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Riparian Zone Associations

Deschutes, Ochoco, Fremont, and Winema National Forests

By Bernard L. Kovalchik

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WHY WE CLASSIFY PLANT ASSOCIATIONS

Those who participate in management of National Forests whether they are foresters, engineers, landscape architects, biologists, hydrologists, fuels managers, geologists, or any other specialists, must in reality function as applied ecologists a large part of the time. The reason is that all parts of the ecosystems we manage are linked, and any decisions or recommendation made about one part produces impacts in the other parts when implemented. Thus, an understanding of the interrelationships between all the ecosystem components is essential to making good choices about land management.

One way to index the nature of ecosystem components is through vegetation. Over time, a relatively stable group of plants, or plant association, comes into equilibrium with the physical, chemical and biological environment on a given site (Daubenmire 1968). By knowsomething about the habitat requirements of these plants, we can often infer a great deal about a site's characteristics, just by looking at the vegetation.

William and Lillybridge (1983) highlight three areas where plant associations are most useful:

1. In planning management strategies - evaluating productivity, resource condition and response to disturbance.

2. In communicating about our management experiences - both successes and failures - by providing a common framework for describing forest stands.

3. In application of research - providing a direct link between research results and practical land management.

The goal of the Area Ecology Program is to help those who manage National Forests understand what the presence of different groups of plants, or plant associations, implies. We do this by classifying and naming the associations, by collecting data on their productivity and response to disturbance, by publishing this information and by providing ongoing training to those who use it.

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INTRODUCTION

RIPARIAN ZONE ASSOCIATIONS OF THE DESCHUTES, OCHOCO, FREMONT, AND WINEMA NATIONAL FORESTS

Bernard L. Kovalchik

INTRODUCTION

Riparian zones (ecosystems) occur along the interface between aquatic and terrestrial ecosystems. These water oriented ecosystems are well defined and are surrounded by much drier upslope ecosystems. They make up a minor portion of the landscape but are extremely important in regard to land management and land use. The riparian zone is composed of two distinct ecosystems:

1) The **riparian ecosystem** is that land, next to water, where plants that are dependent on a perpetual source of water occur. Riparian sites include fluvial surfaces such as streambanks, active channel shelves, active floodplains, and overflow channels.

2) The **transitional ecosystem** occurs on sub-irrigated sites that lie between the riparian and upland. It does not have true riparian vegetation such as sedges and willows yet is uniquely different from uplands. Transition sites include inactive floodplains, terraces, toe-slopes, and meadows which have seasonably high water that recedes to below the rooting zone in mid to late summer.

Until recently, the structural, compositional and functional components of riparian zones received little consideration in ecosystem research, management, and planning (Youngblood and others 1985a). Current Forest Service policy calls for riparian resource management concentrating on the importance and unique values of the system, as well as the classification, inventory, and delineation of riparian ecosystems for land management planning (McGuire 1979). Therefore, this classification for riparian zones is timely and desirable.

SCOPE

The area covered by this classification extends along the Cascade Crest from Mount Jefferson in the north to the California border in the south and eastward through the Deschutes, Winema, Ochoco, and Fremont National Forests (Figure 1).

The classification covers riparian and transitional associations that:

1) occur repeatedly in central Oregon,

2) are large enough to be mapped for project level wildland management, and

3) have distinct management differences.

This classification supplements and expands the riparian information presented in plant association guides by Hall (1973), Volland (1976), Hopkins (1979a and b), and Hopkins and Kovalchik (1983).

Aquatic ecosystems are not included in the classification. Intermittent streams, dry draws, and other land features that may at times transport water but do not support riparian zone vegetation are not included in the classification. Wilderness areas were lightly sampled so that the author could concentrate efforts on riparian ecosystems within intensively managed portions of the Forests. Some portions of the National Forests, such as the Crooked River National Grassland, Maury Mountains, Rager District, and Warner Mountains, may be weakly represented because of the lack of riparian ecosystems in late seral to climax ecological status.

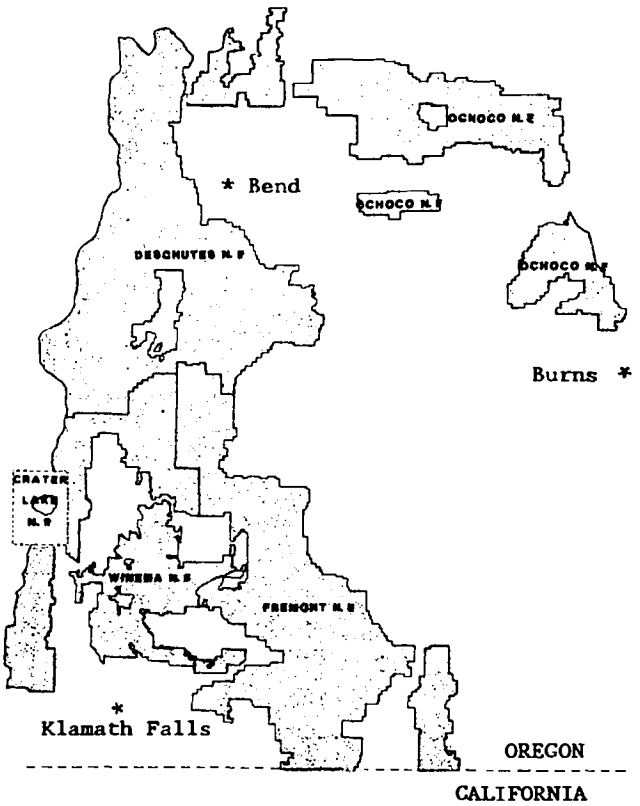


Figure 1. Area covered by this classification showing boundaries of National Forests and major towns.

OBJECTIVES

The objectives of this study are:

1) Describe the general geographic, topographic, edaphic, functional, and floristic features of riparian ecosystems.

2) Describe successional trends and predict vegetative potential on disturbed riparian ecosystems.

3) Present information on resource values and management opportunities.

4) Contribute to the broad regional classification program of the USDA Forest Service, Region 6.

METHODS

Field Methods

Procedures used to collect the information for developing the riparian classification included:

1) Riparian ecosystems throughout central Oregon were sampled in 1982 - 1985. The data base for development of the classification consisted of 637 sample plots. Plots were selected to represent the best available environmental conditions of an area. Climax riparian stands were sampled whenever available. In areas of consistently high levels of disturbance, climax stands were difficult to find and mid to late seral stands were sampled. The classification provides a foundation of associations in climax and late seral ecological status against which stands in all stages of condition can be compared in determining their potential.

2) Reconnaissance of drainages was made prior to plot selection. Samples were then located in reaches of riparian zones that reflected best conditions. A stream reach might include several progressively drier, distinct associations on the various fluvial surfaces occurring between the aquatic and upland ecosystems. A sketch was prepared delineating each association occurring in the reach and each association became a plot. Plot size was unlimited as long as the investigator could see the whole plot, the plot was representative of the stand, and it did not include ecotones.

3) A complete inventory of vascular plants, including estimates of canopy cover, was done in the plot. Generally, this was to the nearest percent up to 10 percent canopy cover, and to the nearest 5 percent thereafter. Plants not field identified were collected for later identification in the office. Collections of all willows (Salix spp.) and most sedges (Carex spp.) were made for further study of these difficult genera.

4) A soil description to suborder level was made on all plots using standard pedon descriptions (USDA-SCS 1975). Thickness, moist and dry color. texture, coarse fragments, and root abundance were recorded by horizon. Other soils data included maximum, present, and minimum water table levels, rooting depth, total soil development depth, and parent material. A 3-inch soil auger proved most effective for digging deep pits in wet soils.

5) Other data collected on each plot included elevation, aspect, slope, landform, microtopography, ecological status, and estimates of herbage production. The percent cover of bare ground, gravel, rock, bedrock, and moss was estimated for the soil surface. Brief descriptions of adjacent uplands, the aquatic system, and wildlife habitat were also included. Site index (100 year) and basal area by tree species was collected on each forested plot.

Office Methods

Procedures followed in developing the riparian classification included:

1) All field data were edited and key-punched for vegetational and environmental analyses. Plots were grouped based on dominant lifeform such as graminoid, willow, alder, deciduous forest, or coniferous forest dominated associations. These groups were retained throughout computer analysis. Association tables (appendix B) were made to group stands with similar floristic characteristics. Region 6 ecology programs (Volland and Connelly 1978) such as CLUSTER ANALYSIS, MEANS, DISCRIMINANT ANALYSIS, and ANALYSIS OF VARIANCE along with Cornell Ecological programs including CONDENSE (Singer and Gauch 1979), TWINSPAN, and DECORANA (Hill 1979) provided more objective techniques for analyzing field data.

2) A preliminary dichotomous key to the classification and association tables were developed in 1985. The key was applied to all of the first 3 year's sample plots and revisions made to accommodate misfit data. The key and association tables were used to test the classification during the summer of 1985. New plot data were collected to fill needs recognized during testing.

3) Final editing and computer analysis in the fall of 1985 provided information for the development of updated dichotomous keys and association tables in 1986.

4) A draft manuscript was completed in 1986. Users were trained in the use of the classification. Their comments and those of reviewers were incorporated into the finished manuscript.

5) Information on geomorphology, to include riparian landforms and the interface of the riparian associations with fluvial surfaces, was incorporated into the final publication in 1986 and 1987.

Taxonomic Considerations

Considerable collections were made of willows, sedges, and other difficult genera. Graminoids were compared at the end of the second field season with the University of Idaho Herbarium. Willows were verified by Steven Brunsfeld at the University of Idaho. Willow taxonomy follows Dorn (1977) and Brunsfeld and Johnson (1985). Monocot taxonomy follows Cronquist and others (1977). Other flora follows Hitchcock and Cronquist (1973).

Fourteen willow species and varieties were identified in central Oregon. Many willows bloom before or simultaneously with vegetation development and the characteristics of female and male aments are used for identification. Later, aments are often lacking so that growth form, leaves, and twigs become important identifying criteria. Some species may hybridize while other species are very similar to one another. This has created considerable confusion in nomenclature. Future plans include publishing a key for willows in central Oregon.

Identification of sedges was initially frustrating but difficulties have been largely resolved. The taxonomy for sedges in Hitchcock and Cronquist (1973) required some clarification. Their dichotomies of sedges are based on characteristics that are at times variable and overlapping. A key to the sedges and other grasslike plants will be provided in a species identification supplement.

Aquatic plants presented a problem because of their slow development. A site with the potential of supporting aquatics may not have aquatic growth in June, may have some vegetative development but no flower development in July, and have both vegetative and flowering material available in August. Some of the most common aquatics, such as pondweed, burreed, and bladderwort, were grouped into genera because of the difficulty in identification to species without flowering parts.

CLASSIFICATION CONCEPTS AND TERMONOLOGY

Community Type Versus Association Concepts

The **community type** and **plant association** are the basic units of the classification. Pfister and others (1979) defined a **plant community** (community) as an assembly of plants living together, reflecting no particular ecological status. The **community type** is an aggregation of all plant communities distinguished by floristic and structural similarities in both overstory and undergrowth characteristics (Youngblood and others 1985). Pfister and others (1979) also defined the **association** as a climax community type. However, this classification chooses to refer to 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). This potential may change in time with change in the soil and water characteristics of the fluvial surface.

This study concentrated on sampling riparian associations in climax and late seral ecological status and avoided highly disturbed sites. Exceptions are a few important widespread naturalized community types such as the **Kentucky bluegrass community type** and obviously seral communities such as those dominated by aspen.

The riparian associations and community types are interdependent with the various fluvial surfaces within a riparian landform. Together, they provide a meaningful way of integrating the various environmental factors such as water regime and soils that affect vegetation. They represent a relatively narrow portion of the environmental variation and reflects a certain potential for vegetation and fluvial surface development. Therefore, the riparian association and community type provide an ecological basis for management oriented guidelines related to ecological status, wildlife, fisheries, productivity, silviculture, succession, range management, and mapping. The following four criteria must be met before a particular assemblage of plants can be classified as a riparian association or community type (Hall 1973):

1) The association (or community type) differs from other associations in opportunities and limitations to land management.

2) The association can be recognized on the ground in any stage of disturbance.

3) The association has limited variation in species composition.

4) The association has limited variability in productivity.

NOMENCLATURE

The riparian associations and community types are named on the basis of characteristic or dominant plant species in the various plant layers (trees/shrubs/herbs). A slash (/) is used to separate the various lifeforms in a community name and a dash (-) separates members of the same lifeform. The association may have only one species in its name as in the case of meadows, two where shrubs are superimposed over the herbaceous layer, or three where there are tree, shrub, and herb layers.

Shade tolerance is also a consideration in nomenclature (Williams and Lillybridge 1983). Thus, the name will be suggestive of plants most capable of growing on a site in more mature stands. For example, where lodgepole pine and Engelmann spruce both occupy a site, Engelmann spruce is used in the name because it will dominate the site as succession proceeds towards climax. In forested stands with shrub undergrowths containing both willows and bog blueberry, bog blueberry is used to name the association because it is more tolerant of shade and is more dominant under trees than willows. In willow shrublands, however, trees are absent and willows are used to name the association even though bog blueberry may form a low shrub layer beneath the willows. The dominant or most characteristic graminoid or herb is used to name the herbaceous layer. For instance, queencup beadlily is the most consistent species in a group of mesic forbs in the undergrowth of the Engelmann spruce/queencup beadlily association and widefruit sedge forms a sward in the Engelmann spruce/widefruit sedge association.

Common names are used throughout the text because of conventions established in previous classifications in central Oregon. Common names, scientific names, and scientific abbreviations head each association description and are referenced in Appendix C to make sure the correct common names are used for each association and species. Figures, tables, and appendixes often use scientific abbreviations for brevity. Terminology follows Hitchcock and Cronquist (1973) .

CLIMATE

The Cascade Range is an important barrier to the movement of maritime and continental air masses. Central Oregon has features of both Pacific maritime and continental climatic patterns. Most weather patterns are cyclonic, moving inland on low-pressure fronts in the Pacific Ocean. These maritime air masses are blocked by the Cascade Range to varying degrees depending on the intensity of the storm system. The land masses just east of the High Cascades lie largely in weather shadows from this effect. Similar phenomena occur more locally and with less effect in the smaller mountain ranges to the east.

Annual precipitation ranges from 60 to 100 inches along the Cascade crests (6000-11,000 feet elevation), declining rapidly eastward. Precipitation in Bend (3600 feet), which lies on the lower fringe of the ponderosa pine zone, is about 12 inches annually. Annual precipitation exceeds 40 inches only on the highest mountains of the Ochoco and Fremont National Forests (generally 6000 or more feet). Precipitation is seasonal, with 55 to 75 percent occurring between October 1 and March 31. Most of the annual precipitation falls as snow and summers are dry.

Areas east of the Cascades have widely fluctuating temperatures,cold winters, and hot summers. Evenings tend to be very cold so that the frost free growing season is short. Climatic gradients between the riparian and upland sites are frequently sharp (Youngblood and others 1985a). Cold air drainage downslope into broad flats, basins, and valley bottoms creates severe summer frost problems in uplands as well as riparian sites. Summer droughts common in the uplands are largely moderated by concentrated water in the riparian. Sites next to larger bodies of water, especially lakes, may have temperatures moderated by standing water (Youngblood and others 1985a).

SOILS

Soils in riparian ecosystems are usually much more complicated than those on adjacent uplands (Youngblood and others 1985a). Soils, especially water tables, soil texture, soils chemistry, soil temperature, and the amount and kind of organic matter, have a large effect on plant species composition in riparian associations. Seasonally or permanently high water tables are necessary for a soil to support riparian vegetation. High water may be brief, with mid to late-summer drought, as in the case of the Cusick bluegrass association, or high nearly season long as in the beaked sedge association. Fine-textured soils have stronger capillary action and remain wetter longer in comparison to coarse soils. Organic matter also helps to retain water and draw it up from the water table below. For instance, peat bogs are especially good "sponges", often remaining surface saturated though the water table is a foot or more below the soil surface. Soils saturated for long periods of time function in an anaerobic state and become gleyed as evidenced by iron oxide spotting and neutral grey to bluish-grey color.

Water levels also have a marked influence on organic matter accumulation. Organic material is generally produced on site in most riparian ecosystems although water does function in moving some organic material from site to site. Accumulation and decomposition proceed rapidly near the soil surface and whether organic matter accumulates or not depends on the water system. Less decomposition occurs under anaerobic conditions and thick layers of organic material accumulate with time. This process is accelerated if anaerobic conditions are accompanied by low soil and water fertility, low soil and water temperatures, and minimally fluctuating water tables such as in bogs. The reverse is true where water tables fluctuate and soils function aerobically.

Taxonomy of riparian soils is in its infancy in central Oregon according to local Soil Conservation Service and Forest Service soil scientists. On their advice this study did not attempt to identify riparian soils beyond suborder. Even at this level, use of the soil taxonomy was unsatisfying. For instance, many bog communities in the Cascade Range had peat surface horizons that were from 4-14 inches thick. The bulk of the root mass occurs in this layer. Yet soil taxonomy requires at least 16 inches of organic matter to key to a histosol.

For these reasons the author referred to general soil texture within the rooting zone in the text instead of using standard soil taxonomy terminology:

1) Organic loams refer to very fine-textured, black soils judged to contain more than 12 percent organic matter. They are generally sapric histosols.

2) Sedge or moss peats are either fibric or hemic histosols while sedimentary peat refers to limnic histosols on the margins of lakes and ponds.

2) Black mucks are sapric histosols.

3) Medium to coarse textured skeletal soils on floodplains and streambanks are entisols.

4) Most fine textured mineral soils on grass dominated or the drier end of sedge dominated associations are mollisols containing 2-12 percent organic matter in the surface horizon.

5) Other mineral soils with no mollic epidon occur mostly in transitional associations such as Engelmann spruce/queencup beadlily and are inceptisols.

GEOMORPHOLOGY AND RIPARIAN CLASSIFICATION

Geomorphology is best defined as the study of landforms (Thornbury 1954, Ritter 1978). Geologic structure, modification process, and stage (time) of modification are the controlling factors in the evolution of landforms. Structure refers to rock attitudes, joints, planes, faults, folds, hardness, permeability of rocks, and other ways in which the earth's crust differs from location to location. Modification processes are the many chemical and physical ways by which the earth's surface undergoes changes. Stage is how long these processes have been modifying a geologic structure. These factors are neither static nor uniformly directional. In central Oregon, the wearing process from weathering, glaciation, and erosion has been episodically interrupted by the building of new structures from within such as volcanoes or fault-block upthrust.

Stream action is a major factor in landscape formation. Valley deepening is often associated with relatively early stages of landscape formation and is a result of hydrologic, corrosive, abrasive, and weathering processes on the valley floor (Thornbury 1954). Valley widening is the result of lateral erosion, slumping, sheet erosion, gullying, weathering, and the erosive effects of lateral tributaries. Valley lengthening is the result of headwall erosion, meander development, and the formation of deltas. All these are indirectly tied to the effects of water and result in the formation of water related landforms in the vicinity of streams and other bodies of water which form the riparian zone.

The gradient or steepness of a valley is often related to the width of the valley floor. Narrow valleys often have V-shaped profiles, moderate to steep gradient, and narrow riparian zones. The rivers in these valleys have high energy, relatively straight channels, and support coarse bedload and sediment loads and form floodplains with moderate to coarse textured, well aerated soils. Wide valleys usually have low valley gradient so that streams meander and lateral erosion dominates. Stream downcutting is imperceptible or nonexistent and valley widening is dominant. These streams carry fine textured sediment loads and form floodplains with finer textured soils that have numerous overflow and cutoff channels.

Both steep and shallowly graded sections are often present on the same stream where changes in structure or process require change in gradient and channel characteristics for the transportation of the stream load.

Geomorphology is an active feature in the riparian classification. Using geomorphology the classification can be organized in three levels:

1) The broadest level is the physiographic area. Each area reflects broad climatic, geologic, and geomorphic processes

2) The intermediate level is the riparian landform. Riparian landforms reflect uniformity in elevation, valley gradient, fluvial processes, water regime, and soils.

3) The base level is the riparian association. Riparian associations occur on predictable fluvial surfaces within riparian landforms.

The three levels of classification are included in a separate key to the riparian landforms and associations for the Ochoco and Fremont National Forests and in the landform sketches included in the descriptions of the associations.

The riparian landforms and the mosaic of riparian associations and fluvial surfaces included in each landform are most determined by four interdependent factors in central Oregon:

1) Climate. Climate is most easily represented by the physiographic area and determines things such as species composition, annual precipitation, and hydrologic regime. Climate also changes with elevation.

2) Valley gradient. Steep valley grades (over 4 %) tend to form narrow, downcutting valley cross sections. Flat gradients (under 1 %) form wide depositional floodplains.

3) Geology. Geology largely determines drainage pattern and the kind of soil deposited on fluvial surfaces.

4) Riparian vegetation. Vegetation filters and traps sediments in helping to build and anchor fluvial surfaces.

Central Oregon can be divided into 9 physiographic areas based on uniformity of geology, topography, stream processes, and soils (Figure 2). The divisions used are largely those outlined by Franklin and Dryness (1973) and Chitwood (1976).

1) The **Ochoco Mountains Physiographic Area** contains some of the oldest rock in Oregon (Baldwin 1964). These Paleozoic and Mesozoic formations (136 to 370 million years old) are largely marine deposits that were folded and uplifted 15,000-18,000 feet some 190 million years ago. They were subsequently buried by massive layers of sandstone and conglomerate intermixed with marine mudstone. These deposits have been largely removed by erosion. Deposits of breccia, conglomerate, tuff, and rhyolite flows accumulated for the next 20 million years and were overlaid by the rhyolite flows, breccia, tuffs, and conglomerates of the John Day formation 26-37 million years ago. Layers of Columbia basalt poured out some 25 million years ago and these layers were then tipped into sloping planes by fault-block slippage. A bed of welded tuff is present in the upper part of the formation and forms a resistant cap on many topographic features throughout the area. Much of the area has been recently covered by a shallow layer of aerially deposited ash, most notably from the Mazama and Newberry eruptions. Subsequent erosion has largely removed this material from south-facing slopes.

Older basalt and pyroclastic sediments are well weathered into dissected topography and deeply incised, moderate to steeply graded drainages that receive effluent seepage throughout the year. The large, steeply sloping fault faces on the north and northeast edges of the area are similar. Where thin layers of basalt overlay weaker John Day Formations wider valleys have formed and thick alluvial deposits border most of the streams.

Elevation ranges from 2200 feet at Black Canyon Creek to 7200 feet at Snow Mountain. Precipitation ranges from 20 to 40 inches a year, mostly in winter and spring.

2) The western portion of the **Grasslands Physiographic Area** is a northern extension of the High Lava Plateau of central Oregon (Franklin and Dyrness 1973). Recent flows of rimrock-forming olivine basalt have covered a wide alluvial valley of Pliocene origin (the Deschutes Formation, 3 to 5 million years old) composed of semi-consolidated layers of sandstone, sandy shale, conglomerate, tuff, and welded tuff. The basalt cap and Deschutes Formation are highly permeable to the scant rainfall (9 inches) of the area so that water on the surface of the plains accumulates only at occasional perched water tables. The Deschutes, Metolius, and Crooked Rivers and Squaw Creek have cut deep rimrock canyons through these layers.

The topography of the eastern half of the Grasslands Physiographic Area is characterized by gently rolling hills and low buttes separated by wide flats (Hopkins and Kovalchik 1983). The large hilly central portion is dominated by a well-weathered mix of silicic volcanic rocks and water-laid deposits of volcanic material plus inclusions of siltstone, tuff, conglomerate, rhyolite, andesite, dactite, and basalt. Many hills and buttes are capped by basaltic rimrock. Low portions of the landscape on the north and east side are covered by fluvial and lacustrine deposits of the Deschutes Formation. Few streams have potential for significant perennial flow due to low annual precipitation and low yield of springs.

3) The **Deschutes Cascades Physiographic Area** is a geologically young and complex volcanic region of mostly Quaternary age (0 to 2 million years) that lies on the east flank of the Cascade Range. Spectacular stratovolcanoes (South Sister is 10,400 feet tall), some deeply eroded by glaciers, line portions of the Cascades. About 200 basalt cinder cones dot the landscape. Lakes and rivers have been formed or removed by volcanic or glacial activity.

Deposition has generally exceeded erosion on the east flank of the Cascades, creating a landscape with, steep-sided valleys and canyons only in deeply incised glacial valleys. Instead, most landforms are positive, constructed volcanic features with flat or gently sloping fields of lava, sediments, or glacial debris lying between and internal drainage. At least three times within the last 300,000 years, glacial ice has covered the Cascade Range from Mt. Jefferson to Mt. McLaughlin in a continuous sheet. The retreat of each sheet left moraines that cover most of the high flanks of the Cascades.

The internal structures of the Cascade Mountains are highly permeable. Most rain and meltwater (30 to 100 inches of precipitation a year) flows into the subsurface and becomes part of a complex ground water system. Large springs discharge from complex perched systems near the base of the area (Chitwood 1976). Many streams in the Deschutes National Forest are controlled by the volcanic sponge. Peak flows are reduced or even delayed until mid summer because of the time it takes for snowmelt to work through the volcanic pile. Base flows are often quite uniform throughout the year compared to other geologic and climatic regions.

4) The **LaPine Basin Physiographic Area** lies in a nearly flat, low gradient basin between the Cascade Range and Newberry Volcano. Elevations are 4200 to 4500 feet. Over the past 500,000 years, the growth of Newberry Volcano has repeatedly dammed an ancient channel of the Deschutes River and created a basin that has since filled with lake and stream deposits up to 2500 feet thick. Local topographic relief seldom exceeds 25 feet. The Deschutes River, Little Deschutes River, Crescent Creek and other streams meander in shallow, wide flood channels. A blanket of pumice from Mount Mazama (Crater

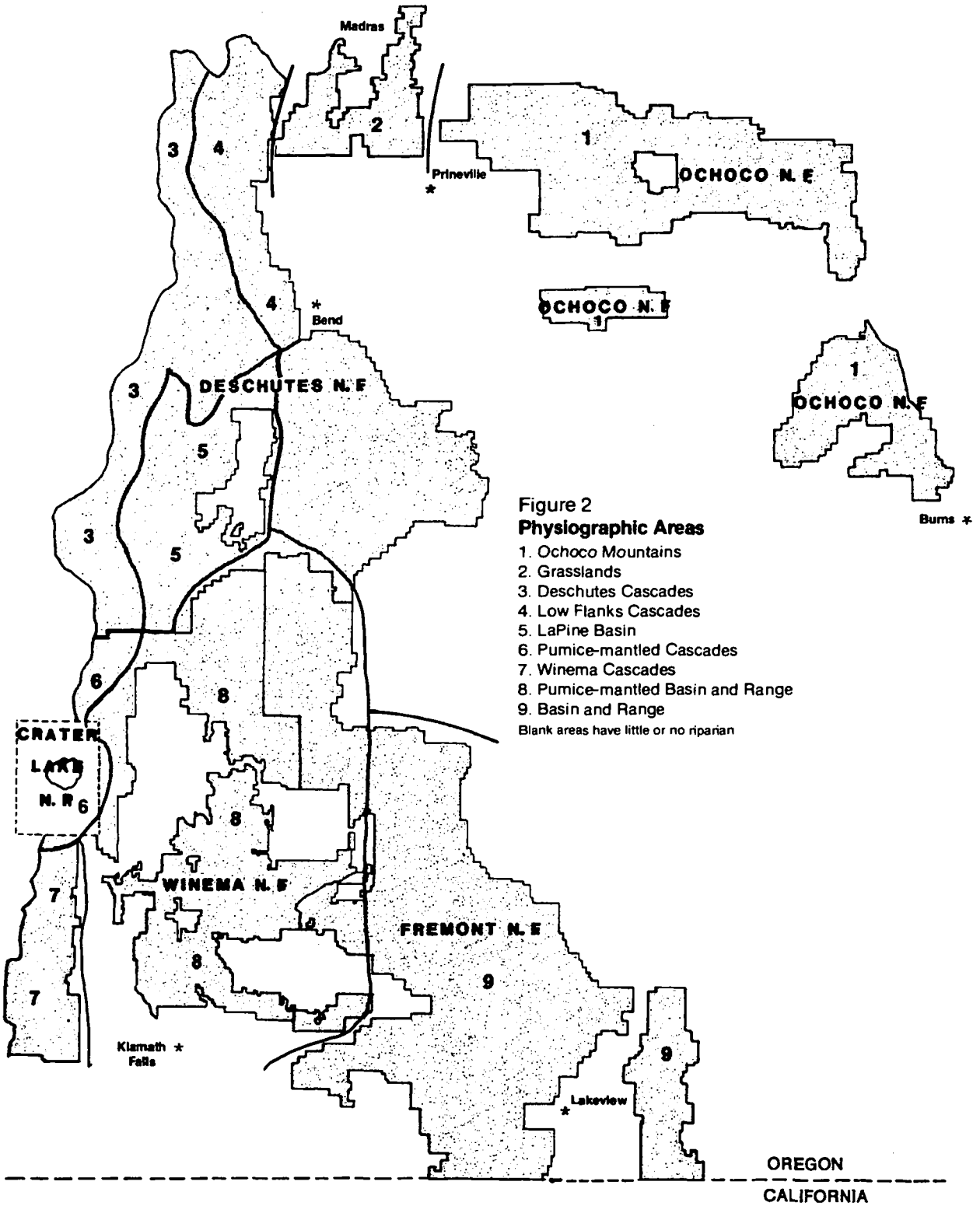


Figure 2
Physiographic Areas

1. *Ochoco Mountains*
2. Grasslands
3. Deschutes Cascades
4. Low Flanks Cascades
5. LaPine Basin
6. Pumice-mantled Cascades
7. Winema Cascades
8. Pumice-mantled Basin and Range
9. Basin and Range

Blank areas have little or no riparian

Lake) covers the entire area to a depth of 10 feet at the south end, decreasing northward to 1 foot. The pumice has generally reduced the steepness of local slopes. Water infiltration rates in the pumice are extremely high but low in the clay, silt, and sand under the pumice. Floodplain landforms are remarkably uniform throughout the basin. Precipitation averages 12 to 30 inches per year, but much more water originates in the Deschutes Cascades Physiographic Area.

5) The **Low Flanks Cascades Physiographic Area** is characterized by gentle slopes on lava fields and glacial outwash dotted with cinder cones and a few stratovolcanoes. Elevations are 2000 to 6000 feet. Considerable local erosion and a few fault scarps add to the variety of a generally subdued topography. Major drainages include the Metolius River, Tumalo Creek, and Squaw Creek.

The Metolius Basin is the major feature of this area, formed when land west of Green Ridge dropped down at least 2000 feet. Ancient rivers and lakes that flourished and disappeared during the uneven descent of the land left deep deposits of silt and sand on the floor of the Metolius Basin and elsewhere in the area. During later ice ages, large outwash fans of sand and gravel with gently sloping surfaces were spread over these sediments and parts of the volcanic pile by sediment-laden water from glaciers. Since the last ice age (about 12,000 years ago) the Metolius River and its tributaries have cut into these outwash fans and, in some places, into older sediments and lava beneath these fans. Volcanism since 12,000 years ago has produced cinder cones and lava flows.

Precipitation ranges from 15 to 40 inches per year. However, vast amounts of ground water that infiltrate the Cascade Mountains emerge from numerous springs at the base of the Deschutes Cascades Physiographic Area. These springs supply large volumes of water to the Metolius River and its tributaries.

6) The **Pumice-mantled Cascades Physiographic Area** is a rugged and scenic area that is dominated by the remnant peaks of Mount Mazama, Mount Thielsen, Tipsoo Peak, Howlack Mountain, and Mount Scott. Elevations range from 4500 to 9200 feet. Glacial ice has periodically covered these volcanoes and glacial features abound.

The pumice-avalanche choked valleys on Mount Mazama have been partially eroded into deep V-shaped canyons. The topography of Mount Thielson, Tipsoo, and Howlack is deep glacial canyons, steep glacier-covered slopes, and knife-edged ridges. The entire area is covered by a deep mantle of pumice from the Mazama eruption.

Snow packs exceed 150 inches and total precipitation varies from 40 to 60 inches in most years. Water quickly infiltrates the mantles of pumice and glacial till on highly fractured basalt bedrock. Streams that have developed in incised drainages follow the paths of glacier carved valleys but often disappear underground shortly after reaching the deep, flat pumice deposits at the foot of the mountains. Most water is absorbed by the volcanic sponge and discharges in springs in the basins below.

7) The **Winema Cascades Physiographic Area** is similar to the glacially eroded Deschutes Cascades Physiographic Area. Glaciers have eroded the Cascade Crests, leaving remnants of volcanoes, abundant glacial lakes, glaciated valleys, and deep mantles and ridges of glacial till. Elevations range from 4200 to over 8000 feet. Precipitation averages 30 to 50 inches per year.

At the head of drainages such as Cherry, Rock, and Lost Creeks the glacial landscape is too young for the fluvial process to have developed significant drainage patterns, although they are better developed than in the Deschutes Cascades. The crests are therefore largely internally drained. Drainages that have formed support seasonal flow and riparian development is minimal. Glacial depressions with lakes and meadows abound.

The flanks of the Winema Cascades are more deeply incised by drainages and its soils less dominated by pumice than the Deschutes Cascades Physiographic Area. Glaciers coming off the Cascade Crests incised deep U-shaped valleys during the Pleistocene. At moderate elevations the valley bottoms support moderate to steeply graded floodplains of various widths. Surface soils are cobbly to gravelly sandy loams to loamy sands. Peak flows at spring runoff are high, supporting coarse sediment loads, while mid-summer flows are reduced or absent.

At low elevation, footslope landforms support wide low gradient floodplains and alluvial fans. The lowered gradient reduces stream energy and the streams dump their coarse sediment load. Many channels flow only in the spring. Sevenmile Creek is the only stream with season-long flow in this landform.

8) The **Pumice-mantled Basin and Range Physiographic Area** is developed from fault basin topography that has been modified by deep pumice deposits from Mount Mazama. The pumice has reduced the steepness of local slopes and generally low gradient basins and drainages are filled with deep deposits of pumice alluvium. Precipitation averaging 20 to 30 inches per year quickly infiltrates the pumice sponge. Many streams express interrupted flows, frequently disappearing below the pumice mantle and emerging downstream.

Moderate to steeply graded streams are rare in this area except on the slopes of fault escarpments and volcanoes. Examples are where Jackson Creek flows down the slope of Yamsey Mountain, the lower reaches of Sprague River as it flows down a fault slope into the Williamson River Valley, and other small streams flowing down fault surfaces.

Several miles of the Williamson River drainage pass through the Winema National Forest in the vicinity of Rocky Ford. The river is moderately large compared to Jack Creek. The stream has a very low gradient, dropping only 6 inches in one-half mile, and is characterized by frequent meander and cutoff channels. The valley is very wide and flat and the soils finer-textured compared to other riverine landforms in the area.

9) The **Basin and Range Physiographic Area** is characterized by fault-block mountains enclosing internal drainages and scattered volcanic peaks (Franklin and Dryness 1973). Elevations are 4000 to 8500 feet. Precipitation ranges from 15 to 30 inches per year. It shares portions of its geologic history with both the Ochoco Mountains and Pumice-Mantled Basin and Range Physiographic Areas. Basement rock of Paleozoic and Mesozoic Era (i.e. Clarno and John Day Formations) are rarely exposed and play little role in the geomorphology of the region. Early Miocene (15 to 20 million years) flows of interbedded and folded breccia, rhyolite, dacite, andesite, basalt, and tuff covered these early marine beds and are evident in the lower faces of Abert and Winter Rims, the Paisley Hills, Warner Mountains, and the slopes west of Goose Lake (Baldwin 1964). Great late Miocene flows of Steens and other basalts then covered the eroded Miocene Formations except where they lapped against mountains that already existed in the Paisley and Warner Mountain areas.

Considerable fault-block movement began 14 to 15 million years ago and ended at the end of the Pliocene Era (2 to 3 million years ago). These north-south tending fault-block mountains and hills are interspersed with frequent alluvial basins and conical or irregularly shaped volcanic mountains. Pliocene to Pleistocene flows of basalt have covered much of the western two thirds of the Forest. The most prominent fault-block faces occur along Winter, Coleman, and Abert Rims.

Eruptive centers are common and range in size from small cinder cones to massive volcanic piles. These landforms are dome-shaped and have radial drainage patterns. Examples are Gearhart Mountain, McComb Butte, Hager Mountain, the Black Hills, and the Drake-McDowell area. Lava from the centers flowed for many miles before cooling and forming plateaus.

Most of the area consists of gentle to moderately steep slopes (up to 40%). Topography ranges from flat to gently rolling lava plateaus and tablelands to some steep, highly dissected landforms. The drainage is mostly interior, with short streams flowing into low lakes and playas that have no outlets. Sprague River, originating in the Gearhart Mountain Wilderness, and Sycan River are the only major drainages which have outlets.

The type of bedrock is a major factor in determining the kind and rate of geologic erosion and the resulting landforms. Much of the flat or gently rolling terrain occurs on basalt lava and tuff plateaus. These rocks are resistant to erosion and have not been deeply incised by streams.

Much of the steep, highly dissected lands such as the Paisley Hills occurs on pyroclastic rocks which are soft and highly susceptible to forces of erosion. Consequently, erosion has progressed rapidly. Uplifting has accelerated the process. Alluvial deposition has been greatest in these zones.

At least two mountains had small alpine glaciation. These are the Gearhart Mountain and Yamsay Mountain eruptive centers. Cirque basins and U-shaped valleys are evidence of past glaciation.

THE RIPARIAN CLASSIFICATION

Fifty-four riparian associations and community types within six major dominance groups have been defined for the central Oregon study area. Twenty-five incidental associations and communities were described briefly in the text but were not included in major association descriptions, tables, and appendixes. The large number of associations and community types results from the climatic, geologic, and floristic diversity in central Oregon. The major associations and community types are listed in Table 1.

The classification is presented in the following order:

1) The dicotomous **vegetative key**, which provides an orderly process for determining the association or community type.

2) The **key using riparian landforms and fluvial surfaces** gives a physically oriented alternative to determine site potential for disturbed stands on the Ochoco and Fremont National Forests.

3) The **association descriptions**, which give information for the distribution, soils, geomorphology, vegetative composition, ecological status, management implications, and rehabilitation for each type.

4) The **appendixes** give support information for the classification.

Users should note that the keys are tools and not the classification. The association and community type descriptions portray riparian stands in late seral and climax ecological status. Thus, highly disturbed stands will not key and the user will have to refer to the association writeups, landform key, landform sketches, and his or her personal experience and intuition. In any dynamic ecosystem, riparian included, variation can be expected in any association. The user is cautioned to validate the "keyed" determination by reading the written description and supporting appendixes before leaving the stand or plot.

TABLE 1. RIPARIAN ZONE ASSOCIATIONS AND COMMUNITY TYPES OF THE DESCHUTES, FREMONT, OCHOCO AND WINEMA NATIONAL FORESTS

TABLE 1.(continued)

ASSOCIATION AND COMMUNITY DESCRIPTION CRITERIA

Location and Riparian Landforms: Describes the National Forest and Physiographic Area locations and elevational range of the association. Describes the riparian landforms the association are found in and provides sketches of landforms so the user can see the kinds of fluvial surfaces that it and other associations occurring in the landform occupy. The vegetation symbols used in the sketches represent the following species:


ponderosa pine


Engelmann spruce


white fir


lodgepole pine

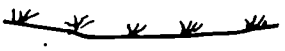

quaking aspen

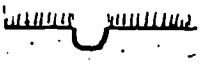

big or silver sagebrush


common snowberry, Douglas spiraea, or bog blueberry

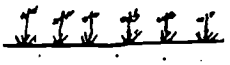

willows


mountain alder


Cusick bluegrass


grasses, sedges, and rushes


common horsetail


tufted hairgrass


queencup beadlily

UL = uplands

Soils: Describes the texture and depths of surface and subsurface soils, available water holding capacity, and water tables.

Floristic Characteristics: Provides a list of dominant vegetation for the association. **Dominants** are plants, expressed in percent crown cover (range, average for each species based upon the total number of sample plots in the association in parentheses) and constancy, dominating the association or community type or occurring in more than 50 percent of the sample plots. The cover value for trees includes the understory. **Potential natural vegetation** provides a verbal description of the vegetative composition of riparian associations and community types in late seral to climax ecological status.

Management and rehabilitation: **Livestock** gives estimated herbage production, describes palatability of important plants, and describes season of use and impacts by domestic livestock. **Livestock** also briefly describes stands with declining vegetative composition because of the influence of livestock and lowered water tables. **Fire** describes the sensitivity of important plants to fire. **Recreation** was used in high elevation associations to help recreation managers to develop management plans in wilderness areas. **Silviculture** provides 100 year site index and current sq ft/acre basal area and helps the silviculturist develop silvicultural plans for forested riparian associations. **Estimating potential on disturbed sites** gives the user hints on how to recognize the vegetative potential for stands in poor ecological status. **Rehabilitation pathways** helps the reader formulate management strategies for rehabilitating disturbed sites.

VEGETATIVE KEY

VEGETATIVE KEY TO DOMINANCE GROUPS, ASSOCIATIONS, AND COMMUNITY TYPES

INSTRUCTIONS TO USING THE KEY

1. Use this key for riparian communities in or near the Deschutes. Fremont. Ochoco. and Winema National Forests.

2. Determine the boundaries of the various riparian stands that exist within the riparian zone being investigated (as many as eight distinct riparian communities have been identified within a single "reach" of a river. riparian basin. etc.).

3. Locate a plot (30-50 feet radius in size is suggested) in a uniform and representative portion of each stand.

4. Identify and record canopy coverages for all key indicator species.

5. While on the plot. key to the appropriate dominance group. In general. a species or group of species will appear to dominate a community if the cover is 25 percent or more.

6. Within the section. key to the appropriate association. Complete the selection by comparing the community composition and site characteristics with written descriptions and appendix B.

7. The key and written descriptions are based largely on relatively undisturbed stands in late seral to climax ecological status. On disturbed sites evaluate each stand against the written descriptions for the associations. Use the landform and fluvial surface key to riparian associations for disturbed sites on the Fremont and Ochoco National Forests.

8. If the site doesn't key to an appropriate association. try again.

9. Depauperate undergrowths. In stands where the undergrowth is obviously reduced in cover from shade. litter. and competition from conifers or shrubs. adjust keys downward to reflect the scant herbaceous cover.

VEGETATIVE KEY TO DOMINANCE GROUPS

1. Sites subalpine and alpine and dominated by species such as red mountainheath. Brewer sedge. black alpine sedge. and Holm's sedge.....**High elevation associations** (p. 20)

1. Sites at lower elevations or otherwise dominated by species not listed above.....2

2. Sites dominated by trees (mountain alder and willows are considered shrubs in this classification). Deciduous and coniferous trees have a combined canopy cover of at least 25 percent.....3

2. Sites dominated by shrubs. graminoids. or forbs.....5

3. Trees capable of attaining normal stature at maturity.....4

3. Trees more or less dwarfed. widely spaced. and incapable of attaining normal size at maturity because of high elevation or soil moisture.....5

4. Conifers dominate the stand. Deciduous trees. if present. are clearly subordinant to conifers.....**Coniferous forest associations** (p. 14)

4. Quaking aspen or cottonwood are at least codominant with conifers in the tree layer.....**Deciduous forest associations** (p. 14)

5. Sites dominated by shrubs. Erect shrubs (mountain alder. willows. bog birch. bog blueberry. Douglas spiraea. big sagebrush. or silver sagebrush) have a combined canopy cover of at least 25 percent.....**Shrub associations** (p. 17)

5. Sites dominated by graminoids or forbs.....6

6. Sites dominated by graminoids.....**Graminoid associations** (p. 18)

6. Sites dominated by forbs.....**Forb associations** (p. 20)

VEGETATIVE KEY TO DECIDUOUS FOREST ASSOCIATIONS

1. Quaking aspen the dominant deciduous tree.....2

1. Black cottonwood the dominant deciduous tree. See the following miscellaneous associations...
Black cottonwood/widefruit sedge.....(p. 136)
Black cottonwood/mountain alder/woolly sedge.....(p. 136)
Black cottonwood-Engelmann spruce/ mountain alder-red osier dogwood.....(p. 136)
Black cottonwood/common snowberry/Kentucky bluegrass....(p. 136)

2. Douglas spiraea (sometimes pyramid spiraea) has at least 25 percent cover.....
Quaking aspen-lodgepole pine/Douglas spiraea/widefruit sedge (p. 63)

2. Vegetation not as above.....3

3. Common snowberry has at least 25 percent cover and Douglas spiraea is largely absent.....
Quaking aspen/common snowberry/blue wildrye (p. 59)

3. Graminoids. especially blue wildrye. Kentucky bluegrass. and forbs dominate the undergrowth...
Quaking aspen/blue wildrye (p. 61)

If you came to a dead end in the key or keyed to an inappropriate association. see the following miscellaneous associations or try the key again.....
Quaking aspen/woolly sedge.....(p. 136)
Quaking aspen-lodgepole pine/Douglas spiraea/forb.....(p. 136)
Quaking aspen-lodgepole pine/bearberry.....(p. 136)

VEGETATIVE KEY TO CONIFEROUS FOREST ASSOCIATIONS

1. Lodgepole pine forms nearly pure stands. Other conifers are scattered to absent.....2

1. Lodgepole pine occurs in mixed stands or is absent. Other conifers will clearly replace lodgepole pine as succession proceeds towards climax.....11

2. Bearberry. willows. bog birch. bog blueberry. and/or Douglas spiraea dominate the undergrowth. Combined canopy cover of these shrubs at least 25 percent.....3

2. These shrubs are subordinant to the herbaceous layer (prostrate shrubs such as twinflower and currants. honeysuckles. and huckleberries other than bog blueberry are included in the herb layer).....8

3. Bearberry dominates the shrub layer. Bog blueberry and Douglas spiraea are scarce.....
Lodgepole pine/bearberry (p. 31)

3. Bearberry scarce or subordinant to bog blueberry or Douglas spiraea.....4

4. Bog sites characterized by cold. water-saturated peat soils and high moss cover. Trees widely spaced and often restricted to hummocks. Few-flowered spikerush at least 5 percent cover. Bog birch. willows. and/or bog blueberry low in stature.....
Lodgepole pine-Engelmann spruce/few-flowered spikerush (p. 45)

4. Site and vegetation not as above.....5

5. Bog blueberry at least 5 percent cover. usually dominant but occasionally subordinant to willows. bog birch. other blueberries and huckleberrys. or Douglas spiraea.....6

5. Bog blueberry scarce to absent. Douglas spiraea at least 5 percent cover. usually dominant but occasionally subordinant to willows or bog birch.....7

6. Widefruit sedge at least 5 percent cover. Sites moist to wet.....
Lodgepole pine/bog blueberry/widefruit sedge (p. 39)

6. Widefruit sedge scarce. Sites drier.....**Lodgepole pine/bog blueberry/forb** (p. 37)

7. Widefruit sedge at least 5 percent cover. Sites moist to wet.....
Lodgpole pine/Douglas spiraea/widefruit sedge (p. 35)

7. Widefruit sedge scarce. Sites drier.....**Lodgepole pine/Douglas spiraea/forb** (p. 33)

8. Bog sites characterized by cold. water-saturated peat soils and high moss cover. Trees widely spaced and often on hummocks. Few-flowered spikerush at least 5 percent cover. Bog birch. willows. and bog blueberry often present. low in stature.....
Lodgepole pine-Engelmann spruce/few-flowered spikerush (p. 45)

8. Site and vegetation not as above.....9

9. Widefruit or aquatic sedge dominate grasses and forbs.....10

9. Kentucky bluegrass (occasionally blue wildrye or bromes) dominate widefruit and aquatic sedge.....**Lodgepole pine/Kentucky bluegrass** (p. 29)

10. Widefruit sedge (rarely woolly sedge) dominant. Deschutes and Winema National Forests...
Lodgepole pine/widefruit sedge (p. 41)

10. Aquatic sedge (rarely woolly sedge) dominant. Ochoco and Fremont National Forests.....
Lodgepole pine/aquatic sedge (p. 43)

11. Engelmann spruce at least 5 percent cover and is replacing itself in the understory. Usually dominant although lodgepole pine may dominate seral stands. Sometimes codominant with white fir or subalpine fir.....12

11. Engelmann spruce scarce or absent. White fir. ponderosa pine. western larch. incense-cedar and/or Douglas-fir dominant.....18

12. Willows. bog birch. bog blueberry. and/ or Douglas spiraea dominate the undergrowth. Combined canopy cover of the shrubs at least 25 percent.....13

12. These shrubs are subordinant to the herbaceous layer (prostrate shrubs such as twinflower and currants. honeysuckles. and huckleberrys other than bog blueberry are included in the herb layer).....16

13. Bog blueberry at least 5 percent cover. Usually dominant but occasionally subordinant to willow. bog birch. or Douglas spiraea.....14

13. Bog blueberry scarce to absent. Douglas spiraea at least 5 percent cover. Usually dominant but occasionally subordinant to willows.....15

14. Widefruit sedge (occasionally Holm's sedge) at least 5 percent cover. Sites moist to wet.....**Engelmann spruce/bog blueberry/widefruit sedge** (p. 53)

14. Widefruit sedge scarce. Sites drier.....**Engelmann spruce/bog blueberry/forb** (p. 51)

15. Widefruit sedge at least 5 percent cover. Sites moist to wet.....
Lodgepole pine/Douglas spiraea/widefruit sedge (p. 35)

15. Widefruit sedge scarce. Sites drier.....**Lodgepole pine/Douglas spiraea/forb** (p. 33)

16. Common horsetail at least 25 percent cover. dominating the wet herbaceous undergrowth....
Engelmann spruce/common horsetail (p. 57)

16. Vegetation not as above.....17

17. Widefruit sedge at least 5 percent cover. dominating the herb layer. Site moist to wet.....
Engelmann spruce/widefruit sedge (p. 55)

17. Ground cover herbaceous. dominated by mesic forbs such as queencup beadlily. sweetscented bedstraw. twistedstalk. and white trillium. Sites drier.....
Engelmann spruce/queencup beadlily (p. 49)

18. White fir at least 5 percent cover and is replacing itself in the understory. Ponderosa pine. Douglas-fir. western larch. and incense-cedar will be replaced by white fir at climax.....19

18. White fir scarce. Ponderosa pine. Douglas-fir. western larch. and/or incense-cedar dominant.....21

19. Vine maple. common snowberry. and/or Douglas spiraea at least 25 percent cover.....20

19. Erect shrubs scarce. Ground cover herbaceous. dominated by mesic forbs such as queencup beadlily and sweetscented bedstraw (prostrate shrubs such as twinflower and currants and honeysuckles may be included in the herb layer).....**White fir/queencup beadlily** (p. 47)

20. Vine maple well represented. Maritime sites in the vicinity of Santiam Pass.....
White fir/queencup beadlily (p. 47)

20. Vine maple scarce to absent. Common snowberry is the dominant shrub. .....
Ponderosa pine/common snowberry (p. 27)

21. Common snowberry at least 25 percent cover on undisturbed sites.....
Ponderosa pine/common snowberry (p. 27)

21. Common snowberry scarce. Herbaceous layer characterized by mesic forbs such as queencup beadlily and sweetscented bedstraw (prostrate shrubs. currants. and honeysuckle may be included in the herb layer.....**White fir/queencup beadlily** (p. 47)

If you came to a dead end in the key or keyed to an inappropriate association. see the following miscellaneous associations or try the key again.....
Lodgepole pine/tufted hairgrass.....(p. 136)
Ponderosa pine-mixed conifer/Douglas spiraea-common snowberry (p. 136)

VEGETATIVE KEY TO SHRUB ASSOCIATIONS

1. Big and/or silver sagebrush dominate the shrub layer. Cusick bluegrass at least 5 percent cover.....**Big sagebrush-silver sagebrush/Cusick bluegrass** (p. 65)

1. Big and silver sagebrush scarce to absent. Cusick bluegrass scarce to absent.....2

2. Mountain alder the dominant shrub.....3

2. Mountain alder scarce to absent.....6

3. Site on slumps and around springs.....**Mountain alder springs** (p. 73)

3. Site on active fluvial surfaces.....4

4. Young (generally less than 20 years old) alder stands on developing sites such as active channel shelves. Douglas spiraea and common snowberry are scarce to absent.....
Mountain alder (p. 67)

4. Sites older. Douglas spiraea or common snowberry at least 5 percent cover on undisturbed stands.....5

5. Douglas spiraea at least 5 percent cover and not subordinant to common snowberry.....
Mountain alder-Douglas spiraea (p. 71)

5. Snowberry at least 5 percent cover and not subordinant to Douglas spiraea.....
Mountain alder-common snowberry (p. 69)

6. Willows (Booth. Geyer. Lemmon. and/or Eastwood willows. sometimes with bog birch) 5 to 15 feet tall the dominant shrubs.....7

6. Low shrubs (bog blueberry: dwarf forms of Booth. Eastwood. and undergreen willows: and/or Douglas spiraea) the dominant shrubs. Bog blueberry usually dominant.....12

7. Beaked and/or inflated sedge at least 25 percent cover. the dominant graminoid.....
Willow/beaked sedge (p. 84)

7. Beaked and/or inflated sedges subordinant to other graminoids.....8

8. Sitka sedge at least 25 percent cover. the dominant graminoid.....
Willow/Sitka sedge (p. 82)

8. Sitka sedge subordinant to other graminoids.....9

9. Aquatic sedge at least 25 percent cover. the dominant graminoid.....
Willow/aquatic sedge (p. 80)

9. Aquatic sedge subordinant to other graminoids.....10

10. Widefruit sedge at least 25 percent cover. the dominant graminoid.....
Willow/widefruit sedge (p. 78)

10. Widefruit sedge subordinant to other graminoids.....11

11. Woolly sedge at least 25 percent cover. the dominant graminoid .....
Willow/woolly sedge (p. 76)

11. Kentucky bluegrass at least 25 percent cover. the dominant graminoid.....
Willow/Kentucky bluegrass (p. 74)

12. Sitka sedge at least 25 percent cover (occasionally suppressed by dense shrub cover). Sites different than above.....**Bog blueberry/Sitka sedge** (p. 86)

12. Few-flowered spikerush at least 5 percent cover. Bog sites characterized by cold. water-saturated. poorly oxygenated. peat soils and high moss cover. Sites undulating. low shrubs on hummocks.....
Bog blueberry/few-flowered spikerush (p. 88)

If you come to a dead end in the key or key to an inappropriate association. see the following miscellaneous associations or try the key again.....
Mountain alder bank.....(p. 137)
Coyote willow.....(p. 137)
Douglas spiraea.....(p. 137)
Willow/monkshood.....(p. 137)
Willow/tufted hairgrass.....(p. 137)
Eastwood willow-undergreen willow.....(p. 137)
Eastwood willow-undergreen willow/Holm's sedge.....(p. 137)
Eastwood willow-Booth willow/black alpine sedge.....(p. 137)
Douglas hawthorn.....(p. 137)
Mixed shrub canyon bottoms.....(p. 137)

VEGETATIVE KEY TO GRAMINOID ASSOCIATIONS

1. Grasses dominant over other graminoids.....2

1. Sedges. spikerushes. or bulrushes the dominant graminoids.....4

2. Cusick bluegrass at least 25 percent cover or the dominant graminoid.....
Cusick bluegrass (p. 90)

2. Cusick bluegrass scarce or absent. tufted hairgrass or Kentucky bluegrass dominant.....3

3. Tufted hairgrass at least 25 percent cover or the dominant graminoid.....
Tufted hairgrass (p. 95)

3. Not as above. Kentucky bluegrass at least 25 percent cover or the dominant graminoid.....
Kentucky bluegrass (p. 92)

4. Bog sites characterized by cold. water-saturated. peat soils. and high moss cover (except in water paths). Few-flowered spikerush usually at least 5 percent cover. Common horsetail. elephanthead. alpine willoweed. bog saxifrage. and hooded ladiestresses often present. Normally robust sedges such as Sitka sedge dwarfed and scattered.....
Few-flowered spikerush (p. 110)

4. Not as above.....5

5. Creeping spikerush at least 25 percent cover or the dominant graminoid.....
Creeping spikerush (p. 120)

5. Not as above.....6

6. Beaked sedge at least 25 percent cover or the dominant graminoid.....**Beaked sedge** (p. 118)

6. Not as above.....7

7. Inflated sedge at least 25 percent cover or the dominant graminoid.....**Inflated sedge** (p. 116)

7. Not as above.....8

8. Sitka sedge at least 25 percent cover or the dominant graminoid.....**Sitka sedge** (p. 114)

8. Not as above.....9

9. Smallfruit bulrush and/or bigleaf sedge at least 25 percent cover or the dominant graminoid..
Small-fruit bulrush (bigleaf sedge) (p. 112)

9. Not as above.....10

10. Widefruit sedge at least 25 percent cover or the dominant graminoid.....
Widefruit sedge (p. 102)

10. Not as above.....11

11. Aquatic sedge at least 25 percent cover or the dominant graminoid.....**Aquatic sedge** (p. 104)

11. Not as above.....12

12. Woolly sedge at least 25 percent or the dominant graminoid.....**Woolly sedge** (p. 98)

12. Not as above.....13

13. Slender sedge at least 25 percent cover or the dominant graminoid.....**Slender sedge** (p. 108)

13. Not as above.....

14. Short-beaked sedge at least 25 percent cover or the dominant graminoid.....
Short-beaked sedge (p. 106)

14. Nebraska sedge at least 25 percent cover or the dominant graminoid.....
Nebraska sedge (p. 100)

If you came to a dead end in the key or key to an inappropriate association, see the miscellaneous associations listed below or try the key again.....

Bluejoint reedgrass.....(p. 138)
Blue wildrye.....(p. 138)
Green-fruited sedge.....(p. 138)
Nevada rush.....(p. 138)
Baltic rush.....(p. 138)

VEGETATIVE KEY TO FORB ASSOCIATIONS

1. Narrow banks along small shaded streams dominated by mesic forbs and grasses.....2

1. Sites different. See miscellaneous **California falsehelebore** (p. 138) or try the key again.

2. Elevations above limits of mountain alder. Mesic forb layer characterized by species such as arrowleaf groundsel, Gray licoriceroot, and/or alpine mitella.....
Arrowleaf groundsel (p. 124)

2. Sites capable of growing alder without shade. Mesic forb layer characterized by species such as queencup beadlily, sweetscented bedstraw, and twistedstalk.....
Queencup beadlily (mountain alder) (p. 122)

VEGETATIVE KEY TO HIGH ELEVATION COMMUNITY TYPES

1. Red mountainheath, sometimes with Eastwood or Booth willows or dwarfed mountain hemlock, at least 25 percent cover.....**Red mountainheath** (p. 134)

1. Not as above.....2

2. Brewer sedge at least 25 percent cover. Tufted hairgrass, black alpine sedge, and Holm's sedge scarce to absent.....**Brewer sedge** (p. 126)

2. Not as above.....3

3. Tufted hairgrass at least 25 percent cover or the dominant graminoid. Black alpine sedge and Holm's sedge clearly subordinant.....**Tufted hairgrass** (p. 95)

3. Not as above.....

4. Black alpine sedge the dominant graminoid.....5

4. Holm's sedge the dominant graminoid.....6

5. Black alpine sedge at least 25 percent cover or the dominant graminoid.....
Black alpine sedge (p. 128)

5. Black alpine sedge and/or Holm's sedge codominant with tufted hairgrass.....
Holm's sedge-black alpine sedge-tufted hairgrass (p. 130)

6. Holm's sedge at least 25 percent cover or the dominant graminoid....**Holm's sedge** (p. 132)

6. Holm's sedge and/or black alpine sedge codominant with tufted hairgrass .....
Holm's sedge-black alpine sedge-tufted hairgrass (p. 130)

If you come to a dead end in the key or key to an inappropriate association, see the following miscellaneous associations or try the key again.....
Eastwood willow-undergreen willow/Holm' sedge.....(p. 137)
Eastwood willow-Booth willow/black alpine sedge....(p. 137)
Green-fruited sedge.....(p. 138)

LANDFORM KEY

KEY TO RIPARIAN ZONE ASSOCIATIONS ON THE OCHOCO AND FREMONT NATIONAL FORESTS USING RIPARIAN LANDFORMS, FLUVIAL SURFACES, AND SUPERFICIAL VEGETATION

This key is provided for major riparian landforms. associations, and community types only. Parentheses about association or community type names indicate altered sites where the natural association has been replaced by drier associations or community types because of overgrazing or lowered water tables in order of increasing disturbance.

OCHOCO NATIONAL FOREST

1. Ochoco Mountains Physiographic Area.....2

1. Grasslands Physiographic Area.....8

2. Low gradient (less than 1 % valley gradient) floodplains at low to moderate elevation (generally below 5200 feet) along streams such as Silver. Nicholl. Sawmill. and Gray Creeks. Big and/or silver sagebrush occurs on the inactive floodplain. Soil parent materal primarily rhyolite and tuff:

Active floodplains.....**Woolly sedge** (p. 98)
Willow/woolly sedge (p. 76)
(Willow/Kentucky bluegrass) (p. 74)
(Kentucky bluegrass) (p. 92)
(Sagebrush/Cusick bluegrass) (p. 65)
Inactive floodplains and terraces.....**Sagebrush/Cusick bluegrass** (p. 65)

2. Sites different.....3

3. Moderate gradient (2-4 %) floodplains at low to moderate elevation (generally below 5500 feet) along streams such as Emigrant. Mill. McKay. Trout. and Black Canyon Creeks. and N. Fk. Crooked River. Ponderosa pine occurs on the inactive floodplain. Soil parent material primarily basalt:

Active channel shelves.....**Small-fruit bulrush (bigleaf sedge)** (p. 112)
Mountain alder (p. 67)
Well developed active fluvial surfaces.....**Mountain alder/common snowberry** (p. 69)
Inactive floodplains.....**Ponderosa pine/common snowberry-floodplain** (p. 27)
(Kentucky bluegrass) (p. 92)

3. Sites otherwise.....4

4. Low gradient floodplains at moderate to moderately high elevation (generally above 5300 feet) in the upper reaches of streams such as Post. Potter. Emigrant. and Peterson Creeks. Lodgepole pine occurs on the inactive floodplains. Soil parent material primarily basalt:

Active fluvial surfaces.....**Aquatic sedge** (p. 104)
Willow/aquatic sedge (p. 80)
(Willow/Kentucky bluegrass) (p. 74)
(Kentucky bluegrass) (p. 92)
Inactive floodplains and terraces.....**Lodgepole pine/aquatic sedge** (p. 43)
(Willow/Kentucky bluegrass) (p. 74)
(Lodgepole pine/Kentucky bluegrass) (p. 29)
(Kentucky bluegrass) (p. 92)

4. Sites different.....5

5. V-shaped valleys with steep valley gradients (greater than 4 %) in first order streams such as Bear. Bug. and Owl Creeks and the head of Trout Creek. Usually in cold air drainages on north to east exposures except for Howard Creek:

Streambanks.....**Queencup beadlily (mountain alder)** (p. 122)
Mountain alder banks (p. 137)
Narrow floodplains and toe slopes.....**Engelmann spruce/queencup beadlily** (p. 49)
White fir/queencup beadlily (p. 47)

5. Sites different.....6

6. Forested basins. toeslopes. and floodplains at moderate to moderately high elevation (generally higher than 5000 feet). Usually in cold air drainages on north to east exposures. White fir or Engelmann spruce climax. Mesic forbs such as queencup beadlily dominate the ground layer:

Streambanks.....**Queencup beadlily (mountain alder)** (p. 122)
Mountain alder banks (p. 137)
Vicinity of Mount Pisgah. Engelmann spruce climax.....
Engelmann spruce/queencup beadlily (p. 49)
Location elsewhere or upslope from Engelmann spruce. White fir climax.....
White fir/queencup beadlily (p. 47)

6. Sites different.....7

7. Meadow basins at moderate to moderately high elevation (generally above 5000 feet) such as Big Summit. Gray. and Boone Prairies. Vegetation dominated by graminoids and forbs:

Wet meadows. streambanks. and swales.....**Beaked sedge** (p. 118)
Inflated sedge (p. 116)
(Nebraska sedge) (p. 100)
Moist meadows.....**Tufted hairgrass** (p. 95)
(Nebraska sedge) (p. 100)
(Kentucky bluegrass) (p. 92)
Dry margins of meadows.....**Sagebrush/Cusick bluegrass** (p. 65)

7. Sites and vegetation different. Try the key again. reading writeups for different choices to be sure of selection. use the vegetative key to the associations. or see the miscellaneous associations and communities described briefly at the end the association descriptions.

8. Canyon bottoms along Squaw Creek. Deschutes River. and Crooked River:

Active channel shelves.....**Small-fruit bulrush (bigleaf sedge)** (p. 112)
Mountain alder (p. 67)
Well developed active fluvial surfaces.....**Mountain alder-Douglas spiraea** (p. 71)
Inactive floodplains.....**Ponderosa pine/common snowberry-floodplain** (p. 27)

8. Sites different.....9

9. Meadows such as next to the old Crooked River National Grassland Headquarters:

Permanent to semi-permanently flooded ponds.....**Creeping spikerush** (p. 120)
Wet meadows, swales, and drainages.....**Beaked sedge** (p. 118)
Small-fruit bulrush (bigleaf sedge) (p. 112)
(Nebraska sedge) (p. 100)
Moist meadows.....**Woolly sedge** (p. 98)
(Kentucky bluegrass) (p. 92)
(Sagebrush/Cusick bluegrass) (p. 65)
Dry margins of meadows, often planted to domestic grasses.....
Sagebrush/Cusick bluegrass (p. 65)

9. Sites different.....10

10. Low gradient floodplains along streams such as Lone Pine and Willow Creeks. These are speculative associations as these drainages have been highly disturbed and natural vegetation is lacking:

Active fluvial surfaces.....**woolly sedge** (p. 98)
Willow/woolly sedge (p. 76)
(Willow/Kentucky bluegrass) (p. 74)
(Kentucky bluegrass) (p. 92)
(Sagebrush/Cusick bluegrass) (p. 65)
Inactive floodplains and terraces.....**(Sagebrush/Cusick bluegrass)** (p. 65)

10. Sites different. Try the key again, reading writeups for different choices to be sure of selection, use the vegetative key to the associations, or see the miscellaneous associations and communities described briefly at the end the association descriptions.

FREMONT NATIONAL FOREST

1. Pumice-mantled Basin and Range Physiographic Area. See the vegetative key to the associations (p. 13).

1. Basin and Range Physiographic Area.....2

2. Low gradient (less than 1 % valley gradient) floodplains at low to moderate elevation (generally below 5500 feet) along streams such as Fishhole. Yokum. and Fivemile Creeks. the Chewaucan River. and the lower reaches of Dairy and Elder Creeks and the Sycan and Sprague Rivers. Soil parent material primarily breccia. rhyolite. and tuff:

Active floodplains.....**Woolly sedge** (p. 98)
Willow/woolly sedge (p. 76)
(Willow/Kentucky bluegrass) (p. 74)
(Kentucky bluegrass) (p. 92)
(Sagebrush/Cusick bluegrass) (p. 65)
Inactive floodplains and terraces.....**Sagebrush/Cusick bluegrass** (p. 65)

2. Sites different.....3

3. Moderate gradient (2-4 %) floodplains at low to moderate elevation (generally below 5500 feet) in the lower reaches of streams such as Swede Cabin. Spring. and Dairy Creeks. Ponderosa pine occurs on the inactive floodplain. Soil parent material primarily basalt:

Active channel shelves.....**Small-fruit bulrush (bigleaf sedge)** (p. 112)
Mountain alder (p. 67)
Well developed active fluvial surfaces.....**Mountain alder-common snowberry** (p. 69)
Inactive floodplains.....**Ponderosa pine/common snowberry-floodplain** (p. 27)

3. Sites different.....4

4. Moderate to steep gradient (greater than 2 %) floodplains at low to moderate elevation (generally below 5500 feet) in deep V-shaped drainages with narrow riparian zones such as Bosworth. S. Fk. Sprague. and N. Fk. Sprague Canyons. Soil parent material primarily basalt:

Active channel shelves.....**Small-fruit bulrush (bigleaf sedge)** (p. 112)
Mountain alder (p. 67)
Well developed active fluvial surfaces.....**Mountain alder-Douglas spiraea** (p. 71)
Inactive floodplains. if present....**Ponderosa pine/common snowberry-floodplain** (p. 27)
or at higher elevations.....**Lodgepole pine/Douglas spiraea/forb** (p. 33)
Lodgepole pine/aquatic sedge (p. 43)

4. Sites different.....5

5. Low to moderate gradient (less than 4 %) floodplains at moderately high elevation (generally above 5500 feet) in the upper reaches of streams such as Elder. Mud. and Dairy Creeks. and the Sycan and Sprague Rivers. and Cottonwood Lake Basin. Lodgepole pine occurs on inactive fluvial surfaces. Soil parent material primarily basalt:

Active fluvial surfaces.....**Aquatic sedge** (p. 104)
Willow/aquatic sedge (p. 80)
(Willow/Kentucky bluegrass) (p. 74)
(Kentucky bluegrass) (p. 92)
Inactive floodplains and terraces.....**Lodgepole pine/aquatic sedge** (p. 43)
(Lodgepole pine/Kentucky bluegrass) (p. 29)
(Kentucky bluegrass) (p. 92)

5. Sites different.....6

6. Low gradient (less than 1 %) meadows at moderately high elevation (generally above 5500 feet) along active streams such as Lee Thomas Meadow. Upper Sycan River Meadow. Elder Creek Meadows. and Corral Creek Campground Meadows:

Active fluvial surfaces.....**Aquatic sedge** (p. 104)
Willow/aquatic sedge (p. 80)
(Willow/Kentucky bluegrass) (p. 74)
(Kentucky bluegrass) (p. 92)
Moist meadows.....**Tufted hairgrass** (p. 95)
(Nebraska sedge) (p. 100)
(Kentucky bluegrass) (p. 92)
Inactive fluvial surfaces supporting lodgepole pine.....
Lodgepole pine/aquatic sedge (p. 43)
(Lodgepole pine/Kentucky bluegrass) (p. 29)
Dry margins of meadows.....**Sagebrusb/Cusick bluegrass** (p. 65)

6. Sites otherwise.....7

7. Low gradient (less than 1 %) meadows at moderately high elevation (generally above 5500 feet) with inactive streams such as Bull Prairie and Crazyman Flat:

Wet meadows. streambanks. amd swales.....**Beaked sedge** (p. 118)
Inflated sedge (p. 116)
Aquatic sedge (p. 104)
(Nebraska sedge) (p. 100)
Moist meadows. .....**Tufted hairgrass** (p. 95)
(Nebraska sedge) (p. 100)
(Kentucky bluegrass) (p. 92)
Inactive fluvial surfaces supporting lodgepole pine.....
Lodgepole pine/aquatic sedge (p. 43)
(Lodgepole pine/Kentucky bluegrass) (p. 29)
Dry margins of meadows.....**Sagebrusb/Cusick bluegrass** (p. 65)

7. Sites otherwise.....8

8. Forested basins. toeslopes. and floodplains at moderate to moderately high elevation (generally above 5500 feet). Usually in cold air drainages on north to east exposures. White fir climax. Mesic forbs such as sweetscented bedstraw dominate the ground layer:

Streambanks.....**Queencup beadlily (mountain alder)** (p. 122)
Mountain alder (p. 137)

Toeslopes. inactive floodplains. and basins. White fir climax.....
White fir/queencup beadlily (p. 47)

8. Sites different.....9

9. V-shaped valleys with steep valley gradients (greater than 4 %) at the heads of streams such as Teepee and Spring Creeks and the many small tributaries of Dairy Creek. Usually in cold air drainages on north to east exposures. Within the range of mountain alder:

Streambanks.....**Queencup beadlily (mountain alder)** (p. 122)
Mountain alder (p. 137)

Narrow floodplains and toeslopes.....**White fir/queencup beadlily** (p. 47)

9. Sites different.....10

10. V-shaped valleys with steep valley gradients (greater than 4 %) at the heads of streams such as the many small tributaries to Cottonwood Lake. Cold air drainages of north to east aspects. Above the elevational limits or outside the range of mountain alder.....
Arrowleaf groundsel (p. 124)

10. Sites and vegetation different. Try the key again. reading writeups for different choices to be sure of selection. use the vegetative key to the associations. or see the miscellaneous associations and communities described briefly at the end the association descriptions

ASSOCIATION DESCRIPTIONS

PONDEROSA PINE/COMMON SNOWBERRY–FLOODPLAIN ASSOCIATION

Pinus ponderosa/Symphoricarpos albus-floodplain
CPS5-11 PIPO/SYAL-FLOOD

Sample Size = 17 plots in mid to late seral ecological status

LOCATION AND RIPARIAN LANDFORMS

The ponderosa pine/common snowberry-floodplain association is abundant on the Ochoco, locally common on the Deschutes, infrequent on the Fremont, and has an unknown status on the Winema National Forests. It is found in the Ochoco Mountains, Grasslands, LaPine Basin, Low Flanks Cascades, and Basin and Range Physiographic Areas. It occurs at low to moderate elevations (2700-4700 feet) within moderately broad, moderate gradient floodplain landforms (Figures 3 and 4) where warm seasonal temperatures, well-aerated soils, and moderate soil moisture favor the development of ponderosa pine on inactive floodplains. At lower elevations these valleys support nonconiferous floodplains and shrub-steppe upland.

