for Yellowstone National Park which included several habitat types with this dominant species. Hansen and others (1988) described a similar **Carex rostrata dominance type** for western and central Montana.

Eleocharis pauciflora c.t. (ELEPAU; ELPA2)

Distribution—The proposed **ELPA2 c.t.** is an incidental type sampled in the western and central Uinta Mountains above 3 050 m (10,000 ft). Though only three communities were sampled, indications are that it may be more widespread on wet, organic meadows throughout the upper elevational range of the Uinta Mountains. Adjacent riparian communities typically belong to the **Carex aquatilis c.t.**, while uplands are often dominated by *Picea engelmannii.*

Vegetation—*Eleocharis pauciflora* dominates a community with low species diversity and production; *Carex aquatilis* may be a codominant with highly reduced production. *Scirpus caespitosus* and *Pedicularis groenlandica* may be associated with this type, though cover is sparse. Few other species were noted.

Soils—Soils were saturated to the surface and were classified as Terric Borofibrists, Typic Borohemists, and Typic Borosaprists. Additional sampling will determine any relationships suggested by these few communities, but *Eleocharis pauciflora* appears to withstand continually saturated situations and may require these soil types.

Succession and Management—The **ELPA2 c.t.** appears to be related to the **Carex aquatilis c.t.** but, in the **ELPA2 c.t.**, production of *Carex aquatilis* is strongly reduced, indicating that these are not optimal conditions for its growth. Little is known of the autecology of *Eleocharis pauciflora,* though it appears in the interspaces of several wet community types. It is less common as a community dominant.

Other Studies—Jensen and Tuhy (1982) described an **Eleocharis pauciflora** understory group for the north slope of the Uinta Mountains. Kovalchik (1987) described a similar **Eleocharis pauciflora** association for central Oregon, while Hansen and others (1988) described a **Eleocharis pauciflora** dominance type at mid to high elevations in western and north-central Montana. Mattson (1984) described the **Eleocharis pauciflora Series** for Yellowstone National Park which included various **Eleocharis pauciflora h.t.s.**

Carex simulata c.t. (CARSIM; CASI)

Distribution—This apparently incidental type was noted sporadically in the Uinta Mountains and on the Wasatch Plateau. It is associated with broad, organic meadows and toe slope seeps. Those few communities sampled occurred between 2 595 and 2 805 m (8,500 and 9,200 ft). Slopes range from nearly level in the meadows to as much as 15 percent on seeps. **CASI** is more common in western Wyoming and adjacent portions of eastern Idaho. The **Carex aquatilis c.t.** may occur adjacent to this type, while uplands may be dominated by *Pinus contorta, Picea engelmannii,* and/or *Populus tremuloides.*

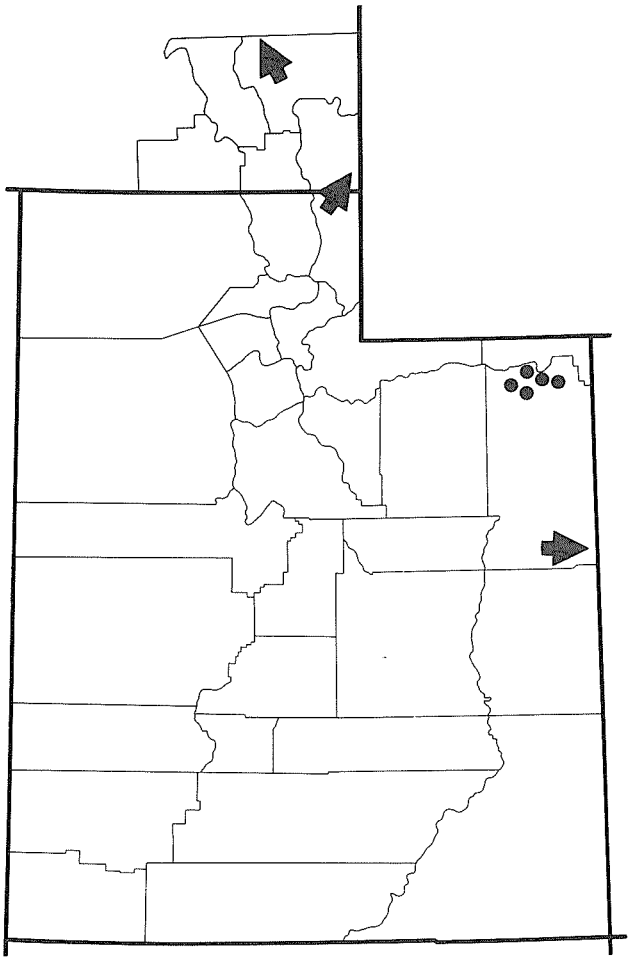
Vegetation—*Carex simulata* dominates a community that typically has low species diversity. *Juncus balticus* and *Parnassia fibriata* may be locally abundant, and moss cover is typically high. Additional species commonly present with scattered occurrence include *Pedicularis groenlandica, Carex aquatilis,* and *Swertia perennis.* Low shrubs such as *Salix brachycarpa, Potentilla fruticosa,* and *Lonicera involucrata* may be present in some communities as accidentals often from adjacent communities or drier habitats.

Soils—The **CASI c.t.** commonly occurs on organic soils or occasionally on mineral soils. Water tables are seasonally at or near the surface. The degree of organic matter decomposition is variable, but no sampled communities were on highly decomposed organics.

Succession and Management—Communities belonging to the **CASI c.t.** occur on sites similar to those dominated by *Carex aquatilis,* and management of this type should be similar to that for the **Carex aquatilis c.t.** The strongly rhizomatous *Carex simulata* appears to form a dense, stable community, and changes in species composition would be slow to occur unless dramatic changes in soil-water characteristics were to take place. Little livestock use was noted in communities on organic soils. Communities that occurred on mineral soils, even those with seasonally high water tables, showed distinct evidence of cattle grazing. *Carex simulata* appears able to withstand moderate grazing pressures, though impacts on soils may include hummocking and pitting.

Other Studies—Youngblood and others (1985a) described this as a minor type in western Wyoming. Tuhy and Jensen (1982) listed the **CASI c.t.** as an incidental type in mountainous portions of central Idaho. Kovalchik (1987) described a similar **Carex simulata association** for Central Oregon, while Hansen and others (1988) described a similar **Carex simulata dominance type** occurring, perhaps, on slightly drier sites in southwestern and central Montana.

***Calamagrostis canadensis* c.t.**
(CALCAN; CACA)



Distribution—CACA (fig. 24) is a major type in the Uinta Mountains Floristic Section. Although not sampled elsewhere, it is also expected to occur in portions of the Wasatch Mountains Floristic Section. It occurs between 2 745 and 2 990 m (9,000 and 9,800 ft) and likely extends its distribution to slightly lower elevations. This c.t. is commonly associated with small streams and moist openings among forested communities. It typically has slightly undulating surface topography and slopes of 2 to 5 percent. Adjacent uplands include the **Pinus contorta/Vaccinium scoparium h.t.**, while adjacent riparian communities include those belonging to the **Carex rostrata c.t.** on wetter sites and the **Conifer/Calamagrostis canadensis c.t.** on similar sites.

Vegetation—*Calamagrostis canadensis* dominates a typically dense graminoid layer. *Carex rostrata, C. canescens, C. aquatilis, C. saxatilis,* and *C. illota* are common associates. Forb cover is variable, from nearly absent to over 25 percent, and may include *Caltha leptosepala, Polygonum bistortoides, Erigeron peregrinus,* and *Pedicularis groenlandica.*

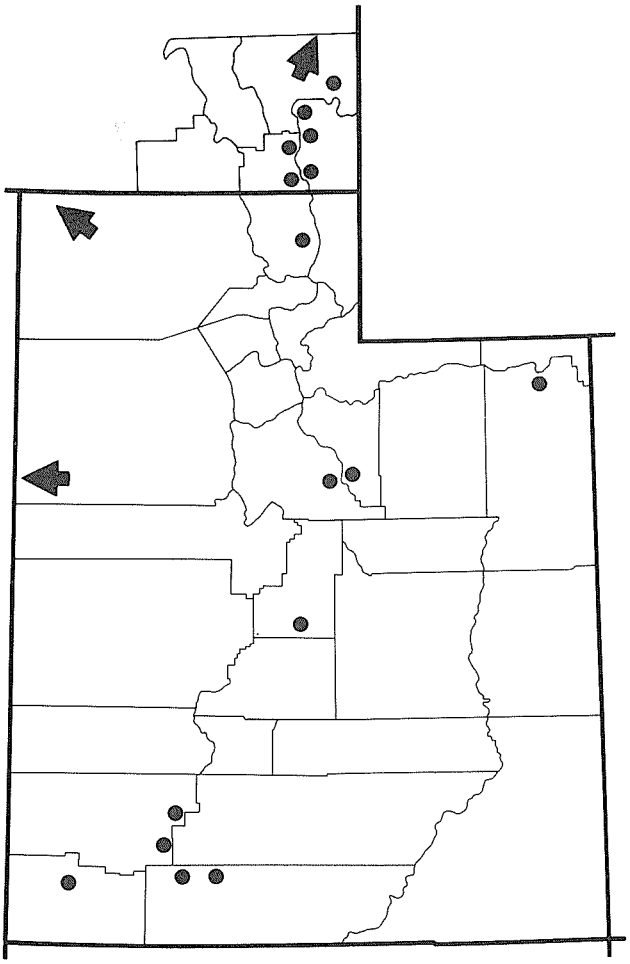
Soils—Communities occurred on a variety of soils including those classified as Typic and Aquic Cryochrepts, Histic Cryaquepts, and Cryaquolls, and Sapric Borohemists. Particle-size classes ranged from fine to loamy-skeletal, and estimated available water-holding capacity ranged from low to high. Water tables were commonly within 50 cm (20 in) of the surface even late in the growing season.

Succession and Management—Because of the dying forests of *Pinus contorta* in the Uinta Mountains due to the pine bark beetle invasion, the **CACA c.t.** appears to be expanding into the moist borders of the forested communities. Communities with dead standing conifers and a dense undergrowth of *Calamagrostis canadensis* are included in this type and represent what may have been the **Conifer/Calamagrostis canadensis c.t.** As conifers die, transpiration of water from the soil becomes less, resulting in higher water tables. This increase in available soil moisture has resulted in the expansion of communities dominated by *Calamagrostis canadensis,* once restricted to only minor portions of adjacent forests. Welsh and others (1987) noted that *Calamagrostis canadensis* is only moderately palatable, and grazing animals may likely seek out more palatable herbaceous undergrowths where available.

Other Studies—Hansen and others (1988) described a **Calamagrostis canadensis dominance type** for western and central Montana. Similar types have been described for central Colorado (Komarkova 1976), central and eastern Idaho (Mutz and Querioz 1983), and central Idaho (Tuhy and Jensen 1982). Mattson (1984) described the **Calamagrostis canadensis Series** for Yellowstone National Park in northwestern Wyoming which included several **CACA h.t.s.**

Figure 24.—**Calamagrostis canadensis c.t.** near East Park north of Vernal, Utah (2 850 m, 9,340 ft). *Calamagrostis canadensis* forms a dense graminoid cover with *Caltha leptosepala* a major forb component. *Aster foliaceus, Polygonum bistortoides,* and several other herbaceous species occur with minor cover.

Carex nebrascensis c.t. (CARNEB; CANE)



Distribution—This major type occurs throughout most of the study area, though it was not sampled in the Abajo or LaSal Mountains of southeastern Utah. The **CANE c.t.** occurs below 2 655 m (8,700 ft) with higher elevation communities typically in southern latitudes. It most often occurs in meadows and on broad alluvial terraces with fine-textured soils but was also sampled on seeps. Adjacent riparian communities most often include those belonging to the **Carex rostrata c.t.**, while the **Poa pratensis, Veratrum californicum, Juncus balticus,** and **Deschampsia cespitosa c.t.s** may also abut this type. Adjacent uplands include those dominated by *Artemisia tridentata* ssp. *vaseyana, Pinus ponderosa, P. contorta, Picea engelmannii, P. pungens, Populus tremuloides,* and/or *Abies lasiocarpa.*

Vegetation—*Carex nebrascensis* typically dominates the community, though cover needs only be 25 percent if *Deschampsia cespitosa* or *Juncus balticus* are codominants. *Poa pratensis* and *Glyceria striata* are among those commonly present in varying amounts. Forb cover is highly variable and often sparse; *Geum macrophyllum, Veronica americana, Aster foliaceus,* and *A. occidentalis* are among those that may be present.

Soils—The **CANE c.t.** is most commonly associated with fine-textured mineral soils (fine, clayey-skeletal, and fine-loamy particle-size classes). Water tables were typically at or near the surface at least early in the growing season, occasionally dropping to more than 1 m (39 in). Rarely did communities occur on organic soils. Most soils were classified as Typic, Cumulic, Pachic, and Histic Cryaquolls, while a few were classified as Pachic Cryoborolls or Typic Haplaquepts. Estimated available water-holding capacity was moderate to high.

Succession and Management—*Carex nebrascensis* is strongly rhizomatous with high underground biomass that, while being highly palatable to livestock, appears to be able to withstand at least moderate, and probably heavy, grazing pressures. Lewis (1958) and Hermann (1970) noted that *C. nebrascensis* is valuable for cattle and horse grazing. Under some conditions it may be an increaser replacing *Deschampsia cespitosa* which occurs on similar sites as a dominant and is commonly present in the **CANE c.t.** Under extreme grazing pressures, especially when accompanied by a drop in water table, *Carex nebrascensis* can be replaced by *Juncus balticus* or *Poa pratensis.* Because of its strong rooting system, *Carex nebrascensis* is excellent for stabilizing streambanks. Soils are susceptible to compaction by livestock because they are typically fine-textured and often saturated to the surface. Heavy machinery use on this c.t. should be avoided.

Other Studies—Mutz and Queiroz (1983) described the **CANE c.t.** in the Centennial Mountains of eastern Idaho. Youngblood and others (1985) maintained this type for their classification for eastern Idaho and western Wyoming. Hansen and others (1988) described a similar **Carex nebrascensis dominance type** for low to mid elevations throughout Montana, while Kovalchik (1987) described a similar c.t. for central Oregon.

Carex microptera c.t. (CARMIC; CAMI)

Distribution—The minor **CAMI c.t.** occurs with sporadic distribution in the Wasatch Mountains and Utah Plateaus Floristic Sections and in the Abajo Mountains of the Canyonlands Floristic Section. It is typically associated with meadows and stream terraces with mineral soils. Elevations range from 1 985 to 2 900 m (6,500 to 9,500 ft). Slopes are usually very gently sloping, though some communities were observed on subirrigated sites with slopes greater than 5 percent. The **Deschampsia cespitosa, Carex rostrata,** and **Veratrum californicum c.t.s** are among the riparian c.t.s that

occur adjacent to this type. Uplands may be dominated by *Populus tremuloides, Pinus ponderosa,* or *Artemisia tridentata ssp.* vaseyana.

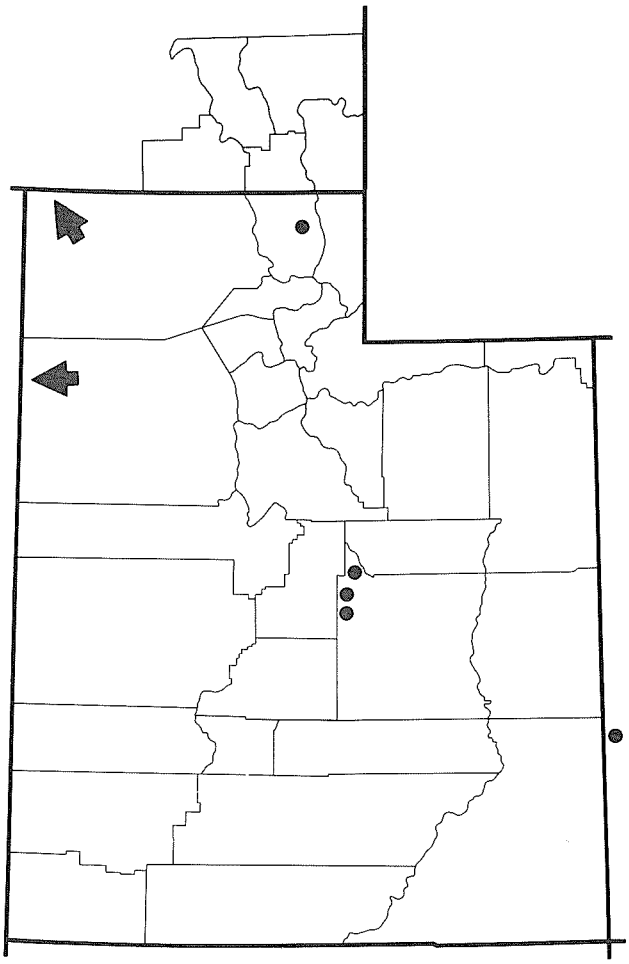
Vegetation—*Carex microptera* dominates a typically dense graminoid layer with *Poa pratensis, Carex praegracilis, C. lanuginosa,* and *Juncus hallii* locally abundant. *Deschampsia cespitosa* is often present with cover ranging from a trace to over 10 percent. Forb cover is highly variable but may include *Taraxacum officinale* and *Trifolium* spp.

Soils—CAMI was sampled on soils typically belonging to fine particle-size classes. Classified as Pachic Cryoborolls, and Aeric Cryaquepts, these soils typically had a high estimated available water-holding capacity. Water tables were seasonally within 50 cm (20 in) of the soil surface as was evidenced by the shallow depth of distinct or prominent mottles.

Succession and Management—Because this type occurs on fine-textured soils that are seasonally wet, they can be subjected to compaction by livestock and heavy machinery. **CAMI** likely represents a stable type in our study area, though it often occurs as small communities or as inclusions in larger riparian complexes. Little is currently understood about the successional status of this type, but it appears to be closely related to the **Deschampsia cespitosa c.t.** Lewis (1958) noted that *Carex microptera* likely is of moderate palatability for cattle and low palatability for sheep. The cespitose growth form of *Carex microptera* causes it to be more susceptible to grazing and trampling than associated sod-forming species, and heavy grazing pressures may result in a conversion from the **CAMI c.t.** to the **Poa pratensis c.t.**

Other Studies—A similar **CAMI c.t.** was described for eastern Idaho and western Wyoming by Youngblood and others (1985a). Hansen and others (1988) described a similar **Carex microptera dominance type** for western and central Montana.

***Carex lanuginosa* c.t.**
(CARLAN; CALA2)



Distribution—This minor type was sampled in the Wasatch Mountains, the Wasatch Plateau, and the LaSal Mountains, though it is expected to occur elsewhere in the study area. **CALA2** occupies broad meadows, stream terraces, and seeps between elevations of 1 585 and 2 805 m (5,200 and 9,200 ft). Slope ranges from 1 to over 5 percent. The **Carex nebrascensis** and **Eleocharis palustris c.t.s** may occur on adjacent wetter sites, while the **Deschampsia cespitosa c.t.** may occur on similar to slightly drier sites. Adjacent uplands may be dominated by *Artemisia tridentata* ssp. *vaseyana, Pinus ponderosa, Populus tremuloides,* or *Abies lasiocarpa.*

Vegetation—*Carex lanuginosa* typically dominates a dense graminoid layer, although cover of *Poa pratensis,* which is commonly present, was greater in at least one community. Other graminoids such as *Deschampsia cespitosa, Carex aquatilis,* and *Juncus balticus* may be present with as much as 25 percent cover, though they

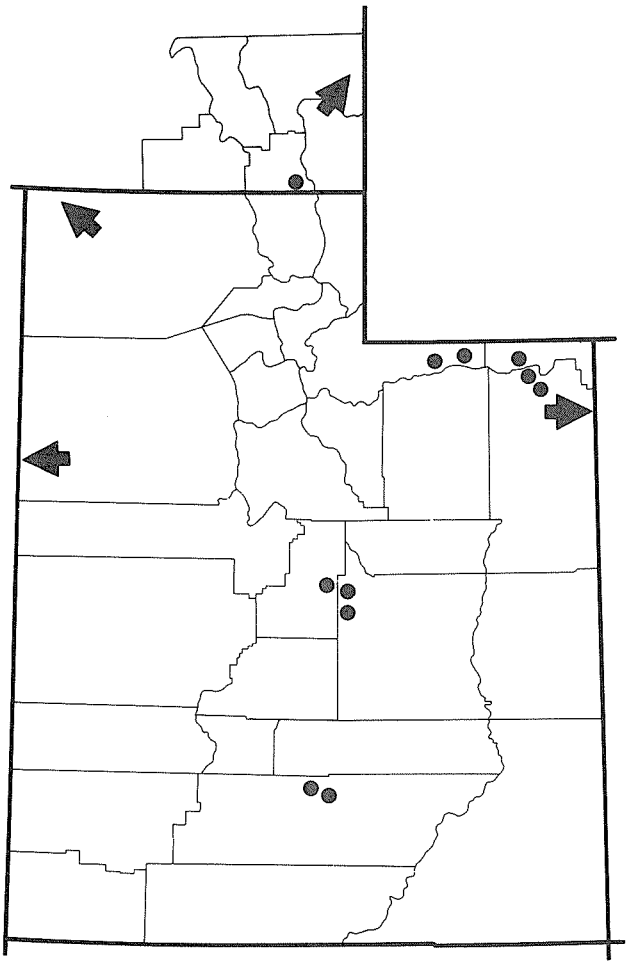
are typically sparse. Some communities, which in the key might be placed in the **Carex aquatilis c.t.**, are included in this type because of the abundance of *Carex lanuginosa* (greater then 75 percent *C. lanuginosa* vs. 25 percent cover of *C. aquatilis*). Forb cover may essentially be absent or may include *Mentha arvensis, Taraxacum officinale,* or *Equisetum arvense.*

Soils—Soils developed from alluvium and colluvium and were classified as Cumulic and Thapto-Histic Cryaquolls, Pachic Haplaquolls, and Pachic Cryoborolls. They had coarse-loamy, fine-loamy, and fine particle-size classes with moderate to high estimated available water-holding capacity. Water tables were typically within 60 cm (24 in) of the soil surface.

Succession and Management—The **CALA2 c.t.** appears to be a fairly stable type because of the strongly rhizomatous nature of *Carex lanuginosa* and the well-developed soils. Because only a few communities dominated by *Carex lanuginosa* have been sampled, little is currently understood about its successional status; it appears to occur on sites similar to those supporting the **Deschampsia cespitosa c.t.** and may replace it under moderate to heavy grazing pressures. Because of the moist, fine-textured soils commonly associated with this type, the use of heavy machinery should be avoided. Heavy livestock use may also result in compaction or displacement of soils.

Other Studies—Kovalchik (1987) described a similar **Carex lanuginosa association** for central Oregon. Hansen and others (1988) described a **Carex lanuginosa dominance type** for Montana.

Deschampsia cespitosa c.t.
(DESCES; DECE)



Distribution—Perhaps one of the most widespread types in the mountainous West, **DECE** is a major type in the Uinta Mountains Floristic Section and portions of the Utah Plateaus and the Wasatch Mountains Floristic Sections. It is typically associated with meadows and stream terraces in moderate to broad valley bottoms. Elevations range from 2 900 to over 3 355 m (9,500 to 11,000 ft), though it also occurs at lower elevations. This c.t. occurs on sites with nearly level to greater than 5 percent slope. Surface topography is typically smooth to slightly undulating. A variety of riparian c.t.s occur adjacent to this type and may include the **Carex aquatilis, Carex rostrata,** and **Carex lanuginosa c.t.s** on wetter sites, the **Artemisia cana/Festuca ovina c.t.** on drier sites, and the **Potentilla fruticosa/Deschampsia cespitosa c.t.** on similar sites. Adjacent upland communities may be dominated by *Picea engelmannii, Pinus contorta, Populus tremuloides,* and *Artemisia tridentata* ssp. *vaseyana.*

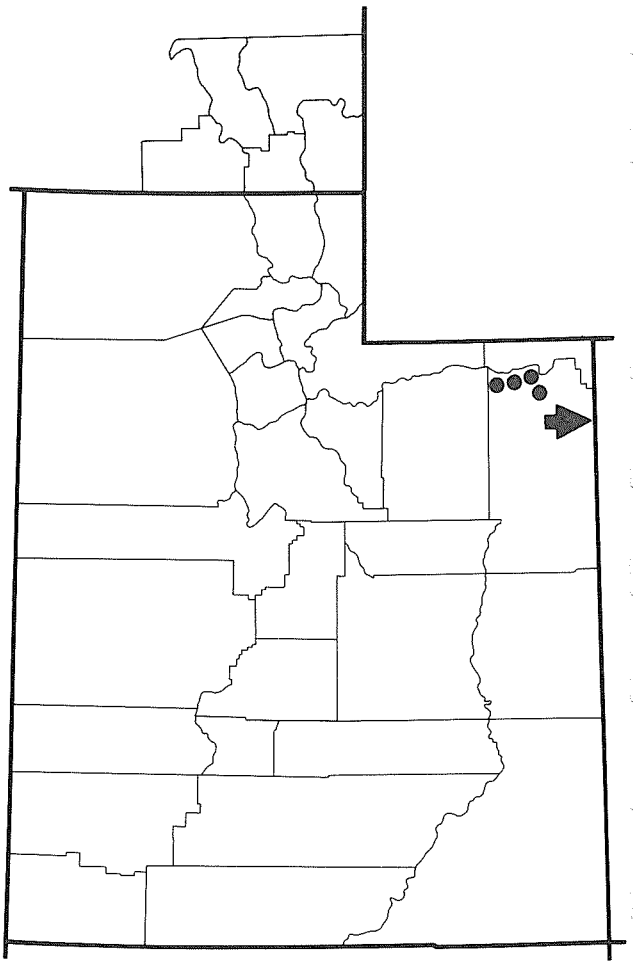
Vegetation—The **DECE c.t.** is a diverse type characterized by a typically dense graminoid layer in which *Deschampsia cespitosa* is usually dominant. Communities with greater than 25 percent cover of *Deschampsia* and a dominance of *Poa pratensis* or *Juncus balticus,* typically considered increasers, are also included in this type. We feel that the significant amount of *Deschampsia cespitosa* in the community is a strong environmental indicator of site potential. In addition to the above mentioned graminoids, *Agrostis scabra, Phleum alpinum, Carex aquatilis,* and *C. praegracilis* may be locally abundant. *Erigeron ursinus* and *Caltha leptosepala* may also be abundant in some communities. Additional species common to this type, typically with low percent cover, include *Carex microptera, Danthonia intermedia, Juncus hallii, J. longistylus, Polygonum bistortoides,* and *Taraxacum officinale.* Moss cover is typically low, but it may be significantly greater than 25 percent.

Soils—Many of the soils were classified as Aquic and Pachic Cryoborolls; others included Aeric Cryaquepts, Aquic Cryochrepts, Histic Cryaquolls, and Terric Borohemists. Surface soil textures were loams, clay loams, and silty clay loams; some had greater than 35 percent coarse fragments in surface or subsurface horizons. Soils were typically moist throughout, and most had distinct or prominent mottles at or near the surface, indicating a seasonally high water table.

Succession and Management—As defined, the **DECE c.t.** may either indicate nondisturbance or disturbance conditions, depending on the abundance of species such as *Poa pratensis, Juncus balticus,* and *Taraxacum officinale.* It is theorized that the **DECE c.t.** once occupied much larger acreages in the Intermountain West, but through long-term, heavy grazing, has been eliminated from many areas. Though we have little direct data to support this idea, indirect information tends to indicate that in all but the more moist sites where *Deschampsia cespitosa* occurs it has been replaced by *Poa pratensis, Juncus balticus, Carex lanuginosa* or other likely increasers. Not all sites on which *Poa pratensis* occurs were likely to have supported *D. cespitosa,* however, and one should avoid this generalization. Bonham and Ward (1970) noted that *Deschampsia cespitosa* occurs along a broad moisture gradient from mesic and dry-mesic environments to those that are wet. Associated species varied as well, with the hairgrass gradually decreasing as environments became drier. There was a more abrupt decrease in *Deschampsia* as habitats became wetter and communities dominated by various *Carex* and *Juncus* spp. replaced the former. *Caltha leptosepala* was also noted by the authors as a dominant on wet habitats. Welsh and others (1987) noted that *Deschampsia cespitosa* often provides an abundant source of forage throughout the growing season. The **DECE c.t.** commonly receives heavy livestock pressure because it typically dries in the upper soil and is relatively palatable, especially to cattle. Use of this type by elk is also very likely, and extensive gopher use was noted in at least one community belonging to this type. Damage by vehicles was also noted, and use of heavy machinery should be avoided, especially while the surface soils are wet and easily compacted.

Other Studies—Youngblood and others (1985a) described a similar **DECE c.t.** for eastern Idaho and western Wyoming. Mutz and Queiroz (1983) also described this type for the Centennial Mountains or eastern Idaho. Other **Deschampsia cespitosa associations** and **c.t.s** have been described by Tuhy and Jensen (1982) for central Idaho, Bonham and Ward (1970) and Hess and Wasser (1982) for Colorado, Hansen and others (1988) for Montana, Kovalchik (1987) for central Oregon, and by Franklin and Dyrness (1973) for Oregon and Washington.

Danthonia intermedia c.t. (DANINT; DAIN)



Distribution—DAIN is a major type sampled only in the Uinta Mountains Floristic Section. It occurs at elevations above 2 865 m (9,400 ft) but may extend to lower sites. It occupies broad, relatively dry meadows and slopes ranging from 1 to 4 percent. Surface topography is

typically smooth to slightly undulating. The **Carex aquatilis, Carex saxatilis,** and **Deschampsia cespitosa c.t.s** are commonly adjacent to this c.t. on slightly to distinctly more moist environments. Adjacent uplands are dominated by *Picea engelmannii* or *Pinus contorta.*

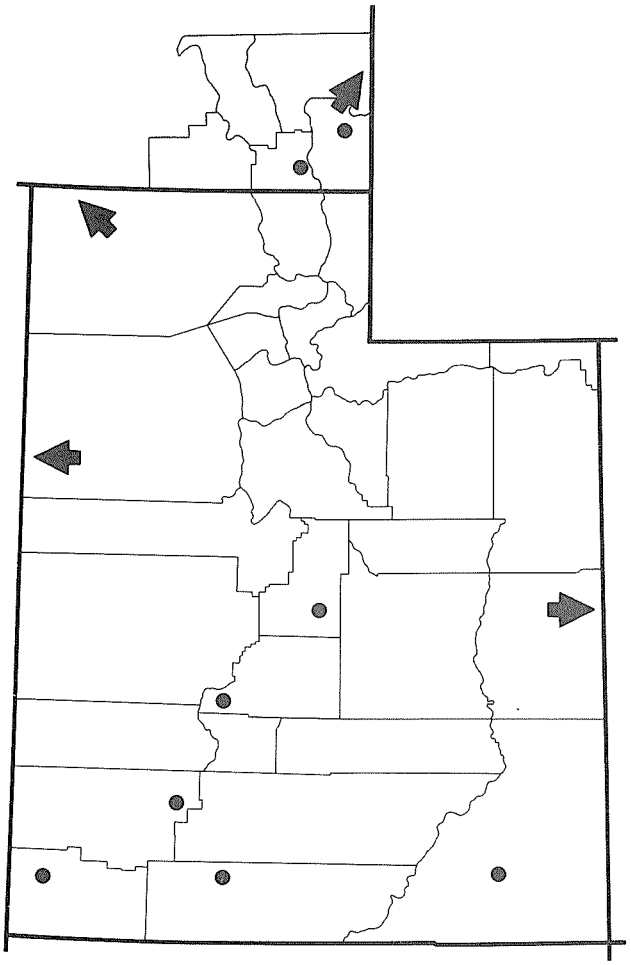
Vegetation—This c.t. is characterized by a low herbaceous community dominated by *Danthonia intermedia* and/or *Agrostis scabra. Juncus drummondii* is typically present though cover is variable. Cover of *Aster foliaceus* or *Erigeron ursinus* is usually significant, while *Phleum alpinum, Festuca ovina* var. *breviflora, Poa pratensis, Carex microptera,* and *Deschampsia cespitosa* are commonly present in minor amounts. Moss cover is conspicuous in most communities sampled.

Soils—Soils were developed from alluvium and colluvium and were classified as Aquic and Typic Cryochrepts and Pachic Cryoborolls. Particle-size classes were loamy-skeletal, and estimated available water-holding capacity was low to high. Water tables ranged from 67 cm (26 in) to over 1 m (39 in). Distinct or prominent mottles were typically present within 30 cm (12 in) of the soil surface, indicating at least a seasonally high water table.

Succession and Management—On the broad meadows typical of the south slope of the Uinta Mountains, the **DAIN c.t.** is perhaps the type that receives the greatest grazing pressure. Because it typically occupies slightly higher positions in the meadows and is relatively dry, livestock are more likely to utilize the vegetation associated with this type. It is less tolerant to livestock grazing than communities on more mesic to wet environments. The typically high cover of low-growing *Aster* and *Erigeron* spp., *Trifolium longipes,* and *Taraxacum officinale* attests to high grazing impacts. Whether these areas previously supported other graminoids or whether *Danthonia intermedia* was more or less abundant prior to livestock introduction is unknown. These areas appear to have relatively low forage production, and the impact of concentrated livestock use may be more significant because of this.

Other Studies—Hall (1971) described a similar **Danthonia-Polytrichum community** for the Aquarius Plateau of south-central Utah. Similar **Danthonia intermedia types** have been described by Hess and Wasser (1982), Komarkova (1976), and Komarkova and Gordon (1982) for Colorado.

Juncus balticus c.t. (JUNBAL; JUBA)



Distribution—This minor type occurs sporadically throughout the study area. It also occurs throughout most of the western states. It was sampled between elevations of 1 830 and 2 530 m (6,000 and 8,300 ft) often associated with meadows and stream terraces. **JUBA** commonly occurs as small inclusions within other larger c.t.s. Slopes are typically gentle, although they may range up to 5 percent. Adjacent riparian communities may include those belonging to the **Salix exigua/Poa pratensis, Carex nebrascensis, Carex rostrata,** or **Carex aquatilis c.t.s.** Uplands are often dominated by *Artemisia tridentata* ssp. *vaseyana, Pinus ponderosa, Quercus gambelii,* or *Pinus edulis* and *Juniperus osteosperma.*

Vegetation—*Juncus balticus* dominates a dense graminoid layer with *Poa pratensis* commonly present with cover as high as 30 percent. Other graminoids are often present with significant cover, including *Agrostis stolonifera, Carex praegracilis, C. nebrascensis,* and *C. lanuginosa.* Forb cover is highly variable, from nearly

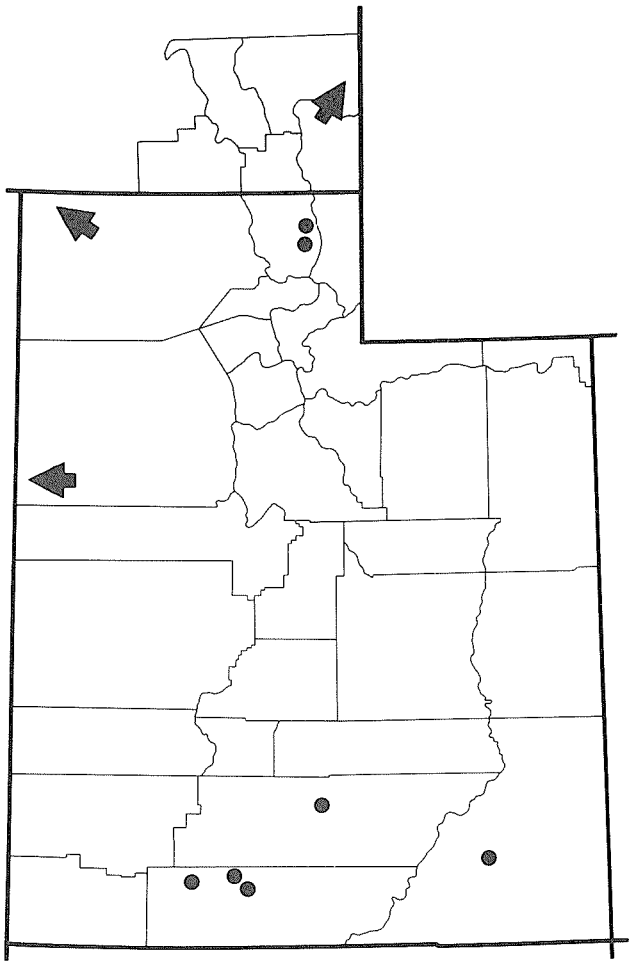
absent to well over 50 percent, and may include *Fragaria virginiana, Smilacina stellata, Trifolium repens, Taraxacum officinale, Potentilla anserina,* or *P. gracilis.*

Soils—JUBA typically occurs on fine-textured surface soils (fine-loamy and fine particle-size classes). Water tables ranged from the surface to 50 cm (20 in) below the surface, occasionally falling below 1 m (39 in). Estimated available water-holding capacity ranged from low to high. A majority of the soils were classified as Typic and Cumulic Cryaquolls and Fluvaquentic Haploborolls; others included Cryochrepts and Borofibrists.

Succession and Management—The **JUBA c.t.** represents, in many situations, a grazing-induced type that has replaced communities which may have been dominated by *Carex nebrascensis* or even *Poa pratensis.* While Hermann and others (1975) described *Juncus balticus* as an important forage plant for livestock when it is young and tender, as it matures it is commonly avoided. Its rhizomatous nature and relatively low palatability later in the growing season make *Juncus balticus* a strong competitor under grazing conditions. The strong rhizomes are also, however, important in stabilizing streambanks, especially where soils are coarse and otherwise unstable.

Other Studies—Mutz and Graham (1982) described a **JUBA c.t.** for the Wyoming Range of western Wyoming, while Youngblood and others (1985a) described a similar type for eastern Idaho and western Wyoming. Similar types have been described by Tuhy and Jensen (1982) for central Idaho and by Padgett (1982) for eastern Oregon. Wasser and Hess (1982) described a similar type for north-central Colorado, Olson and Gerhart (1982) for central Wyoming, and Hansen and others (1988) for Montana.

***Poa pratensis* c.t.**
(POAPRA; POPR)



Distribution—POPR (fig. 25) is a major type in the southern Utah Plateaus Floristic Section, becoming a minor type through most of the remaining study area. It has been described throughout much of the western United States. Elevations range from 1 585 to 2 625 m (5,200 to 8,600 ft). It occurs in meadows and on elevated stream terraces. Surface topography is typically smooth and slopes are often 3 percent or less. Adjacent riparian communities include those dominated by *Potentilla fruticosa,* or on wetter sites, by **Carex nebrascensis** or **Juncus balticus c.t.s.** Uplands represent the broad elevational and latitudinal variation and include those dominated by *Chrysothamnus viscidiflorus, Pseudotsuga menziesii, Populus tremuloides,* or *Picea engelmannii.*

Vegetation—The **POPR c.t.** is typically dominated by a dense cover of *Poa pratensis.* It may, however, have scattered cover of *Poa pratensis* with *Taraxacum officinale, Cirsium arvense,* or *Erigeron flaggelaris* as indicators of heavy grazing pressures. *Agrostis stolonifera, Carex nebrascensis,* or *Trifolium* spp. may be present in varying amounts though most often with minor cover.

Figure 25.—**Poa pratensis c.t.** adjacent to the Left Hand Fork Blacksmiths Fork River east of Hyrum, Utah (1 695 m, 5,560 ft). *Poa pratensis* is the dominant graminoid with scattered *Poa bulbosa* and *Agropyron trachycaulum. Iva xanthifolia* is a conspicuous forb.

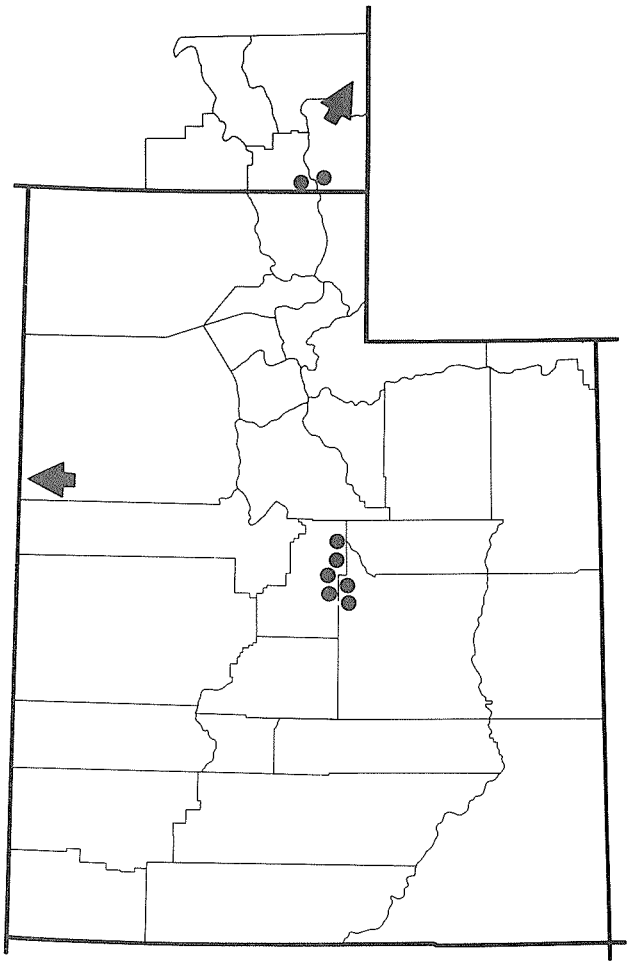
Soils—Soils were developed from alluvium of varying ages and were classified as Pachic Cryoborolls and Haploborolls. Particle-size classes ranged from coarse-loamy and silty to fine and clayey-skeletal. Estimated available water-holding capacity was typically high, and water tables were usually greater than 1 m (39 in) below the surface. Mottles indicated a seasonal water table between 50 and 75 cm (20 and 30 in) deep.

