AN ABSTRACT OF THE THESIS OF

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Title: IDENTIFICATION AND MAPPING OF HABITAT TYPES IN THE VICINITY OF MOUNT TOLMAN IN EASTERN WASHINGTON

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William W. Chilcote

Studies were conducted in the vicinity of Mount Tolman on the Colville Indian Reservation in eastern Washington in order to identify vegetation habitat types of the area. After field studies were completed, Daubenmire's keys to habitat types of eastern Washington (1968, 1970) were used to determine habitat types of the area. On the basis of sampling results, eleven habitat types were identified and described. This information was used in conjunction with aerial photointerpretation to prepare a vegetation map.

Daubenmire's baseline studies, from which the habitat type keys were developed, were conducted in pristine climax stands. The Mount Tolman study area vegetation has been subjected to human disturbance for many years. Agriculture, grazing, logging, mining, and urbanization have all had an impact on the natural vegetation of the area. It was of

interest to see at what levels of disturbance it would still be possible to determine habitat types from remnant native vegetation.

Steppe habitat types identified were Agropyron spicatum/Festuca idahoensis and Purshia tridentata/Agropyron spicatum. Very little vegetation representative of these habitat types remained in the study area because of conversion of most open land to either agricultural crops or pasture. Most steppe portions of the study area had been heavily grazed and supported disclimax vegetation dominated by Bromus tectorum and other weedy species.

Four Pinus ponderosa habitat types were identified. They were Pinus ponderosa/Agropyron spicatum, Pinus ponderosa/Festuca idahoensis, Pinus ponderosa/Purshia tridentata, and Pinus ponderosa/Symphoricarpos albus. Together they composed 43 percent of the study area. Three other forest habitats, Pseudotsuga menziesii/Symphoricarpos albus, Pseudotsuga menziesii/Physocarpus malvaceus, and Abies grandis/Pachistima myrsinites, occupied 30 percent of the study area.

Two riparian habitat types occurred consistently in the creek drainages. One of these was Crataegus douglasii/Symphoricarpus albus, both the Crataegus phase, and Populus

tremuloides phase; the other was Alnus incana/Lysichitum americanum.

Using Daubenmire's keys, coupled with information about seral communities and successional patterns, proved to be effective in determining habitat types in all but the most disturbed sites.

Identification and Mapping of Habitat Types in the Vicinity of Mount Tolman in Eastern Washington

by

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IDENTIFICATION AND MAPPING OF HABITAT TYPES IN THE VICINITY OF MOUNT TOLMAN IN EASTERN WASHINGTON

INTRODUCTION

The necessity of classifying forest vegetation has been recognized throughout North America (Rowe 1971, Kuchler 1973). Classification furnishes information on what types of vegetation are present, the total area of each type, and the patterns of distribution. Classification provides a basis for collecting and interpreting new data as well as supplying information to aid in forest management decisions. As the demands on forest resources increase, the need for expanded information systems becomes even more important in order for these lands to be managed appropriately.

As a result of these needs, many forest classification systems have been developed (Pfister 1976, Kessell 1979, Franklin 1980). Often these systems were designed for a single use, such as assessing timber productivity, and have little application for other management purposes.

Until recently, the most common classification used in the United States was a system of cover types, named for the dominant or most valuable tree growing on the site. The use of cover types has two major disadvantages. First, cover types are often seral species, those which cannot reproduce themselves on the site; therefore, the cover type is not

necessarily a permanent characteristic of the area. Second, a cover type is often not specific enough. For example, a ponderosa pine cover type could range from widely scattered trees on a grassy semiarid site to a mesic forest of dense ponderosa pine with a thick shrub understory.

In contrast to the cover type system, which classifies current vegetation, the habitat type approach is based on classification of the potential climax vegetation of an area. Climax vegetation, sometimes developing over hundreds of years, is a reflection of the overall environment, including the influences of climate, topography, and soils. A particular habitat type includes all areas potentially capable of producing similar climax plant communities even though the current vegetation on the sites may be dissimilar. Knowing the habitat type of a site can supply much information, not only on vegetation potential, but also on soil type, moisture, elevation, and topography. Mapping of habitat types can provide a permanent system of land classification that can serve as a long-term base for research and management. As land management practices have become more broad based, and have included concern for environmental considerations, habitat typing as a classification system has gained acceptance both by land managers and researchers (Layser 1974, Pfister and Arno 1980).

Habitat type classification of forests was first introduced by Daubenmire (1952) in his studies of northern Idaho and eastern Washington. During these studies he sampled undisturbed pristine areas with existing climax communities in order to form the baseline data for his classification systems. He then developed two dichotomous keys: one for determining forest habitat types (Daubenmire and Daubenmire 1968) and one for determining steppe habitat types (Daubenmire 1970).

Much of the present vegetation of the Pacific Northwest is far different from that which the area originally supported. Many areas have a long history of disturbance. Forests have been logged, burned, reforested (with varying degrees of success), and opened to grazing. Many steppe areas have been cultivated or used as grazing land. The Mount Tolman area includes both forest and steppe, and in addition to logging, grazing, and cultivation, has a history of disturbance through mining, recreational use, and some urbanization. The purpose of this investigation was to conduct field studies in the area and, using Daubenmire's keys to habitat types, attempt to determine habitat types of the area. It was of interest to see at what levels of disturbance it would still be possible to determine potential climax vegetation, and therefore, habitat types, from remnant native vegetation in disturbed areas.

The data from this study could then be available for use in future land use management by the Colville Confederated Tribes and the Bureau of Indian Affairs.

DESCRIPTION OF STUDY AREA

Regional Vegetation

The study area lies on the southern edge of the forest vegetation of northeastern Washington. This is a relatively arid transitional area between the mixed conifer forests of the Okanogan Highlands to the north and the dry steppe vegetation of the Columbia Basin to the south (Franklin and Dyrness 1973).

Elements of vegetation typical of the Cascades, the Rocky Mountains, and the Columbia Basin are present here. Steppe plant communities occupy the southern lowlands and often occur at low elevations along river valleys. Pinus ponderosa, Larix occidentalis, and Pseudotsuga menziesii are the dominant forest trees in the lower mountains, while Picea engelmannii, Abies grandis, and Abies lasiocarpa occur on higher slopes (Dryness et al. 1975).

Study Area

The study area is located at the southern edge of the Okanogan Highlands north of the Columbia River in Ferry County, Washington (Figure 1). It is within the Colville Indian Reservation, near the southern boundary. The Sanpoil River, a tributary of the Columbia River, extends from north to south near the eastern limits of the study area. The