1 Ochoco Creek, third order
2 Mountain alder, active channel shelf
3 Mountain alder-common snowberry, banks
4 Ponderosa pine/common snowberry-floodplain, inactive floodplain

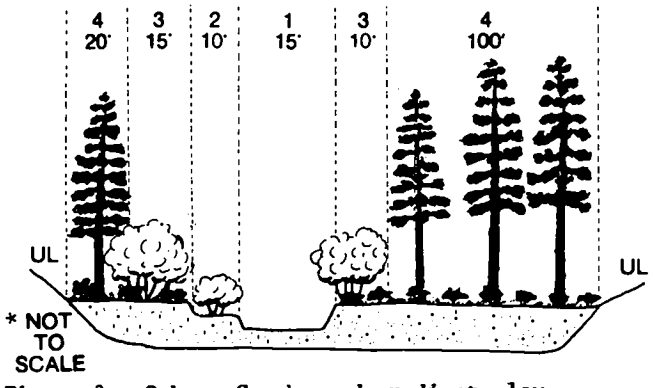


Figure 3. Ochoco Creek; mod gradient, low elevation floodplain; Ochoco Mountains Physiographic Area.

* None of the sketches in figures 3 to 91 are to scale.

1 Lake Creek, third order
2 Small-fruit bulrush (bigleaf sedge). active channel shelves
3 Mountain alder-common snowberry, active floodplains
4 White fir/queencup beadlily, inactive floodplains
5 Ponderosa pine/common snowberry-floodplain, terraces

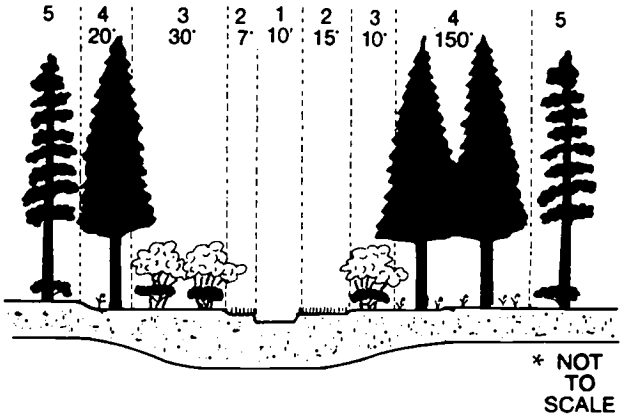


Figure 4. Lake Creek; mod-low gradient, low elevation floodplain; Low Flanks Cascades Physiographic Area.

SOILS

This is one of the driest conifer associations described in this paper. The texture of the surface horizon ranges from coarse sandy loam to sandy clay loam. More recently water-worked soils may contain some cobbles and gravels in the surface horizon but usually these materials are located deeper at zones of past active streambeds. Available water holding capacity is moderate. Water tables are within 3 feet of the soil surface in May and June and lower to more than five feet below the soil surface in July and August.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover		Constancy
Douglas-fir	0-48	(10)	41
Ponderosa pine	1-75	(33)	100
Woods rose	0-10	(3)	94
Common snowberry	15-63	(32)	100
Blue wildrye	0-5	(2)	59
Kentucky bluegrass	0-50	(11)	76
Elksedge	0-35	(4)	35
Western yarrow	0-10	(2)	76
Red columbine	0-3	(1)	53
Strawberry	0-10	(2)	71
Northern bedstraw	0-5	(2)	59
Sweetroot	0-4	(2)	82
Solomonplume	0-7	(2)	71
Meadowrue	0-15	(2)	53
Trees	23-83	(55)	100
Shrubs	17-87	(50)	100
Grasses	3-75	(19)	100
Sedges	0-35	(6)	88
Forbs	10-40	(26)	100

Potential natural vegetation: Stands are dominated by conifers and snowberry. Ponderosa pine is the dominant conifer, but stands may contain some Douglas-fir, incense cedar, western larch, or lodgepole pine. Douglas-fir may be climax on part of the association on the Ochoco National Forest. White fir is incidental. Common snowberry is abundant. On more mesic sites the ground vegetation is typified by forbs such as red columbine, sweetscented bedstraw, and starry solomonplume. On dry sites, elk sedge is well represented along with a dry forb layer typified by northern bedstraw, western yarrow, sweetroot, and meadowrue.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production is highly variable and ranged from 100 to 2500 (699) lbs/acre dry weight. Highest estimates occurred on rested pastures. This association occurs on sites that have received a century or more of intensive use (roads, season-long grazing, logging, splash dams, flooding, mining) because of easy access. Therefore, the majority of stands are highly altered. Past disturbance has reduced the competitive ability of native shrubs and herbs, allowing Kentucky bluegrass to become dominant.

With increased overuse by livestock, Kentucky bluegrass, other graminoids, and forbs become codominant with common snowberry and eventually dominate the stand. Snowberry cover becomes clumpy because of its sensitivity to soil compaction. The coniferous overstory becomes moderately to poorly stocked as soil compaction and grazing prevents conifer regeneration.

Continued overuse may lead to complete replacement of snowberry by Kentucky bluegrass and forbs, increased streambank erosion in the adjacent **mountain alder-snowberry** and **mountain alder associations**, and the inability to control streamflow during peak flows. Stream channels become wide and shallow and mountain alder is eventually eliminated from active fluvial surfaces.

Wildlife and fisheries: The fish habitat on most streams is highly degraded. Degraded streams have wide, shallow, dished profiles and streambanks denuded of alder. The hydrology of these sites is now altered to high peak flows and low base flows. Emphasis should be directed to reestablishing **mountain alder/common snowberry** on active fluvial surfaces for the development of narrow, deep, controlled stream channels. Landforms supporting the **ponderosa pine/common snowberry-floodplain** and **mountain alder/common snowberry associations** provide important habitat for deer and elk throughout the year.

Fire: Vegetation occurring on this association has a moderate resistance to fire. Pole and sawlog ponderosa pine, Douglas-fir, and western larch will tolerate moderate to hot ground fires. However, conifer regeneration should be protected from ground fire if possible. Kentucky bluegrass and elksedge resprout from rhizomes and snowberry resprouts from the stem base following cool and moderate ground fire.

Silviculture: Timber production is variable, depending on the stocking of the stand. 100-year site index ranged from 70 to 130 (95) feet. Basal area ranged from 140 to 320 (187) sq ft/acre on poor to well-stocked stands. Wildlife, fisheries, recreation, understocked conifers, and the replacement of woody debris in streams should be considered in silvicultural plans for the association.

Estimating potential on disturbed sites: On the Ochoco National Forest most moderate gradient floodplains at low to moderate elevations that support ponderosa pine and Kentucky bluegrass belong to the **ponderosa pine/common snowberry-floodplain association**. The association is scattered and restricted to very low elevations on other National Forests.

Rehabilitation pathways: Rapid reestablishment of snowberry on poor condition sites seems impractical given the general lack of snowberry and the competitive advantage of Kentucky bluegrass. Two or three years of rest from livestock grazing will significantly increase Kentucky bluegrass cover, litter, and biomass on deteriorated sites.

The Ochoco National Forest has been successful in developing an upward trend in forage condition by enforcing forage utilization standards. When livestock are removed from these sites at 40% forage use the association can return to late seral or better ecological status in 10-20 years. Rehabilitation can be accelerated by first resting the pastures. Livestock are introduced when alder is established on the streambanks and their stems become tall and thick enough to withstand browsing (about 5 years).

Structures are not needed to rehabilitate alder sites but may be helpful in improving fisheries values and raising water tables. Introducing woody debris of 12 inches or more in diameter will provide long-term stability to the site.

OTHER STUDIES

This association is similar to that portion of Hall's (1973) **ponderosa pine/blue wildrye association** that occurs on floodplains. Kaufman and Krueger (1985) described a similar community type on Catherine Creek in the Blue Mountains.

LODGEPOLE PINE/KENTUCKY BLUEGRASS COMMUNITY TYPE

Pinus contorta/Poa pratensis
CLM1-12 PICO/POPR

Sample size = 8 plots in early to mid seral ecological status

LOCATION AND RIPARIAN LANDFORMS

The lodgepole pine/Kentucky bluegrass community type occurs on sites of various ecological potential where the potential has been altered by grazing and/or the lowering of the water table. It is common in the Basin and Range and Ochoco Mountains Physiographic Areas but is especially abundant on the Pumice-mantled Basin and Range Physiographic Area. Elevations are low to moderate (4400-5900 feet). It occurs on the edge of dry basin and floodplain landforms with gentle slopes and smooth microtopography on a wide variety of landforms once occupied by tufted hairgrass, Cusick bluegrass, lodgepole pine/widefruit sedge, and lodgepole pine/aquatic sedge associations (Figures 5 & 6). Another figure illustrating this association is shown in the willow/Kentucky bluegrass community type (p. 74).

1 Beaked sedge, Jack Creek, intermittent
2 Widefruit sedge, moist meadow
3 Kentucky bluegrass (tufted Hairgrass potential), dry meadow
4 Lodgepole pine/Kentucky bluegrass, invasion into tufted hairgrass
5 Lodgepole pine/bearberry, transitional

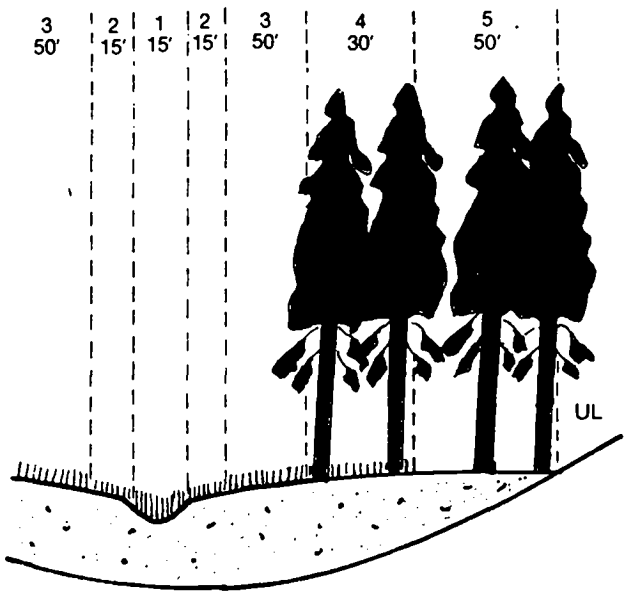


Figure 5. Jack Creek; low gradient, mod-low elevation floodplain; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest.

SOILS

Soil textures and parent materials are variable. Textures range from loamy sand to silty clay loam. Parent materials include pumice, rhyolite, basalt, andesite, and tuff. Available water holding capacity is moderately high. The seasonally high water table is 12-28 inches below the soil surface in June and lowers to 30 to 65 inches below the surface in July.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Lodgepole pine	**37-85 (60)**	**100**
Meadow barley	0-15 (3)	75
Kentucky bluegrass	**15-63 (37)**	**100**
Baltic rush	0-3 (2)	75
Western yarrow	0-15 (4)	63
Broadpetal strawberry	3-15 (5)	100
Northwest cinquefoil	0-15 (3)	88
Dandelion	1-15 (6)	100
Longstalk clover	0-20 (8)	75
Trees	37-90 (61)	100
Grasses	30-87 (50)	100
Sedges	0-30 (8)	88
Forbs	10-63 (36)	100

Potential natural vegetation: Lodgepole pine and a sward of Kentucky bluegrass dominate the stand. Bluegrass growth form occurs as vigorous, erect, loosely clustered tillers growing through a loose mat of grass and pine needle litter. Shading and litter, both from lodgepole pine and Kentucky bluegrass, have a noticeable effect on bluegrass culm density and in the reduction of competitors. Blue wildrye occasionally dominates the moist end of the community. Other graminoids include meadow barley, Timothys, tufted hairgrass, Cusick bluegrass, widefruit sedge, aquatic sedge, and Baltic rush. The forb component includes western yarrow, rose pussytoes, elk thistle, broadpetal strawberry, northwest cinquefoil, dandelion, and longstalk clover.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 300 to 2000 (1063) lbs/ acre dry weight. Livestock use of the community type can be significant because it supplies substantial

forage, provides favored bedding and resting sites, and lies next to tufted hairgrass, Cusick bluegrass, and Kentucky bluegrass meadows. The soils are surface dry in early summer so that livestock use can be nearly season long. However, Kentucky bluegrass can retain competitive ability under a wide range of grazing pressures, reproducing by both tillering and sprouting from seed under light grazing or switching solely to vegetative reproduction under severe grazing systems (Volland 1979).

With increasing overuse by livestock, other grasses and forbs become codominant with Kentucky bluegrass. The bluegrass form is erect, tightly clustered tillers, growing through a compacted and somewhat broken litter layer. Bluegrass is expanding into disturbed areas through vigorous rhizome elongation. Baltic rush and perennial forbs may be aggregated into somewhat large colonies. Annual forbs are restricted to local disturbances such as cattle dusting areas and gopher mounds.

With continued overuse, Kentucky bluegrass becomes subordinant to other grasses and forbs. Its growth form is decumbent, with weak tillers rising close together from short rhizomes. There is little evidence of bluegrass invasion into disturbed areas. The litter layer is compacted or (except for pine needles) absent. Perennial forbs and Baltic rush occur in large patches. Bare ground and soil compaction are evident and annual forbs are widely distributed through the stand.

1 Williamson River, third order
2 Beaked sedge, active channel shelves
3 Beaked sedge, overflow channel
4 Widefruit sedge, moist edges of overflow channels
5 Kentucky bluegrass (Cusick bluegrass potential), inactive floodplains and terraces
6 Lodgepole pine/Kentucky bluegrass (invasion into Cusick bluegrass), inactive floodplains and terraces
7 Lodgepole pine/bearberry, transition slopes

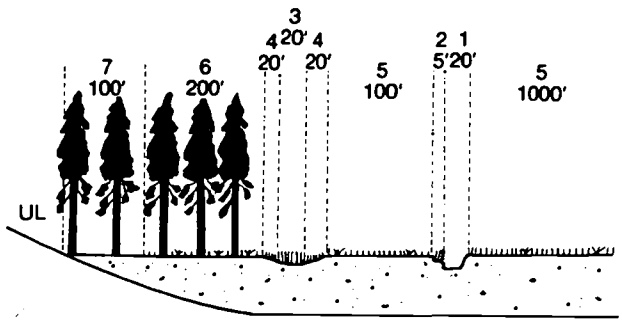


Figure 6. Williamson River; low gradient, mod-low elevation floodplain; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest.

Wildlife and fisheries: Pocket gophers, mice, and Columbian ground squirrels can have significant periodic impact on the type, increasing the prevalence of perennial and annual forbs. It may take several years to reestablish Kentucky bluegrass on sites devastated by ground squirrels (Volland 1979). The community type provides cover and shade for deer and elk while using adjacent meadows and is important habitat for raptors.

Fire: Cool burns should have little impact on rhizomatous Kentucky bluegrass or associated perennial forbs. Fire could be an effective tool to reduce excessive litter buildup on rested pastures if care is taken to protect the fire-sensitive lodgepole pine.

Silviculture: Site index for Lodgepole pine/Kentucky bluegrass ranges from 80 to 120 (91) feet at 100 years. Basal area on fully stocked stands ranged from 180 to 205 sq ft/acre. Natural regeneration was common in most stands. Compaction of moist soils is best avoided by logging late summer or on frozen ground. Pocket gophers often increase after logging. Kentucky bluegrass will be a fierce competitor with conifer regeneration. Consider wildlife preference for this type when planning silvicultural activities.

Estimating potential on disturbed sites: Local experience and insight are required to estimate natural potentials on this type. Look for remnants of original vegetative dominants on microsites or adjacent stands. Decide if the lodgepole pine stand is natural or a result of invasion into meadow sites. Invasion sites likely supported tufted hairgrass or Cusick bluegrass associations. Naturally occurring lodgepole pine may once have had an undergrowth of widefruit or (eastward) aquatic sedge.

Rehabilitation pathways: Renovation of this community type with native graminoids seems impractical given depleted water tables and the morphological flexibility of Kentucky bluegrass. Unless water tables are restored to natural levels, these sites will remain with a ground cover dominated by Kentucky bluegrass. Two or three years of rest will restore the vigor of Kentucky bluegrass on fair or better condition pastures. Since bluegrass is a permanent feature of the site, the introduction of domestic species is not recommended.

OTHER STUDIES:

The lodgepole pine/Kentucky bluegrass community type has not been identified in other studies. It has usually been handled as an invasion or cover type. It is considered a naturalized community in central Oregon.

LODGEPOLE PINE/BEARBERRY ASSOCIATION

Pinus contorta/Arctostaphylos uva-ursi
CLM2-11 PICO/ARUV

Sample size = 7 plots in climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The lodgepole pine/bearberry association was described by Volland (1976). Only two plots were sampled in this study. Five plots were borrowed from Volland. It is one of the driest lodgepole pine associations described in this report. It is common on the Deschutes, Fremont, and Winema National Forest in the LaPine Basin and Pumice-mantled Basin and Range Physiographic Areas. It occurs on imperfectly drained, low gradient landforms on the edges of meadows, forested drainages, and basins (Figures 7 & 8). Elevations are low to moderate (4400- 5900 feet). Other figures illustrating this association are found in the discussions for Cusick bluegrass, lodgepole pine/widefruit sedge, and willow/ Kentucky bluegrass (p. 65, 41, and 74).

1 Beaked sedge, Jack Creek, intermittent
2 Widefruit sedge, moist meadow
3 Kentucky bluegrass (tufted Hairgrass potential), dry meadow
4 Lodgepole pine/Kentucky bluegrass, invasion into tufted hairgrass
5 Lodgepole pine/bearberry, transitional

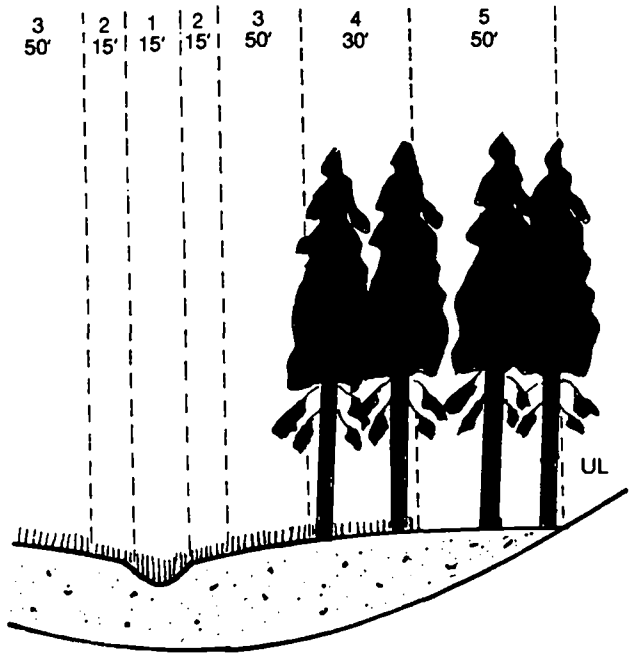


Figure 7. Jack Creek; low gradient, mod-low elevation floodplain; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest.

1 Lodgepole pine/bog blueberry/widefruit sedge, forested wetland
2 Lodgepole pine/bog blueberry/forb, transitional
3 Lodgepole pine/bearberry, transitional

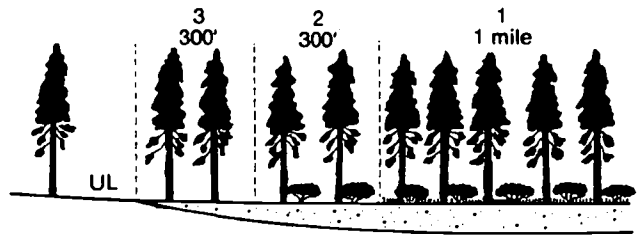


Figure 8. Jackie's Thicket; flat, mod elevation basin; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest.

SOILS

Surface soils are air laid or flow pumice over buried soils from alluvium, lava, or tuff. Surface profile textures range from loamy coarse sand to sandy loam. This often grades into a coarse sandy C horizon that is moist throughout the year. Available water holding capacity is low. In May and June, water levels lie within 2 feet of the soil surface but lower to 4 to 5 feet below the soil surface in August.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Lodgepole pine	20-60 (41)	100
Bearberry	7-65 (25)	100
Bitterbrush	0-2 (1)	100
Douglas spiraea	0-5 (3)	57

Potential natural vegetation: The lodgepole pine/bearberry association is dominated by lodgepole pine and bearberry. Other conifers are not capable of dominating these cold basin sites. Other shrubs include wax currant, bitterbrush, and Douglas spiraea but are scattered subordinants to bearberry. Common grasses are timber oatgrass, bottlebrush squirreltail, western needlegrass, and Ross sedge. Forbs include longstalk clover, small-flower penstemon, western aster, western yarrow, and tawny horkelia.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 10 to 66 (33) lbs/acre dry weight. Livestock spend little time on this association except for shade and bedding.

With increasing overuse by livestock, bearberry decreases in cover with soil disturbance and soil compaction. The herbaceous layer becomes dominated by bare ground rather than a dramatic increase in the cover of graminoids and forbs.

Wildlife and fisheries: **Lodgepole pine/bearberry** provides thermal and hiding cover for deer and elk, which feed in adjacent meadows. It provides perch and nest sites for raptors when located next to meadows.

Fire: Lodgepole pine is killed by all but the coolest ground fires while bearberry is moderately resistant to fire. Lodgepole pine reproduces from prolific seed after fire. Bearberry reproduces from its abundant fleshy seed and by stem budding from its shallow roots (Volland 1981). Cool, light prescribed fire will assure maximum survival of lodgepole pine and regeneration of bearberry.

Silviculture: Lodgepole pine produces an average of 142 sq ft of basal area/acre and grows to 70 feet tall at 100 years (Volland 1976). Natural regeneration is common. The soils are surprisingly fluid during periods of high water. Compaction of moist soils is best avoided by logging late summer or on frozen ground. Dwarf mistletoe is common. Pocket gophers are common and will increase after logging. Silvicultural prescriptions should consider wildlife preferences for this association, proximity to water, and the potential for windthrow in residual trees.

Estimating potential on disturbed sites: Most stands can be recognized on the basis of vegetative composition alone.

Rehabilitation pathways: Revegetation is normally not needed as lodgepole pine and bearberry readily regenerate following logging or wildfire. Soils seem to be too coarse and dry in late summer for Kentucky bluegrass.

OTHER STUDIES

This association is similar to Volland's (1976) **lodgepole pine/bearberry association.**

LODGEPOLE PINE/DOUGLAS SPIRAEA/FORB ASSOCIATION

Pinus contorta/Spiraea douglasii/forb
CLM3-13 PICO/SPDO/FORB

Sample size = 9 plots in climax ecological status

LOCATION AND RIPARIAN LANDFORMS

Lodgepole pine/Douglas spiraea/forb is common at moderately low elevations (4100-5300 feet) on the Deschutes and Winema National Forests and is locally common on the western fringe of the Fremont National Forest (elevations 4800-5800 feet). This transitional association is common on several landforms, including: 1) low gradient, shallowly incised, pumice-filled drainages and basins in the Pumice-mantled Basin and Range Physiographic Area (Figure 9), 2) narrow, deeply incised, moderate gradient drainages with narrow floodplains in the Pumice-mantled Basin and Range Physiographic Area, and 3) moderate gradient, narrow floodplains in deep valleys in the vicinity of the Cascade Mountains and Yamsay Mountain in the Deschutes Cascades, Winema Cascades, and Pumice-mantled Basin and Range Physiographic Areas (Figure 10). See the descriptions for **lodgepole pine/widefruit sedge** and **lodgepole pine/Douglas spiraea/ widefruit sedge** (p. 41 and 35) for other figures showing **lodgepole pine/Douglas spiraea/forb**.

1 Coyote Creek, second-order
2 **Willow/widefruit sedge**, active channel shelves
3 **Lodgepole pine/Douglas spiraea/forb**, inactive floodplains or terraces

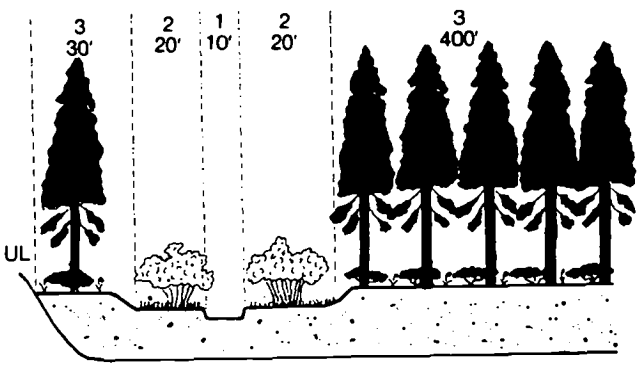


Figure 9. Coyote Creek; low gradient, mod-low elevation floodplain; Pumice-mantled Basin and Range Physiographic Area; Fremont National Forest.

SOILS

Soils are derived from deep pumice alluvium or air-laid pumice. Surface textures ranged from loamy sand to fine sandy loam. Available water holding capacity is moderately low. There is insignificant accumulation of organic matter in the soil surface. Subsurface soils are of very coarse pumice. The association is intermediate in soil moisture between the **lodgepole pine/Douglas spiraea/widefruit sedge** and **lodgepole pine/bearberry associations**. Maximum water tables are 1/2 to 2 feet below the soil surface in May and June. The water table lowers to 3 to 4 feet below the soil surface in August and September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Lodgepole pine	**40-80 (61)**	**100**
Bearberry	0-15 (7)	67
Woods rose	0-15 (3)	67
Douglas spiraea	**15-65 (38)**	**100**
Blue wildrye	0-7 (2)	67
Western yarrow	0-3 (2)	89
Broadpetal strawberry	0-15 (5)	89
Northern bedstraw	0-3 (2)	67
Starry solomonplume	0-3 (1)	67
Longstalk clover	0-37 (6)	56
Trees	52-80 (69)	100
Shrubs	37-75 (57)	100
Grasses	3-15 (7)	100
Sedges	0-3 (1)	78
Forbs	6-63 (26)	100

Potential natural vegetation: The association is characterized by an overstory of lodgepole pine and a dense shrub layer dominated by Douglas spiraea. Lodgepole pine is climax and other conifers are scattered. Bearberry is common on many plots. Willows and sedges are absent or restricted to moist microsites. Grasses are poorly represented, blue wildrye is the only consistent grass found on the sample plots. The relatively dry forb layer includes western yarrow, broadpetal strawberry, northern bedstraw, starry solomonplume, and longstalk clover.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 50 to 500 (250) lbs/acre dry weight. Livestock use the association for bedding and shade while using adjacent openings for forage.

With increasing overuse by livestock, Douglas spiraea decreases in cover because of

trampling. Disturbances are more likely to result in an increase in the cover of bare ground rather than a dramatic increase in grasses and forbs.

Wildlife and fisheries: **Lodgepole pine/Douglas spiraea/forb** provides important raptor habitat where it occurs next to meadows and water. The association provides thermal and hiding cover for deer which feed in adjacent meadows and wetlands. Important trout streams pass through landforms supporting this association.

1 Miller Creek, third order
2 **Mountain alder-Douglas spiraea**, active channel shelves and streambanks
3 **Lodgepole pine/Douglas spiraea/forb**, inactive floodplains

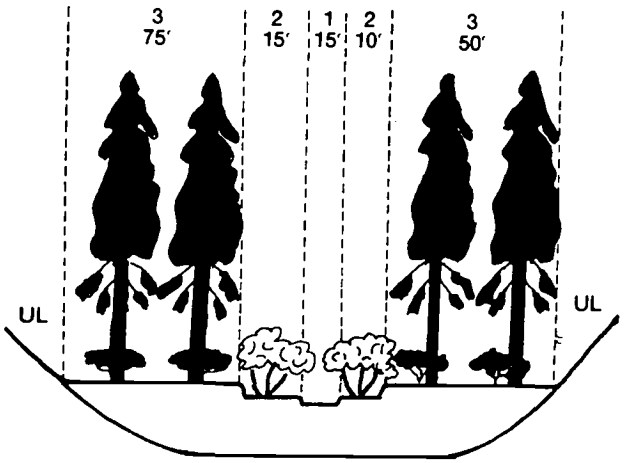


Figure 10. Miller Creek; mod gradient, mod elevation floodplain; Pumice-mantled Cascades Physiographic Area; Winema National Forest.

Fire: Wildfire was probably common in this type. Soils are dry by mid-summer and fire can easily encroach from adjacent uplands. Douglas spiraea will resprout from the stem base. Fire will not change the vegetative composition of the association except for its impacts on lodgepole pine.

Silviculture: 100-year site index ranged from 70 to 100 (84) feet while basal area ranged from 140 to 270 (202) sq ft/acre. Overstory removal will not appreciably change the composition of the ground cover. Timber management should consider special constraints associated with the proximity to water, high water tables, the potential of windthrow in residual trees, fisheries, and wildlife. The coarse soils are surprisingly fluid during periods of high water so that heavy equipment should be kept off the site until July. Locate roads on adjacent uplands where possible.

Recognizing potential on disturbed sites: Most stands can be recognized on the basis of vegetative composition alone.

Rehabilitation pathways: Rehabilitation is not usually necessary as lodgepole pine and Douglas spiraea both regenerate following logging or wildfire. Soils seem to be too coarse and dry for Kentucky bluegrass.

OTHER STUDIES

Lodgepole pine/Douglas spiraea/forb has not been described in other studies.

LODGEPOLE PINE/DOUGLAS SPIRAEA/WIDEFRUIT SEDGE ASSOCIATION

Pinus contorta/Spiraea douglasii/Carex eurycarpa
CLM3-14 PICO/SPDO/CAEU

Sample size = 10 plots in late seral and climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The lodgepole pine/Douglas spiraea/widefruit sedge association is common at low to moderate elevations (4100-5100 feet) on the Winema and Deschutes National Forests and also occurs sporadically on the west fringe of the Fremont National Forest. It is strongly associated with deep pumice mantles on the Pumice-mantled Basin and Range and LaPine Basin Physiographic Areas. It has also been observed in the Low Flanks Cascades Area. Sites are on low gradient, pumice-filled basins (Figure 11) and drainages (Figure 12). These sites are east of the distribution of Engelmann spruce and bog blueberry. Microtopography is flat, slightly undulating, to slightly concave. The sites are intermediate in soil moisture characteristics between lodgepole pine/Douglas spiraea/forb and lodgepole pine/widefruit sedge. Sample plots were located at Sand, Spring, and Tumalo Creeks, Deschutes and Little Deschutes Rivers, and various small, unnamed drainages and basins. See the description for the Sitka sedge association (p. 114) for another figure illustrating the lodgepole pine/Douglas spiraea/widefruit sedge association.

1 Spruce Creek, second-order
2 Willow/widefruit sedge, active floodplain
3 Lodgepole pine/Douglas spiraea/widefruit sedge, inactive floodplains
4 Lodgepole pine/Douglas spiraea/forb, transitional

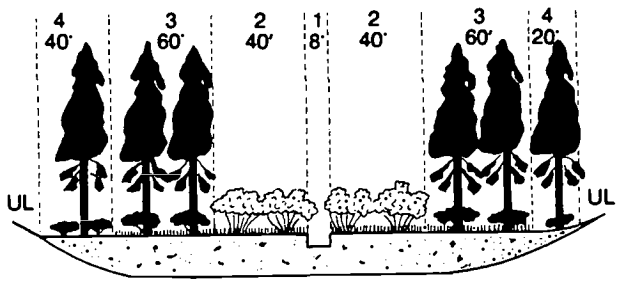


Figure 11. Spruce Creek; low gradient, mod elevation floodplain; LaPine Basin Physiographic Area.

SOILS

Soils are derived from deep pumice alluvium. Surface textures ranged from loamy sands to silty clay loam. Surface horizons do not have enough organic matter to be classified as organic soils. Two sample plots have an organic loam surface horizon. Available water holding capacity is moderate. The water table is near to slightly above the soil surface in June and lowers to 2 to 3 feet below the surface in August.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Lodgepole pine	23-80 (53)	100
Woods rose	0-10 (3)	50
Booth willow	0-15 (5)	60
Geyer willow	0-12 (4)	60
Lemmon willow	0-37 (6)	60
Douglas spiraea	7-60 (25)	100
Blue wildrye	0-15 (3)	60
Kentucky bluegrass	0-15 (3)	70
Widefruit sedge	**0-35 (14)**	**90**
Broadpetal strawberry	0-15 (4)	90
Jacob's-ladder	0-5 (2)	70
Longstalk clover	0-10 (3)	50
Starry solomonplume	0-10 (3)	80
Streambank butterweed	0-5 (2)	60
American vetch	0-3 (2)	60
Trees	25-90 (64)	100
Shrubs	25-80 (49)	100
Grasses	1-31 (11)	100
Sedges	3-50 (20)	100
Forbs	3-37 (26)	100

Potential natural vegetation: Lodgepole pine is climax and the dominant tree. Other conifers are scattered. Quaking aspen was common in several plots where lodgepole pine is gaining dominance over quaking aspen in late succession on the quaking aspen/Douglas spiraea/ widefruit sedge community type. The undergrowth is dominated by low shrubs, especially Douglas spiraea. Willows are more abundant here than on other forest wetland associations. Woods rose is present in many stands. Widefruit sedge is common in the undergrowth except for one plot that was dominated by woolly sedge. Blue wildrye and Kentucky bluegrass are the most common grasses. Fowl bluegrass is common on some of the wetter sites. Forbs include broadpetal strawberry, Jacob's-ladder, starry solomonplume, American vetch, largeleaved avens, western St.Johnswort, steambank butterweed, and longstalk clover.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 250 to 3000 (1200) lbs/acre dry weight. Stands with dense canopies of conifers and shrubs had reduced forage production compared to open stands. Widefruit sedge, Kentucky bluegrass, blue wildrye, and other graminoids are palatable to livestock and can provide considerable forage. Most acres of this association lie outside of existing grazing allotments. If grazed, the grazing season could begin in late July or August or whenever the soil becomes surface dry. Widefruit sedge and other graminoids respond well to rest and late season grazing on sites in mid seral or better ecological status.

With increasing overuse by livestock, Douglas spiraea decreases in cover with soil disturbance and soil compaction. Herbs such as Kentucky bluegrass and forbs increase in cover in response to decreasing cover of widefruit sedge and lowered water tables.

Wildlife and fisheries: Deer use was common on most sample plots. The sites provide forage, browse, cover, and water. Considerable forage is available in adjacent openings. Raptors use the association where adjacent to meadows and

1 Widefruit sedge, swale
2 Quaking aspen-lodgepole pine/Douglas spiraea/widefruit sedge, active floodplain
3 Lodgepole pine/Douglas spiraea/widefruit sedge, active floodplain
4 Lodgepole pine/Douglas spiraea/forb, terrace

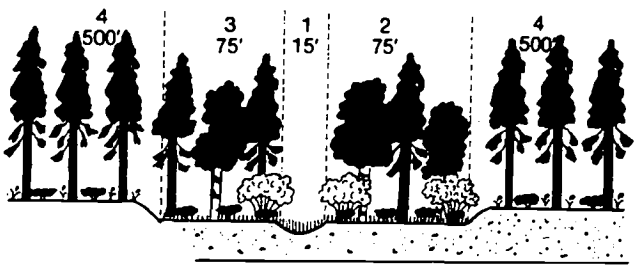


Figure 12. Unnamed drainage between Highway 97 and Williamson River; low gradient, moderately low elevation floodplain; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest.

water. The association often occurs along important trout streams such as Crescent Creek and Little Deschutes River (Deschutes National Forest).

Fire: Wildfire was probably fairly common on the lodgepole pine/Douglas spiraea/widefruit sedge association. Soils usually are surface dry in August, allowing fire to encroach from adjacent uplands. Lodgepole pine is sensitive to all but cool ground fires. The shrubs and herbs are well adapted for regeneration following fire. There may be a dramatic increase in willow cover following reduction in conifer cover.

Silviculture: 100-year site index ranged from 64 to 120 (97) feet while basal area was 120 to 290 (188) sq ft/acre. Regeneration of lodgepole pine may be difficult due to high water tables. Advanced regeneration often occurs on hummocks at the base of trees and should be protected from logging injury. Overstory removal will result in an increase in widefruit sedge and/or shrubs, especially willows, and may result in temporary conversion to the willow/ widefruit sedge or widefruit sedge associations. Silviculturists should consider special constraints due to the potential of windthrow in residual trees, regeneration problems, high water tables, fisheries, and wildlife. The coarse textured C horizon is highly erosive when the sedge sod is broken. Wet soils also create special problems for road construction and maintenance. Keep heavy equipment off saturated soils and locate roads on adjacent uplands where possible.

Estimating potentials on disturbed sites: Where elevated water tables have altered the vegetative composition towards wetter associations, stumps and logs witness the potential for the site to support lodgepole pine.

Rehabilitation pathways: The association has not been observed in deteriorated condition.

OTHER STUDIES

This association is similar to the part of Volland's (1976) lodgepole pine/blueberry/forb wetland that has its undergrowth dominated by Douglas spiraea and widefruit sedge. The association has not been described elsewhere.

LODGEPOLE PINE/BOG BLUEBERRY/FORB ASSOCIATION

Pinus contorta/Vaccinium occidentalis/forb
CLM3-11 PICO/VAOC2/FORB

Sample size = 7 plots in late seral and climax ecological status

LOCATION AND RIPARIAN LANDFORMS

Lodgepole pine/bog blueberry/forb is found on the Deschutes, Winema, and west fringe of the Fremont National Forests. It occurs over a wide range of elevations (4500-5900 feet) and is most common on the Pumice-mantled Basin and Range and LaPine Basin Physiographic Areas. It also occurs in the Winema Cascades, Pumice-mantled Cascades, and Deschutes Cascades Physiographic Areas. This association occurs on the relatively dry, forested margins of meadow, lake, and forest basin landforms (Figure 13). Microtopography is flat and slopes gently towards adjacent meadows and forested wetlands. Sites are intermediate in soil moisture characteristics between the **lodgepole pine/bog blueberry/widefruit sedge** and **lodgepole pine/ bearberry** or **Engelmann spruce/ queencup beadlily** associations. Sample plots were located at Jackie's Thicket, Heavenly Lakes, near Ray Ranch, Sevenmile Marsh, Quinn Springs, and near the Little Deschutes River.

1 **Lodgepole pine/bog blueberry/widefruit sedge**, forested wetland
2 **Lodgepole pine/bog blueberry/forb**, transitional
3 **Lodgepole pine/bearberry**, transitional

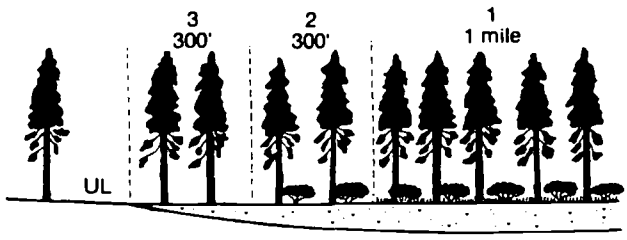


Figure 13. Jackie's Thicket; flat, mod elevation basin; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest.

SOILS

Soils are derived from air-laid pumice, pumice alluvium, or pumice lacustrine deposits. Surface textures range from loamy coarse sand to fine sandy loam. Organic matter content is low. Available water holding capacity is moderate. The soil surface is rarely flooded. The maximum water table lies about 6 inches below the soil surface in June and lowers to about 2 feet below the surface in August and September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Lodgepole pine	**20-62 (47)**	**100**
Douglas spiraea	**0-37 (19)**	**86**
Dwarf huckleberry	3-37 (17)	100
Bog blueberry	10-63 (28)	100
Bluejoint reedgrass	0-37 (7)	86
Timber oatgrass	0-15 (5)	57
Gray licoriceroot	0-3 (1)	43
Longstalk clover	0-15 (4)	57
Trees	30-78 (50)	100
Shrubs	37-87 (60)	100
Grasses	3-37 (13)	100
Sedges	0-3 (1)	71
Forbs	3-37 (15)	100

Potential natural vegetation: **Lodgepole pine/ bog blueberry/forb** has a moderately dense canopy of lodgepole pine over a dense layer of low shrubs. Lodgepole pine is climax and the dominant tree. Mountain hemlock, western white pine, subalpine fir, and white fir occur as scattered individuals. The shrub layer is dominated by bog blueberry, Douglas spiraea, and dwarf huckleberry. Big whortleberry and grouse whortleberry are present in higher elevation stands. Bluejoint reedgrass and timber oatgrass are often common. There is a modest compliment of forbs, none of which have very high cover or constancy.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 50 to 1000 (386) lbs/acre dry weight. The association provides little forage and is of little value for grazing except to provide cover and shade. Much of the association lies outside of existing grazing allotments.

With increasing overuse by livestock, bog blueberry and other shrubs decrease in cover with trampling and soil compaction. Disturbances are more likely to result in an increase in the cover of bare ground rather than an increase in herbs.

Wildlife and fisheries: The **lodgepole pine/bog blueberry/forb association** provides important habitat for raptors where next to meadows and water. It provides fawning habitat, shade, and cover for deer and elk.

Fire: Wildfire was probably fairly frequent in this association. The ground surface is dry by August so that fire can easily move onto the site from adjacent upland. Lodgepole pine is sensitive to all but cool ground fires but regenerates rapidly on burned sites. The shrubs, graminoids, and forbs are well adapted to regenerating themselves after fire so there should be little change in species composition except for a temporary decrease in cover of shrubs and lodgepole pine.

Silviculture: Site index and basal area are lower at higher elevations compared to lower elevations. 100-year site index ranged from 37 to 110 (71) feet while basal area is 120 to 230 (180) sq ft/acre. Overstory removal may result in a slight increase in shrubs and water tables but probably not enough to encourage willows or sedges. There is usually considerable advanced regeneration of lodgepole pine and it reproduces well from seed. Shrubs will compete with conifer regeneration but the surface should be prescribed burned for seedbed preparation and not machine scarified due to problems with compaction and erosive subsoils. Managers should consider special constraints due to the potential for windthrow of residual trees, high water tables, wildlife, and recreation. Heavy equipment will compact moist soils and should be kept off these sites until midsummer. Roads and trails should be located on adjacent uplands.

Estimating potential on disturbed sites: Not really necessary because of low impacts by livestock and quick regeneration of lodgepole pine, shrubs, and herbs following fire or logging. Most stands can be recognized on the basis of vegetative composition alone.

Rehabilitation pathways: All observed stands were at or near climax so that little is known about methods for rehabilitating disturbed stands.

OTHER STUDIES

Lodgepole pine/bog blueberry/forb is similar to Volland's (1976) **lodgepole pine/blueberry/forb association.** It appears that his association also includes several other associations described in this paper such as **lodgepole pine/Douglas spiraea/widefruit sedge** and **lodgepole pine/Douglas spiraea/forb.**

LODGEPOLE PINE/BOG BLUEBERRY/WIDEFRUIT SEDGE ASSOCIATION

Pinus contorta/Vaccinium occidentalis/Carex eurycarpa
CLM3-12 PICO/VAOC2/CAEU

Sample size = 7 plots in late seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The lodgepole pine/bog blueberry/widefruit sedge association occurs on the Winema and Deschutes National Forests. It is not very common because bog blueberry does not extend far below the elevational range of Engelmann spruce except on exceptionally cold sites. It is found on flat, wet, cold floodplain and basin landforms such as the forested margins of Lake of the Woods (Figure 14), the floodplains of Fall River and Crescent Creeks, Jackie's Thicket (Figure 15), and Strawberry Spring. These sites are all within the Pumice-mantled Basin and Range and LaPine Basin Physiographic Areas. Elevations are 4200 to 5100 feet. The microtopogtaphy is slightly undulating, flat, or slightly concave.

1 Lake of the Woods
2 Inflated sedge, permanently flooded shore
3 Nevada rush, semi-permanently flooded shore
4 Slender sedge, semi-perm. flooded shore
5 Tufted hairgrass, moist meadow
6 Lodgepole pine/bog blueberry/widefruit sedge, forested wetland
7 Engelmann spruce/queencup beadlily, terrace

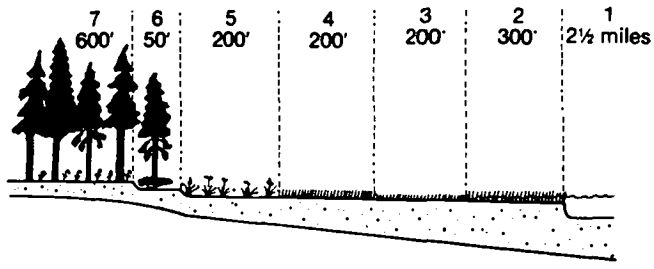


Figure 14. Lake of the Woods; flat, mod elevation lake basin; Winema Cascades Physiographic Area.

This association is also illustrated in figures for the willow/widefruit sedge and slender sedge associations (p. 78 and 108).

SOILS

Lodgepole pine/bog blueberry/widefruit sedge is closely associated with the deep pumice mantles just east of the Cascades. Soils are deep pumice alluviums. Surface horizons are high in organic matter because of long periods of water saturation. However, except for one plot, they do not have enough organic material to be called organic loam. Available water holding capacity is moderate. Subsurface soils are permanently saturated coarse pumice. The soil surface is flooded through July and the water table is 10 to 24 inches below the soil surface in September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Lodgepole pine	36-80 (57)	100
Sweetberry honeysuckle	0-15 (4)	57
Willows	0-20 (10)	86
Douglas spiraea	0-35 (15)	86
Dwarf blueberry	0-15 (5)	71
Bog blueberry	20-37 (31)	100
Bluejoint reedgrass	0-3 (1)	71
Widefruit sedge	5-60 (25)	100
Broadpetal strawberry	1-5 (2)	100
Trees	36-80 (57)	100
Shrubs	44-68 (62)	100
Grasses	1-10 (4)	100
Sedges	6-63 (26)	100
Forbs	1-35 (8)	100

Potential natural vegetation: Lodgepole pine is climax and the dominant tree. Other conifers are scattered. Bog blueberry and Douglas spiraea are the dominant shrubs. A variety of willows, especially Geyer willow, occur in the stands and may increase dramatically in cover with even partial removal of the overstory. The ground cover is characterized by a sward of widefruit sedge. Other grasses and sedges are low in cover. Bluejoint reedgrass is the most consistent grass. Forbs are inconspicuous and include Indian paintbrush, common horsetail, broadpetal strawberry, Oregon checkermallow, glabrate monkeyflower, and bog St.Johnswort.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 250 to 2000 (864) lbs/acre dry weight. Widefruit sedge is palatable to livestock and may provide considerable forage. Even though much of the association lies within grazing allotments most stands are in late seral and climax ecological status. The grazing season is short as livestock avoid the wet site well into the summer. Widefruit sedge responds quickly to rest and late season grazing in stands in mid seral or better ecological status.

With increasing overuse by livestock, bog blueberry decreases in cover with trampling and soil compaction. Grasses such as Kentucky bluegrass and forbs increase in cover in response to the declining vigor of widefruit sedge.

Continued overuse may lead to increased streambank erosion and the inability to control streamflow during peak runoffs. Streambed downcutting may occur and result in lowered water tables. Under these hydrologic conditions the site potential may change to the **lodgepole pine/bog blueberry/forb association** or **lodgepole pine/Kentucky bluegrass community type**.

Wildlife and fisheries: **Lodgepole pine/bog blueberry/widefruit sedge** provides considerable browse, forage, and cover for deer and elk. It also provides important raptor habitat where it occurs next to meadows and water. Streams such as Fall River and Crescent Creeks (Deschutes National Forest) support good trout habitat.

Fire: It will be difficult to burn this site until late summer. Lodgepole pine is sensitive to all but cool ground fire. Willows, Douglas spiraea, and bog blueberry will resprout from stem bases. Fire will not change the composition of the herb layer.

Silviculture: 100-year site index ranged from 50 to 115 (89) feet while basal area ranged from 108 to 216 (169) sq ft/acre. Advanced regeneration of lodgepole pine is often limited to raised microsites beneath the lodgepole pine and should be protected during logging. Prescribed burning should be used instead of mechanical scarification to prepare seedbeds for lodgepole pine. Even then, successful regeneration may be limited to the hummocks. Overstory removal may result in elevated water tables and a long-term conversion of the site potential to **willow/ widefruit sedge**. Managers should consider the potential of windthrow in residual trees, high water tables, wildlife, regeneration problems, and fisheries in planning timber harvest activities on these sites. Wet soils create problems for heavy equipment and road construction and maintenance. Avoid breaking the tough sedge sod which may expose erosive pumice subsoils.

Estimating potential on disturbed sites: Where elevated water tables have altered the vegetative composition towards wetter associations, stumps and logs indicate the potential of the site to eventually support lodgepole pine.

Rehabilitation pathways: All observed stands were at or near climax. Little is known about methods for rehabilitating disturbed stands.

1 **Lodgepole pine/bog blueberry/widefruit sedge**, forested wetland
2 **Lodgepole pine/bog blueberry/forb**, transitional
3 **Lodgepole pine/bearberry**, transitional

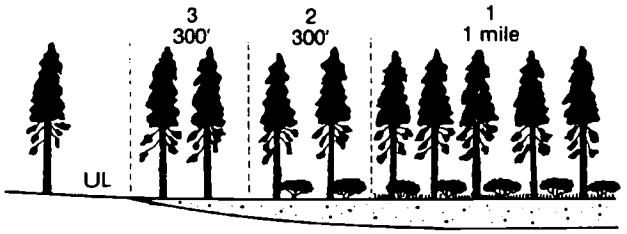


Figure 15. Jackie's Thicket; flat, mod elevation basin; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest.

OTHER STUDIES

The **lodgepole pine/bog blueberry/widefruit sedge association** is part of Vollands (1976) **Lodgepole pine/blueberry/forb wetland**. His association seems to be a composite of several distinctly different associations such as **lodgepole pine/ bog blueberry/widefruit sedge, lodgepole pine/ bog blueberry/forb, lodgepole pine/Douglas spiraea/widefruit sedge, lodgepole pine/Douglas spiraea/forb, and quaking aspen/Douglas spiraea/ widefruit sedge**.

LODGEPOLE PINE/WIDEFRUIT SEDGE ASSOCIATION

Pinus contorta/Carex eurycarpa
CLM1-13 PICO/CAEU

Sample size = 8 plots in late seral and climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The lodgepole pine/widefruit sedge association is strongly associated with deep pumice mantles of the Pumice-mantled Basin and Range and LaPine Basin Physiographic Areas. It has not been observed elsewhere, although it may occur sporadically on the Low Flanks Cascades Physiographic Area. It is similar to Engelmann spruce/widefruit sedge but occurs below the elevational distribution of Engelmann spruce. Elevations are low to moderate (4000-5400 feet). Landforms include: 1) forested floodplains along streams such as the Deschutes River, Crescent Creek, Little Deschutes River, Falls Creek, Meadow Creek, Jack Creek (Figure 16), and Spring Creek; 2) small forested basins such as at Slabhouse Spring; 3) the margins of meadows such as O'Connor Meadow (see figure in the tufted hairgrass association p. 95); and 4) shallow, concave, subirrigated drainages (Figure 17). The microrelief is flat to very slightly undulating to concave.

1 Jack Creek, intermittent stream
2 Beaked sedge, overflow channel
3 Widefruit sedge, active floodplain
4 Lodgepole pine/widefruit sedge, inactive floodplain
5 Lodgepole pine/bearberry, transition slope

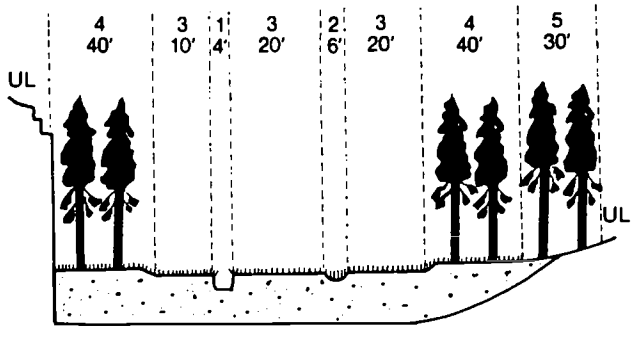


Figure 16. Jack Creek; low gradient, mod elevation floodplain; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest.

1 Widefruit sedge, swale
2 Quaking aspen-lodgepole pine/Douglas spiraea/widefruit sedge, active floodplain
3 Lodgepole pine/Douglas spiraea/widefruit sedge, active floodplain
4 Lodgepole pine/Douglas spiraea/forb, terrace

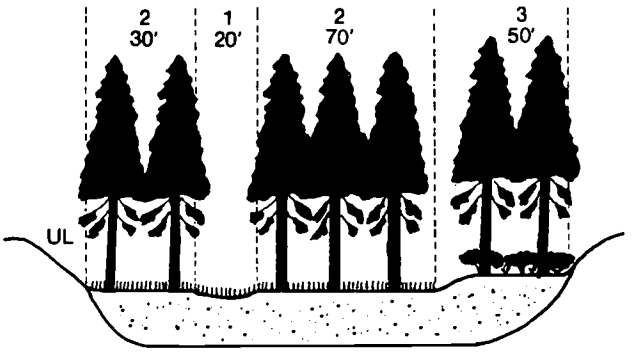


Figure 17. Unnamed drainage between Highway 97 and Williamson River; low gradient, mod-low elevation floodplain; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest.

SOILS

Soils are deep pumice alluviums. Most sites have a moderately deep surface horizon of organic loam. Others classify as sandy loams but still have considerable proportions of organic matter in their surface horizons. Subsurface soils are coarse, saturated, errosive pumice. Available water holding capacity is moderately high. The water table is near to slightly above the soil surface in June and July and is within 2 or 3 feet of the soil surface in September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Lodgepole pine	**40-85 (61)**	**100**
Geyer willow	0-10 (4)	75
Douglas spiraea	0-12 (4)	63
Kentucky bluegrass	3-35 (10)	100
Reedgrasses	0-63 (13)	63
Widefruit sedge	**15-60 (33)**	**100**
Baltic rush	0-3 (2)	63
Western yarrow	0-3 (1)	63
Broadpetal strawberry	0-7 (3)	75
Largeleaved avens	0-3 (1)	75
Trees	40-85 (64)	100
Shrubs	0-20 (10)	75
Grasses	8-63 (30)	100
Sedges	15-63 (41)	100
Forbs	3-37 (24)	100

Potential natural vegetation: Lodgepole pine is climax and the dominant tree. Other conifers are scattered. Widefruit sedge forms a dense sward in climax stands. Bluejoint reedgrass was codominant with widefruit sedge on two plots on wetter sites. Kentucky bluegrass was present on all stands and will increase in cover with overgrazing or lowering of the water table. Other graminoids include Baltic rush, tufted hairgrass, blue wildrye, and fowl bluegrass. The rich forb component includes western yarrow, Watson's willoweed, broadpetal strawberry, largeleaved avens, and dandelion. Geyer willow and Douglas spiraea are present on many stands but are low in cover.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 1000 to 3000 (2187) lbs/acre dry weight. Widefruit sedge is palatable to livestock and may produce considerable forage. The association frequently lies within extensive grazing allotments and next to heavily grazed meadows. Surface soils dry quickly enough that the season of use may begin in late July. Therefore, it is not uncommon to find these sites in degraded condition.

With increasing overuse by livestock, species such as Kentucky bluegrass, bluejoint reedgrass, blue wildrye, and a complex mixture of forbs become codominant with widefruit sedge. The soil surface is somewhat trampled and broken.

With continued overuse, streambank erosion and streambed downcutting may lead to lowering of the water table. Under such hydrologic conditions the site potential is often changed to the **lodgepole pine/Kentucky bluegrass community type**.

Wildlife and fisheries: Landforms supporting this association provide important raptor habitat, especially where it occurs next to water and meadows. Deer and elk appear to spend considerable time in this and adjacent meadows in spring, summer, and fall. This association provides imnportant calving and fawning habitat for elk and deer.

Fire: Wildfire was probably infrequent in the **lodgepole pine/widefruit sedge association**. Lodgepole pine is sensitive to all but the coolest ground fire. Widefruit sedge will regenerate from rhizomes.

Silviculture: 100-year site index ranged from 82 to 120 (94) feet. Basal area ranged from 110 to 260 (178) sq ft/acre. Bark beetle epidemics may be especially severe in this and other riparian lodgepole pine associations. Advanced regeneration of lodgepole pine is often restricted to raised microsites under trees and should be protected during logging. Prescribed fire should be used instead of scarification to prepare seedbeds for lodgepole pine. Even then, successful regeneration may be limited to the hummocks. Silviculturists should consider wet soils, conifer regeneration problems, proximity to water, potential of windthrow of residual trees, and wildlife in planning timber harvest activities for these sites.

Keep heavy equipment off wet soils, especially organic soils. Improper road construction may result in raising water tables upstream and lowering them downstream from the road compaction. Locate roads on adjacent uplands.

Estimating potential on disturbed sites: The loss of the lodgepole pine overstory through logging, fire, or bark beetle epidemics may temporarily convert these sites to **widefruit sedge or willow/widefruit sedge associations**. Stumps and logs attest to potential of these sites to support lodgepole pine. Many **lodgepole pine/Kentucky bluegrass** sites in the Pumice-mantled Basin and Range and LaPine Basin Physiographic Areas have **lodgepole pine/widefruit sedge** potential.

Rehabilitation pathways: Sites in mid seral or better ecological status will increase rapidly in status with rest and late season grazing. Sites that have been converted to the **lodgepole pine/Kentucky bluegrass community type** may need stream rehabilitation to raise the water table, converting the site potential back to **lodgepole pine/widefruit sedge**.

OTHER STUDIES

This association is similar to Volland's (1976) **lodgepole pine/sedge-grass wetland**.

LODGEPOLE PINE/AQUATIC SEDGE ASSOCIATION

Pinus contorta/Carex aquatilis
CLM1-14 PICO/CAAQ

Sample size = 5 plots in mid seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The lodgepole pine/aquatic sedge association is abundant in the upper elevations of the Basin and Range Physiographic Areas (Fremont National Forest) and locally common at higher elevations in the Ochoco Mountains Physiographic Areas. Elevations range from 4600 to 6800 feet. The association is found in landforms supporting active floodplains (Figure 18), shores of lakes and ponds (Figure 19), and forested basins. Microtopography is flat, smooth to slightly undulating, or slightly concave. Sample plots were located at Cougar, Mud, Crazy, and Grey Creeks and a pond near Campbell Lake. This association is also illustrated in figures in the creeping spikerush and willow/aquatic sedge associations (p. 120 and 80).

1 Cougar Creek, first-order
2 Aquatic sedge, active channel shelves and overflow channels
3 Lodgepole pine/aquatic sedge, inactive and active floodplains
4 Floodplain terraces with upland vegetation

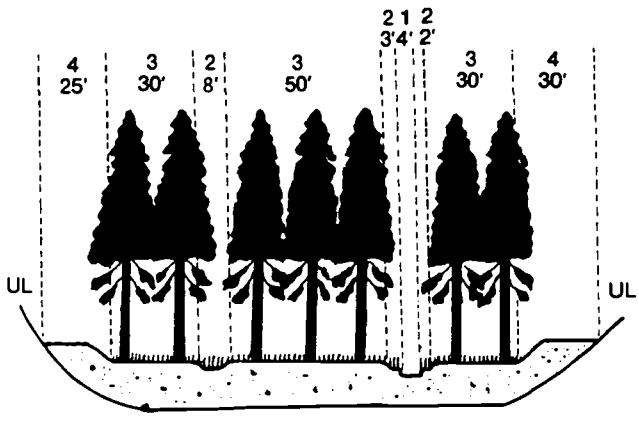


Figure 18. Cougar Creek; low gradient, mod-high elevation floodplain; Basin and Range Physiographic Area; Fremont National Forest.

1 Cottonwood Lake
2 Aquatic sedge, wet meadow
3 Willow/aquatic sedge, wet shrub meadow
4 Lodgepole pine/aquatic sedge, forested wetland

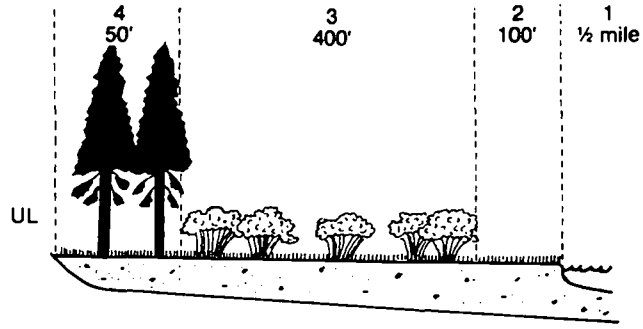


Figure 19. Cottonwood Lake; flat, mod-high elevation, lake basin; Basin and Range Physiographic Area.

SOILS

Surface textures range from sandy loam to loam. One plot had a thin layer of sedge peat on top of a sandy loam subsurface soil at the edge of a pond. Available water holding capacity is moderate to high. The water table is near to slightly above the soil surface in June and is within 24 inches of the surface in August and September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Lodgepole pine	40-75 (61)	100
Blue wildrye	0-5 (2)	60
Meadow barley	0-15 (4)	60
Kentucky bluegrass	0-15 (4)	60
Aquatic sedge	10-50 (24)	100
Western yarrow	1-3 (2)	100
Largeleaved avens	1-3 (1)	60
Gray licoriceroot	0-6 (3)	80
Northwest cinquefoil	0-1 (1)	60
Longstalk clover	3-12 (7)	100
Trees	40-75 (61)	100
Shrubs	3-10 (6)	100
Grasses	5-37 (22)	100
Sedges	15-70 (40)	100
Forbs	10-40 (27)	100

Potential natural vegetation: Lodgepole pine is climax and the dominant tree. Quaking aspen, ponderosa pine, and white fir, if present, are scattered individuals. Willows were present in some wetter stands. The ground cover is domi-

nated by a dense sward of aquatic sedge in stands in late seral and climax ecological status. Common grasses include tufted hairgrass, northern reedgrass, blue wildrye, tall mannagrass, meadow barley, common Timothy, and Kentucky bluegrass. Forbs include western yarrow, largeleaved avens, Gray licoriceroot, northwest cinquefoil, and longstalk clover.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 1000 to 2500 (1800) lbs/acre dry weight. Aquatic sedge is palatable to livestock. The association lies within extensive grazing allotments. Its soils dry relatively quickly so that season of use may begin in late July and last through the summer. Therefore, grazing impacts have been moderately severe and it is common to find these sites in early to mid seral ecological status.

With increasing overuse by livestock, trampling and grazing reduces the competitive ability of aquatic sedge, eventually leading to codominance by Kentucky bluegrass, other grasses, and forbs. On moist sites, species such as northern reedgrass, orange arnica, and common horsetail are prominent. On drier sites, species such as Kentucky bluegrass, meadow barley, Timothy, broadpetal strawberry, Gray licoriceroot, or longstalk clover become prominent. The soil surface is somewhat broken and trampled.

Continued overuse by livestock may lead to increased streambank erosion and streambed downcutting, thus leading to lowered water tables. Under these hydrologic conditions the site potential may be changed to the **lodgepole pine/Kentucky bluegrass community type** or, at higher elevations, forbs become prominent in the ground layer.

Wildlife and fisheries: **Lodgepole pine/aquatic sedge** provides important raptor habitat where it occurs next to meadows and water. Deer and elk spend considerable time in this association and adjacent openings in summer and fall. It may also provide important fawning and calving habitat. Many streams capable of supporting trout pass through landforms supporting the **lodgepole pine/aquatic sedge association.** Consideration should be given to increasing woody debris in the streams and stabilizing banks with sedges and willows.

Fire: Wildfire is somewhat infrequent in this association. Burned stands will regenerate to lodgepole pine. Aquatic sedge will regenerate from rhizomes. Overstory removal on wetter sites may result in elevated water tables and temporary conversion of the site potential to the **willow/aquatic sedge association.**

Silviculture: 100-year site index ranged from 49 to 105 (75) feet while basal area was 100 to 308 (199) sq ft/acre. Advanced lodgepole pine regeneration is often restricted to hummocks under the trees and should be protected during logging. Use prescribed fire instead of mechanical scarification to prepare lodgepole pine seedbeds. Even then, successful regeneration may be restricted to the hummocks. Bark beetle epidemics have been severe in this association. Silviculturists should consider wet soils, proximity to water, regeneration problems, potential for windthrow of residual trees, and wildlife when planning timber harvest activities on these sites.

Keep heavy equipment off wet soils, especially organic soils. Improper road construction may result in raised water tables upstream and lowered water tables downstream from the road location. Locate roads on adjacent uplands.

Estimating potential on disturbed sites: This is the only conifer and wet sedge association on the Fremont (east of the Pumice-mantle Basin and Range Physiographic Area) and Ochoco National Forests. Any lodgepole pine stand supporting wet graminoids and forbs probably has **lodgepole pine/aquatic sedge** potential. Where elevated water tables have converted the site potential to **willow/aquatic sedge**, lodgepole pine stumps and logs attest to the potential of lodgepole pine eventually reoccupying these sites.

Rehabilitation pathways: Stands in mid seral or better ecological status will improve in status with rest and late-season grazing. Sites that have been converted to the **willow/ aquatic sedge association** should be managed as that association until lodgepole pine reoccupies the site. Stream restoration will raise water tables and help convert **lodgepole/Kentucky bluegrass** back to **lodgepole pine/aquatic sedge.**

OTHER STUDIES

Hall (1973) and Hopkins (1979b) did not identify this association in their classifications for the Ochoco and Fremont National Forests. It has not been described elsewhere.

LODGEPOLE PINE–ENGELMANN SPRUCE/FEW-FLOWERED SPIKERUSH ASSOCIATION

Pinus contorta-Picea engelmannii/Eleocharis pauciflora
CLM9-11 PICO-PIEN/ELPA2

Sample size = 5 plots in climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The lodgepole pine-Engelmann spruce/few-flowered spikerush association is common throughout the Cascade Mountains at elevations of 5300 to 6200 feet. It is rare eastward. Bogs develop in basin landforms (Figures 20 & 21) within zones of abundant rainfall (more than 39 inches/year) on flat, poorly-drained sites that support cold, water-saturated, soil development (Gorham 1957). Coastal-influenced wet climate and irregular, glaciated topography help create sites favorable for bog development in the Cascade Mountains. Eastward these requirements are met only at locations such as Pisgah Meadows (Ochoco National Forest), the headwaters of Jack Creek (Winema National Forest), and in the vicinity of Gearheart and Yamsay Mountains (Fremont National Forest).

1 Few-flowered spikerush, bog
2 Lodgepole pine-Engelmann spruce/ few-flowered spikerush, bog
3 Bog blueberry/few-flowered spikerush, bog
4 Engelmann spruce/queencup beadlily, transition slope

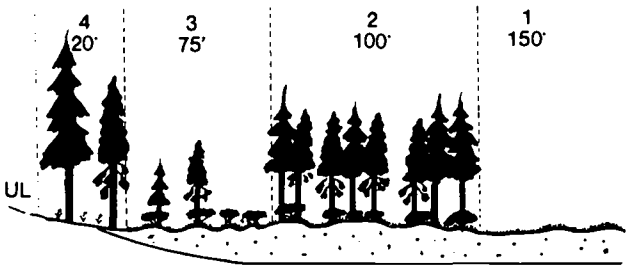


Figure 20. Cascade Lakes Highway Bog (near Wire Meadow); low gradient, mod-high elevation basin; Deschutes Cascades Physiographic Area.

SOILS

Soils range from sedge to sphagnum and moss peats. Peat formation is due to slow plant decomposition on waterlogged sites (Gorham 1957). Low dissolved oxygen and water temperatures, lack of fluctuation in the water table and water temperature, plus concentration of organic and mineral acids (tannins, etc.) in the water table all contribute to slow decomposition of plant residues and peat accumulates. The soil surface is saturated through most of the summer. Available water holding capacity is very high. Long periods of drought may dry the soil surface, starting a trend where decomposition exceeds buildup or where fire lowers the soil surface. However, in the long run these bog sites are self perpetuating. The eventual long-term climax is a larger, deeper bog and not forest.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Engelmann spruce*		
Lodgepole pine	25-50 (39)	100
Bog birch	3-15 (10)	100
Dwarf willows	3-15 (9)	100
Bog blueberry*		
Dwarf blueberry	2-7 (4)	100
Tufted hairgrass	2-10 (4)	80
Aquatic sedge	7-15 (8)	80
Jones sedge	0-15 (8)	80
Muricate sedge	0-7 (3)	60
Few-flowered spikerush	5-45 (18)	100
Leafy aster	0-3 (2)	80
Broadpetal strawberry	0-3 (2)	80
White bogorchid	0-2 (1)	80
Elephanthead	0-10 (3)	80
Bog saxafrage	0-10 (4)	80
Longstalk clover	0-10 (4)	100
Moss	15-85 (50)	100
Trees	30-52 (42)	100
Shrubs	20-35 (24)	100
Grasses	0-15 (7)	100
Sedges	35-75 (50)	100
Forbs	20-63 (28)	100

* = None of the sample plots were located in the Cascades. Therefore, data are unavailable for Engelmann spruce and bog blueberry. They are codominants in the Cascades.