Succession and Management—Much discussion has recently taken place on whether *Poa pratensis* is actually an introduced species or whether it is simply a highly competitive native species. Regardless of its status it is, at the very least, a naturalized species that has become abundant in many of our riparian ecosystems, either as an herbaceous overstory or undergrowth dominant. This is probably the result of past heavy grazing or other disturbance factors. It is likely, however, to remain abundant, especially on the drier extremes of its range. It has been thought that many meadows once supported *Deschampsia cespitosa* communities have been converted, through heavy grazing pressures, to those dominated by *Poa pratensis.* However, not all areas that are dominated by *Poa pratensis* should be considered as potential *Deschampsia cespitosa* habitats. Many of the drier sites may have been dominated by other graminoids, including tufted *Poa* spp. or *Carex microptera.* It may have even replaced communities once dominated by Tall *Mertensia* spp. Little evidence is present in these communities to indicate which species may have previously dominated, however, and more study on the various community types may eventually result in a clearer idea regarding these successional relationships. *Poa pratensis* is highly palatable and nutritious for most large ungulates including livestock, deer, and elk (Welsh and others 1987). Kauffman and others (1983) found that on their study area in northeastern Oregon, livestock use of **Poa pratensis** communities was greater than other adjacent communities variously dominated by *Alnus incana, Crataegus douglassii,* and *Pinus ponderosa,* among others. Although *Poa pratensis* has an extensive rhizome system, its shallow rooting characteristics make it only marginally effective in stabilizing streambanks. Its competitive nature and high ground cover allow it, however, to be a valuable watershed species.

Other Studies—Youngblood and others (1985a) described a similar **POPR c.t.** for eastern Idaho and western Wyoming. Communities dominated by *Poa pratensis*

have previously been described for Oregon by Franklin and Dyrness (1973), Hall (1973), Padgett (1982), and Kauffman and others (1983). Similar **POPR c.t.s** and dominance types have been described by Kovalchik (1987) for central Oregon, Tuhy and Jensen (1982) for central Idaho, and Hansen and others (1988) for Montana. Communities previously included in the **Mesic Forb Meadow c.t.** (Youngblood and others 1985a) may be included in this type and represent greater levels of disturbance.

Veratrum californicum c.t. (VERCAL; VECA)



Distribution—VECA appears to be a major type on the Wasatch Plateau of the northern Utah Plateaus Floristic Section, becoming a minor type in the Wasatch Mountains Floristic Section. It has also been noted as a minor type in meadows of eastern Idaho and western Wyoming. It commonly occurs on areas of snow accumulation and late snowmelt. Slopes are gentle to steep (over 30 percent). Communities were sampled between 2 440 and 3 250 m (8,000 and 10,500 ft). Surface topography may be smooth or slightly concave to gently undulating. Adjacent uplands are commonly dominated by various tall forb communities or *Artemisia tridentata* ssp. *vaseyana* communities with tall forbs, especially on the Wasatch Plateau, or by *Populus tremuloides* or *Abies lasiocarpa.*

Vegetation—*Veratrum californicum* dominates a typically dense forb layer, and *Delphinium occidentale, Rudbeckia occidentalis, Thalictrum fendleri, Helenium hoopesii,* and *Mertensia ciliata* or other Tall *Mertensia* spp. are commonly present in varying amounts. Graminoid cover is usually sparse, if present at all.

Soils—Limited soil information is available, though most of those described had fine-loamy or fine particle-size classes and were classified as Pachic Cryoborolls. Soils were commonly residual or colluvial in nature and were saturated early in the growing season by late snowmelt. Some soils were subirrigated and occurred on alluvial or alluvial-colluvial meadows.

Succession and Management—Heavy past grazing levels are likely to have been responsible for the dramatic increase in the size of **Veratrum californicum** communities. The presence of other tall forbs may indicate previous dominance on sites supporting the **VECA c.t.**, but because of the strongly rhizomatous rooting nature of *Veratrum,* few species if any are likely to be able to out-compete and reestablish themselves as overstory dominants. Because *Veratrum* is rhizomatous, it can aid in stabilizing watersheds and streambanks. Alkaloids present in *Veratrum californicum* can be poisonous to livestock and have been shown to cause congenital deformities in lambs, often resulting in abortion, if ingested by ewes during early gestation (James and others 1980). Sheep, however, usually avoid this species during the growing season (Dayton 1960).

Other Studies—Gregory (1983) described similar communities dominated by *Veratrum californicum* on the Bridger-Teton National Forest of western Wyoming, while Youngblood and others (1985a) described a similar **VECA c.t.** for eastern Idaho and western Wyoming. Kerr and Henderson (1979) described a similar type for the Wasatch Plateau.

Mertensia ciliata c.t. (MERCIL; MECI)

Distribution—MECI is a minor type sampled only in the Wasatch Mountains of southern Idaho. It has been noted to occur in northern Utah and may be expected to occur elsewhere in the study area. This type is more extensive in western Wyoming and northeastern Idaho (Centennial Mountains). It occurs adjacent to small stream channels and on toe slopes in narrow to moderately wide valley bottoms.

Vegetation—*Mertensia ciliata* forms a dense herbaceous layer with *Rudbeckia occidentale, Heracleum lanatum,* and *Geranium richardsonii* often present in varying amounts.

Soils—Soils are typically deep, fine-loamy Mollisols with thick mollic epipedons. Soils are well drained and are likely intergrades to upland situations.

Succession and Management—The **MECI c.t.** is a stable type that may, through extensive grazing, especially by sheep, be converted to communities dominated by various increasers. *Rudbeckia occidentale,* and in some instances, *Veratrum californicum* have likely replaced communities once dominated by *Mertensia ciliata.* This is evidenced by the abundance of the latter species in communities dominated *Veratrum.* Communities where *Veratrum* occur are typically those with late season snowmelt or wet areas immediately adjacent to streams. Similarities between soils associated with the **Veratrum californicum c.t.** and the **MECI c.t.** tend to substantiate this assumption.

Other Studies—Youngblood and others (1985a) described a similar **MECI c.t.** for eastern Idaho and western Wyoming. Youngblood (1980), Norton and others (1981), and Gregory (1983) also described the **MECI c.t.** for various portions of the Bridger Teton National Forest in western Wyoming. Johnston (1987) also noted the presence of a **Mertensia ciliata plant association** in central and northern Colorado.

Miscellaneous Unclassified Herb/Graminoid-Dominated Communities

Communities dominated by *Agrostis stolonifera* are common in the study area but are often too small in area to sample using our methods. Some large communities were, however, sampled in the northern portion of the study area. Site characteristics show that *Agrostis stolonifera* typically occurs on sites wetter than those associated with the **Poa pratensis c.t.**, though *Poa pratensis* is usually present. *Carex nebrascensis, Glyceria striata,* and *Cirsium* spp. may also occur in these communities. *Carex muricata* dominated three communities sampled in the southeastern portion of the Uinta Mountains above 2 745 m (9,000 ft). Each site was associated with seepy organic surface soils in narrow to broad park lands. While two of those communities sampled had at least 25 percent cover of *Caltha leptosepala* and were, therefore, included in the **Caltha leptosepala c.t.**, the distinct dominance of *Carex muricata* indicates that, with further investigation, a new type could be described. *Carex aquatilis, C. illota, Deschampsia cespitosa,* and *Pedicularis groenlandica* are among those species associated with each community sampled. The wet, organic soils make these communities sensitive to livestock trampling and heavy machinery use. *Carex illota* dominates narrow, ecotonal communities that are often near the interface between wet meadows and forested communities on the south slope of the Uinta Mountains. Adjacent wetter communities may belong to the **Carex saxatilis** or **Carex aquatilis c.t.s.** Other communities dominated by a single herbaceous species include one *Carex canescens* community on the Beaver District of the Fishlake National Forest near 3 050 m (10,000 ft). This community occurred on wet, organic soils and on organic over silt-loam and clay-loam soil. On the Paunsaugunt Plateau along the East Fork of the Sevier River, a community dominated by *Juncus nevadensis* was sampled on a site with water flowing slowly over the surface. *Carex rostrata* was a minor component of this community. One community dominated by *Poa reflexa* and *Deschampsia elongata,* with dense *Trifolium* spp., was sampled in Gibson Basin in the Bear River Range of the Wasatch Mountains. This community seemed similar, though slightly drier than the adjacent community belonging to the **Deschampsia cespitosa c.t.** Communities dominated by *Polygonum bistortoides* were sampled in the Bear River Range in southern Idaho and in the Tushar Mountains in south-central Utah. *Carex microptera* was an associate in those communities sampled and may represent successional relationships between these communities and those belonging to the **Carex microptera c.t.** Moderate to heavy livestock use of some communities in these portions of the study area belonging to the **Deschampsia cespitosa c.t.** may also result in a dominance or codominance of *Polygonum bistortoides.*

Cardamine cordifolia or *Nasturtium officinale* [*Rorippa nasturtium-aquaticum*] often dominate communities on fresh water seeps and in slow-moving stream channels. Communities on seeps may also have an abundance of *Mimulus guttatus* and *Veronica americana,* while various aquatic *Ranunculus* spp. are more common associates in stream channels. *Cardamine* or *Nasturtium* may also extend onto the wet zone of adjacent riparian ecosystems as a part of the undergrowth in conifer-dominated as well as other tree- and shrub-dominated overstories. Further sampling on a local scale may indicate a need to define these as additional types.

Along the Logan and Blacksmith Fork Rivers of the Bear River Range, communities dominated by *Phalaris arundinacea* were sampled. This widespread, strongly rhizomatous species occurs throughout much of Utah at mid to low elevations along streams, rivers, and wet meadows. While it can stabilize eroding streambeds, it can also choke off water flows in smaller, slow-moving channels such as irrigation and drainage ditches (Thornburg 1982). Hansen and others (1988) described a similar **Phalaris arundinacea dominance type** for Montana.

Sampled only in a broad, wet meadow along the Blacksmith Fork River was a community dominated by *Scirpus microcarpus.* Communities dominated by this species were noted elsewhere in the study area and typically occur as stringers immediately adjacent to slow-moving stream margins, but they were too small to sample using our current methods. Here, however, a large area with wet, fine-textured soils supports a dense stand of *Scirpus.*

Wetland Communities

Our definition of riparian generally excludes those communities that are permanently inundated with standing water during most years. We consider these communities, in a strict sense, wetland communities (**Definitions**, p. 142). Within the study area, only rarely were wetland communities sampled because they are not common. In addition, management strategies among the various wetland communities do not differ significantly. While our **Typha latifolia c.t.** and some communities belonging to our **Eleocharis palustris c.t.** should be considered wetlands, they have the ability to withstand seasonal periods where water levels draw below the surface. One community dominated by *Carex atherodes* was sampled in Coot Slough on the south end of Fish Lake on the Fishlake Plateau. Youngblood and others (1985a) sampled similar communities in eastern Idaho, while Hansen and others (1988) described a **Carex atherodes dominance type** for western and northern Montana. A few communities dominated by *Carex vesicaria* were noted along the margins of East Park Reservoir on the southeast slope of the Uinta Mountains and at Meeks Cabin Reservoir on the north slope of the Uinta Mountains. While these communities were exposed by draw-down of the reservoir, they are commonly on wetter sites, often in standing water. Some low-elevation areas on the south slope of the Uinta Mountains have wetland communities dominated by *Scirpus acutus* with few associates. Other wetland communities are expected to occur along lake and stream margins, and management should address the importance of these communities to wildlife, and impacts of projects that change water levels should be considered when dealing with them.

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APPENDIX A. NUMBER OF SAMPLE STANDS OF RIPARIAN COMMUNITY TYPES IN FLORISTIC SECTIONS OF UTAH AND ADJACENT PORTIONS OF IDAHO, COLORADO, AND WYOMING.

UP = UTAH PLATEAUS WM = WASATCH MOUNTAINS UM = UINTA MOUNTAINS CL = CANYONLANDS

Community Type	Vicinity UP	WM	UM	CL	TOTAL
CONIFEROUS TREE-DOMINATED C.T.s					
CONIFER/COSE	-	3	-	-	3
CONIFER/EQAR	6	1	-	1	8
CONIFER/CACA	-	-	15	-	15
CONIFER/ELGL	-	1	6	-	7
CONIFER/POFR	2	-	4	-	6
CONIFER/DECE	-	-	7	-	7
CONIFER/POPR	4	-	-	-	4
CONIFER/ACCO	-	1	2	8	11
CONIFER/ACRU	-	6	-	2	8
TALL DECIDUOUS TREE-DOMINATED C.T.s					
POAN/BEOC	2	7	-	1	10
POAN/ACGR	-	5	-	-	5
POAN/COSE	3	6	-	1	10
POAN/ROWO	1	-	-	4	5
POAN/RHAR	3	-	-	2	5
POAN/POPR	10	8	-	-	18
ACNE/COSE	1	11	-	1	13
ACNE/EQAR	-	3	-	-	3
LOW DECIDUOUS TREE-DOMINATED C.T.s					
ALIN/COSE	1	3	-	1	5
ALIN/EQAR	-	1	1	2	4
ALIN/MF	3	5	1	4	13
ALIN/MG	1	1	2	2	6
BEOC/COSE	5	9	-	-	14
BEOC/MF	2	2	1	-	5
BEOC/POPR	6	1	-	-	7
NONWILLOW SHRUB-DOMINATED C.T.s					
COSE/HELA	2	9	-	-	11
POFR/DECE	1	4	2	1	8
POFR/POPR	8	-	-	2	10
ARCA/DECE	2	1	-	-	3
ARCA/POPR	2	2	-	-	4
ARCA/FEOV	2	-	-	-	2
SALIX BOOTHII-DOMINATED C.T.s					
SABO/CAAQ	1	5	2	-	8
SABO/CARO	3	4	-	-	7
SABO/CACA	-	2	2	-	4
SABO/POPA	-	1	-	-	1
SABO/CANE	1	1	-	-	2
SABO/EQAR	1	-	1	-	2
SABO/MF	5	14	3	3	25
SABO/MG	4	4	2	-	10
SABO/POPR	2	6	-	-	8

Community Type	Vicinity UP	WM	UM	CL	TOTAL
SALIX GEYERIANA-DOMINATED C.T.s					
SAGE/CAAQ	3	3	1	-	7
SAGE/CARO	-	-	6	-	6
SAGE/CACA	-	-	2	-	2
SAGE/POPA	-	-	1	-	1
SAGE/MF	1	1	2	-	4
SAGE/DECE	1	2	2	-	5
SAGE/MG	4	3	-	-	7
SALIX EXIGUA-DOMINATED C.T.s					
SAEX/MF	1	3	-	-	4
SAEX/MG	3	3	-	1	7
SAEX/POPR	3	4	-	1	8
SAEX/BARREN	3	4	-	-	7
OTHER TALL WILLOW-DOMINATED C.T.s					
SALA/BARREN	6	-	-	-	6
SABE/MG	4	-	-	4	8
LOW WILLOW-DOMINATED C.T.s					
SAWO/CAAQ	1	-	10	-	11
SAWO/CARO	-	-	3	-	3
SAWO/MF	-	3	2	-	5
SAWO/DECE	2	1	4	-	7
SAPL/CAAQ	1	-	11	-	12
SAPL/CACA	-	-	4	-	4
SAPL/DECE	-	-	10	-	10
SAGL/DECE	-	-	7	-	7
HERBACEOUS C.T.s					
ELPA1	4	1	-	3	8
CALA1	-	-	6	-	6
CALI	-	-	8	-	8
CABU	-	-	4	-	4
CASA	-	-	10	-	10
CALE	5	-	3	-	8
CAAQ	9	5	12	-	26
CARO	11	5	2	-	18
CASI	1	-	2	-	3
ELPA2	-	-	3	-	3
CACA	-	-	5	-	5
CANE	7	9	1	-	17
CAMI	1	2	-	1	4
CALA2	3	1	1	1	6
DECE	5	1	7	-	13
DAIN	-	-	4	-	4
JUBA	5	2	-	1	8
POPR	4	2	-	1	7
VECA	11	3	-	-	14
MECI	-	1	-	-	1

APPENDIX B. CONSTANCY AND AVERAGE COVER (IN PARENTHESES) OF IMPORTANT PLANTS IN UTAH RIPARIAN COMMUNITY TYPES.

	CONIF /EQAR	CONIF /CACA	CONIF /ELGL	CONIF /POFR	CONIF /DECE	CONIF /POPR	CONIF /ACCO	CONIF /ACRU
No. Stands per Group:	8	15	7	6	7	4	11	8
CONIFEROUS TREES								
ABIES LASIOCARPA	38(29)	20(4)	57(20)	-(-)	29(4)	-(-)	100(21)	100(36)
JUNIPERUS SCOPULORUM	13(4)	-(-)	-(-)	-(-)	-(-)	25(6)	-(-)	-(-)
PICEA ENGELMANNII	63(34)	47(11)	29(29)	-(-)	86(36)	25(27)	91(39)	38(38)
PICEA PUNGENS	38(69)	7(T)	14(40)	33(55)	-(-)	75(42)	-(-)	-(-)
PINUS CONTORTA	13(25)	100(47)	71(19)	67(42)	29(45)	-(-)	9(8)	-(-)
PSEUDOTSUGA MENZIESII	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	9(15)	38(29)
DECIDUOUS TREES								
ACER GRANDIDENTATUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	25(5)
ALNUS INCANA	13(20)	-(-)	14(10)	-(-)	-(-)	-(-)	-(-)	13(35)
BETULA OCCIDENTALIS	38(14)	-(-)	-(-)	-(-)	-(-)	25(8)	-(-)	-(-)
POPULUS ANGUSTIFOLIA	13(18)	-(-)	-(-)	-(-)	-(-)	25(17)	-(-)	13(60)
POPULUS TREMULOIDES	25(7)	13(24)	43(15)	17(T)	-(-)	25(6)	36(5)	38(24)
WILLOWS								
SALIX BOOTHII	13(25)	-(-)	14(1)	-(-)	-(-)	-(-)	-(-)	-(-)
SHRUBS								
LONICERA INVOLUCRATA	50(T)	7(T)	14(T)	-(-)	-(-)	-(-)	36(T)	38(4)
MAHONIA REPENS	-(-)	-(-)	14(T)	-(-)	-(-)	-(-)	9(10)	25(1)
PSCHYSTIMA MYRSINITES	13(T)	7(T)	14(T)	-(-)	-(-)	-(-)	9(1)	50(1)
POTENTILLA FRUTICOSA	13(1)	53(4)	-(-)	100(19)	-(-)	25(1)	-(-)	-(-)
PRUNUS VIRGINIANA	-(-)	-(-)	14(2)	-(-)	-(-)	-(-)	9(T)	38(5)
RIBES INERME	25(2)	-(-)	14(2)	17(1)	-(-)	25(T)	-(-)	13(1)
RIBES LACUSTRE	13(T)	-(-)	-(-)	-(-)	-(-)	-(-)	18(2)	-(-)
ROSA	50(1)	13(8)	57(3)	-(-)	-(-)	25(4)	9(T)	50(1)
SYMPHORICARPOS OREOPHILUS	25(1)	7(1)	14(1)	-(-)	-(-)	25(T)	9(T)	75(3)
VACCINIUM CAESPITOSUM	-(-)	20(2)	29(5)	-(-)	57(4)	-(-)	9(5)	-(-)
VACCINIUM MYRTILLUS	-(-)	33(18)	14(T)	-(-)	-(-)	-(-)	9(35)	-(-)
VACCINIUM SCOPARIUM	-(-)	47(4)	43(10)	-(-)	57(4)	-(-)	18(8)	-(-)
GRASSES								
AGROSTIS EXARATA	-(-)	-(-)	14(2)	-(-)	-(-)	-(-)	-(-)	-(-)
AGROSTIS STOLONIFERA	13(10)	-(-)	-(-)	33(14)	-(-)	25(4)	-(-)	-(-)
CALAMAGROSTIS CANADENSIS	25(4)	100(53)	86(8)	-(-)	-(-)	-(-)	27(1)	-(-)
DANTHONIA INTERMEDIA	-(-)	27(T)	29(8)	67(3)	43(9)	-(-)	-(-)	-(-)
DESCHAMPSIA CESPITOSA	-(-)	53(8)	29(5)	50(5)	100(38)	25(T)	9(T)	-(-)
ELYMUS GLAUCUS	-(-)	7(T)	100(24)	-(-)	-(-)	-(-)	9(1)	38(3)
GLYCERIA	25(2)	-(-)	14(3)	-(-)	-(-)	-(-)	-(-)	-(-)
PHLEUM ALPINUM	13(T)	53(2)	29(1)	83(3)	57(T)	-(-)	-(-)	-(-)
POA PRATENSIS	38(7)	7(40)	14(5)	83(6)	-(-)	100(21)	-(-)	-(-)
POA PALUSTRIS/TRIV	13(5)	-(-)	-(-)	17(5)	-(-)	-(-)	-(-)	-(-)
TRISETUM SPICATUM	-(-)	87(3)	57(2)	67(3)	86(1)	-(-)	18(T)	-(-)
SEDGES & OTHER GRASS-LIKES								
CAREX AQUATILIS	-(-)	13(17)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CAREX ATRATA	-(-)	33(5)	14(1)	17(T)	43(1)	-(-)	-(-)	-(-)
CAREX LANUGINOSA	50(12)	-(-)	-(-)	33(10)	-(-)	-(-)	-(-)	-(-)
CAREX MICROPTERA	25(3)	7(1)	14(T)	-(-)	29(T)	-(-)	-(-)	-(-)
CAREX ROSTRATA	-(-)	-(-)	29(5)	-(-)	14(2)	25(8)	-(-)	-(-)
CAREX SCIRPOIDEA	-(-)	-(-)	-(-)	-(-)	71(10)	-(-)	-(-)	-(-)
JUNCUS BALTICUS	25(1)	-(-)	-(-)	17(5)	-(-)	50(3)	-(-)	-(-)
FORBS								
ACONITUM COLUMBIANUM	25(1)	-(-)	14(10)	-(-)	-(-)	-(-)	55(11)	-(-)
ACTAEA RUBRA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	18(7)	100(10)
ARTEMISIA SCOPULORUM	-(-)	-(-)	-(-)	-(-)	43(3)	-(-)	-(-)	-(-)
ASTER OCCIDENTALIS	13(T)	-(-)	29(4)	50(30)	14(15)	-(-)	-(-)	-(-)
CALTHA LEPTOSEPALA	-(-)	33(10)	29(8)	-(-)	29(8)	-(-)	9(1)	-(-)
CIRSIUM	13(1)	20(T)	29(15)	33(T)	-(-)	25(T)	-(-)	-(-)
DELPHINIUM OCCIDENTALE	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	45(16)	25(5)
ERIGERON PEREGRINUS	-(-)	67(3)	14(5)	-(-)	43(3)	-(-)	55(3)	25(5)
FRAGARIA VIRGINIANA	38(T)	93(3)	57(2)	50(7)	-(-)	50(2)	45(1)	25(1)
GALIUM BOREALE	-(-)	73(2)	29(T)	67(1)	-(-)	-(-)	9(T)	13(10)
GALIUM TRIFLORUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	9(1)	63(1)
GERANIUM RICHARDSONII	63(4)	60(2)	57(4)	-(-)	14(3)	-(-)	82(8)	25(15)
HERACLEUM LANATUM	25(1)	-(-)	-(-)	-(-)	-(-)	-(-)	18(4)	25(9)
MERTENSIA ARIZONICA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	36(9)	-(-)
MERTENSIA CILIATA	13(T)	20(16)	14(T)	17(T)	29(T)	-(-)	27(26)	13(T)
MERTENSIA FRANCISCANA	13(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	25(2)
OSMORHIZA	25(T)	47(1)	43(1)	-(-)	-(-)	-(-)	91(11)	88(5)
PEDICULARIS RACEMOSA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	9(15)	13(1)
POLYGONUM BISTORTOIDES	-(-)	47(1)	29(1)	17(T)	86(2)	-(-)	27(1)	-(-)
SAXIFRAGA ODONTOLOMA	13(T)	-(-)	14(4)	-(-)	-(-)	-(-)	55(7)	-(-)
SENECIO SERRA	-(-)	13(T)	-(-)	-(-)	-(-)	-(-)	-(-)	38(1)
SENECIO TRIANGULARIS	13(5)	7(T)	-(-)	-(-)	-(-)	-(-)	55(19)	-(-)
SMILACINA STELLATA	63(9)	-(-)	29(20)	-(-)	-(-)	-(-)	27(1)	50(21)
STREPTOPUS AMPLEXIFOLIUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	27(12)	25(T)
TARAXACUM OFFICINALE	50(T)	27(1)	57(1)	100(21)	14(1)	75(35)	18(T)	-(-)
THALICTRUM FENDLERI	13(1)	13(T)	14(T)	33(T)	-(-)	-(-)	64(3)	63(2)
TRIFOLIUM	-(-)	47(1)	43(15)	50(17)	71(3)	100(18)	36(22)	-(-)
URTICA DIOICA	-(-)	-(-)	14(3)	-(-)	-(-)	-(-)	9(T)	13(2)
MOSS	13(50)	13(15)	14(10)	-(-)	29(1)	-(-)	9(10)	-(-)
EQUISETUM ARVENSE	100(74)	-(-)	29(15)	-(-)	-(-)	50(2)	18(5)	13(4)

APPENDIX B (cont.)

	POAN/ BEOC	POAN/ ACGR	POAN/ COSE	POAN/ ROWO	POAN/ RHAR	POAN/ POPR	ACNE/ COSE
No. Stands per group:	10	5	10	5	5	18	13
CONIFEROUS TREES							
ABIES LASIOCARPA	10(T)	20(18)	10(15)	-(-)	-(-)	-(-)	8(7)
JUNIPERUS SCOPULORUM	40(4)	-(-)	10(6)	20(1)	-(-)	61(7)	-(-)
PINUS PONDEROSA	10(T)	-(-)	10(2)	-(-)	-(-)	6(1)	-(-)
PSEUDOTSUGA MENZIESII	30(10)	20(T)	-(-)	-(-)	-(-)	6(7)	8(T)
DECIDUOUS TREES							
ACER GRANDIDENTATUM	30(24)	100(56)	40(8)	-(-)	-(-)	17(2)	23(17)
ACER NEGUNDO	30(38)	60(48)	20(40)	-(-)	-(-)	11(28)	100(62)
ALNUS INCANA	10(5)	20(10)	20(7)	-(-)	-(-)	-(-)	8(40)
BETULA OCCIDENTALIS	100(56)	20(8)	-(-)	-(-)	20(10)	17(3)	38(64)
FRAXINUS SPP.	-(-)	-(-)	-(-)	-(-)	-(-)	6(10)	8(50)
POPULUS ACUMINATA	-(-)	-(-)	10(40)	-(-)	20(65)	6(95)	-(-)
POPULUS ANGUSTIFOLIA	100(54)	100(64)	90(55)	100(73)	80(92)	89(61)	8(1)
POPULUS FREMONTII	-(-)	-(-)	-(-)	-(-)	-(-)	6(85)	-(-)
POPULUS TREMULOIDES	-(-)	20(3)	20(1)	40(6)	-(-)	6(T)	-(-)
QUERCUS GAMBELII	30(1)	-(-)	10(8)	80(2)	40(3)	17(5)	-(-)
WILLOWS							
SALIX BEBBIANA	-(-)	-(-)	-(-)	20(8)	-(-)	-(-)	-(-)
SALIX DRUMMONDIANA	-(-)	-(-)	10(2)	-(-)	-(-)	-(-)	-(-)
SALIX EXIGUA	-(-)	-(-)	20(38)	-(-)	20(10)	11(4)	8(10)
SALIX LASIANDRA	-(-)	-(-)	10(25)	-(-)	-(-)	-(-)	-(-)
SALIX LASIOLEPIS	-(-)	-(-)	10(5)	-(-)	-(-)	-(-)	-(-)
SALIX LUTEA	20(6)	-(-)	10(35)	-(-)	-(-)	6(9)	15(40)
SHRUBS							
CORNUS SERICEA	60(19)	20(5)	90(80)	20(2)	-(-)	11(2)	100(69)
MAHONIA REPENS	30(6)	60(7)	10(1)	20(1)	-(-)	11(1)	-(-)
PSCHYSTIMA MYRSINITES	20(2)	20(8)	40(13)	-(-)	-(-)	-(-)	15(4)
PRUNUS VIRGINIANA	10(2)	60(14)	10(2)	40(16)	-(-)	6(2)	8(35)
RHUS AROMATICA	20(37)	-(-)	20(8)	20(2)	100(76)	-(-)	-(-)
RIBES AUREUM	10(8)	-(-)	10(2)	-(-)	-(-)	11(10)	-(-)
RIBES INERME	-(-)	-(-)	10(60)	-(-)	-(-)	-(-)	23(3)
ROSA WOODSII/NUTKANA	70(3)	40(2)	80(4)	100(52)	60(8)	61(5)	54(5)
SYMPHORICARPOS OREOPHILUS	30(4)	20(2)	30(3)	80(7)	-(-)	44(3)	15(2)
GRASSES							
AGROSTIS STOLONIFERA	10(6)	-(-)	30(2)	20(15)	-(-)	17(21)	8(7)
ELYMUS GLAUCUS	10(15)	40(12)	40(2)	20(2)	-(-)	22(35)	15(11)
POA PRATENSIS	60(21)	80(38)	60(9)	100(16)	60(25)	94(50)	54(7)
SEDGES & OTHER GRASS-LIKES							
CAREX LANUGINOSA	10(4)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
JUNCUS BALTICUS	-(-)	-(-)	-(-)	-(-)	-(-)	11(13)	-(-)
FORBS							
ACTAEA RUBRA	-(-)	20(5)	10(3)	-(-)	-(-)	-(-)	23(5)
CIRSIUM SPP.	10(T)	-(-)	10(1)	20(T)	40(T)	11(1)	8(3)
DELPHINIUM OCCIDENTALE	-(-)	-(-)	-(-)	-(-)	-(-)	11(1)	-(-)
GALIUM BOREALE	-(-)	20(T)	-(-)	20(7)	-(-)	-(-)	-(-)
GERANIUM RICHARDSONII	10(T)	-(-)	10(T)	20(6)	-(-)	11(10)	-(-)
HERACLEUM LANATUM	-(-)	-(-)	-(-)	-(-)	-(-)	6(2)	23(5)
OSMORHIZA CHILENSIS	30(27)	80(2)	10(5)	40(2)	-(-)	11(8)	38(2)
SENECIO SERRA	-(-)	-(-)	-(-)	-(-)	-(-)	11(1)	15(1)
SMILACINA STELLATA	40(2)	80(7)	50(10)	60(2)	40(2)	28(4)	69(11)
TARAXACUM OFFICINALE	60(3)	60(T)	30(1)	80(4)	-(-)	72(4)	31(1)
THALICTRUM FENDLERI	10(T)	40(4)	-(-)	40(1)	-(-)	17(T)	-(-)
TRIFOLIUM SPP.	-(-)	-(-)	-(-)	40(5)	-(-)	17(3)	-(-)
URTICA DIOICA	-(-)	20(2)	-(-)	-(-)	-(-)	17(1)	23(1)
MOSS	10(2)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
EQUISETUM HYEMALE/LAEVEGATUM	-(-)	-(-)	40(22)	-(-)	-(-)	6(2)	31(5)
EQUISETUM ARVENSE	10(95)	-(-)	60(4)	-(-)	-(-)	22(4)	15(1)

APPENDIX B (cont.)

No. Stands per Group:	ALIN/ COSE 5	ALIN/ EQAR 4	ALIN/ MF 13	ALIN/ MG 6	BEOC/ COSE 14	BEOC/ MF 5	BEOC/ POPR 7
CONIFEROUS TREES							
ABIES LASIOCARPA	-(-)	-(-)	8(8)	-(-)	7(8)	-(-)	14(T)
JUNIPERUS SCOPULORUM	-(-)	-(-)	-(-)	-(-)	14(2)	-(-)	71(6)
PICEA ENGELMANNII	-(-)	-(-)	8(3)	17(5)	-(-)	20(1)	-(-)
PICEA PUNGENS	-(-)	-(-)	-(-)	-(-)	7(3)	-(-)	14(5)
PINUS PONDEROSA	-(-)	-(-)	8(T)	-(-)	-(-)	20(5)	14(6)
PSEUDOTSUGA MENZIESII	-(-)	-(-)	-(-)	-(-)	7(2)	20(T)	-(-)
DECIDUOUS TREES							
ACER NEGUNDO	20(40)	-(-)	15(8)	-(-)	7(2)	-(-)	-(-)
ALNUS INCANA	100(60)	100(70)	100(73)	100(66)	14(7)	20(7)	14(15)
BETULA OCCIDENTALIS	60(18)	-(-)	-(-)	17(20)	100(63)	100(61)	100(73)
POPULUS ANGUSTIFOLIA	-(-)	-(-)	15(15)	-(-)	7(10)	20(20)	14(T)
POPULUS TREMULOIDES	-(-)	-(-)	15(10)	17(T)	7(10)	20(7)	-(-)
QUERCUS GAMBELII	-(-)	-(-)	-(-)	-(-)	7(T)	-(-)	29(T)
WILLOWS							
SALIX BEBBIANA	-(-)	-(-)	-(-)	17(2)	7(20)	-(-)	43(15)
SALIX BOOTHII	-(-)	25(20)	-(-)	-(-)	14(7)	-(-)	14(2)
SALIX DRUMMONDIANA	-(-)	25(6)	15(28)	-(-)	7(8)	-(-)	-(-)
SALIX EXIGUA	-(-)	50(7)	-(-)	17(3)	14(31)	40(33)	14(T)
SALIX LASIANDRA	-(-)	25(40)	15(15)	33(33)	-(-)	-(-)	14(T)
SALIX LASIOLEPIS	-(-)	-(-)	-(-)	-(-)	14(40)	40(8)	14(45)
SALIX LUTEA	60(16)	50(40)	8(25)	33(25)	21(18)	40(22)	-(-)
SHRUBS							
BETULA GLANDULOSA	-(-)	-(-)	-(-)	-(-)	7(45)	-(-)	-(-)
CORNUS SERICEA	100(78)	25(1)	31(12)	17(1)	100(57)	20(10)	14(2)
LONICERA INVOLUCRATA	20(15)	25(T)	38(20)	-(-)	7(3)	20(40)	14(2)
PSCHYSTIMA MYRSINITES	-(-)	-(-)	8(1)	-(-)	14(4)	-(-)	-(-)
PRUNUS VIRGINIANA	20(1)	-(-)	8(10)	-(-)	7(45)	20(1)	14(T)
RHUS AROMATICA	-(-)	-(-)	-(-)	-(-)	7(10)	20(T)	14(3)
RIBES AUREUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	29(4)
RIBES INERME	40(5)	50(4)	54(7)	50(3)	-(-)	20(40)	14(5)
RIBES LACUSTRE	-(-)	-(-)	-(-)	-(-)	7(30)	-(-)	-(-)
ROSA WOODSII/NUTKANA	40(10)	25(4)	46(3)	67(3)	64(12)	40(13)	86(5)
SYMPHORICARPOS OREOPHILUS	-(-)	-(-)	23(4)	17(2)	7(T)	-(-)	14(10)
GRASSES							
AGROSTIS STOLONIFERA	40(3)	50(25)	31(23)	50(27)	7(5)	20(20)	43(20)
CALAMAGROSTIS CANADENSIS	-(-)	-(-)	8(5)	33(11)	7(5)	-(-)	-(-)
DESCHAMPSIA CESPITOSA	-(-)	-(-)	8(10)	-(-)	-(-)	-(-)	-(-)
ELYMUS GLAUCUS	20(1)	50(16)	31(9)	17(5)	14(2)	20(5)	-(-)
GLYCERIA SPP.	20(15)	75(2)	31(3)	33(10)	21(4)	-(-)	14(6)
POA PRATENSIS	20(1)	75(17)	62(29)	83(34)	21(6)	60(27)	100(45)
POA PALUSTRIS/TRIVIALIS	-(-)	25(5)	8(4)	17(5)	21(22)	20(40)	-(-)
SEDGES & OTHER GRASS-LIKES							
CAREX AQUATILIS	-(-)	-(-)	-(-)	17(20)	-(-)	-(-)	-(-)
CAREX LANUGINOSA	20(25)	50(18)	15(T)	17(T)	7(T)	-(-)	29(8)
CAREX MICROPTERA	-(-)	50(T)	23(12)	33(T)	-(-)	20(1)	14(2)
CAREX NEBRASCENSIS	-(-)	-(-)	-(-)	17(2)	7(T)	-(-)	43(3)
CAREX ROSTRATA	-(-)	25(25)	-(-)	50(7)	-(-)	-(-)	-(-)
JUNCUS BALTICUS	-(-)	25(T)	8(T)	-(-)	7(8)	-(-)	57(13)
FORBS							
ACONITUM COLUMBIANUM	-(-)	50(3)	38(11)	-(-)	7(3)	40(19)	-(-)
ACTAEA RUBRA	40(T)	-(-)	31(3)	17(T)	21(4)	20(T)	14(4)
CIRSIUM SPP.	-(-)	50(1)	46(1)	33(1)	14(2)	40(1)	43(1)
DELPHINIUM OCCIDENTALE	-(-)	-(-)	8(20)	-(-)	-(-)	-(-)	-(-)
FRAGARIA VIRGINIANA	-(-)	-(-)	8(T)	-(-)	7(T)	20(3)	14(T)
GALIUM BOREALE	-(-)	-(-)	-(-)	17(T)	-(-)	20(2)	-(-)
GALIUM TRIFLORUM	-(-)	25(T)	23(4)	17(3)	21(3)	20(5)	-(-)
GERANIUM RICHARDSONII	20(T)	50(3)	62(9)	50(1)	14(16)	40(10)	29(5)
HERACLEUM LANATUM	60(3)	50(8)	69(29)	17(T)	21(16)	40(28)	-(-)
HYDROPHYLLUM FENDLERI	-(-)	-(-)	8(55)	-(-)	-(-)	-(-)	-(-)
MERTENSIA ARIZONICA	-(-)	-(-)	8(8)	-(-)	-(-)	-(-)	-(-)
MERTENSIA CILIATA	20(2)	50(3)	15(3)	17(2)	-(-)	-(-)	-(-)
MERTENSIA FRANCISCANA	20(2)	-(-)	31(8)	-(-)	-(-)	-(-)	-(-)
OSMORHIZA SPP.	-(-)	25(1)	38(9)	33(2)	29(1)	20(8)	14(1)
PTERIDIUM AQUILINUM	-(-)	-(-)	8(15)	-(-)	-(-)	20(10)	-(-)
SENECIO SERRA	20(T)	-(-)	-(-)	17(T)	7(1)	20(8)	-(-)
SMILACINA STELLATA	60(4)	25(45)	38(13)	-(-)	50(13)	100(23)	57(2)
TARAXACUM OFFICINALE	-(-)	75(1)	38(3)	100(1)	21(T)	20(T)	86(6)
THALICTRUM FENDLERI	40(1)	25(5)	38(2)	50(2)	21(T)	40(1)	14(10)
TRIFOLIUM SPP.	-(-)	50(1)	8(5)	50(1)	-(-)	20(1)	57(22)
URTICA DIOICA	-(-)	25(1)	62(6)	17(1)	21(10)	20(2)	14(2)
MOSS	20(5)	-(-)	8(3)	17(15)	7(50)	20(1)	-(-)
EQUISETUM HYEMALE/LAEVEGATUM	20(T)	-(-)	8(15)	-(-)	50(17)	20(1)	29(T)
EQUISETUM ARVENSE	20(4)	100(41)	62(3)	83(3)	29(2)	80(38)	57(1)

APPENDIX B (cont.)