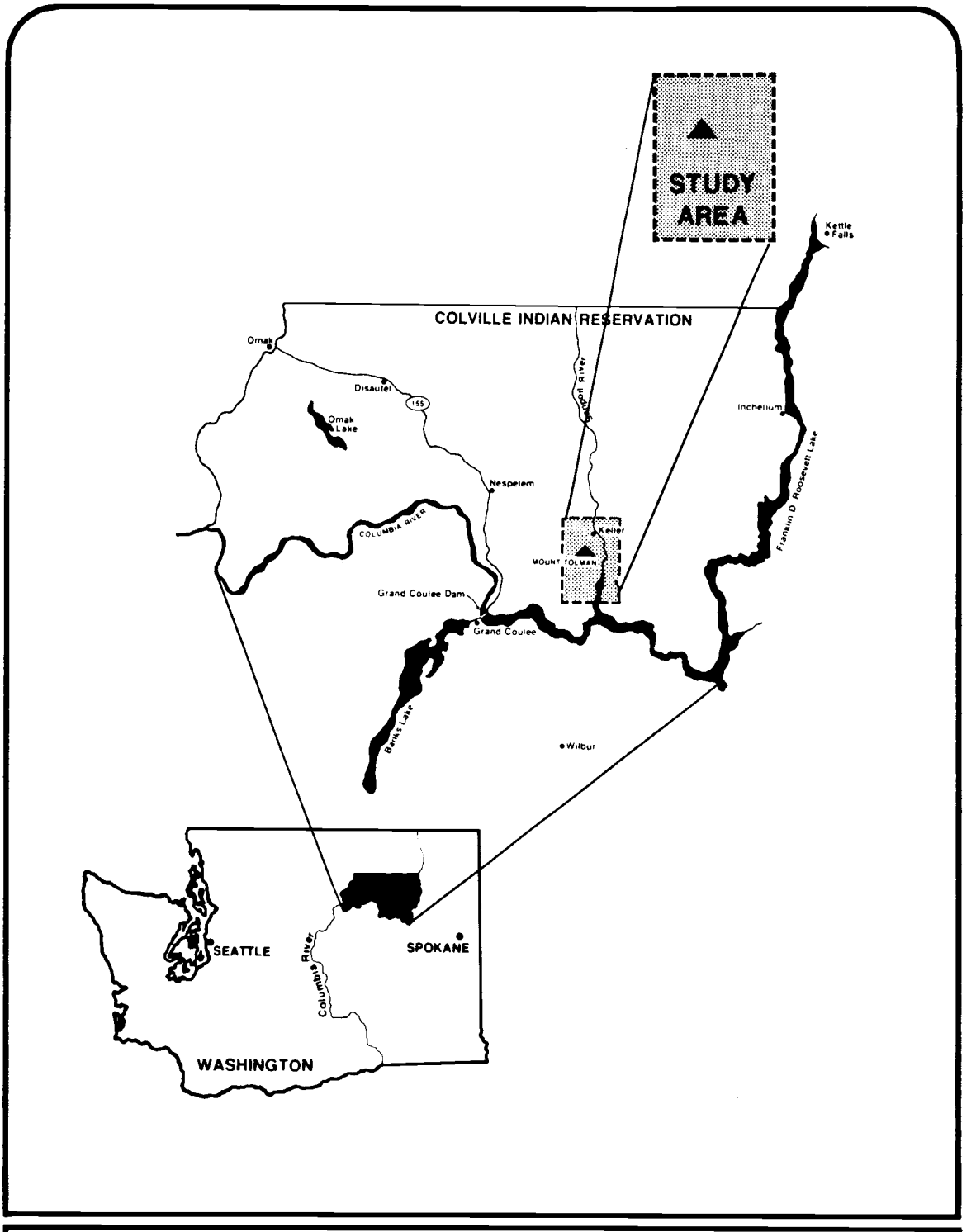


Figure 1. Study area location map.

lower valley of the Sanpoil River contains the Sanpoil Arm of Franklin D. Roosevelt Lake. Elevations range from 393 m on the Sanpoil Arm to 1,220 m at a point on the western boundary. Mount Tolman, which rises to an elevation of approximately 1,070 m, is the dominant land feature.

The study area is in the Pinus ponderosa vegetation zone (Figure 2). Although Pinus ponderosa is the dominant species over most of the area, there are also patches of steppe and mesic forest vegetation. Much of the terrain is characterized by steep sided mountain ridges and rugged uplands separated by deep, narrow drainages (Figure 3). The valleys of the Sanpoil River and its tributaries are steep and narrow in their upper reaches but relatively broad and flat at lower elevations. Few of the streams draining the study area are perennial, but all have cut deep channels through the erodible alluvium of their lower drainages.

The climate combines continental and maritime features (Franklin and Dyrness 1973), with cold, wet winters and hot, dry summers. Average annual precipitation is about 33 cm (Hydro-Triad 1980). There are occasional summer thundershowers, but most precipitation falls as snow during frequent winter storms.

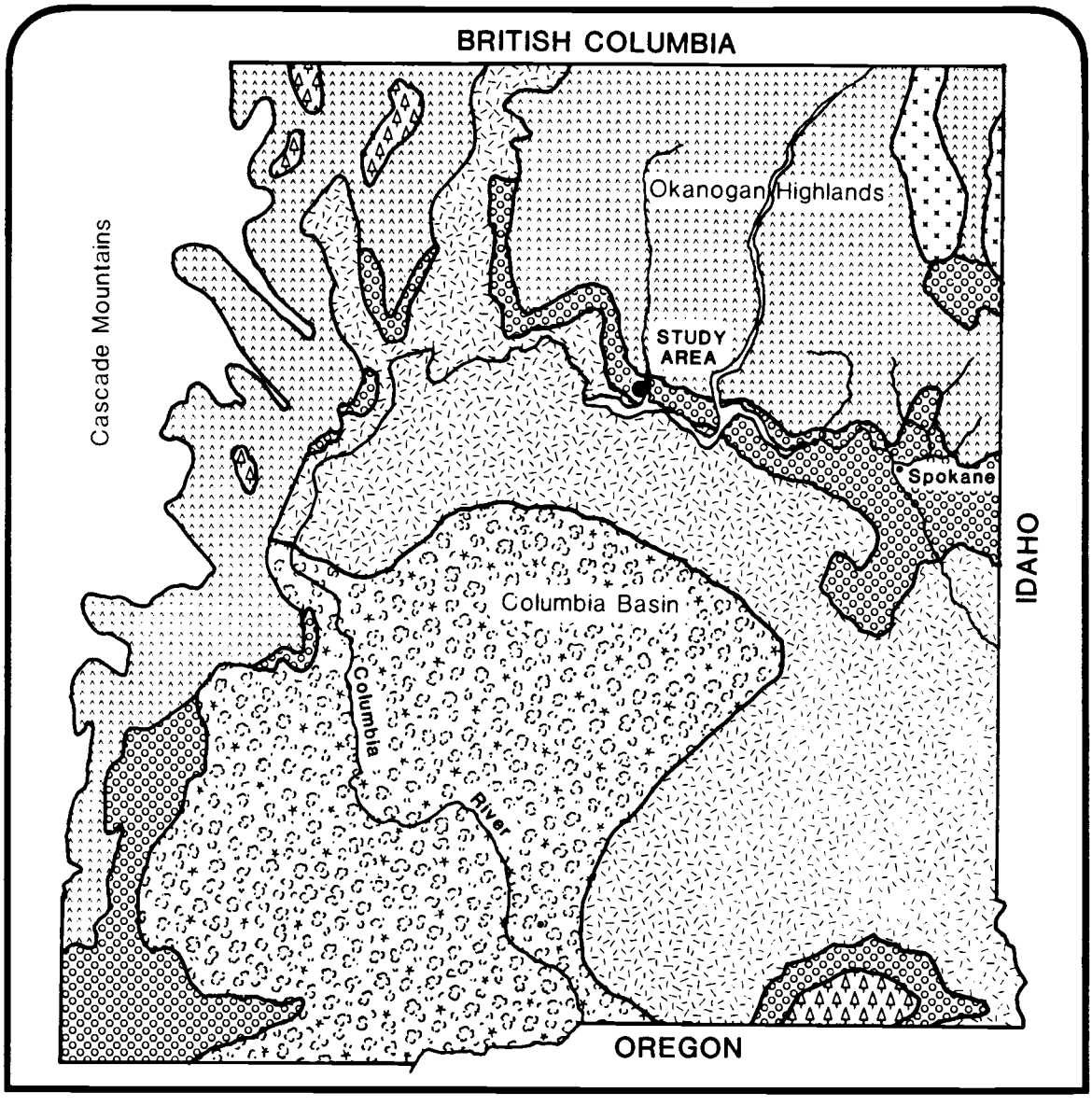


Figure 2. Major vegetation zones in eastern Washington (Franklin and Dyrness).