Potential natural vegetation: Lodgepole pine and Engelmann spruce are codominant in the Cascade mountains. Eastward, Engelmann spruce is usually absent. Dwarfed shrubs, especially bog birch, bog blueberry, Booth willow, undergreen willow, Eastwood willow, alpine laurel, and sweetberry honeysuckle are common and may dominate the ground cover. Few-flowered spikerush and moss are conspicuous in the herb layer. Tufted hairgrass and slender muhly are present on many plots. Other grasses are inconspicuous. Normally robust sedges such as aquatic, widefruit, Sitka, beaked, or Holm's

sedges are dwarfed, scattered, and lack vigor but can have fair canopy cover (7-15%). Which sedge is present depends on the geographic and elevational position of the stand. Jones, mud, and muricate sedges are characteristic bog graminoids. The rich variety of forbs includes leafy aster, strawberry, white bogorchid, elephanthead, bog saxifrage, longstalk clover, shootingstars, tofieldia, alpine willoweed, common horsetail, primrose monkeyflower, and western bistort.

Vegetative composition is variable on these undulating sites. Trees, shrubs, grasses, and taller sedges dominate hummocks, while few-flowered spikerush, mud sedge, great sundew, and aquatic plants such as buckbean or bladderwort dominate the water paths.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 350 to 1000 (970) lbs/acre dry weight. Livestock use is infrequent and most stands lie outside of grazing allotments. Cattle will use spikerush and other herbs in the stand but the palatability of the association is generally low. All observed stands were in climax ecological status.

Wildlife and fisheries: Bogs provide an important source of diversity within the forest landscape. Many species of wildlife are associated with bogs, including deer, elk, and beavers. Bogs often provide green forage in the spring while adjacent uplands are still covered by snow. Fisheries values are low or absent.

Fire: Wildfire is infrequent in bogs (100-300 year frequency). Species composition will remain relatively the same following cool fires except for a reduction in conifers. The shrubs will resprout from stem bases while the various graminoids and forbs will regenerate from roots, rhizomes, and corms. Peat soils are flammable when dry and deeply burning fires will restrict the regeneration of most plants by destroying their roots.

Silviculture: 100-year site index ranged from 44 to 67 (58) feet. Basal area ranged from 60 to 92 (76) sq ft/acre. Trees are usually stunted due to cold, sterile, water-saturated soils. These sites are unsuitable for timber production because of low productivity, low economic value, regeneration problems, equipment restrictions, and permanently saturated soils.

Estimating potential on disturbed sites: The association can be recognized on the basis of soils and vegetation alone.

Rehabilitation pathways: The association has not been observed in degraded condition and little is known about ways to rehabilitate disturbed sites.

1 Jack Creek, first order
2 Willow/widefruit sedge, wet shrub meadow
3 Few-flowered spikerush, bog
4 Lodgepole pine-Engelmann spruce/few-flowered spikerush, bog

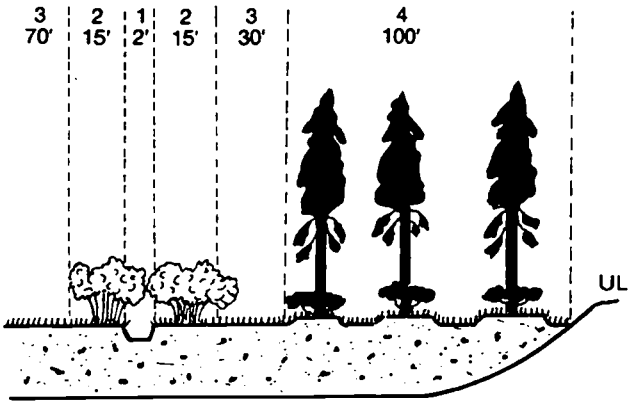


Figure 21. Headwaters Jack Creek; flat, mod elevation basin; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest.

OTHER STUDIES

Seyer's (1979) fewflowered spikerush-mud sedge and fewflowered spikerush-bryophyte communities occur in Crater Lake National Park and are similar to the ground layer of lodgepole pine-Engelmann spruce/few-flowered spikerush but do not include trees.

WHITE FIR/QUEENCUP BEADLILY ASSOCIATION

Abies concolor/Clintonia uniflora
CWF4-31 ABCO/CLUN

Sample size = 14 plots in late seral and climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The transitional white fir/queencup beadlily association is common on the Deschutes, Ochoco, Fremont, and Winema National Forests. It is absent only in the Grasslands and LaPine Basin Physiographic Areas. Landforms containing this association occur on mesic sites on inactive floodplains, toe slopes, and basins (figures 22 & 23). Elevations in the Cascades are 3100 to 4300 feet. Eastward, elevations are 4200 to 6200 feet. The association is similar to **Engelmann spruce/ queencup beadlily** but occurs at generally lower elevations or on relatively warmer sites. It occurs on all aspects except for basins, which tend to face in northerly directions. See the descriptions for **mountain alder/common snowberry, Engelmann spruce/ queencup beadlily,** and **Engelmann spruce/ widefruit sedge** for other figures illustrating this association (p. 69, 49, and 55).

1 Trout Creek, first-order
2 **Queencup beadlily (mountain alder)**, banks
3 **White fir/queencup beadlily**, transitional

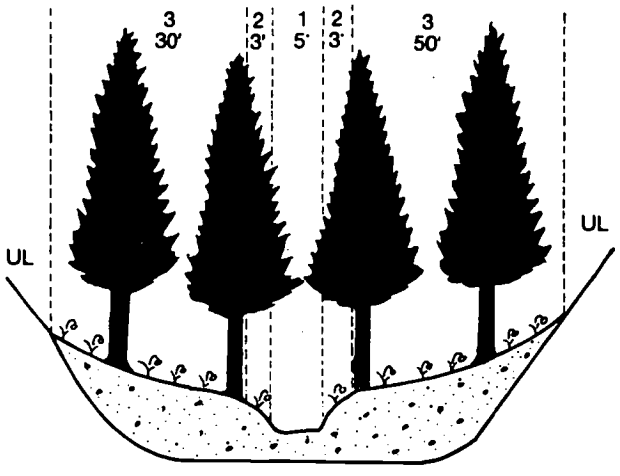


Figure 22. Trout Creek; steep gradient, mod elevation, V-shaped valley; Ochoco Mountains Physiographic Area.

1 Cougar Creek, second order
2 **Mountain alder banks** (misc. type), banks and active floodplains
3 **White fir/queencup beadlily**, inactive floodplain and transition slopes

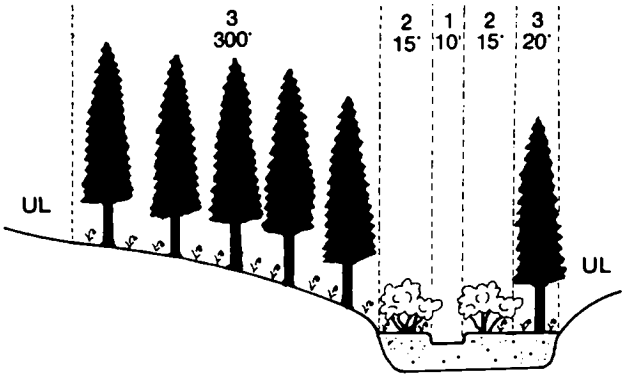


Figure 23. Cougar Creek; mod gradient, mod-high elevation, incised valley; Basin and Range Physiographic Area.

SOILS

Soils are quite variable. Deposition of thick layers of volcanic ash have developed moderately deep, ash soils on toe slopes and northerly basins. Floodplain soils may be moderately fine-textured or mixed with considerable amounts of gravels or cobbles. Available water holding capacity is moderate. The water table is within 2 feet of the soil surface in June and below 4 1/2 feet in August and September. The association is transitional between riparian and adjacent upland as indicated by its mesic ground cover, water table, and topographic position.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Douglas-fir	0-40 (15)	64
White fir	4-87 (44)	100
Prickly currant	0-15 (6)	57
Woods rose	0-3 (1)	50
Snowberry	0-10 (2)	57
Twinflower	0-63 (9)	57
Baneberry	0-3 (1)	50
Queencup beadlily	0-10 (2)	71
Sweetscented bedstraw	0-5 (2)	79
Sweetroot	0-3 (1)	79
Starry solomonplume	0-10 (3)	79
Trees	40-95 (80)	100
Shrubs	1-63 (28)	100
Grasses	0-18 (4)	79
Forbs	3-45 (24)	100

Potential natural vegtation: White fir is capable of gaining dominance over all other conifers as succession proceeds towards climax. Douglas-fir and, locally, lodgepole pine, ponderosa pine, mountain hemlock, and western larch are seral dominants. Douglas-fir is the most consistent seral species. Engelmann spruce and mountain hemlock may occur on the cool, moist edge of the association in the Cascades or near Mount Pisgah but are clearly subordinant to white fir.

A diverse mixture of shrubs may gain temporary dominance of the ground cover under broken canopies. These shrubs include dwarf bramble, California dewberry, prickly currant, woods rose, common snowberry, and twinflower. Shrubs are greatly reduced under closed canopies and in climax stands. Vine maple and Pacific yew often dominate the shrub layer in open stands on the west edge of the Sisters District.

The herbaceous layer includes mesic forbs such as queencup beadlily, sweetscented bedstraw, baneberry, pathfinder, various wintergreens, white trillium, and violets. Queencup beadlily is a reliable indicator for all but the warmest and driest sites. However, on the Fremont National Forest it is absent and other mesic species, especially arrowleaf groundsel, sweet-scented bedstraw, pathfinder, and baneberry, help identify the association.

MANAGEMENT AND REHABILITATION

Livestock: The association is little used by livestock except for shade and cover. Estimated herbage production ranged from 50 to 750 (227) lbs/acre dry weight. The composition of stands overused by livestock is unknown.

Wildlife and fisheries: The **white fir/queencup beadlily association** may provide considerable summer forage for deer and elk during its earlier successional stages. Old growth stands appear to be important calving and fawning areas. Small, first-order streams passing through the association have little fisheries value. However, larger streams such as Seven-mile (Winema National Forest) and Link and Candle Creeks (Deschutes National Forest) contain trout.

Fire: Pole and sapling white fir is susceptible to all but cool ground fire while sawlog white fir is moderately resistant to ground fire. Seral tree species (except lodgepole pine) are moderately to highly resistant to wildfire except for young trees and crown fires. Fire will not appreciably alter the composition of the shrub and herbaceous layers.

Silviculture: 100-year site index ranged from 76 to 165 (110) feet. Basal area on well stocked stands ranged from 230 to 480 (316) sq ft/acre. Site index and basal area tend to be less on Ochoco and Fremont National Forests than on Cascade sites, especially on the Sisters District, Deschutes National Forest. Old growth sites support considerably more biomass than younger stands.

Partial cutting of mixed species stands will lead to dominance by white fir, which is often injured by logging and subsequently invaded by Indian paint and other fungi. Regeneration to a mix of seral species is the best approach for timber management. Silviculturists should consider high water tables, windthrow, and fisheries and wildlife values in planning harvest activities on this association.

The fine-textured soils are compactable. Roads should have adequate drainage to avoid ponding of subsurface water. Soil slumps are common in basin landforms and should be considered in road locations.

Estimating potential on disturbed sites: This isn't necessary on most sites. Much of the association has not been logged because of restricted access or the proximity to water. Where logged, look for remnants of the mesic undergrowth in protected spots such as the shade of logging debris or go to adjacent uncut stands.

Rehabilitation pathways: Conifers, shrubs, and herbs quickly reestablish logged or burned sites.

OTHER STUDIES

The **white fir/queencup beadlily association** is similar to the **grand fir/queencup beadlily habitat type** described by Pfister and others (1979) in Montana and the **grand fir/ pachistima habitat type** described by the Daubenmires (1968) in Northern Idaho. Hall (1973) did not describe the association on the Ochoco National Forest. Volland's (1976) **mixed conifer/snowberry/ twinflower flatland** describes part of the type on floodplains. His **mixed conifer/snowberry/ forb** describes the portion of the association with vine maple on the Sisters District. Hopkins (1979a) **white fir-alder/shrub meadow** is a mix of several distinct associations on floodplains, including the **white fir/queencup beadlily association.**

ENGELMANN SPRUCE/QUEENCUP BEADLILY ASSOCIATION

Picea engelmannii/Clintonia uniflora
CEM2-22 PIEN/CLUN

Sample size = 26 plots in late seral and climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The transitional Engelmann spruce/queencup beadlily association is abundant in the Cascade Mountains. It is also locally common in cold air drainages in the vicinity of Mount Pisgah (Ochoco National Forest). Landforms supporting Engelmann spruce/queencup beadlily occur on floodplains, and the edges of wet meadows, bogs, and marshes (figures 24 & 25). Elevations ranged from 4200 to 5800 feet in most of the Cascades but extended as low as 3150 feet near Mount Jefferson. On the Ochoco National Forest elevations are 5600 to 6200 feet. These sites are colder or above the elevational limits of the white fir/queencup beadlily association.

1 Sevenmile Creek, third order
2 Mountain alder, active channel shelves
3 Queencup beadlily, banks
4 Engelmann spruce/queencup beadlily, inactive floodplains
5 Small-fruit bulrush (bigleaf sedge), cutoff/ overflow channels
6 White fir/queencup beadlily, terrace slope

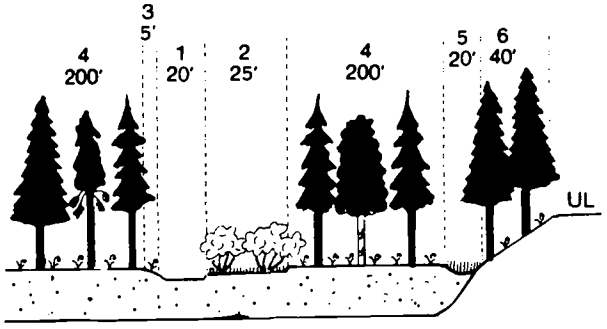


Figure 24. Sevenmile Creek; mod-low gradient, low elevation floodplain; Winema Cascades Physiographic Area.

Other landform figures with Engelmann spruce/ queencup beadlily are found in the beaked sedge, slender sedge, Engelmann spruce/bog blueberry/ forb, lodgepole pine/bog blueberry/widefruit sedge, mountain alder-Douglas spiraea, Engelmann spruce/bog blueberry/widefruit sedge, Engelmann spruce/widefruit sedge, few-flowered spikerush, and bog blueberry/Sitka sedge associations (p. 118, 108, 51, 39, 71, 53, 55, 110, and 86).

SOILS

Soils are variable. Deposition of volcanic ash has contributed to the development of moderately deep, ashy soils on toe slopes and basins. Floodplain soils are moderately fine-textured or mixed with gravels and cobbles on more water active sites. The water table is within 2 feet of the soil surface in June and July and 2 to 4 feet below the surface in September. Available water holding capacity is moderate. This association is not true riparian but is transitional between riparian and upland as indicated by its mesic ground cover, water tables, and topographic position.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Engelmann spruce	0-78 (42)	96
Lodgepole pine	0-64 (11)	54
Mountain hemlock	0-25 (5)	50
Subalpine fir	0-52 (8)	35
White fir	0-47 (7)	73
Twinflower	0-37 (5)	46
Prickly currant	0-15 (2)	42
Dwarf bramble	0-15 (4)	38
Grouse whortleberry	0-63 (7)	54
Queencup beadlily	0-10 (5)	96
Sweetscented bedstraw	0-3 (1)	50
Sweetroot	0-3 (1)	73
One-sided wintergreen	0-10 (2)	81
Arrowleaf groundsel	0-15 (1)	38
Solomonplume	0-20 (3)	54
Twistedstalk	0-20 (4)	65
White trillium	0-3 (1)	65
Trees	40-95 (72)	100
Shrubs	3-75 (29)	100
Grasses	0-37 (4)	73
Sedges	0-7 (1)	50
Forbs	7-63 (33)	100

Potential natural vegetation: Engelmann spruce is capable of gaining dominance over other conifers as succession proceeds towards climax. A few plots at lower elevations had white fir as a minor climax associate with Engelmann spruce. Several plots at high elevations had subalpine fir codominant with Engelmann spruce. Here, subalpine fir is considered climax and Engelmann spruce minor climax but the potential subalpine fir/queencup beadlily association is lumped with the Engelmann spruce/ queencup beadlily association in order to simplify the riparian classification. Douglas-fir, ponderosa pine, lodgepole pine, and, occasionally, cottonwood dominate seral stands at low elevation. At higher elevation lodgepole pine is the seral dominant.

A diverse mixture of shrubs may gain temporary dominance of the ground layer in early successional stages or under broken canopies. These shrubs include dwarf bramble, prickly currant, woods rose, twinflower, grouse whortleberry, big whortleberry, and dwarf blueberry. Shrubs are greatly reduced under closed canopies and in climax stands.

The rich herbaceous layer includes mesic forbs such as queencup beadlily, sweetscented bedstraw, sweetroot, one-sided wintergreen, arrowleaf groundsel, solomonplume, twistedstalk, and white trillium. Alpine mitella, foamflower, baneberry, pathfinder, and lady-fern are also common.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 10 to 1500 (326) lbs/acre dry weight. The association provides little forage for livestock. Most sites lie outside of existing grazing allotments except on the Ochoco National Forest where the site is used for cover, shade, and limited grazing. The vegetative composition of stands overused by livestock is unknown.

Wildlife and fisheries: The **Engelmann spruce/queencup beadlily association** may produce considerable summer forage for deer and elk during earlier successional stages. Valley bottoms supporting this association are

1 Little Cultus Creek, first-order
2 **Few-flowered spikerush**, bog
3 **Bog blueberry/few-flowered spikerush**, wet shrub meadow
4 **Willow/Sitka sedge**, wet shrub meadow
5 **Engelmann spruce/queencup beadlily**, lake terrace and transition slope

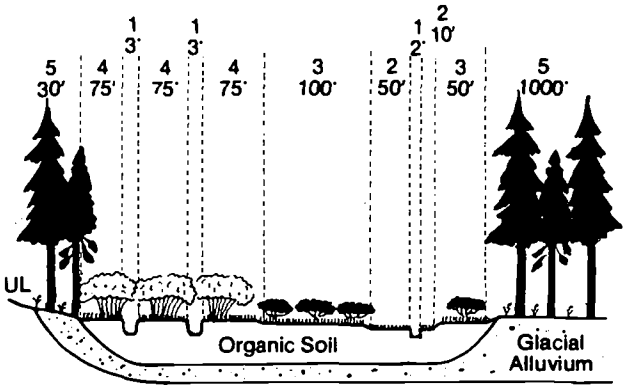


Figure 25. Little Cultus Marsh; flat, mod-high elevation lake basin; Deschutes Cascades Physiographic Area.

important travel corridors for deer and elk. Both elk and deer use old growth sites for bearing and rearing their young. The association does not normally lie in suitable winter range except near Crane Prairie. It provides good raptor habitat where adjacent to meadows or water.

Fire: Engelmann spruce, subalpine fir, mountain hemlock, and lodgepole pine are susceptible to all but cool ground fire. Burned stands will usually regenerate to lodgepole pine. The shrubs and forbs are generally resistant to fire and will resprout from stem bases or underground parts.

Silviculture: 100-year site index ranged from 75 to 138 (105) feet. Basal area on well stocked stands ranged from 208-465 (305) sq ft/acre. Lodgepole pine and Engelmann spruce grow exceptionally well on this site and should be considered for timber management. Partial cutting will favor Engelmann spruce while clearcutting will favor lodgepole pine. White fir and subalpine fir are susceptible to logging injury because of their thin bark. Douglas-fir should be considered only on low elevation sites. Silviculturists should also consider high water tables, conifer windthrow, and high wildlife values before planning timber harvest activities on these sites.

The fine textured soils are compactable. Roads located in the association should have adequate drainage to avoid ponding of subsurface water. Slumps are common on basins and should be considered in road locations.

Recognizing potential on disturbed sites: This isn't necessary on most sites. Much of the association has not been logged because of restricted access or the proximity to water. Where logged, look for remnants of the mesic undergrowth in protected spots such as the shade of logging debris or in adjacent uncut stands.

Rehabilitation pathways: Conifers, shrubs, and herbs quickly reestablish logged or burned sites.

OTHER STUDIES

Engelmann spruce/queencup beadlily is similar to the **Engelmann spruce/queencup beadlily habitat type** described by Pfister and others (1979) in Montana. Hall (1973) did not describe it on the Ochoco National Forest. Volland's (1976) **Engelmann spruce bottomland** describes the portion of the association that has white fir and spruce mixing as codominants at lower elevations. Hopkins (1979a) did not describe the association on the Winema National Forest.

ENGELMANN SPRUCE/BOG BLUEBERRY/FORB ASSOCIATION

Picea engelmannii/Vaccinium occidentalis/forb
CEM3-11 PIEN/VAOC2/FORB

Sample size = 4 plots in late seral and climax ecological status

LOCATION AND RIPARIAN LANDFORMS

Engelmann spruce/bog blueberry/forb is found in the Cascade Mountains at moderate to moderately high elevation (4400-5900 feet). Sites occur on the relatively dry, forested fringes of mountain meadow, stream, and lake landforms (Figure 26). Only four plots were sampled as most of the association occurs in inaccessible portions of the Cascade Mountains. Microtopography is flat and slopes gently towards adjacent meadows.

1 Pond
2 **Inflated sedge**, wet meadow
3 **Tufted hairgrass**, moist meadow
4 **Engelmann spruce/bog blueberry/forb**, transition slope
5 **Engelmann spruce/queencup beadlily**, transition slope

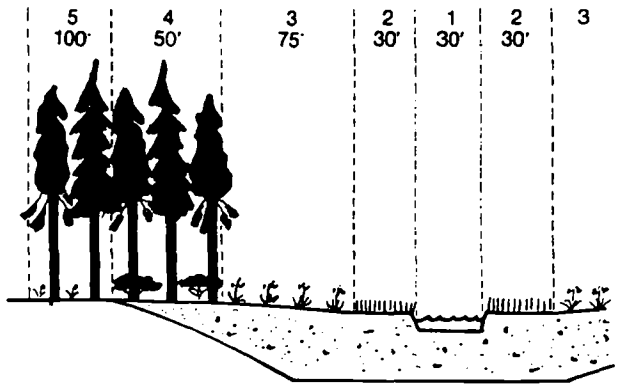


Figure 26. Heavenly Lakes Meadow; flat, mod-high elevation basin; Winema Cascades Physiographic Area.

SOILS

The soils are derived from air-laid pumice, pumice alluvium, or pumice lacustrian deposits. Surface textures range from loamy coarse sand to sandy clay loam. Available water holding capacity ranges from moderate to high. Soil surfaces are rarely flooded. The high water table lies at least 6 inches below the soil surface and lowers to 3 or more feet below the soil surface in September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Engelmann spruce	4-40 (22)	100
Lodgepole pine	1-55 (33)	100
Subalpine fir	0-15 (7)	75
Douglas spiraea	3-15 (8)	100
Dwarf huckleberry	2-20 (13)	100
Bog blueberry	10-63 (32)	100
Queencup beadlily	0-3 (2)	75
Gray licoriceroot	0-3 (2)	75
Lesser wintergreen	0-2 (1)	75
Longstalk clover	0-4 (2)	75
Trees	47-75 (61)	100
Shrubs	60-65 (63)	100
Grasses	3-10 (5)	100
Sedges	0-5 (2)	50
Forbs	3-20 (15)	100

Potential natural vegetation: **Engelmann spruce/bog blueberry/forb** is characterized by a dense canopy of conifers and a dense layer of low shrubs. Engelmann spruce dominates lodgepole pine as succession proceeds towards climax. Lodgepole pine dominates seral stands. Subalpine fir and mountain hemlock are scattered. The shrub layer is dominated by bog blueberry, dwarf huckleberry, and Douglas spiraea. Big whortleberry, sweetberry honeysuckle, and dwarf bramble are often present in the shrub layer. Willows will not grow on these relatively dry sites. Graminoids are scattered in the ground layer. Scattered forbs include queencup beadlily, Gray licoriceroot, lesser wintergreen, and longstalk clover. Without the dense shrub layer the association is similar to **Engelmann spruce/queencup beadlily**.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 25 to 100 (69) lbs/acre dry weight on four sample stands. The association has little forage value and largely lies outside existing grazing allotments and within roadless and wilderness areas. The vegetative composition of stands overused by livestock is unknown.

Wildlife and fisheries: **Engelmann spruce/bog blueberry/forb** provides important raptor habitat where it occurs next to meadows and water. It provides important calving and rearing areas, cover, shade, and browse for elk and deer. Abundant forage grows in adjacent openings.

Fire: Wildfire is fairly frequent on these sites. The ground surface is dry by late summer so that fire would easily move into the stand from adjacent uplands. Both lodgepole pine and Engelmann spruce are sensitive to all but cool ground fires. Burned stands will tend to regenerate to lodgepole pine. Fire will not appreciably alter species composition in the undergrowth except for a temporary decrease in shrub cover.

Silviculture: 100-year site index ranged from 73 to 107 (85) feet and basal area ranged from 160 to 330 (233) sq ft/acre. Overstory removal may result in a slight increase in low shrubs and water tables, but not enough to increase the cover of riparian species such as willows and sedges. Thinnings will favor Engelmann spruce while clearcuts will favor lodgepole pine. There is often considerable advanced conifer regeneration that should be protected during logging. Shrubs will compete with conifer regeneration. Use prescribed fire instead of mechanical scarification to prepare conifer seedbeds. Timber management should consider special constraints due to the potential for windthrow of residual trees, high water tables, and the importance to wildlife and recreation.

The soils are fluid when moist. Heavy equipment will compact moist soils and should not be operated on the site until late summer. Roads and trails would best be located on adjacent uplands.

Recognizing potential on disturbed sites: All sampled and observed stands were in late seral to climax ecological status and could be recognized on the basis of vegetation alone.

Rehabilitation pathways: As all observed stands were in late seral to climax status so little is known about rehabilitating disturbed sites.

OTHER STUDIES

Engelmann spruce/bog blueberry/forb has not been described elsewhere.

ENGELMANN SPRUCE/BOG BLUEBERRY/WIDEFRUIT SEDGE ASSOCIATION

Picea engelmannii/Vaccinium occidentalis/Carex eurycarpa
CEM3-12 PIEN/VAOC2/CAEU

Sample size = 5 plots in climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The Engelmann spruce/bog blueberry/widefruit sedge association is common only in the Cascade Mountains. East of the geographic distribution of Engelmann spruce it is replaced by the lodgepole pine/bog blueberry/widefruit sedge association. It occurs at moderate to moderately high elevations (4300-5600 feet) on the edges of bog, marsh, floodplain, or shallow drainage landforms. It is particularly abundant in cold, wet, headwaters basins such as Refrigerator Creek, Lake of the Woods, Sevenmile Marsh, and bogs near Little Cultus Lake (Figure 27). Microtopography is slightly undulating.

1 Unnamed first order streams
2 Bog blueberry/few-flowered spikerush, bog
3 Willow/Sitka sedge, wet shrub meadow
4 Engelmann spruce/bog blueberry/widefruit sedge, forested wetland
5 Engelmann spruce/queencup beadlily, transition slopes

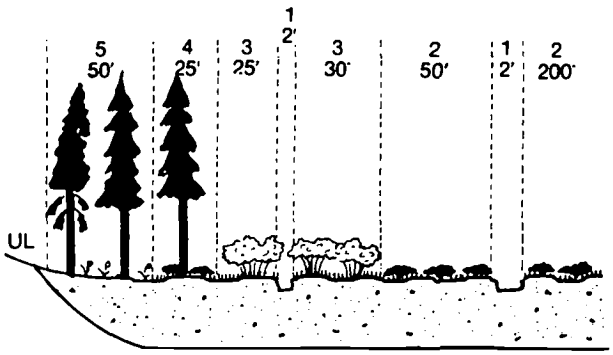


Figure 27. Many Lakes Bog; flat, mod-high elevation basin; Deschutes Cascades Physiographic Area.

SOILS

Surface soils are deep organic loam or sedge peat over a coarse pumice subsoil. Available water holding capacity is high. Sites are flooded from early to mid-summer and the water table is within 2 feet of the soil surface in September. Soils are usually saturated except on hummocks.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Engelmann spruce	2-72 (30)	100
Lodgepole pine	0-27 (15)	80
Willows	1-34 (10)	100
Douglas spiraea	0-7 (4)	80
Bog blueberry	5-40 (18)	100
Bluejoint reedgrass	2-5 (4)	100
Widefruit sedge	0-70 (33)	80
Holm's sedge	0-40 (11)	40
Jones sedge	0-20 (5)	80
Shootingstar	0-5 (2)	80
Common horsetail	0-5 (2)	80
White bogorchid	0-2 (1)	100
Trees	29-75 (47)	100
Shrubs	20-55 (35)	100
Grasses	1-15 (8)	100
Sedges	37-75 (65)	100
Forbs	5-40 (21)	100

Potential natural vegetation: Engelmann spruce dominates lodgepole pine as succession proceeds towards climax. Subalpine fir was a minor climax in one high elevation stand. Conifers are usually located on hummocks so that closed stands are rare. The shrub layer is dominated by bog blueberry and Douglas spiraea. Several species of willows occur in the stands and removal of the coniferous overstory may result in an increase in willow cover. Geyer, Lemmon, yellow, or Sitka willows are present at lower elevations while Booth, Eastwood, and undergreen willows occur at higher elevations. A dense sward of widefruit sedge dominates the ground layer, but at higher elevations Holm's sedge is dominant. Softleaved sedge, Jones sedge, muricate sedge, few-flowered spikerush, beaked sedge, Sitka sedge, and bluejoint reedgrass are other common graminoids that in total are subordinant to widefruit or Holm's sedge. A rich component of wet site forbs includes shooting star, white bogorchid, common horsetail, small bedstraw, western bistort, and pink wintergreen.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 750 to 3000 (2350) lbs/acre dry weight. Widefruit sedge is palatable to cattle and horses. The association might provide valuable forage but lies mostly outside of existing grazing allotments. Widefruit sedge will respond quickly to rest and late-season grazing on stands in mid seral or better ecological status. The vegetative composition of stands overused by livestock is unknown.

Wildlife and fisheries: This association is important to deer and elk, especially by elk on Cascade Mountain sites such as Bridge Creek, Sevenmile Marsh, and the Refrigerator Creek-Big Marsh area. Here, deer and elk use the site for cover, forage, and calving and raising their young. Adjacent openings also provide abundant forage. The association provides important raptor habitat, particularly where it occurs next to meadows. At lower elevations important trout streams pass through landforms containing this association. Consideration should be given to maintaining an adequate supply of woody debris in streams.

Fire: Wildfire is infrequent on the Engelmann spruce/bog blueberry/widefruit sedge association. It would be difficult to burn this site until late summer or fall. Engelmann spruce and lodgepole are sensitive to all but cool ground fire. Burned stands will tend to regenerate to lodgepole pine. Willows, Douglas spiraea, and bog blueberry will regenerate by sprouting from the stem base. Fire will not change the composition of the herbaceous component. Hot fires will consume dry peat soils, killing the reproductive tissue of most plant species.

Silviculture: 100-year site index is moderate, ranging from 62 to 90 (76) feet. Basal area is quite variable, ranging from 96 to 260 sq ft/acre and averaging 161 sq ft/acre. Advanced regeneration of lodgepole pine and Engelmann spruce is often limited to tree hummocks and should be protected during timber harvesting. Prescribed fire should be used instead of mechanical scarification to prepare conifer seedbeds. Even then, regeneration may be successful only on hummocks. Overstory removal will reduce conifer shade, encouraging an increase in the cover of shrubs, especially willows, and higher water tables. This may result in long-term conversion of the site to the willow/widefruit sedge association. Silviculturists should consider regeneration problems, windthrow of residual trees, high water tables, wildlife, and fisheries in planning timber harvest activities on these sites. Saturated soils will create difficult problems for the operation of heavy equipment and road construction.

Estimating potential on disturbed sites: Where elevated water tables have temporarily changed the site potential to wetter associations such as willow/widefruit sedge, stumps and logs attest to the potential of the site to support Engelmann spruce and lodgepole pine.

Rehabilitation pathways: Engelmann spruce/bog blueberry/widefruit sedge sites converted to willow/widefruit sedge by elevated water tables may require several decades to regenerate to conifers. Extreme measures such as scarifying the soil should be avoided on such stands.

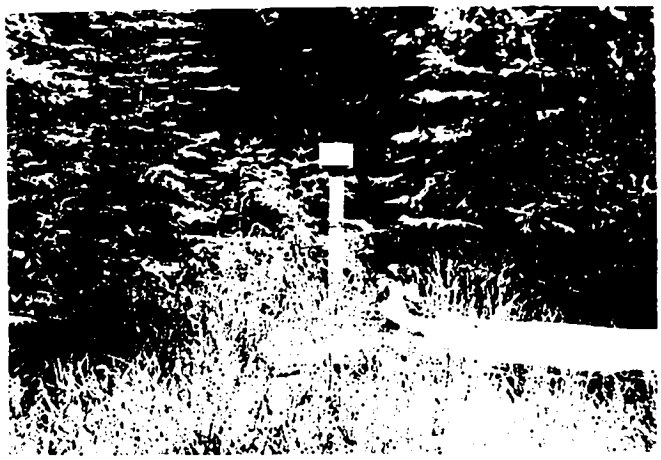
OTHER STUDIES

This association has not been described in other studies.

ENGELMANN SPRUCE/WIDEFRUIT SEDGE ASSOCIATION

Picea engelmannii/Carex eurycarpa
CEM1-11 PIEN/CAEU

Sample size = 10 plots in late seral and climax ecological status



LOCATION AND RIPARIAN LANDFORMS

The **Engelmann spruce/widefruit sedge association** is abundant in the Deschutes Cascades, Pumice-mantled Cascades, and Winema Cascades Physiographic Areas. Landforms supporting this association occur at moderate to moderately high elevations (4200-5100 feet) on flat, wet floodplains and the margins of lakes, marshes, bogs, and forested basins (Figures 28 & 29). Microtopography is flat to slightly undulating. The association is replaced by the **lodgepole pine/widefruit sedge association** below the elevational and cold air limits of Engelmann spruce. Sample stands were located at Sevenmile and Cherry Creeks on the Winema National Forest and Soda Creek, Lava Lake, and Squaw Creek Marsh on the Deschutes National Forest.

1 **Few-flowered spikerush**, bog
2 **Bog blueberry/few-flowered spikerush**, bog
3 **Engelmann spruce/widefruit sedge**, forested wetland
4 **Engelmann spruce/queencup beadlily**, transition slope

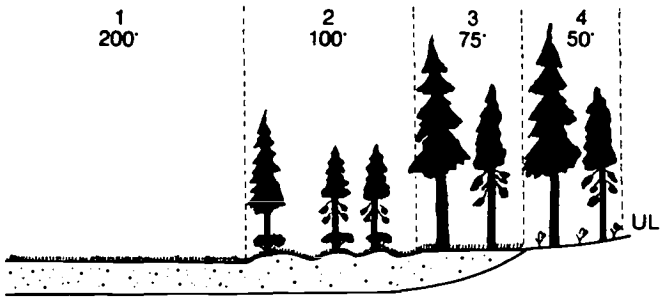


Figure 28. Upper Deschutes River Bog (near Little Lava Lake); low gradient, mod high elevation basin; Deschutes Cascades Physiographic Area.

1 **Short-beaked sedge**, wet meadow
2 **Engelmann spruce/widefruit sedge**, forested wetland
3 **Engelmann spruce/queencup beadlily**, transitional
4 **White fir/queencup beadlily**, terrace

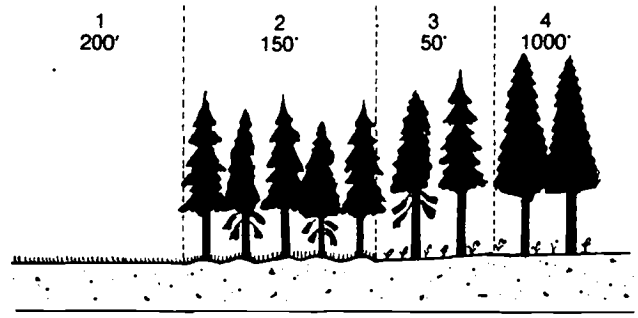


Figure 29. Squaw Creek Marsh; flat, mod elevation basin; Deschutes Cascades Physiographic Area.

SOILS

Soils are variable. On floodplains and the margins of lakes the surface horizons are sandy loams or organic loams developed from pumice, andesite, or basalt alluvium. On the edges of bogs and in wet forest basins the surface texture is organic loam or sedge peat more typical of marsh soils. Available water holding capacity is moderate to high. Maximum water tables are near or slightly flood the soil surface, except on tree hummocks. The water table is within 24 inches of the soil surface in September. Soils are moist through the summer.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Engelmann Spruce	3-83 (42)	100
Lodgepole pine	0-73 (32)	90
Bog blueberry	0-15 (3)	80
Reedgrass	0-15 (3)	50
Tall mannagrass	0-3 (1)	50
Soft-leaved sedge	0-37 (9)	70
Widefruit sedge	20-70 (31)	100
Common horsetail	0-3 (1)	70
Broadpetal strawberry	0-3 (2)	70
Wintergreens	1-9 (3)	100
Violets	0-3 (1)	60
Trees	46-95 (72)	100
Shrubs	3-15 (8)	100
Grasses	1-37 (9)	100
Sedges	20-75 (40)	100
Forbs	7-63 (24)	100

Potential natural vegetation: Engelmann spruce dominates other conifers as succession proceeds towards climax. Lodgepole pine dominates seral stands. Subalpine fir is a minor climax at higher elevations. The ground cover is a dense sward of widefruit sedge. Occasionally, soft-leaved sedge is dominant on the dry edge of the

association. Where the association is grading into bogs and marshes, conifers are somewhat stunted and scattered and beaked sedge may be codominant with widefruit sedge. One plot at the upper elevation limits of the association had Holm's sedge codominant with widefruit sedge. Tall managrass, bluejoint reedgrass, and slimstem reedgrass are often present but are low in cover. The forb layer includes wet site species such as common horsetail, arrowleaf groundsel, white bogorchid, and little buttercup. Mesic forbs characteristic of the **Engelmann spruce/queencup beadlily association** such as queencup beadlily, sweetscented bedstraw, broadpetal strawberry, wintergreens, and violets occur on drier microsites and hummocks.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 500 to 2500 (1480) lbs/acre dry weight. Widefruit sedge is palatable to cattle and horses. **Engelmann spruce/widefruit sedge** might provide valuable forage for livestock but most stands lie outside of existing grazing allotments. In addition, livestock avoid these sites until the surface can be walked on in August or September. Therefore, it is unusual to find the association in degraded condition. Widefruit sedge will respond quickly to rest and late season grazing in stands in mid seral or better ecological status. The vegetative composition of stands overused by livestock is unknown.

Wildlife and fisheries: **Engelmann spruce/widefruit sedge** provides important raptor habitat, especially where it occurs next to meadows and water. Deer and elk appear to spend considerable time in this and adjacent associations in the summer and fall. It may be important fawning area, at least at Squaw Creek Marsh. Where streams pass through the association consideration should be given to maintaining an adequate supply of woody debris in the stream.

Fire: Wildfire is infrequent in this association. Burned stands regenerate to lodgepole pine. The herbaceous composition will remain unchanged. Burned stands may experience a temporary elevation of the water table and an increase in the cover of sedges and willows.

Silviculture: 100-year site index ranged from 54 to 99 (80) feet. Basal area ranged from 127 to 304 (230) sq ft/acre. Engelmann spruce and lodgepole pine are susceptible to logging injury because of their thin bark. Partial cutting will increase the cover of Engelmann spruce while clearcutting will favor lodgepole pine. Advanced conifer regeneration is often restricted to raised hummocks and should be protected during logging activities. Use prescribed fire to create conifer seedbeds. Even then, successful regeneration may be restricted to hummocks. Overstory removal requires special constraints because of wet soils, proximity to water, regeneration problems, potential of windthrow of residual trees, and wildlife. Saturated soils will create difficult problems for road construction and maintenance. Heavy equipment should be kept off the site except on frozen ground.

Estimating potential on disturbed sites: The loss of overstory through fire, logging, or bark beetle epidemics may temporarily convert these sites to the **widefruit sedge** or **willow/widefruit sedge associations**. Stumps and logs attest to the potential of these sites to eventually support lodgepole pine and Engelmann spruce.

Rehabilitation pathways: All sampled and observed stands were in late seral to climax ecological status so little is known about rehabilitating degraded sites.

OTHER STUDIES

The **Engelmann spruce/widefruit sedge association** has not been described elsewhere.

ENGELMANN SPRUCE/COMMON HORSETAIL–TWISTEDSTALK ASSOCIATION

Picea engelmannii/Equisetum arvense-Streptopus
CEM2-21 PIEN/EQAR-STREP

Sample Size = 6 plots in climax and late seral ecological status

LOCATION AND RIPARIAN LANDFORMS

Engelmann spruce/common horsetail-twistedstalk is locally abundant on the Winema Cascades Physiographic Area but was found only at Soda Creek on the Deschutes Cascades Physiographic Area. It occurs on wet, low gradient, poorly drained, floodplain landforms (Figure 30) at low to moderately high elevations (4100-5400 feet). It is scattered in mountain valleys, but is abundant where Sevenmile Creek parallels the Upper Klamath Valley. The association probably formed extensive stands in the Upper Klamath Valley before its conversion to pasture.

1 Sevenmile Creek, third-order
2 **Engelmann spruce/common horsetail-twistedstalk**, active floodplain
3 **Engelmann spruce/queencup beadlily**, inactive floodplain

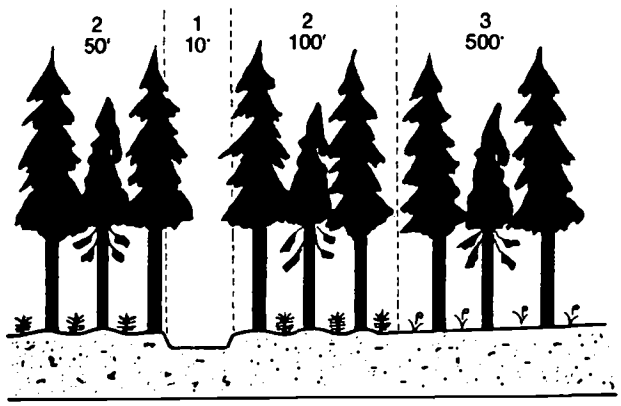


Figure 30. Sevenmile Creek; low gradient, low elevation floodplain; Winema Cascades Physiographic Area.

SOILS

Soils range from deep organic loam to fine sandy loam alluvium. Often there is a thick layer of humus on the soil surface. The sites are very wet and the available water holding capacity is moderate to high. The water table is near or slightly above the soil surface much of the growing season and is within 1 1/2 feet of the soil surface in September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Engelmann spruce	0-68 (36)	83
Subalpine fir	0-52 (13)	33
White fir	0-40 (14)	67
Small-fruit bulrush	0-37 (10)	67
Monkshood	1-3 (1)	100
Common horsetail	20-65 (45)	100
Sweetscented bedstraw	0-3 (1)	67
Alpine mitella	0-3 (1)	67
Wintergreen	0-15 (7)	83
Arrowleaf groundsel	0-3 (1)	67
Twistedstalk	1-3 (2)	100
Trees	38-92 (60)	100
Shrubs	3-35 (12)	100
Grasses	0-63 (22)	67
Sedges	10-37 (22)	100
Forbs	63-75 (68)	100

Potential natural vegetation: Engelmann spruce is climax and dominates the overstory in most stands while subalpine fir is climax only at Soda Creek (5400 feet). Lodgepole pine and white fir are uncommon and located on dry microsites or on the dry fringe of the site. The herbaceous flora is rich and varied. Common horsetail is dominant. Graminoids include small-fruit bulrush, wood reedgrass, tall mannagrass, and widefruit sedge. Monkshood and either claspleaf or rosy twistedstalk are present on all stands. Other forbs include sweetscented bedstraw, alpine mitella, wintergreen, arrowleaf groundsel, queencup beadlily, and lady-fern.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 500 to 1750 (1275) lbs/acre dry weight. Livestock use is moderate along Sevenmile Creek but is absent elsewhere. At Sevenmile Creek the current utilization does not appear to have appreciably altered species composition. The forage is largely herbaceous and palatability and nutritional value is questionable. They probably avoid the site when soils are wet. The vegetative composition of overused stands is unknown.

Wildlife and fisheries: Deer appear to spend considerable time in this and adjacent sites. The Sevenmile Creek stands may be important deer fawning habitat. Sevenmile Creek also supports trout.

Fire: Natural fires were probably infrequent on this association as indicated by extreme ages (200 to 300 years) of fire sensitive Engelmann spruce. Burned stands may experience some raising of the water table but should continue to support Engelmann spruce/common horsetail-twistedstalk.

Silviculture: Tree information was collected on only two stands, where site index averaged 90 feet in 100 years and basal area averaged 258 sq ft/acre. These are reasonable estimates for the association as a whole. Partial cuts are recommended to assure an all-aged distribution of Engelmann spruce. Spruce regeneration is often restricted to hummocks and should be protected during logging. Managers should consider special constraints because of wet soils, regeneration problems, proximity to water, potential windthrow of residual trees, and wildlife habitat when planning timber harvest activities on this site.

Saturated soils will create difficult problems for road construction and maintenance. Heavy equipment should be kept off the site.

Estimating potential on disturbed sites: One observed stand along Sevenmile Creek had the overstory removed by logging. Common horsetail still dominated the ground cover. Logs and stumps witness the potential dominance of Engelmann spruce.

Rehabilitation pathways: Except for the Sevenmile Creek stand, all other stands were unlogged because of their proximity to water or location in roadless areas.

OTHER STUDIES

Similar associations have been recognized by Pfister and others (1979) in Montana, Steele and others (1981) in central Idaho, and Williams and Lillybridge (1983) in north central Washington. Ogilvie (1962) described a Picea/Equisetum habitat type in the Rocky Mountains of Alberta.

QUAKING ASPEN/COMMON SNOWBERRY/BLUE WILDRYE COMMUNITY TYPE

Populus tremuloides/Symphoricarpos albus/Elymus glaucous
HQS2-21 POTR/SYAL/ELGL

Sample Size = 8 plots in mid to late seral ecological status

LOCATION AND RIPARIAN LANDFORMS

Quaking aspen/common snowberry/blue wildrye has been observed throughout central Oregon except in the Cascade Mountains and the Crooked River National Grassland. It is most common in the Ochoco Mountains and Low Flanks Cascades Physiographic Areas. Landforms are moderate gradient floodplains (Figure 31) that also support the ponderosa pine/common snowberry-floodplain and mountain alder/common snowberry associations.

1 Indian Ford Creek, second order
2 Small-fruit bulrush (bigleaf sedge), active channel shelf
3 Quaking aspen/common snowberry/blue wildrye, inactive floodplain

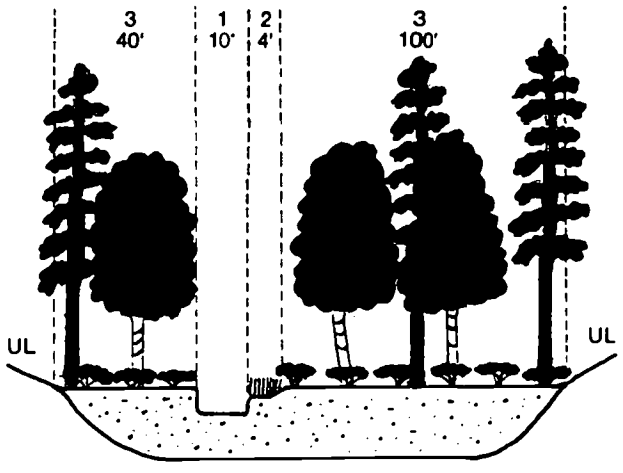


Figure 31. Indian Ford Creek; low gradient, low elevation floodplain; Low Flanks Cascades Physiographic Area.

The association is occasionally found in small basins. Elevations are low to moderate (3600-5800 feet) except in the Warner Mountains where one sample plot was at 7000 feet. Sites are transitional between true riparian and uplands. Microtopography is flat to slightly concave. Sample plots were located at Indian Ford (Deschutes National Forest); Cold Springs Campground, Marks Creek, Duffy Meadow, Silver Creek, and Allison Guard Station (Ochoco National Forest); Crooked Creek (Fremont National Forest); and Sevenmile Creek (Winema National Forest).

SOILS

Soils are derived from alluvium, ash deposited over colluvium, or mixtures of both. They lie near sources of water such as streams, springs, and meadows. Surface horizons range from fine sandy loam to clay loam. Available water holding capacity is high. Decomposition of aspen litter improves soils fertility with increased nitrogen and organic matter. The soil surface may be briefly flooded at snowmelt on frozen soil but the water table lowers to more than 4 feet below the surface in August and September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Ponderosa pine	0-40 (13)	63
Quaking aspen	**38-83 (55)**	**100**
Common snowberry	**7-70 (41)**	**100**
Blue wildrye	**0-25 (10)**	**75**
Kentucky bluegrass	0-25 (5)	50
Western yarrow	0-3 (1)	63
Red columbine	0-3 (1)	75
Rough bedstraw	0-15 (4)	63
Northern bedstraw	0-3 (1)	50
Sweetroot	0-3 (2)	75
Starry solomonplume	0-15 (3)	63
Meadowrue	0-15 (3)	50
Trees	40-84 (69)	100
Shrubs	7-63 (44)	100
Grasses	3-40 (19)	100
Sedges	0-10 (3)	63
Forbs	10-40 (30)	100

Potential natural vegetation: Quaking aspen is the dominant tree in the quaking aspen/common snowberry/blue wildrye community type but most stands are successional to the ponderosa pine/common snowberry-floodplain association or, rarely, the white fir/queencup beadlily association. The shrub layer is dominated by common snowberry. Dominant graminoids are blue wildrye, Kentucky bluegrass, or elk sedge. Common forbs include western yarrow, red columbine, rough bedstraw, northern bedstraw, sweetroot, starry solomonplume, and meadowrue. In aspen stands with white fir potential the herbaceous layer is dominated by mesic forbs such as queencup beadlily and sweetscented bedstraw.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 50 to 1200 (506) lbs/acres dry weight. Livestock make considerable use of the quaking aspen/common snowberry/blue wildrye community type for forage, bedding, and shade. Aspen suckers are readily eaten by livestock, which may prevent replacement of mature and dying trees. Snowberry is especially sensitive to trampling and its cover is reduced in overused pastures. Keep livestock off moist soils to prevent soil compaction.

With increasing overuse by livestock, common snowberry becomes clumpy in distribution and its canopy cover is less than 35%. The aspen overstory is still well stocked but aspen suckering is limited. Kentucky bluegrass is codominant with other grasses and forbs.

With continued overuse, the aspen overstory becomes poorly stocked and overmature. Aspen suckers are absent. Common snowberry is restricted to protected microsites or absent. Kentucky bluegrass, other grasses, and forbs dominate the herbaceous layer. Eventually, grazing may eliminate conifers as well as aspen, converting the site to herbaceous meadows dominated by blue wildrye, Kentucky bluegrass, or forbs.

Wildlife and fisheries: Many quaking aspen/common snowberry/blue wildrye stands are near perennial water and provide important habitat for beaver. Beaver activity in conjunction with browsing by cattle, deer, and elk can severely damage the stand. Aspen stands are especially critical to birds and other wildlife (Thomas and others 1979). Common flickers, black-capped chickadees, hairy woodpeckers, yellow-bellied sapsuckers, and many other species of birds nest in aspen. Deer and, occasionally, elk have been observed during the study feeding and bedding in aspen stands. Deer frequently use aspen stands as fawning ground. Although small in area, aspen stands provide a critical source of diversity within the landscape and should be managed with emphasis on providing habitat for wildlife.

Fire: The suppression of fire has contributed to the conversion of aspen stands to conifers or meadows. Fire can be an important tool for stimulating aspen suckers and rejuvenating deteriorating stands. It will often have to be used in concert with protection from browsing. Snowberry will resprout from stem bases.

Silviculture: Mixed-species site index ranged from 80 to 140 (98) feet in 100 years. Basal area ranged from 108 to 410 (216) sq ft/acre. Clearcutting will favor aspen while partial cutting will favor conifers. Cutting will not elevate water tables sufficiently to change the site potential to wetter associations or community types. Management should emphasize maintaining the aspen as wildlife habitat.

Recognizing potential on disturbed sites: In conifer stands look for scattered aspen overstory, stumps, or logs and snowberry in protected locations. Where aspen stands have been converted to meadows, the vegetation is often different than the surrounding meadow and species such as blue wildrye, columbine, bedstraw, sweetroot, starry solomonplume, meadowrue, and California falsehellebore are dominant.

Rehabilitation pathways: Clearcutting and prescribed burning will help rejuvenate overmature aspen stands when done in conjunction with protection from livestock, big game, and beaver. Aspen resprouts poorly from cuttings but can be transplanted successfully from nursery stock.

OTHER STUDIES

The quaking aspen/common snowberry/blue wildrye community type has not been described elsewhere. Padgett (1981) described moist and dry phases of an aspen range type on the Malheur National Forest, parts of which appear to be disturbed phases of this association.

QUAKING ASPEN/BLUE WILDRYE COMMUNITY TYPE

Populus tremuloides/Elymus glaucous
HQM1-21 POTR/ELGL

Sample size = 13 plots in mid to late seral ecological status

LOCATION AND RIPARIAN LANDFORMS

Quaking aspen/blue wildrye is common in all physiographic areas on the Fremont and Ochoco National Forests except for the Grasslands Physiographic Area. It occurs infrequently on the Deschutes and Winema National Forests in the Pumice-mantled Basin and Range, LaPine Basin, and Low Flanks Cascades Physiographic Areas. Landforms are usually on the margins of well drained basins (Figure 32), but also occur on floodplains and toeslopes. The community type tends to occur above the elevational limits of the quaking aspen/common snowberry/blue wildrye community type. Elevations ranged from 5200 to 7000 feet on the Fremont but were 4400 to 4900 feet elsewhere. Microtopography is flat to concave. Sample plots were located at Crooked, Deep, Spring, Twelvemile, and Drew Creeks, White Pine Marsh, Gearhart Mountain, and Cottonwood Lake on the Fremont National Forest; Cold Springs Guard Station and Dudley Creek on the Ochoco National Forest; Meadow Creek on the Winema National Forest; and Prairie Farm on the Deschutes National Forest.

1 Dudley Creek, first-order
2 Inflated sedge, wet meadow
3 Tufted hairgrass, moist meadow
4 Kentucky bluegrass (tufted hairgrass potential), dry meadow
5 Quaking aspen/blue wildrye, transition slope

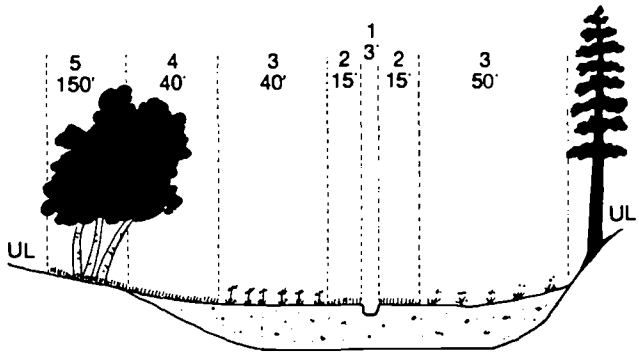


Figure 32. Dudley Creek; low gradient, mod elevation basin; Ochoco Mountains Physiographic Area.

SOILS

Soils are variably of alluvium and/or colluvium. Surface horizons are uniformly fine textured, ranging from fine sandy loam to clay loam. Available water capacity is moderately high to high. Water tables are within 12 inches of the soil surface in May and June and lower to more than 3 feet below the soil surface by mid July. Decomposition of aspen leaves improves soil fertility with increased nitrogen and organic matter.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Lodgepole pine	0-33 (10)	54
Quaking aspen	**38-95 (72)**	**100**
Blue wildrye	**0-63 (15)**	**62**
Kentucky bluegrass	0-40 (9)	54
Western yarrow	0-7 (3)	85
Largeleaved avens	0-2 (1)	54
Sweetroot	0-15 (4)	77
Yampa	0-2 (1)	54
Little buttercup	0-15 (5)	69
Dandelion	0-3 (2)	92
Meadowrue	0-15 (4)	77
Longstalk clover	0-15 (3)	62
Calif. falsehellebore	0-35 (8)	62
Trees	65-95 (86)	100
Grasses	0-65 (36)	92
Forbs	3-90 (49)	100

Potential natural vegetation: Quaking aspen is the dominant tree. Many plots appear to be on meadow invasion sites and show little evidence that aspen is successional to conifers. Some stands are successional to lodgepole pine. Shrubs and sedges are scarce although degraded quaking aspen/common snowberry/blue wildrye stands might appear to belong in this community type. Blue wildrye appears to dominate the herbaceous layer in natural stands but Kentucky bluegrass and/or forbs dominate disturbed stands. Common forbs include western yarrow, largeleaved avens, sweetroot, yampa, little buttercup, dandelion, meadowrue, and longstalk clover. California falsehellebore may become dominant on highly disturbed stands, especially on the Fremont National Forest.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 500 to 3000 (1558) lbs/acre dry weight. Livestock make considerable use of the community type for forage, bedding, and shade. They can

be particularly damaging by browsing aspen suckers and fencing may be needed to help regenerate degraded stands. The ground cover of most stands has been severely altered by grazing and soil compaction. Keep livestock off moist soils to prevent soil compaction.

With continuing overuse by livestock, the aspen overstory is still well stocked with aspen but aspen suckers are limited. Kentucky bluegrass, other grasses, and forbs become codominant with blue wildrye.

With continued overuse, the aspen overstory becomes poorly stocked and overmature. Aspen suckers are absent or severely hedged. Blue wildrye is uncommon or absent and Kentucky bluegrass is codominant or subordinant to forbs. Eventually aspen may be completely eliminated, converting the site to herbaceous meadows dominated by forbs such as California falsehellebore, sweetroot, starry solomonplume, nettle, little buttercup, longstalk clover, meadowrue, and bedstraws.

Wildlife and fisheries: Although small in area, aspen stands provide a critical source of diversity within the landscape and should be managed with emphasis on providing habitat for wildlife. Aspen stands are especially critical to birds and other wildlife (Thomas and others 1979). Common flickers, chickadees, hairy woodpeckers, yellow-bellied sapsuckers and many other species of birds nest in aspen. Deer and elk have been observed feeding, bedding, and raising their young in aspen stands. Many stands are near perennial water and provide important habitat for beaver. Beaver activity in conjunction with browsing by cattle, deer, and elk can severely damage the stand.

Fire: The suppression of fire has contributed to the conversion of aspen stands to lodgepole pine or herbaceous meadows. Fire can be an important tool for stimulating aspen suckers and rejuvenating deteriorated aspen stands. It will often have to be used in concert with protection from browsing and beaver activity.

Silviculture: Site index for aspen ranged from 65 to 110 (85) feet in 100 years. Basal area ranged from 60 to 240 (168) sq ft/acre. Partial cuts will favor conifers where present. Clearcutting will favor aspen by increasing soil temperature and sprouting. Cutting should not result in dramatic increases in water levels. Road construction should allow for adequate drainage of subsurface water. Management should consider maintaining the aspen types as wildlife habitat.

Recognizing potential on disturbed sites: In lodgepole pine stands, look for scattered aspen overstory, saplings, stumps, or logs. Where aspen stands have been converted to meadows, the vegetation is often different than the surrounding meadow and usually is dominated by forbs such as California falsehellebore.

Rehabilitation pathways: Clearcutting and prescribed burning will help rejuvenate overmature aspen when done in conjunction with protection from browsing of aspen sprouts by livestock, big game, and beavers. Aspen resprouts poorly from stem cuttings but can be transplanted successfully from nursery stock.

OTHER STUDIES

The **quaking aspen/blue wildrye community type** has not been described elsewhere.

QUAKING ASPEN-LODGEPOLE PINE/DOUGLAS SPIRAEA/ WIDEFRUIT SEDGE COMMUNITY TYPE

Populus tremuloides-Pinus contorta/Spiraea douglasii/Carex eurycarpa
HQM4-11 POTR-PICO/SPDO/CAEU

Sample size = 6 plots in mid to late seral ecological status

LOCATION AND RIPARIAN LANDFORMS

Quaking aspen-lodgepole pine/Douglas spiraea/ widefruit sedge is common on the LaPine Basin and Pumice-mantled Basin and Range Physiographic Areas of the Deschutes and Winema National Forests. It may also occur on the western fringe of the Fremont National Forest. Landforms are floodplains, basins, and shallow, pumice-filled drainages (Figure 33) at low to moderate elevations (3600-4700 feet). See the description for **Sitka sedge** for another figure showing this community type (p. 114). Microtopography is flat to slightly concave. Sample plots were located in several unnamed drainages on the Winema National Forest and at Shevlin Park, Aspen Camp, and Slough Camp on the Deschutes National Forest.

1 **Widefruit sedge**, intermittently active swale
2 **Quaking aspen-lodgepole pine/Douglas spiraea/ widefruit sedge**, active floodplain
3 **Lodgepole pine/Douglas spiraea/widefruit sedge**, active floodplain
4 **Lodgepole pine/Douglas spiraea/forb**, terrace

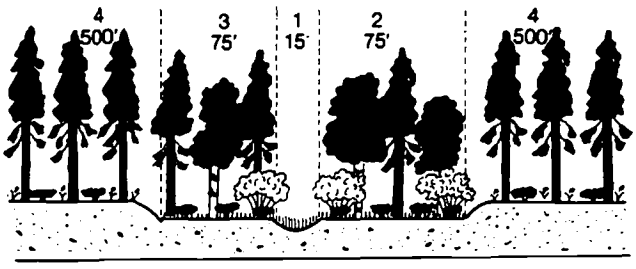


Figure 33. Unnamed drainage near Highway 97 and Williamson River; low gradient, mod elevation floodplain; Pumice-mantled Basin & Range Physiographic Area; Winema National Forest.

SOILS

Soils are derived from alluvium. Surface soil textures ranged from organic loam to loam and grade into permanently saturated coarse pumice subsoil. Available water holding capacity is high. The sites are slightly flooded or the water table is within 12 inches of the soil surface in May and June and are within 3 1/2 feet of the soil surface in August and September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Lodgepole pine	0-70 (32)	83
Quaking aspen	25-95 (60)	100
Woods rose	0-10 (4)	83
Willow	0-24 (9)	83
Douglas spiraea	5-60 (30)	100
Blue wildrye	0-15 (6)	83
Kentucky bluegrass	1-3 (2)	100
Widefruit sedge	5-40 (20)	100
Broadpetal strawberry	0-5 (3)	83
Starry solomonplume	0-10 (4)	67
Trees	85-95 (95)	100
Shrubs	25-80 (46)	100
Grasses	2-20 (10)	100
Sedges	5-40 (20)	100
Forbs	15-35 (24)	100

Potential natural vegetation: **Quaking aspen-lodgepole pine/Douglas spiraea/widefruit sedge** is dominated by an overstory of quaking aspen and a shrub layer of Douglas spiraea (sometimes pyramid spiraea). Widefruit sedge is common. Willows (especially Geyer and Lemmon willows) are present and will dramatically increase in vigor and cover with overstory removal. Forbs are common and include broadpetal strawberry and starry solomonplume. The community type is successional to the **lodgepole pine/Douglas spiraea/widefruit sedge association** except at very low elevations, where quaking aspen is climax.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 250 to 3000 (1500) lbs/acre dry weight. Widefruit sedge, blue wildrye, Kentucky bluegrass, and other graminoids are palatable to livestock and can produce considerable forage in open stands. Aspen suckers are readily eaten by livestock, which may prevent replacement of dead and dying trees. Wet soils discourage livestock use until mid summer. Widefruit sedge and other graminoids should respond well to rest and late season grazing on sites in mid seral or better ecological status. Spiraea is sensitive to trampling so keep livestock off saturated soils to prevent soil compaction.

With increasing overuse by livestock, quaking aspen is still well stocked in the overstory but suckers are limited. Douglas spiraea decreases

in cover and widefruit sedge is codominant with blue wildrye, Kentucky bluegrass, and/or forbs.

Wildlife and fisheries: None of the sample stands showed evidence of beaver but the community type may provide valuable habitat where located adjacent to perennially active streams. Many of the mature aspen have heart rot and provide important habitat for cavity nesting birds. The community type provides forage, cover, calving ground, and water for deer and elk. First order and intermittent streams passing through the community type usually have little potential to support trout.

Fire: Aspen is sensitive to all but the coolest ground fire. It may cause immediate mortality or damage the bole, allowing entrance for wood-rotting fungi. Aspen sprouts vigorously from lateral root buds. Reduced evapotransporation demand caused by removal of the overstory may elevate water tables, increase the cover of willows and interfere with the success of aspen regeneration. Willows and Douglas spiraea will sprout from stem bases.

Silviculture: Mixed species 100-year site index and basal area for aspen and lodgepole pine ranged from 107 to 120 (114) feet and 200 to 260 (232) sq ft/acre respectively. Clearcutting will favor aspen while partial cutting will favor lodgepole pine. Cutting may increase the level of the water table and increase the cover of willows. Management should consider special constraints associated with the potential for windthrow in residual trees, high water tables, and wildlife. Wet soils create special problems for road construction and maintenance. Coarse pumice subsurface soils are conducive to ravelling and headwall cutting when exposed to moving water.

Recognizing potential on disturbed sites: This community type can usually be recognized on the basis of vegetative composition alone.

Rehabilitation pathways: If the water table is not raised, clearcutting and prescribed burning will help rejuvenate overmature aspen when done in conjunction with protection from browsing of aspen sprouts by livestock, big game, and beaver. Widefruit sedge will reestablish from underground rhizomes on rested sites.

OTHER STUDIES

Quaking aspen-lodgepole pine/Douglas spiraea/ widefruit sedge has not been described elsewhere.

SAGEBRUSH/CUSICK BLUEGRASS ASSOCIATION

Artemisia tridentata-Artemisia cana/Poa cusickii
SD23-11 ARTR-ARCA/POCU

Sample Size = 6 plots in mid seral ecological status

LOCATION AND RIPARIAN LANDFORMS

The sagebrush/Cusick bluegrass association is common in the Ochoco Mountains and Basin and Range Physiographic Areas. Elevations are 4400 to 5600 feet (to 7000 feet in the Warner Mountains). Sagebrush/Cusick bluegrass is prominent on two landforms: 1) broad, low gradient floodplains at low to moderate elevation where it occurs on dry terraces and inactive floodplains (Figure 34) and 2) the dry margins of mid elevation meadows (Figure 35). Typical locations are Bull Prairie, Chewaucan River, and Squaw, Fivemile, Fishhole, and Willow Creeks on the Fremont National Forest and Boone Prairie and Gray, Silver, Sawmill, and Nicoll Creek on the Ochoco National Forest.

1 Silver Creek, third-order
2 Willow/woolly sedge, active floodplain
3 Willow/woolly sedge, overflow channel
4 Sagebrush/Cusick bluegrass, terraces and inactive floodplains

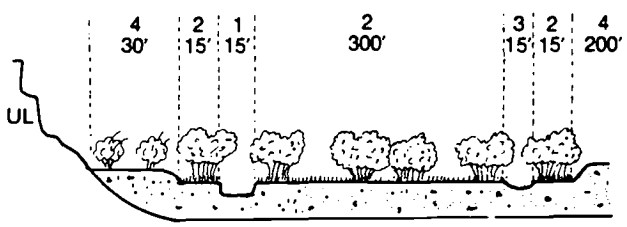


Figure 34. Silver Creek; low gradient, low elevation floodplain; Ochoco Mountains Physiographic Area.

1 Nebraska sedge (inflated sedge potential), swale
2 Tufted hairgrass, moist meadow
3 Sagebrush/Cusick bluegrass, dry meadow

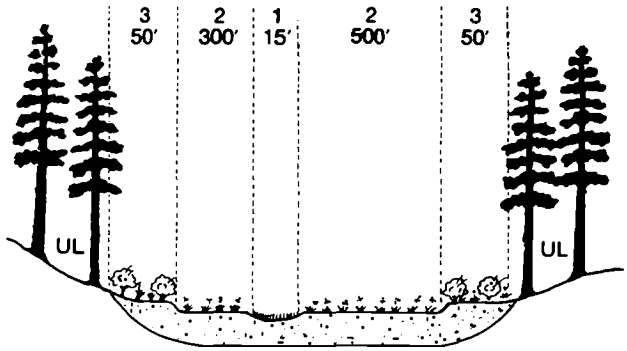


Figure 35. Boone Prairie; low gradient, mod elevation basin; Ochoco Mountains Physiographic Area.

SOILS

Soils are deep, easily eroded alluvium with surface textures of fine sandy to silty clay loams. vailable water holding capacity is moderately high. Water tables are within 2 feet of the soil surface in May and June, dropping to 4 to 5.5 feet below the soil surface in July through September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Big sagebrush	0-25 (13)	83
Silver sagebrush	0-30 (10)	67
Cusick bluegrass	7-25 (17)	100
Bearded wheatgrass	0-7 (3)	83
Prairie junegrass	2-7 (4)	100
Shortleaved muhly	0-5 (3)	83
Western needlegrass	0-3 (2)	83
Clustered fieldsedge	0-7 (4)	83
Western yarrow	2-10 (5)	100
Hoary aster	1-5 (3)	100
Elk thistle	0-3 (2)	83
Shrubs	15-30 (24)	100
Grasses	20-35 (28)	100
Sedges	2-20 (8)	100
Forbs	5-40 (22)	100

Potential natural vegetation: It was difficult to find stands in late seral ecological status. Therefore the successional status of sagebrush and other flora is speculative. Big and/or silver sagebrush dominates the shrub layer. Cusick bluegrass is the dominant grass. Cusick bluegrass interspaces are dominated by litter rather than perennial or annual forbs. Bearded wheatgrass, prairie junegrass, short-leaved muhly, western needlegrass, and clustered field sedge are common. Common forbs include western yarrow, hoary aster, elk thistle, and northwest cinquefoil. Kentucky bluegrass, Baltic rush, and Nebraska sedge, if present, are restricted to moist depressions.

MANAGEMENT AND REHABILITATION

Livestock: Estimates of herbage production ranged from 750 to 1500 (1200) lbs/acre dry weight. The most palatable species are Cusick bluegrass, prairie junegrass, and bearded wheatgrass. This association occurs on some of the most overused grazing allotments in central Oregon. Livestock grazing often has been seasonlong for many decades and plants have been utilized when they were most susceptible to damage.

With increasing overuse by livestock, sagebrushes, graminoids, and forbs become codominant with Cusick bluegrass. Cusick bluegrass clumps are somewhat broken and pedestalled. Perennial and annual forbs are present in moderately large colonies or in the interspaces of Cusick bluegrass. The litter layer is discontinuous and compacted.

With continued overuse, sagebrushes (canopy cover greater than 35 percent) become dominant over graminoids and forbs. Cusick bluegrass is uncommon. Cusick bluegrass clumps are pedestalled and strongly aggregated. Prairie junegrass, bearded wheatgrass, and western needlegrass are scattered while shortleaved muhly and forbs form large patches. Perennial and annual forbs dominate the herbaceous layer. The litter layer is compacted and very broken in distribution.

Most floodplain landforms supporting this association have experienced severe streambed downcutting and lowered water tables. Under these hydrologic conditions **sagebrush/Cusick bluegrass** has often expanded into sites formerly occupied by the **willow/woolly sedge association.**

Wildlife and fisheries: Streams passing through floodplains supporting the **sagebrush/Cusick bluegrass association** are potentially good fisheries but are largely degraded. Streambanks and overflow channels should be revegetated with willows and sedges to narrow and deepen the stream, improve base flows, lower water temperatures, and provide shade, cover, and spawning gravel for salmonids.