	SABO/ CAAQ	SABO/ CARO	SABO/ CACA	SABO/ MF	SABO/ MG	SABO/ POPR	SAGE/ CAAQ	SAGE/ CARO	SAGE/ MF	SAGE/ DECE	SAGE/ MG
No. Stands per Group:	8	7	4	25	10	8	7	6	4	5	7
CONIFEROUS TREES											
ABIES LASIOCARPA	13(T)	-(-)	-(-)	12(4)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	14(2)
PICEA ENGELMANNII	13(9)	-(-)	-(-)	4(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
PICEA PUNGENS	-(-)	-(-)	-(-)	-(-)	-(-)	13(T)	14(11)	-(-)	25(3)	-(-)	14(10)
DECIDUOUS TREES											
ALNUS INCANA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
BETULA OCCIDENTALIS	-(-)	14(2)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
POPULUS ANGUSTIFOLIA	-(-)	-(-)	-(-)	-(-)	-(-)	13(2)	-(-)	-(-)	-(-)	-(-)	-(-)
WILLOWS											
SALIX BEBBIANA	-(-)	-(-)	-(-)	4(2)	-(-)	-(-)	14(10)	-(-)	-(-)	-(-)	-(-)
SALIX BOOTHII	100(63)	100(61)	100(47)	72(67)	100(51)	88(56)	14(8)	50(8)	50(3)	20(7)	14(20)
SALIX DRUMMONDIANA	13(7)	29(14)	25(60)	60(58)	40(70)	50(51)	-(-)	17(2)	-(-)	-(-)	-(-)
SALIX EXIGUA	-(-)	-(-)	-(-)	-(-)	10(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SALIX GEYERIANA	13(15)	14(40)	75(29)	4(65)	10(25)	13(45)	100(44)	100(28)	100(84)	100(60)	100(40)
SALIX LASIANDRA	-(-)	14(2)	-(-)	4(3)	10(1)	13(30)	-(-)	-(-)	-(-)	-(-)	14(3)
SALIX LASIOLEPIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SALIX LUTEA	-(-)	14(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SALIX MONTICOLA	-(-)	-(-)	-(-)	4(90)	10(40)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SALIX PLANIFOLIA	-(-)	-(-)	-(-)	4(1)	-(-)	-(-)	14(1)	33(23)	-(-)	-(-)	-(-)
SALIX WOLFII	25(73)	-(-)	-(-)	-(-)	-(-)	-(-)	29(38)	33(3)	-(-)	-(-)	-(-)
SHRUBS											
BETULA GLANDULOSA	13(4)	14(40)	-(-)	-(-)	-(-)	-(-)	14(1)	17(10)	-(-)	-(-)	14(1)
CORNUS SERICEA	-(-)	14(1)	-(-)	-(-)	-(-)	13(3)	-(-)	-(-)	-(-)	-(-)	14(5)
LONICERA INVOLUCRATA	38(10)	14(20)	50(20)	44(18)	20(9)	13(10)	-(-)	17(T)	-(-)	-(-)	14(5)
POTENTILLA FRUTICOSA	-(-)	-(-)	25(T)	4(T)	10(1)	13(T)	-(-)	-(-)	25(1)	20(3)	29(8)
RIBES AUREUM	-(-)	-(-)	-(-)	4(1)	-(-)	13(1)	-(-)	-(-)	25(2)	-(-)	-(-)
RIBES INERME	13(T)	29(3)	50(10)	44(19)	30(14)	50(11)	29(7)	17(1)	50(7)	60(7)	43(6)
ROSA	-(-)	14(3)	-(-)	16(6)	-(-)	25(2)	-(-)	-(-)	25(8)	-(-)	29(2)
SYMPHORICARPOS OREOPHILUS	-(-)	-(-)	-(-)	8(3)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
GRASSES											
AGROSTIS STOLONIFERA	-(-)	14(2)	25(10)	12(22)	20(13)	50(6)	-(-)	-(-)	25(15)	40(5)	57(7)
BROMUS TECTORUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CALAMAGROSTIS CANADENSIS	25(10)	29(2)	100(59)	8(4)	20(7)	-(-)	43(9)	83(9)	-(-)	-(-)	14(7)
DESCHAMPSIA CESPITOSA	50(4)	14(25)	50(T)	12(2)	10(8)	-(-)	71(2)	33(3)	50(3)	100(16)	14(1)
GLYCERIA	-(-)	71(12)	25(T)	-(-)	30(19)	-(-)	14(2)	-(-)	-(-)	60(1)	14(5)
PHLEUM ALPINUM	13(T)	-(-)	-(-)	8(T)	-(-)	-(-)	29(1)	-(-)	50(1)	40(5)	-(-)
POA PRATENSIS	13(4)	14(50)	75(T)	52(24)	30(16)	75(29)	29(1)	-(-)	50(40)	80(36)	71(44)
POA PALUSTRIS/TRIV	-(-)	29(T)	25(5)	4(10)	10(20)	13(T)	-(-)	17(1)	-(-)	-(-)	14(3)
SEDGES & OTHER GRASS-LIKES											
CAREX AQUATILIS	100(46)	14(10)	25(T)	12(6)	-(-)	-(-)	100(59)	83(7)	-(-)	40(3)	-(-)
CAREX LANUGINOSA	-(-)	14(5)	-(-)	8(1)	30(15)	-(-)	-(-)	-(-)	50(2)	60(19)	71(28)
CAREX MICROPTERA	25(7)	14(T)	75(T)	40(8)	20(2)	13(6)	43(2)	17(T)	75(5)	80(14)	-(-)
CAREX NEBRASCENSIS	-(-)	14(6)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	50(2)	40(3)	14(1)
CAREX PRAEGRACILIS	13(T)	-(-)	-(-)	4(5)	-(-)	-(-)	14(2)	-(-)	-(-)	-(-)	29(73)
CAREX ROSTRATA	38(4)	100(61)	50(T)	8(1)	50(5)	-(-)	71(25)	100(80)	50(1)	40(8)	57(5)
CAREX SIMULATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	20(5)	14(5)
JUNCUS BALTICUS	13(2)	29(10)	-(-)	-(-)	20(33)	13(T)	29(1)	-(-)	25(T)	60(23)	71(15)
FORBS											
ACONITUM COLUMBIANUM	13(15)	-(-)	25(10)	28(4)	10(T)	-(-)	14(1)	-(-)	25(T)	-(-)	-(-)
ACTAEA RUBRA	-(-)	-(-)	-(-)	8(1)	-(-)	13(1)	-(-)	-(-)	-(-)	-(-)	-(-)
ASTER FOLIACEUS	13(3)	14(1)	50(1)	12(2)	-(-)	-(-)	-(-)	-(-)	25(5)	20(40)	-(-)
ASTER OCCIDENTALIS	-(-)	-(-)	-(-)	4(8)	-(-)	-(-)	-(-)	-(-)	-(-)	20(20)	-(-)
CALTHA LEPTOSEPALA	13(90)	-(-)	-(-)	4(T)	10(5)	-(-)	14(T)	-(-)	-(-)	-(-)	-(-)
CIRSIUM	13(T)	29(5)	50(2)	28(7)	20(T)	50(48)	-(-)	-(-)	50(2)	20(1)	29(1)
FRAGARIA VIRGINIANA	25(3)	14(T)	50(6)	36(5)	-(-)	25(28)	29(1)	-(-)	75(12)	60(1)	-(-)
GALIUM BOREALE	25(T)	14(10)	25(T)	4(1)	-(-)	-(-)	-(-)	-(-)	50(T)	20(1)	-(-)
GALIUM TRIFLORUM	-(-)	-(-)	25(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
GERANIUM RICHARDSONII	25(20)	-(-)	50(2)	40(5)	-(-)	-(-)	14(1)	-(-)	25(1)	20(1)	14(10)
GEUM MACROPHYLLUM	25(1)	29(T)	50(6)	32(1)	30(1)	75(2)	86(1)	33(T)	100(2)	80(2)	71(4)
HERACLEUM LANATUM	-(-)	14(5)	-(-)	52(17)	-(-)	25(3)	-(-)	-(-)	-(-)	-(-)	-(-)
HYDROPHYLLUM FENDLERI	-(-)	-(-)	-(-)	4(50)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
MENTHA	13(5)	29(43)	50(5)	16(6)	60(2)	25(2)	-(-)	-(-)	25(3)	20(T)	-(-)
MERTENSIA ARIZONICA	-(-)	-(-)	-(-)	4(60)	-(-)	-(-)	29(1)	-(-)	25(25)	-(-)	14(2)
MERTENSIA CILIATA	13(1)	-(-)	50(4)	48(24)	-(-)	25(3)	-(-)	-(-)	50(35)	20(T)	-(-)
MERTENSIA FRANCISCANA	-(-)	-(-)	-(-)	12(23)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
POLEMONIUM CAERULEUM	38(1)	14(T)	25(T)	28(1)	-(-)	-(-)	29(T)	17(T)	25(15)	20(T)	14(2)
POLYGONUM BISTORTOIDES	-(-)	-(-)	-(-)	4(5)	-(-)	-(-)	14(1)	-(-)	-(-)	-(-)	-(-)
RUDBECKIA OCCIDENTALIS	-(-)	-(-)	-(-)	12(5)	10(T)	38(7)	-(-)	-(-)	-(-)	-(-)	14(1)
CALAMAGROSTIS STRICTA	-(-)	-(-)	-(-)	32(5)	-(-)	25(3)	-(-)	-(-)	-(-)	-(-)	29(T)
SMILACINA STELLATA	13(T)	-(-)	25(40)	60(26)	20(2)	13(2)	-(-)	-(-)	50(15)	-(-)	14(3)
SOLIDAGO CANADENSIS	-(-)	14(1)	25(40)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
TARAXACUM OFFICINALE	25(1)	-(-)	75(1)	12(3)	20(6)	38(1)	29(2)	17(T)	50(6)	100(10)	86(17)
THALICTRUM FENDLERI	25(4)	-(-)	50(2)	40(7)	-(-)	25(4)	57(T)	17(T)	25(T)	20(3)	14(5)
TRIFOLIUM	25(4)	-(-)	50(T)	8(T)	10(1)	-(-)	29(4)	17(T)	25(T)	20(1)	29(2)
URTICA DIOICA	-(-)	-(-)	50(4)	36(14)	40(2)	50(23)	-(-)	-(-)	25(10)	-(-)	14(5)
MOSS	38(55)	29(5)	-(-)	12(13)	10(2)	13(2)	71(24)	17(10)	50(18)	40(12)	14(90)
EQUISETUM ARVENSE	38(3)	29(8)	50(1)	16(2)	40(2)	-(-)	29(1)	-(-)	25(T)	-(-)	29(4)

APPENDIX B (cont.)

	SAEX/ MF	SAEX/ MG	SAEX/ POPR	SAEX/ BRN	SABE/ MG	SALA/ BRN
No. Stands per Group:	4	7	7	7	8	6
CONIFEROUS TREES						
ABIES LASIOCARPA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
PICEA ENGELMANNII	-(-)	-(-)	-(-)	-(-)	13(10)	-(-)
PICEA PUNGENS	-(-)	-(-)	14(T)	-(-)	13(8)	-(-)
DECIDUOUS TREES						
ALNUS INCANA	-(-)	14(8)	14(5)	-(-)	13(2)	-(-)
BETULA OCCIDENTALIS	25(5)	14(5)	-(-)	-(-)	-(-)	-(-)
POPULUS ANGUSTIFOLIA	-(-)	-(-)	14(15)	-(-)	-(-)	-(-)
WILLOWS						
SALIX BEBBIANA	-(-)	-(-)	-(-)	-(-)	100(79)	-(-)
SALIX BOOTHII	75(3)	29(15)	43(9)	14(10)	13(20)	-(-)
SALIX DRUMMONDIANA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SALIX EXIGUA	100(81)	71(39)	71(66)	71(63)	-(-)	-(-)
SALIX GEYERIANA	-(-)	14(3)	-(-)	-(-)	-(-)	-(-)
SALIX LASIANDRA	-(-)	57(49)	57(60)	43(63)	-(-)	-(-)
SALIX LASIOLEPIS	-(-)	14(10)	14(15)	-(-)	-(-)	100(88)
SALIX LUTEA	50(3)	29(6)	29(28)	14(80)	13(15)	-(-)
SALIX MONTICOLA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SALIX PLANIFOLIA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SALIX WOLFII	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SHRUBS						
BETULA GLANDULOSA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CORNUS SERICEA	25(1)	14(1)	-(-)	29(4)	-(-)	-(-)
LONICERA INVOLUCRATA	25(2)	14(T)	-(-)	-(-)	-(-)	-(-)
POTENTILLA FRUTICOSA	-(-)	-(-)	14(3)	-(-)	25(2)	-(-)
RIBES AUREUM	25(T)	14(40)	14(15)	-(-)	-(-)	100(15)
RIBES INERME	75(23)	14(20)	-(-)	29(12)	100(19)	-(-)
ROSA	100(33)	43(5)	57(9)	43(2)	75(13)	67(19)
SYMPHORICARPOS OREOPHILUS	25(1)	14(3)	-(-)	-(-)	75(3)	-(-)
GRASSES						
AGROSTIS STOLONIFERA	50(1)	57(20)	86(19)	14(1)	13(5)	-(-)
BROMUS TECTORUM	-(-)	-(-)	14(60)	-(-)	-(-)	67(1)
CALAMAGROSTIS CANADENSIS	50(3)	-(-)	-(-)	-(-)	-(-)	-(-)
DESCHAMPSIA CESPITOSA	-(-)	14(2)	14(1)	-(-)	-(-)	-(-)
GLYCERIA	25(1)	29(2)	29(7)	14(T)	25(3)	17(T)
PHLEUM ALPINUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
POA PRATENSIS	75(20)	86(24)	86(33)	-(-)	100(26)	50(2)
POA PALUSTRIS/TRIV	-(-)	-(-)	14(1)	-(-)	-(-)	-(-)
SEDGES & OTHER GRASS-LIKES						
CAREX AQUATILIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CAREX LANUGINOSA	25(3)	57(38)	-(-)	14(1)	-(-)	17(1)
CAREX MICROPTERA	25(T)	-(-)	14(2)	-(-)	13(1)	-(-)
CAREX NEBRASCENSIS	-(-)	43(50)	29(4)	-(-)	25(21)	-(-)
CAREX PRAEGRACILIS	-(-)	14(2)	-(-)	-(-)	25(13)	-(-)
CAREX ROSTRATA	-(-)	43(8)	14(T)	14(T)	-(-)	-(-)
CAREX SIMULATA	-(-)	14(T)	-(-)	-(-)	-(-)	-(-)
JUNCUS BALTICUS	25(1)	86(12)	43(13)	-(-)	50(2)	-(-)
FORBS						
ACONITUM COLUMBIANUM	-(-)	-(-)	-(-)	-(-)	13(3)	-(-)
ACTAEA RUBRA	-(-)	-(-)	-(-)	-(-)	25(21)	-(-)
ASTER FOLIACEUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ASTER OCCIDENTALIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CALTHA LEPTOSEPALA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CIRSIUM	25(10)	57(2)	14(3)	-(-)	13(T)	17(T)
FRAGARIA VIRGINIANA	25(T)	-(-)	-(-)	-(-)	13(T)	-(-)
GALIUM BOREALE	50(5)	14(T)	-(-)	-(-)	-(-)	-(-)
GALIUM TRIFLORUM	-(-)	-(-)	-(-)	-(-)	13(40)	-(-)
GERANIUM RICHARDSONII	50(5)	-(-)	14(1)	14(T)	38(1)	-(-)
GEUM MACROPHYLLUM	75(1)	29(1)	29(2)	-(-)	13(T)	-(-)
HERACLEUM LANATUM	50(33)	-(-)	-(-)	-(-)	13(10)	-(-)
HYDROPHYLLUM FENDLERI	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
MENTHA	25(T)	57(7)	29(4)	14(T)	-(-)	17(T)
MERTENSIA ARIZONICA	25(20)	-(-)	-(-)	-(-)	-(-)	-(-)
MERTENSIA CILIATA	25(5)	-(-)	-(-)	-(-)	-(-)	-(-)
MERTENSIA FRANCISCANA	-(-)	-(-)	-(-)	-(-)	13(T)	-(-)
POLEMONIUM CAERULEUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
POLYGONUM BISTORTOIDES	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
RUDBECKIA OCCIDENTALIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CALAMAGROSTIS STRICTA	50(24)	-(-)	-(-)	-(-)	-(-)	-(-)
SMILACINA STELLATA	25(7)	-(-)	29(10)	-(-)	-(-)	-(-)
SOLIDAGO CANADENSIS	25(45)	-(-)	-(-)	-(-)	-(-)	-(-)
TARAXACUM OFFICINALE	-(-)	29(8)	43(5)	-(-)	88(11)	33(T)
THALICTRUM FENDLERI	50(5)	-(-)	-(-)	-(-)	-(-)	-(-)
TRIFOLIUM	-(-)	14(1)	-(-)	14(T)	50(54)	-(-)
URTICA DIOICA	-(-)	14(3)	14(5)	29(1)	13(2)	-(-)
MOSS	-(-)	14(25)	14(5)	-(-)	-(-)	-(-)
EQUISETUM ARVENSE	-(-)	57(15)	43(12)	71(1)	25(25)	17(T)

APPENDIX B (cont.)

No. Stands per Group:	COSE/ HELA 11	ARCA/ DECE 3	ARCA/ POPR 4	POFR/ DECE 8	POFR/ POPR 10
CONIFEROUS TREES					
PICEA ENGELMANNII	-(-)	-(-)	-(-)	-(-)	10(3)
DECIDUOUS TREES					
ACER GRANDIDENTATUM	9(30)	-(-)	-(-)	-(-)	-(-)
ACER NEGUNDO	9(4)	-(-)	-(-)	-(-)	-(-)
ALNUS INCANA	18(8)	-(-)	-(-)	-(-)	-(-)
POPULUS TREMULOIDES	9(T)	-(-)	-(-)	-(-)	10(1)
QUERCUS GAMBELII	9(2)	-(-)	-(-)	-(-)	-(-)
WILLOWS					
SALIX BOOTHII	27(17)	-(-)	25(1)	-(-)	-(-)
SALIX DRUMMONDIANA	18(21)	-(-)	-(-)	-(-)	-(-)
SALIX EXIGUA	64(46)	-(-)	-(-)	-(-)	-(-)
SALIX LASIANDRA	9(12)	-(-)	-(-)	-(-)	-(-)
SALIX LUTEA	36(32)	-(-)	-(-)	-(-)	-(-)
SHRUBS					
ARTEMISIA CANA	-(-)	100(28)	100(43)	13(2)	20(4)
BETULA GLANDULOSA	-(-)	-(-)	-(-)	13(45)	-(-)
CORNUS SERICEA	100(76)	-(-)	-(-)	-(-)	-(-)
LONICERA INVOLUCRATA	9(T)	-(-)	-(-)	-(-)	-(-)
PSCHYSTIMA MYRSINITES	27(5)	-(-)	-(-)	-(-)	-(-)
POTENTILLA FRUTICOSA	-(-)	-(-)	-(-)	100(48)	100(40)
PRUNUS VIRGINIANA	18(4)	-(-)	-(-)	-(-)	-(-)
RIBES AUREUM	9(10)	-(-)	-(-)	-(-)	-(-)
RIBES INERME	18(8)	-(-)	25(2)	-(-)	-(-)
RIBES LACUSTRE	27(8)	-(-)	-(-)	-(-)	-(-)
ROSA WOODSII/NUTKANA	73(7)	-(-)	-(-)	-(-)	-(-)
SYMPHORICARPOS OREOPHILUS	-(-)	-(-)	25(T)	13(10)	-(-)
GRASSES					
AGROSTIS STOLONIFERA	9(T)	-(-)	-(-)	13(2)	10(10)
DANTHONIA INTERMEDIA	-(-)	-(-)	-(-)	25(12)	-(-)
DESCHAMPSIA CESPITOSA	-(-)	100(45)	-(-)	100(29)	20(1)
ELYMUS GLAUCUS	36(2)	-(-)	-(-)	-(-)	-(-)
GLYCERIA STRIATA	36(1)	-(-)	-(-)	-(-)	-(-)
POA PRATENSIS	55(5)	67(13)	100(73)	50(23)	90(47)
POA PALUSTRIS/TRIVIALIS	27(13)	-(-)	-(-)	-(-)	-(-)
SEDGES & OTHER GRASS-LIKES					
CAREX AQUATILIS	-(-)	33(T)	-(-)	25(2)	-(-)
CAREX LANUGINOSA	9(T)	-(-)	-(-)	13(40)	10(1)
CAREX MICROPTERA	9(2)	33(T)	-(-)	63(12)	20(1)
CAREX NEBRASCENSIS	-(-)	-(-)	-(-)	25(4)	-(-)
CAREX ROSTRATA	9(T)	-(-)	-(-)	-(-)	-(-)
CAREX SCIRPOIDEA	-(-)	-(-)	-(-)	13(20)	-(-)
JUNCUS BALTICUS	9(3)	67(65)	50(1)	50(18)	50(6)
FORBS					
ACONITUM COLUMBIANUM	18(2)	-(-)	-(-)	-(-)	-(-)
ACTAEA RUBRA	18(2)	-(-)	-(-)	-(-)	-(-)
ASTER OCCIDENTALIS	-(-)	-(-)	-(-)	13(15)	20(T)
CIRSIUM SPP.	27(1)	-(-)	75(3)	38(1)	30(1)
FRAGARIA VIRGINIANA	-(-)	-(-)	25(20)	38(23)	20(22)
GALIUM TRIFLORUM	18(6)	-(-)	-(-)	-(-)	-(-)
GERANIUM RICHARDSONII	27(1)	-(-)	-(-)	-(-)	-(-)
HERACLEUM LANATUM	64(3)	-(-)	-(-)	-(-)	-(-)
MERTENSIA CILIATA	9(5)	-(-)	-(-)	13(3)	-(-)
OSMORHIZA SPP.	9(10)	-(-)	-(-)	-(-)	-(-)
POLYGONUM BISTORTOIDES	-(-)	33(20)	-(-)	25(35)	10(T)
SENECIO SERRA	27(5)	-(-)	-(-)	-(-)	-(-)
SMILACINA STELLATA	27(4)	-(-)	25(25)	13(T)	-(-)
TARAXACUM OFFICINALE	9(T)	33(2)	75(8)	75(2)	100(21)
THALICTRUM FENDLERI	18(2)	-(-)	-(-)	-(-)	-(-)
TRIFOLIUM SPP.	-(-)	-(-)	25(1)	25(2)	60(26)
URTICA DIOICA	73(6)	-(-)	-(-)	-(-)	-(-)
MOSS	9(T)	-(-)	-(-)	25(23)	-(-)
EQUISETUM HYEMALE/LAEVEGATUM	9(T)	-(-)	25(T)	-(-)	20(1)
EQUISETUM ARVENSE	18(1)	-(-)	25(1)	13(T)	-(-)

APPENDIX B (cont.)

	ELPA1	CALA1	CALI	CABU	CASA	CAAQ	CALE	CARO	CACA
No. Stands per Group:	8	6	8	4	10	26	8	18	5
WILLOWS									
SALIX BOOTHII	-(-)	-(-)	-(-)	-(-)	-(-)	4(T)	25(7)	6(10)	-(-)
SALIX BRACHYCARPA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	13(6)	-(-)	-(-)
SALIX PLANIFOLIA	-(-)	17(3)	-(-)	-(-)	20(2)	8(T)	-(-)	-(-)	40(8)
SHRUBS									
POTENTILLA FRUTICOSA	-(-)	-(-)	-(-)	50(1)	-(-)	4(T)	-(-)	6(3)	40(T)
GRASSES									
AGROSTIS SCABRA	-(-)	-(-)	-(-)	-(-)	-(-)	4(T)	25(5)	-(-)	40(2)
AGROSTIS STOLONIFERA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	11(25)	-(-)
CALAMAGROSTIS CANADENSIS	-(-)	-(-)	-(-)	-(-)	20(1)	8(1)	-(-)	11(8)	100(84)
CALAMAGROSTIS STRICTA	-(-)	-(-)	-(-)	25(10)	20(1)	12(8)	-(-)	-(-)	-(-)
DANTHONIA INTERMEDIA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
DESCHAMPSIA CESPITOSA	-(-)	-(-)	-(-)	75(1)	40(3)	42(10)	88(10)	17(4)	60(1)
GLYCERIA SPP.	13(2)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	11(13)	-(-)
PHLEUM ALPINUM	-(-)	-(-)	-(-)	-(-)	10(3)	4(2)	25(T)	-(-)	20(T)
POA PRATENSIS	25(T)	-(-)	-(-)	-(-)	-(-)	8(15)	13(2)	11(17)	-(-)
SEDGES & OTHER GRASS-LIKES									
CAREX AQUATILIS	-(-)	33(1)	88(13)	75(8)	80(25)	100(82)	88(10)	22(6)	60(7)
CAREX BUXBAUMII	-(-)	-(-)	-(-)	100(59)	-(-)	-(-)	-(-)	-(-)	-(-)
CAREX ILLOTA	-(-)	-(-)	-(-)	-(-)	10(T)	-(-)	25(2)	-(-)	40(5)
CAREX LANUGINOSA	-(-)	-(-)	-(-)	-(-)	-(-)	4(20)	25(8)	-(-)	-(-)
CAREX LASIOCARPA	-(-)	100(89)	13(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CAREX LIMOSA	-(-)	-(-)	100(71)	-(-)	-(-)	15(9)	-(-)	-(-)	-(-)
CAREX MICROPTERA	13(T)	-(-)	-(-)	-(-)	-(-)	15(21)	-(-)	-(-)	40(1)
CAREX MURICATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	38(75)	-(-)	-(-)
CAREX NEBRASCENSIS	-(-)	-(-)	-(-)	-(-)	-(-)	4(20)	-(-)	22(11)	-(-)
CAREX PRAEGRACILIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CAREX ROSTRATA	13(T)	100(4)	38(4)	-(-)	40(2)	31(6)	25(40)	100(89)	60(10)
CAREX SAXATILIS	-(-)	-(-)	-(-)	75(22)	100(70)	8(8)	13(2)	-(-)	40(14)
CAREX SIMULATA	-(-)	-(-)	-(-)	-(-)	-(-)	4(10)	13(15)	-(-)	-(-)
ELEOCHARIS PALUSTRIS	100(73)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ELEOCHARIS PAUCIFLORA	-(-)	-(-)	50(10)	25(1)	10(1)	19(14)	-(-)	-(-)	-(-)
JUNCUS BALTICUS	25(6)	-(-)	-(-)	-(-)	-(-)	8(15)	25(13)	11(2)	-(-)
SCIRPUS CAESPITOSUS	-(-)	-(-)	38(2)	50(38)	-(-)	4(1)	-(-)	-(-)	-(-)
FORBS									
ASTER FOLIACEUS	-(-)	-(-)	-(-)	-(-)	-(-)	4(5)	-(-)	-(-)	20(4)
CALTHA LEPTOSEPALA	-(-)	-(-)	-(-)	75(2)	40(2)	12(18)	100(59)	6(6)	80(10)
CIRSIUM SPP.	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	6(1)	-(-)
DELPHINIUM OCCIDENTALE	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ERIGERON FLAGELLARIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ERIGERON URSINUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
HERACLEUM LANATUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
MENTHA ARVENSIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	6(5)	-(-)
MERTENSIA CILIATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
PEDICULARIS GROENLANDICA	-(-)	-(-)	38(2)	75(1)	60(1)	19(1)	75(9)	-(-)	20(10)
POLYGONUM BISTORTOIDES	-(-)	-(-)	-(-)	-(-)	20(1)	-(-)	13(2)	-(-)	60(1)
RUDBECKIA OCCIDENTALIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
TARAXACUM OFFICINALE	13(T)	-(-)	-(-)	-(-)	-(-)	8(1)	-(-)	-(-)	-(-)
THALICTRUM FENDLERI	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
TRIFOLIUM SPP.	-(-)	-(-)	-(-)	-(-)	-(-)	12(3)	-(-)	6(2)	-(-)
VERATRUM CALIFORNICUM	13(T)	-(-)	-(-)	-(-)	10(T)	-(-)	13(3)	-(-)	-(-)
MOSS	-(-)	-(-)	75(17)	25(1)	10(T)	42(21)	25(43)	22(34)	20(5)
EQUISETUM ARVENSE	-(-)	-(-)	-(-)	-(-)	-(-)	4(2)	13(20)	17(4)	-(-)

APPENDIX B (cont.)

	DECE	DAIN	CAMI	CANE	JUBA	CALA2	POPR	VECA
No. Stands per Group:	13	4	4	17	8	6	7	14
WILLOWS								
SALIX BOOTHII	-(-)	-(-)	25(T)	-(-)	-(-)	-(-)	-(-)	-(-)
SALIX BRACHYCARPA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SALIX PLANIFOLIA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SHRUBS								
POTENTILLA FRUTICOSA	8(T)	-(-)	25(1)	-(-)	-(-)	-(-)	-(-)	-(-)
GRASSES								
AGROSTIS SCABRA	23(24)	100(13)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
AGROSTIS STOLONIFERA	15(11)	-(-)	-(-)	12(6)	25(23)	17(10)	14(85)	-(-)
CALAMAGROSTIS CANADENSIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CALAMAGROSTIS STRICTA	8(10)	-(-)	-(-)	6(1)	-(-)	-(-)	-(-)	-(-)
DANTHONIA INTERMEDIA	46(7)	100(40)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
DESCHAMPSIA CESPITOSA	100(55)	100(5)	100(5)	41(13)	13(2)	50(5)	-(-)	7(1)
GLYCERIA SPP.	-(-)	-(-)	-(-)	35(10)	13(1)	33(3)	14(5)	-(-)
PHLEUM ALPINUM	54(8)	100(6)	25(T)	-(-)	-(-)	-(-)	-(-)	14(3)
POA PRATENSIS	54(18)	75(4)	50(23)	35(8)	75(23)	50(26)	100(77)	-(-)
SEDGES & OTHER GRASS-LIKES								
CAREX AQUATILIS	15(15)	-(-)	-(-)	-(-)	-(-)	33(25)	-(-)	-(-)
CAREX BUXBAUMII	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CAREX ILLOTA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CAREX LANUGINOSA	8(1)	-(-)	25(10)	12(4)	38(7)	100(76)	-(-)	-(-)
CAREX LASIOCARPA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CAREX LIMOSA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CAREX MICROPTERA	62(3)	75(2)	100(83)	18(1)	13(3)	33(5)	-(-)	7(T)
CAREX MURICATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CAREX NEBRASCENSIS	-(-)	-(-)	-(-)	100(89)	50(9)	17(6)	14(10)	-(-)
CAREX PRAEGRACILIS	8(25)	-(-)	25(30)	6(5)	25(25)	-(-)	14(7)	-(-)
CAREX ROSTRATA	-(-)	-(-)	25(T)	18(7)	-(-)	17(6)	-(-)	-(-)
CAREX SAXATILIS	15(1)	-(-)	-(-)	-(-)	-(-)	17(25)	-(-)	-(-)
CAREX SIMULATA	-(-)	-(-)	-(-)	6(35)	-(-)	17(5)	-(-)	-(-)
ELEOCHARIS PALUSTRIS	-(-)	-(-)	-(-)	6(1)	13(2)	17(2)	-(-)	-(-)
ELEOCHARIS PAUCIFLORA	-(-)	-(-)	-(-)	12(1)	-(-)	-(-)	-(-)	-(-)
JUNCUS BALTICUS	46(13)	-(-)	50(1)	47(16)	100(84)	33(3)	14(2)	-(-)
SCIRPUS CAESPITOSUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
FORBS								
ASTER FOLIACEUS	-(-)	75(35)	-(-)	6(T)	-(-)	-(-)	-(-)	-(-)
CALTHA LEPTOSEPALA	46(6)	25(5)	-(-)	-(-)	-(-)	17(2)	-(-)	7(2)
CIRSIUM SPP.	8(T)	50(T)	-(-)	-(-)	25(4)	17(2)	57(13)	-(-)
DELPHINIUM OCCIDENTALE	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	43(10)
ERIGERON FLAGELLARIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	43(28)	-(-)
ERIGERON URSINUS	8(30)	25(25)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
HERACLEUM LANATUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	14(11)
MENTHA ARVENSIS	-(-)	-(-)	-(-)	12(8)	25(4)	17(T)	-(-)	-(-)
MERTENSIA CILIATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	43(14)
PEDICULARIS GROENLANDICA	15(2)	-(-)	-(-)	-(-)	-(-)	17(5)	-(-)	-(-)
POLYGONUM BISTORTOIDES	46(2)	50(5)	25(2)	-(-)	-(-)	-(-)	-(-)	7(1)
RUDBECKIA OCCIDENTALIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	64(3)
TARAXACUM OFFICINALE	62(1)	50(3)	50(25)	-(-)	25(38)	17(15)	57(33)	7(2)
THALICTRUM FENDLERI	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	50(7)
TRIFOLIUM SPP.	23(1)	25(5)	50(27)	18(5)	50(19)	17(3)	29(8)	7(3)
VERATRUM CALIFORNICUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	100(81)
MOSS	23(17)	100(26)	-(-)	29(14)	-(-)	-(-)	-(-)	-(-)
EQUISETUM ARVENSE	-(-)	-(-)	-(-)	12(T)	13(1)	-(-)	-(-)	-(-)

APPENDIX C. SUBSTRATE FEATURES OF UTAH RIPARIAN COMMUNITY TYPES. (Number of Plots per Community Type in Parentheses)

	CONIFER/ EQAR(8)	CONIFER/ CACA(15)	CONIFER/ ELGL(7)	CONIFER/ POFR(6)	CONIFER/ POPR(4)	POAN/ BEOC(10)
Soil Taxomomy (% Occurrence)						
Entisols						
Aquents	-	-	-	-	-	-
Cryaquents	-	-	-	-	-	-
Fluvents						
Cryofluvents	12.5	-	-	-	-	10.0
Udifluvents	-	-	-	-	-	-
Xerofluvents	-	-	-	-	-	20.0
Inceptisols						
Aquepts	-	-	-	-	-	-
Cryaquepts	-	-	-	-	-	10.0
Haplaquepts	-	-	-	-	-	-
Humaquepts	-	-	-	-	-	-
Ochrepts						
Cryochrepts	12.5	20.0	14.3	-	-	-
Dystrochrepts	-	-	-	-	-	-
Xerochrepts	-	-	-	-	-	-
Alfisols						
Cryoboralfs	-	-	-	-	-	-
Mollisols						
Aquolls						
Cryaquolls	25.0	-	-	-	-	-
Haplaquolls	-	-	-	-	-	-
Borolls						
Cryoborolls	12.5	-	28.6	100.0	75.0	-
Haploborolls	-	20.0	-	-	-	50.0
Haploxerolls	-	-	-	-	-	-
Histosols						
Fibrists						
Terric	-	6.7	-	-	-	-
All others	-	-	-	-	-	-
Hemists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	-	-
Saprists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	-	-
Unclassified	25.0	53.3	57.1	-	25.0	10.0
Family Particle-Size Class						
Fine	-	-	-	-	25.0	-
Silty[1]	-	-	-	-	25.0	-
Fine-loamy	25.0	-	-	33.3	-	-
Coarse-loamy	-	-	14.3	-	25.0	10.0
Sandy	-	-	-	-	-	-
Clayey-skeletal	-	6.7	-	-	-	-
Loamy-skeletal	12.5	6.7	14.3	16.7	25.0	20.0
Sandy-skeletal	12.5	-	-	-	-	30.0
Fragmental	-	-	-	-	-	-
Clayey over -skeletal[2]	-	-	-	-	-	10.0
Silty over -skeletal[3]	-	-	-	-	-	-
Fine-loamy over -skeletal[4]	25.0	20.0	14.3	50.0	-	10.0
Coarse-loamy over -skeletal[5]	-	6.7	-	-	-	10.0
Sandy over -skeletal[6]	-	-	-	-	-	-
Organic surface[7]	-	-	-	-	-	-
Organic throughout	-	-	-	-	-	-
Unclassified	25.0	60.0	57.1	-	-	10.0
Water Table (cm)						
Mean[8]	52 n=4	38 n=5	- n<4	- n<4	- n<4	- n<4
Range[9]	44-100+	0-100+	41-100+	48-100+	30-100+	34-100+
Available Water-Holding Capacity (inches water per inch soil)						
Mean[10]	- n<4	.15 n=5	- n<4	.18 n=4	- n<4	.10 n=9
Range[11]	.04-.18	.11-.20	-	.15-.20	.06-.20	.05-.14

APPENDIX C (cont.)

	POAN/ ACGR(5)	POAN/ COSE(10)	POAN/ ROWO(5)	POAN/ RHAR(5)	POAN/ POPR(18)	ACNE/ COSE(13)
Soil Taxomomy (% Occurrence)						
Entisols						
Aquents	-	-	-	-	-	-
Cryaquents	-	-	-	-	-	-
Fluvents						
Cryofluvents	-	-	-	-	11.1	-
Udifluvents	-	10.0	20.0	-	5.6	7.7
Xerofluvents	-	30.0	-	40.0	11.1	-
Inceptisols						
Aquepts	-	-	-	-	-	-
Cryaquepts	-	-	-	-	-	-
Haplaquepts	-	-	-	-	-	-
Humaquepts	-	-	-	-	-	-
Ochrepts						
Cryochrepts	-	-	-	-	-	7.7
Dystrochrepts	-	10.0	-	-	-	-
Xerochrepts	-	-	-	20.0	5.6	-
Alfisols						
Cryoboralfs	-	-	-	-	-	-
Mollisols						
Aquolls						
Cryaquolls	-	-	-	-	-	-
Haplaquolls	-	-	-	-	-	7.7
Borolls						
Cryoborolls	20.0	10.0	40.0	-	16.7	7.7
Haploborolls	20.0	40.0	20.0	-	22.2	38.5
Haploxerolls	20.0	-	-	40.0	22.2	15.4
Histosols						
Fibrists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	-	-
Hemists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	-	-
Saprists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	-	-
Unclassified	40.0	-	20.0	-	5.6	15.4
Family Particle-Size Class						
Fine	-	10.0	-	-	-	-
Silty	-	-	-	-	-	-
Fine-loamy	-	10.0	-	20.0	22.2	7.7
Coarse-loamy	-	10.0	20.0	-	5.6	30.8
Sandy	-	-	-	-	5.6	15.4
Clayey-skeletal	-	-	-	-	5.6	-
Loamy-skeletal	40.0	-	20.0	20.0	5.6	15.4
Sandy-skeletal	20.0	40.0	-	-	38.9	15.4
Fragmental	-	-	-	-	-	-
Clayey over -skeletal	-	-	-	-	-	-
Silty over -skeletal	-	-	-	-	-	-
Fine-loamy over -skeletal	-	20.0	-	20.0	5.6	7.7
Coarse-loamy over -skeletal	20.0	10.0	-	40.0	5.6	-
Sandy over -skeletal	-	-	20.0	-	5.6	-
Miscellaneous	-	-	20.0	-	-	-
Organic surface	-	-	-	-	-	-
Organic throughout	-	-	-	-	-	-
Unclassified	20.0	-	20.0	-	-	7.7
Water Table (cm)						
Mean	-	-	-	-	-	48
	n< 4	n< 4	n< 4	n< 4	n< 4	n = 4
Range	100 +	68-100 +	85-100 +	100 +	61-100 +	21-100 +
Available Water-Holding Capacity (inches water per inch soil)						
Mean	-	.09	-	.14	.10	.15
	n< 4	n = 9	n< 4	n = 4	n = 15	n = 11
Range	.05-.19	.04-.16	.10-.13	.10-.17	.04-.20	.05-.19

APPENDIX C (cont.)

	ALIN/ COSE(5)	ALIN/ EQAR(4)	ALIN/ MF(13)	ALIN/ MG(6)	BEOC/ COSE(14)	BEOC/ MF(5)
Soil Taxomomy (% Occurrence)						
Entisols						
Aquents	-	-	-	-	-	-
Cryaquents	-	-	-	-	14.3	-
Fluvents						
Cryofluvents	20.0	25.0	23.0	16.7	-	-
Udifluvents	20.0	-	7.7	-	7.1	-
Xerofluvents	20.0	-	-	-	14.3	20.0
Inceptisols						
Aquepts	-	-	-	-	-	-
Cryaquepts	-	-	-	-	-	-
Haplaquepts	-	-	-	-	-	-
Humaquepts	-	-	-	-	-	-
Ochrepts						
Cryochrepts	-	-	-	16.7	-	-
Dystrochrepts	-	-	-	-	-	-
Xerochrepts	-	-	-	-	-	-
Alfisols						
Cryoboralfs	-	-	-	-	-	-
Mollisols						
Aquolls						
Cryaquolls	-	-	-	-	-	-
Haplaquolls	-	-	-	-	-	-
Borolls						
Cryoborolls	40.0	75.0	46.2	33.3	28.6	60.0
Haploborolls	-	-	15.4	-	21.4	20.0
Haploxerolls	-	-	-	-	-	-
Histosols						
Fibrists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	-	-
Hemists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	-	-
Saprists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	-	-
Unclassified	-	-	-	16.7	14.3	-
Family Particle-Size Class						
Fine	-	-	-	-	-	-
Silty	-	-	-	-	-	-
Fine-loamy	-	25.0	7.7	16.7	14.3	-
Coarse-loamy	-	-	-	-	-	20.0
Sandy	-	-	-	-	14.3	-
Clayey-skeletal	-	-	-	-	-	-
Loamy-skeletal	20.0	-	46.2	50.0	7.1	40.0
Sandy-skeletal	-	25.0	30.8	-	28.6	20.0
Fragmental	-	-	-	-	-	-
Clayey over -skeletal	-	-	-	-	-	-
Silty over -skeletal	-	-	-	-	-	-
Fine-loamy over -skeletal	-	-	-	-	14.3	-
Coarse-loamy over -skeletal	60.0	50.0	7.7	-	14.3	-
Sandy over -skeletal	20.0	-	7.7	-	7.1	-
Miscellaneous	-	-	-	-	-	20.0
Organic surface	-	-	-	-	-	-
Organic throughout	-	-	-	-	-	-
Unclassified	-	-	-	28.6	-	-
Water Table (cm)						
Mean	-	61	48	51	54	-
	n < 4	n = 4	n = 7	n = 4	n = 5	n < 4
Range	75-100 +	50-80	13-100 +	43-100 +	38-100 +	90-100 +
Available Water-Holding Capacity (inches water per inch soil)						
Mean	.09	.08	.08	.11	.13	.14
	n = 5	n = 3	n = 10	n = 4	n = 12	n = 3
Range	.04-.14	.04-.12	.05-.11	.06-.18	.03-.20	.10-.17

APPENDIX C (cont.)

	BEOC/ POPR(7)	COSE/ HELA(11)	POFR/ DECE(8)	POFR/ POPR(10)	ARCA/ POPR(4)	SABO/ CAAQ(8)
Soil Taxomomy (% Occurrence)						
Entisols						
Aquents	-	-	-	-	-	-
Cryaquents	-	-	-	-	-	-
Fluvents						
Cryofluvents	-	-	-	-	-	-
Udifluvents	-	18.2	-	-	-	-
Xerofluvents	42.9	-	-	-	-	-
Inceptisols						
Aquepts	-	-	-	-	-	-
Cryaquepts	-	-	-	-	-	-
Haplaquepts	-	-	-	-	-	-
Humaquepts	-	-	-	-	-	-
Ochrepts						
Cryochrepts	-	9.1	12.5	10.0	-	-
Dystrochrepts	-	-	-	-	-	-
Xerochrepts	-	-	-	-	-	-
Alfisols						
Cryoboralfs	-	-	12.5	-	-	-
Mollisols						
Aquolls						
Cryaquolls	14.3	9.1	25.0	-	25.0	25.0
Haplaquolls	-	-	-	-	-	-
Borolls						
Cryoborolls	14.3	45.5	50.0	90.0	75.0	12.5
Haploborolls	28.6	18.2	-	-	-	-
Haploxerolls	-	-	-	-	-	-
Histosols						
Fibrists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	-	12.5
Hemists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	-	12.5
Saprists						
Terric	-	-	-	-	-	12.5
All others	-	-	-	-	-	12.5
Unclassified	-	-	-	-	-	12.5
Family Particle-Size Class						
Fine	-	-	12.5	20.0	25.0	12.5
Silty	-	-	12.5	-	-	-
Fine-loamy	-	27.3	25.0	50.0	25.0	12.5
Coarse-loamy	14.3	9.1	-	-	-	-
Sandy	14.3	-	-	-	-	-
Clayey-skeletal	-	-	12.5	-	-	-
Loamy-skeletal	42.9	36.4	37.5	30.0	-	-
Sandy-skeletal	14.3	9.1	-	-	-	-
Fragmental	-	-	-	-	-	-
Clayey over -skeletal	-	-	-	-	50.0	12.5
Silty over -skeletal	-	-	-	-	-	-
Fine-loamy over -skeletal	14.3	-	-	-	-	-
Coarse-loamy over -skeletal	-	18.2	-	-	-	-
Sandy over -skeletal	-	-	-	-	-	-
Organic surface	-	-	-	-	-	12.5
Organic throughout	-	-	-	-	-	37.5
Unclassified	-	-	-	-	-	12.5
Water Table (cm)						
Mean	-	67	33	-	-	9
	n < 4	n = 5	n = 4	n < 4	n < 4	n = 7
Range	45-100 +	40-100 +	7-100 +	62-100 +	40-100 +	0-35
Available Water-Holding Capacity (inches water per inch soil)						
Mean	.09	.12	.16	.15	.19	-
	n = 6	n = 10	n = 8	n = 4	n = 4	n < 4
Range	.04-.18	.08-.20	.11-.20	.07-.20	.16-.20	.19-.20

APPENDIX C (cont.)