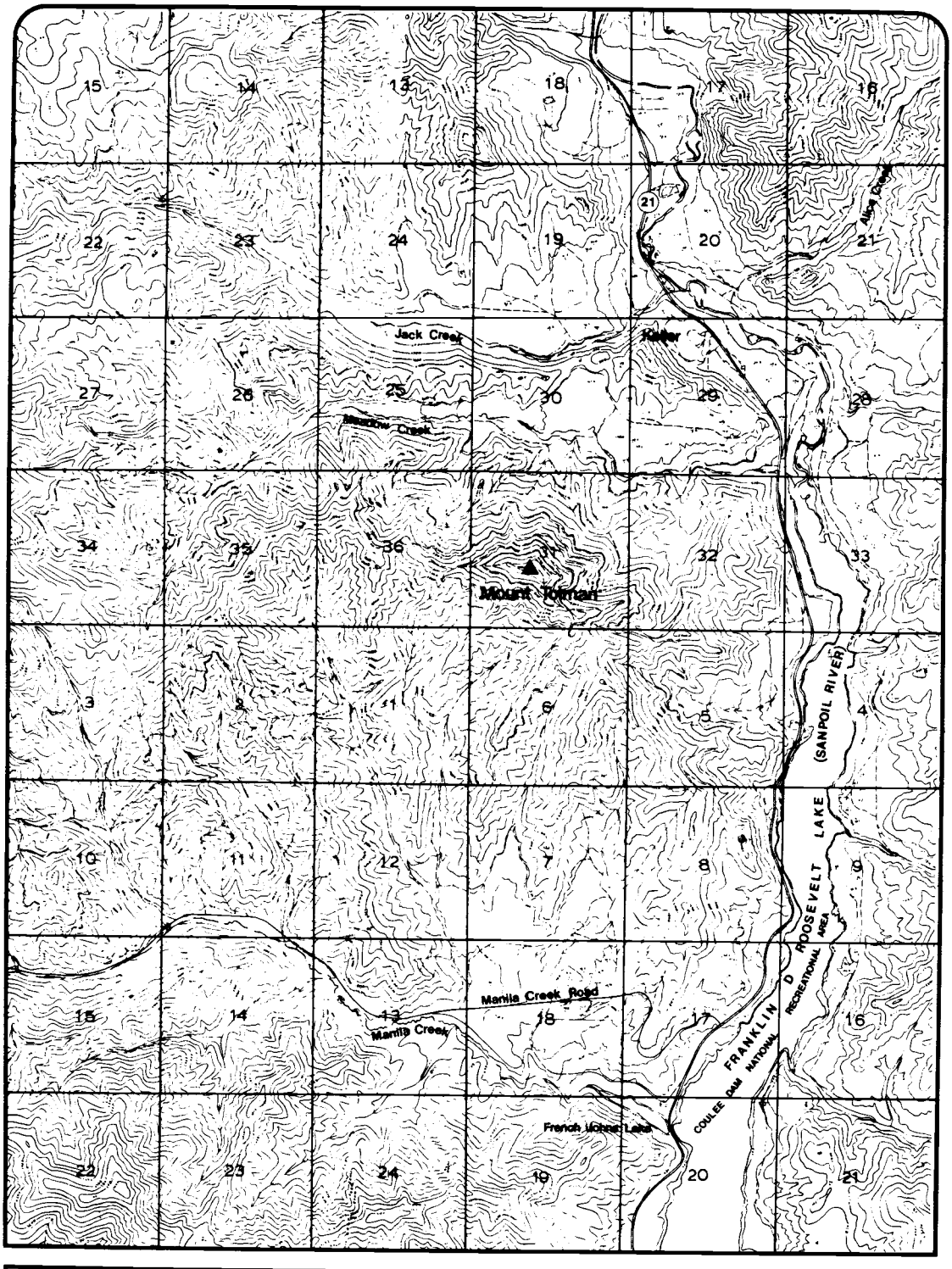


Figure 3. Topography of the study area.

LITERATURE REVIEW

A climax community is a stable community that reproduces itself and is in equilibrium with the existing environment. It will undergo significant change only if there are major environmental changes such as fire or human disturbance. There are various types of climax communities: climatic, edaphic, topographic, and zootic. Using Tansley's (1935) classification system, a climatic climax is the standard type of climax vegetation: self-regenerating; on deep, loamy soils and gentle slopes; and free from disturbance. An edaphic climax is one that differs from the climatic climax because of abnormal soil conditions such as serpentine soils, stoniness, or poor drainage. A topographic climax is one that is modified from the climatic climax by topography, such as steep south-facing slopes versus steep north-facing slopes. A zootic climax is one in which the vegetation is maintained by animal disturbance. There is also a situation called disclimax in which the successional pattern is altered such that the climax community is never attained.

Succession is defined as a progression of changes in plant community composition during development, from initial vegetation colonization of an area to the establishment of the climax vegetation (Raven et al. 1976). In any given

habitat type, successional patterns tend to repeat themselves following disturbance. For instance, in a recently logged area an initial weedy stage (dominated by invading annual herbs) gives way to a shrubby phase in which seedling trees are common. As the trees increase in size, the character of the shrub and herb components often changes also, with some species disappearing and others becoming established. When the trees achieve such a size that the understory is shaded, the only species that can reproduce are those which are shade-tolerant. Whenever a disturbance occurs, the level of succession is set back to a previous stage, but in general the pattern will repeat. The end result of succession is the climax community. Daubenmire's habitat types (Daubenmire and Daubenmire 1968, Daubenmire 1970) represent the actual or potential climax vegetation of sites having given conditions of climate, soils, elevation and topography.

Habitat type classifications derived from Daubenmire's (1952) approach are being used in forests throughout the western United States (Pfister 1976, Franklin 1980). They provide a permanent, ecologically based classification system from which to derive information for land use planning, silviculture program development, and wildlife habitat management (Daubenmire 1973, Arno and Pfister 1977). They also provide a common system for describing forest

communities and sites (Pfister et al. 1977). This classification system is based on potential natural vegetation (i.e., climax communities). In studies by Daubenmire (1952, 1970) and Daubenmire and Daubenmire (1968) sampling was restricted to climax or near-climax stands. Newer systems (i.e., Pfister et al. 1977) have been modified to allow sampling of seral stands so that climax communities can be extrapolated. Systems are also being developed which recognize and classify extensive seral forest types within study areas (Franklin 1980).

Successional patterns in Pinus ponderosa forests have been summarized by Franklin and Dyrness (1973). Fire has been historically important in influencing community structure and species composition. Periodic fires sometimes maintain seral Pinus ponderosa stands where otherwise Pseudotsuga menzieii, Abies concolor, or other climax tree species would be dominant. Fire has also been reported to have increased grass cover at the expense of shrub understory cover. Grazing, on the other hand, reportedly favors shrub understory and has contributed to the spread of Symphoricarpos albus into areas where Agropyron spicatum once dominated. Generally logging does not appear to favor alien species in Pinus ponderosa forests, since they do not seem to increase greatly in the immediate post-logging period. In instances cited by Franklin and Dyrness (1973),

the understory had nearly returned to its previous composition about 14 years after logging.

Introduced or alien plant species often invade disturbed areas and frequently replace the native species which cannot compete successfully with the aliens, thus altering the natural successional patterns (Franklin and Dyrness 1973). This has been found to be particularly evident in areas that are heavily grazed (Daubenmire and Daubenmire 1968, Daubenmire 1970). In habitat types dominated by Pinus and shrubs or grass, the invading species persist for years after the animals are removed. Poa pratensis, Poa compressa, and Bromus tectorum are the main indicators of heavy grazing. They invade in proportion to severity of use, then show almost no decrease after grazing ceases (Daubenmire and Daubenmire 1968). Thus, the amounts of these indicator species in the understory reflect the most severe grazing pressure the stand has had in the past. Pseudotsuga menziesii habitat types usually show the same response to grazing.

In steppe habitat types that have been heavily grazed, native perennials are replaced most frequently by Bromus tectorum or Poa pratensis (Franklin and Dyrness 1973). Chrysothamnus nauseosus, a native shrub, often replaces Purshia tridentata. Bromus tectorum, one of the most

abundant alien plants in the study area, was discussed in depth by Hulbert (1955), Klemmedson and Smith (1964), and Stewart and Hull (1949). Harris (1967) examines the competitive relationships between Bromus tectorum and the native Agropyron spicatum. The latter is a perennial bunchgrass which has largely been replaced on the study area rangelands by the annual Bromus tectorum. Daubenmire (1940) examined plant succession in response to grazing pressure in bunchgrass communities. Young et al. (1972) discussed the changes in steppe vegetation brought about by human activities. Parts of the study area are examples of such changes and are discussed later in this thesis.

There was little specific information available in the literature concerning the vegetation of the Mount Tolman study area. A Bureau of Indian Affairs (1959) publication included a brief summary of vegetation types found on the Colville Indian Reservation, as well as a partial list of vascular plants which occur there. However, it was primarily an inventory of grazing resources and may be out of date. Personnel at the Bureau of Indian Affairs (BIA) office in Nespelem were able to provide information concerning rangeland soils and forestry resources.