Fire: Big sagebrush is sensitive to all but the coolest fire. Silver sagebrush resprouts at all levels of fire intensity. Repeated burning will decrease big sagebrush cover and increase the competitive ability of Cusick bluegrass on sites in mid seral or better ecological status. Silver sagebrush will decrease in cover in response to increased vigor of Cusick bluegrass.

Estimating potential on disturbed sites: The unique mix of plant species present in this association will help in recognizing the potential of highly degraded sites. Even when Cusick bluegrass is scarce or absent, the presence of big and/or silver sagebrush and herbs such as prairie junegrass, bearded wheatgrass, shortleaved muhly, western needlegrass, clustered field sedge, hoary aster, and elk thistle should enable the user to determine site potential. In addition, the riparian landform helps identify the potential to support this association. An increase of surface rock helps distinguish the break to adjacent uplands associations.

Rehabilitation pathways: Rehabilitation of degraded **sagebrush/Cusick bluegrass** sites should be designed for the entire landform.

On the floodplain landform, concentrate efforts on water-active portions of the landform. Primary objectives are to raise water tables throughout the landform and reestablish the **willow/woolly sedge association** on once active fluvial surfaces. A combination of rest from livestock grazing and structures such as loose rock checkdams will give the fastest recovery. Structures result in a quick upward trend because of rapid storage of sediments and water and quick establishment of riparian vegetation between the structures. Place juniper or rock riprap where severe bank erosion is occurring. Willows may be planted but wait until the site shows lack of natural regeneration. When active fluvial surfaces are restored to mid to late seral ecological status, follow with a grazing system designed to improve species composition and canopy cover and limiting the yearly utilization of forage (40%).

On meadow landforms, rehabilitation efforts should be concentrated on the **tufted hairgrass** portion of the landform. Delaying livestock grazing until **tufted hairgrass** sites are dry enough to graze will insure the grasses on the **sagebrush/Cusick bluegrass association** will be mature enough to withstand grazing. Livestock should then be removed at about 40 percent utilization of forage on the **tufted hairgrass association** to protect wetter associations.

On both landforms, use prescribed fire to reduc. the cover of sagebrush and encourage increased density and cover of Cusick bluegrass (seeding may be necessary). An upward trend in status can be accomplished on either landform by livestock management alone if in mid seral or better ecological status. Rest the landform to restore plant vigor and density, especially in the wetter associations, then follow with grazing systems described above.

OTHER STUDIES

The **sagebrush/Cusick bluegrass** association has not been described elsewhere.

MOUNTAIN ALDER ASSOCIATION

Alnus incana
SW29-11 ALIN

Sample Size = 9 plots in late seral ecological status

LOCATION AND RIPARIAN LANDFORMS

The **mountain alder association** is found throughout central Oregon in all physiographic areas. Elevations are low to moderate (2400-5600 feet). Sites are young, seral, active channel shelves that lie between active and flood stage streambanks along second order and larger streams in moderately graded valleys (Figures 36 & 37). These sites are temporal and in 15 to 20 years sediment deposition will change the site potential to the **mountain alder-common snowberry** or **mountain alder-Douglas spiraea associations** in their respective landforms.

1 Ochoco Creek, third order
2 **Mountain alder**, active channel shelf
3 **Mountain alder-common snowberry**, banks
4 **Ponderosa pine-common snowberry-floodplain**, inactive floodplain

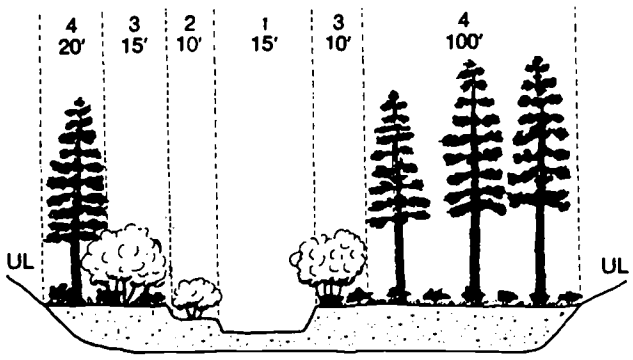


Figure 36. Ochoco Creek; mod gradient, low elevation floodplain; Ochoco Mountains Physiographic Area.

1 Sevenmile Creek, third order
2 **Mountain alder**, active channel shelf
3 **Queencup beadlily (mountain alder)**, banks
4 **Engelmann spruce/queencup beadlily**, inactive floodplain
5 **Smallfruit bulrush (bigleaf sedge)**, cutoff/overflow channel
6 **White fir/queencup beadlily**, terrace slope

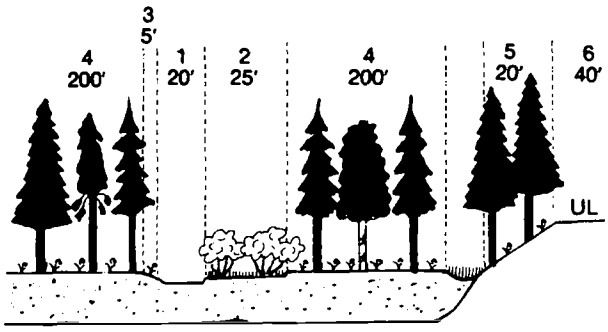


Figure 37. Sevenmile Creek; mod-low gradient, low elevation floodplain; Winema Cascades Physiographic Area.

SOILS

Soils are shallow, skeletal alluvium over water worked cobbles and gravels. Progressively finer textured sediments are deposited as the stand matures. Active channel shelves have surface soil textures that are loamy sands while older sites are silts and loam. Sometimes these sites occur on quiet backwaters and eddies where rapid deposition of water-borne organic sediments develop an organic loam soil. Available water holding capacity is low but the site remains moist and well-aerated throughout the summer. Alder increases soil fertility through nitrogen-fixing root nodules and nitrogen rich leaf litter.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Mountain alder	37-87 (66)	100
Tall mannagrass	0-15 (5)	89
Bigleaf sedge	0-15 (4)	44
Small-fruit bulrush	0-25 (4)	67
Common horsetail	0-75 (10)	78
Sweetscented bedstraw	0-15 (4)	78
Largeleaved avens	0-7 (1)	56
Starry solomonplume	0-3 (1)	67
Shrubs	45-87 (66)	100
Grasses	0-45 (19)	89
Sedges	3-45 (18)	100
Forbs	9-63 (40)	100

Potential natural vegetation: The **mountain alder association** is dominated by a dense overstory of young mountain alder (less than 20 years old) over a rich ground cover of wet site herbs. Shrubs such as dogwood, snowberry, and

various willows are scattered through the stand. Observations suggest the site is capable of supporting many species of willow and, occasionally, cottonwood and aspen if protected from browsing by big game, beavers, and livestock. Common graminoids include tall mannagrass, small-fruit bulrush, and bigleaf sedge. Forbs include common horsetail, sweetscented bedstraw, largeleaved avens, and starry solomonplume. The herbaceous composition is determined in large part by which species first took advantage of the opportunity to colonize the site. Secondarily, species dominance may depend on which species can tolerate periodic flooding and dense alder shade.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 25 to 2000 (1050) lbs/ acre dry weight. The most productive stands had undergrowth dominated by sedges or horsetail. The least productive had either heavy alder shade or deep layers of recent silt deposits suppressing ground vegetation. Bigleaf sedge, small-fruit bulrush, and horsetail are low in palatability to livestock. Many forbs are highly palatable but have low nutritional value. Grasses such as mannagrass or fowl bluegrass provide nutritious forage. Livestock tend to avoid the association until floodwaters recede. However, at lower elevations, especially in landforms supporting ponderosa pine/common snowberry-floodplains, grazing impacts have been severe. Here, grazing has been nearly season long for decades and many stands are in early to mid seral ecological status.

With increasing overuse by livestock, the canopy cover of mountain alder becomes discontinuous. Low alder vigor is indicated by broken stems, disease, highlining, and lack of younger age classes. Overgrazing and trampling break the herbaceous layer, exposing the site to erosion.

With continued overuse, streams develop dished profiles, excessive streambank erosion, and high peak flows. Base flows are low to absent. Both active channel shelves and alder are unable to develop on such disturbed sites.

Wildlife and fisheries: Most streams passing through landforms containing alder associations are degraded although capable of producing valuable fisheries. Banks anchored by alder are stable and can withstand relatively severe spring runoff. Alder controlled streams develop moderately narrow, moderately deep stream profiles and the alder provides cover, food, and shade for salmonids. The diversity provided by the alder provides habitat for many kinds of birds. Browse is available for deer and elk.

Fire: Fire is infrequent in the mountain alder association. Alder will survive only the coolest ground fire. Most fires will destroy the alder, leaving the active fluvial surfaces protected from erosion largely by weak rooted graminoids and forbs.

Recognizing potential on disturbed sites: It is hard to visualize potential on sites with dish profile streams and little riparian development. However, most order 2 and 3 streams at moderate to low elevation, with moderate gradients, and relatively coarse, well aerated soils have the potential to support a dynamic mix of the various alder associations on their active fluvial surfaces.

Rehabilitation pathways: Critical factors in channel shelf formation are season long moisture and rest from grazing. A dish profile stream is often bank full at peak runoff but is dry or nearly so by mid summer. This condition will not support the development of riparian vegetation and with continued overuse by livestock there can not be any positive change in the condition of the site. With rest, it may take 2 to 5 years for the stream to find some relatively permanent channel in which banks and channel shelves stay moist season long and begin to support the growth of riparian vegetation, including alder. This vegetation then traps sediments, starting succession towards alder dominated channel shelves and eventually to more mature alder associations. Once established, it will take at least 5 years for alder to grow to stem heights and diameters that are resistant to grazing. Cattle may then be reintroduced to the site. Base the length of season on 40 percent utilization of the herbaceous vegetation on the adjacent floodplain (not on alder) to insure that livestock is removed before damage occurs on the alder dominated portions of the landform.

OTHER STUDIES

The mountain alder association has not been described elsewhere. Padgett and Youngblood's (1986) mountain alder community type is different.

MOUNTAIN ALDER–COMMON SNOWBERRY ASSOCIATION

Alnus incana-Symphoricarpos albus
SW22-11 ALIN-SYAL

Sample Size = 9 plots in mid seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The mountain alder-common snowberry association is abundant at low to moderate elevations (2200-5500 feet) in the Ochoco Mountains Physiographic Area. It is infrequent on the Deschutes, Winema, and Fremont National Forests, where it occurs on the Basin and Range, LaPine Basin, Pumice-mantled Basin and Range, and Low Flanks Cascades Physiographic Areas. Landforms occur along second order and larger streams in fairly broad, moderate gradient floodplains (Figures 38 & 39). Sites are well developed banks, overflow channels, and channel shelves. Lower reaches of Mill, Deep, Black Canyon, McKay, Ochoco, Canyon, and Emigrant Creeks are typical locations for the Ochoco National Forest. Sample plots were located by the Metolius and Deschutes Rivers on the Deschutes National Forest and Spring and Swede Cabin Creeks on the Fremont National Forest.

1 Ochoco Creek, third order
2 Mountain alder, active channel shelf
3 Mountain alder-common snowberry, banks
4 Ponderosa pine-common snowberry-floodplain, inactive floodplain

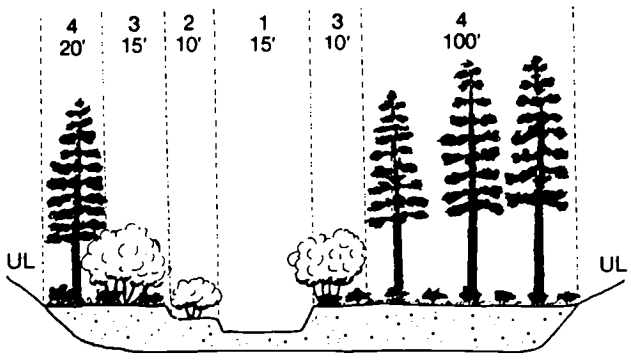


Figure 38. Ochoco Creek; mod gradient, low elevation floodplain; Ochoco Mountains Physiographic Area.

1 Lake Creek, third order
2 Small-fruit bulrush (bigleaf sedge), active channel shelves
3 Mountain alder-common snowberry, active floodplains
4 White fir/queencup beadlily, inactive floodplains
5 Ponderosa pine/common snowberry-floodplain, terraces

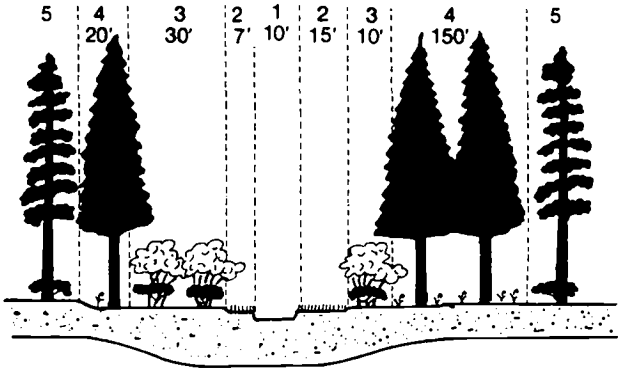


Figure 39. Lake Creek; mod-low gradient, low elevation floodplain; Low Flanks Cascades Physiographic Area.

SOILS

Sediment deposition has built soil depth so that the site potential has changed from the mountain alder association to the mountain alder-common snowberry association. Soils are well aerated alluvium with loam to sandy loam textures that grade into water-worked cobbles and gravels at the zone of the old streambed. The site is often flooded during peak runoff and the water table is within 2.5 feet of the soil surface in late summer. Available water holding capacity is low, but the soils are generally moist through the summer due to the proximity of water. Alder increases soil fertility through nitrogen-fixing root nodules and nitrogen rich leaf litter.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Mountain alder	20-70 (56)	100
Woods rose	0-5 (3)	78
Common snowberry	5-70 (32)	100
Blue wildrye	0-15 (5)	67
Kentucky bluegrass	0-30 (6)	67
Western yarrow	0-3 (1)	67
Northern bedstraw	0-5 (1)	56
Largeleaved avens	0-2 (1)	56
Starry solomonplume	0-15 (4)	89
Shrubs	40-90 (66)	100
Grasses	10-50 (19)	100
Sedges	0-35 (13)	89
Forbs	15-63 (27)	100

Potential natural vegetation: Mountain alder-common snowberry is dominated by mountain alder and common snowberry. Dogwood, woods rose, prickly currant, and willows are scattered. The site is capable of growing several species of willow as well as aspen and cottonwood, but seedlings of these species rarely reach maturity because of browsing by deer, elk, beaver, and livestock. The herb layer reflects drier soils than the mountain alder association and is more closely related to ponderosa pine/common snowberry. Common grasses included blue wildrye and Kentucky bluegrass. Forbs include western yarrow, northern bedstraw, largeleaved avens, starry solomonplume, red columbine, Dutch rush, woods strawberry, and cowparsnip.

MANAGEMENT AND REHABILITATION

Livestock: Estimates of forage production ranged from 100 to 2000 (839) lbs/acre dry weight. Production is lower on steep narrow banks than on active floodplains, meander cutoffs, and overflow channels. The association lies in low elevation floodplains which have been grazed in excess of 100 years.

With increasing overuse by livestock, the alder canopy becomes disrupted and clumpy. Alder decreases in vigor as indicated by dead shrubs, highlining, and lack of young age classes. The competitive ability of snowberry is reduced in favor of Kentucky bluegrass and forbs. The stream channel is wider and shallower because of accelerated erosion and 33-67 percent of the streambanks are being actively eroded.

With continued overuse, both alder and common snowberry become uncommon. They are restricted to protected locations or moist microsites or are absent. Kentucky bluegrass, other grasses, and forbs dominate the site. The stream channel is wide and shallow. Most of the streambanks are eroding because of the absence of alder.

Wildlife and fisheries: Streams passing through mountain alder associations are capable of supporting good fisheries. Alder stands provide good bank stability and protection from floods. Alder controlled streams have narrow, deep profiles and provide shade and cover for trout. The diversity provided by the alder canopy provides habitat for many species of birds. Browse is available for deer and elk.

Fire: Fire is infrequent on these sites. Alder is sensitive to all but cool ground fire. Fire leaves the streambank and other active fluvial surfaces protected from erosion by weak rooted snowberry, grasses, and forbs and reduces the horizontal and vertical diversity of the landform.

Recognizing potential on disturbed sites: It is difficult to visualize mountain alder-common snowberry potential on highly degraded sites. Recognizing the landform supporting the association is essential to recognizing potential for the association. The presence of ponderosa pine on moderate gradient floodplains often indicates the potential for mountain alder-common snowberry on active fluvial surfaces, especially on the Ochoco National Forest.

Rehabilitation pathways: Mountain alder is a prolific seeder and will usually reestablish itself on moist, well-aerated, seral, fluvial surfaces when rested from overuse by livestock and bank erosion. Alder will not root from cuttings, but alder seedlings can be successfully transplanted from other sites or the nursery. Well aerated soils that are moist through the summer are the best planting sites.

The Ochoco National Forest has been successful in developing an upward trend in ecological status by enforcing forage utilization standards. When livestock is promptly removed from the landform at 40 percent forage use mountain alder-common snowberry can return to late seral or better ecological status in 10 to 20 years. The rehabilitation process can be accelerated by resting the pastures for at least 5 years. Livestock are reintroduced when the fluvial surfaces are anchored by alder and the alder stems become tall and thick enough to withstand browsing.

Structures are not needed to rehabilitate alder associations but may be helpful in improving fisheries value and raising water tables. Woody debris of 12 inches or more in diameter will help provide long term stability to the site.

OTHER STUDIES

This association has not been described elsewhere. Padgett (1981) described a mountain alder riparian type on the Malheur National Forest that may be similar to mountain alder-common snowberry.

MOUNTAIN ALDER–DOUGLAS SPIRAEA ASSOCIATION

Alnus incana-Spiraea douglasii
SW22-12 ALIN-SPDO

Sample size = 13 plots in mid seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The **mountain alder-Douglas spiraea association** is common in mountainous physiographic areas within the Deschutes, Fremont, and Winema National Forests. Elevations range from 2200 feet at Squaw Creek (Ochoco National Forest) to 5700 feet in the Cascades. It occurs on active fluvial surfaces within several landforms: 1) moderate to steep gradient floodplains in the Deschutes Cascades and Winema Cascades Physiographic Areas (Figure 40), 2) moderate gradient floodplains in the Low Flanks Cascades Physiographic Area where the adjacent inactive floodplains are dominated by **ponderosa pine/common**

1 Odell Creek, third order
2 **Mountain alder-Douglas spiraea**, banks and active channel shelves
3 **Engelmann spruce/queencup beadlily**, inactive floodplains

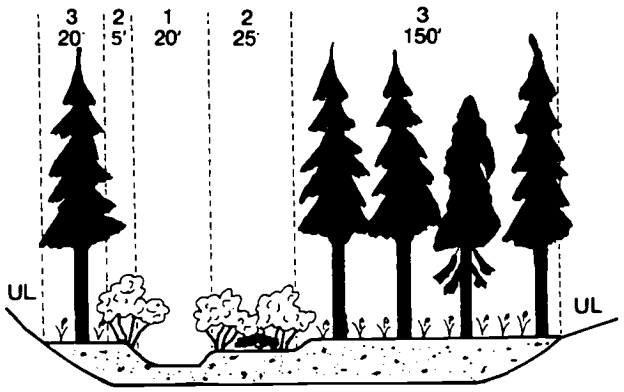


Figure 40. Odell Creek; mod gradient, mod elevation floodplains; Deschutes Cascades Physiographic Area.

snowberry, 3) narrow, deeply incised, moderate gradient drainages in the Pumice-mantled Basin and Range Physiographic Area (see **lodgepole pine/Douglas spiraea/forb**, p. 33), and 4) the banks of large streams in deep, V-shaped canyons such as Squaw Creek and the Deschutes River Canyons in the Grasslands Physiographic Area, the Metolius River in the Low Flanks Cascades Physiographic Area (Figure 41), and Sprague River Canyon in the Basin and Range Physiographic Area.

1 Metolius River, forth order
2 Mountain alder-Douglas spiraea, banks

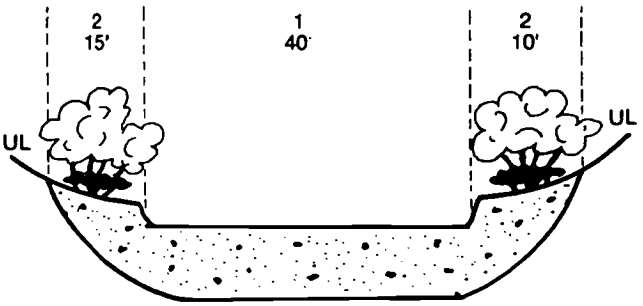


Figure 41. Metolius River; mod gradient, low elevation canyon; Low Flanks Cascades Physiographic Area.

SOILS

Accumulation of stream sediments has built soil depths so that vegetative composition reflects a drier moisture regime than the **mountain alder association**. Soils are well aerated alluvium. Surface soil textures are loam to sandy loam, grading into water-worked cobbles and gravels at the level of the old streambed. Available water holding capacity is low but the soil remains moist season long due the proximity of water. The site is often flooded during peak runoff and the water table is within 2.5 feet of the soil surface in late summer. Alder improves soil fertility through nitrogen-fixing root nodules and nitrogen rich leaf litter.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Mountain alder	20-63 (42)	100
Prickly currant	0-10 (3)	69
Woods rose	0-5 (3)	77
Douglas spiraea	10-37 (18)	100
Softleaved sedge	0-15 (3)	46
Widefruit sedge	0-20 (5)	46
Western yarrow	0-3 (1)	69
Monkshood	0-3 (2)	54
Common horsetail	0-15 (2)	54
Sweetscented bedstraw	0-3 (2)	69
Arrowleaf groundsel	0-3 (1)	54
Starry solomonplume	0-15 (4)	92
Shrubs	63-90 (70)	100
Grasses	1-25 (7)	100
Sedges	0-30 (9)	92
Forbs	3-40 (29)	100

Potential natural vegetation: The association is dominated by mountain alder and Douglas spiraea. Dogwood, woods rose, willows, and prickly currant are scattered through the shrub layer. Pacific ninebark and vine maple are often codominant with alder in the vicinity of Santiam Pass (Deschutes National Forest). The site is capable of growing several species of willow but their seedlings rarely reach maturity because of browsing by deer, elk, beaver, and livestock. Widefruit or softleaved sedge are found on most plots in the Cascade Mountains. Bluejoint reedgrass, tall mannagrass, and blue wildrye are common grasses. A rich mesic forb component usually dominates the graminoids and includes yarrow, monkshood, common horsetail, sweetscented bedstraw, arrowleaf groundsel, starry solomonplume, and Jacob's ladder.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 50 to 100 (450) lbs/acre dry weight. Estimates were lower on narrow banks and higher on other fluvial surfaces. Much of the association is outside of existing allotments or are otherwise isolated from intensive grazing. Where cattle do graze the association, such as Squaw Creek (Ochoco National Forest), it responds similarly to the **mountain alder-common snowberry association.**

With increasing overuse by livestock, the alder canopy becomes disrupted and clumpy. Alder is decreasing in vigor as indicated by dead shrubs, highlining, and lack of younger age classes. Grazing and trampling reduce the competitive ability of Douglas spiraea in favor of Kentucky bluegrass and forbs. The stream channel is wider and shallower due to accelerated erosion and 33-67 percent of the streambanks are being actively eroded.

With continued overuse, grazing and trampling eliminate both alder and spiraea. Grasses and forbs dominate the site. The stream channel is wide and shallow. Most of the streambanks are eroding because of the absence of alder.

Wildlife and fisheries: Streams passing through **mountain alder-Douglas spiraea** support valuable fisheries. Alder sites in late seral or better ecological status withstand relatively severe flooding and provide good bank stability. Under these conditions streams have a moderately narrow and deep profile and alder provides cover, food, and shade for salmonids. The diversity provided by alder provides habitat for many bird species and browse for deer and elk.

Fire: Fire is infrequent on these sites. Alder is sensitive to all but cool ground fire. Burning the alder will leave streambanks protected from erosion by weakly rooted spiraea, grasses, and forbs. Widefruit sedge will provide good bank stability if abundant.

Recognizing potential on disturbed sites: It is difficult to recognize the potential for alder on sites in early seral ecological status. Fortunately **mountain alder-Douglas spiraea** is usually in late seral or better status except on the Crooked River National Grassland. Low to moderate elevation landforms with coarse well aerated soils, and streams with moderate gradients and season long flow help indicate landforms that support alder.

Rehabilitation pathways: Mountain alder is a prolific seeder and will usually reestablish itself on moist, well aerated, seral, fluvial surfaces when rested from overuse by livestock and bank erosion. Alder will not root from cuttings, but alder seedlings can be successfully transplanted from other sites or the nursery. Well aerated soils that are moist through the summer are the best planting sites. The Ochoco National Forest has successfully developed an upward trend in ecological status on similar alder sites by enforcing forage utilization standards. When livestock are removed at 40 percent forage use the association can return to late seral ecological status in 10 to 20 years. The rehabilitation process can be accelerated by first resting the pastures for at least 5 years. Livestock are reintroduced when alder anchors the streambanks and alder stems are tall and thick enough to withstand browsing.

Structures are not needed to rehabilitate alder associations but may be helpful in improving fisheries value and raising water tables. Woody debris 12 inches or more in diameter will help provide long-term stability to the site.

OTHER STUDIES

The **mountain alder-Douglas spiraea association** has not been described elsewhere.

MOUNTAIN ALDER SPRINGS ASSOCIATION

Alnus incana springs
SW22-13 ALIN SPRINGS

Sample size = 6 plots in late seral and climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The total acreage of the mountain alder springs association is small but it is common throughout central Oregon. Mountain alder springs occur throughout the range of mountain alder at seeps and springs and, occasionally, slumping soils. Alder springs originate in a wide variety of landforms already described for other alder associations (no landform figures are provided).

SOILS

Surface soils are usually thin (6-20" thick), organic mucks or organic loams over a stony subsoil. Cold, well aerated spring water emerges through the stony substrait, saturating the organic soil. One plot occurred on a slump and spring zone and had a very deep mixed loam soil. Water tables may lower to within 1 or 2 feet of the soil surface by September but the organic surface remains moist year round.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Mountain alder	37-90 (76)	100
Prickly currant	0-15 (5)	67
Tall mannagrass	0-20 (11)	83
Bigleaf sedge	0-37 (9)	50
Monkshood	1-5 (3)	100
Enchanter's nightshade	0-20 (11)	83
Sweetscented bedstraw	1-3 (3)	100
Largeleaved avens	1-3 (3)	100
Twayblade	0-3 (1)	67
Glabrate monkeyflower	1-15 (5)	100
Jacob's-ladder	0-15 (3)	67
Starry solomonplume	0-37 (9)	83
Shrubs	37-90 (76)	100
Grasses	1-37 (21)	100
Sedges	0-63 (14)	50
Forbs	37-63 (59)	100

Potential natural vegetation: Mountain alder dominates a wet, rich, and varied herbaceous layer. Wet graminoids such as tall mannagrass, bigleaf sedge, or small-fruit bulrush abundant in half of the stands. Forbs dominated the undergrowth in the other stands. Forb include monkshood, enchanter's nightshade, sweetscented bedstraw, largeleaved avens, twayblade, glabrate monkeyflower, Jacob's-ladder, starry solomonplume, lady-fern, Siberian montia, and alpine mitella.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 300 to 2500 (1633) lbs/ acre dry weight. Productivity varies with the density of the alder overstory. The association can provide considerable forage, but of low quality. Small-fruit bulrush and bigleaf sedge have low forage value while the succulent forbs are palatable but low in nutrition. Livestock usually avoid the mucky soils and are restricted in their movements by the dense stand of alder. Mountain alder springs have not been observed in degraded conditions.

Wildlife and fisheries: The vertical and horizontal structural diversity provided by the alder is habitat for many birds and mammals. Some browse is available for big game use.

Fire: The lush, mesic undergrowth and wet soils make these sites relatively unflammable.

Recognizing potential on disturbed sites: Mountain alder springs can be easily recognized on the basis of vegetative composition and site.

Rehabilitation pathways: Mountain alder springs have not been observed in degraded conditions.

OTHER STUDIES

The mountain alder springs association has not been described elsewhere.

WILLOW/KENTUCKY BLUEGRASS COMMUNITY TYPE

Salix/Poa pratensis
SW11-11 SALIX/POPR

Sample Size = 7 plots in mid to late seral ecological status

LOCATION AND RIPARIAN LANDFORMS

Willow/Kentucky bluegrass occurs on sites of various potential that have been highly altered by grazing, lowering of the water table, or both. It is a major community type on the Fremont and Ochoco National Forests (Basin and Range and Ochoco Mountains Physiographic Areas) and uncommon on the Winema and Deschutes National Forests. Elevations are low to moderate (4400-5900 feet). The community type is common on two landforms: 1) broad, flat, low gradient floodplains at low to moderate elevations where it usually replaces the **willow/woolly sedge association** (Figure 42) and 2) similar floodplain landforms at moderately high elevations where it replaces the **willow/aquatic sedge association** (see **willow/aquatic sedge**, p. 80). Sample plots were located at Sawmill and Silver Creeks on the Ochoco National Forest and at Coffeepot, Chocktoot, Thomas, and Fivemile Creeks and the North Fork Sprague River on the Fremont National Forest. See **inflated sedge** (p. 116) for another figure illustrating this community type.

1 **Creeping spikerush**, new sediments between loose rock checkdams
2 **Willow/Kentucky bluegrass (willow/woolly sedge** potential), inactive floodplains
3 **Cusick bluegrass**, inactive floodplains and terraces

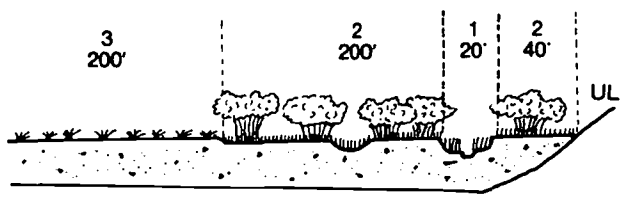


Figure 42. Chocktoot Creek; low gradient, mod-low elevation floodplain; Basin and Range Physiographic Area; Fremont National Forest.

SOILS

Soils are composed of deep fine textured alluvium over subsurface soils of various textures and origin. Surface textures are silt to silty clay loam. One plot was an organic loam, indicating a wetter origin. High water tables ranged from 18 to 28 inches below the soil surface. Water levels lower to 20 to 40 inches below the surface in July. These sites are characterized by having seasonally high water tables followed by mid summer drought. Willows survive these more xeric conditions by sending water seeking roots down to permanent moisture.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Geyer willow	7-55 (32)	100
Lemmon willow	0-35 (7)	29
Prickly currant	0-15 (3)	57
Bearded wheatgrass	0-5 (2)	71
Meadow barley	0-3 (1)	57
Kentucky bluegrass	15-70 (37)	100
Western yarrow	0-5 (3)	86
Bedstraw	0-18 (7)	71
Largeleaved avens	0-15 (4)	86
Northwest cinquefoil	0-3 (2)	71
Starry solomonplume	0-4 (1)	57
Dandelion	0-5 (2)	71
Shrubs	25-87 (50)	100
Grasses	15-75 (42)	100
Sedges	0-50 (13)	86
Forbs	7-50 (30)	100

Potential natural vegetation: The **willow/Kentucky bluegrass community type** is dominated by Geyer and/or Lemmon willows and a sward of Kentucky bluegrass. Kentucky bluegrass growth form occurs as vigorous, erect, loosely clustered tillers growing through a loose mat of litter. Annual forbs are restricted to newly created gopher mounds. Other graminoids, such as bearded wheatgrass and meadow barley, and perennial forbs occur as scattered small colonies or as individual plants that are subordinant to Kentucky bluegrass. Currants form a low shrub layer under the willows. The rich forb component is composed of species such as western yarrow, elk thistle, bedstraw, largeleaved avens, northwest cinquefoil, and starry solomonplume.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 750 to 2500 (1500) lbs/acre dry weight. **Willow/Kentucky bluegrass** is a generally preferred forage area. These relatively xeric sites are often surface dry by July so that livestock use has traditionally been nearly season long. Much of the community type has a long history of overuse, lowering site potential from native graminoids to Kentucky bluegrass which retains competitive ability under a wide range of grazing pressures. It can reproduce by both tillering and sprouting from seed under

light grazing or switch solely to vegetative reproduction from short rhizomes under season long grazing systems (Volland 1985).

With increasing overuse by livestock, willows show declining vigor as indicated by uneven stem age distribution, highlining, clubbing, or dead clumps. Kentucky bluegrass growth form is erect, tightly clustered tillers, growing through a compacted, somewhat broken litter layer. Bluegrass is expanding into disturbed areas through vigorous rhizome elongation. Baltic rush and perennial forbs are aggregated in somewhat large colonies.

With continued overuse, willows show a sharp decline in vigor and may be going out of the stand. Sites with less than 25% willow cover will key to **Kentucky bluegrass**. Kentucky bluegrass is subordinate to other graminoids and forbs and its growth form is decumbent, with weak tillers arising close together from short rhizomes. The litter layer is compacted or absent and bare ground is evident. There is little evidence of bluegrass invasion into disturbed sites. Perennial forbs and Baltic rush occur in large dense colonies.

Wildlife and fisheries: Rodents such as pocket gophers, mice, and the Columbian ground squirrel have significant periodic impact on bluegrass meadows (Volland 1979). Heavier infestations increase the prevalence of perennial and annual forbs. It may take several years to reestablish Kentucky bluegrass sites devastated by ground squirrels (Volland 1979). Willows provide browse for deer and elk and important diversity for other mammals and songbirds. Willows help anchor streambanks and provide cover and shade for salmonids.

Fire: Cool burns should have little impact on rhizomatous species such as Kentucky bluegrass. Fire should be an effective tool to reduce the effect of excessive litter buildup on rested pastures. Willows are sensitive to fire but will resprout from root crowns the following season.

Estimating potential on disturbed sites: The **Willow/Kentucky bluegrass community type** usually occurs on sites once supporting **willow/woolly sedge** or **willow/aquatic sedge**. Managers must recognize the landforms capable of supporting these associations if he wishes to return the sites to their potential. Low to moderate elevation, low gradient floodplains once likely supported the **willow/woolly sedge association**. Similar floodplains at moderately high elevations are typical of **willow/aquatic sedge** sites.

Rehabilitation pathways: Two or three years of rest will restore the vigor of Kentucky bluegrass. Herbaceous production can be doubled or tripled. In five or six years new willow shoots will be 5 to 8 feet tall and resistant to damage by grazing. Unless water tables are restored, these sites will for all practical purposes remain with a ground cover dominated by bluegrass and should be managed as a naturalized community. Renovation of highly degraded sites with native grasses and sedges seems impractical given depleted water tables and the flexibility of Kentucky bluegrass (Volland 1979).

For more information on rehabilitating these sites see the discussion for the **willow/woolly sedge** and **willow/aquatic sedge** associations (p. 77 and 81).

OTHER STUDIES

Volland (1976), Hall (1973), and Hopkins (1979b) described meadows dominated by Kentucky bluegrass but without willows in central Oregon. A similar community type dominated by Geyer willow has been described for eastern Idaho, western Wyoming, and northern Utah and southern Idaho by Youngblood and others (1985 a & b).

WILLOW/WOOLLY SEDGE ASSOCIATION

Salix/Carex lanuginosa
SW11-12 SALIX/CALA3

Sample Size = 7 stands in mid seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

Willow/woolly sedge is found on the Ochoco Mountains and Basin and Range Physiographic Areas and is particularly common on the Lakeview and Bly (Fremont National Forest) and Snow Mountain (Ochoco National Forest) Districts. Landforms supporting the willow/woolly sedge association occur on low-gradient floodplains at low to moderate elevations (4400-5500 feet) (Figure 43). Willow/woolly sedge occurs on active floodplains, overflow channels, and other active fluvial surfaces. Sample plots were located along Silver, Sawmill, and Emigrant Creek on the Snow Mountain District and Dairy and Crooked Creek on the Lakeview District.

1 Silver Creek, third order
2 Willow/woolly sedge, active floodplain
3 Willow/woolly sedge, overflow channel
4 Sagebrush/Cusick bluegrass, terrace or inactive floodplains

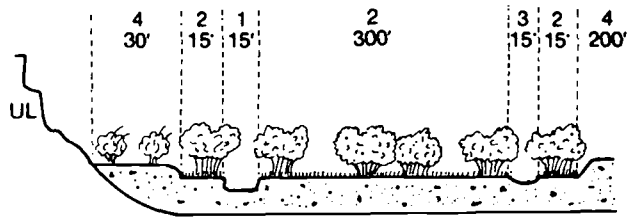


Figure 43. Silver Creek; low gradient, low elevation floodplain; Ochoco Mountains Physiographic Area.

SOILS

This is the driest natural willow association. Soils are deep, erosive, moderately fine textured alluvium. Surface soil textures are fine sandy to silty clay loams. These sites are periodically flooded during spring runoff (typically April or May) but the water table is well down in the rooting zone by mid July. Available water holding capacity is moderately high.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Booth willow	0-65 (26)	71
Geyer willow	0-25 (7)	71
Lemmon willow	0-70 (24)	43
Prickly currant	0-20 (7)	71
Kentucky bluegrass	2-40 (12)	100
Woolly sedge	2-65 (29)	100
Western yarrow	0-7 (2)	57
Bedstraw	2-15 (8)	100
Largeleaved avens	0-5 (2)	86
Dandelion	0-4 (1)	57
Shrubs	25-90 (63)	100
Grasses	2-60 (16)	100
Sedges	2-70 (38)	100
Forbs	20-50 (28)	100

Potential natural vegetation:: The willow/woolly sedge association is dominated by Geyer, Booth, and/or Lemmon willows and a sward of woolly sedge. Currants often occur under the willows. The rich forb component includes plants such as western yarrow, sweetscented bedstraw, largeleaved avens, dandelion, field mint, Jacob's-ladder, northwest cinquefoil, Oregon checkermallow, and starry solomonplume. It was difficult to find stands in late seral and climax ecological status.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 100 to 2000 (1175) lbs/acre dry weight. Lower production occured in dense willow stands with depauperate undergrowth. Woolly sedge is palatable to livestock and may be more sensitive to trampling compared to other indicator sedges and Kentucky bluegrass. The soils are often surface dry by July so that livestock use has traditionally been nearly season long for decades.

With increasing overuse by livestock, Kentucky bluegrass and forbs become codominant with woolly sedge and eventually dominate the stand. Woolly sedge retreats to the willow understory. Willow vigor may decline as evidensed by uneven stem distribution, highlining, dead clumps, and decreasing canopy cover. Soils become trampled and the litter layer is broken. The site potential may be changed to willow/ Kentucky bluegrass or Kentucky bluegrass.

Continued overuse may lead to increased streambank erosion. Streambed downcutting may occur and result in lowered water tables throughout the landform. Under these hydrologic conditions the site potential may be changed from willow/ woolly sedge to sagebrush/Cusick bluegrass.

Wildlife and fisheries: Streams passing through landforms supporting the **willow/woolly sedge association** are usually highly degraded but may be capable of supporting trout. Streams can be stabilized and pool/riffle ratios increased by building structures such as loose rock check-dams. Streambanks, active floodplains, and overflow channels should be revegetated with willows and woolly sedge. Over time, these changes will narrow and deepen the stream profile, improve base flows, lower water temperture, and provide shade and cover for salmonids. Restoring horizontal and vertical diversity to the landform will restore a complex variety of habitats for mammals and songbirds. The **willow/woolly sedge association** provides excellent habitat for deer when in late seral ecological status.

Fire: There is a long period from mid summer to fall that fire can be used in this association. Fire will decrease litter and provide a temporary increase in herbage production. Willows are sensitive to fire but resprout from root crowns the following season. They will be sensitive to grazing for 5 or more years until they attain stem heights and diameters resistant to browsing. Woolly sedge and Kentucky bluegrass re-establish from rhizomes following ground fire.

Estimating potential on disturbed sites: Due to the degraded condition, the floristic key to the riparian associations seldom allows the user to key sites with this potential. However, the potential for supporting **willow/woolly sedge** can be determined by recognizing the lower elevation, low gradient, floodplain landforms that support this and the **sagebrush/ Cusick bluegrass associations**. **Willow/woolly sedge** occupies more active fluvial surfaces within this landform with proper grazing, watershed management, and restored water tables.

Rehabilitation pathways: Woolly sedge and willows will increase in cover with rest and mid to late season grazing in stands in mid seral or better ecological status. Livestock should be kept off the site during periods of high water and wet soils. The length of the grazing season should be based on 40 percent utilization of forage. Where lowered water tables have changed the site potential to **sagebrush/Cusick bluegrass**, use streambank rehabilitation to elevate the water table and return the site potential to **willow/woolly sedge**. Willow cuttings will succeed where water tables are normal and they are protected from livestock, deer, elk, and beaver.

See **sagebrush/Cusick bluegrass** (p. 66) for another discussion of rehabilitation of landforms supporting the **willow/woolly sedge association**.

OTHER STUDIES

This association has not been described elsewhere.

WILLOW/WIDEFRUIT SEDGE ASSOCIATION

Salix/Carex eurycarpa
SW11-13 SALIX/CAEU

Sample size = 19 plots in late seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

Willow/widefruit sedge is widespread on both the Deschutes and Winema National Forests and occurs sporadically on the west fringe of the Fremont National Forest. Elevations are low to moderate (4100-5000 feet). The association occurs on several landforms: 1) low gradient, low elevation floodplains along the Deschutes River and its tributaries in the LaPine Basin Physiographic Area (Figure 44), 2) shallow, pumice-filled drainages in the LaPine Basin and Pumice-mantled Basin and Range Physiographic Areas (Figure 45), and 3) scattered, moderate elevation basins and bogs within the Deschutes and Winema National Forests. See the descriptions for bog blueberry/Sitka sedge, lodgepole pine-Engelmann spruce/few-flowered spikerush, and lodgepole pine/Douglas spiraea/forb for other figures illustrating the willow/widefruit sedge association (p. 86, 45, and 33).

1 Crescent Creek, third order
2 Sitka sedge or beaked sedge, active channel shelves and overflow channels
3 Willow/widefruit sedge, active floodplains
4 Lodgepole pine/bog blueberry/widefruit sedge, inactive floodplains

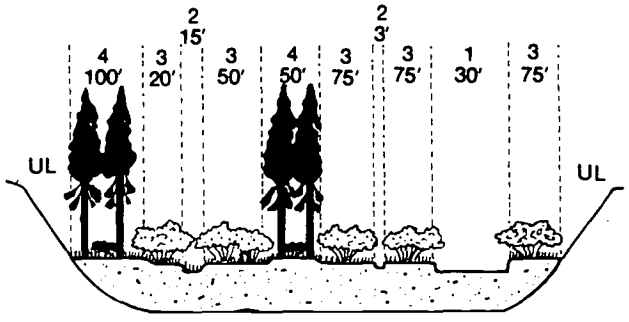


Figure 44. Crescent Creek; low gradient, mod-low elevation floodplains; LaPine Basin Physiographic Area.

1 Spruce Creek, second order
2 Willow/widefruit sedge, active floodplain
3 Lodgepole pine/Douglas spiraea/widefruit sedge, inactive floodplain
4 Lodgepole pine/Douglas spiraea/forb, transitional

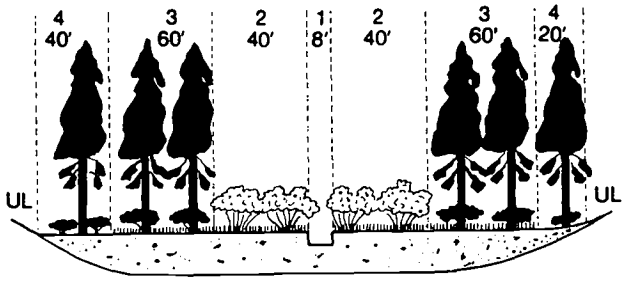


Figure 45. Spruce Creek; low gradient, moderately low elevation floodplains; LaPine Basin Physiographic Area.

SOILS

Soils are variable. Floodplain and swale soils are deep alluvium having surface textures of silt, fine sandy loam, or organic loam. Basin soils are composed of sedge peats or organic loam. Subsurface soils are often coarse, water-saturated pumice. Available water capacity is moderate to high and soils remain moist through the summer in most years. Sites are flooded to 0 to 8 inches above the soil surface in the spring. The water level lowers to 12 to 28 inches below the soil surface by September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Bog birch	0-35 (6)	58
Booth willow	0-90 (25)	50
Geyer willow	0-40 (19)	84
Douglas spiraea	0-37 (10)	68
Bluejoint reedgrass	0-3 (1)	58
Widefruit sedge	3-80 (38)	100
Small bedstraw	0-15 (2)	47
Largeleaved avens	0-3 (1)	42
Shrubs	35-95 (66)	100
Grasses	1-37 (6)	100
Sedges	3-87 (47)	100
Forbs	0-37 (13)	95

Potential natural vegetation: The sites are dominated by tall Geyer, Lemmon, and/or Booth willows and widefruit sedge. One higher elevation stand (5000 feet) near MacKenzie Pass was dominated by Eastwood willow. Other willows include whiplash and yellow willow. Bog birch was common but is never dominant. Douglas spiraea and bog blueberry may be common under the willows. Other graminoids include bluejoint

reedgrass, Kentucky bluegrass, woolly sedge, beaked sedge, Sitka sedge, and Baltic rush. Forbs include orange arnica, Indian paintbrush, small bedstraw, western St.Johnswort, large-leaved avens and Jacob's-ladder.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 50 to 3500 (1805) lbs/acre dry weight. Production was lowest in depauperate undergrowths beneath dense willow canopies (more than 75 percent canopy cover). Widefruit sedge is palatable to livestock. However, livestock tend to avoid this site until surface soils are dry enough to walk on. Therefore, grazing tends to be later in the season and it is unusual to find the association in less than late seral to climax ecological status.

With increasing overuse by livestock, Kentucky bluegrass and other herbs would become codominant with widefruit sedge . Willow cover would decrease in vigor as indicated by uneven distribution, highlining, and decreasing cover.

Wildlife and fisheries: The addition of willow to the sedge layer increases habitat diversity, making these sites attractive to a wide array of birds, and mammals. Low valley gradient, willows, and sedges create excellent habitat for fish and beavers. Coarse sedge rhizomes and willow roots are excellent anchors of streambanks and other fluvial surfaces.

Fire: It may be difficult to burn the association until late summer or fall. Dried vegetation will carry fire, reducing litter buildup and increasing productivity. However, fire may reduce the buffering and filtering capacity of the site during next year's runoff, increasing the chances of erosion. Willows are sensitive to fire but will resprout at the root crown. Sedge peat soils are flammable when dry and can be severely damaged by hot fires.

Estimating potential on disturbed sites: The association has not been observed in less than late seral and climax ecological status and can be recognized on the basis of vegetative composition alone.

Rehabilitation pathways: Usually not needed. Widefruit sedge will increase rapidly in cover with rest and late season grazing on sites in mid seral or better ecological status.

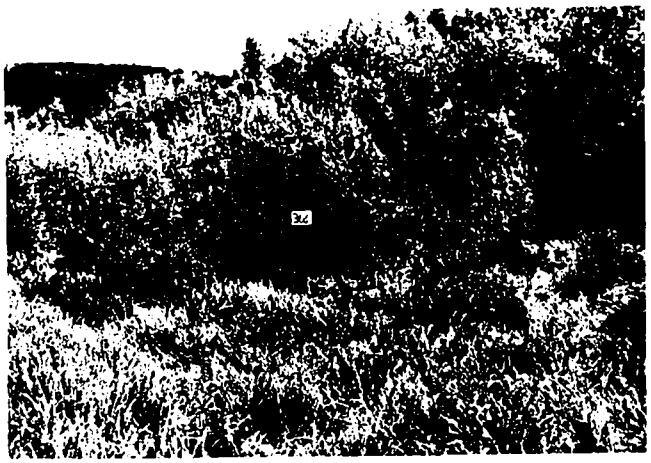
OTHER STUDIES

This association has not been described in other studies.

WILLOW/AQUATIC SEDGE ASSOCIATION

Salix/Carex aquatilis
SW11-14 SALIX/CAAQ

Sample Size = 7 plots in mid seral to climax ecological status



LOCATION AND RIPARIAN LANDFORMS

The willow/aquatic sedge association is abundant on the Fremont National Forest. It was probably common at higher elevations on the Ochoco National Forest but is largely degraded to the Kentucky bluegrass community type by overgrazing and erosion. Elevations are 4800-6300 or more feet. The association is common on two landforms: 1) low gradient basins in the headwaters of drainages such as the North and South Forks of the Sprague River, Sycan River, and Elder Creek (Fremont National Forest) (Figure 46) and 2) narrow, low to moderate gradient floodplains in the upper elevational reaches of the streams mentioned above (Figure 47). See the lodgepole pine/aquatic sedge association (p. 43) for another figure showing the willow/aquatic sedge association.

1 Sycan River, third order
2 Aquatic sedge, streambanks and active floodplains
3 Aquatic sedge, overflow channels
4 Willow/aquatic sedge, active floodplains
5 Tufted hairgrass, moist meadows

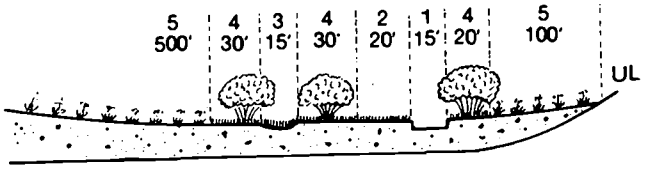


Figure 46. Upper Sycan River Meadow; low gradient, mod-high elevation basin; Basin and Range Physiographic Area; Fremont National Forest.

1 Sycan River, second order
2 Willow/aquatic sedge, streambanks and active channel shelves
3 Lodgepole pine/aquatic sedge, inactive floodplains

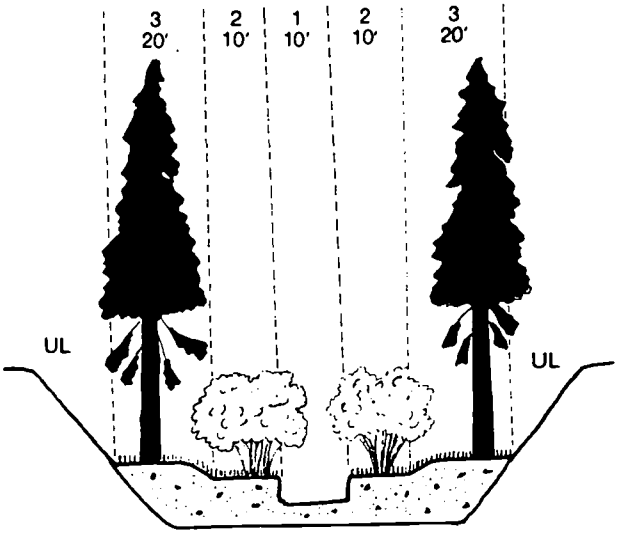


Figure 47. Sycan River; mod gradient, mod-high elevation floodplains; Basin and Range Physiographic Area; Fremont National Forest.

SOILS

Soils are slightly drier than the aquatic sedge association. Surface textures are organic loam or fine sandy to clay loams. Available water holding capacity is moderate to high. The soil surface is flooded in May and June, lowering to within 28 inches of the soil surface by September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Booth willow	0-37 (9)	50
Geyer willow	0-15 (5)	33
Lemmon willow	0-70 (13)	33
Reedgrasses	0-2 (1)	50
Aquatic sedge	15-80 (35)	100
Baltic rush	0-3 (2)	67
Watson's willoweed	1-3 (2)	100
Largeleaved avens	1-10 (3)	100
Glabrate monkeyflower	0-5 (2)	67
Elephanthead	0-3 (2)	83
Jacob's-ladder	0-3 (2)	83
Western bistort	0-10 (3)	83
Bog saxifrage	0-2 (1)	67
Oregon checkermallow	0-3 (1)	83
Shrubs	20-70 (36)	100
Grasses	3-20 (12)	100
Sedges	30-87 (55)	100
Forbs	15-63 (39)	100

Potential natural vegetation: Booth, Geyer, and Lemmon willows - either singly or in combination - dominate the shrub layer. Aquatic sedge is the dominant graminoid. Other graminoids include reedgrass, tufted hairgrass, alpine Timothy, Kentucky bluegrass, and Baltic rush. The rich forb component includes mesic species such as Watson's willoweed, largeleaved avens, glabrate monkeyflower, elephanthead, Jacob's-ladder, western bistort, and bog saxifrage.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 1000 to 3000 (1900) lbs/acre. Herbage production is lower in depauperate undergrowths under dense willow stands. Aquatic sedge is palatable to livestock and may provide valuable forage, but livestock tend to avoid the site until surface soils are dry in July through September.

With increasing overuse by livestock, other graminoids and forbs become codominant with aquatic sedge. There is an increase in Baltic rush and short sedges such as alpine nerved, short-beaked, and Jones sedges. Grasses such as tufted hairgrass, Kentucky bluegrass, and beardless trisetum increase in cover. There is a strong increase in mesic forbs. The soil is somewhat trampled and broken. Willows show some decrease in vigor as indicated by uneven stem age distribution, highlining, or dead clumps.

With continued overuse, rushes, small sedges and forbs dominate aquatic sedge. Willows show a sharp decline in vigor and cover. Streambed downcutting may lower the water table and lower the site potential to **willow/ Kentucky bluegrass** or **Kentucky bluegrass community types**.

Wildlife and fisheries: The addition of willows to the aquatic sedge layer increases habitat diversity, making these sites attractive to a wider array of birds and mammals. Deep, narrow streams, willows, and sedges create excellent habitat for fish and beavers. Coarse sedge rhizomes and willow roots are excellent anchors of streambanks and other fluvial surfaces.

Fire: **Willow/aquatic sedge** can be burned as the herbaceous vegetation dries in late summer and fall. Fire reduces litter and increases productivity and palatability. However, removing the above ground vegetation reduces the ability ability of sedges and willow to buffer water forces and filter sediments during the next peak runoff. Willows are sensitive to fire but will resprout at the stem bases. It will take 5 or more years for the willow to regain stem height and diameters resistant to grazing.

Estimating potential on disturbed sites: Sites in mid seral or better ecological status can be identified by vegetative composition alone. Sites in early seral status are more difficult. In the basin landform, look for evidence of former higher water tables, permanently moist soils, and remnant willows and aquatic sedge to help decide if the potential is **willow/aquatic sedge**. In the floodplain landform active channel shelves and floodplains support **willow/ aquatic sedge** while **lodgepole pine/aquatic sedge** occurs on inactive floodplains and terraces. With decreasing elevation, the potential changes to **willow/wooly sedge** or various **mountain alder associations**.

Rehabilitation pathways: **Willow/aquatic sedge associations** in mid seral or better ecological status will improve rapidly in status with rest from grazing or light, late season grazing. Sites converted to the **Nebraska sedge community type** may slowly change back towards **willow/ aquatic sedge** dominance with rest or improved grazing systems. Sites changed to the **willow/ Kentucky bluegrass** or **Kentucky bluegrass community types** indicate lowered water tables. Stream rehabilitation may be desirable to elevate the water table and return the site potential to the natural **willow/ aquatic sedge association**. Willows can be planted from stem cuttings where water tables are normal.

OTHER STUDIES

A similar **Wolf willow/aquatic sedge community** has been described in eastern Idaho, western Wyoming and northern Utah by Younglood and others (1985 a & b).

WILLOW/SITKA SEDGE ASSOCIATION

Salix/Carex sitchensis
SW11-15 SALIX/CASI3

Sample Size = 11 plots in climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The **willow/Sitka sedge association** association is abundant on the Deschutes National Forest, rare on the Winema and Fremont National Forest, and absent on the Ochoco National Forest. Elevations are low to moderately high, ranging from 3100 at Indian Ford Creek to 4900 feet near Santiam Pass and 5200 feet on Big Marsh Creek (Deschutes National Forest). the association occurs on two landforms: 1) low gradient floodplains along streams in the LaPine Basin and Low Flanks Cascades Physiographic Areas such as the Deschutes and Little Deschutes Rivers (Figure 48), Crescent Creek, and Indian Ford Creek and 2) the headwaters of these and tributary drainages in wet, poorly drained marshes and swamps such as Upper Big Marsh, Little Cultus Marsh (Figure 49), Sparks Lake Marsh, and the marsh at the head of Link Creek (near Santiam Pass). See the descriptions for **Engelmann spruce/bog blueberry/widefruit sedge**, **Sitka sedge**, and **beaked sedge** (p. 53, 114, and 118) for other figures illustrating this association.

1 Deschutes River, fifth order
2 **Sitka sedge**, active floodplain
3 **Beaked sedge**, overflow channel, active channel shelves
4 **Willow/Sitka sedge**, active floodplain
5 **Lodgepole pine/Douglas spiraea/widefruit sedge**, inactive floodplain

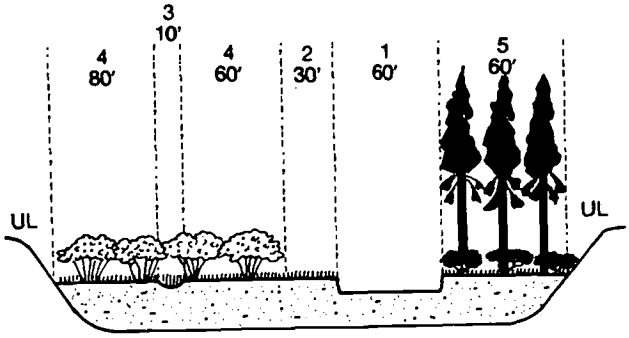


Figure 48. Deschutes River; low gradient, mod-low elevation floodplain; LaPine Basin Physiographic Area; Deschutes National Forest.

1 Little Cultus Creek, first order
2 Few-flowered spikerush, bog
3 Bog blueberry/Sitka sedge, wet shrub meadow
4 **Willow/Sitka sedge**, wet shrub meadow
5 Engelmann spruce/queencup beadlily, terrace and toe slope

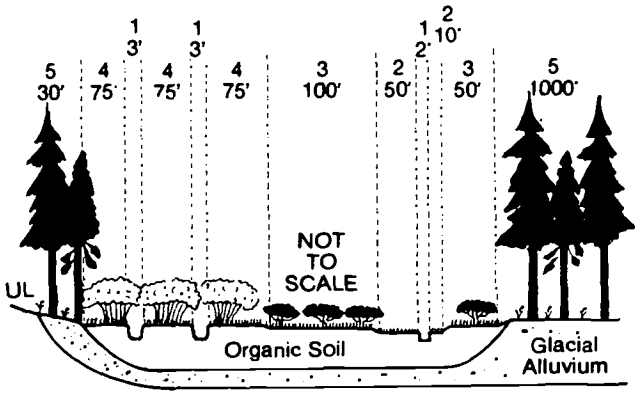


Figure 49. Little Cultus Marsh; low gradient, mod elevation lake basin; Deschutes Cascades Physiographic Area.

SOILS

Floodplain soils are very deep alluviums that usually have surface textures of organic loams. Headwaters basin soils are deep sedge peats. Available water holding capacity is high. Water tables are near to above the soil surface well into the summer. Some of the watersheds with this association have peak water flow in late summer (August) because it takes several months for snowmelt to work through the deep pumice and basalt mantle of the Cascades.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Bog birch	0-65 (18)	55
Geyer willow	**0-60 (22)**	**64**
Lemmon willow	**0-40 (9)**	**36**
Douglas spiraea	0-15 (7)	73
Bog blueberry	0-40 (9)	45
Sitka sedge	**25-90 (55)**	**100**
Shrubs	31-87 (64)	100
Grasses	0-10 (2)	55
Sedges	37-93 (61)	100
Forbs	1-20 (8)	100

Potential natural vegetation: **Willow/Sitka sedge** is dominated by tall willows and a sward of Sitka sedge. The closely related Geyer and

Lemmon willows are dominant in the floodplains landform. In the headwaters landform Eastwood willow (sometimes with Sitka willow) may be codominant with Geyer and Lemmon willows. Eastwood willow or bog birch may be dominant where beaver have reduced the cover of the more palatable Geyer, Lemmon, and Sitka willow. Douglas spiraea and bog blueberry are often common under the shrubs. Beaked sedge is common on wetter sites, but other graminoids and forbs are inconspicuous. Typical forbs include white bogorchid, water hemlock, common horsetail, pink wintergreen, and small bedstraw.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 1500 to 5000 (2378) lbs/acre dry weight. Livestock grazing has not occurred for decades (except on small allotments on Indian Ford Creek) in landforms supporting **willow/Sitka** sedge. Sitka sedge is moderately low in palatability for livestock and will rapidly recolonize disturbed sites with rest from grazing. Livestock avoid the wet organic soils until mid or late summer. Grazing on wet soils may make the site more susceptible to surface and streambank erosion.

Degraded stand conditions are rare. With increasing overuse by livestock, grasses and forbs become more prevalent in the stand. Willows are readily eaten by livestock if forced to overuse the site.

Wildlife and fisheries: Very productive trout streams pass through riparian landforms with the **willow/Sitka sedge association** (Deschutes River, Little Deschutes River, Crescent Creek, etc). Coarse, tough, sitka sedge rhizomes and willow roots are excellent anchors of riverbanks and floodplains and provide shade and cover for salmonids. Additionally, the structural diversity provided by the complex mix of lodgepole pine, willow, and sedge associations on these landforms provides excellent habitat for beaver, deer, elk, and other wildlife.

Fire: It will be difficult to burn this site until late in the summer or fall. Dried vegetation will carry fire, reducing litter buildup and increasing productivity for several years. However, fire may reduce the buffering and filtering effect of sedges and willows during the next season's runoff. Willows are very sensitive to fire and will die back to the root crown, resprouting the next year. Sedge peat soils are flammable when dry.

Estimating potential on disturbed sites: Not necessary because the association is largely in good ecological status and can be recognized on the basis of vegetative composition alone.

Rehabilitation pathways: This association has not been observed in less than late seral ecological status and Sitka sedge will rapidly recolonize the site with rest and late season grazing.

OTHER STUDIES

The **willow/Sitka sedge association** has not been described elsewhere.

WILLOW/BEAKED SEDGE ASSOCIATION

Salix/Carex rostrata
SW11-16 SALIX/CAR02

Sample Size = 6 plots in mid seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

Willow/beaked sedge is a minor association on the Ochoco National Forest and is rare elsewhere. Five of six plots were located in the Ochoco Mountains Physiographic Area and another in the Deschutes Cascades Physiographic Area. Its status is unknown on the Winema and Fremont National Forests. The association most commonly occurs in landforms where poor drainage, beaver dams, road crossings, and other obstructions flood willow sites (Figure 50). Elevations are low to moderately high (4400-5800 feet) and microtopography is flat to slightly undulating or concave. Sample plots were located at Mowich Springs and Allison Guard Station on the Ochoco National Forest and Sparks Lake Marsh on the Deschutes National Forest.

1 Allison Creek, first order
2 Overflow channel
3 Willow/beaked sedge, streambanks, wet shrub meadow

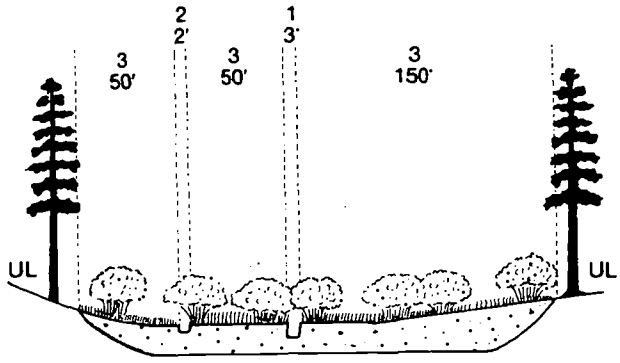


Figure 50. Allison Creek Marsh; low gradient, mod-high elevation basin; Ochoco Mountains Physiographic Area.

SOILS

This is the wettest willow association. All sample plots (except on sites recently flooded by beavers) had very deep organic loam or sedge peat soils. The organic layer often extends to a depth of 3 to 6 or more feet, indicating a very long period (thousands of years) of stability on the site. Available water holding capacity is high. The soil surface is flooded well into the summer. The water table lowers to 1 to 2 feet below the soil surface in September. The surface soils remain moist through the growing season except in driest years.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover		Constancy
Booth willow	0-85	(32)	67
Geyer willow	0-37	(15)	83
Tufted hairgrass	0-15	(5)	67
Beaked sedge	0-87	(44)	83
Inflated sedge	0-37	(6)	17
Watson's willoweed	0-2	(1)	67
Jacob's-ladder	0-15	(3)	83
Western dock	0-3	(1)	67
Longstalk clover	0-5	(2)	67
Shrubs	25-90	(49)	100
Grasses	1-15	(7)	100
Sedges	37-90	(61)	100
Forbs	15-30	(19)	100

Potential natural vegetation: A sward of beaked occurs under a canopy of Geyer or Booth willow. Inflated sedge was dominant at Sparks Lake Marsh. Other sedges such as woolly or aquatic sedge become important on drier margins of the association. Nebraska sedge and Baltic rush increase in cover on disturbed sites. Tufted hairgrass is present on many plots but is very subordinant to sedges. Forbs include Watson's willoweed, Jacob's-ladder, western dock, and longstalk clover.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 400 to 4000 (2233) lbs/acre dry weight. Production is lower under dense willows. Beaked sedge is moderately palatable and inflated sedge is highly palatable to livestock in late summer. These wet sites are avoided by livestock until late summer. The dense, tough sod formed by beaked and inflated sedge is very tolerant to grazing and will rapidly redominate disturbed sites with rest and late season grazing.

With increasing overuse by livestock, other graminoides and forbs become codominant with beaked and inflated sedge. Tufted hairgrass, Nebraska sedge, Baltic rush, and forbs were co-dominant with beaked sedge on two plots in mid seral ecological status.

Wildlife and fisheries: All sample stands were occupied by beaver. Beaver appear to be in

balance with their food source on the willow/ beaked sedge association. Beaver use appears to have been continuous for decades without apparent damage to the willows. Sedges and willows trap sediments and stabilize banks, forming narrow and deep stream profiles. Overhanging sedges, willows, and banks provide shade and cover for salmonids.

Fire: The willow/beaked sedge association can be burned effectively in late summer or fall in drought years. Fire will reduce litter accumulation and increase productivity for several years. Willows are very sensitive to fire but resprout from the root collar. Peat soils are flammable when dry.

Recognizing potential on disturbed sites: The association is in mid seral or better ecological status and the association can be recognized on the basis of vegetative composition alone.

Rehabilitation pathways: Sites in mid seral or better ecological status will respond rapidly to rest and late season grazing. Where necessary, banks may be temporarily restabilized with domestic grasses such as reed canarygrass. However, grasses do not protect the site from erosion as well as willow and beaked sedge so manage for native species wherever possible.

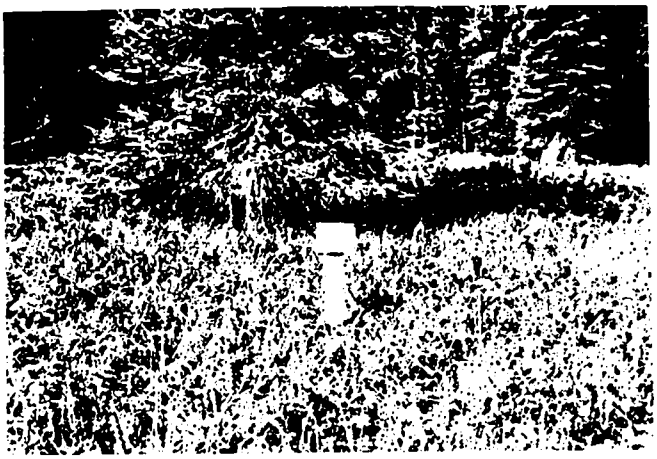
OTHER STUDIES

Youngblood and others (1985a and 1985b) have described similar community types in Idaho, Wyoming, and Utah.

BOG BLUEBERRY/SITKA SEDGE ASSOCIATION

Vaccinium occidentalis/Carex sitchensis
SW41-11 VAOC2/CASI3

Sample Size = 7 plots in climax ecological status



LOCATION AND RIPARIAN LANDFORMS

The bog blueberry/Sitka sedge association is common throughout the Deschutes Cascades and Winema Cascades Physiographic Areas but is absent eastward. Landforms occur in moderately high elevation (4400-5500 feet), low gradient, headwaters basins with cold, poorly drained soils and moderately short growing seasons (Figures 51 & 52). Sample plots were located at Sevenmile Marsh on the Winema National Forest and Santiam Pass, Little Cultus Marsh, Upper Big Marsh, and near Elk Lake on the Deschutes National Forest. Microtopography is slightly undulating. See the description for the beaked sedge association (p. 118) for another figure illustrating bog blueberry/Sitka sedge.

1 Little Cultus Creek, first order
2 Few-flowered spikerush, bog
3 Bog blueberry/Sitka sedge, wet shrub meadow
4 Willow/Sitka sedge, wet shrub meadow
5 Engelmann spruce/queencup beadlily, terrace and toe slope

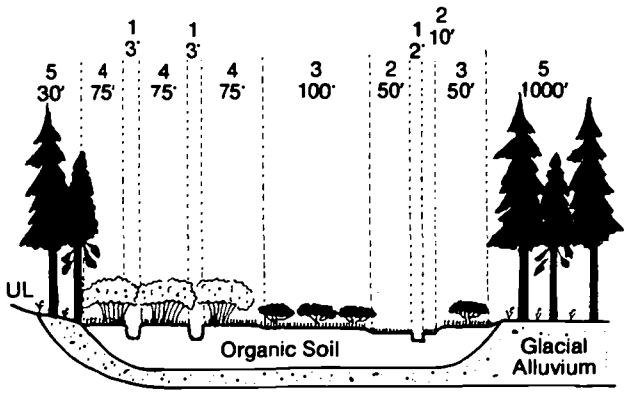


Figure 51. Little Cultus Marsh; low gradient, mod elevation, lake basin; Deschutes Cascades Physiographic Area.

1 Big Marsh Creek, second order
2 Widefruit sedge, dike
3 Willow/widefruit sedge, active floodplain
4 Bog blueberry/Sitka sedge, cutoff/overflow channel
5 Engelmann spruce/queencup beadlily, terrace

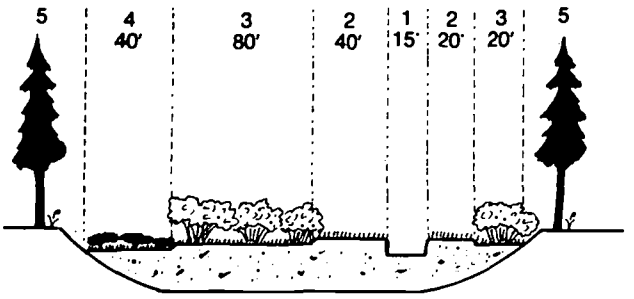


Figure 52. Big Marsh Creek; low gradient, mod elevation floodplain; Deschutes Cascades Physiographic Area.