	SABO/ CARO(7)	SABO/ CACA(4)	SABO/ MF(25)	SABO/ MG(10)	SABO/ POPR(9)	SAGE/ CAAQ(7)
Soil Taxomomy (% Occurrence)						
Entisols						
Aquents	-	-	-	-	-	-
Cryaquents	-	-	-	-	-	-
Fluvents						
Cryofluvents	-	-	-	10.0	-	-
Udifluvents	-	-	-	-	-	-
Xerofluvents	-	-	-	-	-	-
Inceptisols						
Aquepts	-	-	4.0	10.0	-	-
Cryaquepts	14.3	-	-	-	-	-
Haplaquepts	-	-	-	-	-	-
Humaquepts	-	-	-	-	-	-
Ochrepts						
Cryochrepts	-	-	12.0	-	12.5	-
Dystrochrepts	-	-	-	-	-	-
Xerochrepts	-	-	-	-	-	-
Alfisols						
Cryoboralfs	-	-	-	-	-	-
Mollisols						
Aquolls						
Cryaquolls	85.7	25.0	20.0	40.0	12.5	57.1
Haplaquolls	-	-	-	-	-	-
Borolls						
Cryoborolls	-	75.0	52.0	30.0	75.0	-
Haploborolls	-	-	4.0	-	-	-
Haploxerolls	-	-	4.0	-	-	-
Histosols						
Fibrists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	-	-
Hemists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	-	-
Saprists						
Terric	-	-	-	-	-	-
All others	-	-	-	10.0	-	28.6
Unclassified	-	-	4.0	-	-	14.3
Family Particle-Size Class						
Fine	14.3	-	20.0	-	-	14.3
Silty	-	-	-	-	-	-
Fine-loamy	57.1	-	15.0	50.0	25.0	28.6
Coarse-loamy	14.3	-	8.0	10.0	-	-
Sandy	-	-	-	-	-	-
Clayey-skeletal	-	-	-	-	12.5	-
Loamy-skeletal	-	-	4.0	-	-	-
Sandy-skeletal	-	-	8.0	10.0	25.0	-
Fragmental	-	-	-	-	-	-
Clayey over -skeletal	-	25.0	4.0	-	-	-
Silty over -skeletal	-	-	-	-	12.5	-
Fine-loamy over -skeletal	14.3	25.0	20.0	-	25.0	-
Coarse-loamy over -skeletal	-	50.0	12.0	20.0	-	14.3
Sandy over -skeletal	-	-	-	-	-	-
Organic surface	-	-	-	-	-	-
Organic throughout	-	-	-	10.0	-	28.6
Unclassified	-	-	8.0	-	-	14.3
Water Table (cm)						
Mean	39 n=5	- n<4	56 n=8	39 n=8	55 n=4	26 n=5
Range	4-100+	12-100+	28-100+	0-80	23-100+	0-100+
Available Water-Holding Capacity (inches water per inch soil)						
Mean	.18 n=6	- n<4	.15 n=21	.16 n=7	.13 n=9	- n<4
Range	.14-.20	.08-.20	.09-.20	.12-.20	.05-.20	.15-.17

APPENDIX C (cont.)

	SAGE/ CARO(6)	SAGE/ MF(4)	SAGE/ DECE(5)	SAGE/ POPR(6)	SAEX/ MF(4)	SAEX/ MG(7)
Soil Taxomomy (% Occurrence)						
Entisols						
Aquents	-	-	-	-	-	-
Cryaquents	-	-	-	-	-	-
Fluvents						
Cryofluvents	-	-	-	-	-	14.3
Udifluvents	-	-	-	-	-	-
Xerofluvents	-	-	-	-	-	-
Inceptisols						
Aquepts	-	-	-	-	-	-
Cryaquepts	16.7	-	-	-	-	-
Haplaquepts	-	-	-	-	-	-
Humaquepts	-	-	-	-	-	14.3
Ochrepts						
Cryochrepts	-	-	20.0	-	25.0	-
Dystrochrepts	-	-	-	-	-	-
Xerochrepts	-	-	-	-	-	-
Alfisols						
Cryoboralfs	-	-	20.0	-	-	-
Mollisols						
Aquolls						
Cryaquolls	16.7	25.0	20.0	14.3	-	14.3
Haplaquolls	-	-	-	-	-	-
Borolls						
Cryoborolls	16.7	75.0	40.0	57.1	75.0	14.3
Haploborolls	-	-	-	-	-	14.3
Haploxerolls	-	-	-	-	-	14.3
Histosols						
Fibrists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	-	-
Hemists						
Terric	16.7	-	-	-	-	14.3
All others	16.7	-	-	-	-	-
Saprists						
Terric	-	-	-	-	-	-
All others	-	-	-	14.3	-	-
Unclassified	16.7	-	-	14.3	-	14.3
Family Particle-Size Class						
Fine	33.3	-	60.0	14.3	-	14.3
Silty	-	-	-	-	-	-
Fine-loamy	-	-	-	57.1	25.0	14.3
Coarse-loamy	-	-	-	-	-	14.3
Sandy	16.7	25.0	-	-	-	14.3
Clayey-skeletal	-	25.0	-	-	-	-
Loamy-skeletal	-	50.0	20.0	-	50.0	14.3
Sandy-skeletal	-	-	-	-	-	-
Fragmental	-	-	-	-	-	-
Clayey over -skeletal	-	-	20.0	-	-	-
Silty over -skeletal	-	-	-	-	-	-
Fine-loamy over -skeletal	-	-	-	14.3	25.0	-
Coarse-loamy over -skeletal	-	-	-	-	-	14.3
Sandy over -skeletal	-	-	-	-	-	-
Organic surface	16.7	-	-	-	-	14.3
Organic throughout	-	-	-	14.3	-	-
Unclassified	33.3	-	-	-	-	-
Water Table (cm)						
Mean	23	-	35	56	-	53
	n=4	n<4	n=4	n=6	n<4	n=5
Range	0-100+	0-100+	0-100+	0-100+	51-100+	0-100+
Available Water-Holding Capacity (inches water per inch soil)						
Mean	-	-	.15	.18	-	.11
	n<4	n<4	n=4	n=6	n<4	n=6
Range	.15-.19	.09-.19	.13-.19	.17-.20	.11-.20	.06-.15

APPENDIX C (cont.)

	SAEX/ POPR(7)	SAEX/ BRN(7)	SALA/ BRN(6)	SABE/ MG(8)	SAWO/ CAAQ(11)	SAWO/ MF(5)
Soil Taxomomy (% Occurrence)						
Entisols						
Aquents	-	-	-	-	-	-
Cryaquents	-	-	-	-	-	-
Fluvents						
Cryofluvents	14.3	14.3	-	-	-	-
Udifluvents	14.3	14.3	-	-	-	-
Xerofluvents	14.3	-	66.7	-	-	-
Inceptisols						
Aquepts	-	-	-	-	-	-
Cryaquepts	-	-	-	-	18.2	-
Haplaquepts	-	-	-	-	-	-
Humaquepts	14.3	-	-	-	-	-
Ochrepts						
Cryochrepts	-	-	-	12.5	18.2	-
Dystrochrepts	-	-	-	-	-	-
Xerochrepts	-	-	16.7	-	-	-
Alfisols						
Cryoboralfs	-	-	-	-	-	-
Mollisols						
Aquolls						
Cryaquolls	14.3	-	-	-	33.3	40.0
Haplaquolls	-	28.6	-	-	-	-
Borolls						
Cryoborolls	-	28.6	-	87.5	-	60.0
Haploborolls	14.3	-	-	-	-	-
Haploxerolls	14.3	14.3	16.7	-	-	-
Histosols						
Fibrists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	9.1	-
Hemists						
Terric	-	-	-	-	9.1	-
All others	-	-	-	-	9.1	-
Saprists						
Terric	-	-	-	-	9.1	-
All others	-	-	-	-	-	-
Unclassified	-	-	-	-	-	-
Family Particle-Size Class						
Fine	14.3	-	-	12.5	18.2	20.0
Silty	-	-	-	-	-	-
Fine-loamy	-	57.1	-	12.5	9.1	20.0
Coarse-loamy	14.3	-	-	-	-	-
Sandy	-	-	-	-	-	-
Clayey-skeletal	14.3	-	-	-	-	20.0
Loamy-skeletal	28.6	-	-	12.5	-	40.0
Sandy-skeletal	28.6	28.6	83.3	37.5	-	-
Fragmental	-	-	-	-	-	-
Clayey over -skeletal	-	-	-	-	9.1	-
Silty over -skeletal	-	-	-	12.5	-	-
Fine-loamy over -skeletal	-	-	16.7	12.5	27.3	-
Coarse-loamy over -skeletal	-	-	-	-	-	-
Sandy over -skeletal	-	-	-	-	-	-
Organic surface	-	-	-	-	18.2	-
Organic throughout	-	-	-	-	18.2	-
Unclassified	-	-	-	-	-	-
Water Table (cm)						
Mean	43	-	-	-	27	52
	n=4	n<4	n<4	n<4	n=9	n=5
Range	27-100+	0-100+	67-100+	58-100+	0-100+	5-81
Available Water-Holding Capacity (inches water per inch soil)						
Mean	.12	.12	.08	.12	.14	.16
	n=7	n=7	n=4	n=7	n=4	n=4
Range	.07-.14	.04-.18	.07-.11	.06-.18	.12-.17	.13-.17

APPENDIX C (cont.)

	SAWO/ DECE(7)	SAPL/ CAAQ(12)	SAPL/ DECE(10)	SAGL/ DECE(7)	ELPA1 (8)	CALA1 (6)
Soil Taxomomy (% Occurrence)						
Entisols						
Aquents	-	-	-	-	-	-
Cryaquents	-	-	-	-	-	-
Fluvents						
Cryofluvents	-	-	-	-	-	-
Udifluvents	-	-	-	-	-	-
Xerofluvents	-	-	-	-	-	-
Inceptisols						
Aquepts	-	-	-	-	-	-
Cryaquepts	-	8.3	10.0	-	37.5	-
Haplaquepts	-	-	-	-	-	-
Humaquepts	-	-	-	-	-	-
Ochrepts						
Cryochrepts	-	-	10.0	57.1	-	-
Dystrochrepts	-	-	-	-	-	-
Xerochrepts	-	-	-	-	-	-
Alfisols						
Cryoboralfs	-	-	-	-	-	-
Mollisols						
Aquolls						
Cryaquolls	14.3	16.7	-	-	12.5	-
Haplaquolls	-	-	-	-	-	-
Borolls						
Cryoborolls	71.4	-	50.0	28.6	25.0	-
Haploborolls	-	-	-	-	-	-
Haploxerolls	-	-	-	-	-	-
Histosols						
Fibrists						
Terric	-	8.3	-	-	-	-
All others	-	25.0	-	-	-	33.3
Hemists						
Terric	-	8.3	10.0	-	-	-
All others	-	16.7	-	-	12.5	50.0
Saprists						
Terric	14.3	-	-	-	-	-
All others	-	16.7	-	-	-	16.7
Unclassified	-	-	20.0	14.3	12.5	-
Family Particle-Size Class						
Fine	-	-	-	-	50.0	-
Silty	-	-	-	-	-	-
Fine-loamy	14.3	-	-	-	25.0	-
Coarse-loamy	-	-	-	-	-	-
Sandy	-	-	10.0	-	-	-
Clayey-skeletal	-	-	-	-	-	-
Loamy-skeletal	-	-	50.0	85.7	-	-
Sandy-skeletal	-	-	-	-	-	-
Fragmental	-	-	-	-	-	-
Clayey over -skeletal	28.6	-	-	-	-	-
Silty over -skeletal	-	-	-	-	-	-
Fine-loamy over -skeletal	28.6	-	-	-	-	-
Coarse-loamy over -skeletal	-	-	-	-	-	-
Sandy over -skeletal	-	-	-	-	-	-
Organic surface	28.6	41.7	20.0	-	-	-
Organic throughout	-	58.3	-	-	12.5	100.0
Unclassified	-	-	20.0	14.3	12.5	-
Water Table (cm)						
Mean	55 n=6	3 n=11	- n<4	- n<4	0 n=5	0 n=6
Range	0-100+	0-100+	0-100+	100+	0-100+	0-0
Available Water-Holding Capacity (inches water per inch soil)						
Mean	.16 n=5	na -	- n<4	- n<4	- n<4	na -
Range	.16-.17	-	-	-	.15-.20	-

APPENDIX C (cont.)

	CALI (8)	CABU (4)	CASA (10)	CALE (8)	CAAQ (26)	CARO (18)
Soil Taxomomy (% Occurrence)						
Entisols						
Aquents	-	-	-	-	-	-
Cryaquents	-	-	-	-	-	-
Fluvents						
Cryofluvents	-	-	-	-	-	-
Udifluvents	-	-	-	-	-	-
Xerofluvents	-	-	-	-	-	-
Inceptisols						
Aquepts	-	-	-	-	-	-
Cryaquepts	-	25.0	20.0	50.0	-	5.6
Haplaquepts	-	-	-	-	-	-
Humaquepts	-	-	-	-	-	-
Ochrepts						
Cryochrepts	-	-	-	-	-	-
Dystrochrepts	-	-	-	-	-	-
Xerochrepts	-	-	-	-	-	-
Alfisols						
Cryoboralfs	-	-	-	-	-	-
Mollisols						
Aquolls						
Cryaquolls	-	-	10.0	-	15.4	44.4
Haplaquolls	-	-	-	-	-	5.6
Borolls						
Cryoborolls	-	-	-	-	2.6	-
Haploborolls	-	-	-	-	-	-
Haploxerolls	-	-	-	-	-	-
Histosols						
Fibrists						
Terric	12.5	-	-	-	7.6	-
All others	75.0	50.0	10.0	-	26.9	5.6
Hemists						
Terric	-	-	10.0	-	15.4	-
All others	-	-	30.0	-	19.2	11.1
Saprists						
Terric	-	25.0	10.0	12.5	3.8	-
All others	12.5	-	10.0	12.5	3.8	11.1
Unclassified	-	-	-	25.0	-	16.7
Family Particle-Size Class						
Fine	-	-	-	-	-	5.5
Silty	-	-	-	-	-	-
Fine-loamy	-	-	-	-	3.8	16.7
Coarse-loamy	-	-	-	-	3.8	-
Sandy	-	-	-	-	-	-
Clayey-skeletal	-	-	-	12.5	7.6	-
Loamy-skeletal	-	-	-	-	-	-
Sandy-skeletal	-	-	-	-	-	-
Fragmental	-	-	-	-	-	-
Clayey over -skeletal	-	-	-	-	-	-
Silty over -skeletal	-	-	-	-	-	-
Fine-loamy over -skeletal	-	-	-	-	-	-
Coarse-loamy over -skeletal	-	-	-	-	-	-
Sandy over -skeletal	-	-	-	-	-	-
Organic surface	12.5	25.0	50.0	50.0	34.6	33.3
Organic throughout	87.5	75.0	50.0	12.5	50.0	33.3
Unclassified	-	-	-	25.0	-	11.1
Water Table (cm)						
Mean	0 n=8	0 n=4	3 n=8	0 n=6	5 n=26	4 n=15
Range	0-0	0-0	0-100+	0-0	0-71	0-100+
Available Water-Holding Capacity (inches water per inch soil)						
Mean	na -	na -	na -	na -	.16 n=6	.18 n=8
Range	-	-	-	-	.11-.20	.12-.20

APPENDIX C (cont.)

	CACA (5)	CANE (17)	CAMI (4)	CALA2 (6)	DECE (13)	DAIN (4)
Soil Taxomomy (% Occurrence)						
Entisols						
Aquents	-	-	-	-	-	-
Cryaquents	-	-	-	-	-	-
Fluvents						
Cryofluvents	-	-	-	-	-	-
Udifluvents	-	-	-	-	-	-
Xerofluvents	-	-	-	-	-	-
Inceptisols						
Aquepts	-	-	-	-	-	-
Cryaquepts	20.0	-	25.0	16.7	7.7	-
Haplaquepts	-	5.9	-	-	-	-
Humaquepts	-	-	-	-	-	-
Ochrepts						
Cryochrepts	40.0	-	-	-	7.7	75.0
Dystrochrepts	-	-	-	-	-	-
Xerochrepts	-	-	-	-	-	-
Alfisols						
Cryoboralfs	-	-	-	-	7.7	-
Mollisols						
Aquolls						
Cryaquolls	20.0	70.6	-	50.0	7.7	-
Haplaquolls	-	-	-	16.7	-	-
Borolls						
Cryoborolls	-	5.9	75.0	16.7	53.8	25.0
Haploborolls	-	5.9	-	-	-	-
Haploxerolls	-	-	-	-	-	-
Histosols						
Fibrists						
Terric	-	5.9	-	-	-	-
All others	-	-	-	-	-	-
Hemists						
Terric	-	-	-	-	7.7	-
All others	20.0	5.9	-	-	-	-
Saprists						
Terric	-	-	-	-	-	-
All others	-	-	-	-	-	-
Unclassified	-	-	-	-	7.7	-
Family Particle-Size Class						
Fine	-	35.3	75.0	-	15.4	-
Silty	-	-	-	-	-	-
Fine-loamy	-	17.6	-	16.7	7.7	-
Coarse-loamy	-	-	-	16.7	-	-
Sandy	-	-	-	-	-	-
Clayey-skeletal	-	5.9	-	-	7.7	-
Loamy-skeletal	20.0	-	-	50.0	23.1	100.0
Sandy-skeletal	-	-	-	-	-	-
Fragmental	-	-	-	-	-	-
Clayey over -skeletal	-	5.9	-	-	-	-
Silty over -skeletal	-	-	-	-	-	-
Fine-loamy over -skeletal	-	-	-	-	7.7	-
Coarse-loamy over -skeletal	-	-	-	-	-	-
Sandy over -skeletal	20.0	-	-	-	-	-
Miscellaneous	-	5.9	25.0	16.7	7.7	-
Organic surface	40.0	23.5	-	-	15.4	-
Organic throughout	20.0	-	-	-	-	-
Unclassified	-	5.9	-	-	15.4	-
Water Table (cm)						
Mean	15	18	-	28	41	-
	n = 4	n = 14	n < 4	n = 5	n = 5	n < 4
Range	0-100 +	0-100 +	20-100 +	0-100 +	0-100 +	67-100 +
Available Water-Holding Capacity (inches water per inch soil)						
Mean	-	.17	-	-	.16	.12
	n < 4	n = 15	n < 4	n < 4	n = 6	n = 4
Range	.07-.15	.11-.20	.18-.20	.14-.15	.13-.19	.08-.17

APPENDIX C (cont.)

	JUBA (8)	POPR (7)	VECA (14)
Soil Taxomomy (% Occurrence)			
Entisols			
Aquents	-	-	-
Cryaquents	-	-	-
Fluvents			
Cryofluvents	-	-	-
Udifluvents	-	-	-
Xerofluvents	-	-	-
Inceptisols			
Aquepts	-	-	7.1
Cryaquepts	-	-	-
Haplaquepts	-	-	-
Humaquepts	-	-	-
Ochrepts			
Cryochrepts	12.5	14.3	-
Dystrochrepts	-	-	-
Xerochrepts	-	-	-
Alfisols			
Cryoboralfs	-	-	-
Mollisols			
Aquolls			
Cryaquolls	37.5	-	7.1
Haplaquolls	-	-	-
Borolls			
Cryoborolls	-	57.1	21.4
Haploborolls	12.5	14.3	-
Haploxerolls	-	14.3	-
Histosols			
Fibrists			
Terric	-	-	-
All others	12.5	-	-
Hemists			
Terric	-	-	-
All others	-	-	-
Saprists			
Terric	-	-	-
All others	-	-	-
Unclassified	25.0	-	64.3
Family Particle-Size Class			
Fine	25.0	28.6	7.1
Silty	-	14.3	-
Fine-loamy	25.0	14.3	21.4
Coarse-loamy	-	28.6	-
Sandy	-	-	-
Clayey-skeletal	-	-	-
Loamy-skeletal	25.0	-	-
Sandy-skeletal	-	-	-
Fragmental	-	-	-
Clayey over -skeletal	-	-	-
Silty over -skeletal	-	-	-
Fine-loamy over -skeletal	-	14.3	7.1
Coarse-loamy over -skeletal	-	-	-
Sandy over -skeletal	-	-	-
Organic surface	-	-	-
Organic throughout	-	-	-
Unclassified	25.0	-	64.3
Water Table (cm)			
Mean	24	-	-
	n = 6	n < 4	n < 4
Range	0-100+	90-100+	33-100+
Available Water-Holding Capacity (inches water per inch soil)			
Mean	.15	.18	.18
	n = 7	n = 6	n = 5
Range	.13-.19	.13-.20	.15-.20

[1] Includes coarse-silty and fine-silty.
[2] Includes sandy-, loamy-, and clayey-skeletal classes.
[3] Includes sandy-, loamy-, and clayey-skeletal classes.
[4] Includes sandy-, loamy-, and clayey-skeletal classes.
[5] Includes sandy-, loamy-, and clayey-skeletal classes.
[6] Includes sandy-, loamy-, and clayey-skeletal classes.
[7] Includes Terric subgroups of Histosols and Histic subgroups of mineral soils.
[8] Includes only those soils with measurable water table within 1 m.
Sample size > = 4
[9] Includes range of measured water tables for all sampled soils including those with water tables greater than 1m.
(e.g. 44-100+ is read as 44cm to greater than 100 cm)
[10] Includes only non-organic surface horizons (calculated for the top 50 cm).
Sample size > = 4
[11] Includes the range of estimated available water-holding capacity for all sampled soils.

APPENDIX D. GLOSSARY.

The following terms are defined as used in this report. The definitions should minimize misunderstanding resulting from variations in use among different specialists. Primary references include Hanson (1962) and Daubenmire (1968).

Accidental. A species that is found rarely, or at most occasionally, as scattered individuals in a given community type, often as a random or chance occurrence.

Alluvium. Sediments deposited on land by streams and rivers.

Anaerobic. A condition characterized by the absence of free oxygen.

Aquatic ecosystem. The stream channel or lake bed, the water, and the biotic communities associated with them, forming an interacting system.

Available water-holding capacity. The capacity of a soil to hold water in a form available to plants, expressed in inches of water per inch of soil depth. Commonly defined as the amount of water held between field capacity and wilting point. Classes include:

Low 0 - 0.12
Moderate 0.13 - 0.17
High 0.17

Canopy cover. The area covered by the generalized outline of an individual plant's foliage, or collectively covered by all individuals of a species within a stand or sample area. Canopy coverage is expressed as a percentage of the total area in the plot.

Classification. The orderly arrangement of objects according to their similarities and differences in attributes.

Community (plant community). An assemblage of plants occurring together at any point in time, thus denoting no particular ecological status. A unit of vegetation.

Community type. An aggregation of all plant communities distinguished by floristic and structural similarities in both overstory and undergrowth layers. A unit of vegetation within a classification.

Constancy. The percentage occurrence of a species within a given community type.

Depauperate. A condition characterized by an unusually sparse coverage of vegetation.

Ecotone. A transition zone or boundary between adjacent plant communities.

Fluvial. Pertaining to or produced by the action of a stream or river.

Forb. An herbaceous plant, usually broad-leaved, that is not a graminoid.

Gleyed soils. Soils having an intense reduction of iron during soil development, or reducing conditions due to stagnant water, as indicated by base colors that approach neutral (blueish, grayish, or greenish), with or without mottles. In the more extreme conditions, ferrous iron is present.

Graminoid. Grass or grass-like plant, such as *Poa, Carex,* and *Juncus* species.

Habitat Type. An aggregation of all land areas potentially capable of producing a similar, stable plant community. A unit of land.

Herbaceous. Nonwoody vegetation such as graminoids and forbs.

Mottling. Variation of coloration in soils as represented by spots, patches, or blotches of contrasting color. Commonly develops under alternating wet and dry periods with associated reduction and oxidation environments. Mottling generally indicates poor aeration and impeded drainage.

Riparian ecosystem. That ecosystem (typically located between aquatic and terrestrial situations) identified by soil characteristics associated with at least seasonally high water tables (e.g. mottles or gleyed soils), and with distinctive vegetation that requires or tolerates free or unbound water.

Riparian species. Plant species occurring within the riparian zone. Obligate species require the environmental conditions within the riparian zone; facultative species tolerate the environmental conditions, therefore, may also occur away from the riparian zone.

Riparian zone. A geographically delineated portion of the riparian ecosystem.

Seral. Refers to species or communities that are eventually replaced by other species or communities within a successional sere.

Sere. All temporary communities in a successional sequence.

Stable. The condition of little or no perceived change in plant communities that are in relative equilibrium with existing environmental conditions. Describes persistent but not necessarily culminating stages (climax) in plant succession.

Stand. An existing plant community that is relatively uniform in composition, structural, and site conditions; thus it may serve as a local example of a community type.

Stream order. A classification of streams according to the number of tributaries. Order 1 streams have no tributaries; a stream of any higher order has 2 or more tributaries of the next lower order.

Succession. The progressive changes in plant communities toward a steady state. Primary succession begins on a bare surface not previously occupied by plants, such as a recently deposited gravel bar. Secondary succession occurs following disturbances on sites that previously supported vegetation.

Wetland communities. Plant communities that occur on sites with soils typically saturated with or covered with water most of the growing season.

APPENDIX E. ILLUSTRATIONS AND DESCRIPTIONS OF INDICATOR SPECIES FOR THE UTAH RIPARIAN CLASSIFICATION

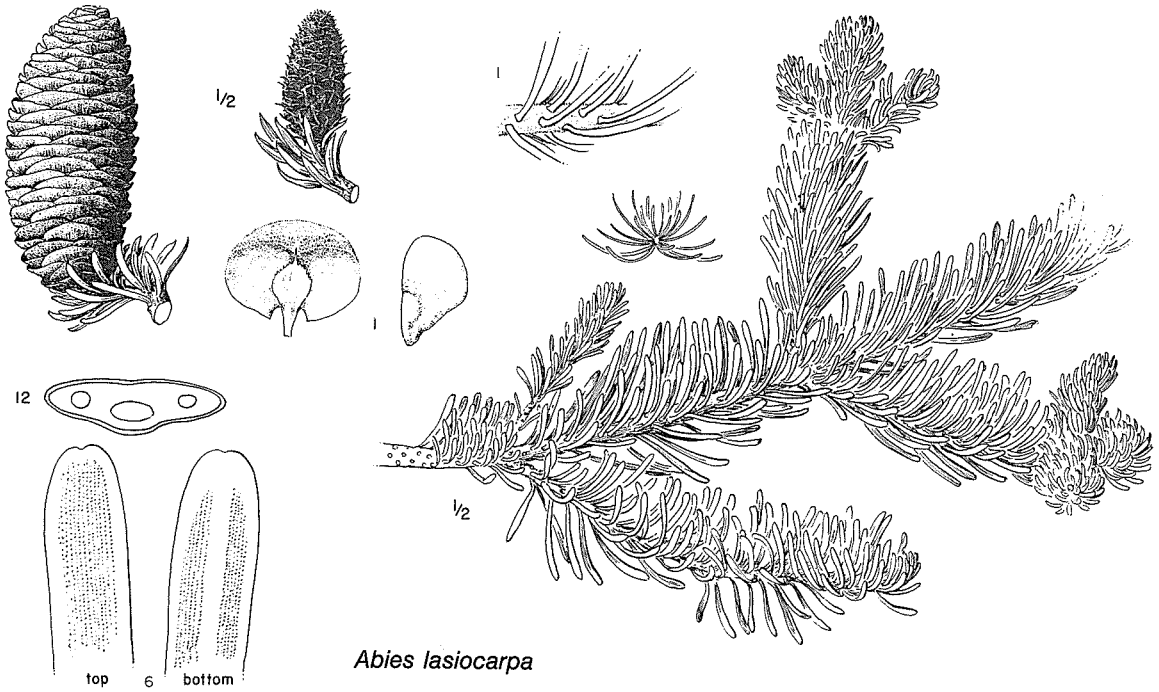
Illustrations by Jeanne R. Janish are used with permission from the University of Washington Press, Seattle, Washington[1] and The New York Botanical Garden, Bronx, New York[2].

Descriptions follow Welsh and other (1987).

CONIFEROUS TREES

Abies lasiocarpa - PINACEAE - subalpine fir[2]

Habit: Mature trees tend to be slender; to 30 m tall; often dwarfed and spreading at high altitudes.
Needles: Tending to turn upward (not horizontal); whitish on both surfaces from lines of stomata.
Cones: Female cones generally near top of trees, erect; scales deciduous by early winter.
General: Bark thin, grayish in early years becoming fissured and scaley.



Abies lasiocarpa

Picea engelmannii - PINACEAE - Engelmann spruce[2]

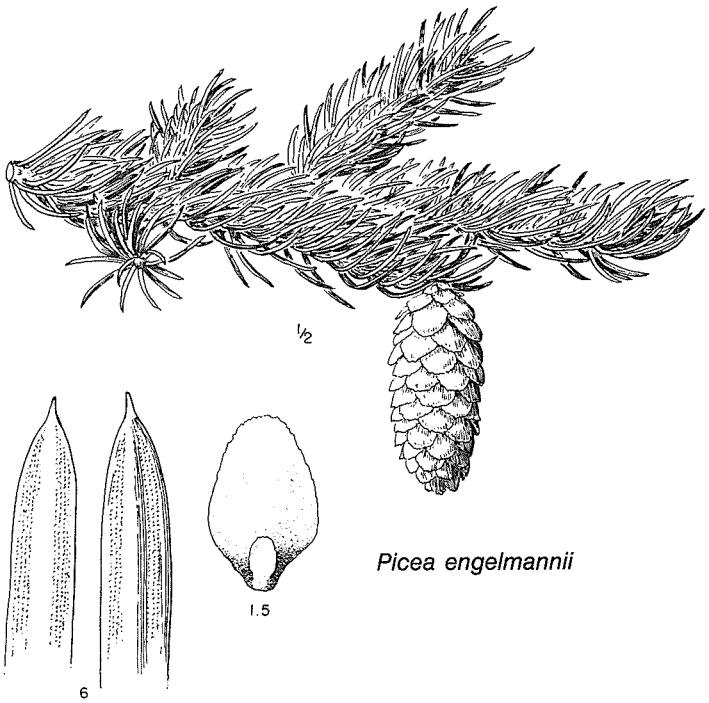
Habit: Narrowly pyramidal trees to 40 m tall; trunk rarely more than 1 m thick; typically an upland species, occasionally entering riparian settings; above 2 440 m (8,000 ft) to krummholz communities—a dense shrub at timberline.

Needles: Rigid, acute, tending to spread in all directions around the twig; those on the lower side more or less turning upward.

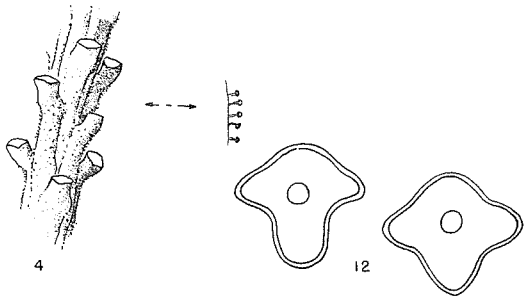
Cones: Female cones 4-6 (7.5) cm long, generally pendent; deciduous as a whole, scales persistent.

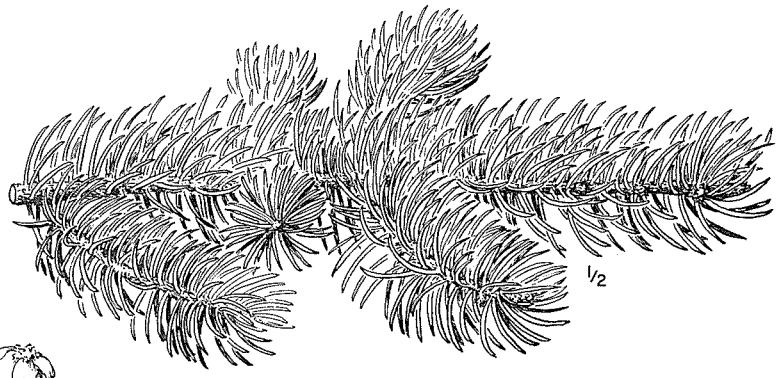
General: Bark thin, scaly, grayish or purplish-brown; young twigs finely pubescent—twigs remain roughened by the persistent leaf bases after needles fall off.

Similar species: *P. pungens.*

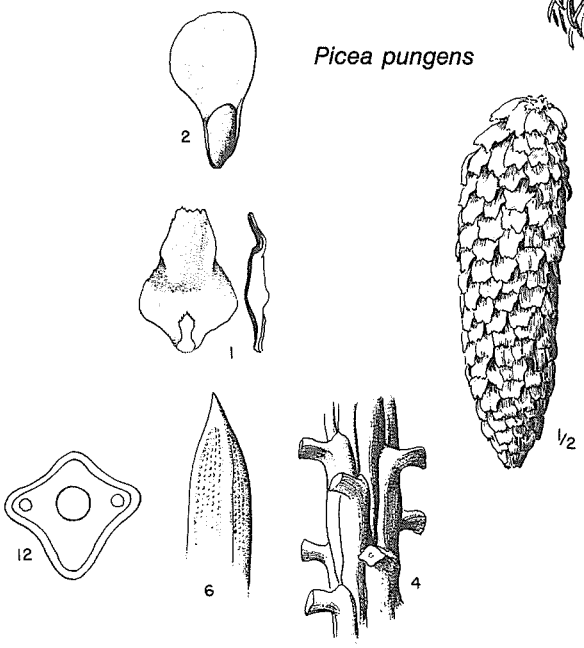


Picea engelmannii





Picea pungens



Picea pungens - PINACEAE - Colorado blue spruce[2]

Habit: Pyramidal tree to 30 (50) m tall; most often in riparian settings below 2 870 m (9,400 ft) but also occurring on well-drained slopes.

Needles: Rigid, very sharp-pointed, more or less radially spreading; occasionally bluish-green glaucous.

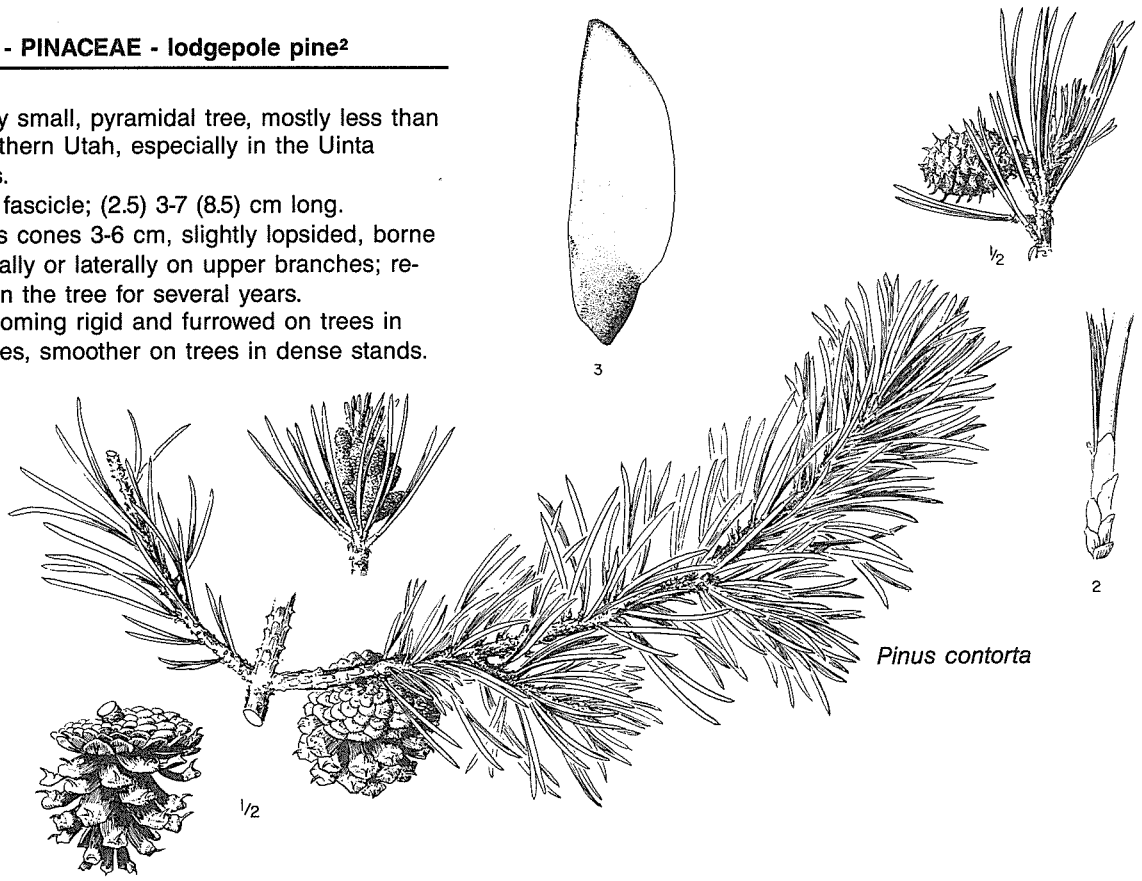
Cones: Female cones 6-10 cm long, pendent; deciduous as a whole; scales persistent.

General: Bark thin, becoming rigid and furrowed on trees in open places; smoother on trees in dense stands.

Similar species: *P. engelmannii.*

Pinus contorta - PINACEAE - lodgepole pine[2]

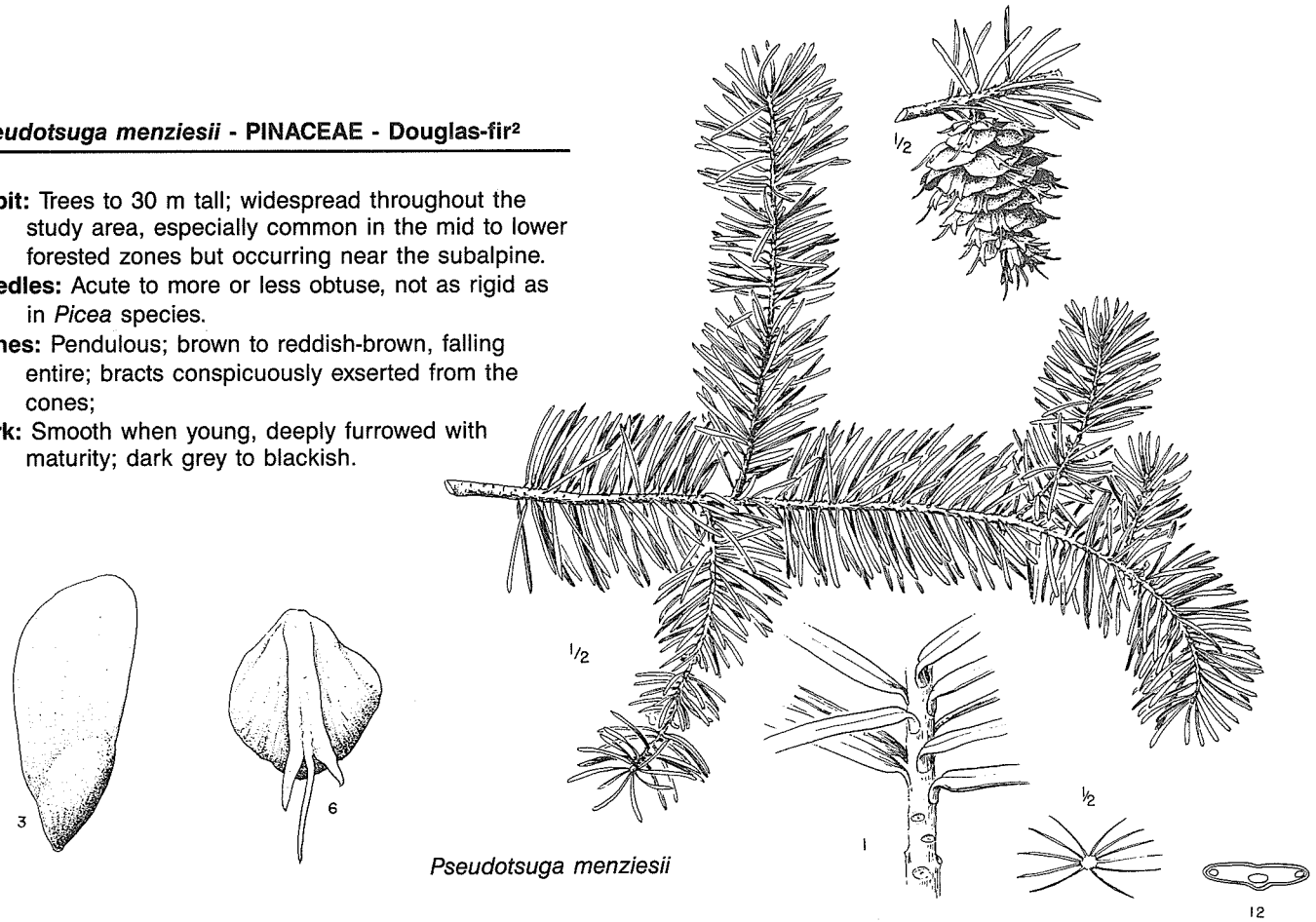
Habit: Relatively small, pyramidal tree, mostly less than 30 m; northern Utah, especially in the Uinta Mountains.
Needles: 2 per fascicle; (2.5) 3-7 (8.5) cm long.
Cones: Females cones 3-6 cm, slightly lopsided, borne subterminally or laterally on upper branches; remaining on the tree for several years.
Bark: Thin, becoming rigid and furrowed on trees in open places, smoother on trees in dense stands.