Information concerning the vegetation of the Okanogan Highlands and northeastern Washington in general was

more plentiful. Daubenmire and Daubenmire's (1968) and Daubenmire's (1970) studies of forest and steppe vegetation were comprehensive. In addition to habitat type descriptions and locations, these studies included discussions of site characteristics, natural succession, response to disturbance, and soils characteristics. Franklin and Dyrness (1973) described the vegetation zones of Washington and Oregon in some detail. Their descriptions included vegetation-soil relationships; the influence of physiography, geology, and climate; and descriptions of special types of plant communities which occur only in restricted areas. Cooke (1955) related fungi, lichens, and mosses to vascular plant communities of the region. The U.S. Forest Service is currently conducting an ecological site classification program in the Okanogan National Forest (Franklin 1980). Results of this study should be completed in 1982 (Dr. Clint Williams, pers. comm.).

METHODS AND PROCEDURES

Investigation Approach

This study examined the vegetation of a 125 km^2 area near Mount Tolman in eastern Washington. Data was gathered and analyzed in order to determine the types of vegetation habitats present. A description of each habitat type and its relationship to the existing environment and a vegetation map of the study area were prepared. A plant species list for the area was compiled and a voucher specimen collection was made.

Initial Preparation

Using aerial photographs taken in June 1978, a preliminary vegetation map of the study area was prepared. Aerial photointerpretation was done using techniques described in Avery (1968), Kuchler (1967), and Forbes (1955). The aerial photographs were examined stereoscopically and all units of vegetation that differed from one another were outlined on mylar overlays attached to the photographs. Several broad general vegetation categories were delineated on a preliminary map. This map was examined for potential sampling transect locations. Before the sampling program began, the study area was explored to determine a subjective pattern of habitat type occurrence in the area and for the purpose of

choosing general areas in which transects could be located (Deitschman 1973, Pfister and Arno 1980). Stands selected were marked on the preliminary vegetation map. Emphasis was placed on recognition of relatively homogenous stands, representing a full range of environmental conditions, to be used for sampling, an approach recommended by Mueller-Dombois and Ellenberg (1973).

Field Methods

The vegetation study included one complete growing season, late March to October, 1979. Habitat type sampling was done from late May to August, 1979. A total of sixty sites were sampled.

Sampling methods were originally to be the nested plot techniques of Daubenmire and Daubenmire (1968). However it was necessary to modify the methods as described below in order to meet the requirements of the client for whom the work was done. A transect was established for each sample site. Each transect was located in an area with vegetation apparently representative of one of the vegetation types on the preliminary vegetation map and relatively uniform for the length of the transect. All transects were 50 m long and extended in a straight line unless an obvious ecotone was encountered. In the one instance where this occurred, two parallel 25 m transects 10 m apart were sampled. The

end points of the transect were marked with stakes and one stake was labeled with a site code. A photograph of the transect was taken which included a site marker board with date and site code on it. Trees having centers within 0.5 m on either side of the transect were recorded by species, and diameter breast high (dbh at 1.4 m above the ground) was measured. Shrubs and saplings (trees less than 1.4 m tall) with aerial parts which occurred within 0.5 m on either side of the transect line were recorded by species, and the length (in centimeters) of interception along the transect was measured. Canopy coverage by species was estimated for herbaceous vascular plants within each of ten 20 x 50 cm microplots located at 5 m intervals along the transect, using Daubenmire's (1968) coverage classes.

Additional data recorded for each transect included:

- Site code
- Township, range, section, quarter section
- Elevation in meters
- Aspect of site
- Azimuth of transect line

Field observations were recorded concerning insect and disease occurrence, animal use, general condition of the stand, logging signs, and other pertinent information directed at characterizing the stand in which the sampling transect was located.

A voucher specimen of each species located in the study area was collected, labeled, identified in the field when possible, placed in a plant press, and dried. Species codes for all field sampling and data analysis were taken from Garrison and Skovlin (1976). All taxonomic identification and nomenclature follow Hitchcock and Cronquist (1973).

After voucher specimens were identified, they were mounted and labeled according to standard herbarium practices. All specimens were deposited in a reference herbarium collection at Beak Consultants Incorporated, in Portland, Oregon.

A plant species list was compiled from the reference collection plus other species sighted and recorded, but not collected (i.e., Rhus radicans, Urtica dioica). A limitation of a sampling program that covers only one growing season is that not all plant species of an area may be collected as some annuals do not appear every year (Franklin and Dyrness 1973). All vascular plants recorded within the study area during 1979 are listed in Appendix A, Table A-1.

Although nonvascular plants were not included in this study, a number of species were identified. Dr. William A. Weber of the University of Colorado provided indentification of the lichens and mosses listed in Appendix A, Table A-2.

Data Analysis

Field data were keypunched and computerized for calculation of tree density and basal area, shrub density and cover, and herb frequency and cover for each transect. When computer calculations were completed, data from each transect was examined for "fit" into one of Daubenmire's habitat types, using either the Key to Coniferous Forest Habitat Types in Eastern Washington and Northern Idaho (Daubenmire and Daubenmire 1968) or Key to Major Steppe Habitat Types in Eastern Washington and Northern Idaho (Daubenmire 1970). After all transects were classified, this study's habitat type data were compared with data and written descriptions of each habitat type in Daubenmire and Daubenmire (1968) or Daubenmire (1970) to assess the accuracy of classification.

Vegetation Map

Aerial photography of the Colville Reservation was flown for the Bureau of Indian Affairs in September, 1979. True color stereo pairs (scale 1:12,000) covering the 125 km^2 study area were obtained for interpretation and vegetation mapping.

Before interpretation began, each of the color photographs was overlaid with mylar. A mirror stereoscope was used to examine the photographs. Each noticeably different

vegetation unit was outlined on the mylar overlays. Locations of all sample transects were marked on the overlays. Using vegetation transect data, as well as observations recorded in the field, each polygon was assigned to one of the following categories:

Agropyron spicatum/*Festuca idahoensis* habitat type
Purshia tridentata/grass habitat types
Pinus ponderosa/grass habitat types
Pinus ponderosa/*Purshia tridentata* habitat type
Pinus ponderosa/*Symphoricarpos albus* habitat type
Pseudotsuga menziesii or *Abies grandis* habitat types
Riparian areas
Disclimax areas
Cultivated areas
Disturbed or developed areas
Rock outcrops

These categories follow, but do not always coincide with, the habitat type designations described in the Results Section. In some cases, several habitat types had to be combined into a single map category; in other cases, map categories did not reflect vegetation so much as land use or disturbance. The following is a brief description of criteria by which assignments to photointerpretation categories were made for the vegetation map.

At all steppe vegetation sites, the mottled texture of bunchgrass areas on the aerial photographs made them distinguishable from the even tan of pure Bromus stands. Some of the less disturbed Purshia tridentata communities had a mixed bunchgrass understory while the more disturbed areas had large amounts of Bromus tectorum in the understory. It was not possible to separate disturbed shrub communities from undisturbed ones on aerial photographs so all Purshia tridentata/grass areas were combined into one mapping unit on the vegetation map. Purshia communities were identifiable on aerial photographs by the distinctive gray-green color and stippled texture of the shrubs.

Two Pinus ponderosa/grass habitat types were represented in the study area: One with Agropyron spicatum as the major understory species; one with Festuca idahoensis. These could be separated on the ground, but as with the Purshia tridentata/grass communities, it was not possible to differentiate between understory species on aerial photographs. Pinus ponderosa/grass habitat types were distinguished from other Pinus habitat types by the open canopy and absence of a shrub understory. The Pinus ponderosa/-Purshia tridentata habitat type had a relatively open canopy, and Purshia tridentata was usually discernible on aerial photographs. The Pinus ponderosa/Symphoricarpos

albus habitat type was distinguished from Pinus ponderosa/-Purshia tridentata on the aerial photographs by color and texture; the Symphoricarpos shrub layer appeared more green and dense than the Purshia areas.

It was not possible to distinguish among the three Pseudotsuga menziesii and Abies grandis habitat types on the aerial photographs, primarily because of the closed canopy. They were easily differentiated from Pinus ponderosa habitat types, however, due to the difference in crown closure, color, texture, and aspect.