SOILS

Soils are wet, cold, deep, organics composed of sedge and woody peats. Soils are saturated season long and the available water holding capacity is very high. Water tables are at or slightly above the soil surface through much of the growing season and are still within 1 foot of the soil surface in September. Bog blueberry/Sitka sedge sites are intermediate in soil moisture relationships between the willow/Sitka sedge and bog blueberry/few-flowered spikerush associations.

FLORISTIC CHARACTERISTICS

Documents	% Canopy Cover		Constancy
Dwarf willows	0-40	(13)	86
Geyer & Lemmon willows	0-20	(4)	43
Bog blueberry	**20-75**	**(51)**	**100**
Sitka sedge	**0-63**	**(33)**	**86**
Shrubs	37-90	(64)	100
Grasses	0-3	(1)	57
Sedges	0-70	(45)	86
Forbs	0-10	(5)	100

Potential natural vegetation: Bog blueberry/Sitka sedge is dominated by short shrubs (less than three feet tall) and a sward of Sitka sedge. Sedges were absent on one plot because of an extremely dense canopy of shrubs. Bog blueberry and the dwarf form of Eastwood willow are the dominant shrubs. Dwarf forms of Booth and undergreen willows are often present and their physiology is very similar to Eastwood willow. Two plots had short, young Geyer and Lemmon willows and may be successional to the willow/Sitka sedge association. Two sample stands had significant cover of bog birch, again in a dwarf form. Grasses and forbs are very

inconspicuous. Bog blueberry/Sitka sedge is distinguished from bog blueberry/few-flowered spikerush by the sward of Sitka sedge and the general absence of bog species such as hooded ladies-tresses, few-flowered spikerush, sundew, bog saxifrage, and one-flowered gentian. It also has a low cover of mosses compared to the bog blueberry/few-flowered spikerush association. Dwarfed Engelmann spruce and lodgepole pine may be scattered through the stand on hummocks but are not representative of the site as a whole.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 50 to 2000 (1333) lbs/acre dry weight. The 50 pound figure represents a plot in which the herbaceous vegetation was suppressed by a very dense shrub canopy. Sitka sedge is low in palatability to livestock and livestock avoid the wet organic soils. Most stands lie outside of existing grazing allotments. Therefore, use of this association is infrequent.

Wildlife and fisheries: Landforms supporting bog blueberry/Sitka sedge provide horizontal and vertical diversity important to many species of wildlife. The various low shrubs provide important browse for deer and elk and these sites often provide green forage earlier in the spring than adjacent uplands. Elk often calve in the adjacent coniferous wetlands. The blueberry crop provides important nutrition to black bears, grouse, and songbirds.

Fire: Fire is not an important tool in this association. The various shrubs readily resprout from stem bases. Sitka sedge is well adapted to withstand fire because of its deep rhizomes except where fire burns deeply into dry organic soils.

Estimating potential or disturbed sites: All observed stands were in climax ecological status and can be recognized on the basis of vegetative composition alone.

Rehabilitation pathways: Rehabilitation is not needed in this association since it is in climax status. Sitka sedge and the various shrubs will rapidly rehabilitate the site when rested from overuse.

OTHER STUDIES

The bog blueberry/Sitka sedge association has not been described elsewhere.

BOG BLUEBERRY/FEW-FLOWERED SPIKERUSH ASSOCIATION

Vaccinium occidentalis/Eleocharis pauciflora
SW41-12 VA0C2/ELPA2

Sample size = 10 plots in climax ecological status

LOCATION AND RIPARIAN LANDFORMS

Bog blueberry/few-flowered spikerush is abundant in the Deschutes Cascades and Winema Cascades Physiographic Areas but is rare eastward. It is a true bog developed in zones of abundant rainfall (more than 39 inches/year). It occurs on flat, cold, poorly-drained landforms (Figures 53 & 54) at moderately high elevations (4600-5700 feet) that are conducive to peat soil development (Graham 1957). The wet, coastal-influenced climate and irregular, glaciated topography of the Cascades help create many sites favorable for bog development. On the Fremont and Ochoco National Forests these requirements are met only in some of the higher mountains such as Pisgah Meadows and Gearhart Mountain. The association was observed but not sampled at Gearhart Marsh. See the description for the **Engelmann spruce/bog blueberry/widefruit sedge association** (p. 53) for another figure illustrating **bog blueberry/few-flowered spikerush**.

1 **Few-flowered spikerush, bog**
2 **Lodgepole pine/few-flowered spikerush, bog**
3 **Bog blueberry/few-flowered spikerush, bog**
4 **Engelmann spruce/queencup beadlily, transition slope**

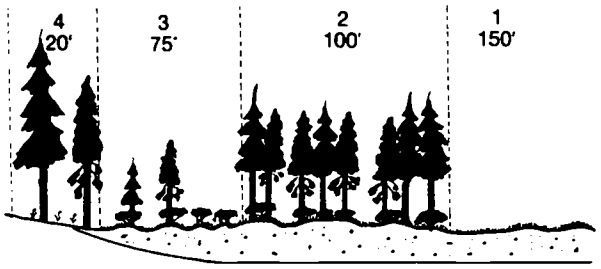


Figure 53. Cascade Lakes Highway Bog (near Wire Meadow): low gradient, mod-high elevation basin; Deschutes Cascades Physiographic Area.

SOILS

Bog blueberry/few-flowered spikerush sites are midway in soil moisture relationships between **few-flowered spikerush** and **lodgepole pine/few-flowered spikerush** bogs. Soils are deep wood, sedge, and moss peats. Peat formation is due to slow plant decomposition in waterlogged sites (Gorham 1957). Low dissolved oxygen, cold soil temperature, lack of fluctuation in the water table, plus concentrations of organic and mineral acids (tannins etc.) in the water table all contribute to slow decomposition. Dead residues from shrubs, graminoids, forbs, and mosses decompose less rapidly than the accumulation from seasonal growths and peat accumulates (Gorham 1957). Water tables are near to slightly above the soil surface season long and available water holding capacity is very high. Peat is like a sponge and may retain 10-20 times its own weight in water. Highly impermeable layers of decayed organic matter or clay subsoil may further retard water percolation. Long periods of drought may dry surfaces of peat soils, starting a trend where decomposition exceeds buildup. However, in the long run bog communities are self perpetuating. The long term climax is probably a larger, deeper bog and not forestland.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Moss	20-90 (61)	100
Lodgepole pine	2-17 (11)	100
Englemann spruce	0-15 (3)	40
Bog birch	0-35 (7)	30
Alpine laurel	0-15 (6)	60
Dwarf willows	0-20 (10)	90
Bog blueberry	**20-60 (36)**	**100**
Tufted hairgrass	0-7 (2)	70
Muricate sedge	0-15 (4)	80
Beaked sedge	0-10 (3)	60
Sitka sedge	0-20 (7)	70
Few-flowered spikerush	**1-40 (17)**	**100**
Shootingstar	0-4 (1)	70
Sundew	0-3 (1)	40
White bogorchid	0-3 (1)	70
Elephanthead	0-3 (1)	70
Western bistort	0-3 (2)	80
Swamp whitehead	0-2 (1)	40
Hooded ladies-tresses	0-2 (1)	60
Tofieldia	0-10 (2)	70
Trees	1-37 (14)	100
Shrubs	35-80 (56)	100
Grasses	0-15 (5)	90
Sedges	15-63 (46)	100
Forbs	7-37 (20)	100

Potential natural vegetation: Dwarf shrubs such as bog blueberry, bog birch, alpine laurel, and Eastwood, undergreen, and Booth willows dominate a herbaceous layer best characterized by few-flowered spikerush. Engelmann spruce and lodgepole pine are scattered individuals or form small clumps but in total their cover is less than 25 percent. Occasionally they may form a

dwarf forest (tree heights less than 20 feet) with considerable canopy cover (up to 37 %). Few-flowered spikerush is usually codominant with other graminoids and forbs in the herb layer. Where it is inconspicuous, other herbaceous vegetation is consistent with the vegetative composition of the association. Moss is abundant. Tufted hairgrass is present on many plots but has low cover. Normally robust sedges such as Holm's, Sitka, or beaked sedge are dwarfed, scattered, and lack vigor but in total can have a fair canopy cover (5-20 percent). Muricate sedge occurs on most plots. There is a rich component of forbs, including sundew, white bogorchid, shootingstar, elephanthead, western bistort, swamp whitehead, hooded ladies-tresses, tofieldia, common horsetail, western St.Johnswort, and primrose monkeyflower.

On sites with undulating topography, the depressions (water paths) may be quite different from the slightly elevated hummocks. Water paths often have little moss cover and are dominated by litter or organic soil. Few-flowered spikerush is the dominant herb in the water paths. Great sundew grows in the water paths while common sundew grows on the edges of hummocks. Aquatic plants such as buckbean and flatleaved bladderwort grow in the water paths during high water. Shrubs are found primarily on the hummocks along with conspicuous amounts of moss, taller sedges, and forbs.

1 **Few-flowered spikerush**, bog
2 **Bog blueberry/few-flowered spikerush**, bog
3 **Engelmann spruce/widefruit sedge**, forested wetland
4 **Engelmann spruce/queencup beadlily**, transition slope

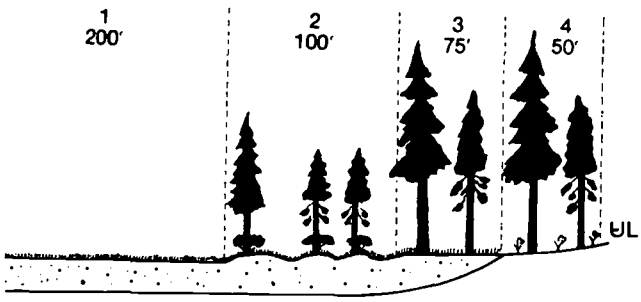


Figure 54. Upper Deschutes River Bog (near Little Lava Lake); low gradient, mod-high elevation basin; Deschutes Cascades Physiographic Area.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 250 to 1500 (900) lbs/acre dry weight. Livestock use this association very infrequently and most stands lie outside of existing grazing allotments. Cattle will use spikerush, other graminoids, and forbs but in general the palatability of the association is low.

Wildlife and fisheries: Bogs provide an important source of diversity within the forest landscape. Higher elevation basins containing bogs offer a rich source of horizontal and vertical diversity for many species of wildlife, including deer, elk, and beavers. Bogs often provide green forage for deer and elk before snow melts in the adjacent uplands. The adjacent coniferous wetlands are important calving grounds for elk.

Fire: Fire is infrequent in bogs (100-300 year frequency). Species composition will remain relatively the same following cool fire except for a temporary reduction in shrubs and dwarf conifers. Bog blueberry and willows are sensitive to cool fires but will resprout from stem bases the following season. Peat soils are very flammable when dry and deeply burning fire will hamper the regenerative ability of most plant species.

Estimating potential on disturbed sites: The association is in climax ecological status and can be recognized on the basis of vegetative composition, site, and soils.

Rehabilitation pathways: The association is in climax status so little is known about ways of rehabilitating disturbed sites.

OTHER STUDIES

Franklin and Dryness (1973) described numerous kinds of bogs in the Cascades of Oregon and Washington. However, they show little relationship to the bog described here.

CUSICK BLUEGRASS ASSOCIATION

Poa cusickii
MD19-11 POCU

Sample size = 6 plots in late seral and climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The Cusick bluegrass association is located in the Pumice-mantled Basin & Range Physiographic Area. It is common on the Chiloquin and Chemult Districts (Winema National Forest) and extends eastward to the western fringe of the Fremont National Forest. Elevations are moderate (4200-6000 feet). Landforms supporting Cusick bluegrass meadows occur on the flat microrelief of dry basins and drainages (figure 55) and inactive floodplains and terraces such as along Chocktoot Creek (figure 56) and the Williamson River (figure 57). Sample plots were located at Long Meadow, Calimus Spring, Abraham Flat, and several unnamed meadows on the Winema National Forest and Chocktoot Creek on the Fremont National Forest.

1 Cusick bluegrass, dry meadow
2 Lodgepole pine/bearberry, transition slope

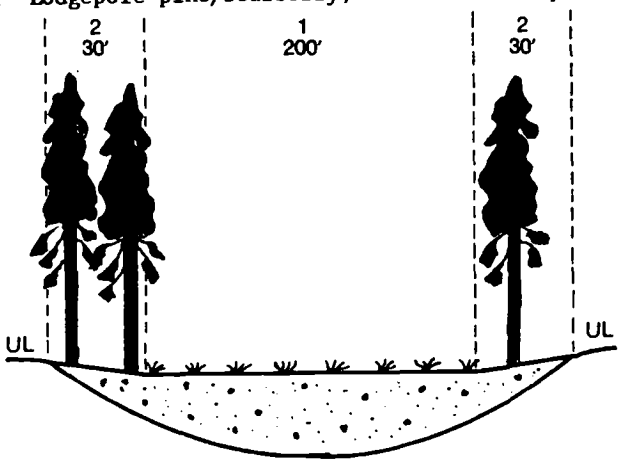


Figure 55. Unnamed meadow near Long Prairie; concave, mod elevation basin; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest.

1 Creeping spikerush, new sediments between loose rock check dams
2 Willow/Kentucky bluegrass (willow/woolly sedge potential), inactive floodplain
3 Cusick bluegrass, inactive floodplain

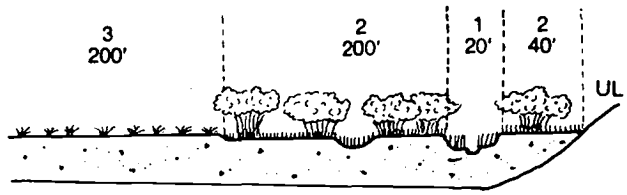


Figure 56. Chocktoot Creek; low gradient, mod-low elevation floodplain; Basin and Range Physiographic Area; Fremont National Forest.

SOILS

Soils are pumice alluvium. Surface textures are silty loam to coarse sandy loam and grade into a gravelly pumice C horizon at 40 to 70 inches below the soil surface. Available water holding capacity is moderately low. The water table is within 24 inches of the soil surface in May and June and may flood the surface into July in abnormally wet years. Water tables lower to 50 to 60 inches below the soil surface by August but may be absent in drier years.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Beardless wheatgrass	0-15 (6)	83
Prairie junegrass	0-15 (5)	83
Shortleaved muhly	3-15 (7)	100
Cusick bluegrass	**27-45 (38)**	**100**
Clustered field sedge	5-20 (8)	67
Western yarrow	2-4 (3)	100
Hoary aster	0-7 (4)	83
Grasses	50-70 (61)	100
Sedges	5-20 (12)	100
Forbs	5-35 (19)	100

Potential natural vegetation: Cusick bluegrass is the dominant graminoid. Other graminoids include Oregon bentgrass, prairie junegrass, beardless wheatgrass, shortleaf muhly, and clustered field sedge. Common forbs include western yarrow, pale agoseris, northwest cinquefoil, elk thistle, rosy pussytoes, and hoary aster. Kentucky bluegrass is uncommon except on moister portions of the association along the Williamson River. The absence of sagebrush distinguishes this from sagebrush/Cusick bluegrass.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 1200 to 1750 (1533) lbs/acre dry weight. Volland (1976) reported 1333 lb/acre. The most palatable species are Cusick bluegrass, prairie junegrass, and beardless wheatgrass. Cusick bluegrass meadows are often heavily grazed in

early summer. Livestock grazing is intensive until the vegetation dries in midsummer and livestock move to wetter meadows. Thus the vegetation is used when it is most susceptible to damage and **Cusick bluegrass associations** in early to mid seral ecological status are common. Stands in late seral or better status are rare and only located where livestock access is limited. Damage by herded sheep appears to be minimal except where sheep are bedded.

With increasing overuse by livestock, Cusick bluegrass distribution becomes irregular and it becomes codominant with other graminoids and forbs. Beardless wheatgrass is rare. Perennial forbs occur as larger colonies or are common within the interspaces of Cusick bluegrass. The litter layer is somewhat discontinuous and compacted. Cusick bluegrass may be pedestalled and annual forbs are common in the bunchgrass interspaces, especially in moist years.

With continued overuse, Cusick bluegrass becomes subordinant to other grasses, sedges, and forbs. Prairie junegrass and beardless wheatgrass are rare while shortleaved muhly, Baltic rush, perennial forbs, and clustered field sedge form large colonies. The litter layer is compacted and broken. Cusick bluegrass is pedestalled and the bunchgrass interspaces are dominated by perennial and annual forbs.

Wildlife and fisheries: **Cusick bluegrass** provides important habitat for raptors. Rodents such as mice, pocket gophers, and the Columbian ground squirrel can have large periodic impact on **Cusick bluegrass** meadows (Volland 1979). Heavy infestation increases the prevalence of perennial and annual forbs. It may take several years to reestablish bluegrass on sites devastated by ground squirrels. The association provides important feeding areas for deer and elk.

Fire: Little is known about the effect of prescribed burning in this association. Cusick bluegrass is more sensitive to burning than rhizomatous species such as Kentucky bluegrass or widefruit sedge. However, wildfire was probably frequent (less than 15 year intervals) in these meadows before the advent of fire control and Cusick bluegrass should be well adapted to such events.

Estimating potential on disturbed sites: The characteristic set of species associated with the **Cusick bluegrass association** helps determine the potential of degraded sites. Additionally, dry basins and drainages, highly fluctuating water tables, and gray meadow soils should help identify the site. The association can usually be differentiated from adjacent uplands by the deep alluvial soils and lack of surface gravel or rock. Adjacent associations such as tufted hairgrass and **widefruit sedge** have higher water tables and different species composition.

Rehabilitation pathways: The Winema National Forest has had excellent response to resting **Kentucky bluegrass** pastures (**Cusick bluegrass** potential) along the Williamson River. These pastures have tripled their forage production in 3-5 years, with excellent cover and uniform distribution of Kentucky bluegrass, rapid litter development, and subsequent reduction of competing species. Similar results can be expected on **Cusick bluegrass** meadows that are in mid seral or better ecological status. However, most sites are highly degraded, have low density of Cusick bluegrass, and respond slowly to improved livestock management systems.

On floodplain landforms Kentucky bluegrass may be seeded with good results although it would be preferable to plant Cusick bluegrass. Drier sites are more common and may not be suitable for introduction of the bulk of domestic grass species because of highly fluctuating water tables, fine textured soils, and extreme summer drought. Cusick bluegrass is best suited to these sites and a commercial seed source needs to be developed.

The season of use should begin when adjacent wetter meadows are dry enough to graze. At this time, Cusick bluegrass meadows will be mature and able to tolerate grazing. Sheep should be herded and not allowed to congregate in one spot for long periods of time. Establish sheep bedding ground in adjacent lodgepole pine stands.

OTHER STUDIES

This is the same association as Volland's (1976) **dry bluegrass meadow**. It has not been described elsewhere.

KENTUCKY BLUEGRASS COMMUNITY TYPE

Poa Pratensis
MD31-11 POPR

Sample size = 8 plots in early to mid seral ecological status

LOCATION AND RIPARIAN LANDFORMS

The Kentucky bluegrass community type occurs on sites of various potential once occupied by tufted hairgrass, Cusick bluegrass, willow/woolly sedge, willow/aquatic sedge, willow/widefruit sedge, and ponderosa pine/common snowberry associations. It is abundant on the Fremont, Ochoco, and Winema National Forests but is uncommon on the Deschutes National Forest. It has been found in all physiographic areas except in the Cascade Mountains. Elevations are 3000 to 5000 feet. Landforms are dry basins and floodplains with gentle slopes and smooth microtopography (figures 57 & 58). See the woolly sedge association (p. 98) and quaking aspen/blue wildrye community type (p. 61) for other figures illustrating this community type. Sample plots were located at Williamson River and Meadow Creek (Winema National Forest); Sawmill Creek and Marks Creek (Ochoco National Forest); Foster Field and Coffeepot Creek (Fremont National Forest); and Dorrance Meadow (Deschutes National Forest).

1 Williamson River, third-order
2 Beaked sedge, active channel shelf
3 Beaked sedge, overflow channel
4 Widefruit sedge, moist edges of overflow channels
5 Kentucky bluegrass (Cusick bluegrass potential), inactive floodplains and terraces
6 Lodgepole pine/Kentucky bluegrass (invasion into Cusick bluegrass), inactive floodplains and terraces
7 Lodgepole pine/bearberry, transiton slopes

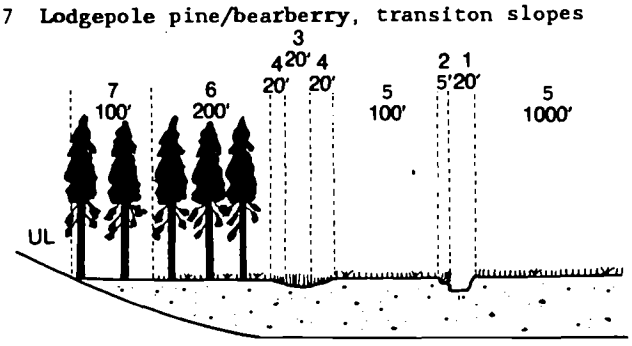


Figure 57. Williamson River; low gradient, mod elevation floodplain; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest

SOILS

Soils are variable. Surface textures range from sandy loam to clay loam and organic loam. Soil parent materials range from pumice alluvium to rhyolite, breccia, basalt, andesite, and tuff. The seasonally high water table is within 1 foot of the soil surface in June and lowers to below the rooting zone by mid-summer. Available water holding capacity is moderate to high but soils are surface dry by mid summer.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Kentucky bluegrass	35-70 (45)	100
Baltic rush	0-35 (12)	75
Meadow barley	0-63 (10)	63
Western yarrow	0-15 (4)	75
Rosy pussytoes	0-15 (4)	88
Northwest cinquefoil	0-10 (3)	63
Grasses	37-87 (62)	100
Sedges	1-40 (20)	100
Forbs	5-63 (31)	100

Potential natural vegetation: Past grazing, often associated with lowering of water tables, has reduced the competitive ability of native species so that Kentucky bluegrass becomes dominant. Kentucky bluegrass growth form is vigorous, erect, loosely clustered tillers growing through a loose mat of litter (Volland 1985). Graminoids such as Baltic rush, tufted hairgrass, Cusick bluegrass, aquatic sedge, widefruit sedge, woolly sedge, and Nebraska sedge are widely scattered. Annual forbs dominate soils associated with gopher colonies. Perennial forbs occur as scattered small colonies or as individual plants. Sites planted to domestic grasses such as timothy or brome might logically be included in this type. Common forbs include western yarrow, rosy pussytoes, northwest cinquefoil, Watson's willoweed, broadpetal strawberry, northern bedstraw, common silverweed, and Oregon checkermallow.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 1500 to 2500 (2000) lbs/acre dry weight. Volland (1976) reported 2009 lbs/acre. Kentucky bluegrass meadows are preferred forage areas over more moist associations and are more palatable into mid-summer than the drier Cusick

bluegrass association. Grazing pressures can be severe. Management practices strongly influence the type of growth form present in individual pastures (Volland 1985). Season long grazing encourages weak, densely scattered culms along short internodes of the rhizomes. Stem numbers are maximized at the expense of foliar biomass. On the other hand, grazing systems providing periodic rest encourage individual plant vigor. The litter layer becomes loose and thick, shading the leaf sheath. Rhizomes become elongated so that fewer aerial shoots are produced per unit area. Even though there are fewer shoots per unit area, individual shoots are vigorous so that total biomass of bluegrass is greater on rested pastures. Therefore, bluegrass remains competitive under a wide range of grazing pressures, reproducing by both tillering and sprouting from seed under light grazing or switching solely to vegetative reproduction from short rhizome internodes under season long grazing systems.

With increasing overuse by livestock, other graminoids and forbs become codominant with Kentucky bluegrass. Its growth form is erect, tightly clustered tillers growing through a compacted and somewhat broken litter layer (Volland 1985). Bluegrass is noticeably expanding into disturbed areas through vigorous rhizome elongation. Annual forbs become prevalent on locally disturbed sites. Baltic rush and perennial forbs such as yarrow, pussytoes, and cinquefoil are aggregated in large colonies.

With continued overuse, Kentucky bluegrass becomes subordinant to other graminoids and forbs. Bluegrass growth form is decumbent, with weak tillers arising close together from short rhizomes (Volland 1985). Litter layers are compacted to absent. Bare ground is very evident. Annual forbs are common on disturbed areas such as rodent mounds, salt grounds, and dusting areas. There is little evidence of bluegrass invasion into disturbed sites. Perennial forbs and Baltic rush occur in large dense colonies.

On very degraded sites Kentucky bluegrass occurs in small scattered colonies and is weakly tillered from weakened rhizomes. Bare ground is the most prominent feature of the stand. Plants such as slender muhly and Baltic rush form dense colonies within an open stand of perennial and annual forbs. Common forbs include yarrow, strawberry, aster, silverweed, cudweed, and sandwort.

Wildlife and fisheries: This community type provides important habitat for raptors. Rodents such as mice, pocket gophers, and the Columbian ground squirrel can have large periodic impact on Kentucky bluegrass meadows (Volland 1979). Heavy infestation increases the prevalence of perennial and annual forbs.

Kentucky bluegrass and its associated grasses and forbs are not very resistant to bank erosion or overland flow of water. Bank erosion and channel downcutting are often severe in comparison to sites supporting natural landforms with willow and sedge anchored banks. Therefore, fisheries potential in streams boardered by the Kentucky bluegrass community type is low.

Fire: Fire is an effective tool in reducing the effects of excessive litter buildup on rested pastures. Cool burns should have little impact on Kentucky bluegrass (Volland 1981).

Estimating potential on disturbed sites: Since Kentucky bluegrass meadows occupy sites once dominated by a number of natural associations, local experience and insight are required to estimate vegetative potentials. Low-elevation floodplains formerly occupied by ponderosa pine once supported ponderosa pine/common snowberry-floodplains. Dry, flat meadow sites are typical of tufted hairgrass and Cusick bluegrass potentials. Wet meadow sites likely supported the widefruit sedge or aquatic sedge associations. Low gradient floodplains with active streams supported associations such as willow/woolly sedge or willow/aquatic sedge.

Rehabilitation pathways: Avoid early season use to prevent soil compaction and breaking of the sod. Two or three years of rest will restore lost vigor and vegetative composition on sites in mid seral or better ecological status. Restore natural sedge and willow associations on

1 Beaked sedge, Jack Creek intermittent
2 Widefruit sedge, moist meadow
3 Kentucky bluegrass (tufted hairgrass potential), dry meadow
4 Lodgepole pine/Kentucky bluegrass (invasion into tufted hairgrass), transitional
5 Lodgepole pine/bearberry, transition slope

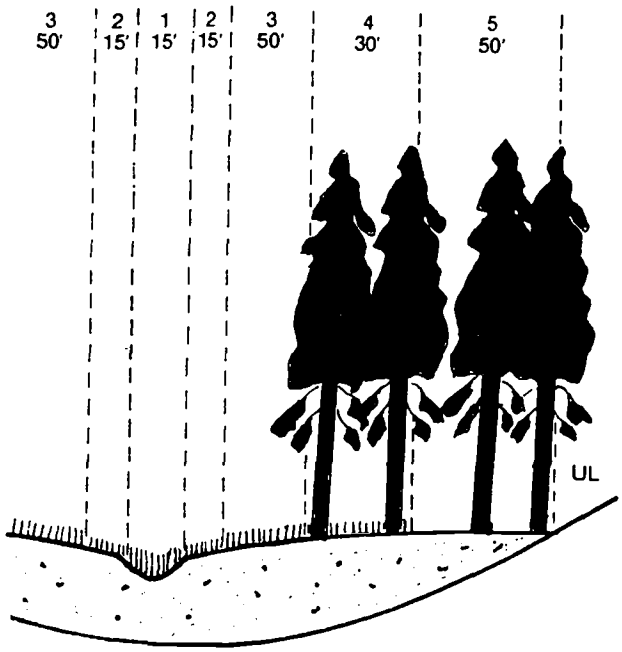


Figure 58. Jack Creek; low gradient, low elevation floodplain; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest.

active fluvial surfaces to help prevent further streambank erosion and streambed downcutting.

Renovation of Kentucky bluegrass sites with native species such as Cusick bluegrass and tufted hairgrass seems impractical given the flexibility of Kentucky bluegrass (Volland 1979). It is also impractical to consider reestablishment of sedges or willows on sites that once supported these species unless the water table is raised to former levels.

OTHER STUDIES

Communities dominated by **Kentucky bluegrass** have been described for Oregon (Volland 1976, Hopkins 1979b, Hall 1973, and Padgett 1981), Idaho and western Wyoming (Youngblood and others 1985a), southern Idaho and northern Utah (Youngblood and others 1985b), and southern Utah (Padgett and Youngblood 1986).

TUFTED HAIRGRASS ASSOCIATION

Deschampsia cespitosa
MM19-12 DECE

Sample size = 30 plots in mid seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

Because of the broad elevational and geographic distribution of sites, tufted hairgrass is one of the most abundant and diverse association in central Oregon. It occurs on all National Forests and all but the Grasslands Physiographic Area. Elevations range from 4000 feet to 7500 feet in the Cascades. Landforms occur on meadow sites in flat to slightly concave drainages and basins (figures 59. 60. & 61) and lake shores. See sagebrush/Cusick bluegrass, slender sedge, willow/aquatic sedge, lodgepole pine/bog blueberry/widefruit sedge, and quaking aspen/blue wildrye for other figures showing this association (p. 65, 108, 80, 39, and 61).

1 Inflated sedge, intermittent streambed
2 Widefruit sedge, moist meadow
3 Tufted hairgrass, dry meadow
4 Lodgepole pine/widefruit sedge, forested wetland
5 Widefruit sedge, cutoff/overflow channel

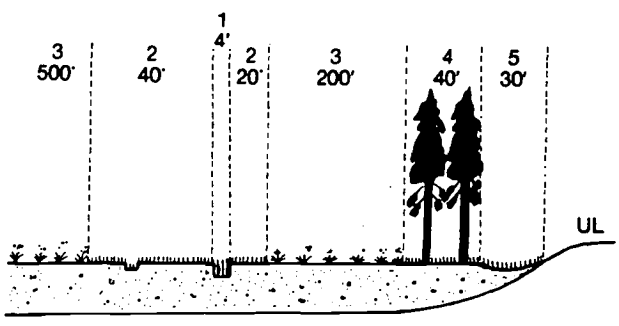


Figure 59. O'Connor Meadow; low gradient, mod elevation basin; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest.

1 Pond
2 Inflated sedge. wet meadow
3 Tufted hairgrass, moist meadow
4 Engelmann spruce/bog blueberry/forb, transitional
5 Engelmann spruce/queencup beadlily, transition slope

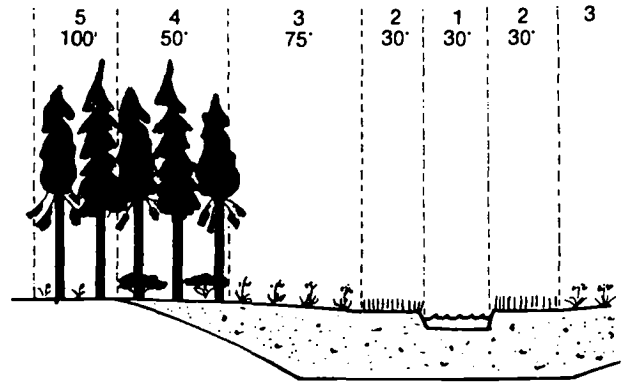


Figure 60. Heavenly Lakes Meadow; concave, mod-high elevation basin; Winema Cascades Physiographic Area; Winema National Forest.

SOILS

Soils are equally variable. On drier portions of the association, soils are mineral alluvium similar to those found on Cusick bluegrass meadows. Surface textures are silt, sandy loam, and silty clay loam. On moist sites surface textures range from silt loam to organic loam and sedge peat. Water tables range from near or slightly above the soil surface at snowmelt to 20 to 45 inches below the soil surface by late July and August (September at high elevations). Water levels are generally higher on organic than on mineral soils. Available water holding capacity is moderate to high and soils remain fairly moist through much of the summer.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Tufted hairgrass	25-60 (39)	100
Reedgrasses	0-15 (2)	47
Oatgrass	0-35 (3)	37
Muhlys	0-20 (4)	63
Western aster	0-10 (1)	43
Primrose monkeyflower	0-15 (2)	37
Longstalk clover	0-37 (6)	57
Grasses	25-65 (47)	100
Sedges	0-35 (15)	90
Forbs	5-37 (22)	100

Potential natural vegetation: Tufted hairgrass is dominant over other graminoids and forbs and is distributed uniformly throughout the stand (canopy cover is generally more than 30 %). Litter is thick on drier sites but may be absent on moist sites. Because of variation in soil moisture and elevation, tufted hairgrass meadows

have a high degree of species diversity. Few species occur in more than 25 percent of the plots. Grasses such as Kentucky bluegrass, bluejoint reedgrass, California oatgrass, and prairie junegrass are subordinant to tufted hairgrass. Slender and shortleaved muhly are scattered. Western yarrow and rosy pussytoes are typical forbs on drier sites. Longstalk clover, western aster, cinquefoils, and buttercups are found throughout the association but are more abundant on drier sites. Orange arnica, common silverweed, Pacific silverweed, and small bedstraw are typical plants on moist sites. Baltic rush is present at lower elevations. Sedges such as Nebraska sedge, slender sedge, aquatic sedge, widefruit sedge, beaked sedge, inflated sedge, and Holm's sedge are locally common on moist portions of the association.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 500 to 3000 (1362) lbs/acre dry weight. These estimates include 1500 to 3000 lbs/acre on lower elevation meadows and 500 to 1500 lbs/acre on higher elevation meadows and lake shores. Volland (1976) reported 1947 lbs/acre for seven low elevation meadows. The most palatable species are tufted hairgrass, Kentucky bluegrass, and Nebraska sedge. Tufted hairgrass is moist until mid-summer and is preferred as mid to late season pasture by livestock following forage depletion on adjacent uplands and drier Kentucky bluegrass and Cusick bluegrass sites. Therefore, the season of use often coincides with tufted hairgrass maturity and grazing by all classes of livestock has limited impact on tufted hairgrass meadows when done with moderation (Volland 1985).

Sustained close grazing reduces the reproductive potential and vigor of tufted hairgrass through reduced seedhead production and depletion of carbohydrate reserves. A reduction of tufted hairgrass vigor is indicated by a decline in root length, basal area, and leaf length. The competitive ability decreases and stand composition shifts to less preferred species (Volland 1985).

1 Todd Creek, first-order
2 Holm's sedge, active channel shelves
3 Holm's sedge, overflow channel
4 Tufted hairgrass, dry meadow

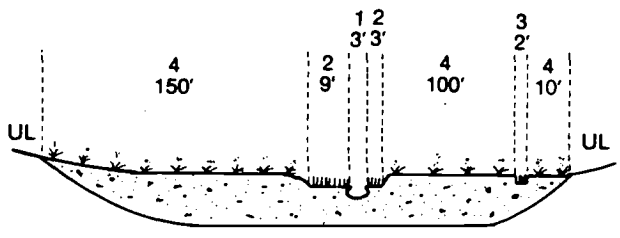


Figure 61. Water Tower Meadow; low gradient, subalpine basin; Deschutes Cascades Physiographic Area.

With increasing overuse by livestock, tufted hairgrass becomes codominant with other graminoids and forbs, irregular in distribution, and reduced in cover (15-30 percent). On dry sites the litter layer becomes somewhat disrupted and grasses such as shortleaved muhly, prairie junegrass, and oatgrass increase in importance. Baltic rush, Nebraska sedge, and/or reedgrass become codominant with tufted hairgrass on moister sites. Herbs such as orange arnica, silverweed, and shortleaved muhly are common on moist sites.

With continuing overuse, tufted hairgrass vigor is reduced and it becomes subordinant to other graminoids and forbs (canopy cover < 15 percent). Bare ground is prominent on dry sites due to the thinning of litter and increased rodent activity. Dry sites are dominated by graminoids such as shortleaved muhly, Kentucky bluegrass, timber oatgrass, and Baltic rush and have a preponderance of forbs such as longstalk clover, western yarrow, and western aster. Moist sites become dominated by Baltic rush, Nebraska sedge, other sedges, and by large colonies of mesic forbs such as orange arnica and silverweed. These sites now key to Kentucky bluegrass, Nebraska sedge, or Baltic rush community types.

Wildlife and fisheries: Ponds and productive trout streams are often associated with landforms supporting tufted hairgrass meadows but are usually separated from the tufted hairgrass site by zones of willows or sedges. If the willows and sedge associations are eliminated by erosion, tufted hairgrass has little value for protecting the fluvial surfaces from further erosion because of its thin, fibrous root system. Deer, elk, Columbian ground squirrels, pocket gophers, mice, and raptors are common.

Fire: Repeated burning of tufted hairgrass meadows may favor rhizomatous species such as Kentucky bluegrass, beardless wheatgrass, and western needlegrass (Volland 1985). However, these meadows have developed through thousands of years of frequent wildfire without noticeable affect on tufted hairgrass.

Estimating Potential on Disturbed Sites: Many tufted hairgrass meadows are in mid seral or better ecological status and can be identified on the basis of vegetative composition alone. Where the association is in early seral status, the site potential has often been altered to communities dominated by Kentucky bluegrass on drier sites and Nebraska sedge or Baltic rush on moist sites. These community types are also capable of replacing several other associations than tufted hairgrass so that information on landforms, soils, and water tables is necessary to identify the correct potential.

Rehabilitation pathways: To develop an upward trend in ecological status, time the season of livestock use to both drying of the soil surface and to maturation of tufted hairgrass seedheads. Remove livestock at 40 percent utilization of herbaceous forage. Sheep have light

impact on hairgrass meadows when herded. Bed sheep in adjacent uplands.

Tufted hairgrass meadows in mid seral or better ecological status will respond rapidly to improved grazing strategies. Increased vigor of tufted hairgrass, coupled with rapid litter buildup, will decrease the competitive ability of its competitors and cause a shift towards better status. On stands in early seral status the density of tufted hairgrass is too low to achieve such a response, so more intensive rehabilitation strategies will be required. Domestic species such as Kentucky bluegrass, Timothy, and meadow foxtail may be seeded but tufted hairgrass is preferable.

Road construction and heavy equipment are not appropriate to the site. In the pumice zone, avoid breaking through the surface horizon and exposing the erosive coarse pumice subsoil.

OTHER STUDIES

This association is much more diverse than **tufted hairgrass associations** reported elsewhere. Volland (1976), Hall (1973), and Hopkins (1979b) reported on a portion of the association occurring at lower elevations. Helpern and others (1984) reported several associations dominated by tufted hairgrass at higher elevations in the Three Sisters Wilderness Area. **Tufted hairgrass** meadows are also described in Washington (Franklin 1973), Montana (Mueggler and Steward 1980), eastern Idaho and western Wyoming (Youngblood and Others, 1985a), northern Utah and southern Idaho (Youngblood and Others, 1985b), and the Sierra Nevadas (Ratliff 1982). They also occur in northern Arizona and New Mexico (personal communication with Will Moir, 1984) and Colorado (Wasser and Hess 1982).

WOOLLY SEDGE ASSOCIATION

Carex lanuginosa
MM29-11 CALA3

Sample size = 9 plots in mid seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The **woolly sedge association** is abundant on the Ochoco and Fremont National Forests, rare on the Winema National Forest, and is presumed absent on the Deschutes National Forest. It is most common on active fluvial surfaces within low gradient, low to moderate elevation (4400-5600 feet), floodplains in the Basin and Range and Ochoco Mountains Physiographic Areas. This landform is illustrated in the **willow/woolly sedge association** (p. 76). Here, **Woolly sedge** may in part be successional to **willow/woolly sedge**. Other landforms include headwaters basins in the Grasslands and Ochoco Mountains Physiographic Areas (figure 62). The **woolly sedge association** may have once been common at lower elevations on Bureau of Land Management and private lands. Sample plots were located at Howard, Sugarpine, and Silver Creek, the wet meadow near the old headquarters for the Crooked River National Grassland, and Biggs Spring on the Ochoco National Forest; Coffeepot Creek on the Fremont National Forest; and Miller Creek on the Winema National Forest.

1 **Quaking aspen/woolly sedge**, forested wetland
2 **Woolly sedge**, moist meadow
3 **Kentucky bluegrass** (ponderosa pine/common snowberry-floodplain potential), transitional

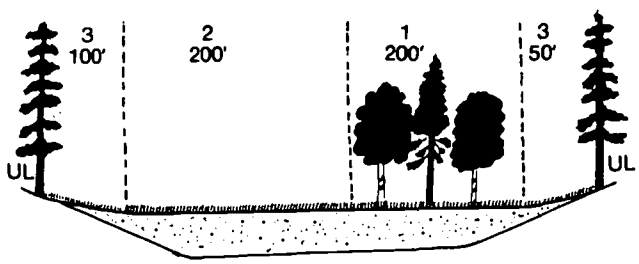


Figure 62. Biggs Spring Aspen Exclosure; concave, mod elevation basin: Ochoco Mountains Physiographic Area.

SOILS

Soils are variable. Surface textures range from fine sandy to sandy clay loams on floodplains to organic loam in basins. Available water holding capacity is moderate to high. Floodplain soils are often flooded during spring runoff. Here, the water table is well down in the rooting zone (within 50 inches of the surface) by mid-July. The basin sites have higher water tables and are moist through most summers.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Slimstem reedgrass	0-12 (3)	56
Kentucky bluegrass	0-25 (5)	55
Woolly sedge	**20-60 (37)**	**100**
Nebraska sedge	0-20 (6)	55
Short-beaked sedge	0-30 (8)	33
Small-fruit bulrush	0-15 (4)	33
Baltic rush	0-15 (6)	67
Watson's willoweed	0-4 (1)	56
Largeleaved avens	0-5 (1)	56
Glabrate monkeyflower	0-5 (1)	44
Shrubs	0-10 (4)	67
Grasses	3-37 (17)	100
Sedges	40-87 (67)	100
Forbs	0-37 (18)	100

Potential natural vegetation: Woolly sedge is the dominant graminoid. Kentucky bluegrass is subordinant to woolly sedge. Common sedges and rushes include Baltic rush, Nebraska sedge, small-fruit bulrush, and short-beaked sedge. Mesic forbs include Watson's willoweed, western yarrow, longstalk clover, largeleaved avens, and glabrate monkeyflower. Only one site located near Biggs Spring was in climax ecological status.

MANAGEMENT AND REHABILITATION

Livestock: Herbage production ranged from 1500 to 2500 (2040) lbs/acre dry weight. Woolly sedge is highly palatable to livestock. Livestock avoid the more mesic basins until they are surface dry, usually in August. Floodplain sites, however, tend to become surface dry by July so that livestock use can be nearly season long. Here, most sites have been altered to drier site potential because of streambed downcutting and lowered water tables.

With increasing overuse by livestock, graminoids such as Nebraska sedge, small-fruit bulrush, short-beaked sedge, Baltic rush, Kentucky bluegrass, tall mannagrass, and meadow foxtail increase in cover and in total are codominant with woolly sedge. Lowering water tables encourage an increase in the cover of Kentucky bluegrass and forbs such as northwest cinquefoil, western aster, western yarrow, dandelion, and largeleaved avens are common.

With continuing overuse on moist basin landforms, woolly sedge is replaced by graminoids such as Nebraska sedge, Baltic rush, and short-beaked sedge. On drier floodplain landforms, overgrazing changes the site potential towards the **Kentucky bluegrass community type**. On most sites streambed downcutting has lowered water tables and changed the site potential to the **sagebrush/Cusick bluegrass association**.

Wildlife and fisheries: Streams passing through the floodplain landform have good fisheries potential. However, most of these streams are in degraded condition. Streams can be stabilized and pool riffles increased by building structures such as loose rock checkdams. Streambanks and other active fluvial surfaces should be revegetated with woolly sedge and, if possible, willows. Over time, these improvements will narrow and deepen the stream channel, improve base flows, lower water temperatures, and provide shade and cover for salmonids. Landforms containing **woolly sedge** provide important habitat for raptors, deer, and elk. Deer use the basin landform for fawning.

Fire: Moist basins with **woolly sedge** can be burned in the late summer. Fire can be used in spring or late summer in the floodplain landform. Fire will help reduce litter accumulation and competitors. Woolly sedge should be very resistant to damage by ground fire.

Estimating potential on disturbed sites: The floristic key seldom allows users to identify floodplain sites with the potential to support **woolly sedge**. Therefore, to recognize the potential for **woolly sedge** the user must recognize the riparian landforms that support the association. The most common landform occurs on low gradient floodplains such as Silver Creek that are presently dominated by **Kentucky bluegrass** or **sagebrush/Cusick bluegrass**. Here, **woolly sedge** or **willow/woolly sedge** have the potential to occupy active fluvial surfaces with restored water tables and proper grazing management. The headwaters basins supporting **woolly sedge** can usually be identified on the basis of vegetative composition alone.

Rehabilitation pathways: In stands in mid seral or better ecological status, woolly sedge will rapidly reoccupy disturbed sites with rest and mid to late season grazing. Livestock should be removed when 40 percent of the forage has been utilized to insure an upward trend in ecological status.

Where lowered water tables have changed the site potential to **Kentucky bluegrass** or **sagebrush/Cusick bluegrass**, use stream rehabilitation to elevate the water table and return the site potential to the **woolly sedge association**.

Livestock should be kept off these sites until the surface soils are dry. Heavy equipment and road construction are inappropriate on wet soils. Roads should be located on the adjacent uplands.

OTHER STUDIES

This association has not been described elsewhere. It may be part of Youngblood and others (1985a) **Kentucky bluegrass community type**.

NEBRASKA SEDGE COMMUNITY TYPE

Carex nebraskensis
MM29-12 CANE

Sample size = 9 plots in early to mid seral ecological status

LOCATION AND RIPARIAN LANDFORMS

Communities dominated by Nebraska sedge are found in most physiographic areas east of the Cascade Mountains. Elevations are low to moderate (4000-5500 feet). The Nebraska sedge community type occurs on a variety of landforms once occupied by the beaked sedge, inflated sedge, widefruit sedge, woolly sedge, and tufted hairgrass associations. It also occurs at the lower elevational edge of the aquatic sedge association. There are too many landforms to report here and only one sketch is provided (Figure 63). Sample plots were located at Big Summit Prairie, North Fork Crooked River, Indian Creek, Double Cabin Pond, Morris Meadow, and Egypt Creek on the Ochoco National Forest; Meadow Creek on the Winema National Forest; and several stockponds.

1 Nebraska sedge (inflated sedge potential), swale
2 Tufted hairgrass, moist meadow
3 Sagebrush/Cusick bluegrass, dry meadow

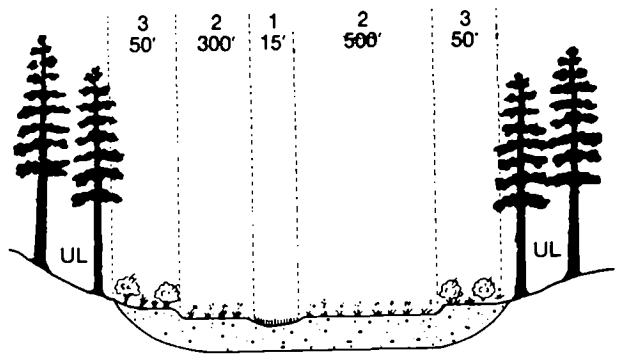


Figure 63. Boone Prairie; flat, mod elevation basin; Ochoco Mountains Physiographic Area.

SOILS

Soils are commonly smooth organic loams derived from alluvium. The Nebraska sedge community type can also occur on mineral soils on the edges of stockponds or reservoirs and on active channel shelves. The soil surface is flooded in May and June. Low water tables are still within the rooting zone in late summer. Soils are moist through most summers.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Nebraska sedge	**35-90 (62)**	**100**
Tufted hairgrass	0-7 (2)	56
Short-beaked sedge	0-15 (9)	56
Baltic rush	2-15 (5)	100
Watson's willoweed	0-7 (2)	56
Water lentil	0-50 (10)	56
Western dock	0-3 (1)	56
Grasses	5-18 (10)	100
Sedges	63-95 (78)	100
Forbs	3-37 (22)	100

Potential natural vegetation: Past management, especially season long grazing, has reduced the competitive ability of normal climax dominants and Nebraska sedge now dominates the site. Nebraska sedge probably becomes dominant because of its ability to withstand trampling. Other sedges and rushes are common but are very subordinant to Nebraska sedge. Common grasses include various mannagrasses, fowl bluegrass, and weak alkaligrass. Common forbs include Watson's willoweed, western dock, largeleaved avens, glabrate monkeyflower, American veronica, and water lentil.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 1500 to 3000 (2222) lbs/acre dry weight. Nebraska sedge is very palatable to livestock and can withstand a high degree of defoliation and trampling without apparent damage. It is subordinant to other graminoids in natural associations described for central Oregon. However, it responds dramatically to continued season long grazing by increasing its cover at the expense of the normal climax dominants.

With increasing overuse by livestock, other grasses, sedges, and forbs become codominant with Nebraska sedge This change is mostly associated with an increase in the cover of Baltic rush, other rushes, and forbs. There is a noticeable displacement of the soil surface and pedestalling of Nebraska sedge by trampling.

Continued overuse will result in extreme displacement of the soil surface, abundant bare ground, broken and pedestalled Nebraska sedge. and soil erosion.

Wildlife and fisheries: Collapsed banks, broken soil, and dished stream profiles associated with the Nebraska sedge community type do not create good fish habitat. Where streams capable of supporting trout pass through the community type, late season grazing and light forage utilization will help bank stabilization and develop narrow, deep stream profiles. The community type may then gradually change to natural sedge and willow associations.

Fire: It will be difficult to burn Nebraska sedge except as plants mature and dry in late summer. Fire will decrease litter buildup and increase productivity. However, burning would remove above ground shoots needed to moderate stream velocities and trap sediments during spring runoff. Nebraska sedge should be resistant to damage by fire.

Estimating potential on disturbed sites: The Nebraska sedge community type has come to occupy sites once occupied by a number of natural associations. In many cases the original dominants are absent, making estimates of potential difficult. Local experience and insight are important in recognizing vegetative potential on such sites. Meadow sites with soils saturated at snowmelt but lowering to 20 to 40 inches below the soil surface by late July may have been dominated by tufted hairgrass. Wet streambanks, active channel shelves, and swales were probably dominated by beaked, inflated, or widefruit sedge associations. Low gradient floodplains such as Silver Creek once supported the willow/woolly sedge or woolly sedge associations on active fluvial surfaces. Nebraska sedge is capable of growing only at lower elevations in the aquatic sedge association. Look for remnants of these species in making estimates of the potential. Comparing water tables to association descriptions may prove helpful.

Rehabilitation pathways: Nebraska sedge forms thick, dense, rhizome mats that resist streambank erosion and erosion from overland flow. It would be desirable to manage these sites so they return to dominance by natural plant associations, but this may be difficult given the competitive ability of Nebraska sedge.

Ratliff (1983) felt reproduction of Nebraska sedge is mostly vegetative and that a management goal of producing an abundance of healthy rhizomes is implied. However, this indicates early season grazing which may not be compatible with other resources. Proper management may be to restrict grazing to a system that will maintain high vegetative ground cover as well as reducing erosion and soil compaction, such as mid to late season grazing at a 40 percent utilization standard.

Early season grazing on wet soils will cause soil trampling, pedestalling of Nebraska sedge, as well as breaking of sod. Similarly, heavy equipment and road construction should be restricted to the adjacent upland.

OTHER STUDIES

The Nebraska sedge community type is part of the wet sedge meadow associations that Hall (1973), Volland (1982), and Hopkins (1979b) described for central Oregon. Youngblood and others (1985a) described it for eastern Idaho and western Wyoming and later for northern Utah and southern Idaho (1985b). Padgett and Youngblood (1986) desribe a similar type for southern Utah. The community type occurs as far south as Arizona and New Mexico (personal conversations with Will Moir, 1984).

WIDEFRUIT SEDGE ASSOCIATION

Carex eurycarpa
MM29-13 CAEU

Sample size = 13 plots in late seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The widefruit sedge association is widespread on both the Winema and Deschutes National Forests where it is most common in the LaPine Basin and Pumice-mantled Basin and Range Physiographic Areas. It also occurs on the west fringe of the Fremont National Forest (Pumice-mantled Basin and Range Physiographic Area). It is especially abundant in drainages east of Highway 97 on the Winema National Forest. Elevations are low to moderate (3000-5700 feet). The most common landforms are meadows (Figure 64), active floodplains (Figure 65), and small, shallow, pumice-filled drainages. See the descriptions for **bog blueberry/Sitka sedge**, **lodgepole pine/widefruit sedge**, **quaking aspen-lodgepole pine/Douglas spiraea/widefruit sedge**, and **Kentucky bluegrass** for other figures illustrating this association (p.86, 41, 63, and 92). Sample plots were located at Quinn Springs, Elk Lake, Lava Lake, Little Deschutes and Deschutes Rivers, and Canyon Creek on the Deschutes National Forest; Jack Creek, Little Round and O'Connor Meadows, and Mountain Lakes Wilderness on the Winema National Forest; and Coyote Creek on the Fremont National Forest.

1 **Inflated sedge**, intermittent streambed
2 **Widefruit sedge**, moist meadow
3 **Tufted hairgrass**, dry meadow
4 **Lodgepole pine/widefruit sedge**, active floodplain
5 **Widefruit sedge**, cutoff/overflow channel

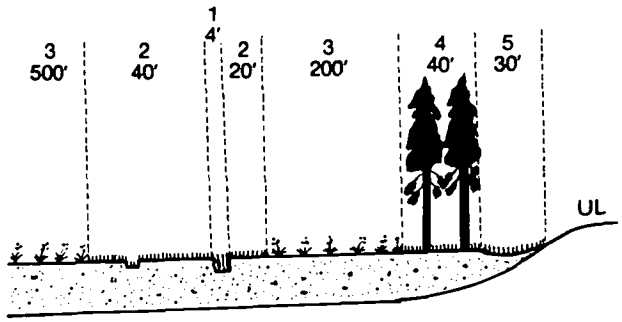


Figure 64. O'Connor Meadow; low gradient, mod elevation basin, Pumice-mantled Basin and Range Physiographic Area, Winema National Forest.

1 Jack Creek, first-order
2 **Beaked sedge**, overflow channel
3 **Widefruit sedge**, active floodplain
4 **Lodgepole pine/widefruit sedge**, active floodplain
5 **Lodgepole pine/bearberry**, transition slope
6 Basalt cliff

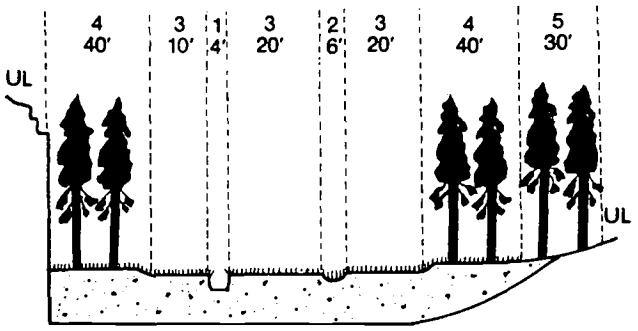


Figure 65. Jack Creek; low gradient, mod elevation floodplain; Pumice-mantled Basin and Range, Physiograhic Area; Winema National Forest

SOILS

Widefruit sedge is closely associated with deep deposits of pumice ejected during the Mazama eruption. Soils are pumice alluvium. Surface horizons are organic loam, sedge peat, or sandy loam that grade to gravelly pumice in the C horizon. Available water holding capacity is moderate to high. The site is flooded to depths of 15 inches in the spring. The water table is within 20 inches of the soil surface in August and September. Soils remain moist through the summer except in drought years.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Widefruit sedge	25-75 (51)	100
Reedgrasses	0-35 (4)	54
Tufted hairgrass	0-15 (5)	77
Beaked sedge	0-15 (3)	31
Inflated sedge	0-10 (1)	23
Baltic rush	0-20 (3)	54
Grasses	0-40 (16)	92
Sedges	37-87 (59)	100
Forbs	10-45 (18)	100

Potential natural vegetation: Widefruit sedge is the dominant graminoid and forms a dense sward. Other sedges, rushes, and forbs are

subordinant. Bluejoint and slimstem reedgrasses form occasional colonies and tufted hairgrass is common on the dry end of the association. Kentucky bluegrass and Baltic rush are uncommon in climax stands but increase in cover on disturbed sites. Beaked sedge and inflated sedge become common on wetter portions of the association. Forbs have low canopy cover and low plot frequency. Some of the more common forbs are small bedstraw, largeleaved avens, Jacob's-ladder, western bistort, and longstalk clover. Tall shrubs such as willows are uncommon. Some stands once supported lodgepole pine/widefruit sedge but the trees were killed in recent bark beetle epidemics or because of higher water tables.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 1500 to 3000 (2038) lbs/acre dry weight. Widefruit sedge is moderately high in palatable to livestock and may provide valuable mid to late season forage. Livestock tend to avoid these sites until surface soils can be walked on in late july through September. Therefore, it is unusual to find this association in less than late seral ecological status, except on the Chiloquin District (Winema National Forest).

With increasing overuse by livestock, other graminoids and forbs become codominant with widefruit sedge. Season long grazing decreases the competitive ability of widefruit sedge, increasing the cover of Baltic rush, Kentucky bluegrass, Nebraska sedge, and forbs such as western yarrow, western aster, willoweeds, small bedstraw, and Jacob's-ladder. The soil is somewhat broken and trampled.

With continued overuse, other graminoids and forbs dominate widefruit sedge. On the Chiloquin District **Nebraska sedge** occupies moist, overgrazed sites while sites with both overuse and lowered water tables have been converted to **Kentucky bluegrass**. Elsewhere, these conditions seldom occurs because of the resiliency of widefruit sedge and because livestock avoid the wet soils until mid and late summer.

Wildlife and fisheries: Landforms with the **widefruit sedge association** often contain streams with narrow, deep profiles and overhanging sedge and willow cover that provide important habitat for salmonids. Sites in late seral or better ecological status slow stream velocity, filter sediments, and store water for discharge in late summer. These landforms also provide important habitat for deer, elk, raptors, and many other species of wildlife.

Fire: The widefruit sedge association can be burned in late summer or early fall. Fire can help reduce litter and increase productivity for several years. Hot fires may penetrate dry organic soils, destroying sedge rhizomes.

Estimating potential on disturbed sites: Most sites are in late seral or climax ecological status and can be recognized by the presence of widefruit sedge. On the Chiloquin District many sites have been converted to **Nebraska sedge** or **Kentucky bluegrass community** types. On **Kentucky bluegrass** look for evidence of abnormally low water tables caused by streambed downcutting. On **Nebraska sedge** examine the relative proportions of widefruit sedge, inflated sedge, beaked sedge, and tufted hairgrass to help decide the association potential.

Rehabilitation pathways: Widefruit sedge will rapidly recolonize sites in mid seral or better ecological status with rest and late season grazing. Removing cattle at 40 percent utilization of forage will insure maintenance of sites in late seral or climax status. Where lowered water tables have changed the site potential to **Kentucky bluegrass**, reestablish sedges on the streambanks and , if necessary, use artificial structures such as loose rock checkdams to raise the water table and restore **widefruit sedge** potential. Willow cuttings may be successful where water tables are normal and the willow regeneration is protected from browsing by deer, elk, livestock, and beavers.

OTHER STUDIES

The **widefruit sedge association** is part of Volland's (1976) wet sedge meadow. It has not been described elsewhere.

AQUATIC SEDGE ASSOCIATION

Carex aquatilis
MM29-14 CAAQ

Sample Size = 7 plots in late seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The aquatic sedge association is fairly common at higher elevations on the Ochoco Mountain Physiographic Area and is widespread at higher elevations on the Basin and Range Physiographic Area of the Fremont National Forest. Sample plot elevations were normally 6000 to 6800 feet. However, the association occurs up to 7000 or more feet in the Warner Mountains (Fremont National Forest). Aquatic sedge is found on moist to wet, flat, smooth or slightly concave meadows (figure 66) or active fluvial surfaces along floodplains (Figure 67). It can also be found on silted in beaver ponds, and the margins of lakes. See the description for lodgepole pine/aquatic sedge (p. 43) for another figure illustrating this association. Sample plots were located at Pisgah Meadows on the Ochoco National Forest and Cottonwood Lake, White Pine Marsh, Mosquito Creek, Bull Prairie, and Cougar Creek on the Fremont National Forest

1 Sycan River, second order
2 Aquatic sedge, active floodplain
3 Aquatic sedge, overflow channel
4 Willow/aquatic sedge, active floodplain
5 Tufted hairgrass, moist meadow

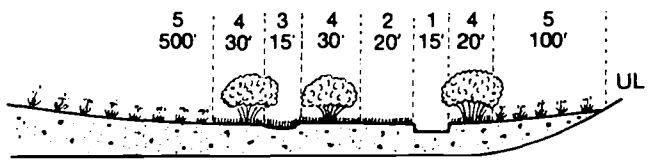


Figure 66. Sycan River Meadow; low gradient, mod-high elevation basin; Basin and Range Physiographic Area; Fremont National Forest.

1 Cougar Creek, first-order
2 Aquatic sedge, active channel shelves and streambanks, overflow channel
3 Lodgepole pine/aquatic sedge, inactive and active floodplains
4 Terraces without measurable water tables or transitional vegetation

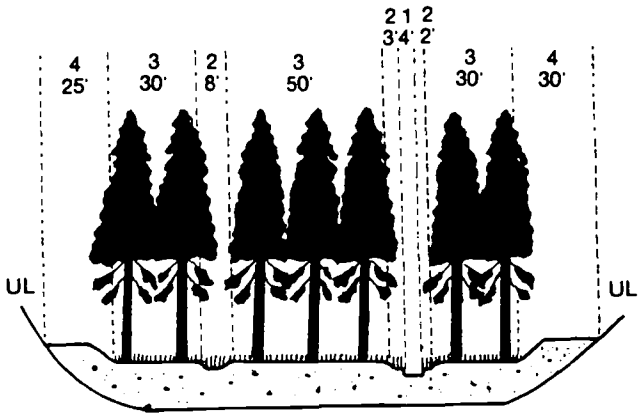


Figure 67. Cougar Creek; mod-low gradient, mod-high elevation floodplain; Basin and Range Physiographic Area; Fremont National Forest.

SOILS

Soils are sandy loams on streambanks and freshly filled beaver ponds and organic loams or sedge peat in meadows, older beaver ponds, and basins. Available water holding capacity is moderate to high. The site is flooded to as much as 1 foot above the soil surface in May and June. The water table lowers to 16 to 20 inches below the soil surface in August and September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Aquatic sedge	35-90 (62)	100
Tufted hairgrass	0-10 (3)	57
Meadow barley	0-3 (1)	57
Beaked sedge	0-30 (8)	71
Inflated sedge	0-20 (5)	43
American speedwell	0-3 (1)	71
Common horsetail	0-3 (1)	57
Western dock	0-3 (1)	71
Grasses	3-15 (8)	100
Sedges	45-90 (81)	100
Forbs	5-37 (12)	100

Potential natural vegetation: Aquatic sedge is the dominant graminoid and forms a dense sward. Willows, bog birch, and other shrubs are uncommon. The absence of willows in the aquatic sedge association may be attributed in part to lack of periodic floods and associated sediment deposition needed for willow seedbeds. Grasses such as tufted hairgrass and meadow barley are present but are subordinant to sedges. Other sedges are common but are subordinant to aquatic sedge. Beaked and inflated sedge are common on

wetter portions of the association. Baltic rush increases in cover on disturbed sites. Because of mountain pine beetles or raised water tables, many lodgepole pine/aquatic sedge sites have lost the lodgepole pine and been converted to the willow/aquatic sedge or aquatic sedge associations.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 2000 to 4000 (2930) lbs/acre dry weight. Aquatic sedge is moderately high in palatablity to livestock and may provide valuable forage. Livestock tend to avoid the aquatic sedge association until surface soils are dry in August and September. Season long grazing will trample and compact the soil and break the sod, increasing the cover of Baltic rush, small sedges, Kentucky bluegrass, and forbs.

With increasing overuse by livestock, other graminoids and forbs become codominant with aquatic sedge. There is a strong increase in Baltic rush and short sedges such as short-beaked or Jones sedge. There is also a strong increase in mesic forbs such as orange arnica, western aster, Watson's willoweed, western dock, small bedstraw, or longstalk clover. Species richness is greater. The soils are somewhat broken and trampled.

With continued overuse, rushes, forbs, and small sedges become dominant over aquatic sedge. Streambed downcutting may lower the water table and convert the site potential to Kentucky bluegrass or tufted hairgrass. This condition is somewhat uncommon because of the ability of aquatic sedge to reoccupy disturbed sites and because livestock avoid the site when the soils are wet.

Wildlife and fisheries: Valuable trout streams often pass through riparian landforms supporting aquatic sedge. Aquatic sedge rhizomes strongly anchor streambanks. These landforms also provide a rich source of horizontal and vertical diversity that support a wide variety of wildlife.

Fire: Aquatic sedge usually dries sufficiently to be burned in late summer or fall. Fire will reduce litter and increase productivity where litter accumulation has reduced production on sites with little grazing. However, burning also reduces the ability of sedges to buffer water forces and filter sediments during spring runoff.

Estimating potential on disturbed sites: Most sites are in mid seral or better ecological status and can be recognized on the basis of vegetative composition alone. Otherwise, the landform descriptions and sketches will help determine the site.

Rehabilitation pathways: Aquatic sedge meadows in mid seral or better status will improve rapidly with rest and late season grazing. Where lowered water tables have changed the site potential to Kentucky bluegrass, use improved grazing systems or structures such as loose rock checkdams to raise the water table to previous levels, thus restoring aquatic sedge potential. Willow cuttings may be successfully planted on drier portions of the association when protected from browsing by beaver, livestock, deer, and elk. Where necessary, wet site grasses such as meadow foxtail, bentgrass, reedgrass, or Timothy can be used for temporary bank stabilization. However, manage for native sedges and grasses where possible. Late season grazing will reduce bank damage that would occur if the soils were wet. However, such grazing may remove valuable cover and shade needed by trout and reduce sediment filtering capacity during spring runoff.

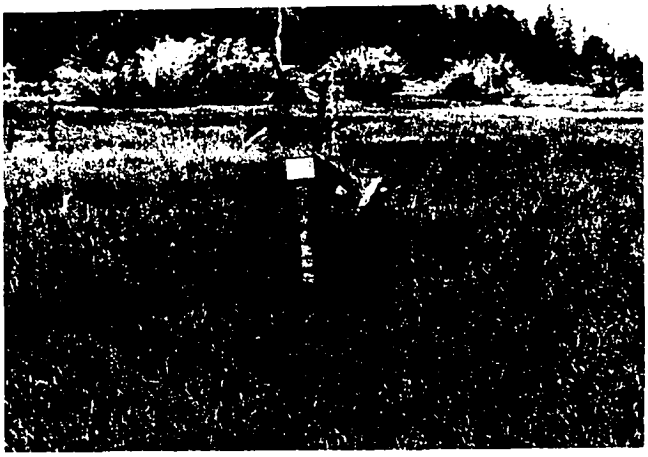
OTHER STUDIES

The aquatic sedge association is part of the wet sedge meadows described by Hall (1973), Volland (1976), and Hopkins (1979b) in central Oregon. Youngblood and others (1985 a & b) described a similar type for eastern and southern Idaho, western Wyoming, and northern Utah. Padgett and Youngblood (1986) described a similar type for southern Utah.

SHORT-BEAKED SEDGE ASSOCIATION

Carex simulata
MM29-15 CASI2

Sample size = 7 plots in late seral to climax ecological status



LOCATION AND RIPARIAN LANDFORMS

The short-beaked sedge association is scattered throughout central Oregon. It has been observed on all but the Winema Cascades, Pumice-mantled Cascades, and Grasslands Physiographic Areas. Landforms are on flat to gently sloping, bog-like meadows with a layer of cold, mucky, ground water below the soil surface (Figures 68 & 69). Thus, the soils often quake when walked on. The association occurs at toeslopes and the edges of meadows and short-beaked sedge changes to other associations as these waters accumulate below. Elevations are low to moderate (4500-6000 feet). Sample plots are located at Squaw Creek and Upper Big Marsh on the Deschutes National Forest; Stimson Meadow on the Winema National Forest; Cold Springs Guard Station and Morris Meadow on the Ochoco National Forest; and Coffeepot Creek and Crazyman Flat on the Fremont National Forest.

1 Short-beaked sedge, wet meadow
2 Engelmann spruce/widefruit sedge, forested wetland
3 Engelmann spruce/queencup beadlily, transitional
4 White fir/queencup beadlily, terrace

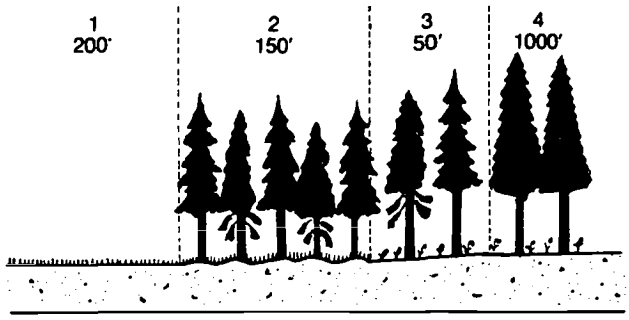


Figure 68. Squaw Creek Marsh; low gradient, mod elevation basin; Deshutes Cascades Physiographic Area.

1 Slender sedge, wet meadow
2 Short-beaked sedge, wet meadow
3 Lodgepole pine/bog blueberry/widefruit sedge, forested wetland

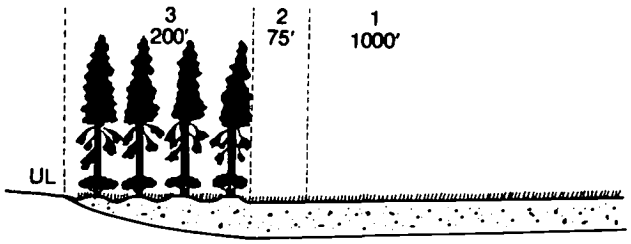


Figure 69. Stimson Meadow; flat, mod-high elevation basin; Pumice-mantled Basin and Range Physiographic Area; Winema National Forest.

SOILS

Soils are organic loam and sedge peat. Available water holding capacity is high and soils remain saturated through the summer in most years. The site is shallowly flooded with a few inches of water in June and July and the water table is within 18 inches of the soil surface in September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Short-beaked sedge	22-75 (41)	100
Mosses	0-87 (27)	86
Tufted hairgrass	0-7 (3)	71
Few-flowered spikerush	0-15 (5)	57
Baltic rush	0-15 (3)	57
Oregon saxafrage	0-3 (1)	57
Grasses	0-15 (7)	86
Sedges	37-90 (72)	100
Forbs	2-20 (7)	100

Potential natural vegetation: Short-beaked sedge is the dominant graminoid. Other sedges such as aquatic, widefruit, beaked, and Sitka sedge are scattered and stunted. Few-flowered spikerush and Baltic rush are often present but are low in cover except on the Squaw Creek Marsh plot. Mosses are abundant except on more permanently flooded sites such as Stimson Meadow. Forbs are usually weakly represented. Dwarfed willows and bog birch are often present but are inconspicuous and restricted to dry microsites. The vegetative composition suggests a close relationship to the few-flowered spikerush association.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 1000 to 2500 (1750) lbs/acre dry weight.