Pinus contorta

Pseudotsuga menziesii - PINACEAE - Douglas-fir[2]

Habit: Trees to 30 m tall; widespread throughout the study area, especially common in the mid to lower forested zones but occurring near the subalpine.
Needles: Acute to more or less obtuse, not as rigid as in *Picea* species.
Cones: Pendulous; brown to reddish-brown, falling entire; bracts conspicuously exserted from the cones;
Bark: Smooth when young, deeply furrowed with maturity; dark grey to blackish.

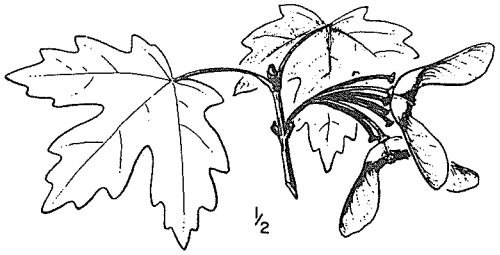


Pseudotsuga menziesii

DECIDUOUS TREES

Acer grandidentatum - ACEARACEAE - bigtooth maple[1]

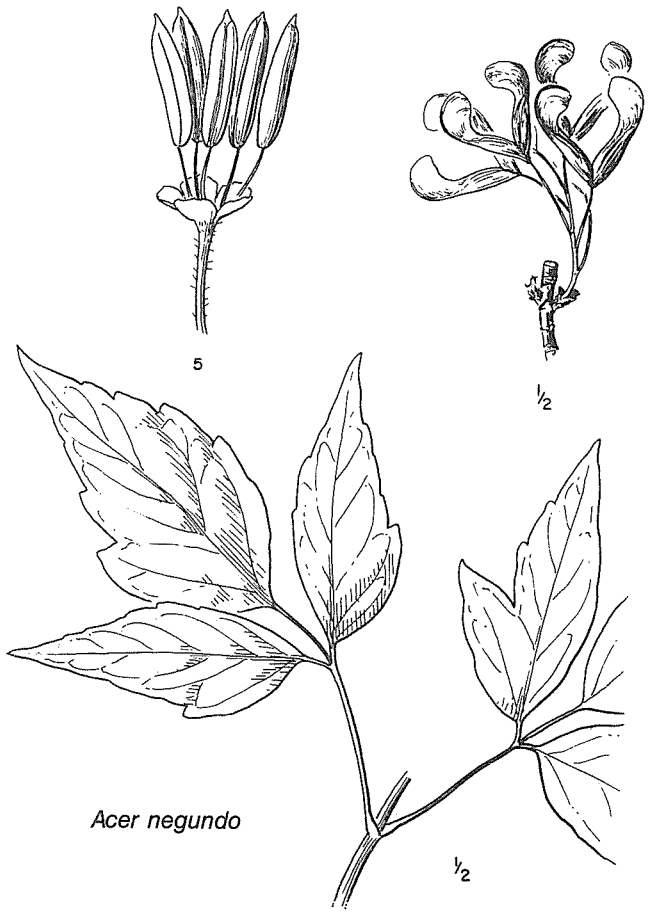
Habit: Small deciduous tree, 4-8 m tall; dry bottom lands to oak, oak-maple, sagebrush, Douglas-fir, and white fir communities.
Leaves: Palmately 3-5 lobed to near the middle; lower leaf surface villous to puberulent.
Fruit: Samaras; more or less long-hairy.



Acer grandidentatum

Acer negundo - ACERACEAE - box elder[1]

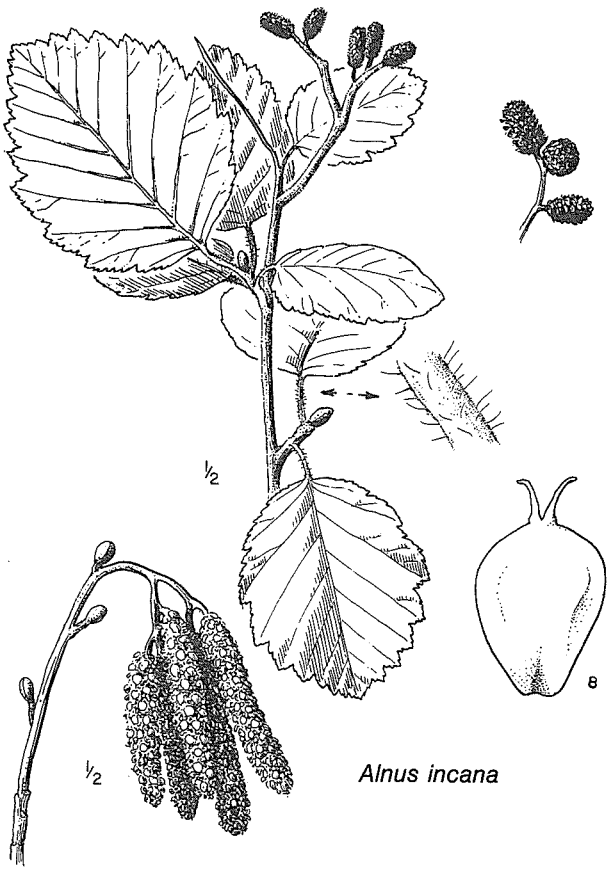
Habit: Deciduous tree to 12 (20) m tall; dioeceous; widespread, along streams and bottom lands at mid to low elevations.
Leaves: Trifoliate, the leaflets oblong-lanceolate to oblanceolate.
Fruit: Samaras.
General: Introduced (var. *negundo*) and native (var. *interior*).



Acer negundo

Alnus incana - BETULACEAE - mountain alder[1]
[*A. tenuifolia*]

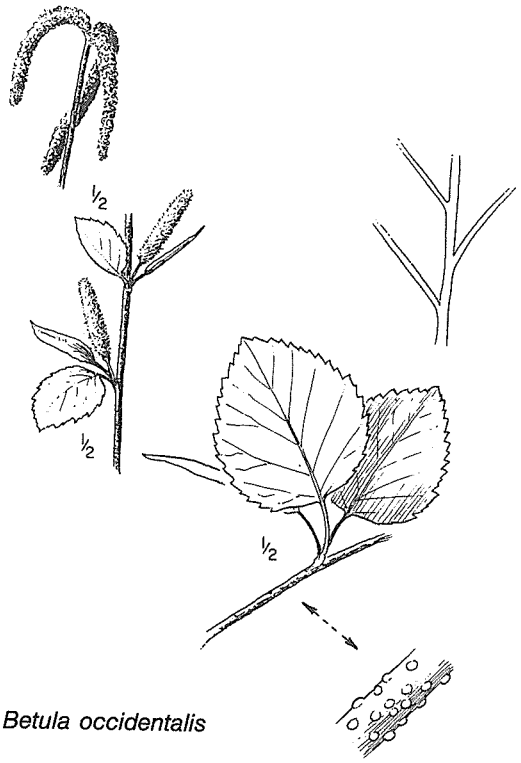
Habit: Deciduous shrub or low trees; 2-5 (12) m tall; moist to wet places, typically adjacent to streams at mid to high elevations.
Leaves: Broadly elliptic or ovate-oblong, rounded to subcordate at the base; 3-7 (11) cm long; margins serrate-denticulate; upper surface green, lower surface pale.
Bark: Grayish-brown or reddish.
General: Aments developing before the leaves and produced on growth of the previous season.



Alnus incana

***Betula occidentalis* - BETULACEAE - water birch[1]**
[*B. fontinalis*]

Habit: Deciduous shrubs or small trees to 8 (15) m tall; monecious; typically adjacent to streams and rivers at moderately low to mid elevations.
Leaves: Blades usually glandular; ovate to orbicular, apex rounded to acute; margins once or twice serrate.
Bark: Older bark mostly smooth, coppery to dark reddish or reddish brown.
General: Occurs on sites similar to *Alnus incana,* but *Betula* tends to occur at lower elevations.



Betula occidentalis

***Populus acuminata* - SALICACEAE - lanceleaf cottonwood[1]**

Habit: Small to large trees; near rivers and flood plains, typically below 1 920 m (6,300 ft) in Utah.
Leaves: 1-2.4 times longer than wide.
General: Considered to be a hybrid between *P. angustifolia* (p. 148) and broad leaved taxa such as *P. fremontii* and *P. deltoides* var. *occidentalis*—features are therefore intermediate between the two extremes.
Similar Species: *P. angustifolia.*

Populus acuminata

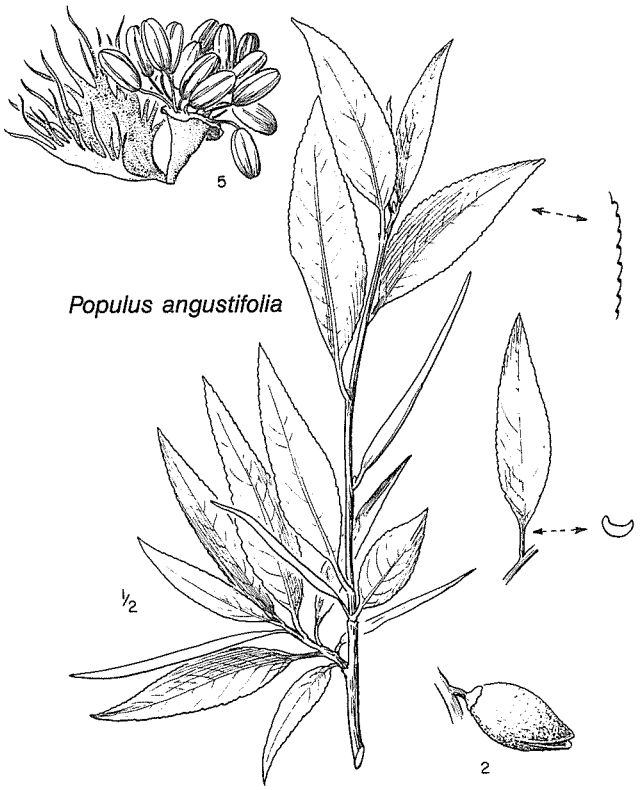
***Populus angustifolia* - SALICACEAE - narrowleaf cottonwood[1]**

Habit: Small to large trees, 7-15 (20) m tall; near rivers and flood plains, typically below 2 440 m (8,000 ft) in Utah.

Leaves: Blades 4-14 cm long, 2.5-6 (9.5) times longer than wide, lanceolate to occasionally narrow elliptical or ovate, usually acute at the apex and rounded at the base; margins finely to coarsely serrate.

Bark: Pale green to whitish when young, becoming deeply furrowed and grayish on old trunks.

Similar species: *P. acuminata.*



Populus angustifolia

***Populus fremontii* - SALICACEAE - Fremont cottonwood** (NOT SHOWN)

Habit: Trees 10-25 m tall, with broad rounded crowns; flood plains of rivers, washes, irrigations ditches, below 1 860 m (6,100 ft) in Utah.

Leaves: Blades 4-10 cm long, 4.5-12.5 cm wide, 0.6-1.2 times as long as wide; deltoid, ovate, with truncate to cordate base; greenish or yellow-green on both sides.

Bark: Smooth and whitish when young, deeply furrowed on old trunks.

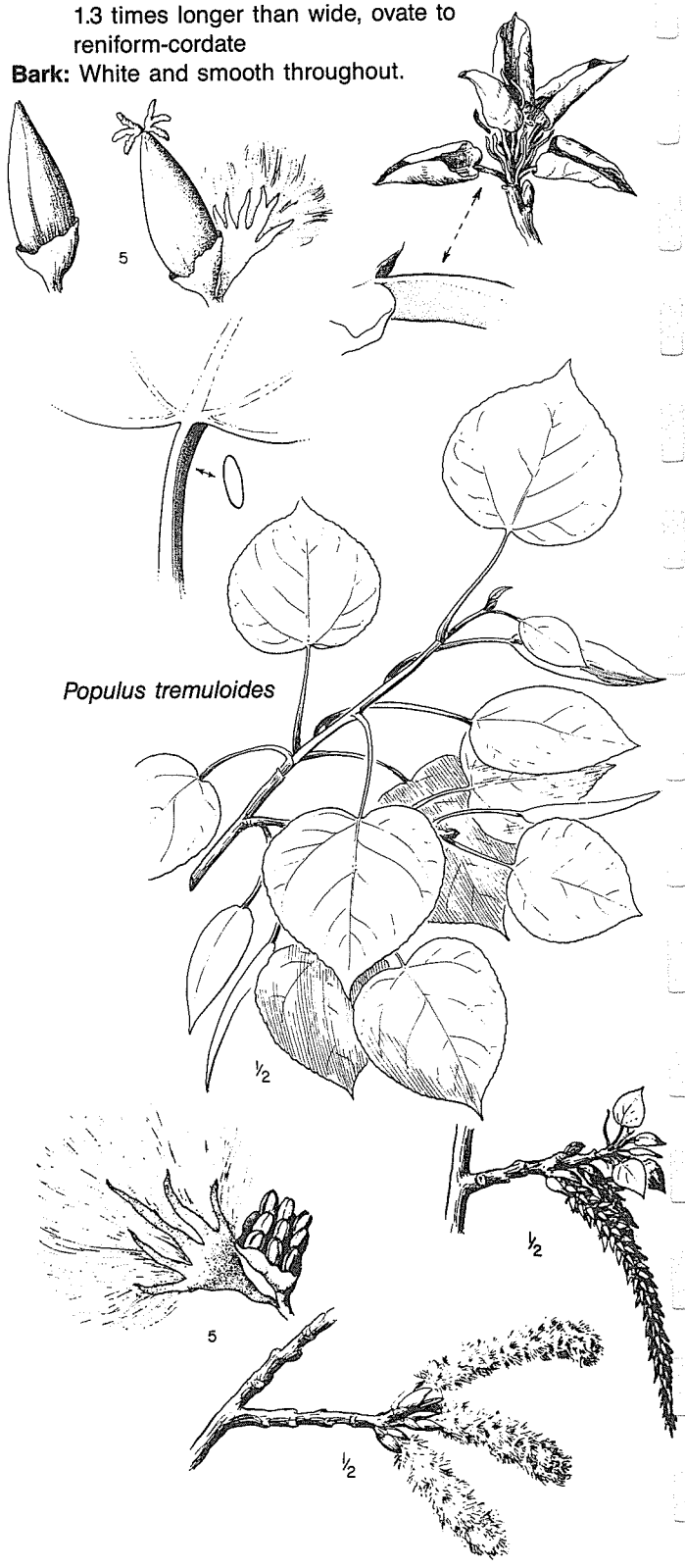
Similar species: *P. balsamifera.*

***Populus tremuloides* - SALICACEAE - quaking aspen[1]**

Habit: Colonial trees, 10-15 (20) m tall; streamsides, canyons, and mountain slopes above 1 375 m (4500 ft).

Leaves: Blades 2-6.5 cm long, 1.8-6.5 cm wide; 0.75 to 1.3 times longer than wide, ovate to reniform-cordate

Bark: White and smooth throughout.



Populus tremuloides

SHRUBS

***Artemisia cana* - ASTERACEAE - mountain silver sagebrush[1]**

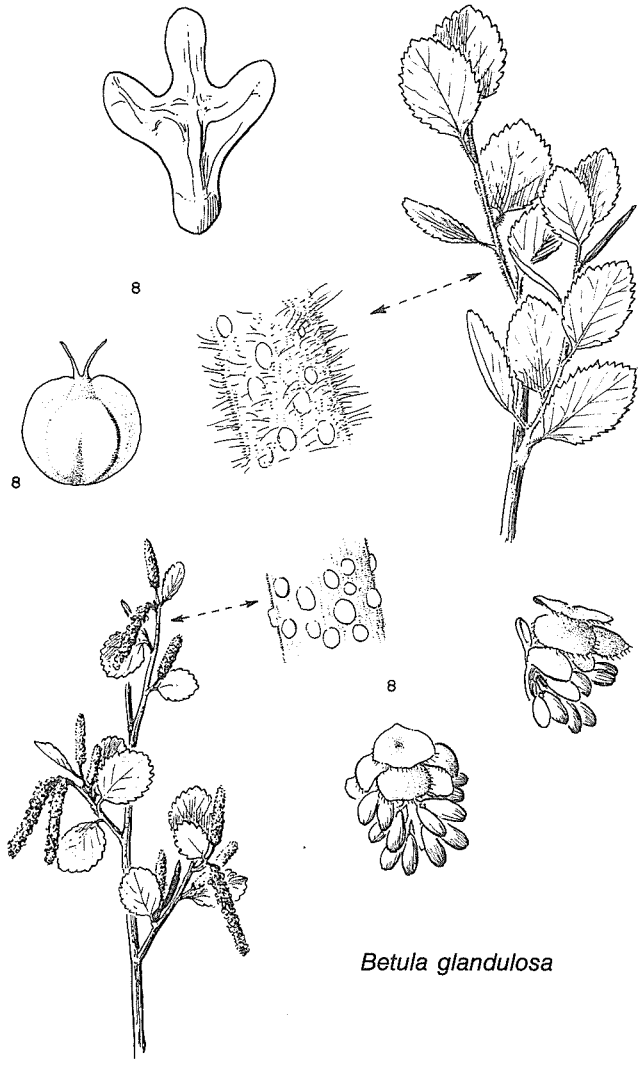
Habit: Evergreen shrub, 2.5-12 dm tall; often rooting, sprouting or layering; moist to dry mountain meadows and open hillsides, at mid to high elevations.
Leaves: Linear (not dentate) to narrowly elliptic or oblong; appressed tomentose, silvery canescent.
Inflorescence: Loosely paniculate to subspikate.
Similar species: *A. tridentata.*

Artemisia cana

2/5

***Betula glandulosa* - BETULACEAE - bog birch[1]**

Habit: Spreading to erect shrub, typically 1-2 m tall; wet, often, swampy, boggy places, mid to high elevations.
Leaves: Blades mostly oval or oblong-elliptic, 1-2 cm long; finely serrate, glandular on both surfaces.
Bark: Becoming reddish-brown; resinous, with wart-like crystalline glands; young branches usually densely puberulent.



Betula glandulosa

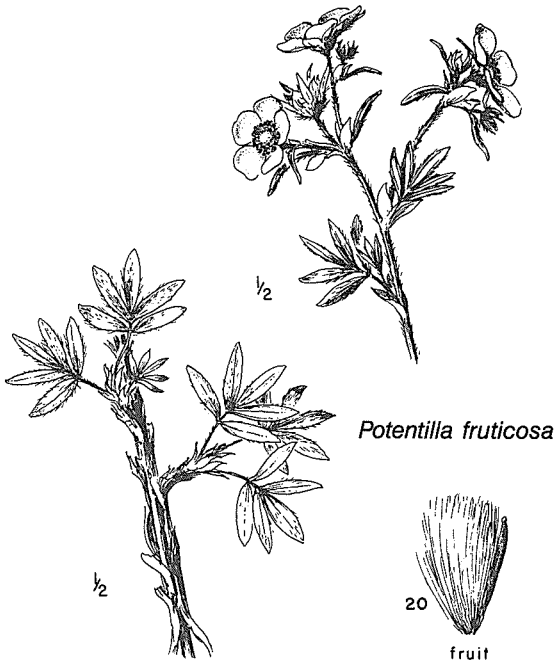
***Cornus sericea* - CORNACEAE - red-osier dogwood[1]**
[*C. stolonifera*]

Habit: Many-stemmed shrub, 2-6 m tall, spreading by the layering of decumbent or prostrate stems, typically red to purplish-red, that simulate stolons; moist places, typically near rivers and streams; rarely at high elevations.
Leaves: Opposite, ovate to elliptic-ovate; 4-12 cm long; greenish on upper surface, paler beneath.
Bark: Younger branches usually bright red to reddish purple, turning grayish green.
Inflorescence: Flowers in flat-topped cyme.
Fruit: White to bluish drupes.

Cornus sericea

***Potentilla fruticosa* - ROSACEAE - shrubby cinquefoil[1]**

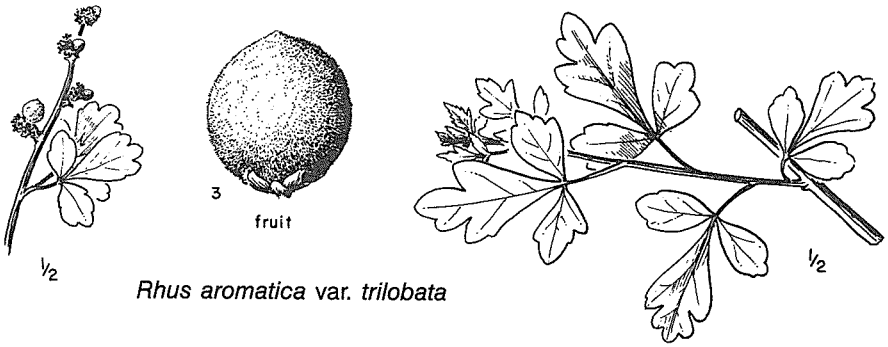
Habit: Much branched shrubs, to 1 m tall; moist places from mid to subalpine elevations.
Leaves: Compound, pinnately 3- to 7-foliate; densely leafy, green and sparsely hairy to glabrate above, grayish and silvery hairy below.
Flowers: Conspicuous; petals yellow.



Potentilla fruticosa

***Rhus aromatica* var. *trilobata* - ANACARDIACEAE - skunkbush[1]**
[*R. trilobata*]

Habit: Shrubs, 0.5-2.5 m tall, forming thickets; streambanks, terraces, seeps, mesic slopes below 2 380 m (7,800 ft).
Leaves: Simple, trifoliate, thin; leaflets 0.8-9.4 cm long, 0.6-7 cm wide.
Fruit: Drupes, red-orange



Rhus aromatica var. *trilobata*

Salix bebbiana

Salix bebbiana - SALICACEAE - Bebb willow[1]

Habit: Shrubs, occasionally tree-like, growing from a single base or several stems, (2) 4-6 (8) m tall; meadows, streams, or irrigations from 1 310 to 2 715 m (4,300 to 8,900 ft).

Leaves: 1-4 cm long, 1.2-2 cm wide, elliptical, obovate or oblanceolate, often slightly crenate; dark green and glabrous above, glaucous beneath when mature, usually a few hairs near the midrib on lower leaf surface.

Inflorescence: Aments on a leafy peduncle, 3-15 mm long; bracts pale green to brown, silky pubescent, persistent; capsules, pubescent, 6-8 mm long with long, slender beak, capsules very loosely arranged on long stipes (2-3.5 mm long)

Similar species: *S. scouleriana.*

Salix boothii

Salix boothii - SALICACEAE - Booth's willow[1]

[*S. myrtillifolia* (misapplied), *S. pseudocordata*]

Habit: Shrubs, (1) 2-4 m tall; streams and meadows, mid to high elevations, very common.

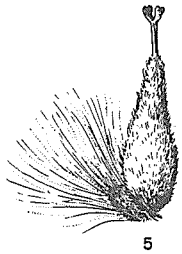
Leaves: 2.5-6 cm long, 8-22 mm wide, often lanceolate; entire to serrualte, sparingly to moderately pubescent, becoming glabrate.

Inflorescence: Staminate aments 1-2.5 cm long; pistillate aments (1) 2-4 (6) cm long; capsules glabrous.

Similar species: *S. monticola, S. lutea, S. lasiandra.*

Salix drummondiana - **SALICACEAE - Drummond willow**[1]
[*S. subcoerulea*]

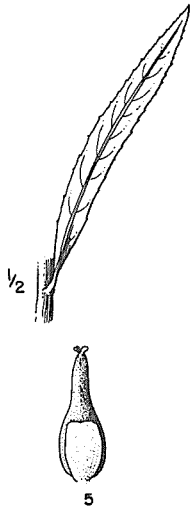
Habit: Shrubs (1) 2-3 (4) m tall; streams, rivers and wet meadows, mid to high elevations.
Leaves: Dark green and glabrous above, silvery white pubescent and glaucous beneath; margins often revolute, 2.2-8 cm long, 13-20 mm wide.
Inflorescence: Staminate aments 19-22 mm long; pistillate aments 2-4.5 cm long; capsules pubescent, very densely arranged on the rachis.
General: Young twigs strongly glaucous, persisting into second year, yellow-brown to blackish-purple beneath the bloom.
Similar species: *S. geyeriana.*



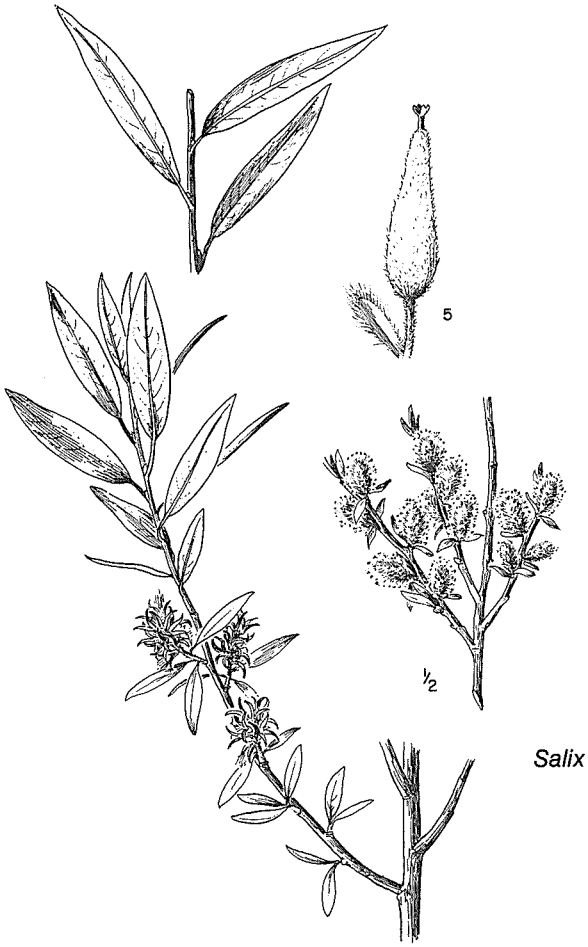
Salix drummondiana

Salix exigua - **SALICACEAE - coyote willow**[1]

Habit: Colonial, often pioneering shrub, (1) 2-3 m tall, rarely treelike to 8 m tall; streams, rivers, ditches, low to mid elevations, widespread.
Leaves: Linear, entire or serrualte-dentate with glandular teeth; glabrate to densely white sericeous.
Inflorescence: Staminate aments 1.5-4.5 cm long; pistillate aments 1.5-6 cm long; capsules mostly glabrous, sometimes pubescent.



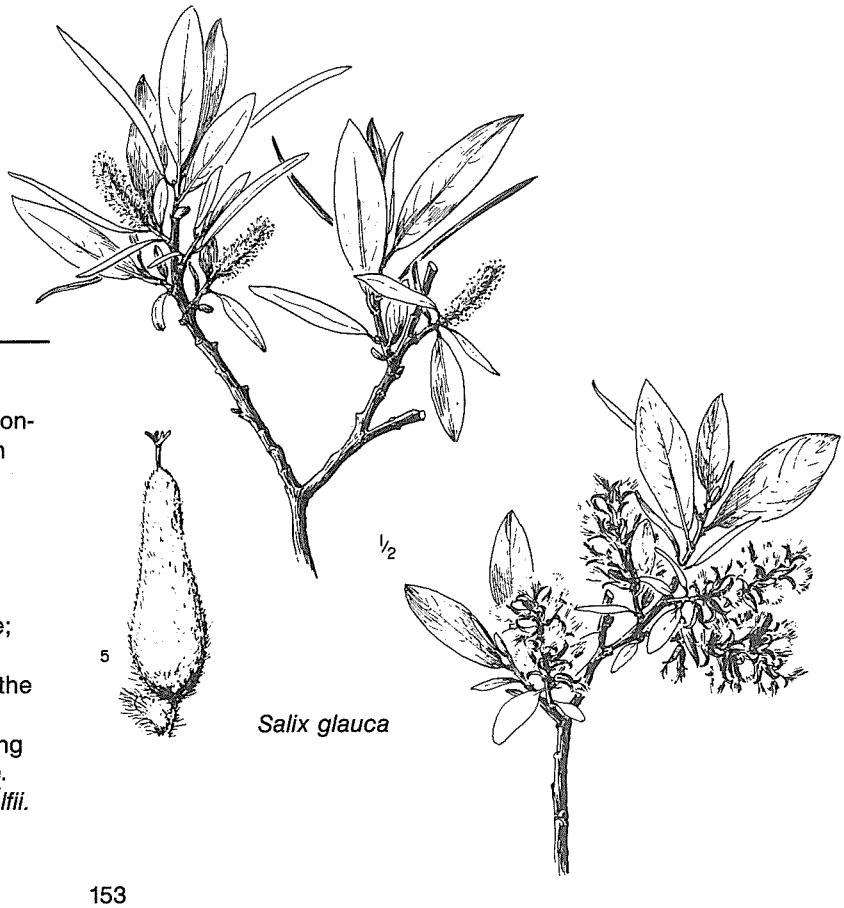
Salix exigua



Salix geyeriana

***Salix geyeriana* - SALICACEAE - Geyer willow[1]**

Habit: Shrubs, 1.5-4.5 m tall, often widely spaced; open meadows and along streams and rivers, mid to moderately high elevations; typically associated with non-forested upland communities.
Leaves: 2-4.5 cm long, 8-12 mm wide, narrow elliptical to narrow lanceolate; entire, glaucous beneath, sericeous when unfolding, becoming sparsely to moderately sericeous at maturity.
Inflorescence: Staminate aments 7-15 mm long; pistillate aments 1-2 cm long; capsules pubescent.
General: Twigs stongly glaucous, the bloom sometimes deciduous.
Similar species: *S. drummondiana.*



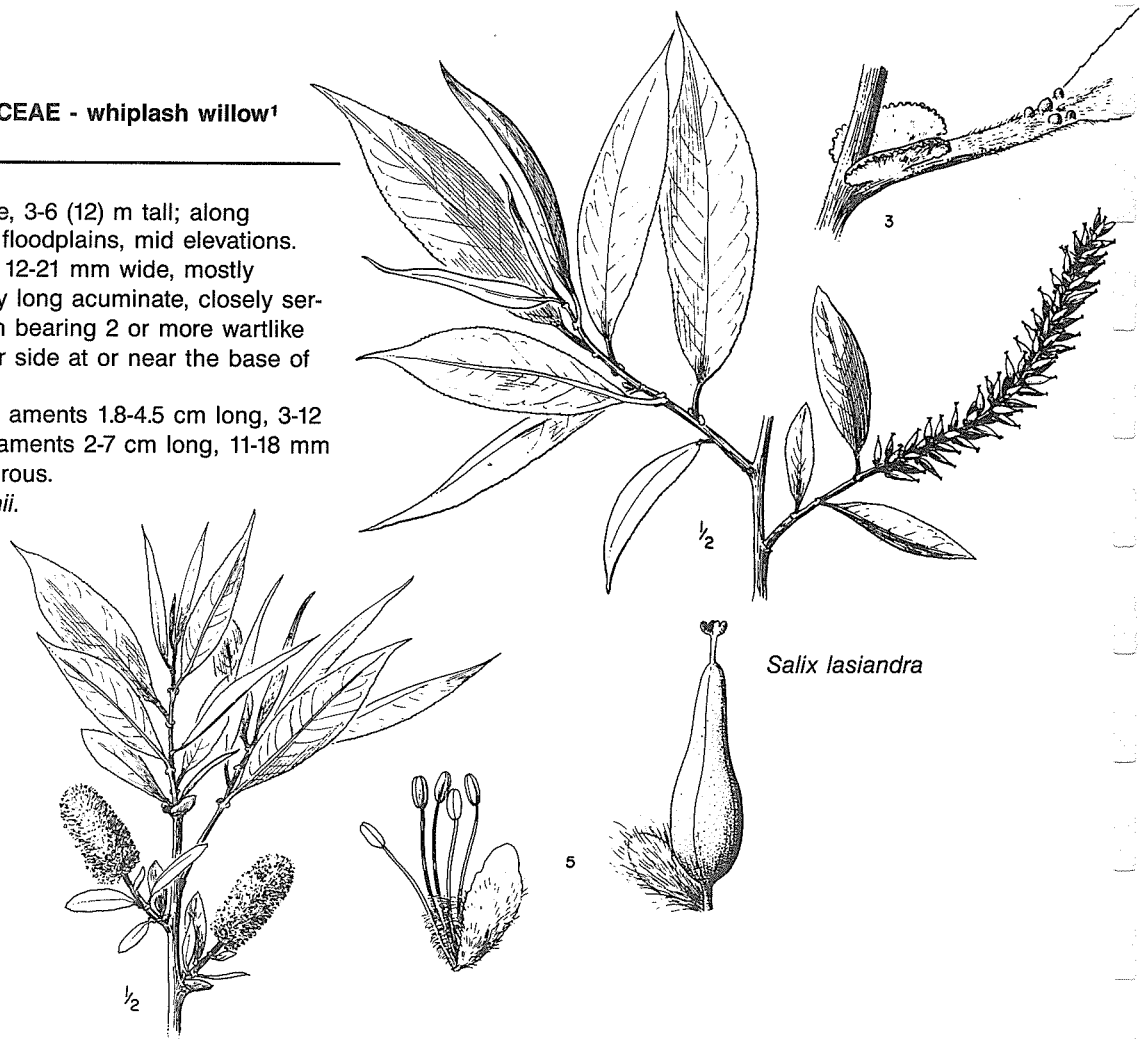
Salix glauca

***Salix glauca* - SALICACEAE - glaucous willow[1]**
[*S. pseudolapponum*]

Habit: Low shrubs, 0.3-1 (3) m tall; meadows, talus slopes, and areas of late snowmelt, often on convex slopes; subalpine to tundra above 2 745 m (9,000 ft).
Leaves: 2-55 mm long, 7-22 mm wide, elliptical, pubescent when young becoming glabrate or glabrous in age, entire or rarely serrate.
Inflorescence: Staminate aments 1.5-4 cm long; pistillate aments 1.5-5 cm long, 1.1-1.5 cm wide; capsules densely pubescent to glabrous or glabrate with age, crowded on the rachis, but the rachis usually apparent.
General: Twigs often with exfoliating epidermis, young twigs pubescent with a tuft of hair at the node.
Similar species: *S. planifolia, S. brachycarpa, S. wolfii.*

***Salix lasiandra* - SALICACEAE - whiplash willow[1]**
[*S. caudata*]

Habit: Shrub or small tree, 3-6 (12) m tall; along streams, rivers and floodplains, mid elevations.
Leaves: 5.5-11.5 cm long, 12-21 mm wide, mostly lanceolate, gradually long acuminate, closely serrulate; petioles often bearing 2 or more wartlike glands on the upper side at or near the base of the blade.
Inflorescence: Staminate aments 1.8-4.5 cm long, 3-12 mm wide; pistillate aments 2-7 cm long, 11-18 mm wide; capsules glabrous.
Similar species: *S. boothii.*



Salix lasiandra

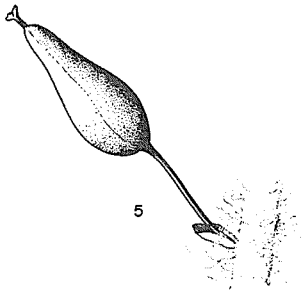
***Salix lasiolepis* - SALICACEAE - arroyo willow[2]**

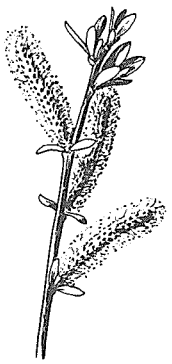
Habit: Shrub or small tree, 4-6 m tall; along perennial and ephemeral streams, low elevations in the Great Basin or areas of Great Basin influence.
Leaves: 1.5-4.2 (11) cm long, 6-13 (25) mm wide, mostly oblanceolate, or oblong, entire, somewhat revolute (especially when young), dark green and glabrous above, glaucous and hairy beneath when mature, more or less coriaceous.
Inflorescence: Staminate aments 2.2-4.5 cm long; pistillate aments 2.2-4.5 cm long, 10-12 mm wide, capsules glabrous, stipe 1-2 cm long.