Riparian areas were identified by the bright green color and distinctive texture of deciduous trees and shrubs. In steeper drainages, the narrowness of riparian vegetation prevented mapping it.

Disclimax vegetation generally occurred in steppe areas where almost all native grasses and forbs had been replaced by Bromus tectorum and other weedy species. Chrysothamnus nauseosus often occurred as scattered shrubs. These areas were generally uniformly tan and had little texture on the aerial photographs.

Areas mapped as disturbed or developed were those where native vegetation was no longer definable due to human disturbance. Populated areas such as the town of Keller were

included in this category, as were gravel pits and slump areas along the shores of Lake Roosevelt. Areas which had been so heavily logged as to make assignment of the vegetation to habitat type impossible were also mapped in this category.

After polygons had been assigned to a map category, they were transferred to a base map (scale 1:12,000). Approximately 10 percent of the polygons were ground truthed by another botanist for accuracy of interpretation and correct placement of boundaries between map categories. Any areas that had been difficult to categorize were also checked. Ground truth information was incorporated into the draft map, and the final vegetation map prepared (Plate 1).

The total area of each map unit within the 125 km^2 study area was calculated using a proportional weights method as described by Welch (1948).

The vegetation map was also overlaid with a soils map of the study area (BEAK 1980) to determine if there were correlations between habitat types and soil series of the study area.

RESULTS

Results of field sampling for steppe and forest habitat types are given in Appendix B and are summarized below. The total area of each habitat type or map category is given in Table 1. Table 2 lists the major soil series associated with each habitat type. Plate 1 is the vegetation map of the study area.

Steppe Communities

Two steppe habitat types occur in the study area. They occupy the more xeric sites in the study area, generally near its eastern and southern boundaries. They often occur as small patches at the edge of large disclimax areas dominated by Bromus tectorum. They are also found as part of a mosaic of Pinus ponderosa and steppe communities on drier forest sites.

The major herbaceous species are caespitose grasses dominated by Agropyron spicatum and Festuca idahoensis. The major shrub is Purshia tridentata.

Agropyron spicatum/Festuca idahoensis Habitat Type

Because of conversion of most open land to either agricultural crops or pasture, very little of the original bunchgrass vegetation remains in the study area (see Table

TABLE 1. TOTAL AREA OF EACH VEGETATION CATEGORY IN THE STUDY AREA.

Vegetation Category	Vegetation Map Unit	Area (ha)	Percent of Total Area
Agropyron spicatum/Festuca idahoensis	1	104	0.8
Purshia tridentata/grass	2	440	3.5
Pinus ponderosa/grass	3	1,528	12.3
Pinus ponderosa/Purshia tridentata	4	2,641	21.2
Pinus ponderosa/ Symphoricarpos albus	5	1,191	9.6
Pseudotsuga menziesii and *Abies grandis*	6	3,651	29.4
Riparian areas	7	285	2.3
Disclimax areas	8	932	7.5
Cultivated areas	9	207	1.7
Disturbed or developed areas	10	752	6.1
Rock outcrops	11	259	2.1
Sanpoil Arm	--	440	3.5
TOTAL		12,430	100.0

TABLE 2. VEGETATION CATEGORIES OR HABITAT TYPES AND ASSOCIATED SOILS.

Habitat Type	Vegetation Map Unit	Soils Map Unit[1]	Soil Name
Agropyron spicatum/Festuca idahoensis	1	3	Rockly
		1	Skanid
		16	Rufus
Purshia tridentata/grass	2	3	Rockly
		35	Spokane Loam
		1	Skanid
		20	Speigle Variant
		16	Rufus
Pinus ponderosa/grass	3	35	Spokane Loam
		19	Phoebe
		1	Skanid
		20	Speigle Variant
		3	Rockly
		11	Haley Variant
Pinus ponderosa/Purshia tridentata	4	35	Spokane Loam
		1	Skanid
		16	Rufus
		14	Spokane Variant
		20	Speigle Variant
Pinus ponderosa/Symphoricarpos albus	5	19	Phoebe
		35	Spokane Loam
		14	Spokane Variant
		17	Cedonia
Pseudotsuga menziesii or *Abies grandis*	6	24	Dinkleman
		35	Spokane Loam
		14	Spokane Variant
		13	Shamel
		21	Dinkleman Variant
		28	Martella Variant
		27	Speigle
		4	Raisio
		5	Brief
Riparian	7	10	Xerofluvents-Riverwash Complex
		15	Mollic Fluvaquents
		46	Winthrop-Riverwash Complex
Disclimax	8	19	Phoebe
		11	Haley Variant
		3	Rockly
		1	Skanid

[1]See BEAK 1980, Soils Technical Report No. 7, Plate 1.

1). Remnant patches occur primarily on shallow, well-drained soils with rock outcrops and are generally found on ridgetops and upper slopes (Table 2). Only one grassland sample site is identified as a bunchgrass community. This is a small remnant of the Agropyron spicatum/Festuca idahoensis habitat type on an open east-facing slope above the Sanpoil Arm (Figure 4). It has evidently been relatively protected from grazing as native bunchgrasses are abundant. Phlox speciosa, Lupinus polyphyllus, and Achillea millefolium are the major forbs present. Invader species such as Bromus tectorum, Holosteum umbellatum, and Dactylis glomerata are also present, an indication that the area has undergone some disturbance.

Purshia tridentata/Agropyron spicatum Habitat Type

The one shrub-steppe community in the study area is the Purshia tridentata/Agropyron spicatum habitat type (Figure 5). This habitat type is uncommon in Washington, and usually occurs as small fragments (Daubenmire 1970). In the study area it is found primarily along the Sanpoil Arm or as occasional patches interspersed with Pinus/grass or Pinus/-Purshia sites. Four sample stands are assigned to this habitat type. Purshia tridentata is the major shrub species with Agropyron spicatum and Bromus tectorum the major herbaceous understory species. Other species present include

Figure 4. Agropyron spicatum/Festuca idahoensis habitat type.

Figure 5. Purshia tridentata/Agropyron spicatum habitat type.

Achillea millefolium, Gaillardia aristata, Balsamorhiza sagittata, and several species of Phlox. This habitat type is associated with well-drained soils, usually shallow to deep stoney loams (Table 2).

Pinus Ponderosa Communities

There are four Pinus ponderosa habitat types in the study area, comprising 43 percent of the total area (Table 1). According to Daubenmire (1976) pine habitat types can be divided into two groups. One is a grassy group which grows on drier sites in shallow or stony soils. The other is a shrubby group which occurs on more mesic sites in deeper, more fertile soil. Three of the pine habitats observed in the study area are in the grassy group: Pinus/-Agropyron spicatum, Pinus/Festuca idahoensis, and Pinus/-Purshia tridentata (in which the shrub layer is superimposed over the same xerophytic grass layer as is found in the first two). The fourth pine habitat type is in the more mesic shrubby group.

Pinus ponderosa/Agropyron spicatum and Pinus ponderosa/Festuca idahoensis Habitat Types

These two habitat types have Pinus ponderosa as the dominant tree species with an open understory of caespitose xerophytic grasses. The Pinus ponderosa/Agropyron spicatum (Figure 6) and Pinus ponderosa/Festuca idahoensis (Figure 7)

Figure 6. Pinus ponderosa/Agropyron spicatum habitat type.

Figure 7. Pinus ponderosa/Festuca idahoensis habitat type.

habitat types are similar, with Agropyron occurring on slightly drier sites than Festuca. The Ponderosa/Festuca habitat types often occupy the flats, while Ponderosa/Agropyron habitat types are more commonly found on slopes. In the study area, these two habitats intergrade, and are distinguished from one another by the presence of either Agropyron or Festuca as a major understory species. Five sample sites were identified as Pinus/Agropyron, and four were Pinus/Festuca. Associated species in Pinus/Agropyron habitat type are Bromus tectorum, Achillea millefolium, and Lupinus leucophyllus. In the Pinus/Festuca habitat type, the most common associated species are Bromus tectorum, Lupinus leucophyllus, Fragaria virginiana, and Montia linearis. Pinus ponderosa/grass habitat types are associated with shallow, sandy or gravelly loams (Table 2).