Short-beaked sedge appears to be unpalatable to livestock and when coupled with wet soils results in little use of this association by livestock.

Wildlife and fisheries: Deer have been observed in this association where it is in close proximity to hiding cover. The short-beaked sedge association may provide early spring forage when adjacent uplands are still covered by snow. Streams are too small or intermittent to support salmonids.

Fire: Prescribed fire is not a useful tool on this association. If the soil surface becomes dry the organic soils may be quite flammable and fire will penetrate the soil and destroy sedge rhizomes.

Recognizing potential on disturbed sites: Most stands are in late seral or climax ecological status and can be identified on the basis of vegetative composition alone.

Rehabilitation pathways: Rehabilitation is not needed as the association is in late seral or climax ecological status.

OTHER STUDIES

The short-beaked sedge association has been described in eastern Idaho by Youngblood and others (1985a).

SLENDER SEDGE ASSOCIATION

Carex lasiocarpa
MW29-11 CALA4

Sample size = 5 plots in climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The slender sedge association is locally abundant at moderate elevations (4600-5700 feet) on the Deschutes and Winema National Forests in the Pumice-mantled Basin and Range, LaPine Basin, Winema Cascades, and Deschutes Cascades Physiographic Areas. The association occurs on poorly drained landforms in flat basins and along lake shores that are anaerobically favorable to the buildup of deep organic soils (figures 70 & 71). See the description for short-beaked sedge for another figure showing this association (p. L06). Plots were located at Stimson Meadow and Lake of the Woods on the Winema National Forest and Lava Lake and Big Marsh on the Deschutes National Forest.

1 Big Marsh Creek, second-order
2 Beaked sedge, active channel shelves and overflow channels
3 Tufted hairgrass, moist meadows
4 Slender sedge, wide, shallow overflow channels, and poorly drained flats
5 Lodgepole pine/tufted hairgrass forested wetland
6 Engelmann spruce/queencup beadlily, transition slopes

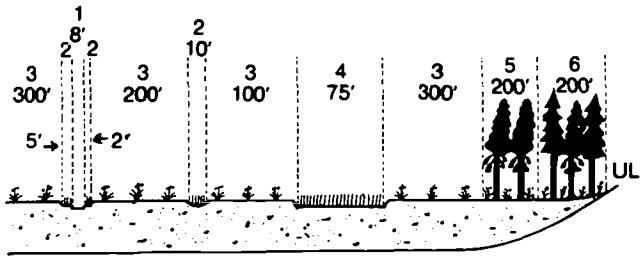


Figure 70. Big Marsh; flat, mod elevation basin; Deschutes Cascades Physiographic Area.

1 Lake of the Woods
2 Inflated sedge, permanently flooded shore
3 Nevada rush, semi-permanently flooded shore
4 Slender sedge, semi-permanently flooded shore
5 Tufted hairgrass, moist meadow
6 Lodgepole pine/bog blueberry/widefruit sedge, forested wetland
7 Engelmann spruce/queencup beadlily, terrace

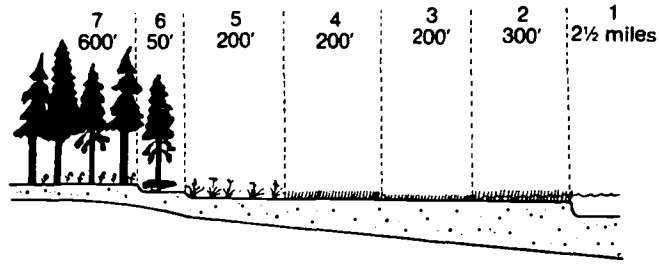


Figure 71. Lake of the woods; flat, mod elevation lake basin; Winema Cascades Physiographic Area.

SOILS

The marsh and lake sites support deep sedge and sedimentary peat soils, respectively. Available water holding capacity is high. The soil surface is often flooded into July and August and water tables are within 20 inches of the soil surface in September except in drought years.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Slimstem reedgrass	0-7 (3)	80
Tufted hairgrass	2-3 (3)	100
Slender sedge	20-40 (33)	100
Baltic rush	0-7 (4)	80
Nevada rush	0-12 (5)	60
Grasses	3-13 (5)	100
Sedges	37-65 (47)	100
Forbs	0-8 (3)	80

Potential natural vegetation: Slender sedge dominates other graminoids and forbs. Grasses such as tufted hairgrass and slimstem reedgrass are a minor component of the stand. Baltic and Nevada rush are subordinant to slender sedge and forbs are scarce. However, aquatic forbs such as pondweed and bladderwort may be common while the site is flooded in June and July.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 1000 to 3000 (2150) lbs/acre dry weight. Slender sedge is low in palatability to livestock. Livestock avoid the sites until they are surface dry in August or September. Slender sedge will rapidly reoccupy disturbed sites with rest and late season grazing.

The slender sedge association has not been observed in less than climax ecological status

and little is known about the effect of overuse by livestock on this site.

Wildlife and fisheries: Slender sedge sites are flooded long enough to provide nesting habitat for ducks, especially teal. The association has limited utility for songbirds and small mammals because of the lack of diversity and flooded soils. Mule deer have been observed feeding here, presumably on scattered forbs and the seedheads of sedges. Lava Lake, Lake of the Woods, and Big Marsh Creek support important fisheries.

Fire: The site can be burned in late summer. The rhizomatous nature of slender sedge should make it resistant to damage by fire except where hot fires penetrate the peat soil.

Estimating potential on disturbed sites: The slender sedge association has only been observed in climax ecological status. It can be recognized on the basis of vegetative composition alone.

Rehabilitation pathways: Slender sedge will quickly regain dominance on disturbed sites. Livestock should be kept off wet soils and grazed late in the summer if at all. Where stream downcutting has lowered the water table, water levels should be restored with stream rehabilitation efforts such as loose rock checkdams. It is unlikely that these sites are capable of supported willows.

The operation of heavy equipment and road construction are inappropriate to the site. Roads must be located on the adjacent upland.

OTHER STUDIES

This association has not been described in other studies.

FEW-FLOWERED SPIKERUSH ASSOCIATION

Eleocharis pauciflora
MW49-11 ELPA2

Sample Size = 20 plots in climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The **Few-flowered spikerush association** is abundant throughout the Cascade Mountains but is scattered eastward. In the Cascade Mountains landforms supporting the **few-flowered spikerush association** are found in headwaters basins such as Seven-mile Marsh (Winema National Forest) and Wire Meadow and Little Cultus Marsh (Deschutes National Forest)(Figures 72 & 73). Elevations are moderate to high (4700-6000 feet). Bogs develop in zones of abundant rainfall (more than 39 inches/year), cool climate, and short growing season. Sites are poorly drained basins and flats or seeps that are conducive to cold water saturated soil development (Gorham 1957). The coastal influenced wet climates and irregular, glaciated topography of the Cascades help create many sites favorable for bog development. On the Fremont and Ochoco National Forests, these requirements are met only in the higher mountains, such as Pisgah Meadow and in the vicinity of Yamsey and Gearheart Mountains. See the decriptions for **lodgepole pine-Engelmann spruce/ few-flowered spikerush** and **Engelmann spruce/ widefruit sedge** for other figures illustrating this association (p. 45 and 55).

1 Little Cultus Creek, first-order
2 **Few-flowered spikerush**, bog
3 **Bog blueberry/Sitka sedge**, wet shrub meadow
4 **Willow/Sitka sedge**, wet shrub meadow
5 **Engelmann spruce/queencup beadlily**, transition slope and lake terrace

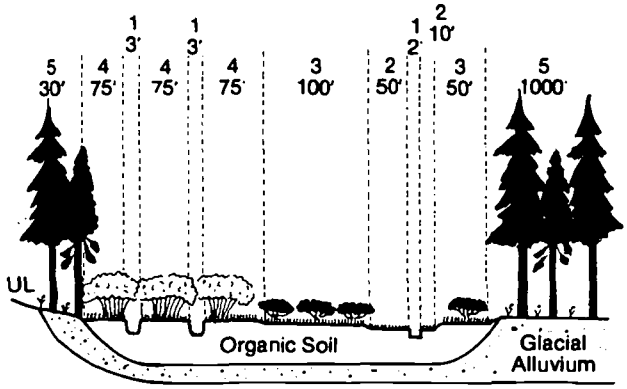


Figure 72. Little Cultus Marsh; flat, mod elevation lake basin; Deschutes Cascades Physiographic Area.

SOILS

Soils range from sedge to sphagnum and moss peats. Occasionally, a bog develops on organic root mats floating on mucky seeps and springs. Available water holding capacity is high. Soil surfaces are saturated through most of the summer. Peat formation is due to slow plant decomposition in waterlogged sites (Gorham 1957). Low dissolved oxygen and water temperatures, lack of fluctuation in the water table, cold water temperature, plus concentrations of organic and mineral acids (tannins, etc) in the water table all contribute to slow decomposition of plant residues and peat accumulates. Long periods of drought may dry the surfaces of peat soils, starting a trend where decomposition exceeds buildup or where fire drastically lowers the soil surface. However, in the long run bog associations are self perpetuating. The eventual climax is probably a larger, deeper bog and not forest.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Few-flowered spikerush	**0-65 (23)**	**100**
Mosses	**0-90 (57)**	**90**
Tufted hairgrass	0-12 (2)	60
Muhly	0-15 (3)	45
Aquatic sedge	0-15 (3)	40
Jones sedge	0-15 (2)	30
Woodrush sedge	0-20 (3)	40
Muricate sedge	0-15 (2)	30
Beaked sedge	0-15 (2)	45
Sitka sedge	0-15 (1)	25
Holm's sedge	0-30 (5)	40
Nevada rush	0-20 (3)	30
Shooting star	0-5 (1)	55
Alpine willoweed	0-3 (1)	50
Common horsetail	0-15 (3)	45
Primrose monkeyflower	0-20 (5)	70
Oregon saxifrage	0-10 (2)	55
Hooded ladies-tresses	0-3 (1)	45
Tofieldia	0-5 (1)	45
Grasses	0-15 (5)	80
Sedges	15-90 (51)	100
Forbs	7-37 (25)	100

Potential natural vegetation: Few-flowered spikerush is usually conspicuous and codominant with other plant species. Where spikerush is absent or low in cover other herbaceous species

are consistent with other plots in the association. Moss is usually very conspicuous. However, a few flat bogs were semi-permanently flooded and had little or no moss cover. Here, the mosses may become more prominent during drier climatic cycles. Tufted hairgrass and slender and shortleaved muhly were present on most plots but have very low cover. Normally robust sedges such as aquatic, beaked, Holm's, and Sitka sedge have a surprising ability to persist in a dwarfed, scattered form on these unfavorable sites. Other sedges include Jones and muricate sedge. Nevada rush is common in some stands. Forbs include sundews, alpine willowweed, common horsetail, bog orchid, primrose monkeyflower, elephanthead, western bistort, Oregon saxifrage, swamp whitehead, ladies-tresses, and one-flowered gentian. Dwarf shrubs such as bog birch, alpine laurel, and Booth, undergreen, and Eastwood willows are inconspicuous and restricted to dry microsites. Engelmann spruce and lodgepole pine are dwarfed and scattered.

Sites with slightly undulating surfaces display a considerable amount of vegetative diversity even though the difference in height between water paths and hummocks is only a few inches. Often the water paths have very little moss cover and are dominated by litter or organic soil. Here, few-flowered spikerush dominates the herbaceous layer and there are fewer grasses, sedges, and forbs. Mud sedge is also associated with the water paths. Other sedges, mosses, and forbs are more abundant on the hummocks. Great sundew often grows in the water paths while oval sundew grows on the edges of the hummocks. Aquatic plants such as buckbean and bladderworts grow in flooded water paths.

1 **Few-flowered spikerush**, bog
2 **Lodgepole pine/few-flowered spikerush**, bog
3 **Bog blueberry/few-flowered spikerush**, bog
4 **Engelmann spruce/queencup beadlily**, transition slopes

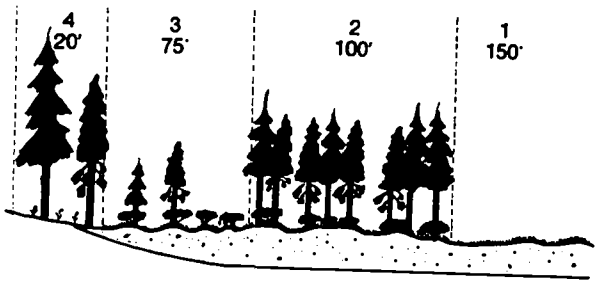


Figure 73. Cascade Lakes Highway Bog (near Wire Meadow); low gradient, mod elevation basin; Deschutes Cascades Physiographic Area.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 500 to 1500 (698) lbs/acre dry weight. Cattle will use few-flowered spikerush and other herbs in the stand but in general the palatability of the association is low. Livestock use is very infrequently and most stands lie outside of existing grazing allotments. Stands in less than climax ecological status have not been observed in central Oregon.

Wildlife and fisheries: Bogs provide an important source of diversity within the forest landscape. The higher elevation basins containing bogs offer a rich source of horizontal and vertical diversity within the forest for many species of wildlife, including deer, elk, and beavers. Bogs may provide a source of green forage in spring when snow still covers adjacent uplands.

Fire: **Few-flowered spikerush** remains wet summer long except in extreme drought years. Therefore, prescribed fire is not an important tool in bogs. Vegetative composition should remain the same following cool fires. However, peat soils are very flammable when dry and hot, deeply burning fires will hamper the regenerative ability of most species by burning their roots.

Recognizing potential on disturbed sites: The association is in climax ecological status and can be recognized on the basis of vegetative composition alone.

Rehabilitation pathways: Little is known about ways to rehabilitate disturbed sites.

OTHER STUDIES

Franklin and others (1973) described several kinds of bogs in Oregon and Washington. None of them seem to be like the **few-flowered spikerush association**. Seyer (1979) described **few-flowered spikerush-mud sedge** and **few-flowered spikerush-moss associations** in Crater Lake National Park. Her **mud sedge phase** describes the water paths and her **moss phase** the more elevated portions of the **few-flowered spikerush association**. The **few-flowered spikerush association** was not described by Volland (1976), Hall (1973), or Hopkins (1979a & b).

SMALL-FRUIT BULRUSH (BIGLEAF SEDGE) ASSOCIATION

Scirpus microcarpus (Carex amplifolia)
MW19-21 SCMI (CAAM)

Sample size = 22 plots in late seral ecological status

LOCATION AND RIPARIAN LANDFORMS

Small-fruit bulrush (bigleaf sedge) is infrequent on the Winema National Forest and common on the other three National Forests. It has been observed in the LaPine Basin, Low Flanks Cascades, Grasslands, Ochoco Mountains, and Basin and Range Physiographic Areas. Elevations are low to moderate (2400-5700 feet). It occurs on seral, water worked sites on overflow channels (Figure 74), active channel shelves (Figure 75), active floodplains, and wet meadows and basins. Small-fruit bulrush and bigleaf sedge will be replaced by other sedges or mountain alder as the fluvial surfaces mature. See the description for the Quaking aspen/common snowberry/blue wildrye community type (p. 59) for another figure illustrating this association.

1 Sevenmile Creek, third-order
2 Mountain alder, active channel shelf
3 Queencup beadlily (mountain alder), banks
4 Engelmann spruce/queencup beadlily, inactive floodplain
5 Small-fruit bulrush (bigleaf sedge), cutoff/overflow channel
6 White fir/queencup beadlily, terrace slope

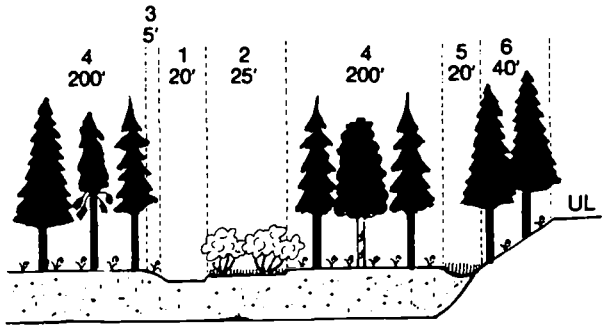


Figure 74. Sevenmile Creek; mod-low gradient, low elevation floodplain; Winema Cascades Physiographic Area.

SOILS

Active channel shelf soils are water worked alluvium. Textures are coarse sandy loam to fine sandy loam. Cobble and gravels are often prominent at early stages of development but become covered by sandy loam soils as riparian vegetation filters and traps stream sediments. Overflow channels, scour channels, and cutoff channels are active fluvial surfaces where water forces are low and stream sediments and organic matter are rapidly building the soil profile. Here, soil textures range from silts to fine sandy loams, organic loams, and mucks. Wet meadow soils are organic loam or sedge peat except for recent mineral deposits associated with the flood event that created the opportunity for small-fruit bulrush and/or bigleaf sedge invasion. Available water holding capacity is moderate to high. Active channel shelves and overflow channels are flooded during spring runoff. Meadows are flooded into June or July and the water table is within 20 inches of the soil surface in August and September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Small-fruit bulrush	**0-87 (37)**	**91**
Bigleaf sedge	**0-37 (11)**	**41**
Mountain alder	0-20 (2)	45
Tall managrass	0-20 (4)	78
Weak alkaligrass	0-15 (2)	41
Willoweeds	0-10 (2)	56
Largeleaved avens	0-3 (1)	56
Glabrate monkeyflower	0-7 (1)	52
American veronica	0-3 (1)	56
Grasses	0-37(13)	91
Sedges	31-87(63)	100
Forbs	3-37(26)	100

Potential natural vegetation: The **small-fruit bulrush (bigleaf sedge) association** is dominated by small-fruit bulrush and/or bigleaf sedge. Mountain alder is often present on active channel shelves in moderately graded floodplain landforms such as Ochoco Creek (Ochoco National Forest). Graminoids such as woolly, widefruit, and beaked sedge and grasses such as tall mannagrass, fowl bluegrass, and weak alkaligrass are common. Mesic forbs include willoweed, largeleaved avens, glabrate monkeyflower, and American veronica. Forbs are more abundant on active channel shelves, banks, and overflow channels than in meadows.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 1500 to 3000 (1989) lbs/acre dry weight. Production averaged higher on meadows than on other sites (2350 vs. 1850 lbs/acre, respective-

ly). Small-fruit bulrush and bigleaf sedge are low in palatability to livestock except in the spring. Livestock avoid active channel shelves and overflow channels until floodwaters recede, at which point the association may provide valuable forage from grasses and forbs. Season long use on active fluvial surfaces will cause rounding of banks, dished stream profiles, and increased erosion.

With increasing overuse by livestock, other graminoids and forbs become codominant with small-fruit bulrush and bigleaf sedge. The soil surface is trampled and broken and streambank and channel erosion are evident.

With continued overuse, bigleaf sedge and small-fruit bulrush become dominated by other graminoids and forbs. Forbs achieve maximum cover and species richness here due to continual trampling and grazing. There are many acres of active channel shelf and overflow channel sites in this condition.

1 Lake Creek, third-order
2 Small-fruit bulrush (bigleaf sedge), active channel shelves
3 Mountain alder-common snowberry, active floodplain
4 White fir/queencup beadlily, inactive floodplain
5 Ponderosa pine/common snowberry-floodplain, terrace

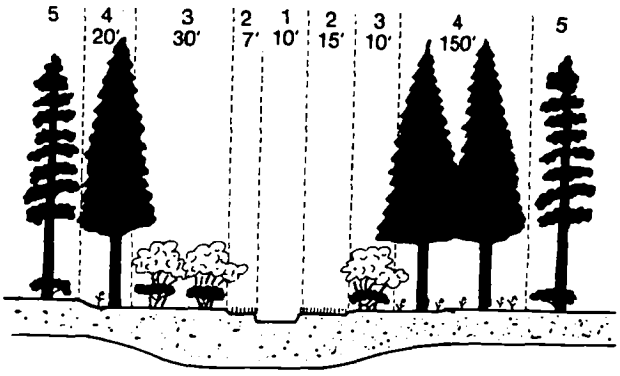


Figure 75. Lake Creek; mod-low gradient, low elevation floodplain; Low Flanks Cascades Physiographic Area.

Wildlife and fisheries: Small-fruit bulrush (bigleaf sedge) on active fluvial surfaces filters and traps stream sediments during spring runoff, builds soil depth, and changes successionally to more stable associations. The association is a critical building block in determining the later character of the stream. Overgrazing, trampling, and erosion disrupt the normal successional pattern and prevents development of good fisheries habitat.

Fire: Small-fruit bulrush and bigleaf sedge should be resistant to ground fire. On meadow sites fire could be used in late summer to reduce litter and competition. Fire should not be used on active fluvial surfaces because it would remove above ground plant parts critical to sediment entrapment during spring runoff, slowing the soil building process.

Recognizing potential on disturbed sites: With this association we are not dealing with potential in the normal sense because it occurs on obviously seral sites. Active fluvial surfaces at low to moderate elevation with with fresh sediment deposition are capable of supporting the association.

Rehabilitation pathways: Revegetation is not generally needed as small-fruit bulrush and bigleaf sedge have dense, thick rhizomes that respond rapidly to rest and late season grazing. They are both proliferic seeders that quickly establish on new sites. Where bank and channel erosion is severe, grasses such as reed canarygrass, Timothy, reedgrass, bentgrass, and meadow foxtail may be used to temporarily stabilize active fluvial surfaces. Sites with good soil buildup (1-2' deep) may respond to willow or mountain alder plantings on appropriate landforms.

OTHER STUDIES

Small-fruit bulrush (bigleaf sedge) has not been described elsewhere.

SITKA SEDGE ASSOCIATION

Carex sitchensis
MW19-22 CASI3

Sample size = 14 plots in climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The **Sitka sedge association** is abundant on the Deschutes but is uncommon on the Winema and absent on the Ochoco and Fremont National Forests. It is most common on low gradient floodplain landforms along the Deschutes River and its major tributaries in the LaPine Basin Physiographic Area (Figure 76). It also occurs on similar landforms along Indian Ford Creek in the Low Flanks Cascades Physiographic Area (Figure 77). The **Sitka sedge association** also occurs in flat, headwaters basins such as Sevenmile Marsh, Big Marsh, Sparks Lake Marsh, and the many marshes between Santiam Pass and Mt. Washington on the Deschutes and Winema Cascades Physiographic Areas. Elevations are low to moderately high, ranging from 3100 feet along Indian Ford Creek and 4000 feet along the Deschutes River to 5700 feet in Sevenmile Marsh. See the description of **willow/widefruit sedge** (p. 78) for another figure illustrating this association.

1 Deschutes River, fifth-order
2 **Sitka sedge**, active floodplain
3 **Beaked sedge**, overflow channels and active channel shelves
4 **Willow/Sitka sedge**, active floodplains
5 **Lodgepole pine/Douglas spiraea/widefruit sedge**, inactive floodplains

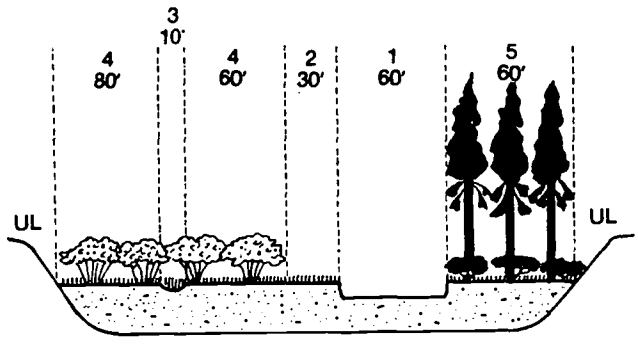


Figure 76. Deschutes River; low gradient, low elevation floodplain; LaPine Basin Physiographic Area.

1 Indian Ford Creek, second order
2 **Sitka sedge**, active floodplains
3 **Willow/Sitka sedge**, active floodplains
4 **Beaked sedge**, overflow channels
5 **Quaking aspen-lodgepole pine/Douglas spiraea/widefruit sedge**, transition slope

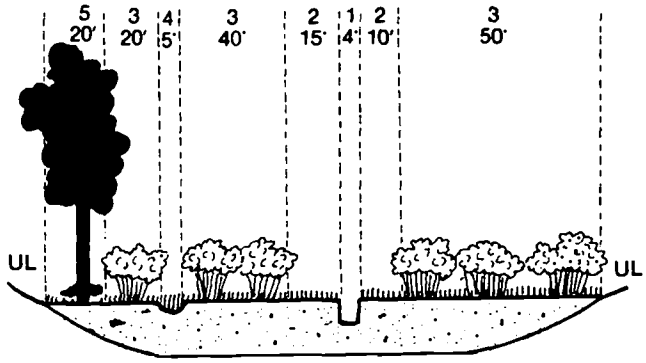


Figure 77. Indian Ford Creek; low gradient, low elevation floodplain; Low Flanks Cascades Physiographic Area.

SOILS

Soils along floodplains are deep alluviums that are high in organics. Surface textures are fine sandy to organic loams. Marsh soils are deep sedge peats. Available water holding capacity is moderate to high. Water tables are normally near to well above the soils surface for much of the summer. Some of the watersheds in which this association occur, especially the Deschutes River, may have peak water flow in August because it takes several months for snowmelt to work through the deep volcanic mantle of the Cascades.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Sitka sedge	37-90 (70)	100
Willows	0-9 (2)	50
Reedgrass	0-15 (2)	57
Beaked sedge	0-5 (2)	43
Grasses	0-30 (5)	57
Sedges	63-90 (75)	100
Forbs	1-20 (8)	100

Potential natural vegetation: The association is dominated by a sward of Sitka sedge. Other graminoids become significant only where the **Sitka sedge association** is ecotonal to other associations such as **beaked sedge** or **widefruit sedge**. Willows were present in small amounts on several plots, indicating that lowering of the water table through soil deposition or stream downcutting may change site potential to the **willow/Sitka sedge association**.

MANAGEMENT AND REHABILITATION

Livestock: The **Sitka sedge association** is among the most productive riparian sites in central Oregon. However, Sitka sedge is moderately low in palatability for livestock. Estimated herbage production ranged from 2000 to 4000 (2722) lbs/acre dry weight. Livestock grazing has not occurred for decades along the many critical recreation zones associated with these landforms except along Indian Ford Creek (Deschutes National Forest). Additionally, soils are often wet well into the summer, further restricting use by livestock. Therefore, most stands are climax ecological status.

With increasing overuse by livestock, grasses and forbs become codominant with Sitka sedge. With continued overuse, streambed downcutting may lower water tables, converting site potential to drier associations such as **widefruit sedge**.

Wildlife and fisheries: Some of the most productive trout waters in central Oregon (the Deschutes and Little Deschutes Rivers and their tributaries) pass through riparian landforms containing the **Sitka sedge association**. Coarse tough Sitka sedge rhizomes are excellent anchors of river banks and floodplains and provide shade and cover for salmonids. Additionally, there is extreme structural habitat diversity from the complex mix of sedge, willow, and lodgepole pine associations occuring in the landform. These landforms provide excellent habitat for elk, deer, and beaver.

Fire: It would be difficult to burn this association except in late summer or fall. Dried vegetation will carry fire, reducing litter buildup and increasing productivity for 1 or 2 years. However, fire may reduce the buffering and filtering effect of Sitka sedge during spring runoff and may increase erosion. Additionally, the proximity of fire sensitive species such as willow and lodgepole pine in adjacent associations may make it difficult to burn the landform without affecting these associations. Sedge peat soils are flammable when dry and hot fire could destroy sedge rhizomes by consuming the soil.

Estimating potential on disturbed sites: All observed **Sitka sedge associations** were in late seral to climax ecological status and can be identified on the basis of vegetative composition alone.

Revegetation: Sites in mid seral or better ecological status will be rapidly recolonized by Sitka sedge with rest and late season grazing

OTHER STUDIES

This association has not been described elsewhere.

INFLATED SEDGE ASSOCIATION

Carex vesicaria
MW19-23 CAVE

Sample size = 20 plots in late seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

Because of its wide geographic and elevational distribution, the inflated sedge association occurs in a wide variety of low gradient landforms supporting shallow flooding or semi-permanently saturated soils. It is present to some extent in every physiographic area in central Oregon except perhaps the Grasslands Physiographic Area. Landforms range from flooded basins to floodplains (Figure 78), lakeshores (Figure 79), and wet meadows. Elevations are low to moderately high (4000-6000 feet). It is similar to the beaked sedge association except it occurs on slightly drier sites and extends to higher elevation in the Cascade Mountains. The inflated sedge and beaked sedge associations are occasionally found together on the same landform, but here they form distinct adjacent associations, indicating differences in site requirement between the two sedges. See the descriptions for the quaking aspen/blue wildrye community type and tufted hairgrass and creeping spikerush associations for other figures illustrating this association (p. 61, 95, and 120).

1 Fivemile Creek, second order
2 Inflated sedge, streambanks
3 Inflated sedge, overflow channel
4 Willow/Kentucky bluegrass (willow/woolly sedge potential), inactive floodplains
5 Sagebrush/Cusick bluegrass, terraces
6 Lodgepole pine/Kentucky bluegrass (invasion into Kentucky bluegrass), inactive floodplain
7 Lodgepole pine/bearberry, transitional

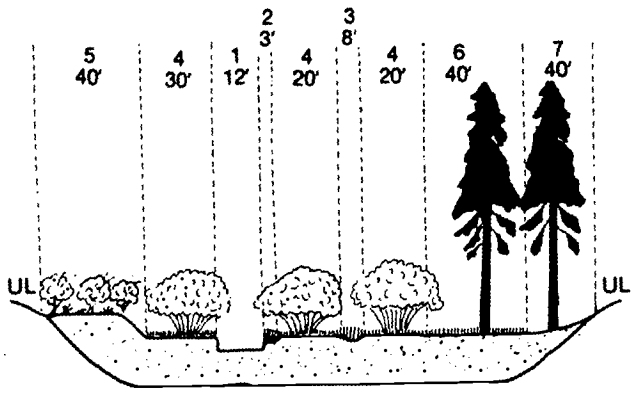


Figure 78. Fivemile Creek; low gradient, low elevation floodplain; Pumice-mantled Basin and Range Physiographic Area; Fremont National Forest.

SOILS

Soils are deep sedge and sedimentary peats or organic loam except on seral sites such as active channel shelves. Deep organic soils indicate mature, long lived, anaerobic sites. Mineral soils range from coarse sandy loam to silty clay loam. Available water holding capacity is moderate to high. Wetter sites such as semi-permanently flooded shores are flooded through the summer except in drought years. Here, maximum water depths ranged from 10 to 30 inches above the soil surface in June and July and near to slightly above the soil surface in September. Water depths on drier sites ranged from 0 to 20 inches above the surface in June and July and lowered to 12 to 24 inches below the soil surface in September. Soils are moist to saturated throughout the growing season.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Inflated sedge	17-95 (51)	100
Tufted hairgrass	0-3 (1)	40
Northern mannagrass	0-10 (1)	35
Beaked sedge	0-15 (2)	40
Creeping spikerush	0-10 (2)	45
Pondweed	0-32 (12)	35
Bladderwort	0-10 (2)	30
Grasses	0-37 (6)	90
Sedges	25-95 (63)	100
Forbs	0-63 (16)	80

Potential natural vegetation: Inflated sedge is the dominant sedge. Grasses, especially northern mannagrass and reed canarygrass, are more abundant here than in the beaked sedge association. Grasses such as tufted hairgrass and fowl bluegrass occur on drier sites. Forbs such as orange arnica, western dock, and small bedstraw are low in cover except on disturbed portions of drier sites. Aquatic forbs such as pondweed and bladderwort can have up to 63 percent canopy cover on flooded sites.

Poorly drained basins may have considerable variation in their forb component in wet versus dry years. In wet years they may be flooded year round and aquatic forbs are common. In dry years aquatic forbs will be present only during high water, if at all.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 1000 to 4000 (2238) lbs/acre dry weight. Production tends to be lower on permanently flooded sites, especially at higher elevations.

Inflated sedge is moderately high in palatablity to livestock and provides important forage in late summer. Livestock avoid wet organic soils but move into the association as soils become less wet and vegetation on adjacent uplands and drier meadows becomes less abundant and less palatable.

With increasing overuse by livestock on drier sites, graminoids such as Baltic rush, Nebraska sedge, tufted hairgrass, muhly, and reedgrass increase in cover and become codominant with inflated sedge. Forbs such as small bedstraw, orange arnica, western dock, field mint, and silverweed become common. The soil surface is broken and trampled. Wetter sites have not been observed in less than climax ecological status.

With continued overuse, grazing, trampling, and erosion changes the association to communities

1 Lake of the Woods
2 Inflated sedge, permanently flooded shore
3 Nevada rush, semi-permanently flooded shore
4 Slender sedge, semi-permenently flooded shore
5 Tufted hairgrass, moist meadow
6 Lodgepole pine/bog blueberry/widefruit sedge, forested wetland
7 Engelmann spruce/queencup beadlily, terrace

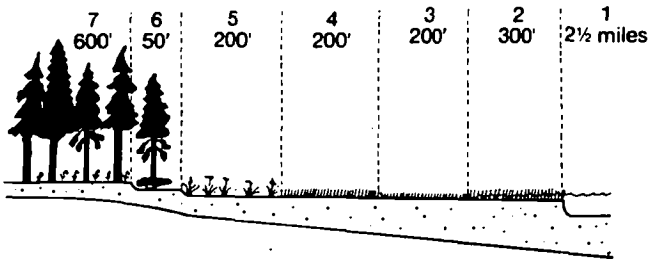


Figure 79. Lake of the Woods; mod-low elevation lake basin; Winema Cascades Physiographic Area.

such as Nebraska sedge or the site is lost to erosion.

Wildlife and fisheries: The inflated sedge association provides a formidable barrier to streambank erosion, helping to form narrow, deep stream profiles along trout streams. Undercut banks and overhanging sedges provide cover and shade for salmonids. Ponded sites provide important nesting and feeding habitat for a wide variety of waterfowl. Inflated sedge provides important forage for elk in mid to late summer.

Fire: The inflated sedge association can be burned only in late summer or fall. Fire will reduce litter accumulation and increase productivity for several years but will not change species composition. Peat soils are flammable when dry and hot fires may penetrate the soil, destroying sedge rhizomes.

Estimating potential on disturbed sites: The association is largely in climax ecological status on wet sites and in the Cascade Mountains. Here, it can be recognized by vegetative composition alone. The association can often be found in degraded condition on drier sites, especially on the Ochoco and Fremont National Forests. Here, overuse by livestock may convert the site to the nebraska sedge community type or erosion may eliminate the site entirely. Look for remnants of inflated sedge or use the landform key to determine the potential of disturbed sites.

Rehabilitation pathways: The dense rhizomes of inflated sedge are very resistant to trampling. Disturbed sites in mid seral or better ecological status will be rapidly recolonized by inflated sedge with rest and late season grazing. Where necessary, banks may be revegetated using grasses such as reed canarygrass, tall mannagrass, Timothy, and reedgrass. However, these grasses are not as resistant to erosion as inflated sedge. These sites may be too wet for willow plantings.

OTHER STUDIES

The inflated sedge association has not been described elsewhere.

BEAKED SEDGE ASSOCIATION

Carex rostrata
MW19-24 CARO2

Sample size = 27 plots in late seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

Beaked sedge is one of the wettest riparian associations. Because of its wide geographic and elevational distribution, the association occurs on a wide variety of physiographic areas and riparian landforms. It is present to some extent in every physiographic area in central Oregon. Low gradient landforms supporting **beaked sedge** range from permanently flooded basins (Figure 80) to floodplains (Figure 81) and wet meadows. **Beaked sedge** occurs on wet fluvial surfaces such as streambanks, active channel shelves, overflow channels, marshes, and fens. Elevations are low to moderately high (4000-6000 feet). See the descriptions for

1 Beaver pond (Link Creek)
2 **Beaked sedge**, permanently flooded shore
3 **Bob blueberry/Sitka sedge**, active channel shelf
4 **Willow/Sitka sedge**, wet shrub meadow
5 **Engelmann spruce/queencup beadlily**, transition slope

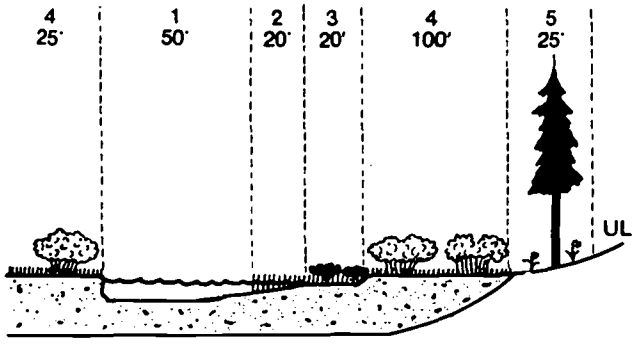


Figure 80. Santiam Pass Marsh; flat, mod-high elevation basin; Deschutes Cascades Physiographic Area.

Lodgepole pine/ Kentucky bluegrass, widefruit sedge, willow/widefruit sedge, slender sedge, and **Sitka sedge** for other figures illustrating this association (p. 29, 102, 78. 108, and 114).

1 Deschutes River, fifth order
2 **Sitka sedge**, active floodplain
3 **Beaked sedge**, overflow channels and active channel shelves
4 **Willow/Sitka sedge**, active floodplains
5 **Lodgepole pine/Douglas spiraea/widefruit sedge**, inactive floodplains

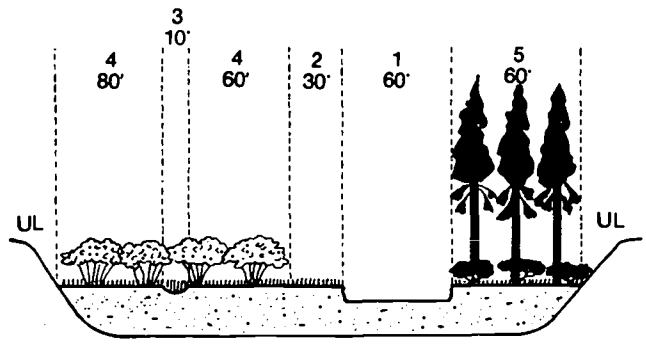


Figure 81. Deschutes River; low gradient, low elevation floodplain; LaPine Basin Physiographic Area.

SOILS

Soils are deep sedge or sedimentary peats, organic loam, or muck except for recently deposited alluvium on sites such as active channel shelves. The organic layers are often quite deep (20 to 40 or more inches) indicating mature, anaerobic, soils. Available water holding capacity is moderate to high. Wet sites such as lake shores and flooded basins have water tables ranging from 8 to 35 inches above the soil surface in June and July and 5 to 25 inches above the soil surface in September. Drier sites such as meadows have water tables 0 to 20 inches above the soil surface in June and July, lowering to 12 to 16 inches below the soil surface in September. Soils remain moist to saturated throughout the growing season except in driest years.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Beaked sedge	20-90 (52)	100
Shrubs	0-5 (1)	33
Grasses	0-3 (3)	56
Sedges	20-99 (66)	100
Forbs	0-31 (11)	85

Potential natural vegetation: **Beaked sedge** is the dominant graminoid. Sitka, beaked, aquatic, and widefruit sedges are common where the **beaked sedge association** is ecotonal to associations dominated by these species. Shrubs and grasses

are scattered. Grasses on drier sites include tall mannagrass, fowl bluegrass, slender muhly, and tufted hairgrass. Northern mannagrass is the only common grass on the more permanently flooded portions of the association. Forbs on drier sites include glabrate monkeyflower, western dock, Oregon saxifrage, Watson's willoweed, and largeleaved avens. Wet sites support aquatic forbs such as buckbean, pond-lily, burreed, pondweed, bladderwort, and water lentil. Their cover is variable, ranging from nearly absent in early summer to abundant in late summer.

The beaked sedge association has considerable variation in its forb component in wet versus dry climatic cycles. In wet years it may be flooded nearly summer long and aquatic forbs become common. In drought years flooding is brief and the aquatic component will be present only during high water or absent.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 1000 to 4000 (2081) lbs/acre dry weight. Production is lower on flooded sites, especially at higher elevations. Beaked sedge is moderately palatable to cattle in late summer. Cattle move onto these sites as soils become less wet and vegetation on uplands and drier meadows becomes less abundant and less palatable.

With increasing overuse by livestock on drier sites, graminoids such as tall mannagrass, meadow barley, tufted hairgrass, small-fruit bulrush, slender muhly, Nebraska sedge, and short-beaked sedge increase in cover and become codominant with beaked sedge. Forbs such as western dock, Watson's willoweed, largeleaved avens, western aster, and orange arnica are common. The soil surface is somewhat broken and trampled. Semi-permanently to permanently flooded sites have not been observed in less than late seral ecological status.

With continued overuse, the beaked sedge association is altered to Nebraska sedge or the site is lost to streambank erosion or streambed downcutting.

Wildlife and fisheries: The beaked sedge association anchors banks along many trout streams, forming narrow and deep stream profiles. Overhanging sedges and undercut banks provide cover and shade for salmonids. Semi-permanently and permanently flooded sites provide habitat for many species of waterfowl.

Fire: The beaked sedge association can be burned effectively only in drier summers when water tables are below the soil surface. Fire will reduce litter accumulation and increase productivity for several years but will not change species composition. Peat soils are flammable when dry and hot fires may penetrate the soil, destroying sedge rhizomes.

Estimating potentials on disturbed sites: The beaked sedge association is largely in climax ecological status on wet sites and the Cascade Mountains. To the east, especially on drier landforms, the site may be converted by overgrazing to the Nebraska sedge community type or lost to erosion or lowered water tables. Look for remnants of beaked sedge on wetter fluvial surfaces or use the landform key to determine potential for the beaked sedge association.

Rehabilitation pathways: The dense sod is very resistant to trampling and beaked sedge will rapidly recolonize disturbed sites with rest and late season grazing. Where necessary, banks may be temporarily revegetated with grasses such as reed canarygrass, tall mannagrass, Timothy, and reedgrass. However, these grasses are not as resistant to erosion as beaked sedge. These sites are usually too wet for willow plantings, although such plantings have been successful on the Williamson River (Winema National Forest).

OTHER STUDIES

The beaked sedge association has been recognized in eastern Idaho, western Wyoming, southern Idaho, and northern Utah (Youngblood and others 1985a & b). Similar types exist in Colorado (Hess and Wassner 1982) although these authors include aquatic sedge in the community. It has has also been noted in Sequoia National Park (Helpern 1986), southern Utah (Padgett and Youngblood 1986), central Utah (Kern and Henderson 1979), central Idaho (Schlatterer 1972), and eastern Oregon (Sayer 1979; Padgett 1981). It is part of the wet meadow associations described in central Oregon by Hall (1973), Volland (1976), and Hopkins (1979b).

CREEPING SPIKERUSH ASSOCIATION

Eleocharis palustris
ME49-12 ELPA

Sample size = 7 plots in mid seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The creeping spikerush association is found throughout central Oregon on a wide range of elevations (3000-6800 feet), riparian landforms, and physiographic areas. These landforms are characterized by low valley gradient and standing bodies of water in natural or manmade settings. It occurs on seasonally to permanently flooded sites such as the margins of reservoirs, ponds (figure 82), lakes, and stockponds or in internally drained basins. It frequently forms a seral community in ponded sites between stream rehabilitation structures such as loose rock checkdams (Figure 83).

1 Shallow, Indian pondlily-dominated pond
2 Creeping spikerush, permanently flooded shore
3 Inflated sedge, semi-permenently flooded shore
4 Lodgepole pine/aquatic sedge, forested wetland
5 White fir/queencup beadlily, transition slope

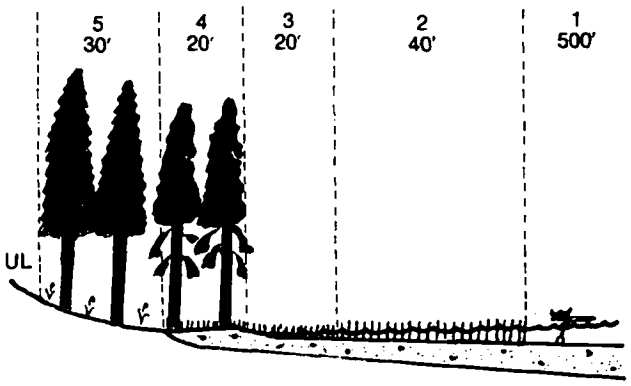


Figure 82. Pond near Campbell Lake; concave, mod-high elevation basin; Basin and Range Physiographic Area; Fremont National Forest.

1 Creeping spikerush, new sediments between loose rock checkdams on Chocktoot Creek
2 Willow/Kentucky bluegrass (willow/woolly sedge potential), inactive floodplains and overflow channels
3 Cusick bluegrass, inactive floodplains

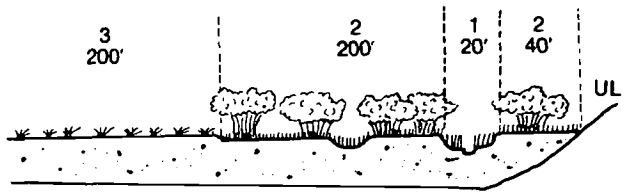


Figure 83. Chocktoot Creek; low gradient, mod-low elevation floodplain; Basin and Range Physiographic Area; Fremont National Forest.

SOILS

Soils on the margins of lakes and older reservoirs are organic loam and sedimentary peat. Soils associated with stockponds are fine sandy loams. Available water holding capacity is moderate to high. This is the wettest association described in this publication. Sites are semi-permanently to permanently flooded. Maximum water levels were 16 to 24 inches above the soil surface, lowering to 0 to 16 inches above the soil surface except in drought years. Reservoirs, stockponds, and lakes with more than 2 to 4 feet seasonal fluctuation in their water tables will not support this or other riparian associations along their margins.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Creeping spikerush	30-63 (48)	100
Inflated sedge	0-15 (3)	43
Pondweed	0-15 (5)	57
Grasses	0-20 (4)	71
Sedges	45-87 (63)	100
Forbs	0-99 (22)	71

Potential natural vegetation: Creeping spikerush is the dominant graminoid. Small-fruit bulrush and Nebraska sedge are prominant on the margins of some stockponds. Aquatic forbs are abundant along the shallow margins of lakes and reservoirs by mid summer. In basins they will be present in flooded years and absent in dry years.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 500 to 2500 (1571) lbs/ acre dry weight. Lower production is associated with stockponds. Spikerush is low in palatability to all classes of livestock and big game so that use is light even in dry years. Stockponds are damaged as livestock trample the narrow spikerush zone while drinking and feeding.

Sites associated with large bodies of water are usually in climax ecological status. Margins of stockponds are often severely trampled by cattle and sites are in early to mid seral ecological status. Severe disturbance often leaves the soil surface largely bare of vegetation. Here, spikerush is subordinant to little meadow foxtail, Nebraska sedge, small-fruit bulrush, and/or Baltic rush.

Wildlife and fisheries: The broad zones of creeping spikerush along major lakes, larger stockponds, and reservoirs offer valuable habitat for water fowl. The seeds of creeping spikerush, rushes, and sedges provide fair to good forage for ducks and geese (Martin and Uhler 1939). Associated pondweeds, smartweeds, and water lentils are excellent forage for ducks and geese. On Davis Lake (Deschutes National Forest) there is a large nesting ground for grebes located in the **creeping spikerush association**. Here, grebes build floating nest platforms out of creeping spikerush and Baltic rush and feed on easily available aquatic forbs and graminoids.

Fire: Prescribed burning is not practical except in drought years. Fire will reduce litter accumulation but will not change species composition unless the fire penetrates the organic soil.

Estimating potential on disturbed sites: Not needed except where cattle have trampled the edges of stockponds.

Rehabilitation pathways: Generally not needed on lakes, reservoirs, and basins. Stockponds will revegetate rapidly if protected from trampling. They should be fenced and the water gravity fed to stock tanks to prevent trampling of bank vegetation and lowered water quality.

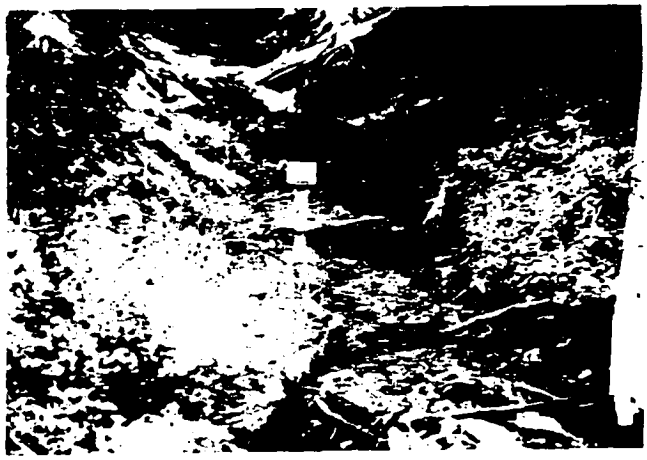
OTHER STUDIES

The **creeping spikerush association** has not been described elsewhere.

QUEENCUP BEADLILY (MOUNTAIN ALDER) ASSOCIATION

Clintonia uniflora (Alnus incana)
FW41-11 CLUN (ALIN)

Sample size = 16 plots in late seral to climax ecological status



LOCATION AND RIPARIAN LANDFORMS

Queencup beadlily (mountain alder) is found in all four National Forests and in all but the LaPine Basin and Grasslands Physiographic Areas. It occurs on the narrow banks of first order streams in moderate to steeply graded, mesic, V-shaped valley landforms (Figure 84). Aspects are mostly north to east on the Ochoco and Fremont and variable on the Deschutes and Winema National Forests. The riparian zone is narrow, thus limiting the variety of plant associations present in the landform. Elevations are low to moderate (3200-5800 feet) and lie within the elevational limits of mountain alder. See Engelmann spruce/queencup beadlily for another figure illustrating this association (p. 49).

1 Trout Creek, first order
2 Queencup beadlily (mountain alder), banks
3 White fir/queencup beadlily, transition slopes

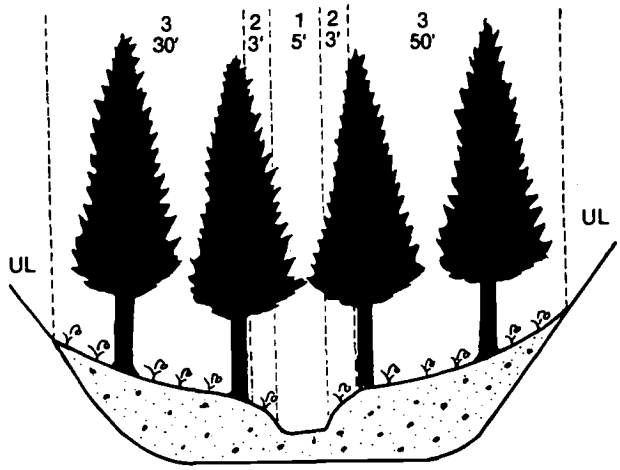


Figure 84. Trout Creek; steep gradient, mod elevation, V-shaped valley; Ochoco Mountains Physiographic Area.

SOILS

Soils are variable. Rubble, bedrock, and woody debris are important in controlling stream gradient and local soil characteristics. The soil pattern may change from year to year as water forces change the landscape next to the stream. The banks have cool, well aerated soils composed of a mix of alluvium and colluvium that contain significant proportions of cobbles or stone. Surface soil textures range from sandy loam to loam and, rarely, clay loam. Water tables are near the surface as streamflow increases during spring runoff or summer thunderstorms. Minimum water levels are within 2 feet of the soil surface much of the year. Streams are perennial flowing or nearly so.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Mountain alder	0-20 (4)	69
Prickly currant	0-25 (8)	94
Wood reedgrass	0-15 (3)	63
Tall mannagrass	0-20 (5)	69
Monkshood	0-15 (4)	75
Baneberry	0-3 (1)	63
Pathfinder	0-15 (3)	63
Enchanter's nightshade	0-20 (6)	63
Queencup beadlily	0-10 (2)	75
Sweetscented bedstraw	0-3 (3)	88
Sweetroot	0-3 (1)	75
Brook saxafrage	0-20 (5)	50
Claspleaf twistedstalk	0-15 (4)	94
Overhanging trees	40-90 (56)	100
Shrubs	3-40 (16)	100
Grasses	0-20 (10)	94
Sedges	0-15 (2)	75
Forbs	15-63 (44)	100

Potential natural vegetation: Queencup beadlily (mountain alder) is characterized by a rich, mesic, composition of forbs. These forbs are similar to those found in the white fir/queencup beadlily and Engelmann spruce/queencup beadlily associations and include queencup beadlily, sweetscented bedstraw, claspleaf and rosy twistedstalks, monkshood, baneberry, pathfinder, lady-fern, enchanter's nightshade, largeleaved avens, glabrate monkeyflower, alpine mitella, sweetroot, and brook saxafrage. Queencup beadlily is absent on the Fremont National Forest, but the association is otherwise similar to the association description and does not justify individual status in the classification. Wood reedgrass and tall mannagrass are common. Prickly currant is a common shrub. The banks are normally shaded by a moderate to dense canopy of conifers located on the adjacent upland, but the banks themselves support few conifers. Mountain alder has less than 25

percent canopy cover (usually uncommon) but may increase in cover with removal of conifer shade (except on sites shaded by adjacent slopes).

MANAGEMENT AND REHABILITATION

Livestock: Estimates of herbage production ranged from 50 to 1500 (528) lbs/acre dry weight. Woody debris, low forage value, narrow valley bottoms, and obstacles to movement limit the use of the queencup beadlily (mountain alder) association by livestock. The gradient and hydrolic forces of the stream are greatly reduced by the presence of rubble, bedrock, and/or woody debris. Therefore, timber harvest and the removal of woody debris are often followed by grazing and trampling by livestock, loss of bank vegetation, and erosion. This has been more common on southerly exposures where adjacent uplands are more likely to provide long term grazing opportunities.

Wildlife and fisheries: Streams passing through queencup beadlily (mountain alder) are often too small to support viable populations of trout. However, they provide a critical supply of cold, clean water and nutrients for downstream fisheries. The association provides important travel corridors and summer habitat for deer and elk. Many species of birds and mammals are dependent on bank and toeslope landforms.

Fire: Wildfire is infrequent in the queencup beadlily (mountain alder) association (100 years or more). Catastrophic wildfire in adjacent uplands will reduce conifer shade and may result in an increase in mountain alder cover. Fire should not appreciably change the vegetative composition of the ground cover.

Silviculture: Logging on adjacent slopes should use off ground systems for transporting logs across streams and banks. A buffer strip one tree height in width will maintain the herbaceous composition and provide for future input of woody debris. Woody debris should remain in the stream. Where woody debris has been removed from the stream system, the effective stream gradient is increased, exposing the stream channel to increased streambed downcutting and bank erosion. Careful removal of trees within the buffer strip would provide the option to manage for a period of dominance by mountain alder.

Roads crossing first order streams are not a problem as long as culverts are designed with flow capacities exceeding maximum estimated seasonal flows. Heavy equipment should not be operated in the streams or on the banks.

Estimating potentials on disturbed sites: Narrow, moderate to steep gradient, first order streams in mesic, V-shaped valleys at moderately low to moderately high elevations (generally less than 5500 feet) identify the potential for supporting the queencup beadlily (mountain alder) association.

Rehabilitation pathways: Rest from grazing, reestablishing conifer cover on adjacent slopes, and control of stream gradient by reintroduction of woody debris or use of artificial structures such as log dams will help control erosion and establish vegetation on the banks. Initial management for alder would be beneficial on disturbed sites. Alder is very effective in stabilizing banks, trapping sediments, and increasing soil fertility.

OTHER STUDIES

The queencup beadlily (mountain alder) association has not been described elsewhere.

ARROWLEAF GROUNDSEL ASSOCIATION

Senecio triangularis
FW42-11 SETR

Sample size = 18 plots in climax ecological status

LOCATION AND RIPARIAN LANDFORMS

Arrowleaf groundsel is similar to the queencup beadlily (mountain alder) association except for lying above the elevational limits or outside the geographic distribution of mountain alder. The association is common at moderate to moderately high elevation (5300-6400 feet) in the various Cascades Physiographic Areas on the Deschutes and Winema National Forests. It is less common in the higher elevation mountains of the Fremont National Forest and is very rare on the Ochoco National Forest. Sites are narrow banks of first order streams incised into moderate to steeply graded, V-shaped valley landforms (Figure 85). The riparian zone is usually just a few yards wide and limits the variety of plant associations present in the landform. Aspects are variable. The microclimate is cold and humid.

1 Todd Creek, first-order
2 Arrowleaf groundsel, banks

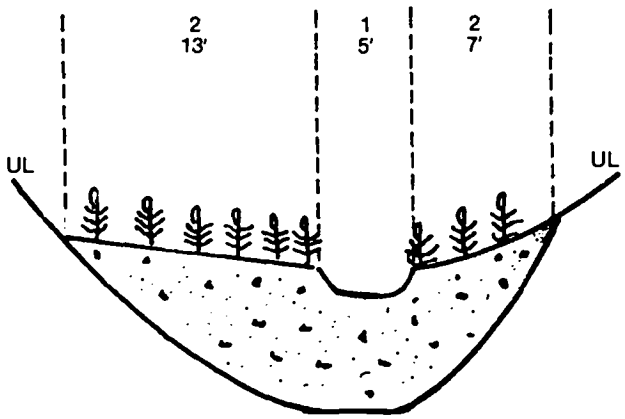


Figure 85. Todd Creek; steep gradient, subalpine, V-shaped valley; Deschutes Cascades Physiographic Area.

SOILS

Soils are variable. Woody debris, rubble, and bedrock are important in controlling stream gradients and local soil characteristics. The soil pattern may change from year to year as water forces change the landscape next to the stream. The banks have cold, well aerated soils composed of a mix of alluvium and colluvium and often contain a significant proportion of stone and cobbles. Textures range from stony sandy loam to loam. Water tables are near the soil surface as streamflows increase during spring runoff and summer thunderstorms. Minimum water tables are within 2 feet of the soil surface much of the summer. Streams are perennially flowing or nearly so.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Prickly currant	0-10 (2)	44
Big whortleberry	0-15 (2)	44
Grouse whortleberry	0-15 (3)	72
Woodrush sedge	0-15 (2)	50
Drummond rush	0-3 (1)	44
Merten rush	0-2 (1)	50
Monkshood	0-20 (4)	61
Hairy aster	0-4 (1)	50
Gray licoriceroot	0-15 (3)	72
Alpine mitella	0-5 (3)	94
Sweetroot	0-3 (1)	61
Lesser wintergreen	0-5 (1)	50
Arrowleaf groundsel	**0-40 (10)**	**94**
Twistedstalk	0-20 (5)	61
Longstalk clover	0-35 (5)	50
Wormskjold speedwell	0-15 (2)	55
Overhanging trees	3-95 (45)	100
Shrubs	0-20 (8)	94
Grasses	1-20 (7)	100
Sedges	0-15 (8)	94
Forbs	10-90 (52)	100

Potential natural vegetation: The arrowleaf groundsel association is identified by a rich, mesic composition of herbs, especially forbs. Elevations are near or above the limits of queencup beadlily and arrowleaf groundsel is the most characteristic forb. Other forbs include Gray licoriceroot, claspleaf twistedstalk, monkshood, hairy aster, alpine mitella, sweetroot, lesser wintergreen, lady-fern, longstalk clover, and wormskjold speedwell. Graminoids are subordinant to forbs and include wood reedgrass, tall mannagrass, woodrush sedge, Drummond rush, and Merten rush. The banks are often shaded by conifers except in alpine settings. The association is above the elevational limits of mountain alder and low shrubs such as prickly currant, big whortleberry, and grouse whortleberry increase in cover with removal of conifers from adjacent slopes.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 25 to 1500 (586) lbs/acre dry weight. High

elevation, woody debris, narrow valley bottoms, low forage values, and other obstacles to movement limit the utility of the association to livestock. Much of the association lies outside existing grazing allotments on the Deschutes and Winema National Forests.

The gradient and hydrologic force of the stream are reduced by bedrock, rubble, and/or woody debris. Streambank and streambed erosion are uncommon during normal runoff. Any decrease in the ecological status of the **arrowleaf groundsel** association is probably the result of natural flood events and not grazing. Catastrophic torrents rearrange woody debris and rubble, resulting in bank erosion and streambed downcutting.

Wildlife and fisheries: Streams are too small and cold to support important fisheries. They do provide a critical supply of cold, clean water and nutrients for downstream fisheries. The association provides summer habitat and travel corridors for deer and elk. Many species of birds and mammals are dependent on bank and mesic toeslope landforms.

Fire: Wildfire is infrequent in this association (100 year or more intervals). Vegetative composition will not be changed significantly by fire.

Silviculture: Logging on adjacent slopes should use off ground systems for transporting logs across streams and banks. A buffer strip one tree height in width will maintain the herbaceous composition and provide for future input of woody debris. Existing woody debris should remain in the stream.

Roads crossing first order streams are common and are not a problem as long as culverts are designed with flow capacities exceeding maximum estimated seasonal flows. Heavy equipment should not be operated in the streams or on the banks.

Estimating potential on disturbed sites: Narrow, moderate to steep gradient streams in V-shaped valleys at moderately high elevation identify the potential for **arrowleaf groundsel**.

Rehabilitation pathways: Rest from grazing, establishing coniferous shade on adjacent slopes, and control of stream gradient with woody debris or the use of artificial structures such as log dams will help control erosion and establish vegetation on disturbed banks.

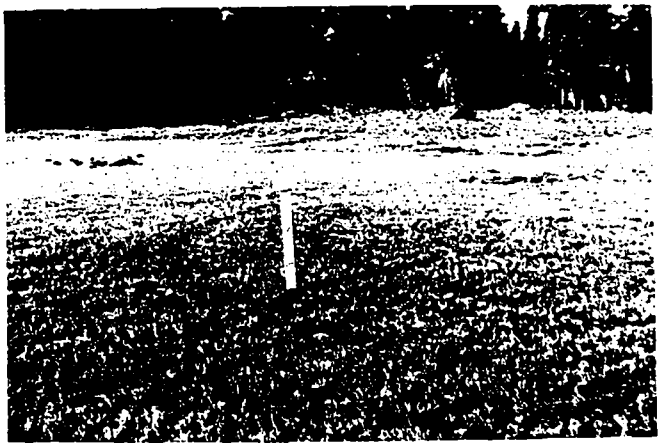
OTHER STUDIES

The arrowleaf groundsel association has not been described elsewhere.

BREWER SEDGE ASSOCIATION

Carex brewerii
MS11-11 CABR

Sample Size = 4 plots in late seral to climax ecological status



LOCATION AND RIPARIAN LANDFORMS

The Brewer sedge association is locally abundant in subalpine and alpine settings, primarily in the Deschutes Cascades Physiographic Area. It has been observed only in the Three Sisters Wilderness Area (Deschutes National Forest) and Crater Lake National Park but may occur on other high Cascade Mountains having thick mantels of ash and pumice. Elevations are 6500 to 7000 feet. It occurs on very low gradient, internally drained meadows, drainages, and basins where snowmelt is late and the snow free season is less than 3 months long (Figure 86).

1 Brewer sedge, dry meadow

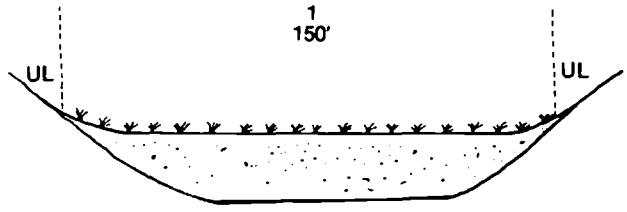


Figure 86. Unnamed drainage near Round Meadow; low gradient, subalpine drainage; Deschutes Cascades Physiographic Area.

SOILS

The soil is composed of pumice alluvium. Surface textures range from loamy sand to coarse sandy loam and grade into a coarse pumice C horizon. Available water holding capacity is low. Soils are briefly saturated at snowmelt but the water table lowers to more than 5 feet below the soil surface by September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Brewer sedge	**30-55 (41)**	**100**
Drummond rush	1-5 (2)	100
Black alpine sedge	1-3 (2)	100
Alpine pussytoes	0-3 (2)	75
Alpine aster	0-2 (1)	75
Umbellate pussypaws	0-2 (1)	75
Grasses	1-5 (2)	100
Sedges	32-60 (47)	100
Forbs	5-8 (7)	100

Potential natural vegetation: Brewer sedge forms a loose sod in which other herbs are inconspicuous. Drummond rush, black alpine sedge, and Mt. Shasta sedge are present but have little cover. The most consistent forbs are alpine pussytoes, alpine aster, and alpine pussypaws. Species richness is low. Dwarfed lodgepole pine are widely scattered in the association but show little ability to dominate the site as in the red mountainheath association. Bare ground is conspicuous between the small clumps of Brewer sedge.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 450 to 1000 (688) lbs/acre dry weight. Brewer sedge is probably low in palatability except for its seed heads. Where livestock have grazed the association there is greater cover of bare ground and less total canopy cover. Trampling probably is the biggest factor on reducing condition and not forage utilization itself.

With increasing overuse by livestock, Brewer sedge is still dominant (15-30 percent canopy cover) although total plant cover is decreasing. Other graminoids and herbs increase only slightly, even on poor condition sites. Bare ground occurs in open, scattered patches. The soil surface becomes somewhat broken, trampled, and compacted.

With continued overuse, Brewer sedge and other herbs develop broken, erratic distributions within large patches of bare ground. Pedestaling of Brewer's sedge may be evident. The soil surface becomes very broken and trampled.

Recreation: Brewer sedge has only moderately low resistance to trampling compared to black alpine and Holm's sedges. Scars from off-road vehicle traffic are evident for many years. Therefore, existing access roads need to be well maintained to discourage off-road travel. The impact from camping can be reduced by encouraging dispersed, infrequent camping on the Brewer sedge association. Since these sites become surface dry rapidly after snow melt they may be suitable for trail use, but only on flats and gentle slopes as soils are easily eroded. Early trail use on wet soils encourages multiple trail development. Where possible, locate trails on adjacent uplands.

Wildlife and fisheries: The use of this association is probably limited because of lack of forage, cover, and structural diversity.

Fire: Little is known about the effects of fire on this association. Wildfire is probably infrequent because of low plant density and biomass. Brewer sedge is resistant to cool fires because of its underground rhizomes.

Estimating potential on disturbed sites: Vegetative composition and site distinguishes Brewer sedge from other associations. Most sites are in late seral to climax ecological status and can be recognized on vegetative composition alone.

Rehabilitation pathways: Sites in mid seral ecological status will improve very slowly, even with complete exclosure. Domestic seed sources are not available for these high elevation sites. Brewer sedge plugs might be used to revegetate disturbed sites.

OTHER STUDIES

The Brewer sedge association has not been described elsewhere.

BLACK ALPINE SEDGE ASSOCIATION

Carex nigricans
MS21-11 CANI2

Sample size = 16 plots in late seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The black alpine sedge association is locally abundant in subalpine and alpine settings in the Deschutes Cascades Physiographic Area. Sample plots were located in the Three Sisters and Mt. Jefferson Wilderness Areas (Deschutes National Forest). The association may also occur on other high Cascade Mountains such as Crater Lake National Park and on Mt. Washington (Deschutes National Forest). Elevations are 6,500 to 7,000 or more feet in the Three Sisters Wilderness Area and above 5,700 feet in the Mount Jefferson Wilderness Area. Landforms are flat, poorly drained meadows, floodplains (Figure 87), and depressions where snowmelt is late. The snow free growing season is generally 2 to 3 months. Sites along streams may have slightly longer growing seasons.

1 Middle Fork Tumalo Creek, first order
2 Holm's sedge, active channel shelves and banks
3 Black alpine sedge, moist meadow
4 Holm's sedge-black alpine sedge-tufted hairgrass, moist meadow

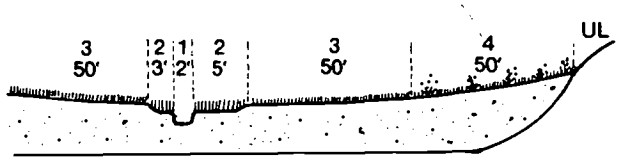


Figure 87. Broken Top Meadow; low gradient, subalpine basin; Deschutes Cascades Physiographic Area.

SOILS

Soils are composed of pumice alluvium on meadow and floodplain sites and pumice colluvium on snowbank sites. Meadows sometimes have a thin layer of organic loam or sedge peat over a loamy sand subsurface horizon. Elsewhere, surface textures are loamy sand to sandy loam. These surface horizons gradually mix into coarser pumice below. Available water holding capacity is moderate. Water tables occur at the soil surface at snow melt and lower to 16 to 35 inches below the soil surface in September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Black alpine sedge	20-85 (55)	100
Holm's sedge	0-35 (6)	63
Drummond rush	0-3 (1)	81
Tufted hairgrass	0-20 (2)	38
Alpine aster	0-35 (6)	81
Gray licoriceroot	0-10 (2)	50
Fanleaf cinquefoil	0-30 (6)	69
Grasses	0-35 (4)	63
Sedges	21-85 (62)	100
Forbs	3-60 (23)	100

Potential natural vegetation: Black alpine sedge forms a dense, tough sod which affords little growing space for other plants. Other graminoids include tufted hairgrass, Holm's sedge, and Drummond rush. Holm's sedge increases in cover on the moist edge of the association while tufted hairgrass and forbs increase on the dry side. Common forbs include alpine aster, Gray licoriceroot, and fanleaf cinquefoil.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 750 to 1500 (1130) lbs/acre dry weight. General palatability and forage value of the association is unknown but is assumed to be moderately low.

Moderate grazing and trampling by livestock or big game seems to increase overall plant cover by increasing the cover of perennial forbs. Forbs become codominant with Black alpine sedge. Bare ground is still inconspicuous although the soil surface may be somewhat trampled and broken.

Severely degraded conditions have not been observed during the study but may occur where there is severe trampling disturbance from livestock, packstock, hiking, or camping. Bare ground becomes abundant.

Recreation: The black alpine sedge association is moderately resistant to trampling except when the soils are wet. Off-road vehicles should be restricted to established, maintained roads. Impacts by recreationists can be reduced by encouraging dispersed, infrequent camping (Cole 1982). Hiking on trails with wet soils encourages multiple parallel trail development. If possible, locate trails on adjacent green fescue and mountain hemlock uplands.

Wildlife and fisheries: Landforms supporting the **Black alpine sedge** association are important summer ranges for deer and elk.

Fire: Prescribed burning has limited usefulness in high altitude sites. However, Black alpine sedge should be highly resistant to fire because of its underground rhizomes.

Estimating potential on disturbed sites: Most sites are in late seral or climax ecological status and can be recognized by vegetative composition alone.

Rehabilitation pathways: Sites in mid seral or better ecological status will improve rapidly with protection from disturbance. Domestic seed sources are not suitable for high elevation sites. Black alpine sedge plugs have proved helpful in revegetating disturbed sites in the Blue Mountains (Cole 1982).

OTHER STUDIES

Black alpine sedge has been described in western Oregon and Washington and southern Alaska (Henderson 1973, Kuramoto and Bliss 1970, Douglas 1972, Campbell 1977, Vander Schaff 1978 and 1980, Helpern and others 1984, and Brooke and others 1970), northeastern Oregon (Cole 1982), and Colorado (Cox 1937). It has not been previously described in central Oregon.