Salix lasiolepis

***Salix lutea* - SALICACEAE - yellow willow[1]**
[*S. l.* var. *platyphylla, S. l. watsonii, S. rigida* var. *watsonii*]

Habit: Shrubs or rarely small trees, several stemmed at base; (2) 3-5 (9) m tall; streams and ditches, moderately low to mid elevations.
Leaves: (1) 2-5.5 cm long, (4) 9-21 mm wide, lanceolate or elliptical; glaucous beneath.
Inflorescence: Staminate aments 2-5 cm long, about 1 cm wide; pistillate aments 2-7 cm long, to 2 cm wide; capsules glabrous.
Similar species: *S. boothii, S. monticola.*

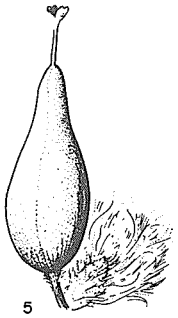




Salix lutea

***Salix monticola* - SALICACEAE - mountain willow[1]**

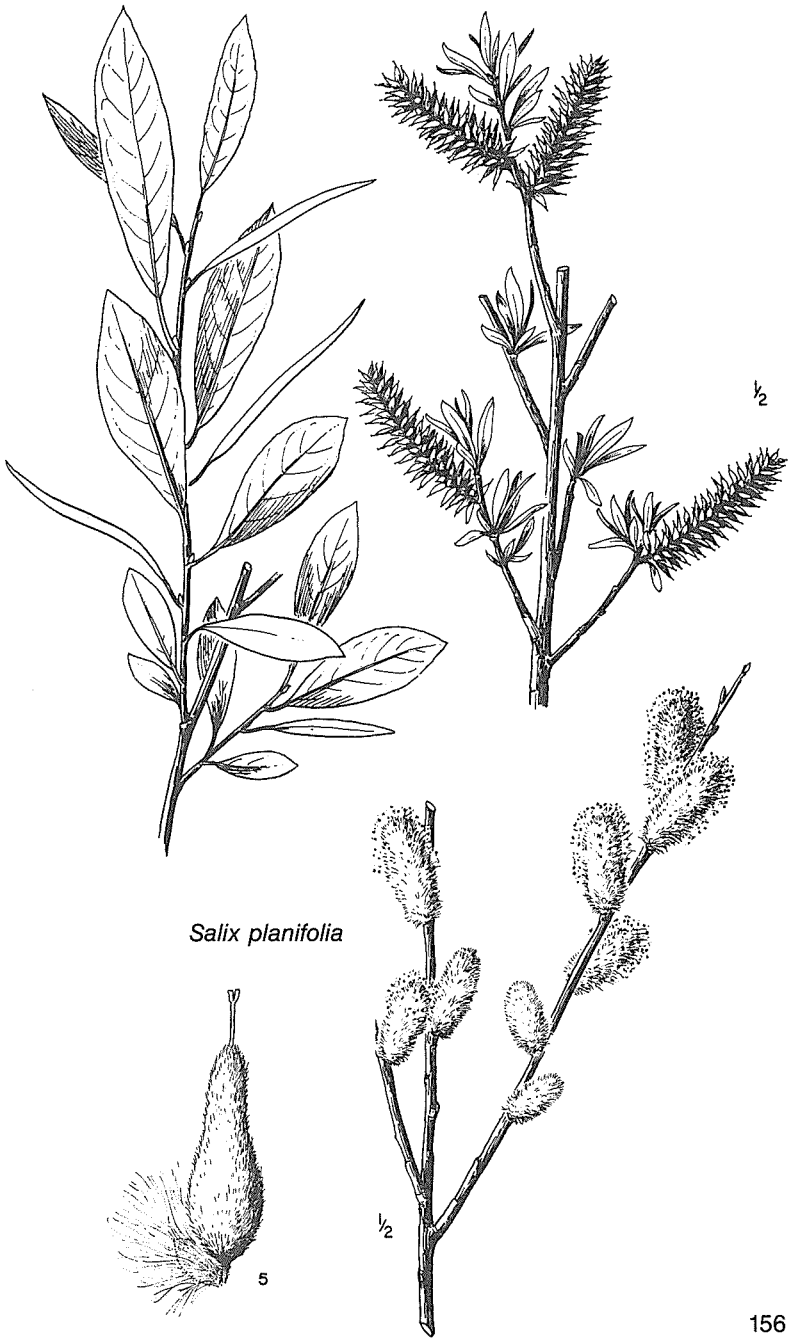
Habit: Shrubs, 1.5-4 m tall; streams and other wet places, mid to high elevations, uncommon.
Leaves: 2-5 cm long, 7-15 mm wide, often elliptical or elliptical ovate; entire to serrate, sparingly pubescent when young, becoming glabrous, glaucous beneath.
Inflorescence: Staminate aments 2-3.5 cm long; pistillate aments 2-6 cm long, 1-1.5 mm wide; capsules glabrous.
General: Twigs yellowish when fresh.
Similar species: *S. boothii, S. lutea.*



Salix monticola

***Salix planifolia* - SALICACEAE - plainleaf willow[1]**
[*S. phylicifolia* ssp. *planifolia*]

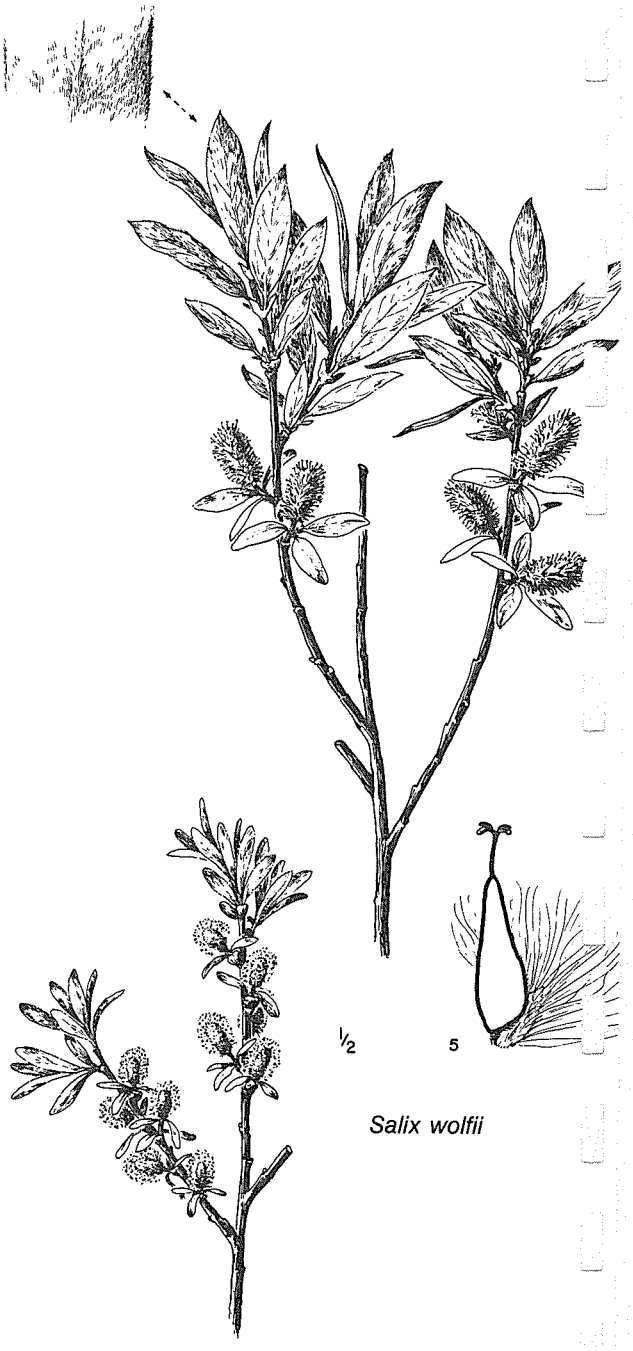
Habit: Low shrubs, 0.5-1.5 (4) m tall; wet meadows, lake and pond margins, high to subalpine (alpine) elevations.
Leaves: 1.2-3.8 (8) cm long, 4-13 (30) mm wide, elliptical or narrow elliptical; glabrous and dark green above, glaucous beneath, entire or rarely with minute teeth.
Inflorescence: Staminate aments 10-25 mm long; pistillate aments 2-4 cm long, 1-1.5 cm wide; capsules typically pubescent at least near the base.
General: Twigs below the leaves often with exfoliating epidermis, younger twigs glabrous and lustrous black or purplish-black, rarely glaucous.
Similar Species: *S. brachycarpa, S. glauca.*



Salix planifolia

***Salix wolfii* - SALICACEAE - Wolf's willow[1]**

Habit: Shrubs, 0.6-1.5 (2) m tall; stream, lake and pond margins, wet meadows, moderately high to high (subalpine) elevations.
Leaves: 1.2-4.2 cm long, 5-13 mm wide, narrow elliptical; entire, sparsely to densely sericeous-tomentose on both sides, occasionally glabrate beneath with age.
Inflorescence: Staminate aments 10-15 mm long; pistillate aments 8-20 (30) mm long; capsules glabrous (var. *wolfii*) or rarely pubescent (var. *idahoensis*).
Similar species: *S. glauca.*

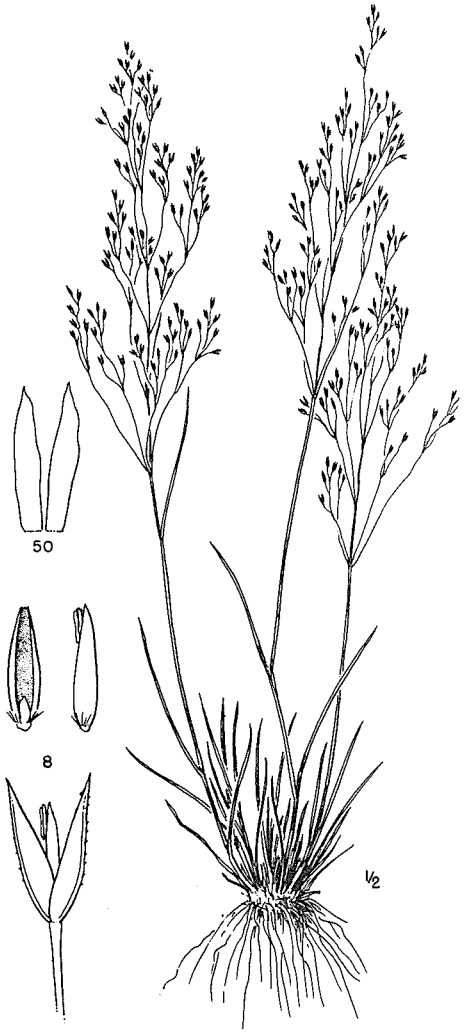


Salix wolfii

GRASSES

***Agrostis scabra* - POACEAE - ticklegrass[1]**

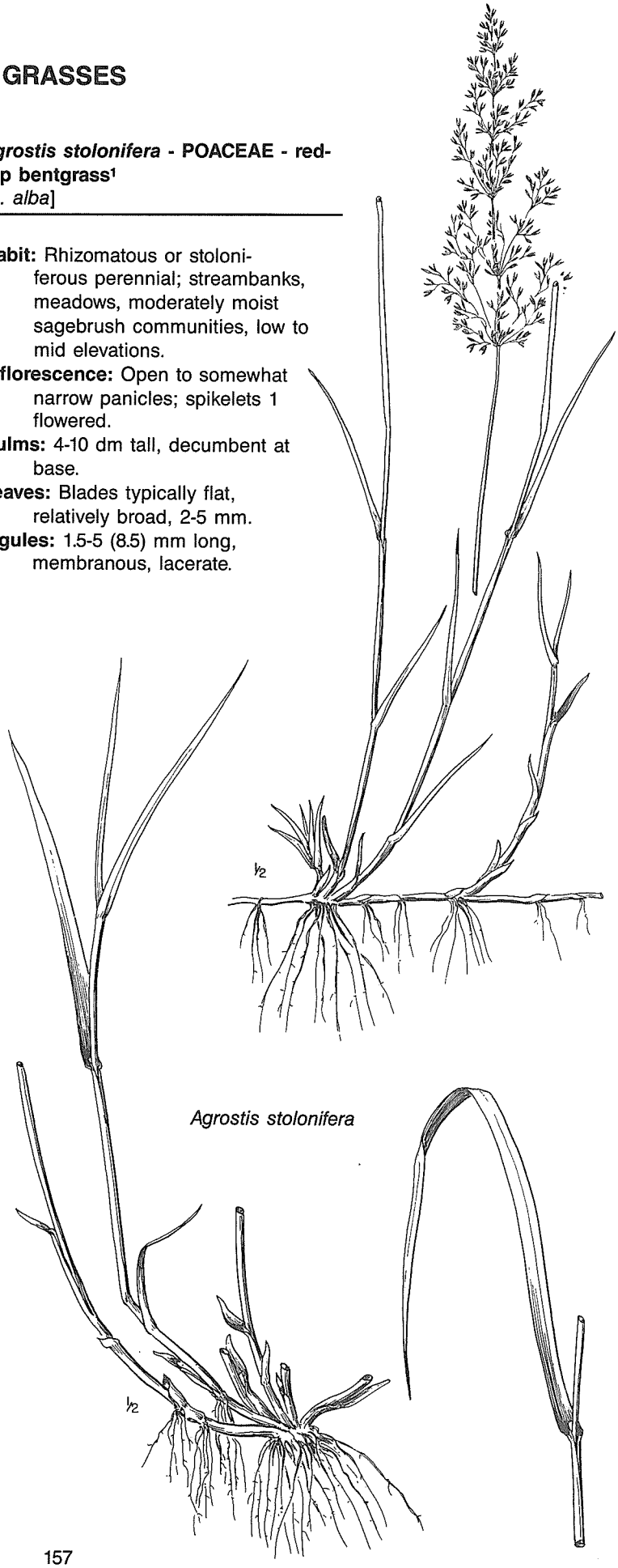
Habit: Tufted perennial; meadow communities, extending to drier shrub and forest communities, from 2 440 to 3 355 m (8,000 to 11,000 ft).
Inflorescence: Typically open, widely spreading panicles; spikelets 1-flowered.
Culms: 0.5-6 (7) dm tall, erect.
Leaves: Blades 0.5-2 mm wide, flat to involute; often scabrous.
Ligules: (1.2) 2-7 mm long.



Agrostis scabra

***Agrostis stolonifera* - POACEAE - redtop bentgrass[1]**
[*A. alba*]

Habit: Rhizomatous or stoloniferous perennial; streambanks, meadows, moderately moist sagebrush communities, low to mid elevations.
Inflorescence: Open to somewhat narrow panicles; spikelets 1 flowered.
Culms: 4-10 dm tall, decumbent at base.
Leaves: Blades typically flat, relatively broad, 2-5 mm.
Ligules: 1.5-5 (8.5) mm long, membranous, lacerate.



Agrostis stolonifera

Calamagrostis canadensis - **POACEAE - bluejoint reedgrass**[1]

Habit: Rhizomatous, coarse perennial; wet places in meadows and stream banks, low to high elevations.
Inflorescence: Relatively open panicle, 8-17 cm long; spikelets 1-flowered, bristles at the base.
Culms: Stout, 6-12 dm tall.
Leaves: Blades usually flat, 2-6 mm wide; scabrous.
Ligules: 3-7 mm, membranous, lacerate.

Calamagrostis canadensis

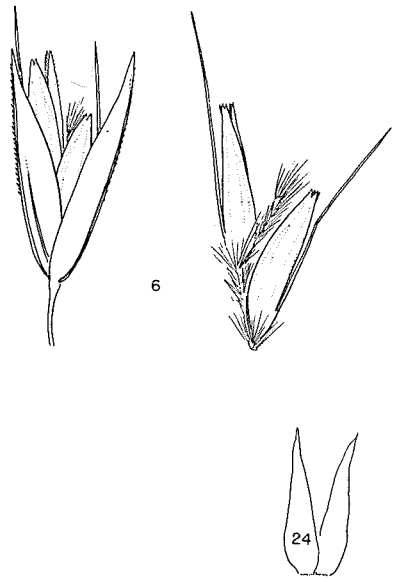
Danthonia intermedia - **POACEAE - timber oatgrass**[1]

Habit: Tufted perennial; meadows to rocky slopes, typically above 2 440 m (8,000 ft).
Inflorescence: Narrow with 4-9 spikelets; spikelets with 3-6 florets, usually with bristles at the base; awns twisted and bent from a bifid apex.
Culms: 1-5 (7) dm tall, erect.
Leaves: Blades 1-4 mm wide, flat to involute; glabrous to sparsely long-hairy.
Ligules: Ligule of hairs to 1 mm long.

Danthonia intermedia

***Deschampsia cespitosa* - POACEAE - tufted hairgrass[1]**

Habit: Densely tufted perennial; stream banks, lake and pond margins, wet mountain meadows, moderately high to subalpine and alpine elevations.
Culms: 2-8 (13) dm tall, erect.
Inflorescence: Loose, often nodding panicle, open to narrow, 5-20 cm long; spikelets usually shiny purplish; lemmas with awns 2-5 mm long attached from the lower back.
Leaves: Firm flat or folded, 1-3 (5) mm wide.
Ligules: 3-7.5 mm long, narrow, acuminate, often lacerate.



Deschampsia cespitosa

Elymus glaucus - POACEAE - blue wildrye[1]

Habit: Loosely tufted perennial; mountain brush, spruce, fir, lodgepole communities, often on stream terraces; above 1 525 m (5,000 ft).

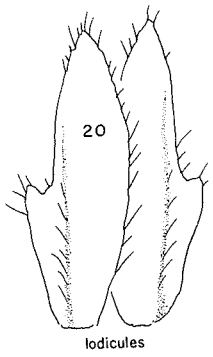
Inflorescence: Erect spike, typically with 2 spikelets per node; glumes narrow; 2-4 florets per spikelet.

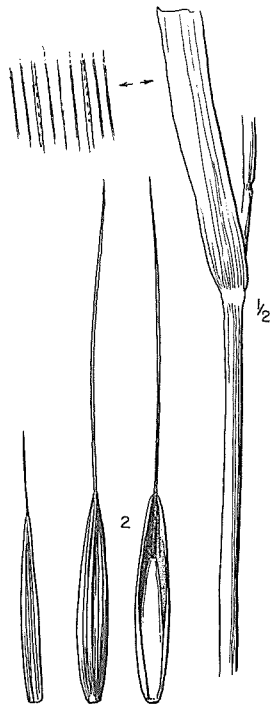
Culms: 0.6-1.8 m tall, erect.

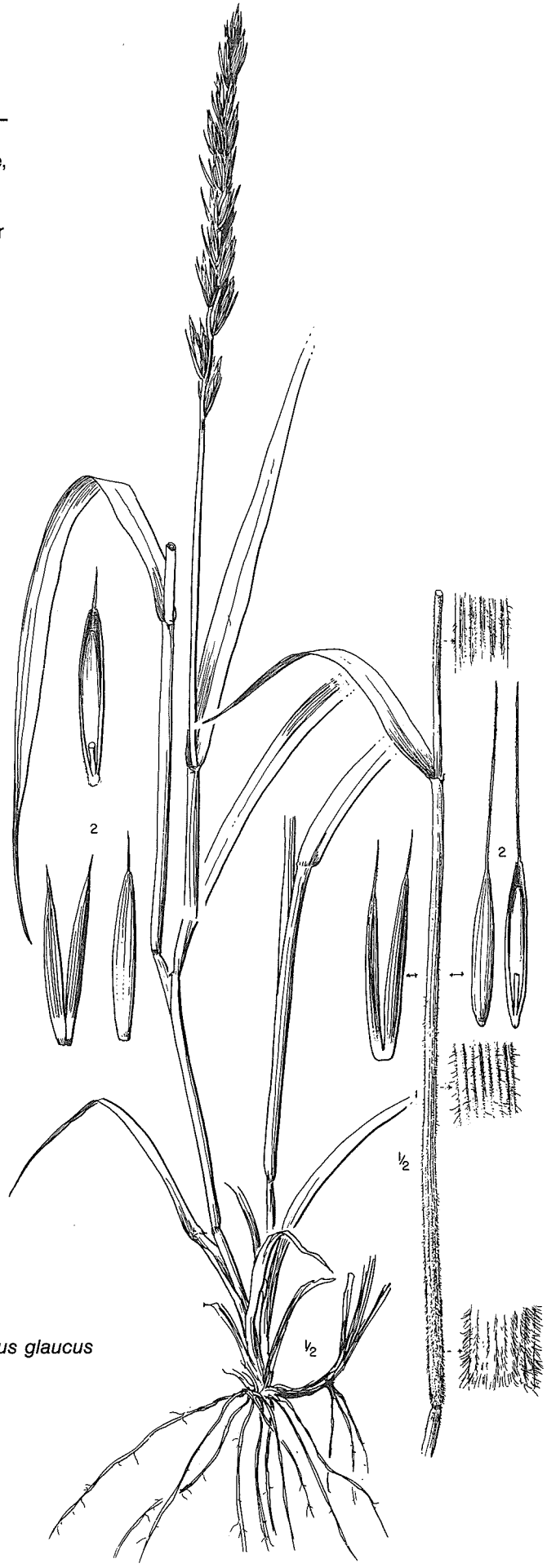
Leaves: Glaucous to dark green; mostly occurring on the stems (cauline), with well developed auricles; blades lax, flat, 4-19 mm wide.

Ligules: 0.3-1.5 mm long.

Similar species: *E. triticoides* (rhizomatous), *Agropyron trachycaulum.*





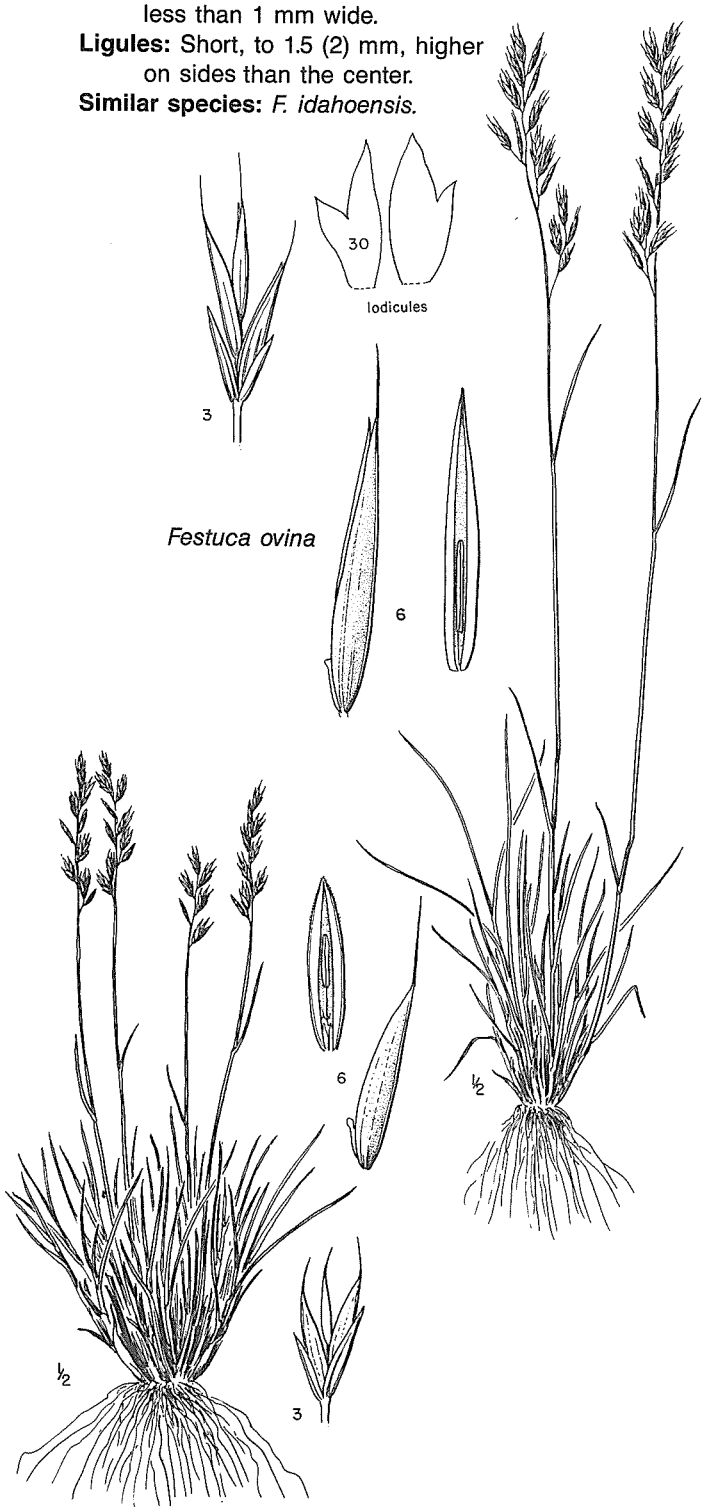


Elymus glaucus

***Festuca idahoensis* - POACEAE - Idaho fescue[1]**
(NO DESCRIPTION)

***Festuca ovina* - POACEAE - sheep fescue[1]**

Habit: Densely tufted perennial; sagebrush, aspen, conifer, and mountain grass communities, from low to alpine elevations.
Inflorescence: Narrow, loosely compressed panicle, 1-12 (15) cm long; lemmas with awns 0.5-4 mm long, awned from the tip; spikelets typically 3-7 flowered.
Culms: Erect, 0.2-11 dm tall.
Leaves: Mostly basal; blades firm, folded-involute, less than 1 mm wide.
Ligules: Short, to 1.5 (2) mm, higher on sides than the center.
Similar species: *F. idahoensis.*



Glyceria striata - POACEAE - fowl mannagrass[1]

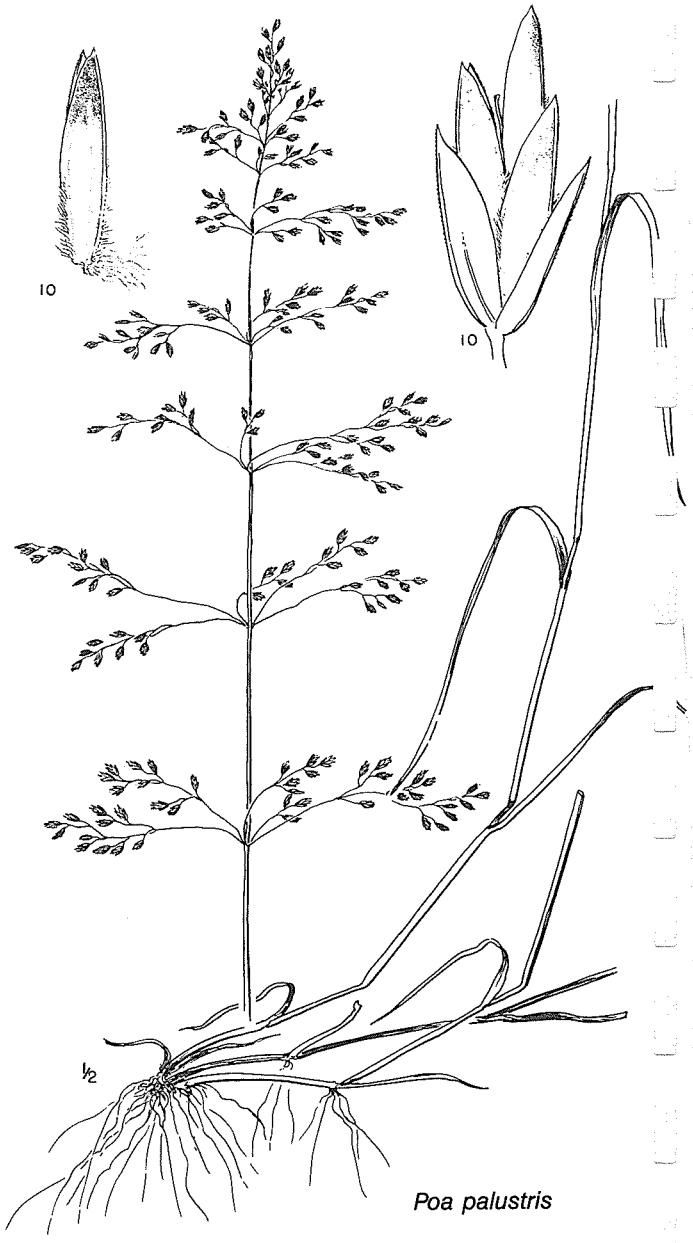
[*G. elata*]

Habit: Rhizomatous perennial; wet meadows and other wet sites above 1 220 m (4,000 ft).
Inflorescence: Open, drooping panicle, 0.5-3 dm long; spikelets 3-7 flowered; lemmas prominently nerved, green to purplish.
Culms: Erect or, typically, decumbent at the base, (1.5) 3-10 (15) dm tall.
Leaves: Blades typically flat, 2-10 (12) mm wide.
Ligules: 1-4 mm long.
Similar species: *G. grandis.*

Glyceria striata

Poa palustris - POACEAE - fowl bluegrass[1]

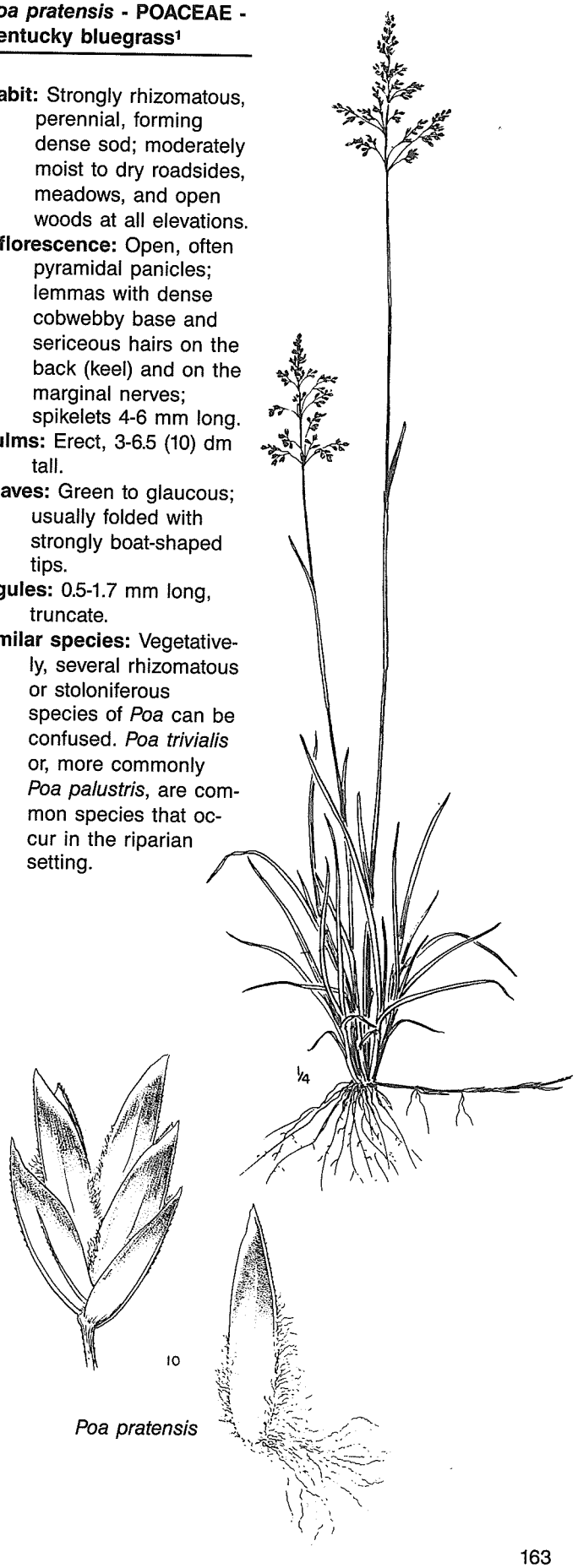
Habit: Decumbent perennial, often appearing rhizomatous; moist meadows, ditches, and open ground.
Inflorescence: Open, loose, pyramidal or oblong panicle, often nodding, 7-25 cm long; lemmas with cobwebby tuft, villous on the back and on marginal nerves.
Culms: Typically decumbent at the base, 2.5-9.5 dm tall.
Leaves: 1-3.5 mm wide, soft, flat or folded, boat-shaped tip.
Ligules: 1-5 mm long, acute to obtuse.
Similar species: *P. trivialis, P. glauca.*



Poa palustris

***Poa pratensis* - POACEAE - Kentucky bluegrass[1]**

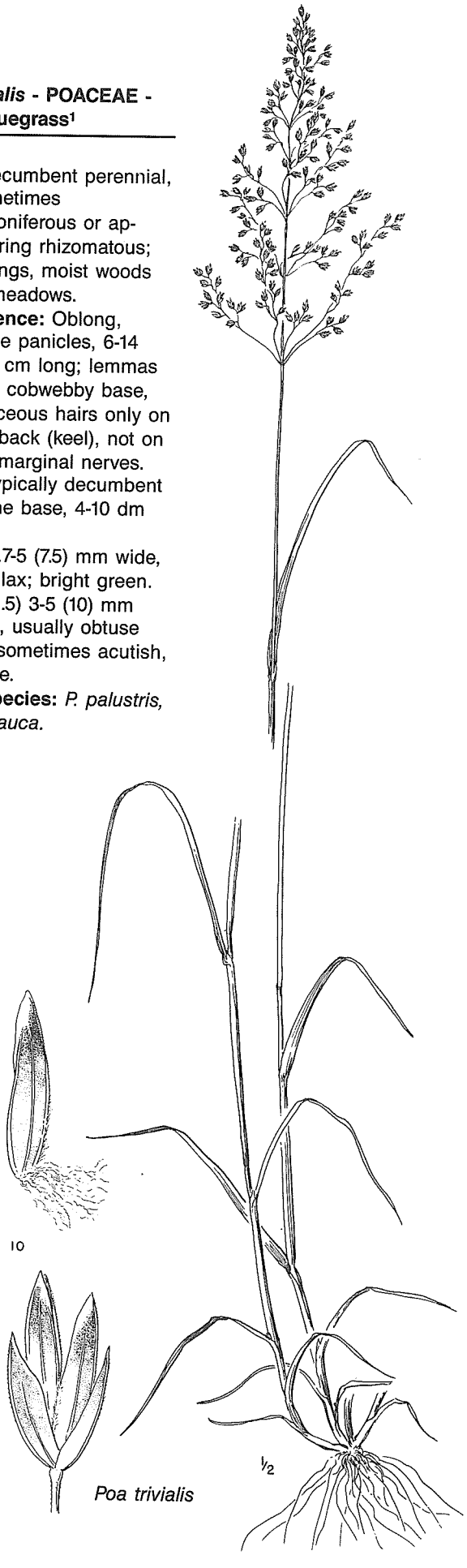
Habit: Strongly rhizomatous, perennial, forming dense sod; moderately moist to dry roadsides, meadows, and open woods at all elevations.
Inflorescence: Open, often pyramidal panicles; lemmas with dense cobwebby base and sericeous hairs on the back (keel) and on the marginal nerves; spikelets 4-6 mm long.
Culms: Erect, 3-6.5 (10) dm tall.
Leaves: Green to glaucous; usually folded with strongly boat-shaped tips.
Ligules: 0.5-1.7 mm long, truncate.
Similar species: Vegetatively, several rhizomatous or stoloniferous species of *Poa* can be confused. *Poa trivialis* or, more commonly *Poa palustris*, are common species that occur in the riparian setting.



Poa pratensis

***Poa trivialis* - POACEAE - rough bluegrass[1]**

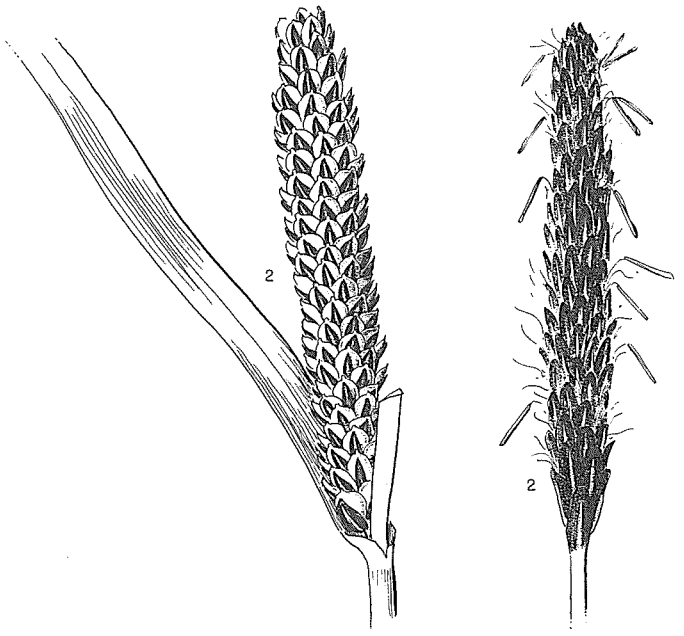
Habit: Decumbent perennial, sometimes stoloniferous or appearing rhizomatous; springs, moist woods or meadows.
Inflorescence: Oblong, loose panicles, 6-14 (22) cm long; lemmas with cobwebby base, sericeous hairs only on the back (keel), not on the marginal nerves.
Culms: Typically decumbent at the base, 4-10 dm tall.
Leaves: 1.7-5 (7.5) mm wide, flat, lax; bright green.
Ligules: 1.5) 3-5 (10) mm long, usually obtuse but sometimes acutish, entire.
Similar species: *P. palustris, P. glauca.*

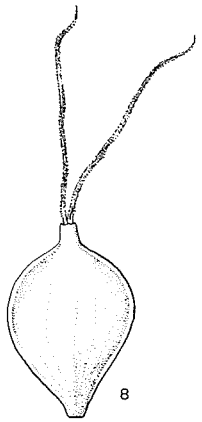


Poa trivialis

***Carex aquatilis* - CYPERACEAE - water sedge[1]**

Habit: Rhizomatous; wet and boggy meadows, streams, lake and pond margins, moderately high to subalpine elevations.
Inflorescence: Spikes sessile, cylindric; terminal spike staminate; lowest bract elongate and leaf-like, typically exceeding the inflorescence.
Culms: Borne singly or few together.
Leaves: Elongate, flat, mostly 2-7 mm wide; typically glaucous-tipped, especially when young.
Perigynia: Elliptic to obovate, 2.0-3.3 mm including the beak; nerveless except for well developed marginal nerves; pistillate scales reddish-brown to purplish-black usually with pale midrib.
Pistil: Stigmas 2; achene lenticular.
Similar species: *C. nebrascensis, C. scopulorum.*





Carex aquatilis

***Carex buxbaumii* - CYPERACEAE - Buxbaum sedge[1]**

Habit: Rhizomatous; wet and boggy meadows and seeps, 2 260 to 2 900 m (7,400 to 9,500 ft).
Inflorescence: Cylindric, erect to ascending, sessile or longer than peduncles; 3.5-6.5 cm long; spikes 3-4, 0.7-2.2 cm long, 4-8 mm wide.
Culms: Arising singly or 2-3 together, well spaced on the rhizome.
Leaves: Blades 1-3 mm wide; leaves all cauline on the lower culms, lower ones reduced to sheaths.
Perigynia: 2.5-4 mm long, elliptic or elliptic-obovate, faintly nerved; pistillate scales awn-pointed, brownish or purplish-black with green midrib.
Pistil: Stigmas 3; achene trigonous.
Similar species: *C. paupercula.*

Carex buxbaumii

Carex disperma - **CYPERACEAE - softleaved sedge**[1]

Habit: Densely tufted; wet and boggy meadows, and along streams, lake and pond margins, moderately high to subalpine elevations.
Inflorescence: Spikes sessile, androgynous, and few-flowered with 1-2 staminate flowers and 1-3 pistillate flowers.
Culms: 10-45 cm long.
Leaves: 0.5-2 mm wide, flexuous.
Perigynia: Elliptic, 2-3 mm long, with very short beak.
Pistil: Stigmas 2, achene lenticular.

Carex disperma

***Carex lanuginosa* -**
CYPERACEAE - woolly sedge[1]

Habit: Rhizomatous; streams, meadows, and other moist to wet areas, widespread from 1 220 to 2 775 m (4,000 to 9,100 ft).

Inflorescence: 8-21 cm long; spikes cylindrical, sessile to pedunculate; 1-3 female spikes, 1-4.8 cm long; male spike terminal.

Culms: Typically a few culms arising together in small tufts from dense, sod-forming rhizomes; plants 2.4-8 dm tall.

Leaves: Mostly arising from the lower half of the culm; upper blades 2-6 mm wide.

Perigynia: One of the few common sedges with pubescent perigynia, evidently nerved; conspicuous bidentate beak.

Pistil: Stigmas 3; achene trigonous.

Similar species: *C. lasiocarpa* (also with pubescent perigynia but only occurring, in Utah, in the Sims Peak Potholes region of the Ashley National Forest).

Carex lanuginosa

Carex lasiocarpa - **CYPERACEAE - slender sedge**[1]

Habit: Rhizomatous; only known location in Utah is the Sims Peak Potholes area on the Vernal District of the Ashley National Forest.

Inflorescence: Spikes cylindrical, sessile or nearly so; female spikes 1-4.5 cm long

Culms: Stems arising singly or a few together from creeping rhizomes; plants 4-12 dm tall.

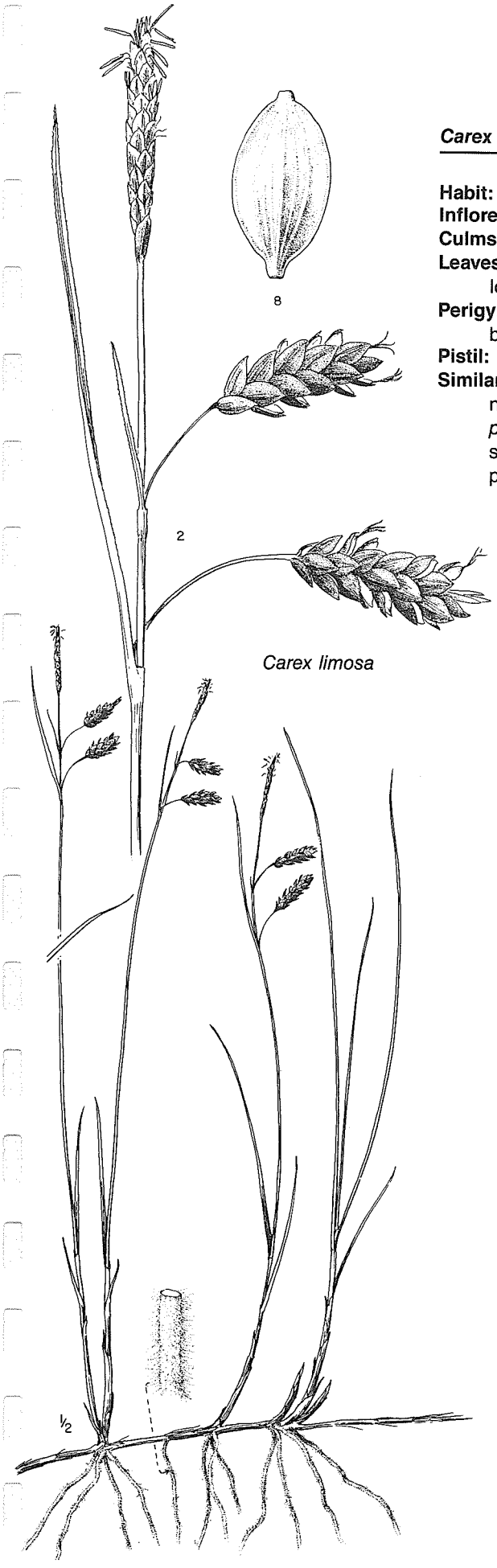
Leaves: Leaves arising well above the base, lower leaves reduced to sheaths; blades narrow (1-1.5 mm wide), folded, appearing subterete.

Perigynia: Densely velvety, obscurely nerved, prominent beak.

Pistil: Stigmas 3; achene trigonous.

Similar species: *C. lanuginosa.*

Carex lasiocarpa

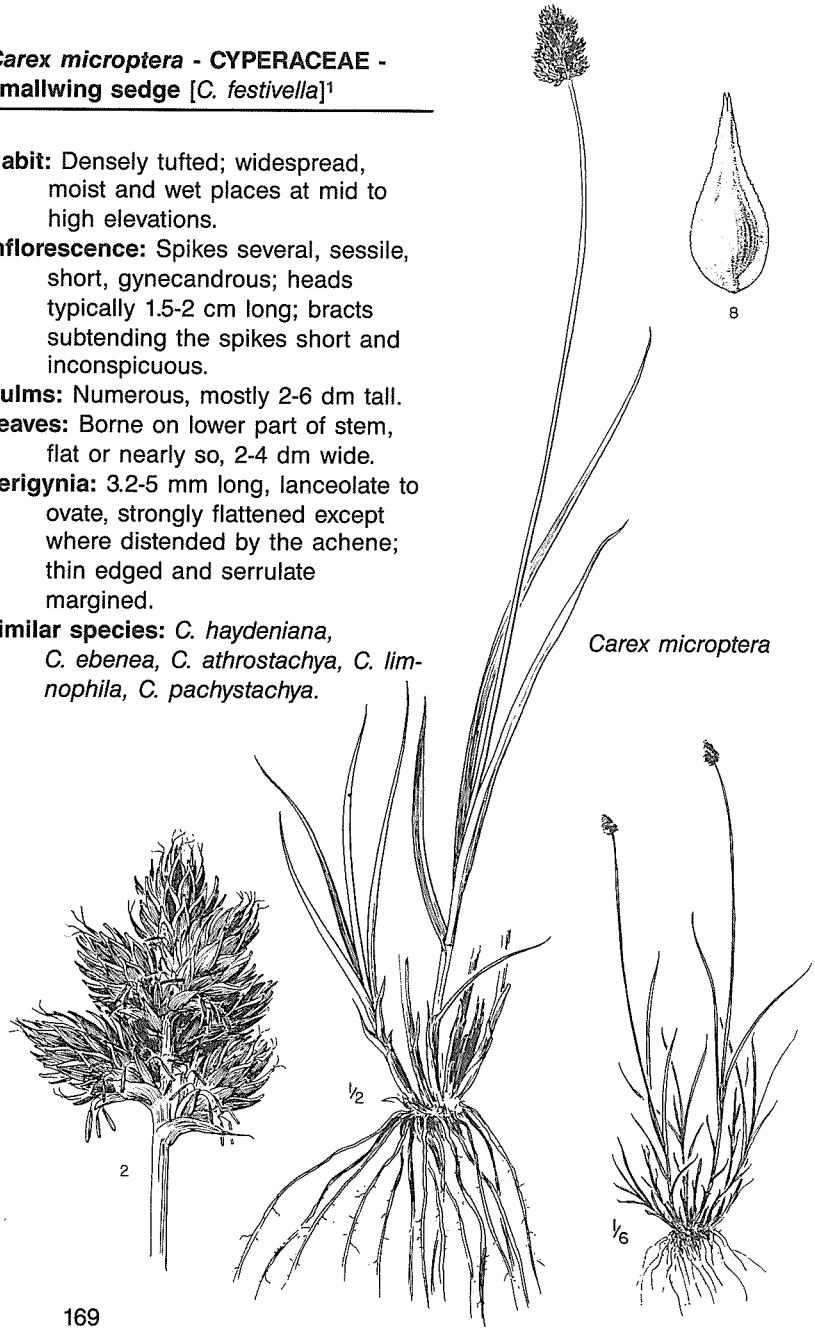


Carex limosa - CYPERACEAE - mud sedge[1]

Habit: Rhizomatous; floating bogs and boggy soils, above 2 560 m (8,400 ft).
Inflorescence: 1-2 lateral spikes; spikes drooping on peduncles 5-22 mm long.
Culms: Plants 1.3-2.6 dm tall, arising from slender rhizomes.
Leaves: Blades 0.5-1.5 mm wide, more or less flat, arising mostly from the lower half of the culm.
Perigynia: Pale green and densely white-granular; pistillate scales greenish brown to dark reddish brown with a green midrib, obtuse to acute.
Pistil: Stigmas 3; achene trigonous.
Similar species: *C. paupercula* (occurs on similar sites; main distinction is the narrower, more acute pistillate scales of *C. paupercula;* in addition *C. paupercula* may have a few staminate flowers at the **base** of the pistillate spikes, *C. limosa* may have a few staminate flowers at the **tip** of the pistillate spikes).