Pinus ponderosa/Purshia tridentata Habitat Type

The Pinus ponderosa/Purshia tridentata habitat type (Figure 8) was identified in nine of the sample stands. It occurs on dry sites and has the same herbaceous understory of caespitose grasses as the pine/grass habitats described above. The primary difference is the addition of a shrub understory. The shrub layer may be diverse, but Purshia is the dominant shrub. The herbaceous layer is much the same as seen in the Pinus/grass habitat types, with the addition

Figure 8. Pinus ponderosa/Purshia tridentata habitat type.

of such species as Balsamorhiza sagittata, Lupinus polyphyllus, and Spiraea betulifolia. Bromus tectorum is present, and as abundant as in the Pinus/grass habitat types. Soils are shallow sandy or gravelly loams (Table 2).

Pinus ponderosa/Symphoricarpos albus Habitat Type

The more moist Pinus ponderosa/Symphoricarpos albus habitat type (Figure 9) is assigned to six of the sample stands. Symphoricarpos albus is the dominant shrub with Rosa spp. occurring less abundantly. There are fewer grasses in this habitat type and forbs are more numerous. Species common in this habitat type are Lupinus leucophyllus, Lupinus polyphyllus, Achillea millefolium, and Fragaria virginiana. The soils are deep, well-drained loams and sandy loams (Table 2).

Pseudotsuga menziesii and Abies grandis Communities

These three habitat types are examples of topographic climax in the study area; they occur almost entirely on north-facing slopes. Occupancy seems to reflect response to a moisture gradient with Pseudotsuga on the drier sites and Abies on the wetter sites.

Figure 9. Pinus ponderosa/Symphoricarpos albus habitat type.

Pseudotsuga menziesii/Symphoricarpos albus Habitat Type

The Pseudotsuga menziesii/Symphoricarpos albus (Figure 10) habitat type is the driest of those dominated by Pseudotsuga. Eight sample stands were identified as this habitat type. It is most like the Pinus ponderosa/Symphoricarpos albus habitat type and usually occurs adjacent to it. Pinus ponderosa and Larix occidentalis are seral components of this habitat type. There is a mixed shrub layer dominated by Symphoricarpos albus. Shrubs are small and generally scattered. Herbaceous species commonly associated with this habitat type are Arnica cordifolia, Erythronium grandiflorum, Heuchera cylindrica, and Fragaria virginiana. This habitat type is the one most common on north-facing slopes in the study area. The soils are deep, well-drained loams, silt loams, or sandy loams (Table 2).

Pseudotsuga menziesii/Physocarpus malvaceus Habitat Type

The Pseudotsuga menziesii/Physocarpus malvaceus habitat type (Figure 11) was identified in four sample stands. this habitat type occurs on more mesic sites than Pseudotsuga/-Symphoricarpos. The tree layer is once again dominated by Pseudotsuga menziesii. Larix occidentalis and Pinus ponderosa occur in varying numbers. The shrub layer is dominated by Physocarpus malvaceus or Holodiscus discolor. The herbaceous layer is similar to that of Pseudotsuga

Figure 10. Pseudotsuga menziesii/Symphoricarpos albus habitat type.

Figure 11. Pseudotsuga menziesii/Physocarpus malvaceus habitat type.

menziesii/Symphoricarpos albus habitat type, with Liliaceae genera such as Disporum and Smilacina occurring in greater abundance. The soils are all deep, well-drained loams, silt loams, or sandy loams (Table 2).

Abies grandis/Pachistima myrsinites Habitat Type

The Abies grandis/Pachistima myrsinites habitat type (Figure 12) occupies the coolest and wettest forest sites found in the study area. The two sample stands are on very steep north-facing slopes at the west end of Jack Creek drainage. The dense tree layer is dominated by Abies grandis and Pseudotsuga menziesii, with the former reproducing. The shrub layer includes Pachistima myrsinites, Acer glabrum, Rosa spp., and two species of Ribes. The tree canopy is dense enough that most of the shrubs and herbs occur only in openings. Some areas of the forest floor are covered only by a mat of fir needles. Herbs that occur occasionally are Smilacina stellata, Mitella trifida, Disporum spp., and Linnaea borealis. The soils are all deep, well-drained loams, silt loams, or sandy loams (Table 2).

Riparian Communities

One plant community that is common along the benches of the Sanpoil River represents a transitional phase between

Figure 12. Abies grandis/Pachistima myrsinites habitat type.

the Pinus ponderosa/Symphoricarpos albus habitat type and the band of Populus and Salix that lines the river banks (Figure 13). Three stands of this habitat type were sampled. Species diversity is high since the area contains representatives of both upland and riparian communities. The shrub layer includes Crataegus douglasii, Clematis ligusticifolia, Populus angustifolia, and Populus tricocarpa, in addition to those shrubs usually occurring in the Pinus ponderosa/Symphoricarpos albus habitat type. Soils are deep and excessively drained, and often derived from landslides (Table 2).

Crataegus douglasii/Symphoricarpos albus Habitat Type

The Crataegus douglasii/Symphoricarpos albus habitat type occurs along creek drainages, particularly in Jack Creek and Meadow Creek valleys. It is represented by both a thicket phase dominated by Crataegus, and an aspen phase where Crataegus is present but not abundant (Figure 14). The dense Crataegus thickets have Symphoricarpos and Rosa contributing to their near impenetrability. A variety of grasses, sedges, and forbs provide a rich herbaceous layer. At some sites, however, Populus tremuloides has overtopped the Crataegus, causing its decline. The understory in the Populus phase is much more open, but a rich carpet of herbaceous growth remains. The Populus is short-lived, however,

Figure 13. Transitional Pinus ponderosa/Symphoricarpos albus riparian habitat type.

Figure 14. Crataegus douglasii/Symphoricarpos albus habitat type (Populus tremuloides phase).

and dies back to the ground after about 50 years. The remnant Crataegus then redevelops as the thicket phase and the cycle begins again (Daubenmire 1970). Examples of both phases are present in the study area. One stand in each phase was sampled.

Alnus incana/Lysichitum americanum Habitat Type

Another riparian habitat type typical of the creek drainages is an Alnus incana/Lysichitum americanum habitat type (Figure 15). One stand was sampled in this habitat type. Alnus incana dominates a shrub-tree layer that includes occasional individuals of Crataegus and Betula spp. The understory herbaceous layer consists of Lysichitum americanum, several grass and sedge species, and forbs such as Viola, Veronica and other mesic or hydric species.

The riparian habitat types generally occur on deep, poorly drained soils, although some well-drained areas occur along active stream courses (Table 2).

Disclimax Areas

As stated earlier, most of the native grassland and shrub-steppe habitat types no longer exist in the study area. Native bunchgrasses and shrubs have been replaced by Bromus tectorum and other weedy herbs and shrubs (Figure 16). Normally after disturbance, there is a successional return

Figure 15. Alnus incana/Lysichitum americanum habitat type.

Figure 16. Bromus tectorum disclimax.

to a given climax vegetation when the disturbance (e.g., grazing) is eliminated. However, the introduction of Bromus tectorum to the drier zones of Washington apparently has altered this natural successional pattern. In eastern Washington steppes, a stand of Bromus tectorum apparently has the ability to maintain itself indefinitely, even if the disturbance which led to its establishment is removed. Daubenmire (1975) found no evidence that Bromus tectorum ever gives way to native grasses, even after 50 years of protection from grazing. Bromus tectorum, because of its phenology, effectively prevents Agropyron spicatum from reestablishing. Faster root growth in winter and exhaustion of soil moisture early in summer enable Bromus to replace many native perennial bunchgrasses (Harris 1967).

Almost all of the steppe vegetation on both the east and west sides of the Sanpoil have been converted to a disclimax community dominated by Bromus tectorum. Six of the seven grassland sample sites were identified as this community type. Occasional other grasses, Lupinus leucophyllus, Plantago patagonica, and Tragopogon dubius are common associated species. Some of these areas have developed a Chrysothamnus nauseosus/Bromus tectorum community. Daubenmire (1970) points out that this successional pattern may reflect even further site degradation, since animals may graze on Bromus, but will avoid Chrysothamnus.