HOLM'S SEDGE–BLACK ALPINE SEDGE–TUFTED HAIRGRASS ASSOCIATION

Carex scopulorum-Carex nigricans-Deschampsia cespitosum
MS21-12 CASC5-CANI2-DECE

Sample Size = 13 plots in mid to late seral ecological status

LOCATION AND RIPARIAN LANDFORMS

Holm's sedge-black alpine sedge-tufted hairgrass is common in the Three Sisters and Mount Jefferson Wilderness Areas (Deschutes National Forest). It may occur sporadically southward at high elevations on the Winema National Forest. Its elevational range is 5900 to 6700 or more feet. Landforms are low to moderate gradient, moist meadows, streambanks, and floodplains (Figure 88). The site is intermediate in soil moisture between **tufted hairgrass** and **Black alpine sedge** or **Holm's sedge associations**.

1 Middle Fork Tumalo Creek, first order
2 **Holm's sedge**, active channel shelves and streambanks
3 **Black alpine sedge**, moist meadow
4 **Holm's sedge-black alpine sedge-tufted hairgrass**, moist meadow

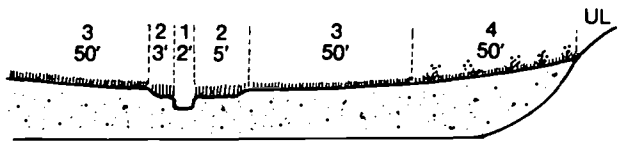


Figure 88. Broken Top Meadow; low gradient, subalpine basin; Deschutes Cascades Physiographic Area.

SOILS

Soils are variable. About half of the plots had organic loam or sedge peat surface horizons 8 to 20 inches thick over alluvium subsoils. In some horizons buried organic soils were intermixed with layers of pumice. Organic surfaces may indicate the site was once dominated by wetter associations. Other sites were drier and surface textures were coarse sandy to fine sandy loams. Available water holding capacity is moderate to high. Soils are saturated at snowmelt and the water table lowers to 8 to 31 inches below the soil surface in September.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Holm's sedge	0-50 (16)	77
Black alpine sedge	0-30 (10)	69
Few-flowered spikerush	0-20 (5)	38
Tufted hairgrass	0-70 (21)	100
Timber oatgrass	0-10 (4)	54
Slender muhly	0-25 (5)	54
Alpine pussytoes	0-10 (3)	38
Alpine aster	0-40 (9)	85
Gray licoriceroot	0-3 (1)	46
Fanleaf cinquefoil	0-37 (6)	69
Fewleaved groundsel	0-54 (9)	69
Longstalk clover	0-54 (9)	69
Grasses	1-80 (27)	100
Sedges	15-60 (31)	100
Forbs	12-75 (38)	100

Potential natural vegetation: This association is characterized by codominance of graminoids and forbs. Tufted hairgrass, along with Holm's sedge and/or black alpine sedge are the dominant graminoids. Other graminoids include timber oatgrass, few-flowered spikerush, and slender muhly. Forbs include alpine pussytoes, gray licoriceroot, alpine aster, fanleaf cinquefoil, fewleaved groundsel, and longstalk clover. Moss and litter are common.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 200 to 750 (433) lbs/acre dry weight. General palatability and forage value of this association are unknown but is assumed to be moderate.

Increasing overuse by livestock increases forb and bareground cover at the expense of tufted hairgrass, Holm's sedge, and black alpine sedge. Grasses such as timber oatgrass or slender muhly have more cover than tufted hairgrass. Continued overuse, especially on wet soils, decreases total herbaceous cover and increases the amount of bare ground.

Recreation: Most of the association seems to be moderately degraded due to past grazing and existing use by big game and recreationists. Therefore, the sites are relatively fragile and could be easily started in a downward trend with uncontrolled recreation use. Managers should encourage dispersed recreation and infrequent camping on this association. Trails are fairly stable except on wet soils. Hiking on trails with wet soils will encourage multiple trail development. Off road vehicles cause serious long-term damage to these sites. Maintain established roads to discourage off road vehicle use.

Wildlife and Fisheries: Landforms supporting Holm's sedge-black alpine sedge-tufted hairgrass provide valuable summer range for deer and elk.

Fire: Prescribed fire has little usefulness on high elevation sites. Most species in this association will regenerate from underground parts following cool ground fire.

Estimating potential on disturbed sites: The ecological status of Holm's sedge-black alpine sedge-tufted hairgrass is speculative. Given the large cover of forbs, these stands may be degraded Holm's sedge or Black alpine sedge associations. Sites with Holm's sedge as the dominant sedge and with moderately thick, wet, organic surface soils may have Holm's sedge potential. Drier sites, especially those with mineral soils, may have Black alpine sedge potential.

Rehabilitation pathways: Sites in mid seral ecological status will improve slowly with protection from disturbance. Domestic seed sources are not available for these high elevation sites. Plugs of black alpine and Holm's sedges may speed revegetation (Cole 1982).

OTHER STUDIES

This association has not been described elsewhere.

HOLM'S SEDGE ASSOCIATION

Carex scopulorum
MS31-11 CASC5

Sample Size = 11 plots in late seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The Holm's sedge association is found at high elevations (5500-7300 or more feet) in the Cascade Mountains. It is common in the vicinity of the Three Sisters and Mount Jefferson Wilderness Areas (Deschutes National Forest) and occurs sporadically southward into the Winema Cascades Physiographic Area. Several unsampled Holm's sedge meadows were observed in the Gearheart Mountain Wilderness Area (Fremont National Forest). It occurs on cold, wet, poorly-drained meadows, streambanks, and active channel shelves (Figures 89 & 90). The snow free growing season is 3 to 4 months long.

1 Todd Creek, first-order
2 Holm's sedge, active channel shelves and streambanks
3 Holm's sedge, overflow channel
4 Tufted hairgrass, dry meadow

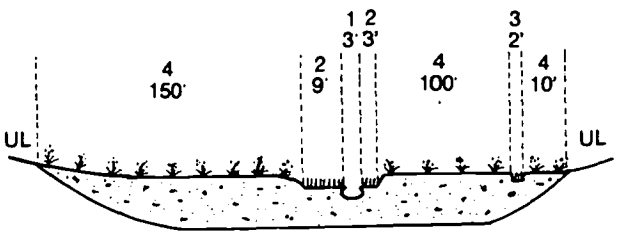


Figure 89. Water Tower Meadow; low gradient, subalpine basin; Deschutes Cascades Physiographic Area.

SOILS

Soils are shallow to moderately deep (3 to 16 inches) organic loam or sedge peat over buried pumice. Two plots occurred on coarse sands and gravels deposited by floodwaters and have buried organic horizons. Available water holding capacity is moderate to high. The sites are flooded during spring runoff and the water table is within 1 foot of the soil surface in September.

1 Middle Fork Tumalo Creek, first order
2 Holm's sedge, active channel shelves and streambanks
3 Black alpine sedge, moist meadow
4 Holm's sedge-black alpine sedge-tufted hairgrass, moist meadow

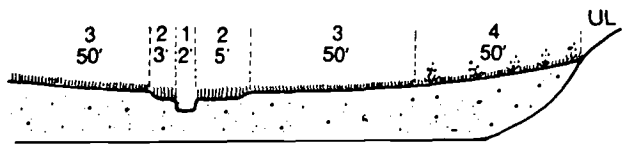


Figure 90. Broken Top Meadow; low gradient, subalpine basin; Deschutes Cascades Physiographic Area.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Holm's sedge	40-90 (64)	100
Black alpine sedge	0-20 (6)	82
Few-flowered spikerush	0-40 (7)	45
Tufted hairgrass	0-10 (5)	82
Alpine aster	0-60 (6)	45
Alpine shootingstar	0-3 (1)	55
Gray licoriceroot	0-10 (2)	64
Fanleaf cinquefoil	0-15 (3)	45
Longstalk clover	0-40 (6)	64
Grasses	2-37 (9)	100
Sedges	63-95 (79)	100
Forbs	0-75 (25)	91

Potential natural vegetation: Holm's sedge forms a dense, tough, sod and is dominant over other herbs. Black alpine sedge becomes common on the drier edge of the association. Few-flowered spikerush was codominant with Holm's sedge on one plot that was transitional to the **few-flowered spikerush association**. Tufted hairgrass is often common. Forbs include alpine aster, alpine shootingstar, Gray licoriceroot, fanleaf cinquefoil, and longstalk clover. Dwarf willows are present in many stands but show little potential to dominate the site.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 750 to 2500 (1625) lbs/acre dry weight. General palatability and forage value of the association is unknown but is assumed to be moderate.

Moderate grazing and trampling by livestock or big game seems to increase overall plant cover by increasing the cover of perennial forbs. Continued heavy grazing, especially on wet

soils, decreases herbaceous cover and sites become dominated by bare ground.

Recreation: The association is moderately resistant to trampling by livestock, big game, packstock, and campers. Trail erosion can be severe when packstock or hiker use occurs on wet soils, which encourages multiple, parallel trail development. Disturbances on camping sites are less noticeable than on other alpine associations. Off road vehicles cause serious long-term damage. Maintain existing access roads to help discourage off-road travel. Locate trails and roads on adjacent upland.

Wildlife and fisheries: Landforms supporting this association provide important summer habitat for deer and elk.

Fire: Wildfire is rare in this association. Holm's sedge will resprout from underground rhizomes following fire.

Estimating potential on disturbed sites: The majority of these sites are in late seral to climax ecological status and can be recognized on the basis of vegetative composition alone. Holm's sedge has wetter soils and higher water tables than other high elevation associations.

Rehabilitation pathways: Because of the vigorous rhizomes of Holm's sedge, deteriorated sites in mid seral seral or better ecological status will improve rapidly with protection from disturbance. Holm's sedge plugs should be helpful in revegetating disturbed sites (Cole 1982). Domestic grasses are not available for these high elevation sites.

OTHER STUDIES

The Holm's sedge association is part of Cole's (1982) subalpine meadow community type in the Eagle Cap Wilderness of northeast Oregon. Campbell (1977) described a similar association in the Cascades of Washington and Oregon. Helpern and others (1984) described a similar association for the Three Sisters Wilderness Area.

RED MOUNTAINHEATH ASSOCIATION

Phyllodoce empetriformis
SS19-11 PHEM

Sample Size = 13 plots in mid seral to climax ecological status

LOCATION AND RIPARIAN LANDFORMS

The red mountainheath association is abundant in subalpine and alpine settings in the Cascade Mountains (Deschutes National Forest) at elevations ranging from 5700 to more than 7000 feet. Sample plots were located in the Three Sisters and Mount Jefferson Wilderness Areas (Deschutes National Forest). The association is probably found at other locations in the Cascade Mountains such as Crater Lake National Park, Mount Thielson (Winema National Forest), and Mount Washington (Deschutes National Forest). Sites are well-drained streambanks (Figure 91) and floodplains or moderate to steeply-sloping, moist, rocky sites below snowbanks and springs.

1 Crater Creek, first-order
2 Red mountainheath, streambank

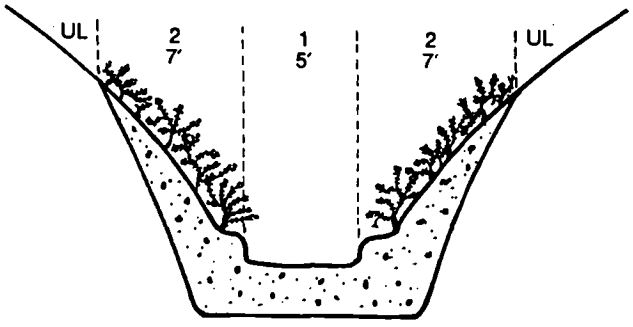


Figure 91. Crater Creek; steep gradient, alpine, V-shaped valley; Deschutes Cascades Physiographic Area.

SOILS

Soils are well drained alluvium. The surface soils on streambanks and floodplains are coarse textured, well-drained, and often have a high percentage of gravels and cobbles deposited by periodic floods. Meadows have finer textured, well-drained, loamy sands.

FLORISTIC CHARACTERISTICS

Dominants	% Canopy Cover	Constancy
Mountain hemlock	0-37 (14)	85
Red mountainheath	7-65 (34)	100
Delicious blueberry	0-50 (9)	62
Black alpine sedge	0-37 (6)	77
Drummond rush	2-13 (3)	100
Alpine aster	0-20 (4)	85
Gray licoriceroot	0-10 (5)	92
Fanleaf cinquefoil	0-15 (2)	54
Shrubs	25-75 (55)	100
Grasses	0-6 (1)	69
Sedges	2-40 (11)	100
Forbs	10-40 (25)	100

Potential natural vegetation: The red mountainheath association is dominated by woody vegetation, especially red mountainheath. Dwarfed mountain hemlock or shrubs such as delicious blueberry, mountain wintergreen, or moss heather are often common. Dwarfed willows such as Eastwood, undergreen, and Booth willows are often codominant with red mountainheath. Common forbs and graminoids include black alpine sedge, Drummond rush, alpine aster, Gray licoriceroot, and fanleaf cinquefoil.

This association has the potential for massive invasion by mountain hemlock. Several sample plots had abundant invasion by mountain hemlock in the past 50 years. Usually the trees are dwarfed, less than 10 feet tall, and 20-50 years old. It appears that mountain hemlock requires a fresh deposition of coarse alluvium as a seedbed which must be timed with successful seed producing years followed by summers of above normal precipitation and temperature (Henderson 1973). Franklin and others (1971) suggest that warmer and drier climatic trends in the past 100 years could be responsible for the invasion.

Due to the dynamic nature of this association, it is difficult to speculate on its ecological status. Periodic high runoff inundates streambanks, the upper ends of meadows, and floodplains with deposits of coarse alluvium, creating sites for red mountainheath. In the absence of high runoff, soil surfaces gradually become dominated by fine sediments and the site changes towards black alpine sedge or Holm's sedge associations.

MANAGEMENT AND REHABILITATION

Livestock: Estimated herbage production ranged from 50 to 750 (282) lbs/acre dry weight. Palatability and forage value on the red mountainheath association is low. Continued trampling by livestock would eventually convert the shrub ground cover to dominance by bare ground, forbs, and graminoids.

Recreation: The visual attractiveness of this association encourages leaving the trail or campsite for a closer look (Cole 1982). The brittle stems of the shrubs are easily broken when trampled. Trails located on this association tend to deteriorate, particularly on steep slopes and in response to early season use (Cole 1982). Therefore, campsites and trails should avoid this association as much as possible.

Wildlife and fisheries: Landforms supporting the red mountainheath association provide important summer range for deer and elk.

Fire: Fire will favor delicious blueberry and willows over mountain hemlock and red mountainheath. Blueberry and willows will resprout from root collars while the others are more sensitive to fire. Mountain hemlock invasion can be controlled with prescribed burning.

Estimating potential on disturbed sites: The shrubby vegetation and coarse, well-drained, mineral soils distinguish this from other high elevation riparian associations.

Rehabilitation pathways: Recovery of graminoids and forbs will be fairly rapid on trampled sites while recovery of shrubs will be slow. Hemlock, shrubs, graminoids, and forbs will slowly occupy fresh alluvium.

OTHER STUDIES

Red mountainheath occurs throughout the Pacific Northwest. Similar associations have been described in western Oregon and Washington by Vander Schaff (1978 and 1980), Henderson (1973), Kuramoto and Bliss (1970), Campbell (1977), Douglas (1972), Brooke and others (1970), Franklin and others (1973). Cole (1982) describes similar sites in the Eagle Cap Wilderness of northeast Oregon.

MISCELLANEOUS ASSOCIATIONS AND COMMUNITY TYPES

CONIFEROUS FOREST DOMINATED

Lodgepole pine/tufted hairgrass association (PICO/DECE) CLM1-15: Four plots were sampled at Big Marsh, McKenzie Pass, Klamath Point, and Swampy Lakes (Deschutes and Winema National Forests). The association occurs wherever lodgepole pine is invading tufted hairgrass meadows. The ground layer is dominated by tufted hairgrass. These stands are either isolated from or protected from recent grazing. In several cases elevations were too high for Kentucky bluegrass. Elsewhere, grazing and bedding activities appear to rapidly reduce the competitive ability of tufted hairgrass in favor of Kentucky bluegrass and the site will key to the **lodgepole pine/Kentucky bluegrass community type**. The **lodgepole pine/tufted hairgrass association** was not included in the keys and larger texts because of its limited area. Site and soils are as in the tufted hairgrass association.

Ponderosa pine-mixed conifer/Douglas spiraea-common snowberry association (PIPO-MC/SPDO-SYAL) CPS5-12: Plots were sampled on the Deschutes River and Shevlin Park (near Bend, Oregon) and Silver Creek (Fremont National Forest). This low-elevation association occurs on mesic floodplains at low elevations. Sites are similar to the **Ponderosa pine/common snowberry association** but are more mesic. Ponderosa pine and lodgepole pine usually dominate the tree layer. Western larch was common at Shevlin Park. Other conifers are scattered. The undergrowth is characterized by a dense shrub layer of Douglas spiraea and common snowberry. The rich herbaceous layer includes blue wildrye, western yarrow, broadpetal strawberry, and starry solomonplume. Soils are deep loams.

DECIDUOUS FOREST DOMINATED

Quaking aspen-lodgepole pine/Douglas spiraea/forb community type (POTR-PICO/SPDO/FORB) HQC1-11: Three plots were sampled in the Pumice-mantled Basin and Range Physiographic Area at Indian Creek, Meadow Creek, and a nearby drainage. Sites are on inactive floodplains in small, pumice-filled drainages at moderately low elevations (4600-5300 feet). Quaking aspen is dominant but the community type is successional to **lodgepole pine/Douglas spiraea/forb**. The herbaceous layer is dominated by forbs such as broadpetal strawberry, northern bedstraw, and starry solomonplume. Soils are pumice alluvium with surface textures that are loamy coarse sand to sandy loam.

Quaking aspen-lodgepole pine/bearberry community type (POTR-PICO/ARUV) HQC1-12: One plot was sampled on Chiloquin District, Winema National Forest. The community type is successional to the **lodgepole pine/bearberry association**. Quaking aspen and lodgepole pine are dominant. The undergrowth is dominated by bearberry. Golden currant is common while Douglas spiraea and bitterbrush are scattered. The scant herb layer includes nodding brome, bottlebrush squirreltail, Ross sedge, and northern bedstraw. Soils are coarse pumice alluvium with a weak A horizon.

Black cottonwood/widefruit sedge community type POTR2/CAEU) HCG1-11: One plot was sampled at Prairie Farm (Deschutes National Forest). The tree layer was dominated by highly productive cottonwood (142 feet tall in 100 years). Lodgepole pine and quaking aspen were scattered. The herb layer was dominated by widefruit sedge and starry solomonplume. The stand is successional to **lodgepole pine/widefruit sedge**. The wet basin site has a deep loam soil. The water table is at the soil surface in June and within 2 feet of the soil surface in September.

Black cottonwood/mountain alder/woolly sedge community type (POTR2/ALIN/CALA3) HCS1-11: One plot was sampled on floodplains adjacent to Dairy Creek (Fremont National Forest). This mid-seral community type is dominated by black cottonwood and mountain alder. Lodgepole pine is scattered. The herbaceous layer is dominated by woolly sedge. The site is successional to **lodgepole pine/aquatic sedge**. Soils are sandy loams deposited on stream-laid cobbles and gravels. Sites are flooded in May and June and the water table is within 2 feet of the soil surface in September.

Black cottonwood-Engelmann spruce/mountain alder-red-osier dogwood community type (POTR2-PIEN/ALIN-COST) HCC1-11: One plot was sampled on Cherry Creek (Winema National Forest). This community type occurs on active, water-worked soils with sandy-skeletal soils. They are often flooded in the spring while late summer levels may be below the rooting zone. Cottonwood dominates the overstory along with a scattering of conifers such as white fir or Engelmann spruce. The eventual climax is **Engelmann spruce/queencup beadlily**. The shrub layer is dominated by red-osier dogwood and other tall shrubs such as mountain alder, yellow willow, Sitka willow, or Scouler willow. Common snowberry is usually present. Herbaceous species include queencup beadlily, sweetscented bedstraw, and blue wildrye.

Black cottonwood/common snowberry/Kentucky bluegrass community type (POTR2/SYAL/POPR) HCS3-11: Three plots were sampled on the Ochoco National Forest. The tree layer is dominated by black cottonwood. Ponderosa pine, Douglas-fir, and/or quaking aspen are scattered. The community type is successional to the **ponderosa pine/common snowberry-floodplain association**. Snowberry dominated the undergrowth on two plots but had been completely eliminated by trampling on the third. The herb layer is dominated by a sward of Kentucky bluegrass. It lies on low elevation floodplains. Soils are deep, loamy alluvium.

SHRUB DOMINATED

Mountain alder bank association (ALIN BANK) SW22-14: Five plots were sampled at low to moderate elevation on moderate gradient floodplains and outwash fans along Squaw and Candle Creeks (Deschutes National Forest) and Silver and Sawmill Creeks (Ochoco National Forest). It has also been observed at Lake, Jack, and other creeks in the Low Flanks Cascades Physiographic Area where they descend through alluvial fans at the base of the Cascade Mountains. Sites seems to occur where larger streams become incised into the general floodplain or on sunny queencup **beadlily (mountain alder)** landforms. Thus, there is little opportunity for active channel shelf development and alder is restricted to the steep streambank. Mountain alder is dominant. Other shrubs include red-osier dogwood, sticky currant and willows. Vine maple is locally abundant on the Sisters District, Deschutes National Forest. Sedges and grasses are scattered. Common forbs include sweetscented bedstraw, largeleaved avens and cowparsnip. Soils are loamy sands to sandy loams.

Coyote willow association (SAEX) SW11-17: Four plots were sampled on floodplains along Emigrant Creek, N. Fk. Crooked River, and the S. Fk. John Day River (Ochoco National Forest). This association is abundant at low elevations but rarely extends very far into the National Forests. The tall shrub layer is dominated by coyote willow. Less common shrubs may include mountain or white alder, yellow, Lemmon, Booth, and Pacific willow, or red-osier dogwood. The herbaceous layer is quite variable and may include woolly sedge, small-fruit bulrush, common horsetail, Dutch rush, and field mint. Soils are skeletal.

Eastwood willow-undergreen willow/Holm's sedge association (SAEA-SACO2/CASC) SW11-21: Three plots were sampled at moderately high elevations in the vicinity of the Three Sisters and Mount Jefferson Wilderness Areas. Eastwood and/or undergreen willow (4-6 feet tall) dominate the shrub layer . Booth willows may also be present. The herbaceous layer is dominated by Holm's sedge. Sites are stream terraces. Soils are sandy loams on top of stream worked cobbles and gravels.

Eastwood willow-Booth willow/black alpine sedge association (SAEA-SABO/CANI2) SW11-22: Two plots were sampled at high elevations in the Three Sisters Wilderness Area. Sites are on glacial outwash floodplains on the west and north sides of Green Lakes. The low shrub layer (1 to 3 feet tall) is dominated by Eastwood and Booth willows and also includes red mountain-heath and alpine laurel. The sparse undergrowth is dominated by black alpine sedge but includes other high elevation plants such as Holm's sedge, Drummond rush, few-flowered spikerush, little elephanthead, timber pussytoes, tofieldia and broadleaf lupine. Soils are sandy skeletal.

Eastwood willow-undergreen willow association (SAEA-SACO2) SW11-20: Two plots were sampled at the edges of bogs at Pisgah Meadows (Ochoco National Forest) and in the Gearhart Mountain Wilderness Area (Fremont National Forest). Both plots lie on shrubby fringes of the **few-flowered spikerush association**. The site would include bog blueberry if not outside the geographic distribution of that species. The dwarf shrub layer (less than 3 feet tall) is dominated by either Eastwood or undergreen willow. Dwarfed bog birch may also be present. Herbs include aquatic sedge, few-flowered spikerush, common horsetail, bog saxifrage and longstalk clover. Soils are deep peat.

Willow/monkshood association (SALIX/ACCO) SW11-18: Three plots were sampled on the Fremont National Forest. It is locally abundant in wide floodplains and basins at higher elevations in the southern Warner Mountains but is rare elsewhere. The dense, tall shrub layer is dominated by Lemmon or Booth willow. Currants often grow under the willow canopy. Graminoids are scarce in the undergrowth. The forb layer includes monkshood, Oregon checkermallow, arrowleaf grounsel, starry solomonplume, longstalk clover and California falsehellebore. Soils are deep loams.

Willow/tufted hairgrass association (SALIX/DECA) SW11-19: One plot was sampled on the Ochoco National Forest. The site was on the moist end of tufted hairgrass distribution and Nebraska sedge was nearly codominant with hairgrass in the undergrowth. Microtopography was flat on a broad moist floodplain with organic loam soils. Two other stands were seen but not sampled. Both were in poor condition.

Douglas spiraea association (SPDO) SW41-13: Two plots were sampled in moderately high elevation shrub basins and intermittent streambeds in the Cascade Mountains. It appears to become more important west of the Cascades (personal observations). The dense shrub layer is dominated by Douglas spiraea. California dewberry, dwarf bramble, dwarf blueberry, or Sitka willow are scattered in the shrub layer. The scant herb layer includes species such as bluejoint reedgrass, Gray licoriceroot, arrowleaf groundsel, and longstalk clover. Soils are saturated in early summer, but water levels are very deep by late summer. Soil textures range from sandy skeletal loam to loam.

Douglas hawthorn association (CRDO) SW31-11: One plot was sampled on the floodplains of the Metolius River (Deschutes National Forest). The association is scattered on the Ochoco National Forest and becomes common eastward. Douglas hawthorn forms a tall shrub layer. Common snowberry and woods rose are also present. Graminoids include woolly, widefruit, and bigleaf sedges, and Kentucky bluegrass. Forbs included cowparsnip, hedgenettle, common horsetail, starry solomonplume, sweetscented bedstraw, and meadowrue. Soils are deep, moist, fine textured alluvium.

Mixed shrub canyon bottoms association (SHRUB BOTTOMS) SM39-11: Four plots were sampled in or near the Fremont National Forest. In general the association occurs in low elevation canyons,

mostly below Forest Service ownership. Tall shrubs include common chokecherry, serviceberry, woods rose, red-osier dogwood, various willows, Klamath plum, and/or mountain alder. Low shrubs include Douglas spiraea, common snowberry, and various currants. The undergrowth is variable but sparse. Soils are skeletal sands mixed with tallus or cobbles.

GRAMINOID DOMINATED

Bluejoint reedgrass association (CACA) GM41-11: Three plots were sampled in small basins and drainages at moderately high elevations in the Cascade Mountains. The ground layer is dominated by bluejoint reedgrass. Other graminoids include blue wildrye and meadow barley. Forbs include arrowleaf groundsel and longstalk clover. Soils are shallow organic loams over deep loamy subsoils.

Blue wildrye association (ELGL) GM41-12: Three plots were sampled at Evening Creek and Mountain Lakes Wilderness (Winema National Forest) and Gearhart Mountain (Fremont National Forest). Sites are dry floodplains and basins at moderate elevations. Blue wildrye is the dominant graminoid. Other graminoids include bluejoint reedgrass, nodding brome, meadow barley, and thickheaded sedge. Forbs include western yarrow, broadpetal strawberry, California falsehellebore, Gray licoriceroot, arrowleaf groundsel, and starry solomonplume. Soils are deep loams that are saturated at snow melt but droughty by mid to late summer. On the Ochoco National Forest, dry headwaters basins may have supported this association but are now converted to domestic grasses.

Green-fruited sedge association (CAIN3) MW19-25: Two sample plots were located in wet, subalpine basins and meadows in the Three Sisters and Mount Jefferson Wilderness Areas (Deschutes National Forest). Elevations appear to be above the limits of closely related sedges such as widefruit and Sitka sedge. Sites are more permanently water saturated than the **Holm's sedge association**. Soils are sedge peats.

Nevada rush association (JUNE) MW39-11: Four plots were sampled at Lake of the Woods, Hog Creek, and an unnamed bog near the Mountain Lakes Wilderness Area (Winema National Forest) and Little Cultus Lake (Deschutes National Forest). Sites appear to be shallow ice worked shores of ponds and lakes and, occasionally, swales. Nevada rush dominates the herbaceous layer. Other graminoids include inflated sedge and Baltic rush. Forbs are mostly aquatics and include bladderworts, pondweeds, buckbean, and orange arnica. Soils are sedimentary and sedge peats or organic loam.

Baltic rush community type (JUBA2) MW39-12: Seven plots were sampled near the marsh by the old Grasslands headquarters, Big Summit Prairie, Carol Meadows, and Marks Creek Pass (Ochoco National Forest) and at Foster Field and an unnamed playa near Louse Lake (Fremont National Forest). Sites are moist portions of highly disturbed meadows where Baltic rush has replaced associations such as **tufted hairgrass, woolly sedge, aquatic sedge, and inflated sedge**. Very degraded **Kentucky bluegrass** and **Nebraska sedge community types** are replaced by the **Baltic rush community type**. Vegetative composition is inconsistent except for dominance by Baltic rush.

FORB DOMINATED

California falsehellebore community type (VECA) FW51-21: This community type is found throughout central Oregon but is especially abundant on the Fremont National Forest. Sites with a high percent of ground cover in falsehellebore often indicates degraded rangeland. Heavy livestock grazing has reduced the competitive ability of natural dominants in favor of California falsehellebore and other herbs. Common grasses include bluejoint reedgrass, blue wildrye, and Kentucky bluegrass. The forb component includes longstalk cover, sticky starwort, mountain bluebell, sweetroot, and meadowrue. Soils are very deep organic and clay loams. The community type seems to be especially dominant on meadows once dominated by **quaking aspen/blue wildrye, blue wildrye, and bluejoint reedgrass**. The Fremont National Forest may wish to recognize this as a major disturbance type.

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APPENDICES

APPENDIX A: NUMBER OF SAMPLE PLOTS BY ASSOCIATION OR COMMUNITY TYPE AND VICINITY IN CENTRAL OREGON *

D = DESCHUTES NATIONAL FOREST
F = FREMONT NATIONAL FOREST
O = OCHOCO NATIONAL FOREST
W = WINEMA NATIONAL FOREST

U = STATUS UNKNOWN
I = RARELY OCCURS IN MORE THAN A FEW LOCATIONS (INFREQUENT)
C = (COMMON) SCATTERED THROUGHOUT AN AREA BUT SELDOM DESCRIBING LARGE UNITS OF VEGETATION
M = (MAJOR) EXTENSIVE ACRES OF VEGETATION

ASSOCIATION OR COMMUNITY TYPE	VICINITY				
	D	F	O	W	TOTAL
Coniferous forest dominated					
Ponderosa pine/common snowberry-floodplain	6 C	1 I	10 M	. I	17
Lodgepole pine/Kentucky bluegrass	. I	2 M	1 C	5 M	8
Lodgepole pine/bearberry	4 M	. C	.	3 M	7
Lodgepole pine/Douglas spiraea/forb	1 M	4 C	.	4 M	9
Lodgepole pine/Douglas spiraea/widefruit sedge	6 M	. I	.	4 M	10
Lodgepole pine/bog blueberry/forb	2 C	.	.	5 C	7
Lodgepole pine/bog blueberry/widefruit sedge	2 C	.	.	5 C	7
Lodgepole pine/widefruit sedge	2 C	.	.	6 M	8
Lodgepole pine/aquatic sedge	.	4 M	1 I	.	5
Lodgepole pine-Engelmann spruce/ few-flowered spikerush	. M	3 I	1 I	1 C	5
White fir/queencup beadlily	5 C	2 C	3 C	4 C	14
Engelmann spruce/queencup beadlily	13 M	.	2 C	11 M	26
Engelmann spruce/bog blueberry/forb	3 M	.	.	1 M	4
Engelmann spruce/bog blueberry/ widefruit sedge	3 C	.	.	2 C	5
Engelmann spruce/widefruit sedge	8 M	.	.	2 C	10
Engelmann spruce/common horsetail-twistedstalk	2 I	.	.	4 C	6
	57	16	18	57	148
Deciduous forest dominated					
Quaking aspen/common snowberry/blue wildrye	2 C	2 C	3 C	1 I	8
Quaking aspen/blue wildrye	1 I	9 C	2 C	1 I	13
Quaking aspen-lodgepole pine/ Douglas spiraea/widefruit sedge	3 C	.	.	3 C	6
	6	11	5	5	27
Shrub dominated					
Sagebrush/Cusick bluegrass	.	4 M	2 M	.	6
Mountain alder	2 C	3 C	3 C	1 C	9
Mountain alder-common snowberry	2 I	2 I	5 M	. I	9
Mountain alder-Douglas spiraea	5 M	3 C	2 I	3 M	13
Mountain alder springs	1 C	1 C	4 C	. C	6
Willow/Kentucky bluegrass	. I	5 M	2 M	. I	7
Willow/woolly sedge	.	2 M	5 M	.	7
Willow/widefruit sedge	13 M	2 I	.	4 M	19
Willow/aquatic sedge	.	6 M	. I	.	6
Willow/Sitka sedge	8 M	1 I	.	2 I	11
Willow/beaked sedge	1 I	. U	5 I	. U	6
Bog blueberry/Sitka sedge	5 M	.	.	2 M	7
Bog blueberry/few-flowered spikerush	7 M	. I	. I	3 M	10
	44	29	28	15	116

APPENDIX A (cont.)

D = DESCHUTES NATIONAL FOREST
F = FREMONT NATIONAL FOREST
O = OCHOCO NATIONAL FOREST
W = WINEMA NATIONAL FOREST

U = STATUS UNKNOWN
I = RARELY OCCURS IN MORE THAN A FEW LOCATIONS (INFREQUENT)
C = (COMMON) SCATTERED THROUGHOUT AN AREA BUT SELDOM DESCRIBING LARGE UNITS OF VEGETATION
M = (MAJOR) EXTENSIVE ACRES OF VEGETATION

ASSOCIATION OR COMMUNITY TYPE	VICINITY				
	D	F	O	W	TOTAL
Graminoid dominated					
Cusick bluegrass	.	1 I	.	5 M	6
Kentucky bluegrass	1 I	2 M	2 M	3 M	8
Tufted hairgrass	10 M	4 M	2 M	14 M	30
Woolly sedge	.	3 C	5 C	1 I	9
Slender sedge	4 I	.	.	1 I	5
Nebraska sedge	. I	1 M	6 M	2 C	9
Widefruit sedge	8 M	1 I	.	4 M	13
Aquatic sedge	.	6 M	1 C	.	7
Short-beaked sedge	2 I	2 I	2 I	1 I	7
Few-flowered spikerush	9 M	5 I	2 I	4 M	20
Small-fruit bulrush	6 C	4 C	10 M	2 C	22
Sitka sedge	11 M	.	.	3 I	14
Inflated sedge	2 C	3 C	4 C	11 M	20
Beaked sedge	13 M	4 C	7 C	3 C	27
Creeping spikerush	1 C	2 C	4 C	. U	7
	67	38	45	54	204
Forb dominated					
Queencup beadlily (mountain alder)	4 C	1 C	10 M	1 C	16
Arrowleaf groundsel	8 M	2 I	1 I	7 M	18
	12	3	11	8	34
High elevation					
Brewer sedge	4 C	.	.	. I	4
Black alpine sedge	16 M	.	.	. U	16
Holm's sedge-black alpine sedge-tufted hairgrass	13 M	.	.	. U	13
Holm's sedge	11 M	. I	.	. U	11
Red mountainheath	13 M	.	.	. U	13
	57				57
Miscellaneous Associations and Communities					51
Total plots used to develop the classication					637

* This table is not meant to represent proportions of acre distribution on the National Forests and refers to sample plot distribution only.

APPENDIX B: CONSTANCY AND AVERAGE COVER OF IMPORTANT RIPARIAN ZONE PLANTS IN CENTRAL OREGON

Constancy is the Percent of Plots in Which the Species Occured
Average Canopy Cover ( ) is Calculated for all Plots in each Association or Community Type

Association		PIPO/ SYAL-FLOOD	PICO/ POPR	PICO/ ARUV	PICO/ SPDO/ FORB	PICO/ SPDO/ CAEU	PICO/ VAOC2/ FORB	PICO/ VAOC2/ CAEU
Number of Plots		17	8	7	9	10	7	7
Trees		10(55)	10(61)	10(41)	10(69)	10(64)	10(50)	10(57)
Douglas-fir	(PSME)	4(10)	.....	.....	.....	.....	.....	.....
Engelmann spruce	(PIEN)	.....	.....	.....	1(1)	2(1)	1(t)	.....
Lodgepole pine	(PICO)	1(2)	10(60)	10(41)	10(61)	10(53)	10(47)	10(57)
Ponderosa pine	(PIPO)	10(33)	3(t)	.....	3(1)	1(t)	.....	.....
Quaking aspen	(POTR)	1(t)	1(t)	.....	2(1)	3(10)	.....	1(t)
Mountain hemlock	(TSME)	.....	.....	.....	1(t)	.....	3(1)	.....
Subalpine fir	(ABLA)	.....	.....	.....	.....	2(t)	3(1)	.....
White fir	(ABCO X ABGR)	4(3)	1(t)	.....	4(3)	2(t)	4(1)	.....
Shrubs		10(50)	9(3)	10(35)	10(57)	10(49)	10(60)	10(62)
Bearberry	(ARUV)	.....	4(1)	10(25)	7(7)	3(3)	3(3)	1(1)
Big sagebrush	(ARTR)	.....	1(t)	.....	.....	.....	.....	.....
Bog birch	(BEGL)	.....	.....	.....	1(t)	3(2)	.....	3(8)
Booth willow	(SABO)	.....	.....	.....	.....	6(5)	.....	1(t)
Bog blueberry	(VAOC2)	.....	.....	.....	2(t)	1(t)	10(28)	10(31)
Common snowberry	(SYAL)	10(32)	.....	.....	3(5)	1(t)	.....	.....
Douglas spiraea	(SPDO)	2(1)	.....	6(3)	10(38)	10(25)	9(19)	9(15)
Eastwood willow	(SAEA)	.....	.....	.....	.....	.....	.....	.....
Geyer willow	(SAGE)	1(t)	1(t)	2(t)	.....	6(4)	.....	9(7)
Lemmon willow	(SALE)	1(t)	.....	.....	1(t)	6(6)	.....	.....
Mountain alder	(ALIN)	3(1)	1(t)	.....	1(1)	.....	.....	.....
Prickly currant	(RILA)	1(t)	1(t)	.....	6(1)	3(2)	.....	4(1)
Red mountainheath	(PHEM)	.....	.....	.....	.....	.....	.....	.....
Silver sagebrush	(ARCA)	.....	1(t)	.....	.....	.....	.....	.....
Undergreen willow	(SACO2)	.....	.....	.....	.....	.....	.....	.....
Grasses		10(19)	10(50)	10(4)	10(7)	10(11)	10(13)	10(4)
Blue wildrye	(ELGL)	6(2)	4(1)	.....	7(2)	6(3)	3(1)	3(1)
Cusick bluegrass	(POCU)	.....	3(1)	.....	.....	.....	.....	.....
Kentucky bluegrass	(POPR)	8(11)	10(37)	.....	3(1)	7(3)	1(t)	1(t)
Reedgrassses	(CACA and CANE3)	.....	1(t)	.....	1(t)	3(t)	7(7)	7(1)
Tufted hairgrass	(DECE)	.....	1(t)	.....	1(t)	1(1)	6(1)	3(1)
Sedges and Rushes		9(6)	9(8)	6(1)	8(1)	10(20)	7(1)	10(26)
Aquatic sedge	(CAAQ)	.....	1(t)	.....	.....	.....	.....	.....
Baltic rush	(JUBA2)	.....	8(2)	4(1)	3(1)	6(1)	1(t)	4(1)
Beaked sedge	(CARO2)	.....	.....	.....	.....	.....	.....	1(1)
Bigleaf sedge	(CAAM)	.....	.....	.....	.....	.....	.....	.....
Black alpine sedge	(CANI2)	.....	.....	.....	.....	.....	.....	.....
Brewer sedge	(CABR)	.....	.....	.....	.....	.....	.....	.....
Creeping spikerush	(ELPA)	.....	.....	.....	.....	.....	.....	.....
Drummond rush	(JUDR)	.....	.....	.....	.....	.....	.....	.....
Few-flowered spikerush	(ELPA2)	.....	.....	.....	.....	.....	2(1)	1(1)

Association		PIPO/ SYAL-FLOOD	PICO/ POPR	PICO/ ARUV	PICO/ SPDO/ FORB	PICO/ SPDO/ CAEU	PICO/ VAOC2/ FORB	PICO/ VAOC2/ CAEU
Number of Plots		17	8	7	9	10	7	7
Holm's sedge	(CASC5)	.....	.....	.....	1(t)	.....	2(3)	1(2)
Inflated sedge	(CAVE)	.....	.....	.....	.....	1(1)	.....	.....
Nebraska sedge	(CANE)	.....	3(1)	.....	.....	.....	.....	.....
Nevada rush	(JUNE)	.....	.....	.....	.....	.....	.....	.....
Short-beaked sedge	(CASI2)	.....	.....	.....	.....	.....	2(1)	1(1)
Sitka sedge	(CASI3)	.....	.....	.....	.....	.....	.....	.....
Slender sedge	(CALA4)	.....	.....	.....	.....	.....	.....	.....
Small-fruit bulrush	(SCMI)	.....	.....	.....	.....	.....	.....	.....
Widefruit sedge	(CAEU)	2(1)	3(4)	.....	2(t)	9(14)	4(1)	10(25)
Woolly sedge	(CALA3)	2(t)	.....	.....	1(t)	2(5)	.....	1(t)
Forbs		10(26)	10(36)	10(17)	10(26)	10(26)	10(15)	10(8)
Alpine aster	(ASAL)	.....	.....	.....	.....	.....	.....	.....
Alpine mitella	(MIPE)	.....	.....	.....	.....	1(t)	.....	.....
Alpine pussytoes	(ANAL)	.....	.....	.....	.....	.....	.....	.....
Alpine willoweed	(EPAL)	.....	.....	.....	.....	.....	.....	.....
Arrowleaf groundsel	(SETR)	.....	.....	.....	1(t)	.....	1(1)	.....
Bog saxafrage	(SAOR)	.....	.....	.....	.....	1(t)	.....	3(1)
Bog St. Johnswort	(HYAN)	.....	.....	.....	.....	.....	.....	1(t)
Broadpetal strawberry	(FRVI)	7(2)	10(5)	10(3)	9(5)	9(4)	3(1)	10(2)
Calif. falsehellebore	(VECA)	.....	.....	.....	.....	1(t)	.....	.....
Claspleaf twistedstalk	(STAM)	.....	.....	.....	.....	.....	.....	.....
Common horsetail	(EQAR)	2(1)	3(1)	.....	1(t)	3(t)	.....	3(t)
Elephanthead	(PEGR)	.....	.....	.....	.....	.....	.....	1(t)
Enchanter's nightshade	(CIAL)	.....	1(t)	.....	.....	.....	.....	.....
Glabrate monkeyflower	(MIGU)	.....	.....	.....	.....	2(t)	.....	1(t)
Gray licoriceroot	(LIGR)	1(t)	1(t)	.....	2(t)	.....	4(1)	.....
Lady-fern	(ATHYR)	.....	.....	.....	.....	.....	.....	.....
Largeleaved avens	(GEMA)	1(t)	3(t)	.....	2(t)	4(1)	.....	1(t)
Longstalk clover	(TRLO)	1(t)	8(8)	4(2)	6(6)	5(3)	6(4)	1(t)
Meadowrue	(THALI)	5(2)	1(t)	.....	3(1)	1(t)	.....	.....
Monkshood	(ACCO)	.....	.....	.....	1(t)	.....	.....	.....
Northern bedstraw	(GABO)	6(2)	1(t)	.....	7(2)	4(1)	3(2)	1(t)
Northwest cinquefoil	(POGR)	3(1)	9(3)	.....	2(t)	5(1)	3(t)	.....
Primrose monkeyflower	(MIPR)	.....	.....	.....	.....	.....	1(t)	1(t)
Queencup beadlily	(CLUN)	.....	.....	.....	.....	.....	3(1)	.....
Rosy pussytoes	(ANMI)	1(t)	5(3)	10(2)	1(t)	.....	3(2)	.....
Rosy twistedstalk	(STRO)	.....	.....	.....	.....	.....	.....	.....
Small bedstraw	(GATRI)	.....	.....	.....	.....	2(t)	.....	3(t)
Starry solomonplume	(SMST)	7(2)	3(1)	.....	7(1)	8(3)	.....	1(t)
Sweetroot	(OSMOR)	8(2)	3(t)	.....	4(1)	3(1)	.....	.....
Sweetscented bedstraw	(GATR)	4(2)	3(1)	.....	2(t)	2(t)	.....	.....
Watson's willoweed	(EPWA)	.....	.....	.....	.....	2(t)	.....	1(t)
Western aster	(ASOC)	2(t)	4(1)	6(1)	1(t)	3(1)	1(t)	.....
Western St.Johnswort	(HYFO)	1(t)	.....	.....	1(t)	5(1)	.....	1(t)
Western yarrow	(ACMI)	8(2)	6(4)	.....	9(2)	3(1)	3(1)	.....
Moss (Sphagnum and others)		5(3)	5(3)	5(2)	1(2)	2(3)	9(14)	10(21)

Code to constancy values: 1 = 5-15%. 2 = 15-25%. 3 = 25-35%. 4 = 35-45%. 5 = 45-55%. 6 = 55-65%. 7 = 65-75%. 8 = 75-85%. 9 = 85-95%. 10 = 95-100%

APPENDIX B (cont.)

Association		PICO/ CAEU	PICO/ CAAQ	PICO-PIEN/ ELPA2	ABCO/ CLUN	PIEN/ CLUN	PIEN/ VAOC2/ FORB	PIEN/ VAOC2/ CAEU
Number of Plots		8	5	5	14	26	4	5
Trees		10(64)	10(61)	10(42)	10(80)	10(72)	10(61)	10(47)
Douglas-fir	(PSME)	1(t)	.....	.....	6(15)	2(1)	.....	.....
Engelmann spruce	(PIEN)	.....	.....	2(1)	3(3)	10(43)	10(22)	10(30)
Lodgepole pine	(PICO)	10(61)	10(61)	10(39)	4(3)	5(11)	10(33)	8(15)
Ponderosa pine	(PIPO)	1(t)	2(t)	.....	4(2)	1(1)	.....	.....
Quaking aspen	(POTR)	1(2)	2(t)	.....	1(t)	.....	.....	.....
Mountain hemlock	(TSME)	.....	.....	.....	3(7)	5(5)	5(2)	.....
Subalpine fir	(ABLA)	.....	.....	.....	.....	3(8)	8(7)	4(3)
White fir	(ABCO AND ABGR)	.....	4(1)	.....	10(44)	7(7)	3(t)	.....
Shrubs		8(10)	10(6)	10(24)	10(28)	10(29)	10(63)	10(35)
Bearberry	(ARUV)	4(1)	.....	.....	.....	.....	3(t)	.....
Big sagebrush	(ARTR)	.....	.....	.....	.....	.....	.....	.....
Bog birch	(BEGL)	4(1)	2(1)	10(10)	.....	.....	.....	2(1)
Booth willow	(SABO)	1(t)	2(t)	2(1)	.....	.....	.....	4(2)
Bog blueberry	(VAOC2)	3(1)	.....	4(5)	.....	.....	10(32)	10(18)
Common snowberry	(SYAL)	.....	.....	.....	6(2)	.....	3(1)	.....
Douglas spiraea	(SPDO)	6(4)	.....	2(t)	1(t)	.....	10(8)	8(4)
Eastwood willow	(SAEA)	.....	.....	4(5)	.....	.....	.....	.....
Geyer willow	(SAGE)	8(4)	2(1)	8(2)	.....	.....	.....	4(1)
Lemmon willow	(SALE)	.....	2(t)	2(t)	.....	.....	.....	2(3)
Mountain alder	(ALIN)	.....	2(t)	.....	3(1)	2(t)	.....	.....
Prickly currant	(RILA)	2(t)	6(2)	.....	6(6)	4(2)	3(1)	2(t)
Red mountainheath	(PHEM)	.....	.....	.....	.....	.....	.....	.....
Silver sagebrush	(ARCA)	.....	.....	.....	.....	.....	.....	.....
Undergreen willow	(SACO2)	.....	.....	2(1)	.....	.....	.....	2(t)
Grasses		10(30)	10(22)	10(7)	8(4)	7(4)	10(5)	10(8)
Blue wildrye	(ELGL)	5(2)	6(2)	2(t)	4(2)	3(1)	3(2)	2(t)
Cusick bluegrass	(POCU)	.....	.....	.....	.....	.....	.....	.....
Kentucky bluegrass	(POPR)	10(10)	6(4)	.....	.....	.....	.....	.....
Reedgrassses	(CACA and CANE3)	6(13)	.....	2(1)	.....	.....	3(1)	10(4)
Tufted hairgrass	(DECE)	5(1)	6(2)	8(4)	.....	.....	3(t)	6(1)
Sedges and Rushes		10(41)	10(40)	10(50)	2(t)	5(1)	5(2)	10(65)
Aquatic sedge	(CAAQ)	.....	10(24)	8(8)	.....	.....	.....	.....
Baltic rush	(JUBA2)	6(2)	4(1)	2(1)	.....	1(t)	.....	.....
Beaked sedge	(CARO2)	3(1)	2(1)	2(t)	.....	.....	.....	2(3)
Bigleaf sedge	(CAAM)	.....	.....	.....	.....	.....	.....	.....
Black alpine sedge	(CANI2)	.....	.....	.....	.....	.....	.....	.....
Brewer sedge	(CABR)	.....	.....	.....	.....	.....	.....	.....
Creeping spikerush	(ELPA)	.....	.....	.....	.....	.....	.....	.....
Drummond rush	(JUDR)	.....	2(1)	.....	.....	.....	.....	.....
Few-flowered spikerush	(ELPA2)	.....	.....	10(18)	.....	.....	.....	4(2)
Holm's sedge	(CASC5)	.....	.....	4(2)	.....	.....	.....	4(11)
Inflated sedge	(CAVE)	1(t)	2(4)	2(t)	.....	.....	.....	.....
Nebraska sedge	(CANE)	.....	2(2)	.....	.....	.....	.....	.....

Association		PICO/ CAEU	PICO/ CAAQ	PICO-PIEN/ ELPA2	ABCO/ CLUN	PIEN/ CLUN	PIEN/ VAOC2/ FORB	PIEN/ VAOC2/ CAEU
Number of Plots		8	5	5	14	26	4	5
Nevada rush	(JUNE)	3(1)	6(1)	4(1)	.....	.....	.....	.....
Short-beaked sedge	(CASI2)	1(t)	.....	4(4)	.....	.....	.....	.....
Sitka sedge	(CASI3)	1(t)	.....	.....	.....	.....	.....	6(3)
Slender sedge	(CALA4)	.....	.....	.....	.....	.....	.....	.....
Small-fruit bulrush	(SCMI)	1(t)	2(t)	4(1)	.....	.....	.....	.....
Widefruit sedge	(CAEU)	10(33)	.....	2(3)	1(t)	2(t)	5(2)	8(33)
Woolly sedge	(CALA3)	4(2)	4(5)	.....	....	.....	.....	.....
Forbs		10(24)	10(27)	10(28)	10(24)	10(33)	10(15)	10(21)
Alpine aster	(ASAL)	.....	.....	.....	.....	.....	.....	.....
Alpine mitella	(MIPE)	.....	2(t)	2(t)	4(1)	4(1)	.....	2(t)
Alpine pussytoes	(ANAL)	.....	.....	.....	.....	.....	.....	.....
Alpine willoweed	(EPAL)	.....	.....	8(1)	.....	.....	.....	.....
Arrowleaf groundsel	(SETR)	1(t)	2(t)	4(t)	2(t)	4(1)	3(1)	4(1)
Bog saxafrage	(SAOR)	1(t)	4(t)	8(4)	.....	.....	.....	2(1)
Bog St. Johnswort	(HYAN)	.....	.....	4(1)	.....	.....	3(t)	4(1)
Broadpetal strawberry	(FRVI)	8(3)	4(3)	8(2)	3(1)	5(1)	5(2)	4(1)
Calif. falsehellebore	(VECA)	1(t)	4(1)	4(1)	2(t)	2(t)	.....	4(t)
Claspleaf twistedstalk	(STAM)	.....	.....	.....	3(t)	3(2)	3(1)	.....
Common horsetail	(EQAR)	1(t)	4(4)	6(1)	.....	2(1)	3(1)	8(2)
Elephanthead	(PEGR)	.....	4(t)	8(3)	.....	.....	.....	.....
Enchanter's nightshade	(CIAL)	.....	.....	.....	2(t)	1(t)	.....	.....
Glabrate monkeyflower	(MIGU)	4(2)	4(t)	4(1)	.....	1(t)	.....	.....
Gray licoriceroot	(LIGR)	.....	8(3)	4(t)	.....	2(t)	8(2)	4(1)
Lady-fern	(ATHYR)	.....	.....	.....	3(1)	2(2)	.....	.....
Largeleaved avens	(GEMA)	8(1)	6(1)	4(1)	1(t)	1(t)	.....	.....
Longstalk clover	(TRLO)	5(4)	10(7)	10(4)	.....	4(4)	8(2)	4(3)
Meadowrue	(THALI)	3(t)	.....	.....	1(t)	.....	.....	.....
Monkshood	(ACCO)	.....	2(t)	.....	2(1)	2(1)	.....	4(1)
Northern bedstraw	(GABO)	3(1)	4(1)	.....	1(t)	1(t)	3(1)	.....
Northwest cinquefoil	(POGR)	5(1)	6(1)	.....	.....	.....	.....	.....
Primrose monkeyflower	(MIPR)	1(t)	.....	6(1)	.....	1(t)	.....	4(1)
Queencup beadlily	(CLUN)	.....	.....	.....	7(2)	10(5)	8(2)	4(1)
Rosy pussytoes	(ANMI)	3(t)	.....	.....	.....	.....	3(t)	.....
Rosy twistedstalk	(STRO)	.....	.....	.....	2(t)	4(3)	3(t)	.....
Small bedstraw	(GATRI)	5(1)	4(1)	2(t)	.....	.....	.....	4(1)
Starry solomonplume	(SMST)	4(3)	2(1)	.....	8(3)	5(3)	5(1)	.....
Sweetroot	(OSMOR)	4(1)	.....	.....	8(1)	7(1)	5(1)	.....
Sweetscented bedstraw	(GATR)	1(1)	.....	.....	8(2)	5(1)	.....	.....
Watson's willoweed	(EPWA)	5(1)	2(t)	.....	.....	.....	.....	5(1)
Western aster	(ASOC)	5(1)	2(t)	2(t)	.....	1(t)	3(t)	.....
Western St.Johnswort	(HYFO)	3(1)	.....	.....	.....	.....	.....	.....
Western yarrow	(ACMI)	6(1)	10(2)	2(t)	3(t)	2(t)	3(1)	2(t)
Moss (Sphagnum and others)		9(7)	8(14)	10(50)	7(10)	7(9)	8(22)	10(48)

Code to constancy values: 1 = 5-15%. 2 = 15-25%. 3 = 25-35%. 4 = 35-45%. 5 = 45-55%. 6 = 55-65%. 7 = 65-75%. 8 = 75-85%. 9 = 85-95%. 10 = 95-100%

APPENDIX B (cont.)

Association		PIEN/ CAEU	PIEN/ EQAR-STREP	POTR/ SYAL/ ELGL	POTR/ ELGL	POTR-PICO/ SPDO/ CAEU	ARTR-ARCA/ POCU	ALIN
Number of Plots		10	6	8	13	6	6	9
Trees		10(72)	10(64)	10(70)	10(86)	10(95)	5(1)	4(8)
Douglas-fir	(PSME)	.....	.....	1(t)	1(t)	.....	.....	.....
Engelmann spruce	(PIEN)	10(42)	8(36)	.....	.....	.....	.....	1(1)
Lodgepole pine	(PICO)	9(32)	3(3)	4(2)	5(10)	8(32)	5(1)	1(t)
Ponderosa pine	(PIPO)	.....	.....	6(13)	7(2)	3(1)	.....	1(1)
Quaking aspen	(POTR)	.....	.....	10(55)	10(72)	10(60)	.....	.....
Mountain hemlock	(TSME)	1(t)	.....	.....	.....	.....	.....	.....
Subalpine fir	(ABLA)	2(3)	3(13)	.....	.....	.....	.....	.....
White fir	(ABCO AND ABGR)	2(t)	7(14)	5(8)	5(4)	3(t)	.....	3(1)
Shrubs		10(8)	10(12)	10(44)	9(2)	10(46)	10(24)	10(66)
Bearberry	(ARUV)	.....	.....	.....	1(t)	2(t)	.....	.....
Big sagebrush	(ARTR)	.....	.....	.....	.....	.....	8(13)	.....
Bog birch	(BEGL)	1(t)	.....	.....	.....	.....	.....	.....
Booth willow	(SABO)	.....	.....	.....	.....	.....	.....	1(t)
Bog blueberry	(VAOC2)	8(3)	.....	.....	.....	.....	.....	.....
Common snowberry	(SYAL)	2(t)	.....	10(41)	1(t)	2(2)	.....	6(1)
Douglas spiraea	(SPDO)	5(1)	3(1)	1(t)	1(t)	10(30)	.....	1(t)
Eastwood willow	(SAEA)	.....	.....	.....	.....	.....	.....	.....
Geyer willow	(SAGE)	.....	.....	.....	.....	8(3)	.....	1(1)
Lemmon willow	(SALE)	3(2)	.....	.....	.....	7(2)	.....	.....
Mountain alder	(ALIN)	1(t)	5(3)	.....	1(t)	.....	.....	10(66)
Prickly currant	(RILA)	3(1)	5(1)	3(1)	4(1)	2(t)	.....	4(1)
Red mountainheath	(PHEM)	.....	.....	.....	.....	.....	.....	.....
Silver sagebrush	(ARCA)	.....	.....	.....	.....	.....	7(10)	.....
Undergreen willow	(SACO2)	.....	1(t)	.....	.....	.....	.....	.....
Grasses		10(9)	7(22)	10(19)	9(36)	10(10)	10(28)	9(19)
Blue wildrye	(ELGL)	2(t)	3(1)	8(10)	6(15)	8(6)	.....	4(2)
Cusick bluegrass	(POCU)	.....	.....	.....	.....	.....	10(17)	.....
Kentucky bluegrass	(POPR)	2(t)	.....	5(5)	5(9)	10(2)	2(1)	3(1)
Reedgrassses	(CACA and CANE3)	3(3)	5(3)	.....	.....	.....	.....	1(t)
Tufted hairgrass	(DECE)	4(2)	3(t)	.....	1(t)	3(1)	.....	.....
Sedges and Rushes		10(40)	10(22)	6(3)	9(3)	10(20)	10(8)	10(18)
Aquatic sedge	(CAAQ)	.....	.....	.....	2(t)	.....	.....	.....
Baltic rush	(JUBA2)	2(1)	.....	.....	.....	7(1)	8(2)	.....
Beaked sedge	(CARO2)	2(2)	.....	.....	.....	.....	.....	.....
Bigleaf sedge	(CAAM)	.....	.....	1(t)	.....	.....	.....	4(4)
Black alpine sedge	(CANI2)	.....	.....	.....	.....	.....	.....	.....
Brewer sedge	(CABR)	.....	.....	.....	.....	.....	.....	.....
Creeping spikerush	(ELPA)	.....	.....	.....	.....	.....	.....	.....
Drummond rush	(JUDR)	.....	3(t)	.....	.....	.....	.....	.....
Few-flowered spikerush	(ELPA2)	1(t)	2(t)	.....	.....	.....	.....	.....
Holm's sedge	(CASC5)	1(5)	3(1)	.....	.....	.....	.....	1(t)
Inflated sedge	(CAVE)	.....	3(1)	.....	.....	.....	.....	.....
Nebraska sedge	(CANE)	.....	.....	.....	.....	2(t)	.....	1(t)

Association		PIEN/ CAEU	PIEN/ EQAR-STREP	POTR/ SYAL/ ELGL	POTR/ ELGL	POTR-PICO/ SPDO/ CAEU	ARTR-ARCA/ POCU	ALIN
Number of Plots		10	6	8	13	6	6	9
Nevada rush	(JUNE)	.....	2(t)	.....	1(t)	.....	.....	.....
Short-beaked sedge	(CASI2)	.....	.....	.....	1(t)	.....	.....	.....
Sitka sedge	(CASI3)	1(1)	2(1)	.....	.....	.....	.....	.....
Slender sedge	(CALA4)	.....	.....	.....	.....	.....	.....	.....
Small-fruit bulrush	(SCMI)	1(1)	7(10)	.....	1(t)	.....	.....	7(4)
Widefruit sedge	(CAEU)	10(31)	3(3)	.....	.....	10(20)	.....	1(4)
Woolly sedge	(CALA3)	1(t)	.....	.....	1(t)	.....	.....	1(t)
Forbs		10(24)	10(60)	10(30)	10(49)	10(24)	10(22)	10(40)
Alpine aster	(ASAL)	.....	.....	.....	.....	.....	.....	.....
Alpine mitella	(MIPE)	4(1)	7(1)	.....	.....	.....	.....	1(T)
Alpine pussytoes	(ANAL)	.....	.....	.....	.....	.....	.....	.....
Alpine willoweed	(EPAL)	1(t)	3(1)	.....	.....	.....	.....	.....
Arrowleaf groundsel	(SETR)	5(1)	7(1)	.....	.....	.....	.....	3(1)
Bog saxafrage	(SAOR)	1(t)	.....	.....	.....	.....	.....	.....
Bog St. Johnswort	(HYAN)	2(2)	.....	.....	.....	.....	.....	.....
Broadpetal strawberry	(FRVI)	7(2)	2(t)	1(t)	2(2)	8(3)	.....	2(t)
Calif. falsehellebore	(VECA)	1(t)	2(t)	4(3)	6(8)	.....	.....	.....
Claspleaf twistedstalk	(STAM)	4(t)	3(1)	.....	.....	.....	.....	1(t)
Common horsetail	(EQAR)	7(1)	10(45)	.....	2(1)	3(1)	.....	8(10)
Elephanthead	(PEGR)	1(t)	.....	.....	.....	.....	.....	.....
Enchanter's nightshade	(CIAL)	.....	2(t)	3(1)	1(t)	.....	.....	2(1)
Glabrate monkeyflower	(MIGU)	2(t)	5(1)	3(t)	3(t)	3(1)	.....	3(1)
Gray licoriceroot	(LIGR)	2(t)	5(t)	3(t)	4(2)	.....	.....	.....
Lady-fern	(ATHYR)	1(t)	5(3)	.....	.....	.....	.....	3(2)
Largeleaved avens	(GEMA)	.....	3(1)	4(1)	5(1)	5(1)	2(t)	6(1)
Longstalk clover	(TRLO)	3(2)	3(3)	5(3)	6(3)	3(3)	5(2)	.....
Meadowrue	(THALI)	.....	.....	.....	8(4)	.....	.....	1(t)
Monkshood	(ACCO)	2(t)	10(1)	3(t)	5(1)	.....	.....	3(1)
Northern bedstraw	(GABO)	.....	.....	5(1)	5(2)	3(1)	2(1)	.....
Northwest cinquefoil	(POGR)	.....	.....	1(t)	3(1)	5(1)	7(2)	.....
Primrose monkeyflower	(MIPR)	1(t)	.....	.....	.....	.....	.....	.....
Queencup beadlily	(CLUN)	5(2)	3(1)	1(t)	.....	.....	.....	1(t)
Rosy pussytoes	(ANMI)	.....	2(2)	.....	2(t)	.....	5(1)	.....
Rosy twistedstalk	(STRO)	1(t)	8(1)	.....	.....	.....	.....	1(t)
Small bedstraw	(GATRI)	2(1)	.....	.....	.....	3(1)	.....	.....
Starry solomonplume	(SMST)	4(1)	3(1)	6(3)	4(4)	7(4)	.....	7(1)
Sweetroot	(OSMOR)	1(t)	7(1)	8(2)	8(4)	5(1)	.....	3(1)
Sweetscented bedstraw	(GATR)	5(1)	7(1)	3(2)	1(t)	2(1)	.....	8(4)
Watson's willoweed	(EPWA)	2(t)	.....	1(t)	2(t)	3(1)	.....	2(t)
Western aster	(ASOC)	2(1)	.....	1(t)	1(t)	.....	.....	1(t)
Western St.Johnswort	(HYFO)	2(t)	2(t)	.....	.....	5(1)	.....	.....
Western yarrow	(ACMI)	1(t)	2(t)	6(1)	9(3)	2(1)	10(5)	3(t)
Moss	(Sphagnum and others)	8(24)	10(13)	3(5)	1(1)	3(6)	5(6)	9(23)

Code to constancy values: 1 = 5-15%. 2 = 15-25%. 3 = 25-35%. 4 = 35-45%. 5 = 45-55%. 6 = 55-65%. 7 = 65-75%. 8 = 75-85%. 9 = 85-95%. 10 = 95-100%

APPENDIX B (cont.)

Association		ALIN-SYAL	ALIN-SPDO	ALIN SPRINGS	SALIX/ POPR	SALIX/ CALA3	SALIX/ CAEU	SALIX/ CAAQ
Number of Plots		9	13	6	7	7	19	7
Trees		6(6)	8(12)	3(4)	6(3)	1(t)	5(4)	5(2)
Douglas-fir	(PSME)	1(t)	1(t)	.....	.....	.....	.....	.....
Engelmann spruce	(PIEN)	1(t)	4(5)	2(t)	.....	.....	1(t)	.....
Lodgepole pine	(PICO)	.....	3(4)	.....	3(2)	.....	4(4)	5(2)
Ponderosa pine	(PIPO)	2(1)	2(1)	.....	1(1)	.....	1(t)	2(t)
Quaking aspen	(POTR)	1(1)	1(t)	.....	1(t)	1(t)	.....	2(t)
Mountain hemlock	(TSME)	.....	.....	.....	.....	.....	.....	.....
Subalpine fir	(ABLA)	.....	1(t)	.....	.....	.....	.....	.....
White fir	(ABCO AND ABGR)	3(2)	2(1)	3(3)	.....	.....	.....	.....
Shrubs		10(66)	10(70)	10(76)	10(50)	10(63)	10(66)	10(36)
Bearberry	(ARUV)	.....	.....	.....	.....	.....	.....	.....
Big sagebrush	(ARTR)	.....	.....	.....	4(1)	.....	.....	.....
Bog birch	(BEGL)	.....	1(1)	.....	1(t)	.....	6(6)	5(4)
Booth willow	(SABO)	.....	1(t)	.....	.....	7(26)	5(25)	5(9)
Bog blueberry	(VAOC2)	.....	.....	.....	.....	.....	3(5)	.....
Common snowberry	(SYAL)	10(32)	4(4)	2(2)	.....	1(t)	1(t)	.....
Douglas spiraea	(SPDO)	3(1)	10(18)	.....	.....	.....	7(10)	.....
Eastwood willow	(SAEA)	.....	.....	.....	.....	.....	2(6)	.....
Geyer willow	(SAGE)	.....	.....	.....	10(32)	7(7)	8(19)	3(5)
Lemmon willow	(SALE)	.....	.....	.....	3(7)	4(24)	1(t)	3(13)
Mountain alder	(ALIN)	10(56)	10(42)	10(76)	1(1)	.....	1(t)	.....
Prickly currant	(RILA)	4(2)	7(3)	7(5)	6(3)	7(7)	.....	3(1)
Red mountainheath	(PHEM)	.....	.....	.....	.....	.....	.....	.....
Silver sagebrush	(ARCA)	.....	.....	.....	3(1)	.....	.....	.....
Undergreen willow	(SACO2)	.....	.....	.....	.....	.....	.....	.....
Grasses		10(19)	10(7)	10(21)	10(42)	10(16)	10(6)	10(12)
Blue wildrye	(ELGL)	7(5)	5(1)	.....	.....	1(t)	2(t)	.....
Cusick bluegrass	(POCU)	.....	.....	.....	.....	.....	.....	.....
Kentucky bluegrass	(POPR)	7(6)	2(2)	2(1)	10(37)	10(12)	5(1)	7(1)
Reedgrassses	(CACA and CANE3)	.....	2(2)	3(1)	.....	1(1)	6(1)	5(1)
Tufted hairgrass	(DECE)	.....	.....	.....	1(t)	1(t)	3(t)	5(1)
Sedges and Rushes		9(13)	9(9)	5(14)	9(13)	10(38)	10(47)	10(55)
Aquatic sedge	(CAAQ)	1(2)	.....	.....	3(1)	1(1)	.....	10(35)
Baltic rush	(JUBA2)	1(t)	.....	.....	3(3)	1(1)	4(1)	7(2)
Beaked sedge	(CARO2)	.....	.....	.....	.....	3(1)	5(3)	2(1)
Bigleaf sedge	(CAAM)	.....	1(t)	5(9)	.....	.....	.....	.....
Black alpine sedge	(CANI2)	.....	.....	.....	.....	.....	.....	.....
Brewer sedge	(CABR)	.....	.....	.....	.....	.....	.....	.....
Creeping spikerush	(ELPA)	.....	.....	.....	.....	.....	.....	.....
Drummond rush	(JUDR)	.....	.....	.....	.....	.....	.....	.....
Few-flowered spikerush	(ELPA2)	.....	.....	.....	.....	.....	.....	3(1)
Holm's sedge	(CASC5)	.....	1(1)	.....	.....	.....	.....	.....
Inflated sedge	(CAVE)	.....	1(t)	2(2)	1(t)	1(t)	3(3)	.....
Nebraska sedge	(CANE)	1(t)	.....	.....	2(t)	1(t)	1(t)	1(t)

Association		ALIN-SYAL	ALIN-SPDO	ALIN SPRINGS	SALIX/POPR	SALIX/CALA3	SALIX/CAEU	SALIX CAAQ
Number of Plots		9	13	6	7	7	19	7
Nevada rush	(JUNE)	.....	.....	.....	1(t)	1(1)	.....	3(1)
Short-beaked sedge	(CASI2)	.....	.....	.....	1(t)	.....	1(t)	3(2)
Sitka sedge	(CASI3)	.....	.....	.....	.....	.....	3(3)	.....
Slender sedge	(CALA4)	.....	.....	.....	.....	.....	.....	.....
Small-fruit bulrush	(SCMI)	2(1)	2(1)	2(6)	1(6)	3(2)	1(t)	.....
Widefruit sedge	(CAEU)	2(4)	5(5)	.....	1(t)	.....	10(38)	2(1)
Woolly sedge	(CALA3)	1(t)	1(t)	.....	3(1)	10(29)	1(1)	2(t)
Forbs		10(27)	10(29)	10(59)	10(30)	10(28)	10(13)	10(39)
Alpine aster	(ASAL)	.....	.....	.....	.....	.....	.....	.....
Alpine mitella	(MIPE)	1(t)	2(t)	5(1)	.....	.....	1(t)	2(t)
Alpine pussytoes	(ANAL)	.....	.....	.....	.....	.....	.....	.....
Alpine willoweed	(EPAL)	.....	.....	.....	.....	.....	.....	.....
Arrowleaf groundsel	(SETR)	1(t)	5(1)	2(1)	.....	1(t)	1(t)	5(2)
Bog saxafrage	(SAOR)	.....	.....	2(1)	1(t)	.....	2(t)	7(1)
Bog St. Johnswort	(HYAN)	.....	.....	2(2)	.....	.....	.....	2(t)
Broadpetal strawberry	(FRVI)	1(t)	4(1)	.....	3(3)	3(1)	2(t)	3(t)
Calif. falsehellebore	(VECA)	1(t)	1(t)	2(t)	.....	1(t)	1(t)	7(3)
Claspleaf twistedstalk	(STAM)	1(t)	2(1)	3(1)	.....	.....	.....	.....
Common horsetail	(EQAR)	3(t)	5(2)	.....	1(t)	1(t)	2(t)	2(t)
Elephanthead	(PEGR)	.....	.....	.....	.....	.....	1(t)	8(2)
Enchanter's nightshade	(CIAL)	3(3)	.....	8(11)	.....	.....	.....	2(t)
Glabrate monkeyflower	(MIGU)	1(t)	2(t)	10(5)	1(t)	1(t)	2(t)	7(2)
Gray licoriceroot	(LIGR)	3(1)	3(1)	.....	1(t)	1(t)	.....	5(1)
Lady-fern	(ATHYR)	2(t)	2(1)	5(2)	.....	.....	.....	.....
Largeleaved avens	(GEMA)	6(1)	1(t)	10(3)	9(4)	9(2)	4(1)	10(3)
Longstalk clover	(TRLO)	.....	2(t)	2(t)	1(3)	3(1)	1(t)	3(5)
Meadowrue	(THALI)	4(2)	5(1)	.....	4(1)	3(t)	1(t)	2(t)
Monkshood	(ACCO)	3(1)	5(2)	10(3)	.....	1(t)	1(t)	5(1)
Northern bedstraw	(GABO)	6(1)	3(t)	.....	3(1)	4(1)	1(t)	.....
Northwest cinquefoil	(POGR)	2(t)	.....	.....	7(2)	4(1)	.....	3(1)
Primrose monkeyflower	(MIPR)	.....	.....	.....	.....	.....	1(t)	.....
Queencup beadlily	(CLUN)	2(t)	3(2)	3(t)	.....	.....	.....	.....
Rosy pussytoes	(ANMI)	.....	.....	.....	1(t)	.....	.....	.....
Rosy twistedstalk	(STRO)	1(t)	2(t)	.....	.....	.....	.....	.....
Small bedstraw	(GATRI)	1(t)	1(t)	2(1)	.....	.....	5(2)	3(t)
Starry solomonplume	(SMST)	9(4)	9(4)	8(9)	6(1)	4(2)	2(1)	5(1)
Sweetroot	(OSMOR)	3(1)	5(1)	5(1)	1(t)	1(t)	1(t)	.....
Sweetscented bedstraw	(GATR)	2(1)	7(2)	10(3)	.....	6(4)	1(t)	2(t)
Watson's willoweed	(EPWA)	3(1)	2(t)	5(3)	3(1)	.....	3(t)	10(2)
Western aster	(ASOC)	.....	1(t)	.....	3(3)	1(1)	2(t)	2(t)
Western St.Johnswort	(HYFO)	1(1)	3(t)	.....	.....	.....	4(1)	.....
Western yarrow	(ACMI)	7(1)	7(1)	3(t)	9(3)	6(2)	3(1)	7(1)
Moss	(Sphagnum and others)	4(4)	7(8)	8(22)	1(t)	4(9)	4(9)	10(20)

Code to constancy values: 1 = 5-15%. 2 = 15-25%. 3 = 25-35%. 4 = 35-45%. 5 = 45-55%. 6 = 55-65%. 7 = 65-75%. 8 = 75-85%. 9 = 85-95%. 10 = 95-100%

APPENDIX B (cont.)