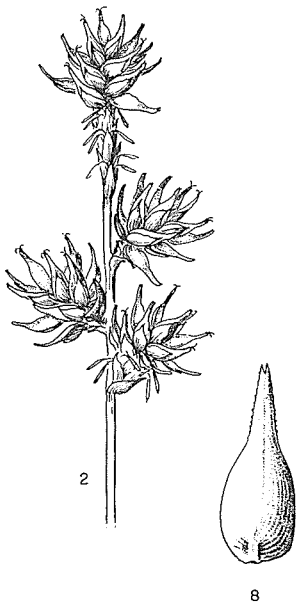
Carex microptera - CYPERACEAE - smallwing sedge [*C. festivella*][1]

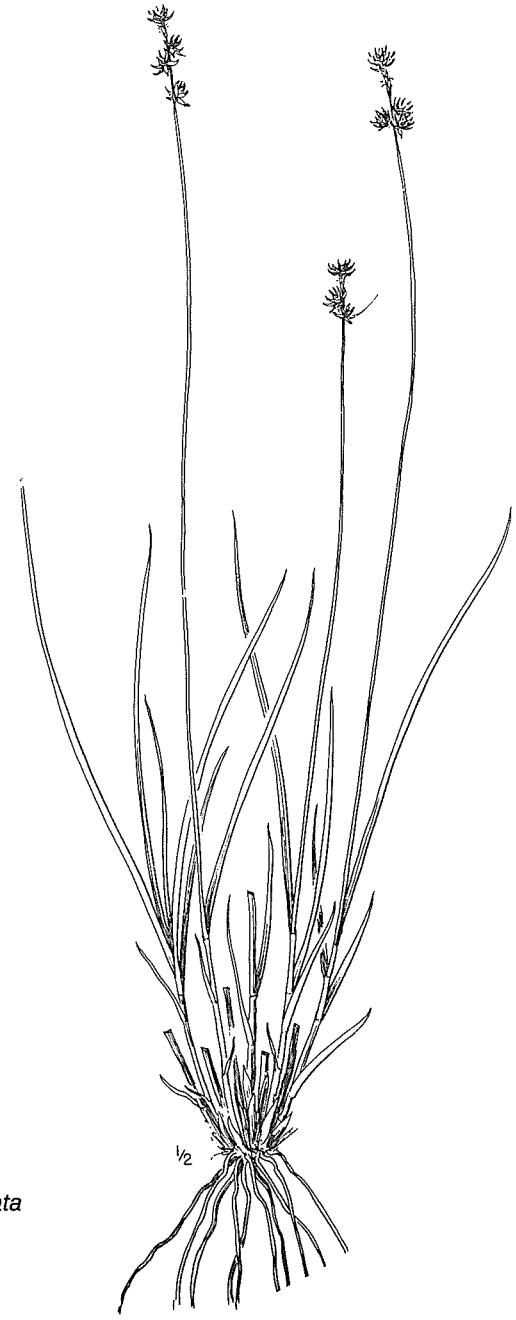
Habit: Densely tufted; widespread, moist and wet places at mid to high elevations.
Inflorescence: Spikes several, sessile, short, gynecandrous; heads typically 1.5-2 cm long; bracts subtending the spikes short and inconspicuous.
Culms: Numerous, mostly 2-6 dm tall.
Leaves: Borne on lower part of stem, flat or nearly so, 2-4 dm wide.
Perigynia: 3.2-5 mm long, lanceolate to ovate, strongly flattened except where distended by the achene; thin edged and serrulate margined.
Similar species: *C. haydeniana, C. ebenea, C. athrostachya, C. limnophila, C. pachystachya.*



Carex muricata - CYPERACEAE - pointed sedge[1]

Habit: Densely tufted; wet meadows and boggy soils at mid to high elevations.
Inflorescence: 1-2.3 cm long; terminal spikes gynecandrous; lateral spikes few-flowered; perigynia widely spreading.
Culms: 1-3 dm tall, arising from densely tufted bases.
Leaves: Blades 1-2.2 mm wide, flat.
Perigynia: Conspicuously beaked, marginal nerves prominent; pistillate scales pale green or stramineous with a pale midrib and hyeline margins.
Pistil: Stigmas 2; achene lenticular.
Similar species: *C. interior* (appears more common on calcareous or more basic substrates).





Carex muricata

***Carex nebrascensis* - CYPERACEAE - Nebraska sedge[1]**

Habit: Rhizomatous—rhizomes long, stout, and scaly; wet meadows, streams, ditches, etc., moderately low to high elevations, tolerant of some alkali.

Inflorescence: Spikes 3-6, erect, sessile or the lower ones evidently penduculate, cylindric and elongate; terminal spike(s) staminate; lowest bract leaf-like, commonly equal to or surpassing the inflorescence.

Culms: Sharply triangular, 2-10 dm tall.

Leaves: Firm, typically 4-10 mm wide; blue-glaucous.

Perigynia: Elliptic to obovate; 3-4 mm long including the beak; 5- to 10-nerved on both faces; beak 0.4-0.6 mm.

Pistil: Stigmas 2; achene lenticular.

Similar species: *C. aquatilis.*

Carex nebrascensis

Carex praegracilis - CYPERACEAE - silver sedge[1]

Habit: Rhizomatous, with black or brownish-black rhizomes; wet to somewhat dry meadows, streams, etc., often saline soils, low to moderately high elevations.

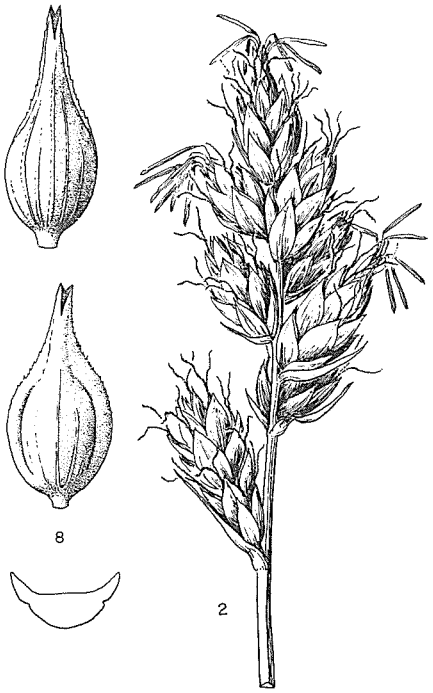
Inflorescence: Spikes 6-25, short, sessile, androgynous or some plants largely pistillate and others largely staminate (not truly dioecious); heads typically 1.5-3.5 cm long; lower spikes often somewhat removed; bracts subtending spikes more or less inconspicuous.

Culms: Arising singly or few together, often elongate.

Leaves: Firm, more or less elongate, mostly 1-3 mm wide.

Pergynia: 2.9-3.8 mm long, ovate or lanceolate to elliptic, plano-convex, sharp-edged; beak prominent, 0.6-1.3 mm long.

Similar species: *C. simulata*.



Carex praegracilis

***Carex rostrata* - CYPERACEAE - beaked sedge[1]**

Habit: Plants coarse, strongly rhizomatous; in and around ponds and lakes (commonly in silted-in beaver ponds), swampy meadows, mid to high elevations.

Inflorescence: Spikes several, erect or nearly so, cylindric and elongate; upper spikes staminate, lower ones pistillate; all but the lowest spike typically sessile; pistillate spikes 2-10 cm long and about 1 cm wide.

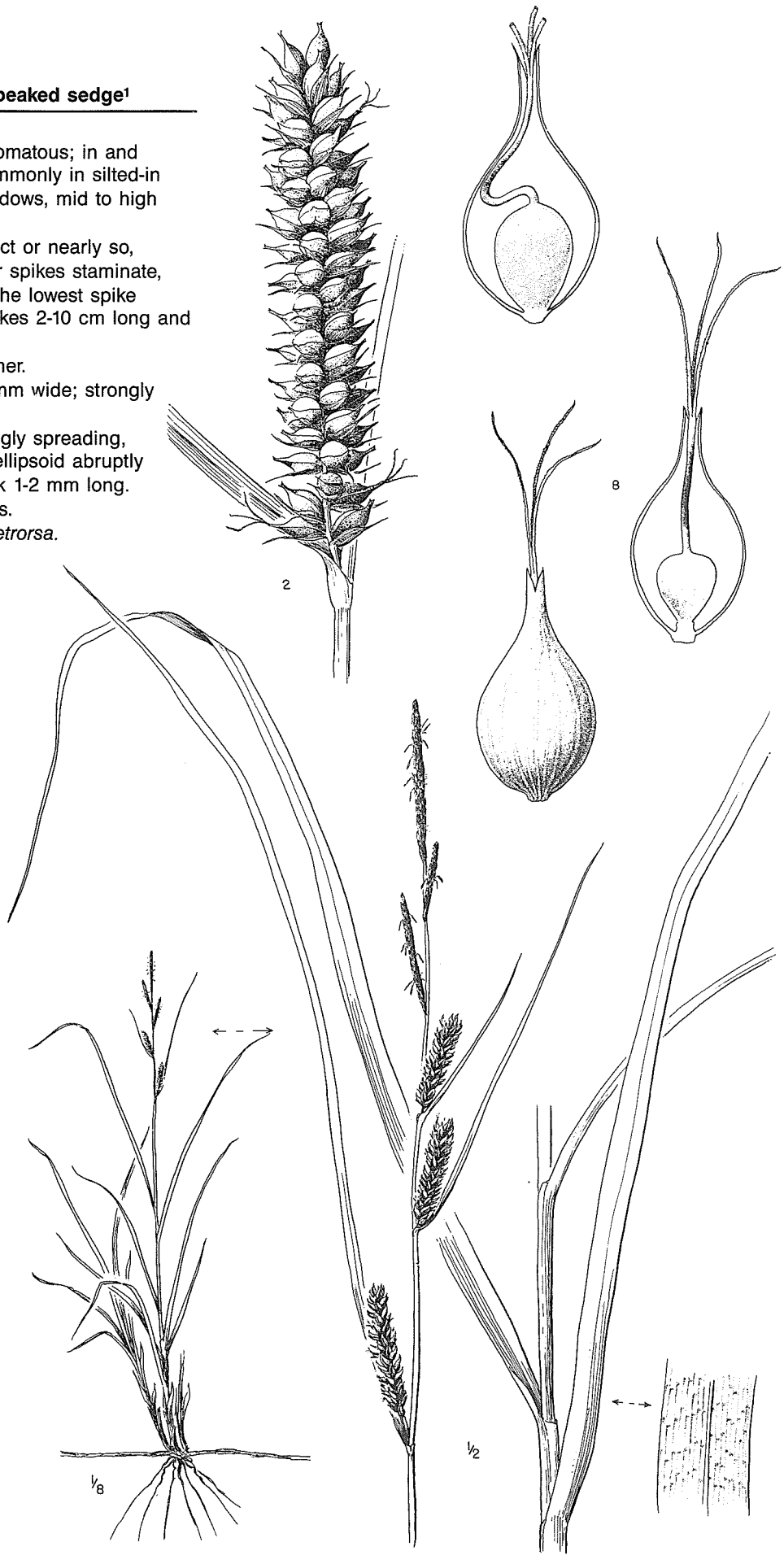
Culms: Arising singly of few together.

Leaves: Firm, flat, elongate, 4-12 mm wide; strongly scabrous.

Perigynia: Densely crowded, strongly spreading, inflated at maturity; broadly ellipsoid abruptly contracted to an evident beak 1-2 mm long.

Pistil: Stigmas 3; achene trigonous.

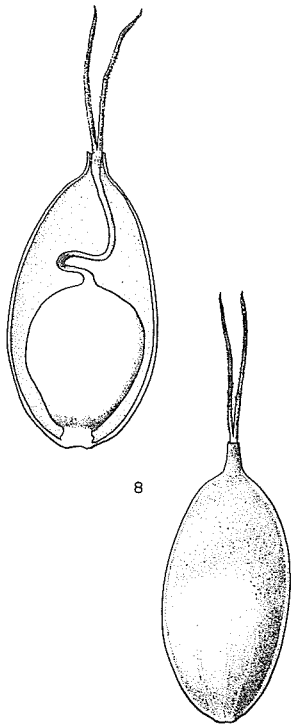
Similar species: *C. vesicaria, C. retrorsa.*



Carex rostrata

Carex saxatilis - CYPERACEAE - russet sedge[1]

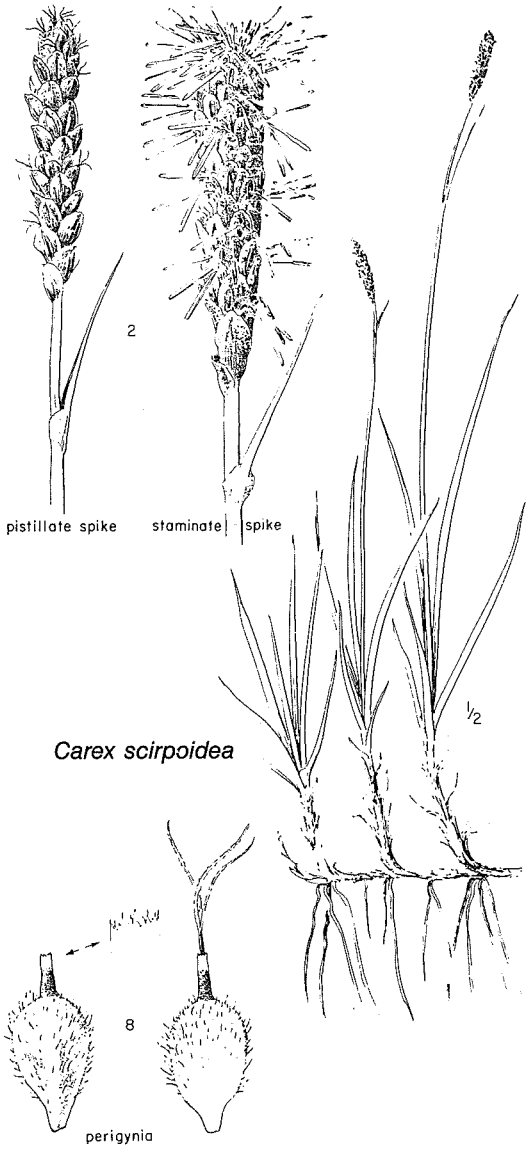
Habit: Rhizomatous; wet to boggy meadows, lake and pond margins at mid elevations to the alpine.
Inflorescence: 4-9 cm long; spikes cylindrical; pistillate spikes 1-2.6 cm long, 5-8 mm wide, sessile or drooping on peduncles to 3 cm long.
Culms: Plants 2-4 dm tall; culms typically arising closely spaced from creeping rhizomes.
Leaves: Blades flat, 1.5-3 mm wide.
Perigynia: Slightly inflated, black or blackish purple, tapering to a short beak; pistillate scales dark brown to purple black or black.
Pistil: Stigmas 2 or occasionally 3; achene lenticular or trigonous.
Similar species: *C. vesicaria,* some specimens of *C. rostrata.*



Carex saxatilis

Carex scirpoidea - CYPERACEAE - false bulrush sedge[2]

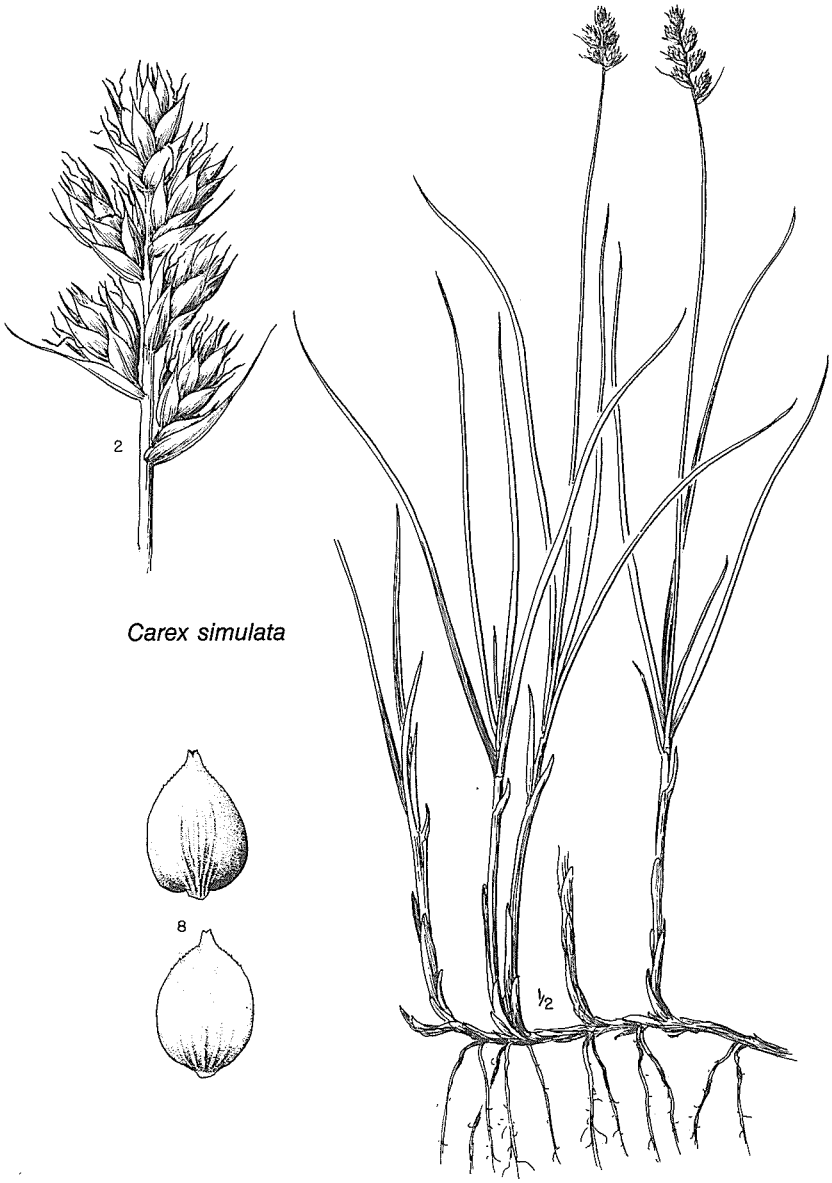
Habit: Short rhizomatous; typically unisexual; dry subalpine meadows, krummholtz, alpine tundra.
Inflorescence: Single terminal spike, cylindric, 1.5-4 cm long; spikes bractless or with inconspicuous basal bract.
Culms: Plants 0.4-4 dm tall
Leaves: Blades linear, 1.5-3.5 cm long, 3-7 mm wide.
Perigynia: obovoid, pubescent; pistillate and staminate scales blackish purple.
Similar species: *Kobresia bellardii, K. simpliciuscula.*



Carex scirpoidea

Carex simulata - CYPERACEAE - analogue sedge[1]

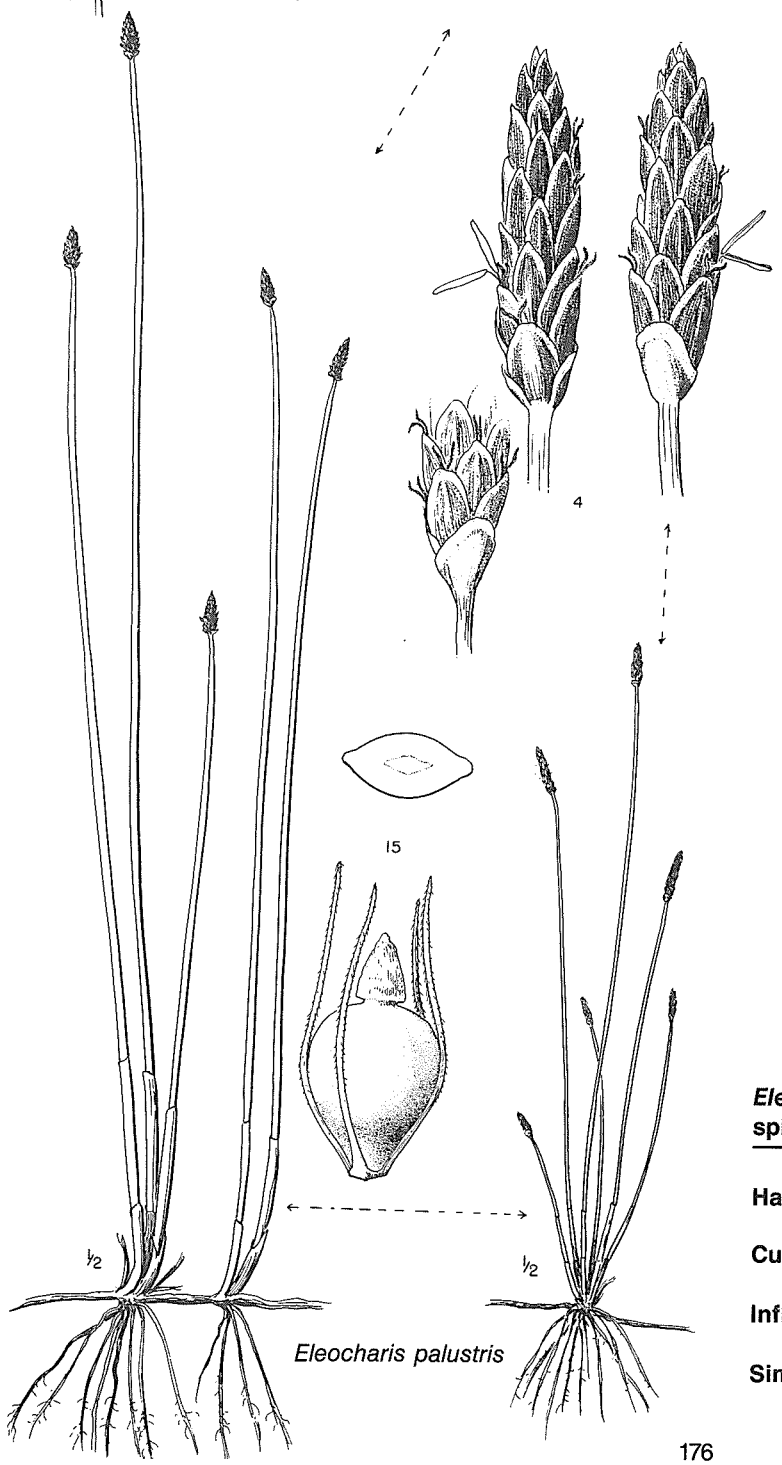
Habit: Rhizomatous—rhizomes brownish to light tan; boggy meadows and streamside communities, mid to moderately high elevations.
Inflorescence: Spikes 8-25, short, sessile, androgynous or plants largely pistillate and others largely staminate (not truly dioecious); heads more or less distinguishable, mostly 1.5-3 cm long; bracts subtending spikes more or less inconspicuous.
Culms: Arising singly or few together.
Leaves: Flat or nearly so, 1-2.5 mm wide.
Perigynia: Relatively small, 1.7-2.4 mm long, ovate or elliptic-ovate, more or less planoconvex; beak very short, 0.2-0.4 mm long.
Similar species: *C. praegracilis.*



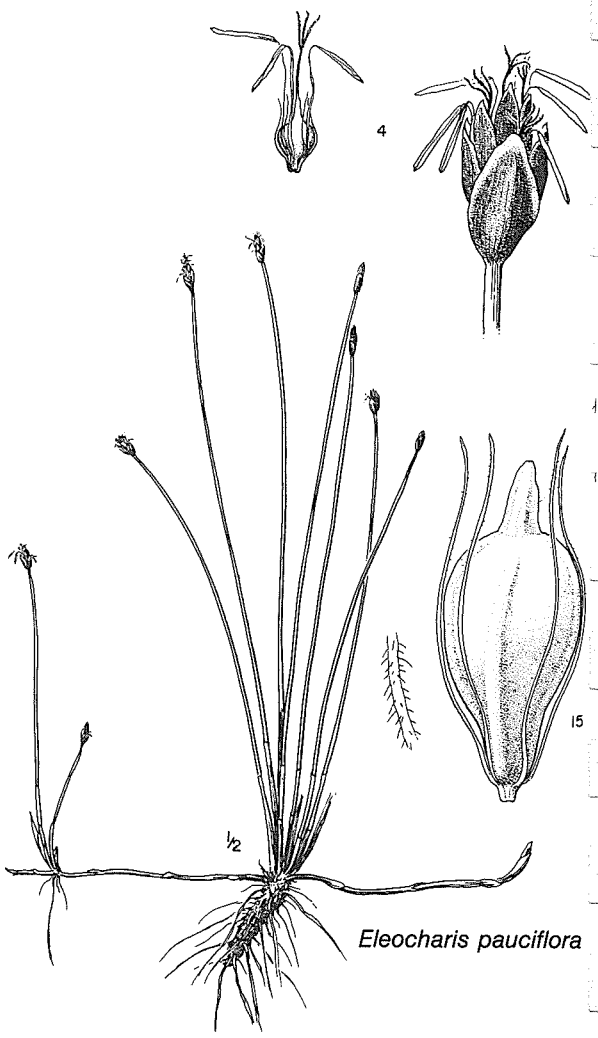
Carex simulata

***Eleocharis palustris* - CYPERACEAE - common spikerush[1]**

Habit: Rhizomatous perennial; lake and pond margins and other wet places, often in shallow, standing water, moderately low to high elevations.
Culms: Scattered or in small clusters on the rhizome, slender to stout; 1-10 dm tall.
Inflorescence: Spikelets single, terminal 5-23 mm long; stigmas 2.
Similar species: *E. pauciflora, E. parishii.*



Eleocharis palustris



Eleocharis pauciflora

***Eleocharis pauciflora* - CYPERACEAE - few-flowered spikerush[1]**

Habit: Rhizomatous perennial; wet and boggy meadows and along streams moderate to high elevations.
Culms: Arising singly or few together or occasionally tufted from slender rhizomes; culms 7-20 cm tall.
Inflorescence: Spikelets single, terminal 4-8 mm long; stigmas 3.
Similar species: *Scirpus caesptosus, E. parishii.*

***Juncus balticus* - JUNCACEAE - baltic rush[1]**
[*J. arcticus* var. *balticus*]

Habit: Rhizomatous; widespread in low, wet, often alkaline places from valleys to mid elevations.

Culms: Stems firm, wiry 3-9 dm tall, 1.5 to 3 mm thick; closely or loosely distributed on rhizomes.

Leaves: Bladeless or nearly so; lowest bract of the inflorescence terete, 2-20 cm long, appearing to be a continuation of the stem.

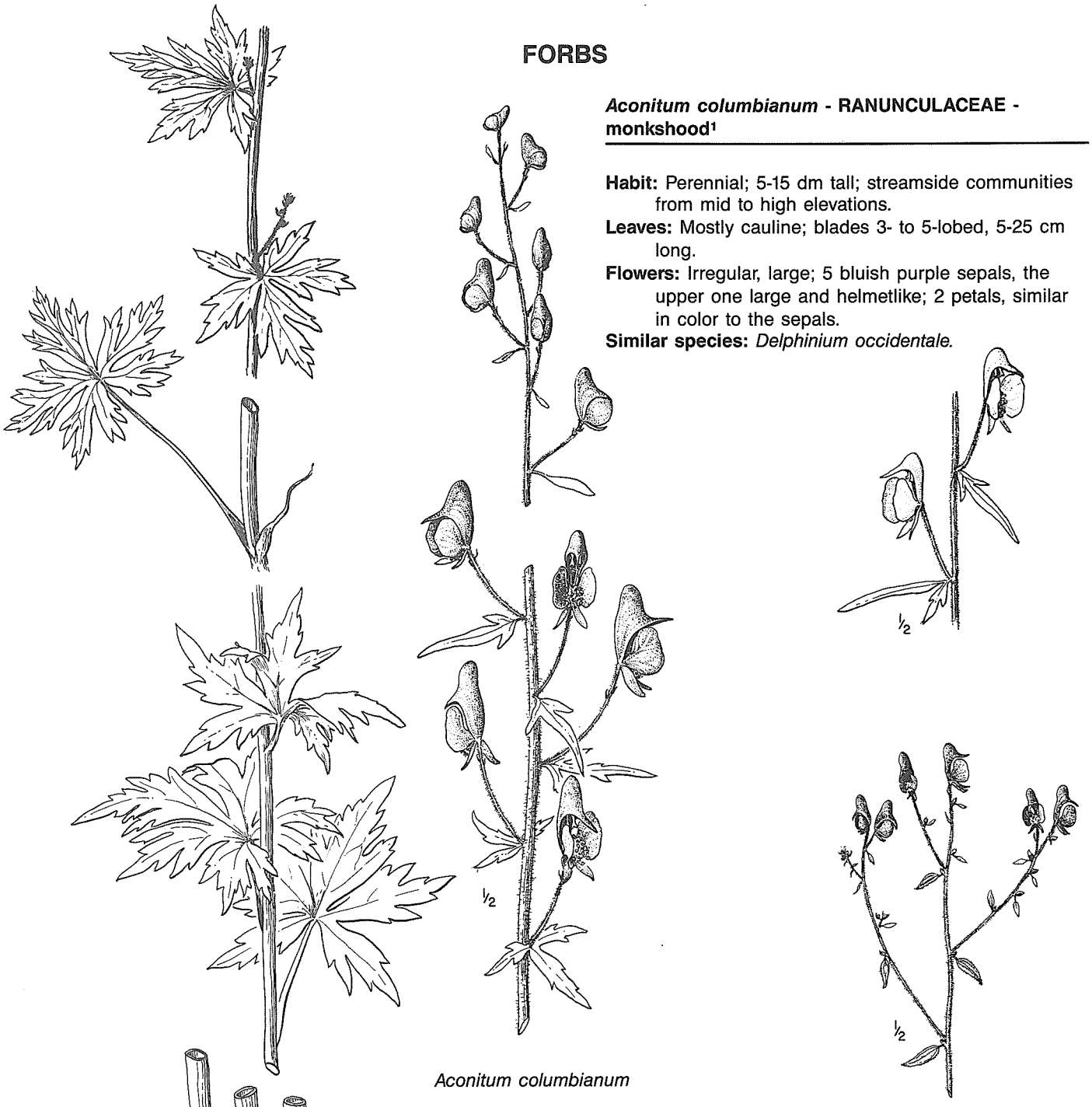
Inflorescence: Variable, (5)10-50 flowered in compact to loose inflorescence, appearing lateral.

Similar species: *J. filiformis.*

Juncus balticus

***Aconitum columbianum* - RANUNCULACEAE - monkshood[1]**

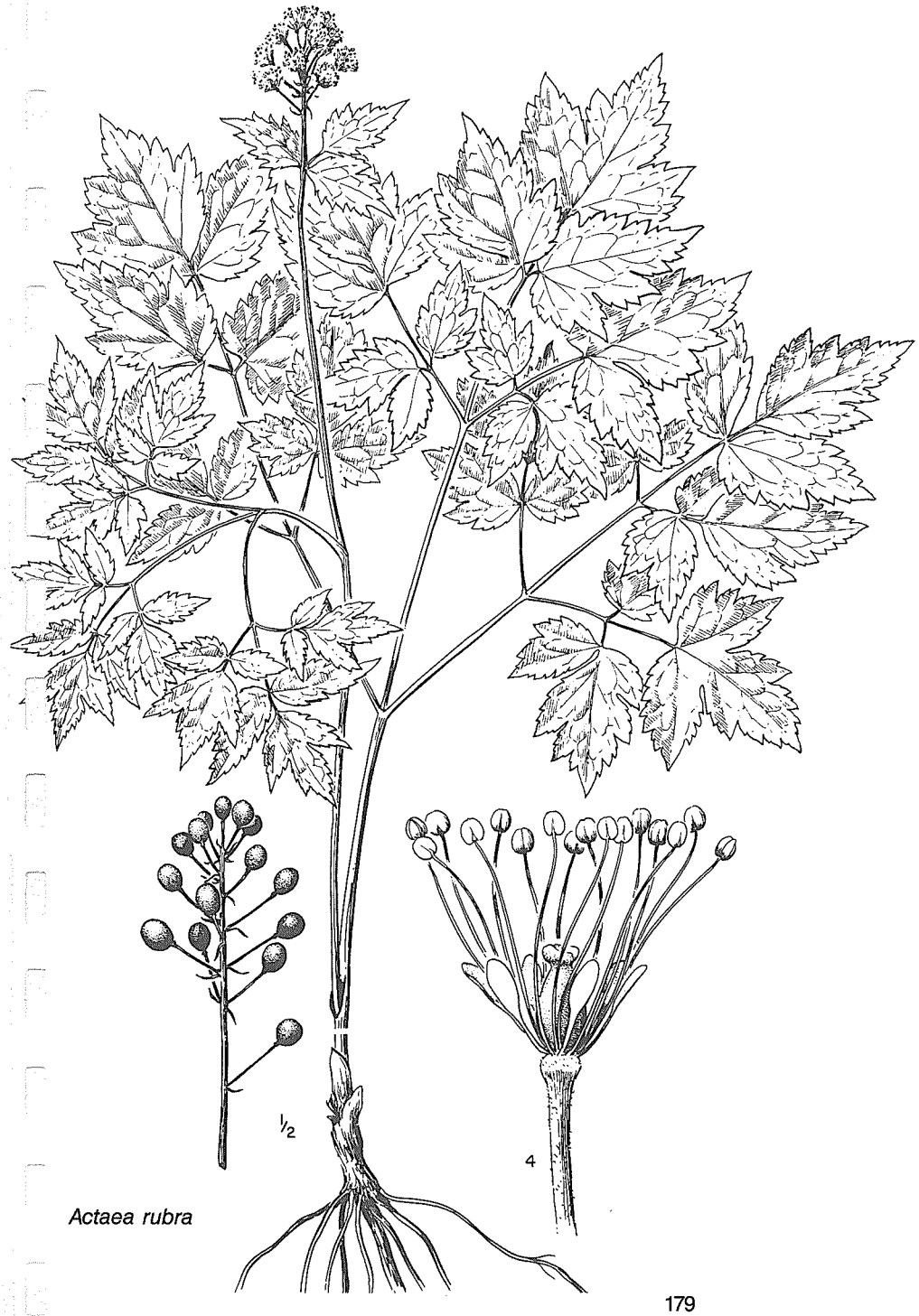
Habit: Perennial; 5-15 dm tall; streamside communities from mid to high elevations.
Leaves: Mostly cauline; blades 3- to 5-lobed, 5-25 cm long.
Flowers: Irregular, large; 5 bluish purple sepals, the upper one large and helmetlike; 2 petals, similar in color to the sepals.
Similar species: *Delphinium occidentale.*



Aconitum columbianum

Actaea rubra - RANUNCULACEAE - baneberry[1]

Habit: Perennial; 1 to several stems, 4-10 dm tall, usually branched; moist woodlands, moderate to high elevations.
Leaves: Large, biternately or biternately-pinately dissected; sharply toothed.
Inflorescence: Flowers many, in axillary and terminal racemes.
Flowers: Petals narrow, antners numberous; more or less inconspicuous individually.
Fruit: Typically bright red though occasionally may be white, roundish berry.



Actaea rubra

Artemisia scopulorum - ASTERACEAE - dwarf sagewort[1]

Habit: Perennial forb, 0.5-3.7 dm tall from simple or branched caudex; talus slopes, moraines, and moist slopes from subalpine to alpine.
Leaves: Basal rosette, bipinnate, pubescent, 1.5-9 cm long.
Inflorescence: Spicate to racemose with several heads; composite, rayless heads erect to nodding; involucral bracts villous, 3-5 mm long.

Artemisia scopulorum

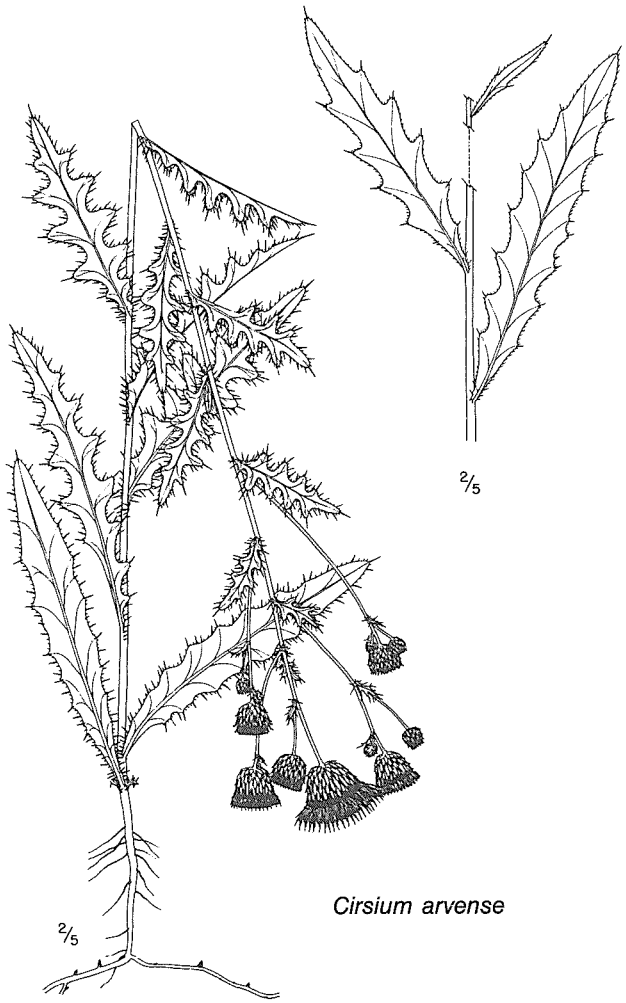
Caltha leptosepala - **RANUNCULACEAE - marsh marigold[1]**

Habit: Perennial; subrhizomatous herbs; wet meadows, seeps, springs, mid elevations to the alpine.
Leaves: Basal, 4-30 cm long, oval- to oblong-cordate; stems usually with a single leaf.
Inflorescence: 1-flowered on peduncles 4-33 cm long; flowers regular, showy; sepals white, 5-12, often yellow-tipped; petals lacking; stamens numerous.
Fruit: Subsessile follicle, 5 to many.

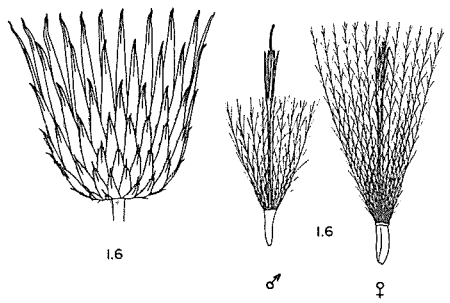
Caltha leptosepala

Cirsium arvense - **ASTERACEAE - Canada thistle[1]**

Habit: Introduced perennial; rhizomatous; disturbed sites, widespread at low to mid elevations.
Leaves: 3-15 cm long, 1-6 cm wide; deeply pinnatifid, basal and cauline.
Inflorescence: Composite flower head, numerous heads; involucral bracts spine tipped; corollas pink-purple to whitish.
Similar species: Several species of *Cirsium* have similar leaves and are difficult to distinguish, especially in the vegetative state.

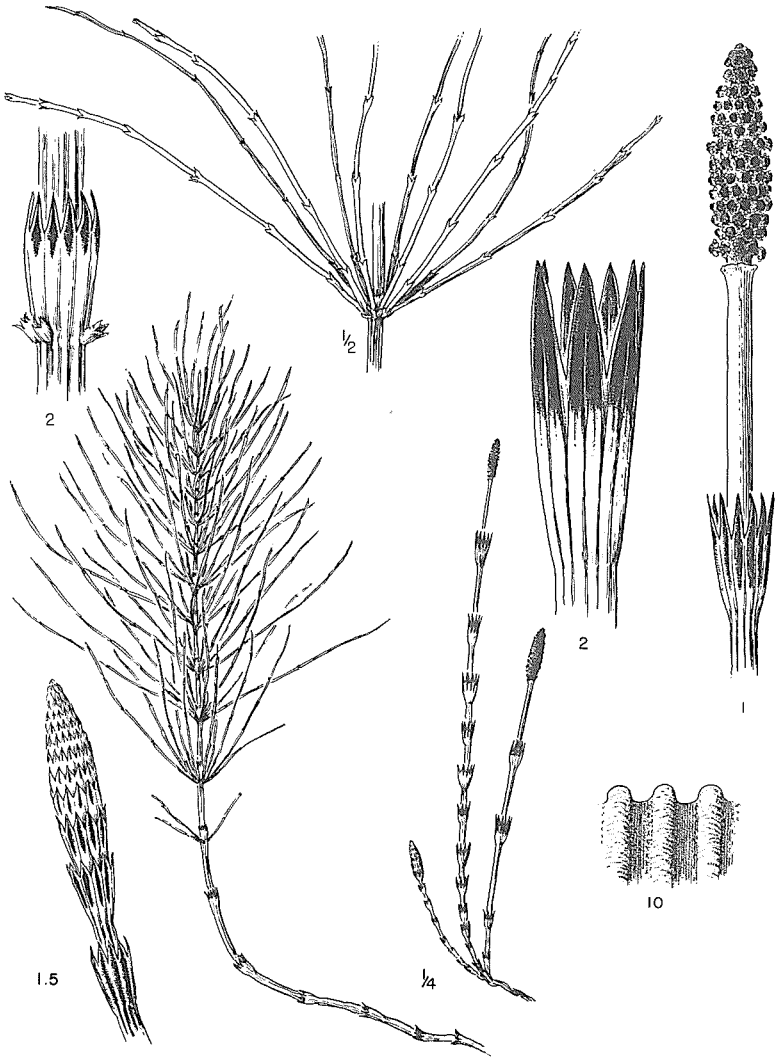


Cirsium arvense



Equisetum arvense - EQUISETACEAE - common horsetail[1]

Habit: Colonial perennials; rhizomatous; wet places especially near streams, to high elevations.
Stems: Epidermis with silicified cell walls, rough to the touch; aerial stems annual, dimorphic; sterile stems typically 1.5-6 dm tall with branches in whorls; fertile stems short-lived, up to 3 dm tall.