Much of the shrub-steppe vegetation along the Sanpoil River also has been altered. Four of the Purshia sample stands were identified as disclimax communities. The Purshia tridentata shrub layer remains, but is often accompanied by Chrysothamnus nauseosus. The understory bunchgrasses have been replaced by Bromus tectorum. Plantago patagonica, Gaillardia aristata, and Lupinus leucophyllus are common associated species. Pine/grass understory vegetation shows a similar pattern of Bromus tectorum invasion, though to a lesser degree.

DISCUSSION

A comparison of data from Daubenmire and Daubenmire (1968) and Daubenmire (1970) with the results of this study confirms preliminary observations which indicated that the habitat types in the study area are disturbed and that they represent seral stages rather than climax vegetation. Table 3 compares several parameters for selected species which are either typical of Daubenmire's habitat types or abundant in the study area.

Native grass cover in the study area was much less than reported by Daubenmire, and Bromus tectorum cover was greater. The proportion of alien species to natives was also greater in the study area than reported in Daubenmire's studies. The higher cover values for Bromus tectorum and the greater proportion of alien plants were indicative of both disturbance and nonclimax vegetation. Figure 17 compares mean herbaceous cover with mean cover of alien species (e.g., Bromus tectorum, Holosteum umbellatum, Erodium cicutarium) for each of the eleven habitat types and the disclimax vegetation. The high proportion of weeds in disclimax, grass, shrub/grass and transitional riparian vegetation probably reflects higher human use of these areas as well as greater grazing pressure.

TABLE 3. COMPARISON OF DAUBENMIRE'S (1968, 1970) DATA WITH RESULTS OF THE MOUNT TOLMAN HABITAT TYPE STUDY.

Habitat Type/Species	Mean Tree Basal Area (m^2/ha)		Mean Tree Density (Trees/ha)		Mean Percent Cover (Shrubs, herbs)	
	Daubenmire	Mount Tolman	Daubenmire	Mount Tolman	Daubenmire	Mount Tolman
Agropyron spicatum/Festuca idahoensis						
Agropyron spicatum					58.6	9.8
Bromus tectorum					1.4	50.0
Festuca idahoensis					52.9	1.5
Purshia tridentata/Agropyron spicatum						
Purshia tridentata					11.7	32.9
Agropyron spicatum					51.7	11.3
Balsamorhiza sagittata					10.0	2.0
Bromus tectorum					23.3	22.0
Poa sandbergii					16.7	<0.1
Pinus ponderosa/Agropyron spicatum						
Pinus ponderosa	No Data	28.3	No Data	1,080		
Agropyron spicatum					60.6	10.0
Bromus tectorum					0.9	9.8
Pinus ponderosa/Festuca idahoensis						
Pinus ponderosa	17.8	62.9	2,653	1,050		
Agropyron spicatum					5.4	<0.5
Bromus tectorum					<0.5	7.7
Festuca idahoensis					76.5	1.0

TABLE 3. (Continued).

Habitat Type/Species	Mean Tree Basal Area (m^2/ha) Daubenmire	Mean Tree Basal Area (m^2/ha) Mount Tolman	Mean Tree Density (Trees/ha) Daubenmire	Mean Tree Density (Trees/ha) Mount Tolman	Mean Percent Cover (Shrubs, herbs) Daubenmire	Mean Percent Cover (Shrubs, herbs) Mount Tolman
Pinus ponderosa/Symphoricarpos albus						
Pinus ponderosa	42.5	33.4	997	1,100		
Prunus virginiana					0.5	1.5
Rosa					6.5	2.0
Spiraea betulifolia					5.5	5.8
Symphoricarpos albus					45.8	5.7
Bromus tectorum					0.7	6.5
Pseudotsuga menziesii/Symphoricarpos albus						
Abies grandis	41.2	58.2	0	0		
Larix occidentalis			3	Present		
Pinus ponderosa			417	925		
Pinus contorta			20	0		
Pseudotsuga menziesii			12,410	950		
Berberis aquifolium					1.5	0.5
Spiraea betulifolia					9.6	2.0
Symphoricarpos albus					13.9	4.6
Arnica cordifolia					6.1	3.3
Bromus tectorum					<0.5	4.5

TABLE 3. (Continued).

Habitat Type/Species	Mean Tree Basal Area (m^2/ha) Daubenmire	Mean Tree Basal Area (m^2/ha) Mount Tolman	Mean Tree Density (Trees/ha) Daubenmire	Mean Tree Density (Trees/ha) Mount Tolman	Mean Percent Cover (Shrubs, herbs) Daubenmire	Mean Percent Cover (Shrubs, herbs) Mount Tolman
Pseudotsuga menziesii/Physocarpus malvaceus						
Abies grandis			16	Present		
Larix occidentalis			6	Present		
Pinus ponderosa	43.2	32.4	39	200		
Pseudotsuga menziesii			1,760	1,850		
Tsuga heterophylla			16	0		
Ceanothus sanguineus					0.5	0.3
Holodiscus discolor					4.9	11.8
Physocarpus malvaceus					33.0	9.5
Rosa					3.2	7.0
Spiraea betulifolia					3.5	3.5
Symphoricarpos albus					12.2	9.0
Arnica cordifolia					11.5	10.5
Bromus tectorum					<0.5	0.5