Association		SALIX/ CASI3	SALIX/ CARO2	VAOC2/ CASI3	VAOC2/ ELPA2	POCU	POPR	DECE
Number of Plots		11	6	7	10	6	8	30
Trees		7(4)	2(t)	9(6)	10(14)	3(t)	2(t)	3(1)
Douglas-fir	(PSME)	.....	.....	.....	.....	.....	.....	.....
Engelmann spruce	(PIEN)	4(2)	.....	4(4)	4(3)	.....	.....	.....
Lodgepole pine	(PICO)	4(2)	.....	7(3)	10(11)	3(t)	1(t)	3(1)
Ponderosa pine	(PIPO)	.....	2(t)	.....	.....	.....	1(t)	.....
Quaking aspen	(POTR)	.....	.....	.....	.....	.....	.....	.....
Mountain hemlock	(TSME)	.....	.....	1(t)	1(t)	.....	.....	.....
Subalpine fir	(ABLA)	.....	.....	1(t)	2(1)	.....	.....	.....
White fir	(ABCO AND ABGR)	.....	.....	1(t)	.....	.....	.....	.....
Shrubs		10(64)	10(49)	10(64)	10(56)	2(t)	3(2)	4(1)
Bearberry	(ARUV)	.....	.....	.....	.....	.....	.....	.....
Big sagebrush	(ARTR)	.....	.....	.....	.....	2(t)	3(1)	.....
Bog birch	(BEGL)	5(18)	.....	4(4)	3(7)	.....	.....	.....
Booth willow	(SABO)	.....	7(32)	1(1)	5(1)	.....	1(t)	.....
Bog blueberry	(VAOC2)	4(9)	.....	10(51)	10(36)	.....	.....	.....
Common snowberry	(SYAL)	.....	.....	.....	.....	.....	.....	1(t)
Douglas spiraea	(SPDO)	7(7)	.....	6(5)	2(t)	.....	.....	2(t)
Eastwood willow	(SAEA)	2(10)	.....	7(11)	7(8)	.....	.....	.....
Geyer willow	(SAGE)	6(22)	8(15)	1(t)	3(1)	.....	.....	.....
Lemmon willow	(SALE)	4(9)	.....	3(3)	.....	.....	1(t)	.....
Mountain alder	(ALIN)	1(t)	.....	.....	.....	.....	.....	.....
Prickly currant	(RILA)	1(t)	3(2)	1(t)	.....	.....	.....	.....
Red mountainheath	(PHEM)	.....	.....	.....	.....	.....	.....	.....
Silver sagebrush	(ARCA)	.....	.....	.....	.....	2(t)	.....	.....
Undergreen willow	(SACO2)	1(t)	.....	1(t)	1(t)	.....	.....	.....
Grasses		6(2)	10(7)	6(1)	9(5)	10(61)	10(62)	10(47)
Blue wildrye	(ELGL)	.....	.....	.....	.....	.....	.....	.....
Cusick bluegrass	(POCU)	.....	.....	.....	.....	10(38)	1(1)	.....
Kentucky bluegrass	(POPR)	1(t)	5(1)	.....	.....	.....	10(45)	2(1)
Reedgrassses	(CACA and CANE3)	3(1)	3(1)	3(1)	2(1)	.....	1(t)	4(2)
Tufted hairgrass	(DECE)	1(t)	7(5)	.....	7(2)	.....	1(1)	10(39)
Sedges and Rushes		10(61)	10(61)	9(45)	10(46)	10(12)	10(20)	9(15)
Aquatic sedge	(CAAQ)	.....	2(3)	1(9)	2(3)	.....	.....	1(t)
Baltic rush	(JUBA2)	2(2)	5(5)	3(1)	5(1)	7(1)	8(12)	5(3)
Beaked sedge	(CARO2)	3(6)	8(44)	.....	6(3)	.....	1(t)	.....
Bigleaf sedge	(CAAM)	.....	2(t)	.....	.....	.....	.....	.....
Black alpine sedge	(CANI2)	.....	.....	.....	.....	.....	.....	.....
Brewer sedge	(CABR)	.....	.....	.....	.....	.....	.....	.....
Creeping spikerush	(ELPA)	.....	.....	.....	.....	.....	.....	.....
Drummond rush	(JUDR)	.....	.....	.....	1(t)	.....	.....	1(t)
Few-flowered spikerush	(ELPA2)	.....	.....	.....	10(17)	.....	.....	1(t)
Holm's sedge	(CASC5)	.....	2(t)	1(t)	3(3)	.....	.....	1(1)
Inflated sedge	(CAVE)	1(t)	2(6)	1(t)	1(t)	.....	.....	3(2)
Nebraska sedge	(CANE)	.....	3(5)	.....	1(t)	7(1)	1(2)	2(2)
Nevada rush	(JUNE)	1(t)	2(t)	3(t)	4(1)	.....	1(t)	1(1)
Short-beaked sedge	(CASI2)	.....	.....	.....	5(1)	.....	1(1)	1(t)

Association		SALIX/ CASI3	SALIX/ CARO2	VAOC2/ CASI3	VAOC2/ ELPA2	POCU	POPR	DECE
Number of Plots		11	6	7	10	6	8	30
Sitka sedge	(CASI3)	10(55)	.....	9(33)	7(7)	.....	.....	.....
Slender sedge	(CALA4)	.....	.....	.....	.....	.....	.....	1(1)
Small-fruit bulrush	(SCMI)	2(1)	.....	.....	.....	.....	.....	.....
Widefruit sedge	(CAEU)	2(2)	.....	.....	1(t)	.....	.....	1(1)
Woolly sedge	(CALA3)	1(t)	2(2)	1(3)	.....	.....	1(t)	1(t)
Forbs		10(8)	10(19)	10(5)	10(20)	10(19)	10(31)	10(22)
Alpine aster	(ASAL)	2(t)	.....	.....	2(2)	.....	3(1)	1(1)
Alpine mitella	(MIPE)	1(t)	.....	.....	.....	.....	.....	.....
Alpine pussytoes	(ANAL)	.....	.....	.....	.....	.....	.....	1(t)
Alpine willoweed	(EPAL)	1(t)	.....	1(t)	.....	.....	3(1)	2(t)
Arrowleaf groundsel	(SETR)	1(t)	.....	1(t)	.....	.....	.....	.....
Bog saxafrage	(SAOR)	.....	2(3)	3(t)	2(t)	.....	.....	1(t)
Bog St. Johnswort	(HYAN)	.....	2(t)	.....	5(3)	.....	1(t)	2(1)
Broadpetal strawberry	(FRVI)	.....	.....	1(t)	.....	2(t)	4(2)	.....
Calif. falsehellebore	(VECA)	.....	.....	1(t)	1(t)	.....	.....	1(t)
Claspleaf twistedstalk	(STAM)	.....	.....	.....	.....	.....	.....	.....
Common horsetail	(EQAR)	4(2)	2(t)	4(1)	5(1)	.....	.....	.....
Elephanthead	(PEGR)	2(t)	.....	1(t)	7(1)	.....	.....	.....
Enchanter's nightshade	(CIAL)	.....	.....	.....	3(1)	.....	.....	.....
Glabrate monkeyflower	(MIGU)	.....	3(1)	.....	.....	2(t)	1(1)	1(t)
Gray licoriceroot	(LIGR)	.....	.....	.....	3(t)	.....	.....	1(t)
Lady-fern	(ATHYR)	.....	.....	.....	.....	.....	.....	.....
Largeleaved avens	(GEMA)	.....	5(2)	.....	.....	.....	3(1)	1(t)
Longstalk clover	(TRLO)	.....	7(2)	.....	3(2)	5(1)	4(4)	6(6)
Meadowrue	(THALI)	1(t)	.....	.....	.....	.....	.....	.....
Monkshood	(ACCO)	2(t)	.....	.....	.....	.....	.....	.....
Northern bedstraw	(GABO)	.....	.....	.....	.....	.....	4(1)	.....
Northwest cinquefoil	(POGR)	.....	5(1)	.....	.....	7(2)	6(3)	3(1)
Primrose monkeyflower	(MIPR)	.....	.....	.....	5(2)	.....	.....	4(2)
Queencup beadlily	(CLUN)	1(t)	.....	1(t)	.....	.....	.....	.....
Rosy pussytoes	(ANMI)	.....	.....	.....	.....	7(2)	9(4)	1(t)
Rosy twistedstalk	(STRO)	.....	.....	1(t)	1(t)	.....	.....	.....
Small bedstraw	(GATRI)	4(1)	5(1)	.....	.....	.....	1(t)	2(t)
Starry solomonplume	(SMST)	1(t)	3(1)	.....	.....	.....	1(1)	.....
Sweetroot	(OSMOR)	.....	.....	.....	.....	.....	.....	.....
Sweetscented bedstraw	(GATR)	1(t)	2(2)	.....	.....	.....	.....	.....
Watson's willoweed	(EPWA)	3(t)	7(1)	.....	.....	2(t)	3(1)	.....
Western aster	(ASOC)	2(t)	.....	3(1)	4(1)	.....	4(1)	4(1)
Western St.Johnswort	(HYFO)	2(t)	2(t)	.....	.....	.....	1(t)	.....
Western yarrow	(ACMI)	.....	.....	.....	.....	10(3)	8(4)	2(1)
Moss	(Sphagnum and others)	6(7)	3(6)	10(17)	10(61)	8(9)	5(2)	5(12)

Code to constancy values: 1 = 5-15%. 2 = 15-25%. 3 = 25-35%. 4 = 35-45%. 5 = 45-55%. 6 = 55-65%, 7 = 65-75%. 8 = 75-85%. 9 = 85-95%. 10 = 95-100%

APPENDIX B (cont.)

Association		CALA3	CANE	CAEU	CAAQ	CASI2	CALA4	ELPA2
Number of Plots		9	9	13	7	7	5	20
Trees		3(2)	1(t)	8(2)	2(2)	3(t)	.....	6(2)
Douglas-fir	(PSME)	.....	.....	.....	.....	.....	.....	.....
Engelmann spruce	(PIEN)	.....	.....	.....	.....	.....	.....	1(t)
Lodgepole pine	(PICO)	3(2)	1(t)	8(2)	1(1)	3(t)	.....	4(1)
Ponderosa pine	(PIPO)	.....	.....	.....	.....	.....	.....	.....
Quaking aspen	(POTR)	.....	.....	.....	1(t)	.....	.....	.....
Mountain hemlock	(TSME)	.....	.....	.....	.....	.....	.....	1(t)
Subalpine fir	(ABLA)	.....	.....	.....	.....	.....	.....	1(t)
White fir	(ABCO AND ABGR)	.....	.....	.....	.....	.....	.....	.....
Shrubs		7(4)	4(3)	5(5)	10(4)	6(4)	2(t)	10(9)
Bearberry	(ARUV)	.....	.....	.....	.....	.....	.....	.....
Big sagebrush	(ARTR)	.....	.....	.....	.....	.....	.....	.....
Bog birch	(BEGL)	.....	.....	.....	1(t)	1(t)	.....	3(1)
Booth willow	(SABO)	1(t)	1(t)	2(1)	1(t)	1(t)	....	3(1)
Bog blueberry	(VAOC2)	.....	.....	1(1)	1(t)	1(1)	.....	5(3)
Common snowberry	(SYAL)	1(t)	.....	1(t)	.....	.....	.....	.....
Douglas spiraea	(SPDO)	1(t)	.....	2(1)	.....	.....	2(t)	.....
Eastwood willow	(SAEA)	.....	.....	.....	1(t)	1(t)	.....	4(2)
Geyer willow	(SAGE)	3(1)	2(1)	2(1)	3(t)	3(2)	.....	1(t)
Lemmon willow	(SALE)	2(t)	1(t)	.....	4(2)	1(t)	.....	1(t)
Mountain alder	(ALIN)	1(1)	1(t)	1(t)	.....	.....	.....	.....
Prickly currant	(RILA)	1(t)	.....	.....	1(t)	.....	.....	1(t)
Red mountainheath	(PHEM)	.....	.....	.....	.....	.....	.....	1(t)
Silver sagebrush	(ARCA)	1(t)	1(t)	.....	.....	.....	.....	.....
Undergreen willow	(SACO2)	.....	.....	.....	1(t)	.....	.....	1(t)
Grasses		10(17)	10(10)	9(16)	10(8)	9(7)	10(5)	8(5)
Blue wildrye	(ELGL)	2(t)	.....	2(1)	1(t)	.....	.....	.....
Cusick bluegrass	(POCU)	.....	.....	.....	.....	.....	.....	.....
Kentucky bluegrass	(POPR)	6(5)	7(2)	2(1)	1(t)	2(1)	.....	1(t)
Reedgrasses	(CACA and CANE3)	6(3)	.....	5(4)	4(1)	.....	.....	1(t)
Tufted hairgrass	(DECE)	2(2)	6(2)	8(5)	6(3)	7(3)	10(3)	6(2)
Sedges and Rushes		10(67)	10(78)	10(59)	10(81)	10(72)	10(47)	10(51)
Aquatic sedge	(CAAQ)	1(t)	1(t)	.....	10(62)	3(2)	.....	4(3)
Baltic rush	(JUBA2)	7(6)	10(9)	5(3)	3(1)	6(3)	8(4)	1(1)
Beaked sedge	(CAR02)	2(2)	1(t)	3(3)	7(8)	4(3)	4(1)	5(2)
Bigleaf sedge	(CAAM)	.....	1(t)	2(1)	.....	.....	.....	.....
Black alpine sedge	(CANI2)	.....	.....	.....	.....	.....	.....	1(1)
Brewer sedge	(CABR)	.....	.....	.....	.....	.....	.....	.....
Creeping spikerush	(ELPA)	2(1)	2(2)	.....	1(t)	.....	1(t)	1(t)
Drummond rush	(JUDR)	.....	.....	.....	.....	.....	.....	1(t)
Few-flowered spikerush	(ELPA2)	.....	1(t)	1(t)	.....	6(5)	.....	10(23)
Holm's sedge	(CASC5)	.....	.....	.....	.....	.....	2(t)	4(5)
Inflated sedge	(CAVE)	.....	1(t)	2(1)	4(5)	.....	2(1)	5(t)
Nebraska sedge	(CANE)	6(6)	10(62)	.....	4(2)	3(6)	.....	1(t)
Nevada rush	(JUNE)	1(1)	3(3)	.....	3(1)	3(2)	6(5)	3(3)
Short-beaked sedge	(CASI2)	3(8)	6(5)	.....	1(t)	10(41)	4(1)	3(1)

Association		CALA3	CANE	CAEU	CAAQ	CASI2	CALA4	ELPA2
Number of Plots		9	9	13	7	7	5	20
Sitka sedge	(CASI3)	.....	.....	.....	.....	1(2)	2(t)	3(1)
Slender sedge	(CALA4)	.....	.....	.....	.....	3(3)	10(33)	.....
Small-fruit bulrush	(SCMI)	3(4)	2(2)	.....	3(1)	.....	.....	2(1)
Widefruit sedge	(CAEU)	2(1)	.....	10(51)	.....	3(t)	2(t)	1(1)
Woolly sedge	(CALA3)	10(37)	3(4)	1(t)	1(t)	2(t)	.....	.....
Forbs		10(18)	10(22)	10(18)	10(12)	10(7)	8(2)	10(25)
Alpine aster	(ASAL)	.....	.....	.....	.....	.....	.....	3(1)
Alpine mitella	(MIPE)	.....	.....	1(t)	1(t)	.....	.....	2(t)
Alpine pussytoes	(ANAL)	.....	.....	.....	.....	.....	.....	.....
Alpine willoweed	(EPAL)	.....	1(t)	.....	1(t)	4(1)	.....	5(1)
Arrowleaf groundsel	(SETR)	.....	.....	2(1)	4(1)	.....	.....	2(t)
Bog saxafrage	(SAOR)	1(1)	.....	.....	3(t)	6(1)	.....	6(2)
Bog St. Johnswort	(HYAN)	2(1)	.....	2(t)	1(t)	1(t)	.....	4(1)
Broadpetal strawberry	(FRVI)	1(t)	1(t)	1(t)	.....	.....	.....	1(t)
Calif. falsehellebore	(VECA)	1(t)	.....	2(1)	6(1)	.....	.....	2(1)
Claspleaf twistedstalk	(STAM)	.....	.....	.....	.....	.....	.....	1(t)
Common horsetail	(EQAR)	3(2)	1(t)	1(t)	6(1)	2(1)	.....	5(3)
Elephanthead	(PEGR)	.....	.....	1(t)	3(1)	.....	.....	6(2)
Enchanter's nightshade	(CIAL)	1(t)	.....	.....	.....	.....	.....	.....
Glabrate monkeyflower	(MIGU)	4(1)	3(1)	2(t)	4(1)	4(1)	.....	4(1)
Gray licoriceroot	(LIGR)	.....	.....	.....	1(t)	.....	.....	2(t)
Lady-fern	(ATHYR)	.....	.....	.....	.....	.....	.....	.....
Largeleaved avens	(GEMA)	6(1)	3(t)	3(t)	4(t)	1(t)	.....	1(t)
Longstalk clover	(TRLO)	4(1)	3(1)	2(1)	4(1)	.....	.....	2(2)
Meadowrue	(THALI)	.....	.....	.....	.....	.....	.....	.....
Monkshood	(ACCO)	.....	.....	2(t)	3(t)	.....	.....	2(t)
Northern bedstraw	(GABO)	1(t)	1(t)	2(1)	.....	.....	.....	.....
Northwest cinquefoil	(POGR)	2(2)	3(t)	1(t)	1(t)	.....	2(t)	.....
Primrose monkeyflower	(MIPR)	.....	.....	2(t)	1(t)	3(2)	.....	7(5)
Queencup beadlily	(CLUN)	.....	.....	.....	.....	.....	.....	.....
Rosy pussytoes	(ANMI)	.....	.....	.....	.....	.....	.....	.....
Rosy twistedstalk	(STRO)	.....	.....	.....	.....	.....	.....	.....
Small bedstraw	(GATRI)	1(1)	2(t)	5(1)	4(1)	.....	.....	1(t)
Starry solomonplume	(SMST)	1(t)	.....	1(t)	.....	.....	.....	.....
Sweetroot	(OSMOR)	1(t)	.....	.....	.....	.....	.....	.....
Sweetscented bedstraw	(GATR)	1(t)	.....	1(t)	.....	.....	.....	3(1)
Watson's willoweed	(EPWA)	6(1)	6(2)	2(1)	4(1)	4(1)	.....	3(t)
Western aster	(ASOC)	1(t)	1(t)	2(t)	.....	1(t)	.....	1(t)
Western St.Johnswort	(HYFO)	.....	.....	2(1)	.....	2(t)	.....	1(t)
Western yarrow	(ACMI)	4(1)	.....	3(1)	3(t)	1(t)	.....	2(t)
Moss	(Sphagnum and others)	6(7)	3(4)	7(18)	4(3)	9(27)	.....	9(57)

Code to constancy values: 1 = 5-15%. 2 = 15-25%. 3 = 25-35%. 4 = 35-45%. 5 = 45-55%. 6 = 55-65%. 7 = 65-75%. 8 = 75-85%. 9 = 85-95%. 10 = 95-100%

APPENDIX B (cont.)

Association		SCMI (CAAM)	CASI3	CAVE	CAR02	ELPA	CLUN (ALIN)	SETR
Number of Plots		22	14	20	27	7	16	18
Trees		3(6)	1(t)	1(t)	1(t)	.....	10(56)	10(45)
Douglas-fir	(PSME)	1(1)	.....	.....	.....	.....	3(2)	.....
Engelmann spruce	(PIEN)	1(1)	.....	.....	.....	.....	2(1)	3(2)
Lodgepole pine	(PICO)	.....	1(t)	1(t)	1(t)	.....	1(t)	2(1)
Ponderosa pine	(PIPO)	1(1)	.....	.....	.....	.....	.....	.....
Quaking aspen	(POTR)	1(1)	.....	1(t)	.....	.....	.....	.....
Mountain hemlock	(TSME)	.....	.....	.....	.....	.....	1(t)	8(5)
Subalpine fir	(ABLA)	.....	.....	.....	.....	.....	.....	5(2)
White fir	(ABCO AND ABGR)	2(1)	.....	.....	.....	.....	8(6)	3(1)
Shrubs		8(6)	6(3)	4(1)	3(1)	1(t)	10(16)	9(8)
Bearberry	(ARUV)	.....	.....	.....	.....	.....	.....	.....
Big sagebrush	(ARTR)	.....	.....	.....	.....	.....	.....	.....
Bog birch	(BEGL)	.....	1(1)	.....	1(t)	.....	.....	.....
Booth willow	(SABO)	1(t)	2(t)	1(t)	2(t)	.....	.....	.....
Bog blueberry	(VAOC2)	.....	3(1)	.....	.....	.....	.....	.....
Common snowberry	(SYAL)	3(1)	.....	1(t)	.....	.....	3(1)	1(t)
Douglas spiraea	(SPDO)	1(t)	1(t)	1(t)	1(t)	.....	1(t)	1(t)
Eastwood willow	(SAEA)	.....	1(t)	.....	1(t)	.....	.....	.....
Geyer willow	(SAGE)	1(t)	4(1)	1(1)	2(t)	.....	.....	.....
Lemmon willow	(SALE)	1(1)	1(t)	1(t)	1(t)	.....	.....	.....
Mountain alder	(ALIN)	5(2)	.....	.....	.....	.....	7(4)	1(t)
Prickly currant	(RILA)	3(1)	.....	1(t)	.....	.....	9(8)	4(2)
Red mountainheath	(PHEM)	.....	.....	.....	.....	.....	.....	2(t)
Silver sagebrush	(ARCA)	.....	.....	.....	.....	.....	.....	.....
Undergreen willow	(SACO2)	.....	.....	.....	.....	.....	.....	.....
Grasses		9(13)	6(5)	9(6)	6(3)	7(4)	9(10)	10(7)
Blue wildrye	(ELGL)	1(t)	.....	.....	.....	.....	2(t)	3(t)
Cusick bluegrass	(POCU)	.....	.....	.....	.....	.....	.....	.....
Kentucky bluegrass	(POPR)	4(1)	1(t)	1(t)	2(t)	.....	.....	.....
Reedgrassses	(CACA and CANE3)	1(t)	6(2)	1(t)	1(t)	.....	.....	1(t)
Tufted hairgrass	(DECE)	1(t)	2(t)	4(1)	2(1)	.....	.....	1(t)
Sedges and Rushes		10(63)	10(75)	10(63)	10(66)	10(63)	8(2)	9(8)
Aquatic sedge	(CAAQ)	1(t)	.....	2(2)	2(2)	.....	.....	.....
Baltic rush	(JUBA2)	2(1)	4(4)	4(2)	3(2)	3(2)	1(t)	.....
Beaked sedge	(CARO2)	2(4)	4(2)	4(2)	10(52)	.....	.....	.....
Bigleaf sedge	(CAAM)	4(11)	.....	1(t)	.....	.....	3(1)	.....
Black alpine sedge	(CANI2)	.....	.....	.....	.....	.....	.....	1(1)
Brewer sedge	(CABR)	.....	.....	.....	.....	.....	.....	.....
Creeping spikerush	(ELPA)	1(1)	1(t)	5(2)	2(1)	10(48)	.....	.....
Drummond rush	(JUDR)	.....	.....	.....	.....	.....	.....	4(1)
Few-flowered spikerush	(ELPA2)	.....	.....	1(t)	.....	.....	.....	.....
Holm's sedge	(CASC5)	.....	1(t)	.....	.....	.....	.....	3(1)
Inflated sedge	(CAVE)	1(1)	.....	10(51)	2(1)	4(3)	.....	.....
Nebraska sedge	(CANE)	1(1)	.....	2(2)	3(2)	3(1)	.....	.....
Nevada rush	(JUNE)	1(t)	.....	3(1)	1(t)	1(t)	.....	.....

Association		SCMI (CAAM)	CASI3	CAVE	CARO2	ELPA	CLUN (ALIN)	SETR
Number of Plots		22	14	20	27	7	16	18
Short-beaked sedge	(CASI2)	1(t)	1(t)	1(t)	2(1)	.....	.....	.....
Sitka sedge	(CASI3)	.....	10(70)	.....	2(4)	.....	.....	.....
Slender sedge	(CALA4)	.....	.....	1(t)	.....	.....	.....	.....
Small-fruit bulrush	(SCMI)	9(37)	4(2)	1(t)	2(1)	3(7)	1(t)	1(t)
Widefruit sedge	(CAEU)	2(5)	.....	1(t)	1(t)	1(t)	.....	1(t)
Woolly sedge	(CALA3)	2(t)	1(t)	1(t)	1(1)	.....	.....	.....
Forbs		10(26)	10(8)	8(16)	9(11)	7(22)	10(44)	10(52)
Alpine aster	(ASAL)	.....	.....	.....	.....	.....	.....	.....
Alpine mitella	(MIPE)	1(t)	.....	.....	.....	.....	5(1)	9(3)
Alpine pussytoes	(ANAL)	.....	.....	.....	.....	.....	.....	1(t)
Alpine willoweed	(EPAL)	1(t)	1(t)	1(t)	1(t)	.....	1(t)	4(1)
Arrowleaf groundsel	(SETR)	1(t)	1(t)	.....	.....	.....	1(t)	9(10)
Bog saxafrage	(SAOR)	1(1)	.....	.....	2(2)	.....	.....	2(t)
Bog St. Johnswort	(HYAN)	1(1)	1(t)	.....	1(t)	.....	.....	2(t)
Broadpetal strawberry	(FRVI)	1(t)	.....	.....	1(t)	.....	1(t)	1(t)
Calif. falsehellebore	(VECA)	1(t)	1(t)	.....	1(t)	.....	1(t)	3(t)
Claspleaf twistedstalk	(STAM)	1(t)	.....	.....	.....	.....	9(4)	3(2)
Common horsetail	(EQAR)	4(1)	2(1)	1(t)	1(t)	.....	1(3)	3(1)
Elephanthead	(PEGR)	.....	.....	.....	.....	.....	.....	.....
Enchanter's nightshade	(CIAL)	2(1)	.....	.....	.....	.....	6(6)	1(t)
Glabrate monkeyflower	(MIGU)	5(1)	1(t)	1(t)	3(t)	.....	6(1)	5(1)
Gray licoriceroot	(LIGR)	2(1)	.....	.....	.....	.....	1(t)	7(3)
Lady-fern	(ATHYR)	2(2)	.....	.....	.....	.....	5(3)	4(5)
Largeleaved avens	(GEMA)	6(1)	1(t)	1(t)	2(t)	.....	5(1)	1(t)
Longstalk clover	(TRLO)	1(t)	.....	.....	1(1)	.....	2(2)	5(5)
Meadowrue	(THALI)	.....	.....	.....	.....	.....	.....	.....
Monkshood	(ACCO)	2(t)	.....	.....	.....	.....	8(4)	6(4)
Northern bedstraw	(GABO)	1(t)	.....	.....	1(t)	.....	1(t)	.....
Northwest cinquefoil	(POGR)	.....	.....	.....	.....	.....	.....	.....
Primrose monkeyflower	(MIPR)	.....	1(t)	1(t)	1(t)	.....	.....	.....
Queencup beadlily	(CLUN)	.....	.....	.....	.....	.....	8(2)	3(1)
Rosy pussytoes	(ANMI)	.....	.....	.....	.....	.....	.....	.....
Rosy twistedstalk	(STRO)	1(t)	.....	.....	.....	.....	1(t)	4(3)
Small bedstraw	(GATRI)	1(t)	3(t)	2(1)	2(t)	1(t)	1(t)	.....
Starry solomonplume	(SMST)	3(2)	.....	1(t)	1(t)	.....	3(3)	1(t)
Sweetroot	(OSMOR)	1(t)	.....	.....	.....	.....	8(1)	6(1)
Sweetscented bedstraw	(GATR)	.....	.....	.....	.....	.....	9(3)	4(2)
Watson's willoweed	(EPWA)	6(2)	2(t)	3(1)	3(1)	.....	3(1)	3(1)
Western aster	(ASOC)	1(t)	1(t)	1(t)	.....	1(t)	1(t)	1(t)
Western St.Johnswort	(HYFO)	1(t)	1(t)	5(t)	.....	.....	.....	3(t)
Western yarrow	(ACMI)	2(t)	1(t)	.....	1(t)	.....	3(t)	2(t)
Moss (Sphagnum and others)		7(15)	2(3)	4(3)	3(8)	1(2)	10(34)	10(38)

Code to constancy values: 1 = 5-15%. 2 = 15-25%. 3 = 25-35%. 4 = 35-45%. 5 = 45-55%. 6 = 55-65%. 7 = 65-75%. 8 = 75-85%. 9 = 85-95%. 10 = 95-100%

APPENDIX B (cont.)

Association		CABR	CANI2	CASC5-CANI2-DECE	CASC5	PHEM
Number of Plots		4	16	13	14	13
Trees		8(2)	1(2)	3(1)	4(1)	9(15)
Douglas-fir	(PSME)	.....	.....	.....	.....	.....
Engelmann spruce	(PIEN)	.....	1(t)	.....	1(t)	.....
Lodgepole pine	(PICO)	8(2)	1(t)	2(1)	2(t)	2(1)
Ponderosa pine	(PIPO)	.....	.....	.....	.....	.....
Quaking aspen	(POTR)	.....	.....	.....	.....	.....
Mountain hemlock	(TSME)	.....	1(1)	2(t)	1(t)	9(14)
Subalpine fir	(ABLA)	.....	1(t)	2(t)	2(t)	2(1)
White fir	(ABCO AND ABGR)	.....	.....	.....	.....	.....
Shrubs		.....	8(3)	7(3)	6(3)	10(55)
Bearberry	(ARUV)	.....	.....	.....	.....	.....
Big sagebrush	(ARTR)	.....	.....	.....	.....	.....
Bog birch	(BEGL)	.....	.....	.....	.....	.....
Booth willow	(SABO)	.....	1(t)	1(t)	3(1)	1(1)
Bog blueberry	(VAOC2)	.....	1(t)	1(t)	2(1)	2(t)
Common snowberry	(SYAL)	.....	.....	.....	.....	.....
Douglas spiraea	(SPDO)	.....	.....	.....	1(t)	.....
Eastwood willow	(SAEA)	.....	1(t)	.....	3(1)	1(2)
Geyer willow	(SAGE)	.....	.....	.....	.....	.....
Lemmon willow	(SALE)	.....	.....	.....	.....	.....
Mountain alder	(ALIN)	.....	.....	.....	.....	.....
Prickly currant	(RILA)	.....	.....	.....	.....	.....
Red mountainheath	(PHEM)	.....	7(2)	2(1)	1(t)	10(34)
Silver sagebrush	(ARCA)	.....	.....	.....	.....	.....
Undergreen willow	(SACO2)	.....	.....	1(t)	2(1)	.....
Grasses		10(2)	6(4)	10(27)	10(9)	7(1)
Blue wildrye	(ELGL)	.....	.....	.....	1(t)	.....
Cusick bluegrass	(POCU)	.....	.....	.....	.....	.....
Kentucky bluegrass	(POPR)	.....	.....	.....	.....	.....
Reedgrassses	(CACA and CANE3)	.....	.....	.....	1(t)	.....
Tufted hairgrass	(DECE)	3(t)	4(2)	10(21)	8(5)	2(t)
Sedges and Rushes		10(47)	10(62)	10(31)	10(79)	10(11)
Aquatic sedge	(CAAQ)	.....	.....	.....	.....	.....
Baltic rush	(JUBA2)	.....	.....	.....	.....	.....
Beaked sedge	(CARO2)	.....	1(t)	.....	.....	.....
Bigleaf sedge	(CAAM)	.....	.....	.....	.....	.....
Black alpine sedge	(CANI2)	10(2)	10(55)	7(10)	8(6)	8(6)
Brewer sedge	(CABR)	10(41)	1(1)	1(t)	.....	1(t)
Creeping spikerush	(ELPA)	.....	.....	.....	.....	.....
Drummond rush	(JUDR)	10(2)	8(1)	2(t)	4(1)	10(3)
Few-flowered spikerush	(ELPA2)	.....	1(t)	4(5)	5(7)	1(1)
Holm's sedge	(CASC5)	.....	6(6)	8(16)	10(64)	3(2)
Inflated sedge	(CAVE)	.....	.....	1(t)	.....	.....
Nebraska sedge	(CANE)	.....	.....	.....	.....	.....
Nevada rush	(JUNE)	.....	.....	.....	.....	.....

Association		CABR	CANI2	CASC5-CANI2-DECE	CASCR	PHEM
Number of Plots		4	16	13	14	13
Short-beaked sedge	(CASI2)	.....	.....	.....	.....	.....
Sitka sedge	(CASI3)	.....	.....	.....	.....	.....
Slender sedge	(CALA4)	.....	.....	.....	.....	.....
Small-fruit bulrush	(SCMI)	.....	.....	.....	.....	.....
Widefruit sedge	(CAEU)	.....	.....	.....	.....	.....
Woolly sedge	(CALA3)	.....	.....	.....	.....	.....
Forbs		10(7)	10(23)	10(38)	9(25)	10(25)
Alpine aster	(ASAL)	8(1)	8(6)	9(9)	5(6)	9(4)
Alpine mitella	(MIPE)	.....	.....	1(t)	.....	1(t)
Alpine pussytoes	(ANAL)	8(2)	8(6)	4(3)	2(t)	3(1)
Alpine willoweed	(EPAL)	.....	3(t)	2(1)	.....	1(t)
Arrowleaf groundsel	(SETR)	.....	.....	2(t)	5(1)	2(1)
Bog saxafrage	(SAOR)	.....	.....	2(t)	2(1)	.....
Bog St. Johnswort	(HYAN)	.....	.....	.....	4(1)	.....
Broadpetal strawberry	(FRVI)	.....	.....	.....	2(t)	.....
Calif. falsehellebore	(VECA)	.....	.....	1(t)	.....	2(t)
Claspleaf twistedstalk	(STAM)	.....	.....	.....	.....	.....
Common horsetail	(EQAR)	.....	.....	2(t)	2(t)	.....
Elephanthead	(PEGR)	3(t)	1(t)	1(t)	1(t)	2(t)
Enchanter's nightshade	(CIAL)	.....	.....	.....	.....	.....
Glabrate monkeyflower	(MIGU)	3(t)	.....	.....	1(t)	.....
Gray licoriceroot	(LIGR)	.....	5(2)	5(1)	6(2)	9(5)
Lady-fern	(ATHYR)	.....	.....	.....	.....	.....
Largeleaved avens	(GEMA)	.....	.....	.....	.....	.....
Longstalk clover	(TRLO)	.....	1(1)	7(9)	6(6)	2(1)
Meadowrue	(THALI)	.....	.....	.....	.....	.....
Monkshood	(ACCO)	.....	.....	.....	1(t)	.....
Northern bedstraw	(GABO)	.....	.....	.....	.....	.....
Northwest cinquefoil	(POGR)	.....	.....	.....	.....	.....
Primrose monkeyflower	(MIPR)	.....	.....	2(t)	2(t)	.....
Queencup beadlily	(CLUN)	.....	.....	.....	.....	.....
Rosy pussytoes	(ANMI)	.....	.....	.....	.....	.....
Rosy twistedstalk	(STRO)	.....	.....	.....	.....	.....
Small bedstraw	(GATRI)	.....	.....	.....	1(t)	.....
Starry solomonplume	(SMST)	.....	1(t)	.....	.....	.....
Sweetroot	(OSMOR)	.....	.....	.....	.....	.....
Sweetscented bedstraw	(GATR)	.....	.....	.....	.....	.....
Watson's willoweed	(EPWA)	.....	.....	.....	1(t)	.....
Western aster	(ASOC)	.....	1(1)	.....	1(t)	.....
Western St.Johnswort	(HYFO)	.....	.....	.....	.....	.....
Western yarrow	(ACMI)	.....	.....	.....	1(t)	.....
Moss	(Sphagnum and others)	5(10)	8(13)	9(20)	7(25)	5(14)

Code to constancy values: 1 = 5-15%, 2 = 15-25%, 3 = 25-35%, 4 = 35-45%, 5 = 45-55%, 6 = 55-65%, 7 = 65-75%, 8 = 75-85%, 9 = 85-95%, 10 = 95-100%

APPENDIX C: COMMON RIPARIAN ZONE VEGETATION ON CENTRAL OREGON NATIONAL FORESTS

Common Name	Code	Scientific Name
SEDGES		
Alpine nerved sedge	CANE2	Carex neurophora
Aquatic sedge	CAAQ	C. aquatilis
Beaked sedge	CARO2	C. rostrata
Bigleaf sedge	CAAM	C. amplifolia
Black alpine sedge	CANI2	C. nigricans
Brewer sedge	CABR	C. breweri
Clustered field sedge	CAPR5	C. praegracilis
Elk sedge	CAGE	C. geyeri
Green-fruited sedge	CAIN3	C. interrupta
Holm's sedge	CASC5	C. scopulorum
Inflated sedge	CAVE	C. vesicaria
Jones sedge	CAJO	C. jonesii
Mud sedge	CALI	C. limosa
Muricate sedge	CAMU2	C. muricata
Mt. Shasta sedge	CAST2	C. straminiformis
Nebraska sedge	CANE	C. nebraskensis
Ross sedge	CARO	C. rossii
Short-beaked sedge	CASI2	C. simulata
Sitka sedge	CASI3	C. sitchensis
Slender sedge	CALA4	C. lasiocarpa
Soft-leaved sedge	CADI	C. disperma
Thick-headed sedge	CAPA	C. pachystachya
Widefruit sedge	CAEU	C. eurycarpa
Woodrush sedge	CALU	C. luzulina
Woolly sedge	CALA3	C. lanuginosa
SPIKERUSHES		
Creeping spikerush	ELPA	Eleocharis palustris
Few-flowered spikerush	ELPA2	E. pauciflora
BULRUSHES		
Small-fruit bulrush	SCMI	Scirpus microcarpus
RUSHES		
Baltic rush	JUBA2	Juncus balticus
Drummond rush	JUDR	J. drummondii
Merten rush	JUME	J. mertensianus
Nevada rush	JUNE	J. nevadensis
GRASSES		
Alpine Timothy	PHAL	Phleum alpinum
Beardless trisetum	TRWO	Trisetum wolfii
Beardless wheatgrass	AGCA	Agropyron caninum
Blue wildrye	ELGL	Elymus glaucus
Bluejoint reedgrass	CACA	Calamagrostis canadensis

APPENDIX C (cont.)

Common Name	Code	Scientific Name
Bottlebrush squirreltail	SIHY	Sitanion hystrix
Brome	BROMU	Bromus spp.
California oatgrass	DACA	Danthonia californica
Cheatgrass	BRTE	Bromus techtorum
Common Timothy	PHPR	Phleum pratense
Cusick bluegrass	POCU	Poa cusickii
Fowl bluegrass	POPA	Poa palustris
Fowl mannagrass	GLST	Glyceria striata
Kentucky bluegrass	POPR	Poa pratensis
Little meadow foxtail	ALAE	Alopecurus aequalis
Meadow barley	HOBR	Hordeum brachyantherum
Nodding brome	BRAN	Bromus anomalus
Northern mannagrass	GLBO	Glyceria borealis
Oregon bentgrass	AGOR	Agrostis oregonensis
Prairie junegrass	KOCR	Koeleria cristata
Reed canarygrass	PHAR	Phalaris arundinacea
Shortleaved muhly	MURI	Muhlenbergia richardsonis
Slender muhly	MUFI	Muhlenbergia filiformis
Slimstem reedgrass	CANE3	Calamagrostis neglecta
Tall mannagrass	GLEL	Glyceria elata
Timber oatgrass	DAIN	Danthonia intermedia
Tufted hairgrass	DECE	Deschampsia cespitosa
Weak alkaligrass	PUPA	Puccinellia pauciflora
Western needlegrass	STOC	Stipa occidentalis
Wood reedgrass	CILA2	Cinna latifolia
FORBS		
Alpine aster	ASAL	Aster alpigenus
Alpine shootingstar	DOAL	Dodecatheon alpinum
Alpine mitella	MIPE	Mitella pentandra
Alpine pussytoes	ANAL	Antennaria alpina
Alpine willoweed	EPAL	Epilobium alpinum
American bistort	POBI	Polygonum bistortoides
American speedwell	VEAM	Veronica americana
American vetch	VIAM	Vicia americana
Arrowleaf groundsel	SETR	Senecio triangularis
Ballhead waterleaf	HYCA	Hydrophyllum capitatum
Baneberry	ACRU	Actaea rubra
Beargrass	XETE	Xerophyllum tenax
Bog saxifrage	SAOR	Saxafraga oregana
Broadleaf lupine	LULA	Lupinus latifolius
Broadpetal strawberry	FRVI	Fragaria virginiana
Brook saxifrage	SAAR4	Saxifraga arguta
Bunchberry dogwood	COCA	Cornus canadensis
California falsehellebore	VECA	Veratrum californicum
Claspleaf twistedstalk	STAM	Streptopus amplexifolius
Common dandelion	TAOF	Taraxacum officinale
Common horsetail	EQAR	Equisetum arvense
Common pink wintergreen	PYAS	Pyrola asarifolia
Common silverweed	POAN4	Potentilla anserina
Common willoweed	EPGL2	Epilobium glandulosum
Cooley's hedgenettle	STCO4	Stachys cooleyae

APPENDIX C (cont.)

Common Name	Code	Scientific Name
Coolwart foamflower	TITR	Tiarella trifoliata
Cowparsnip	HELA	Heracleum lanatum
Dutch rush	EQHY	Equisetum hyemale
Elephanthead	PEGR	Pedicularis groenlandica
Elkslip marshmarigold	CALE2	Caltha leptosepala
Elk thistle	CIFO	Circium foliosum
Enchanter's nightshade	CIAL	Circaea alpina
Fanleaf cinquefoil	POFL2	Potentila flabellifolia
Few-leaved groundsel	SECY	Senecio cymbalaroides
Field mint	MEAR3	Mentha arvense
Glabrate monkeyflower	MIGU	Mimulus guttatus
Gray licoriceroot	LIGR	Ligusticum grayii
Great sundew	DRAN	Drosera angelica
Hoary aster	ASCAB	Aster canescens var. bloomeri
Hooded ladies-tresses	SPRO	Spiranthes romanzoffiana
Jacob's-ladder	POOC	Polemoneum occidentale
Lady-fern	ATHYR	Athyrium spp.
Largeleaved avens	GEMA	Geum macrophyllum
Leafless pyrola	PYAP	Pyrola aphylla
Leafy aster	ASFO	Aster foliaceus
Lesser wintergreen	PYMI	Pyrola minor
Little buttercup	RAUN2	Ranunculus uncinatus
Longstalk clover	TRLO	Trifolium longipes
Marsh cinquefoil	POPA3	Potentila palustris
Meadowrue	THALI	Thalictrum spp.
Monkshood	ACCO	Aconitum columbianum
Mountain bluebell	MECI	Mertensia ciliata
Northern bedstraw	GABO	Galium boreale
Northwest cinquefoil	POGR	Potentilla gracilis
One-flowered gentian	GESI	Gentiana simplex
One-sided wintergreen	PYSE	Pyrola secunda
Orange arnica	ARCH	Arnica chamissonis
Oregon checkermallow	SIOR	Sidalcea oregana
Oval sundew	DRRO	Drosera rotundifolia
Pacific silverweed	POPA8	Potentila pacifica
Pale agoseris	AGGL	Agoseris glauca
Pathfinder	ADRU	Adenocaulon rubra
Primrose monkeyflower	MIPR	Mimulus primuloides
Queencup beadlily	CLUN	Clintonia uniflora
Red columbine	AQFO	Aquilegia formosa
Rosy pussytoes	ANMI	Antennaria microcephala
Rosy twistedstalk	STRO	Streptopus roseus
Rough bedstraw	GAAS	Galium asperrimum
Rydberg penstemon	PERY	Penstemon rydbergii
Scarlet painbrush	CAMI2	Castilleja miniata
Shootingstar	DODEC	Dodecatheon spp.
Siberian montia	MOSIS	Montia siberica var. siberica
Shore buttercup	RAFL2	Ranunculus flamula
Small bedstraw	GATRI	Galium trifidum
Starry solomonplume	SMST	Smilacina stellata
Sticky starwort	STJA	Stellaria jamesiana
Stinging nettle	URDI	Urtica dioica
Streambank butterweed	SEPS	Senecio pseudaureus
Swamp whitehead	SPCA	Sphenosciadium capitellatum

APPENDIX C (cont.)

Common Name	Code	Scientific Name
Sweetroot	OSMOR	Osmorhiza spp.
Sweetscented bedstraw	GATR	Galium triflorum
Tall mountain shootingstar	DOJE	Dodecatheon jeffreyi
Tawny horkelia	HOFU	Horkelia fusca
Thymeleaf speedwell	VESE	Veronica serpyllifolia
Tofieldia	TOGL	Tofieldia glutinosa
Twayblade	LISTE	Listera spp.
Twinflower marshmarigold	CABI	Caltha biflora
Umbellate pussypaws	SPUM	Spraguea umbellata
Valeriana	VALER	Valeriana spp.
Violet	VIOLA	Viola spp.
Watson's willoweed	EPWA	Epilobium watsonii
Western aster	ASOC	Aster occidentalis
White bogorchid	HADI2	Habenaria dilitata
Western buttercup	RAOC	Ranunculus occidentalis
Western dock	RUOC2	Rumex occidentalis
Western St. Johnswort	HYFO	Hypericum formosum
Western waterhemlock	CIDO	Cicuta douglasii
Western yarrow	ACMI	Archillia millefolium
White trillium	TROV	Trillium ovatum
Woods strawberry	FRVE	Fragaria vesca
Wormskjold speedwell	VEWO	Veronica Wormskjoldii
Yampa	PEGA2	Perideridia gairdneri
AQUATIC FORBS		
Bladderwort	UTRIC	Utricularia spp.
Buckbean	METR	Menyanthes trifoliata
Burreed	SPARG	Sparganium spp.
Common bladderwort	UTVU	Utricularia vulgaris
Common cattail	TYLA	Typha latifolia
Flatleaved bladderwort	UTIN	Utricularia intermedia
Indian pondlily	NUPO	Nuphar polysepala
Pondweed	POLYG	Polygonum spp.
Water lentil	LEMI	Lemna minor
White waterbuttercup	RAAQ	Ranunculus aquatilis
SHRUBS		
Alpine laurel	KAMI	Kalmia microphylla
Antelope bitterbrush	PRTR	Purshia tridentata
Bearberry	ARUV	Arctostaphylos uva-ursi
Big sagebrush	ARTR	Artemisia tridentata
Big whortleberry	VAME	Vaccinium membranaceum
Bog birch	BEGL	Betula glandulosa
Bog blueberry	VAOC2	Vaccinium occidentale
Booth willow	SABO	Salix boothii
California dewberry	RUUR	Rubus ursinus
Common chokecherry	PRVI	Prunus virginiana
Common snowberry	SYAL	Symphoricarpos albus
Coyote willow	SAEX	Salix exigua
Delicious blueberry	VADE	Vaccinium deliciosum
Douglas-hawthorn	CRDO	Crataegus douglasii

APPENDIX C (cont.)

Common Name	Code	Scientific Name
Douglas spiraea	SPDO	Spiraea douglasii
Dwarf blueberry	VACA	Vaccinium caespitosum
Dwarf bramble	RULA	Rubus lasiococcus
Eastwood willow	SAEA	Salix eastwoodiae
Geyer willow	SAGEG	Salix geyeriana var. geyeriana
Geyer willow	SAGEM	Salix geyeriana var. meleiana
Grouse whortleberry	VASC	Vaccinium scoparium
Honeysuckle	LONIC	Lonicera spp.
Lemmon willow	SALE	Salix lemmonii
Moss heather	CAME	Cassiope mertensiana
Mountain alder	ALIN	Alnus incana
Pacific ninebark	PHCA3	Physocarpus capitatus
Pacific willow	SALAL	Salix lasiandra var. lasiandra
Prickly currant	RILA	Ribes lacustre
Pyramid spiraea	SPPY	Spiraea pyramidata
Red mountainheath	PHEM	Phyllodoce empetriformis
Red-osier dogwood	COST	Cornus stolanifera
Scouler willow	SASC	Salix scouleriana
Serviceberry	AMAL	Amelanchier alnifolia
Silver sagebrush	ARCA	Artemisia cana
Sitka willow	SASI2	Salix sitchensis
Subalpine spiraea	SPDE	Spiraea densiflora
Sweetberry honeysuckle	LOCA3	Lonicera caerulea
Twinflower	LIBO2	Linnaea borealis
Undergreen willow	SACO2	Salix commutata
Vine maple	ACCI	Acer circinatum
Wax currant	RICE	Ribes cereum
Western wintergreen	GAHU	Gaultheria humifusa
Whiplash willow	SALAC	Salix lasiandra var. caudata
Woods rose	ROWO	Rosa woodsii
Yellow willow	SALU	Salix lutea
TREES		
Black cottonwood	POTR2	Populus trichocarpa
Douglas-fir	PSME	Pseudotsuga menziesii
Engelmann spruce	PIEN	Picea engelmannii
Grand fir	ABGR	Abies grandis
Incense cedar	LIDE2	Libocedrus decurrens
Lodgepole pine	PICO	Pinus contorta
Mountain hemlock	TSME	Tsuga mertensiana
Pacific silver fir	ABAM	Abies amabilis
Pacific yew	TABR	Taxus brevifolia
Ponderosa pine	PIPO	Pinus ponderosa
Quaking aspen	POTR	Populus tremuloides
Subalpine fir	ABLA2	Abies lasiocarpa
Western larch	LAOC	Larix occidentalis
Western white pine	PIMO	Pinus monticola
Whitebark pine	PIAL	Pinus albicaulis
White fir	ABCO	Abies concolor

APPENDIX D: BASAL AREA AND 100-YEAR SITE INDEX FOR FORESTED ASSOCIATIONS AND COMMUNITY TYPES

ASSOCIATION	BASAL AREA RANGE	BASAL AREA MEAN	SITE INDEX RANGE	SITE INDEX MEAN
Coniferous forest				
PIPO/SYAL-FLOOD	140-320	(187)	70-130	(95)
PICO/POPR	180-205	(195)	80-120	(91)
PICO/ARUV		(142)		(70)
PICO/SPDO/FORB	140-270	(202)	70-100	(84)
PICO/SPDO/CAEU	120-290	(188)	64-120	(97)
PICO/VAOC2/FORB	120-230	(180)	37-110	(71)
PICO/VAOC2/CAEU	108-216	(169)	50-115	(89)
PICO/CAEU	110-260	(178)	82-120	(94)
PICO/CAAQ	100-308	(199)	49-105	(75)
PICO-PIEN/ELPA2	60-92	(76)	44-67	(58)
ABCO/CLUN	230-480	(316)	76-165	(110)
PIEN/CLUN	208-465	(305)	75-138	(105)
PIEN/VAOC2/FORB	160-330	(233)	73-107	(85)
PIEN/VAOC2/CAEU	96-260	(161)	62-90	(76)
PIEN/CAEU	127-304	(230)	54-99	(80)
PIEN/EQAR-STREP	244-272	(258)	90-90	(90)
Deciduous forest				
POTR/SYAL/ELGL	108-410	(216)	80-140	(98)
POTR/ELGL	60-240	(168)	65-110	(85)
POTR-PICO/SPDO/CAEU	200-260	(232)	107-114	(114)

APPENDIX E: GLOSSARY

Abundant. When relating to plant coverage in the association key, any species having a canopy coverage of 25 percent or more in a stand.

Accidental (incidental). A species that is found rarely, or at most occasionally, as scattered individuals in an association; often as a random or chance occurrence.

Alluvium. Sediments deposited on land by streams and rivers.

Alpine. The elevational range above the upper limits of (erect) tree growth.

Anaerobic. A condition characterized by the absence of free oxygen.

Aquatic ecosystem. The stream channel or lake bed, the water, and the vegetative communities associated with them, forming an interacting system.

Association (plant association). Normal usage is a climax community type (climax plant community)(Pfister and others 1979). However, in this classification it refers to an assemblage of native or naturalized riparian vegetation occuring together in equilibrium with the environment for a given fluvial surface (i.e. the potential riparian vegetation on a fluvial surface).

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 +

Bank. The sloping land bordering a channel. The bank has a steeper slope than the bottom of the channel and is usually steeper than the land surrounding the channel.

Bar. An elongated landform formed by waves and currents, usually running parallel to the shore, composed predominantly of unconsolidated sand, gravel, stones, cobbles, or rubble and with water on two sides.

Basal area. The area of the cross-section of a tree trunk 4.5 feet above the ground, usually expressed as the sum of tree basal areas in square feet per acre.

Basin. A depression or hollow in the land, surface surrounded by higher ground.

Bog. A soil/vegetation complex in which the lower parts are dead peat, gradually changing upwards to living plant tissues. Usually saturated, relatively acid, and dominated at ground level by mosses. Bogs may be either forested or open. They are distinguished from swamps and fens by the dominance of mosses and the presence of peat deposits.

Browse. Shrubby or woody forage utilized especially by big game.

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 of the plot.

Canyon. A long, deep, narrow, very steep sided valley with high and precipitous walls in an area of high local relief.

Carr. Alder and/or willow dominated riparian sites. Peat and/or other mosses are sometimes present. The water table is usually near the surface most of the year and there is little or no accumulation of peat. Also, called shrub-carr.

Channel. An open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water.

Classification. The orderly arrangement of objects according to their differences and similarities.

Clay. Rock fragments less than 0.002 mm in diameter.

Climax. Climax has been defined as the kind of plant community that will come to occupy a site under existing climate, soils, and topography. It is the "stable state" where change in the vegetation is minimal over time and competition is so great from dominant species that "invaders" are excluded and "increasers" are held to low levels.

Climax species. A species that is self regenerating, in the absence of disturbance, with no evidence of replacement by other species.

Cobbles. Rock fragments 7.6 cm (3 inches) to 25.4 cm (10 inches) in diameter.

Colluvial. Pertaining to material transported and deposited by gravitational action and local unconcentrated runoff on and at the base of steep slopes.

Colluvium. Unconsolidated earth material deposited on and at the base of steep slopes by direct gravitational action and local unconcentrated runoff.

Common. When relating to plant coverageany species having a canopy coverage of 5 percent or more in a stand.

APPENDIX E (cont.)

Community (plant community). An assemblage of plants occurring together at any point in time, thus denoting no particular ecological status.

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. In this classification, it is used to name naturalized riparian communities such as Kentucky bluegrass or obviously seral communities such as quaking aspen/Douglas spiraea/ widefruit sedge.

Constancy. The percentage occurrence of a species within an association with no emphasis provided for either size or numbers.

Depauperate. Describing an unusually sparse coverage of undergrowth vegetation. This condition usually develops beneath an especially dense forest canopy, often on sites having a deep layer of duff.

Disturbed. Directly or indirectly altered, by humans, from a natural condition, yet retaining some natural characteristics.

Diversity. The number of species in a community, and their relative abundances, per unit area or volume.

Dominant. The species controlling the environment.

Ecological status. The degree of departure of the current vegetation from climax. Cause of departure is not considered; therefore, ecological status may include, but is not limited to, the concept of range condition. The only consideration is the difference in species density and composition between existing and climax vegetation. Three classes are used:

Climax/Late Seral
Mid Seral
Early Seral

Ecosystem. A complete interacting system of organisms and their environment.

Ecotone. A boundary between adjacent plant communities.

Edaphic. Due to soil or topography rather than climate.

Emergent vegetation. Dominated by erect, rooted, herbaceous angiosperms which may be temporarily to permanently flooded at the base but do not tolerate prolonged inundation of the entire plant.

Entisol. Those soils that have little or no evidence of pedogenic horizons, normally, as a result of recent deposition by fluvial action, entisols encountered during this study belong to the Cryofluvent subgroup.

Erosion. The wearing away of the land surface by running water, waves, moving ice and wind, or by such processes as mass wasting and corrosion.

Fen. A peatland dominated by graminoids, sometimes with sparse scattered shrubs or trees. The water table is at the surface most of the year. There may be a flow of groundwater upward through the peat. Usually circumneutral and mineral-rich. Intergrades with bog and marsh.

Floodplain. The nearly level alluvial plain that borders a stream. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the stream.

Flood storage. The process by which peak flows (from precipitation, runoff, groundwater discharge, etc.) enter a wetland and are delayed in their downslope journey.

Fluvial. Pertaining to or produced by the action of a stream or river.

Fluvial surfaces. The various land surfaces associated with the riparian zone such as active and inactive floodplains, active channel shelves, streambanks, and overflow channels.

Foothills. A steeply sloping upland with hill relief (up to 1000 ft) that fringes a mountain range or high plateau escarpment.

Forage condition. An ecological concept used to interpret livestock grazing impacts on vegetation. The departure from potential under existing environmental conditions assuming a causal relationship between the vegetation and domestic ungulate grazing.

Foraging/feeding. Providing habitat for collection or consumption of food, gravel, or necessities for nutrition.

Forb. Any herbaceous plant, usually broadleafed, that is not a grass or grasslike plant.

Forested vegetation. Dominated by woody vegetation 6 meters (20 feet) or more in height.

Freshwater impounded wetland. A palustrine or lacustrine wetland formed in a topographic depression, or by the natural or artificial damming of a river, stream, or other channel.

Geomorphic surface. A mappable part of the land surface that is defined in terms of morphology origin, age, and stability of component landforms.

Geomorphology. The science that treats the general configuration of the Earth's surface; specifically the study of the classification, description, nature, origin, and development of landforms and their relationships to underlying structures, and of the history of geologic changes as recorded by these surface features.

APPENDIX E (cont.)

Glacial outwash. Stratified sand and gravel carried, sorted, and deposited by water that originated mainly from the melting of glacial ice.

Glacial till. Unsorted and unstratified glacial drift, generally unconsolidated, deposited directly by a glacier without subsequent reworking by water from the glacier.

Gleyed soils. Soils having a 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 condition, ferrous iron is present.

Gradient (valley gradient). The slope of the valley floor in percent:

Low	0-1 percent.
Moderate	1-4 percent.
Steep	greater than 4 percent.

Graminoid. Grass or grasslike plant, such as Poa, Carex, and Juncus species.

Gravel. A mixture composed primarily of rock fragments 2 mm (0.08 inch) to 7.6 cm (3 inches) in diameter. Usually contains much sand.

Groundwater. Subsurface water in porous strata within the zone of saturation.

Growing season. The frost free period of the year (see U.S. Department of Interior, National Atlas 1970:110-111 for generalized regional delineation).

Forage (herbage) production. The air dried pounds per acre of all grasses, sedges, and forbs; no allowance is made for proper use factors.

Habitat type. All the land capable of producing similar plant communities at climax.

Herbaceous. Non-woody vegetation, such as grasses and forbs.

Herbage production. See forage production.

Histosol. Soils that contain a surface horizon of organic matter that is at least 40 cm (16 inches) thick. Suborders are distinguished by the degree of decomposition of organic material and the presence of moss fibers:

Fibric - Plant remains are so little decomposed that they are not destroyed by rubbing and their botanical origin can be determined (young soils).

Hemic - Organic materials have decomposed enough that the botanical origin of as much as two-thirds of the materials cannot be readily identified or the fibers are largely destroyed by rubbing between the fingers.

Sapric - Consists of totally decomposed plant remains. The fibers rub smooth. The botanic origin cannot be determined. Soils are usually black and consist of the residue that remains after aerobic decomposition on sites with widely fluctuating water tables.

Limnic - Consists of thick layers of sedimentary organic material on the bottoms of lakes or ponds. The fibers rub smooth. Usually olive to olive brown color. Formed under totally anaerobic decomposition.

Impounded. Formed in a topographic depression or by the natural or artificial damming of a river, stream, or other channel.

Inceptisol. Soils that lack the mollic epipedon and have high available water throughout the growing season, textures finer than loamy sand, and altered horizons that have lost bases but retain some weatherable minerals. Surface horizons are grey to black and are high in carbon.

Indicator plant. A plant whose presence or abundance indicates certain environmental conditions--presence of a habitat type, association, or community type.

Intermittent stream. A stream, or reach of a stream, that flows for protracted periods only when it receives ground water discharge or continued contributions from melting snow or other surface and shallow subsurface sources.

Krumholtz. Trees dwarfed and twisted because of severe climate (wind, low temperature, etc.) at the high elevation limits of forest development.

Lacustrine. Permanently flooded lakes and reservoirs, whose total area exceeds 8 hectares (19.768 acres) or whose maximum depth exceeds 2 meters at low water.

Landform. Any element of the landscape characterized by a distinctive surface expression, internal structure or both, and sufficiently conspicuous to be included in a physiographic description.

Low elevation. The elevation range between sea level and the Midmontane zone. NOTE: The upper limit of this region varies with microclimatic conditions and may extend above the base of adjacent foothills.

Marsh. Vegetation dominated by graminoids, with the water table at or above the surface most of the year and with little or no accumulation of peat.

APPENDIX E (cont.)

Meander. A meander is one of a series of sinuous loops, with sine-wave form, in the course of a stream channel. Meandering stream channels commonly have cross sections with low width to depth ratios, fine grained bank materials, and low gradient.

Moderate elevation (midmontane). A zone identified by characteristic vegetation which does not extend below the upper elevation of adjacent foothills or into the subalpine. The boundary between the midmontane and subalpine zones varies considerably from one geographical region to another and with microclimatic conditions.

Mineral soil. Soil composed of predominantly mineral rather than organic materials.

Mollic epipedon. Abstraction of properties common to the soils of the steppes of America, Europe, and Asia, focuses immediate attention on the horizons at or near the surface rather than the deeper ones.

Mollisol. Soils having a dark brown to black surface horizon (mollic epipedon) that is relatively thick, has a high base saturation, and usually well developed structure. The mollic epipedon is the result of underground decomposition of organic residues in the presence of bivalent cation such as calcium.

Moraine. A rounded ridge, hill, or mound of rubble left behind by a retreating glacier.

Mottling. Variation of coloration in soils as represented by localized 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.

Natural. Dominated by native biota and occurring within a physical system which has developed through natural processes without human intervention.

Organic loam. A generalized name for soils having more than 12 percent organic particles in addition to clay, silt, and sand.

Organic soil. Soil composed of at least 12 percent organics in addition to the mineral material. Equivalent to Histosol or Mollisol.

Palustrine. Tidal and nontidal wetlands dominated by trees, shrubs, persistent emergents, and emergent mosses or lichens where salinity due to ocean-derived salts is below 0.5 ppt; also included are wetlands without such vegetation, but with all of the following characteristics: 1) area less than 8 hectares; 2) active wave formed or bedrock shoreline features lacking; maximum water depth less than 2 meters at low water; 3) ocean-derived salinity less than 0.5 ppt.

Peat. Unconsolidated soil material consisting largely of undercomposed or only slightly decomposed organic mater accumulated under conditions of excessive soil moisture.

Moss peat. Peat soil composed of partially decomposed sphagnum and/or other mosses.

Sedge peat. Peat soil composed of partially decomposed sedges, bulrushes, rushes, etc.

Woody peat. Peat soil composed of partially decomposed wood.

Permanently flooded. Water covers the land surface throughout the year in all years.

Pioneer plants. Herbaceous annual and seedling perennial plants that colonize bare areas as a first stage in secondary succession.

Plant community. See community.

Poorly represented. When relating to plant coverage in the association descriptions, any species that is absent or has a canopy coverage of less than 5 percent.

Restored. Artificially returned from a disturbed or totally altered condition, to a state which mimics the original, natural condition.

Riparian. That land, next to water, where plants dependent on a perpetual source of water occur.

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 but may also occur away from the riparian zone.

Riparian wetland. An out-of-channel, palustrine wetland associated with the flowing water of a Riverine system.

Riparian zone (ecosystem). The interface between aquatic and terrestrial ecosystems that is identified by the presence of vegetation that requires or tolerates free or unbound water or conditions that are more moist than normal (Franklin 1973).

Riverine. All wetlands and deepwater habitats contained within an open conduit (channel) either naturally or artificially created, which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water, EXCEPT: wetlands dominated by trees, shrubs, persistent emergents, and emergent mosses or lichens.

Sand. Composed predominantly of coarse grained mineral sediments with diameters larger than 0.074 mm and smaller than 2 mm (0.08 inches) in diameter.

APPENDIX E (cont.)

Saturated. The substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present.

Scarce. When relating to plant coverage in the association and community type writeups, any species that is absent or has a canopy coverage of less than 1 percent.

Seasonally flooded. Surface water is present for extended periods especially early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the land surface. (See also: Semi-permanently flooded.)

Sediment. Solid material, both mineral and organic, that is in suspension, is being transported or has been moved from its site of origin by water, and has come to rest on the Earth's surface.

Sediment trapping. The process by which particulate matter is deposited and retained (by any mechanism or process) within a wetland.

Semi-permanently flooded. Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface.

Seral. Refers to species or communities that are eventually replaced by other species or communities within a successional sere.

Shore. Land on or near an ocean, lake, river, or stream between the ordinary high water mark and low water mark.

Shoreline anchoring. The stabilization of soil at the water's edge, or in shallow water, by fibrous plant roots and may include long-term buildup of riparian soil.

Shrub. A woody plant which at maturity is usually less than 6 meters (20 feet) tall and generally exhibits several erect, spreading, or prostrate stems and has a bushy appearance; e.g., mountain alder (Alnus incana) or Geyer willow (Salix geyeriana).

Silt. Rock fragments between 0.02 mm and 0.002 mm in diameter; as a textural class, a mixture of 20-50% sand, 30-80% silt, and 10-30% clay-sized particles.

Site index. An index of timberland productivity based on the height of specific trees at 100 years.

Sphagnum bog. A palustrine impounded wetland with a mineral-poor substrate composed primarily of Sphagnum spp. and which is acidic (pH 5.5).

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 or association.

Stone. Rock fragments larger than 25.4 cm (10 inches) but less than 60.9 cm (24 inches).

Stream order. A classification of streams according to the number of the tributaries. Order 1 streams have no tributaries; a stream of any higher order has 2 or more tributaries of the next lower order.

Subalpine. The elevational region, identifiable by characteristic vegetation, between the mid-montane and alpine zones. The boundaries between these zones vary considerably from one geographical region to another and with microclimatic conditions.

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.

Sward (turf). A covering of grass or grasslike plants, with its matted roots, forming the surface of a grassland, meadow, etc.

Swamp. Vegetation dominated by trees, with the water table at or above the surface most of the year and with little or no accumulation of peat. Intergrades with bog, fen, and carr.

Terrace. A step-like surface, bordering a valley floor or shoreline, that represents the former position of an alluvial plain or lake or sea shore.

Timber production. The indexing of a forest stand to produce wood fiber in cubic feet/acre/year.

Toe slope. The geomorphic component that forms the outermost, gently inclined surface at the base of a hillslope.

Topography. The relative positions and elevations of the natural or manmade features of an area that describe the configuration of its surface.

Transition zone (ecosystem). The interface between the riparian and adjacent terrestrial ecosystems that is identified by conditions that are more moist than normal. Soils are briefly

saturated only in the spring, if at all, although soil moisture relationships are excellent due to the proximity to riparian.

Tree. A woody plant which at maturity is usually 6 meters (20 feet) or more in height and generally has a single trunk unbranched to about 1 meters (3 feet) above the ground, and a more or less definite crown.

Upland. Land at a higher elevation, in general, than the alluvial plain or low stream terrace.

Valley. An elongate, relatively large, externally drained depression of the earth's surface that is primarily developed by stream erosion.

Volcanic. Pertaining to the structures, rocks, and landforms produced by volcanic action.

Water path. Used in the description of bogs such as the **few-flowered spikerush association** to describe shallow, wide depressions in which water collects and flows during periods of high water. These are not streambeds.

Water table. The depth below which the ground is saturated with water. The depth to standing water.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents with essentially no transport of the altered material. These changes result in disintegration and decomposition of the material.

Wetland. An area having one or more of the following three attributes: (1) at least periodically the substrate is dominated by facultative or obligate hydrophytes; (2) the substrate is predominantly hydric soil; (3) the substrate is nonsoil and is either saturated with or covered by shallow water at some time during the growing season.