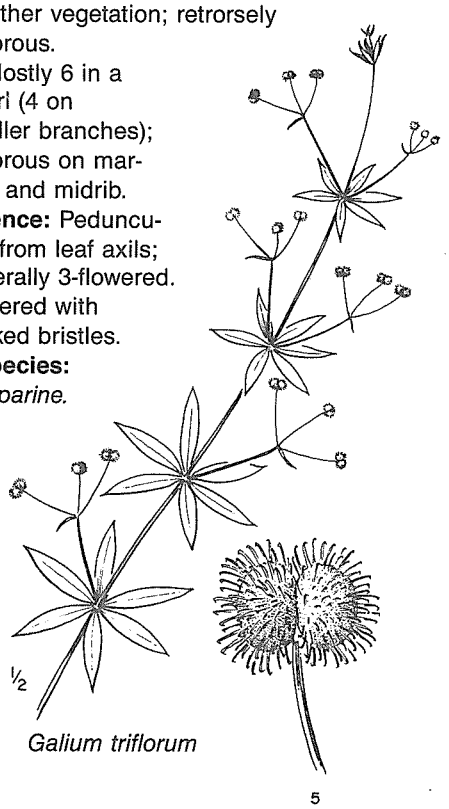
Equisetum arvense

Geranium richardsonii - GERANIACEAE - Richardson geranium[1]

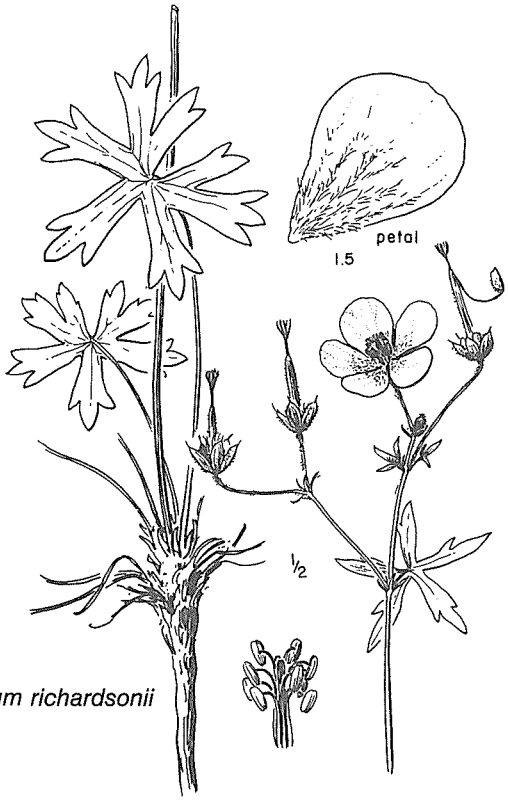
Habit: Perennial; arising from a branched caudex; widespread in riparian, shrub, and forested communities from mid to subalpine elevations.
Leaves: Mostly basal; palmately 3- to 7-lobed.
Inflorescence: Flowers regular (5-petals, 5-sepals), usually 2 per peduncle; petals white to pale lavender with darker veins.
Pistils: Style 1.6-2.8 cm long.
Similar species: *G. viscosissimum, G. caespitosum.*

Galium triflorum - RUBIACEAE - sweetscented bedstraw[1]

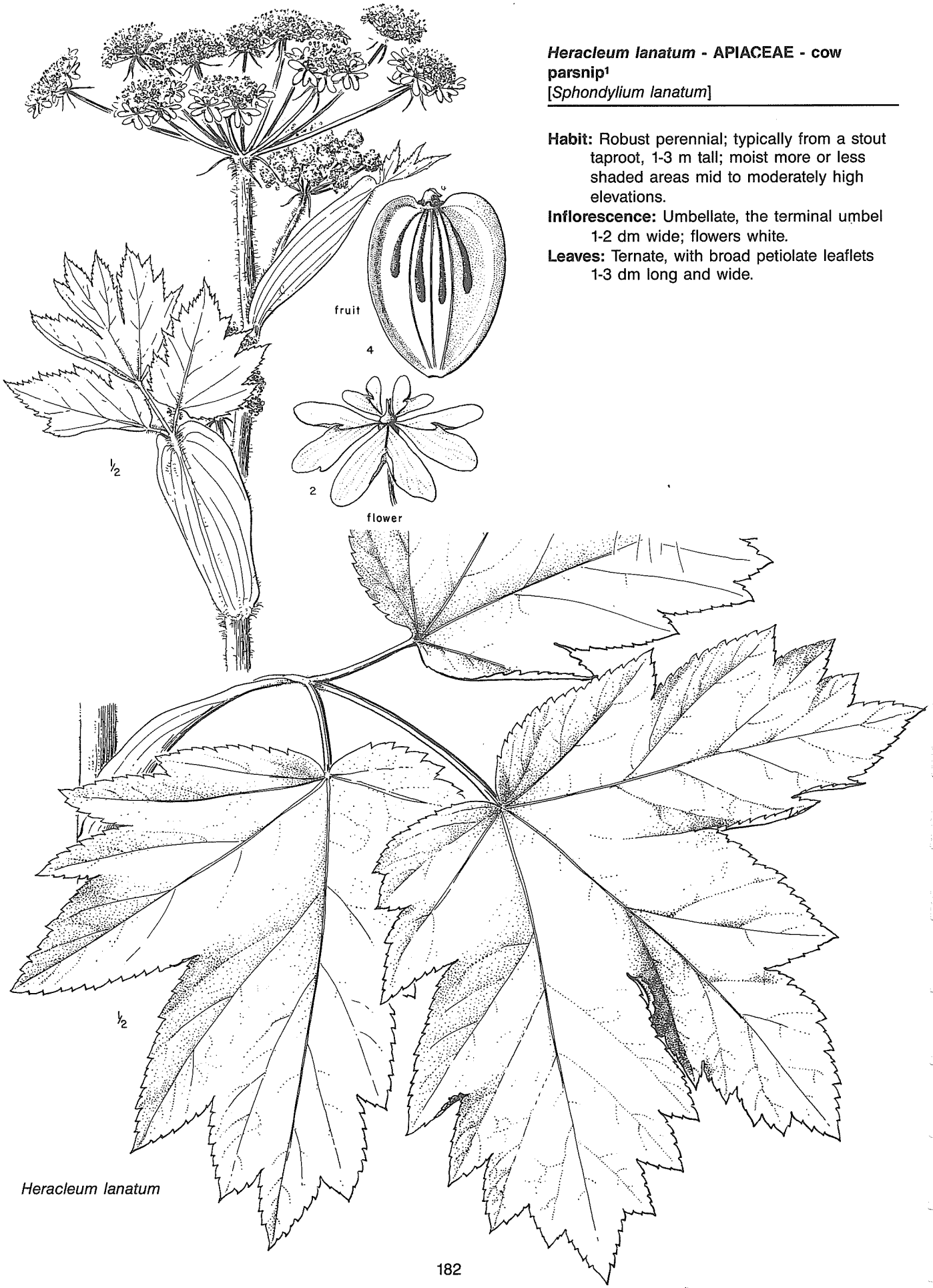
Habit: Perennial; from creeping rhizomes; moist shaded and wooded places at mid elevations.
Stems: 2-8 cm long, prostrate or ascending on other vegetation; retrorsely scabrous.
Leaves: Mostly 6 in a whorl (4 on smaller branches); scabrous on margins and midrib.
Inflorescence: Peduncu-late from leaf axils; generally 3-flowered.
Fruit: Covered with hooked bristles.
Similar species: *G. aparine.*



Galium triflorum



Geranium richardsonii



***Heracleum lanatum* - APIACEAE - cow parsnip[1]**
[*Sphondylium lanatum*]

Habit: Robust perennial; typically from a stout taproot, 1-3 m tall; moist more or less shaded areas mid to moderately high elevations.

Inflorescence: Umbellate, the terminal umbel 1-2 dm wide; flowers white.

Leaves: Ternate, with broad petiolate leaflets 1-3 dm long and wide.

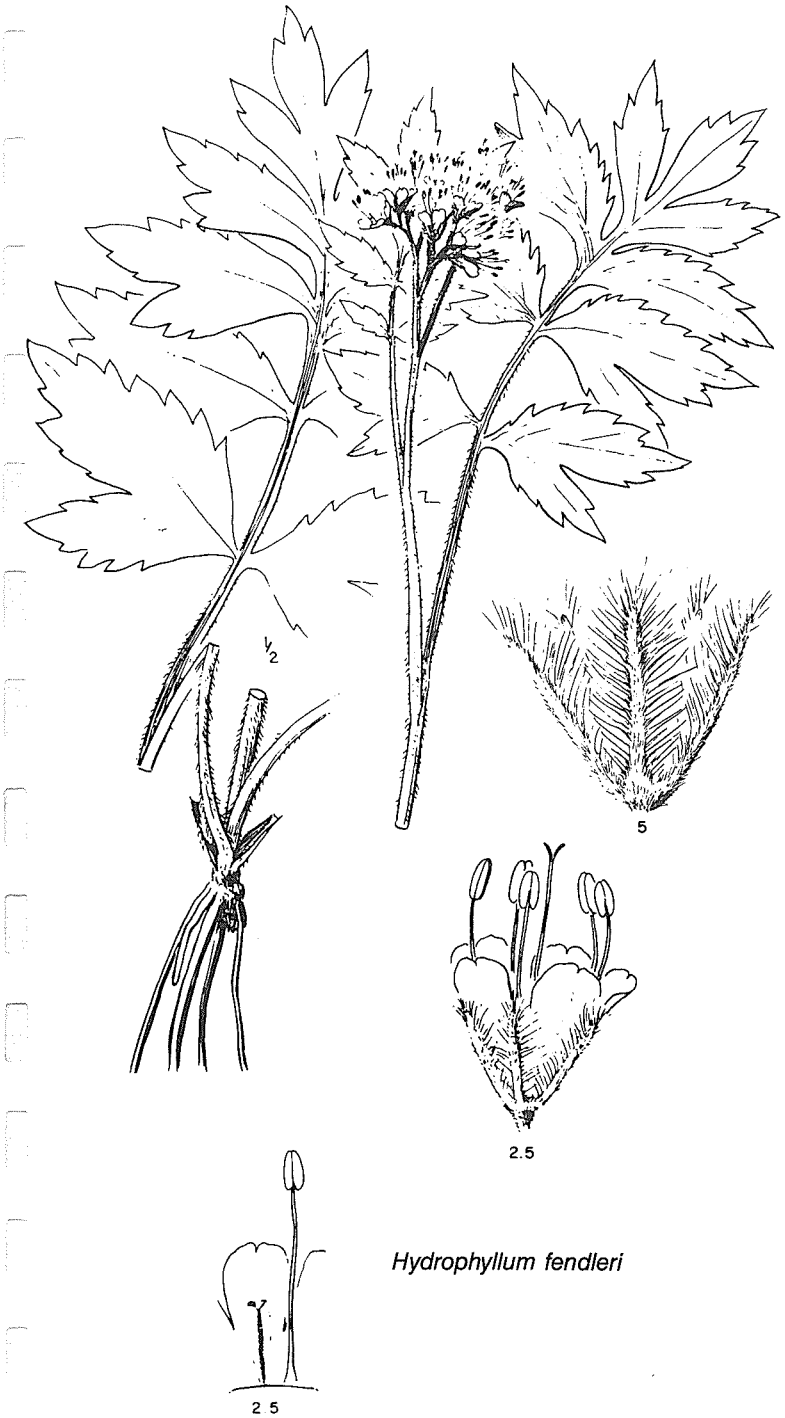
Heracleum lanatum

***Hydrophyllum fendleri* - HYDROPHYLLACEAE - Fendler waterleaf[1]**

Habit: Perennial; from a short rhizome, stems solitary; plants 2-9 dm tall; moist places in the Abajo Mountain of southeastern Utah.

Leaves: Pinnately compound, 5-28 cm long, to 15 cm wide; mostly long petiolate.

Inflorescence: 1-several lax cymes; corolla 6-10 mm long, white to violet; stamens exerted 4-6 mm; style exerted 5-7 mm.



Hydrophyllum fendleri

***Ligusticum tenuifolium* - APIACEAE - small ligusticum[1]**

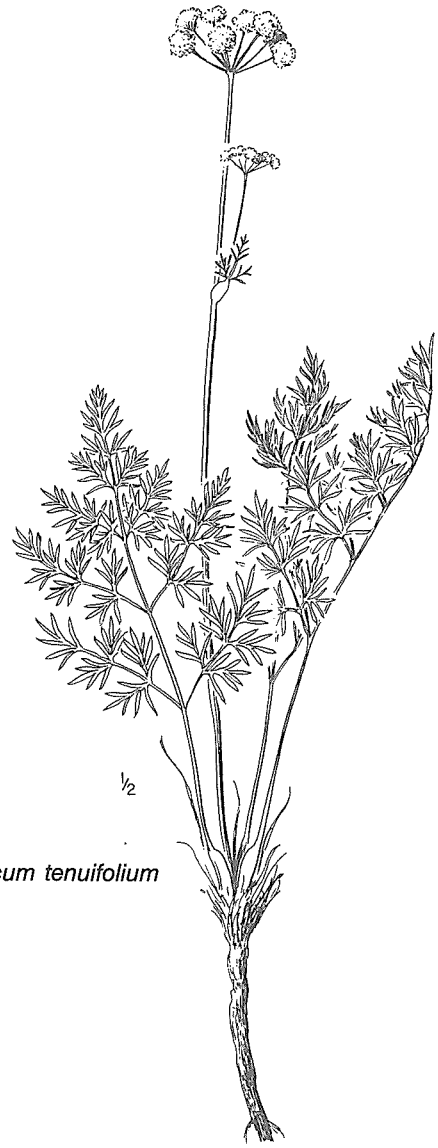
[*L. filicinum* var. *tenuifolium*]

Habit: Perennial; from a taproot; plants 1.1-6.4 dm tall; moist to wet sites in meadows and along streams above 2 440 m (8,000 ft).

Leaves: Basal, ternate, 2-3 times pinnate with 5-7 pairs of lateral primary leaflets; blades 3-19 cm long.

Inflorescence: Solitary umbel or sometimes subtended by 1-2 lateral umbels; calyx absent; petals 1 mm long, white.

Similar species: *L. filicinum.*



Ligusticum tenuifolium

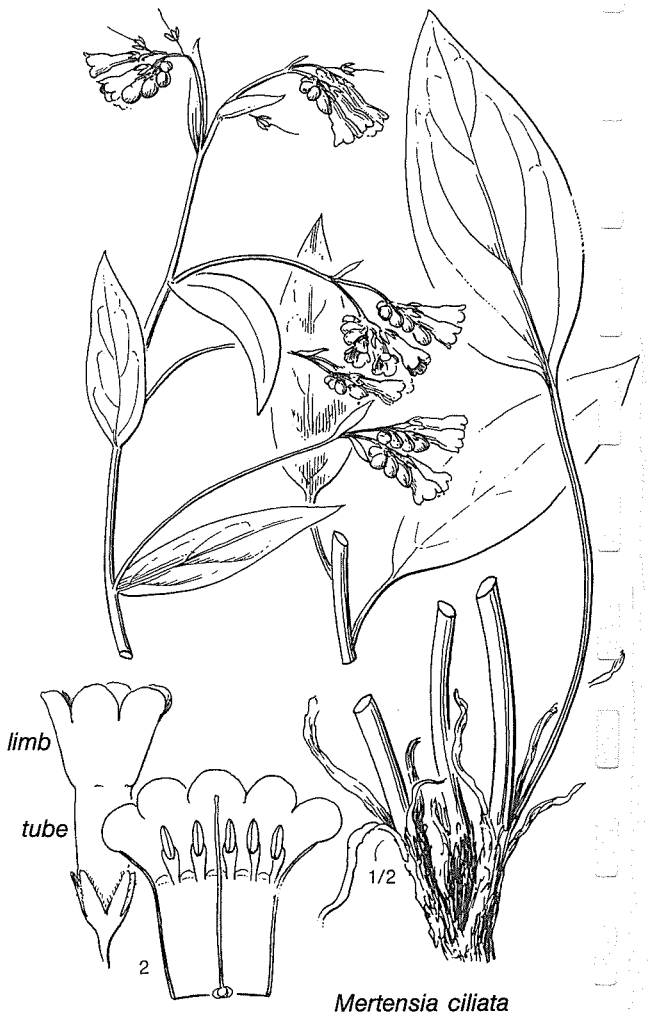
Mertensia arizonica - **BORAGINACEAE - tall bluebells[2]**

Habit: Coarse, leafy-stemmed perennial; growing from a taproot and braching caudex; 3-8 dm tall; moist places especially near streams or meadows mid elevations to subalpine.
Leaves: Evidently veiny, often slightly glaucous, glabrous; sometimes pustulate above but pustules not supporting hairs; basal leaves often lacking but when present, obviously petiolate.
Inflorescence: Open and branching with many flowers, typically drooping.
Flowers: Calyx 3-8 mm long, glabrous except for ciliolate margins; corollas blue, mostly 12-20 mm long, the limb distinctly longer than the tube (see illustration for description of flower parts).
Similar species: *M. ciliata, M. franciscana.*

Mertensia arizonica

Mertensia ciliata - **BORAGINACEAE - streamside bluebells[2]**

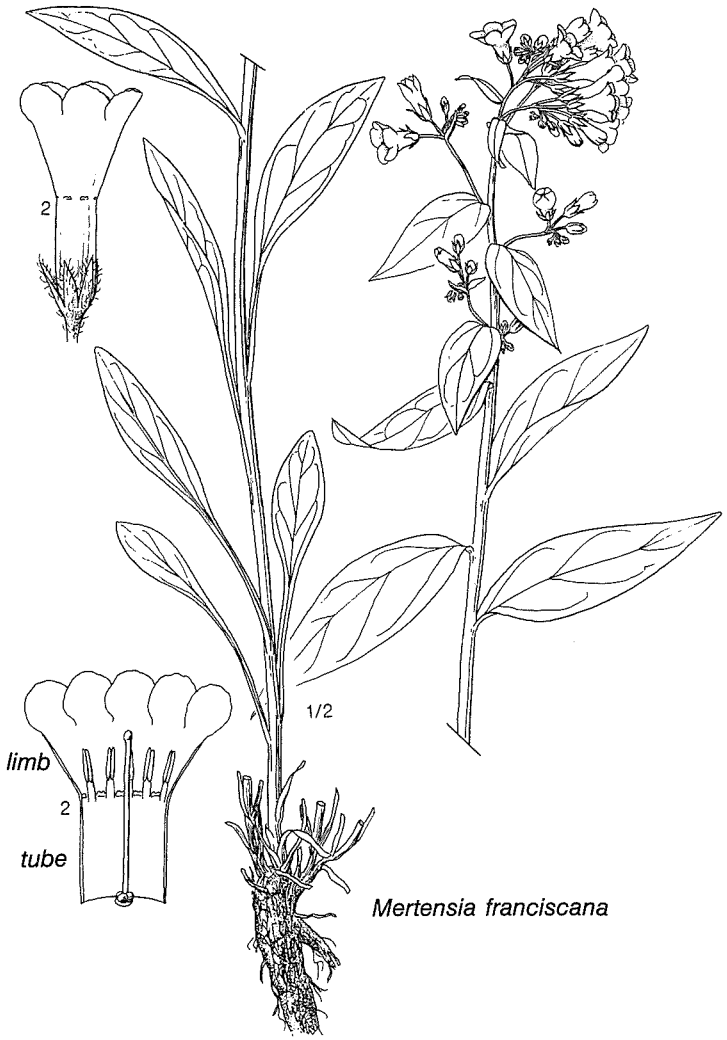
Habit: Coarse, leafy-stemmed perennial; growing from a taproot and braching caudex; 4-10 dm tall; moist often shaded places especially near streams seeps, mid to high elevations.
Leaves: Evidently veiny, often slightly glaucous, glabrous; often pustulate but pustules not supporting hairs; basal leaves when present obviously petiolate; cauline leaves generally tapering to a sessile or subsessile base.
Inflorescence: Open and branching with many flowers, typically drooping.
Flowers: Corollas tubular, blue turning somewhat violet with age, 10-17 mm long; the limb slightly shorter to longer than the tube; calyx 1.5-3 mm long, shortly ciliate on the margins.
Similar species: *M. arizonica, M. franciscana.*



Mertensia ciliata

***Mertensia franciscana* - BORAGINACEAE - Flagstaff bluebells[2]**

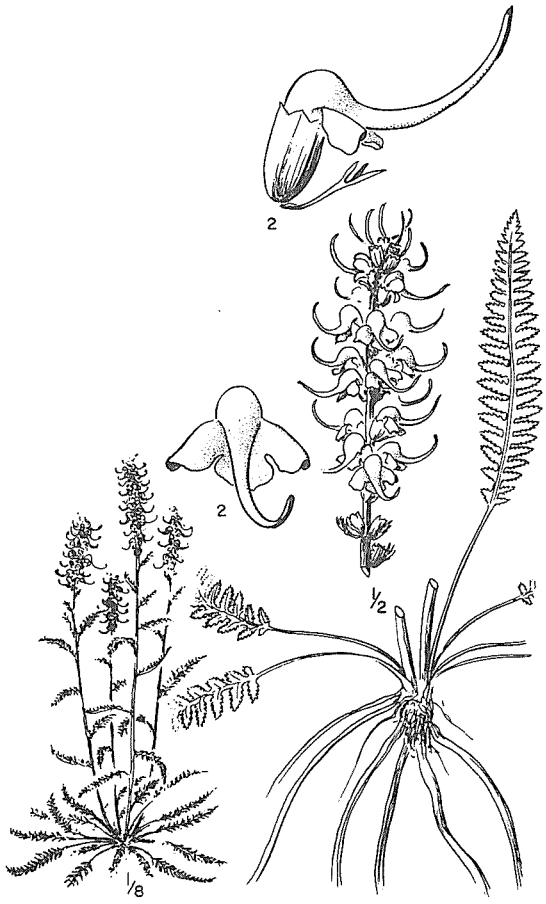
Habit: Coarse, leafy-stemmed perennial; growing from a taproot or braching caudex; 4-10 (15) dm tall; moist or wet meadows and moist open or wooded slopes, mid to high elevations in southern Utah.
Leaves: Evidently veiny, strigose on the upper surface, glabrous to strigose on the lower surface; basal leaves petiolate, often deciduous; cauline leaves generally short-petiolate to sessile.
Inflorescence: Open and branching with many flowers, typically drooping.
Flowers: Corollas tubular, mostly 10-15 mm long; the tube about equal to the slightly flaired limb (see illustrations for description of flower parts); calyx 2.5-4 mm long, ciliate on the margins and often loosely strigose on the backs.
Similar species: *M. arizonica, M. ciliata.*



Mertensia franciscana

***Pedicularis groenlandica* - SCROPHULARIACEAE - elephant's head[1]**
[*Elephantella groenlandica*]

Habit: Perennial; typically 2-4.5 dm tall; wet meadows and streamsides, mid to subalpine elevations.
Leaves: Mostly basal, the cauline ones short; pinnatified, glabrous.
Inflorescence: Spike, densely flowered, 4-15 cm long.
Flowers: Irregular, resembling an elephant's head; violet, pink to purple.
Similar species: *P. attollens.*



Pedicularis groenlandica

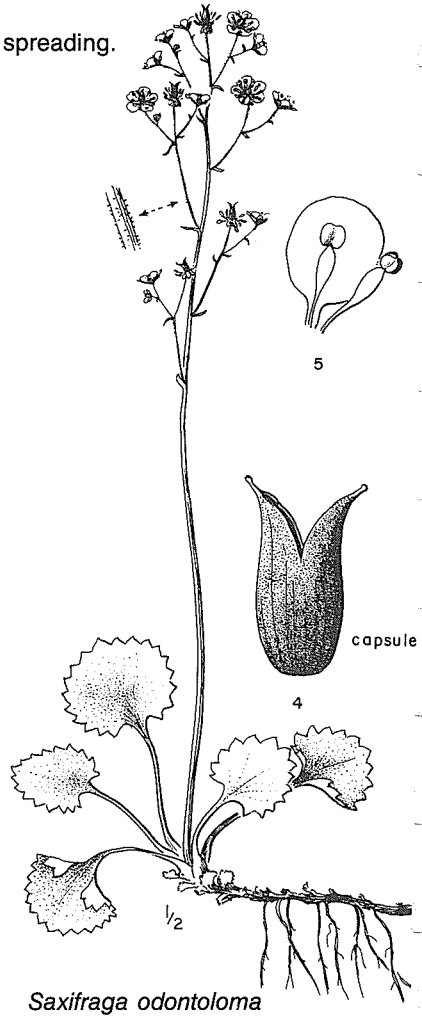
***Polygonum bistortoides* - POLYGONACEAE - American bistort[1]**

Habit: Perennial; from thickened bulblike bases and rhizomes; moist meadows, aspen, and conifer communities at mid to subalpine (alpine) elevations.
Leaves: Basal leaves well developed, 2-20 cm long, 3-35 mm wide; cauline leaves reduced.
Inflorescence: Flowers numerous, in a terminal spikelike raceme, 1-7 cm long; perianth white to sometimes pinkish.
Similar species: *P. viviparum.*

Polygonum bistortoides

***Saxifraga odontoloma* - SAXIFRAGACEAE - brook saxifrage[1]**
[*S. arguta*]

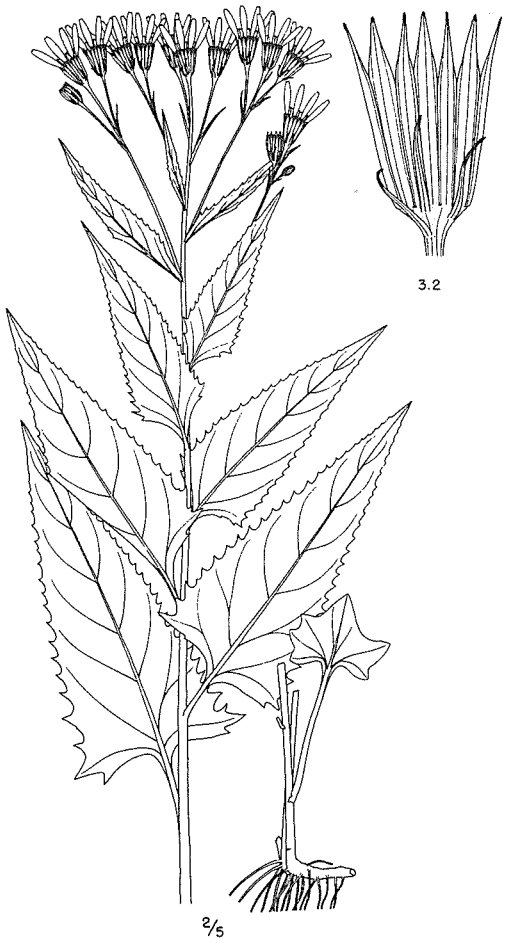
Habit: Perennial; rhizomatous; moist stream banks, seeps, and springs, mid to subalpine elevations.
Leaves: Plants scapose, leaves all basal; blades orbicular to reniform, coarsely dentate.
Inflorescence: Spreading cymose panicle, several flowered.
Flowers: Petals white, spreading.



Saxifraga odontoloma

***Senecio triangularis* - ASTERACEAE - arrowleaf groundsel[1]**

Habit: Perennial; rhizomatous; 2.5-12 dm tall; wet meadows and stream banks, mid to high elevations.
Leaves: stems equally leafy throughout; leaves petiolate, lance-oblong to triangular; typically glabrous, 3-15 cm long, margins dentate.
Inflorescence: Heads few to many; subcorymbose.
Flowers: Composite; 5-9 ray flowers, 6-15 mm long.
Similar species: *S. serra.*



Senecio triangularis

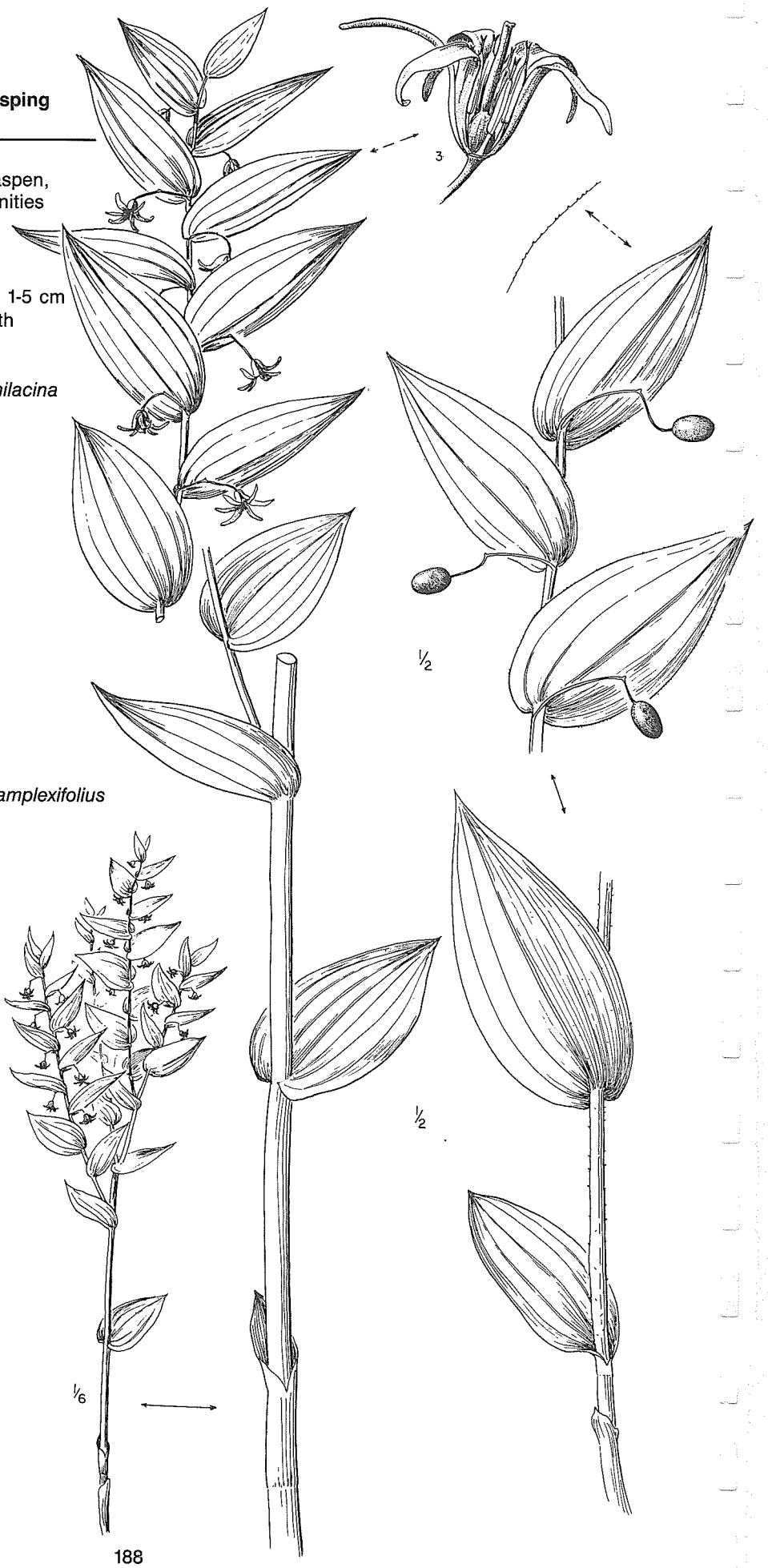
***Smilacina stellata* - LILIACEAE - starry solomon-plume[1]**

Habit: Perennial; rhizomatous; 2-6 dm tall; moist shaded areas at mid elevations.
Leaves: Sessile, parallel-veined, sometimes appearing to spiral up the stem.
Influence: Terminal raceme with 5-10 flowers.
Similar species: *S. racemosa.*

Smilacina stellata

***Streptopus amplexifolius* - LILIACEAE - clasping twisted-stalk[1]**

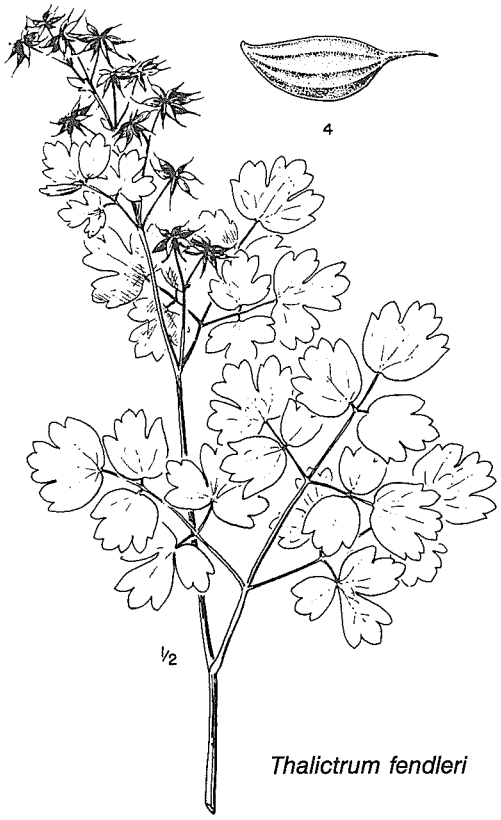
Habit: Perennial; rhizomatous; 3-10 dm tall; aspen, lodgepole, and spruce-fir forest communities above 2 135 m (7,000 ft).
Leaves: Auriculate-clasping, ovate-lanceolate; 5-15 cm long.
Inflorescence: 1- to 2-flowered on peduncles 1-5 cm long, from the upper leaf axiles; perianth yellowish-white, with 6 segments.
Fruit: Red berry, 3-loculed.
Similar species: *Disporum trachycarpum, Smilacina racemosa.*



Streptopus amplexifolius

Thalictrum fendleri - RANUNCULACEAE - Fendler meadowrue[1]

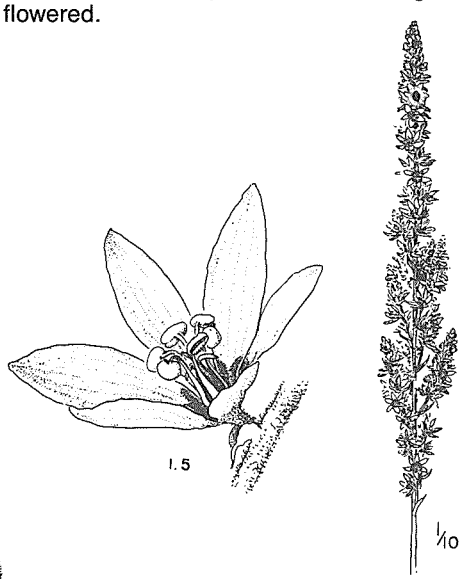
Habit: Dioecious perennial; 3-6 (10) dm tall; moist soils of streams and meadows often in shade, moderately low to high elevations.
Leaves: Compound, 3(4) times ternate; dark green and glabrous above, pale and often glandular beneath.
Fruit: Achenes spreading, 4-7 mm long, strongly compressed.
Inflorescence: Large, leafy-bracteate panicles; flowers inconspicuous, petals lacking, sepals greenish-white.
Similar species: *T. occidentale;* some young vegetative specimens of *Aquilegia.*



Thalictrum fendleri

Veratrum californicum - LILIACEAE - false hellebore[1]

Habit: Erect perennial; colonial, growing from thick rhizomes; 1.5-2 m tall; wet meadows and banks, moderately high to high elevations.
Leaves: Numerous large, broad, coarsely-veined, strongly sheathing at the base; more or less corrugated in appearance.
Inflorescence: Dense, terminal panicle 3-6 cm long, closely flowered.



Veratrum californicum

APPENDIX F. FIELD FORM FOR THE IDENTIFICATION OF UTAH RIPARIAN COMMUNITY TYPES.

Name		Date	Plot Number
Topography	Horizontal Configuration	Location	
1 - Lower slope 2 - Bench or Flat 3 - Stream Bottom 4 - Wide Meadow 5 - Seep	1 - Convex 2 - Straight 3 - Concave 4 - Undulating		
		Topography	Configuration
		Elevation	% Slope

Scientific Name	Canopy Cover %	Scientific Name	Canopy Cover %
TREES		**FORBS**	
Abies lasiocarpa		Aconitum columbianum	
Acer grandidentatum		Actaea rubra	
Acer negundo		Artemisia scopulorum	
Alnus incana		Caltha leptosepala	
Betula occidentalis		Cirsium spp.	
Picea engelmannii		Equisetum arvense	
Picea pungens		Galium triflorum	
Pinus contorta		Geranium richardsonii	
Pseudotsuga menziesii		Heracleum lanatum	
Populus acuminata		Hydrophyllum fendleri	
Populus angustifolia		Ligusticum tenuifolium	
Populus fremontii		Mertensia arizonica	
Populus tremuloides		Mertensia ciliata	
		Mertensia franciscana	
		Polygonum bistortoides	
		Saxifraga odontoloma	
		Senecio triangularis	
		Smilacina stellata	
		Streptopus amplexifolius	
		Taraxacum officinale	
		Thalictrum fendleri	
		Trifolium spp.	
		Typha latifolia	
		Veratrum californicum	
GRAMINOIDS		**SHRUBS**	
Agrostis scabra		Artemisia cana	
Agrostis stolonifera		Betula glandulosa	
Bromus tectorum		Cornus sericea	
Calamagrostis canadensis		Potentilla fruticosa	
Carex aquatilis		Rhus aromatica	
Carex buxbaumii		Rosa spp.	
Carex disperma		Salix bebbiana	
Carex lanuginosa		Salix boothii	
Carex lasiocarpa		Salix drummondiana	
Carex limosa		Salix exigua	
Carex microptera		Salix geyeriana	
Carex muricata		Salix glauca	
Carex nebrascensis		Salix lasiandra	
Carex praegracilis		Salix lasiolepis	
Carex rostrata		Salix lutea	
Carex saxatilis		Salix monticola	
Carex scirpoidea		Salix planifolia	
Carex simulata		Salix wolfii	
Danthonia intermedia			
Deschampsia cespitosa			
Eleocharis palustris			
Eleocharis pauciflora			
Elymus glaucus			
Festuca idahoensis			
Festuca ovina			
Glyceria striata			
Juncus balticus			
Poa palustris			
Poa pratensis			
Poa trivialis			

COMMUNITY TYPE _____

APPENDIX G. OVERSTORY/UNDERGROWTH RELATIONSHIPS OF SOME RIPARIAN COMMUNITY TYPES IN UTAH.

Understory Dominance Groups	Community Types	Miscellaneous Overstories[1]
Cornus sericea	CONIFER/COSE	*Populus tremuloides*
	POAN/COSE	
	ACNE/COSE	
	ALIN/COSE	
	BEOC/COSE	
	COSE/HELA	
Carex aquatilis	SABO/CAAQ	
	SAGE/CAAQ	
	SAWO/CAAQ	
	SAPL/CAAQ	
	CAAQ	
	CALI[2]	
	CABU[2]	
	CASA[2]	
	CALE[2]	
	ELPA2[2]	
Carex rostrata	SABO/CARO	*Salix planifolia*
	SAGE/CARO	*Alnus incana*
	SAWO/CARO	
Equisetum arvense	CONIFER/EQAR	*Betula occidentalis*
	ACNE/EQAR	*Salix lutea*
	ALIN/EQAR	
	SABO/EQAR	
Calamagrostis canadensis	CONIFER/CACA	*Salix wolfii*
	SABO/CACA	
	SAGE/CACA	
	SAPL/CACA	
	CACA	
Mesic Forb	CONIFER/ACCO	*Salix planifolia*
	CONIFER/ACRU	*Salix glauca*
	ALIN/MF	*Populus angustifolia*
	BEOC/MF	*Acer negundo*
	SABO/MF	
	SAGE/MF	
	SAEX/MF	
	SAWO/MF	
Deschampsia cespitosa	CONIFER/DECE	
	POFR/DECE	
	ARCA/DECE	
	SAGE/DECE	
	SAWO/DECE	
	SAPL/DECE	
	SAGL/DECE	
	DECE	
Mesic Graminoid	ALIN/MG	*Salix wolfii*
	SABO/MG	
	SAB0/CANE	
	SAGE/MG	
	SAEX/MG	
	SABE/MG	
	CANE	
	JUBA	
	CAMI	
	CALA[2]	
	DAIN	
Poa pratensis	CONIFER/POPR	*Salix bebbiana*
	POAN/POPR	
	BEOC/POPR	
	POFR/POPR	
	ARCA/POPR	
	SABO/POPR	
	SAGE/POPR	
	SAEX/POPR	
	POPR	

[1] Communities with these overstory dominants have been sampled or noted within the undergrowth guilds.

[2] *Carex aquatilis* is commonly abundant, occasionally codominant in these community types.

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