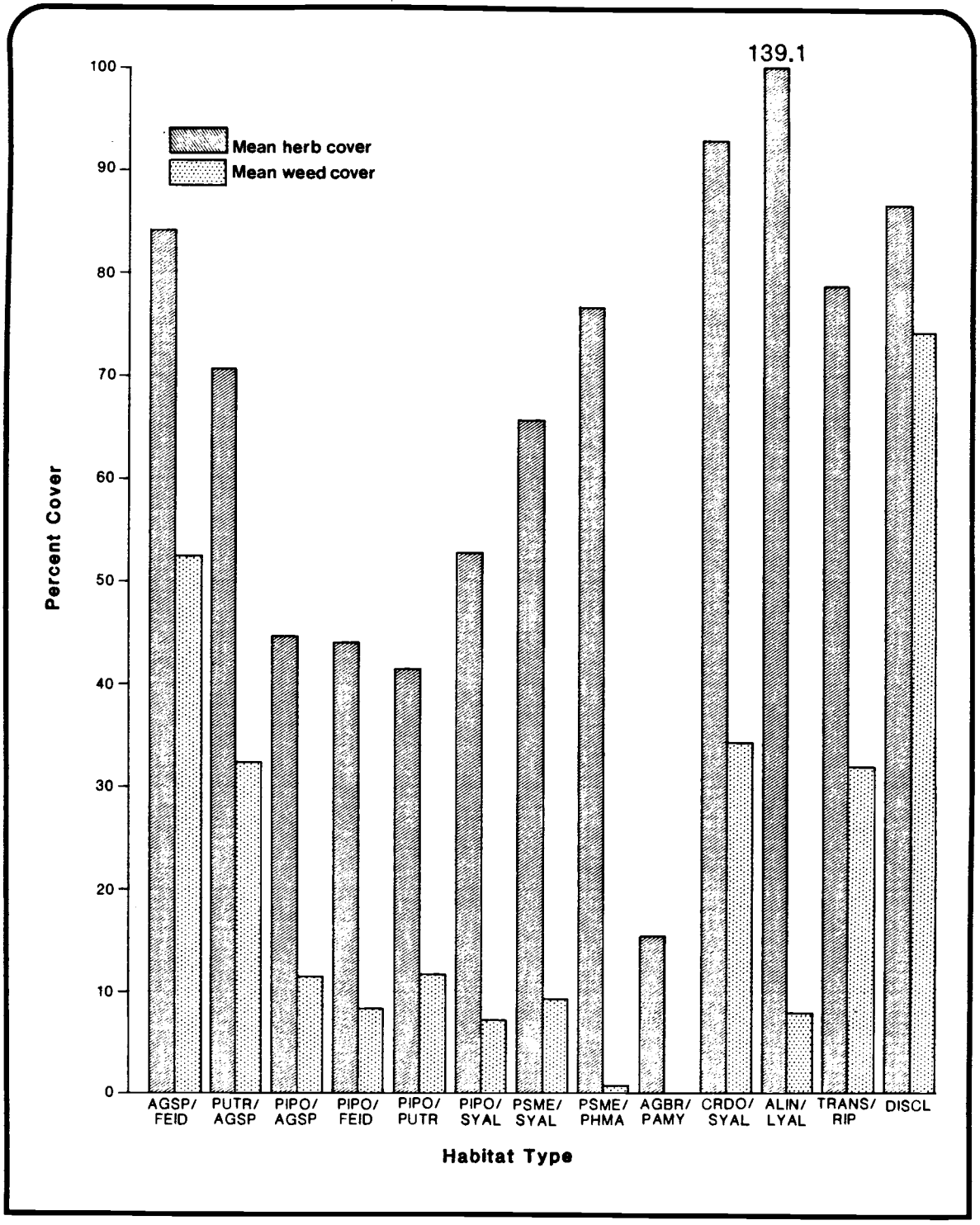
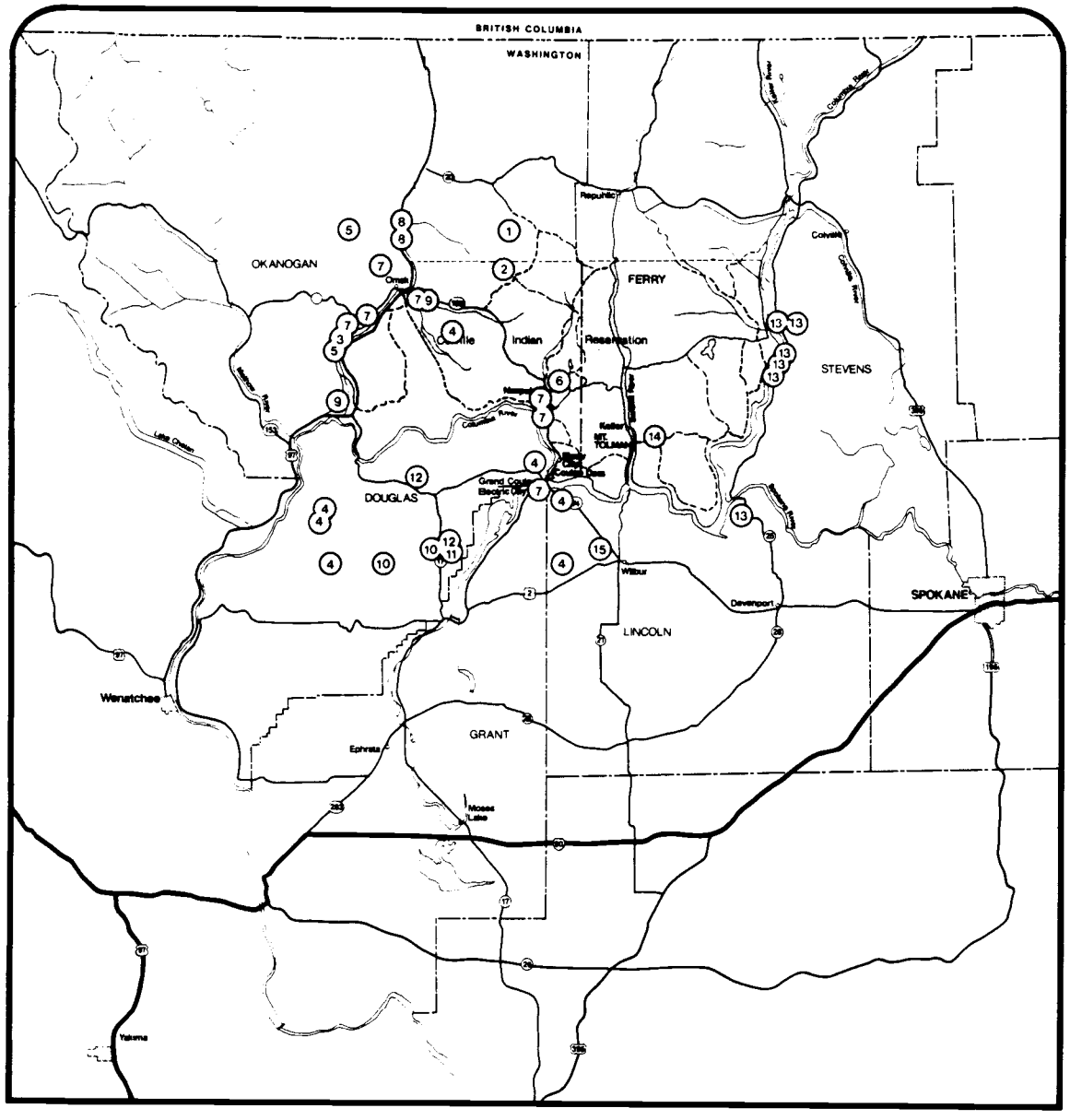


Figure 17. Comparison of mean herb cover and mean cover of weedy alien species in sampled habitats. (Habitat type codes are listed in Appendix A.)

Daubenmire's sample sites (Figure 18) were deliberately selected in areas having little evidence of disturbance and as close to being climax stands as possible. Those at the study area were selected as typical of similar stands throughout the study area and were considered representative of the remaining native vegetation plus alien species. It is generally accepted that Bromus tectorum and other alien plants will replace natives in response to heavy grazing or other prolonged disturbance (Franklin and Dyrness 1973). This is apparently the case in the study area.

The forested sites studied by Daubenmire and Daubenmire (1968) had never been logged. In all forest stands sampled during this study, there was evidence of past logging. This may account for some of the differences in tree density shown in Table 3. However, the mean basal area and tree density data are anomalous. In an area with a history of logging, the expected results would be quite different from those shown. Logging should have removed the larger trees and thus basal area means should be lower in logged areas. This was not true in the Pinus/Festuca and Pseudotsuga/-Symphoricarpos habitat types in the study area. It is possible that the sampling methods used may have biased the tree data. An attempt was made to avoid any bias when laying out transects, including trees if they occurred directly along the 50 m line. In doing so, trees may have



See Appendix A for species abbreviations.

Figure 18. Daubenmire (1968, 1970) sample sites in vicinity of study area.

been included that a truly random site layout would have excluded. However, the major difficulty was probably the limited sample area from which tree data were collected. The modification of sampling methods required for this study reduced the sample plot to a 1 m by 50 m strip rather than Daubenmire's 15 m by 25 m rectangle. According to Mueller-Dombois and Ellenberg (1974), 50 m^2 is adequate for sampling forest understory and steppe vegetation, but it is below the minimal area required for sampling trees in a temperate forest.

It is probable that the lack of climax stands in the study area is related to man-made disturbance rather than natural causes such as fire. Fires have occurred within the study area in the recent past, but not to an extent which could explain the lack of climax vegetation. It is more likely that grazing, logging, and other human activities have slowed successional processes and destroyed climax stands. The end result is a pattern of seral stands containing indications of what habitat types the area could support if it were to remain undisturbed over a long period of time.

CONCLUSIONS

Using Daubenmire's keys proved to be effective in determining habitat types in all but the most disturbed sites. A knowledge of seral communities and successional patterns, coupled with Daubenmire's descriptions of each habitat type, helped in determining the accuracy of the classifications. Classification of some of the disturbed sites, especially the forest sites that had been recently logged and some of the heavily grazed steppe areas, could possibly be extrapolated by examining similar sites that are less disturbed in areas adjacent to the study area.

More is known about the habitat types of the area than is reflected in the vegetation map. Using additional ground reconnaissance, it would be possible to delineate the habitat types in the generalized map units that could not be defined using the aerial photographs.

Information on habitat types gained in this research may be of use in several areas of resource management. Some of particular interest in the study area may be timber productivity and reforestation, maintenance of wildlife habitats, watershed management, recreation, and mine reclamation.

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APPENDICES

APPENDIX A-1. VASCULAR PLANTS OBSERVED IN THE STUDY AREA.

CODE	SCIENTIFIC NAME	COMMON NAME
EQUISETACEAE (Horsetail Family)		
EQAR	Equisetum arvense L.	Field horsetail
EQLA	Equisetum laevigatum A. Br.	Smooth horsetail
SELAGINELLACEAE (Selaginella Family)		
SEWA2	Selaginella wallacei Hieron.	Wallace's selaginella
POLYPODIACEAE (Fern Family)		
ATFI	Athyrium filix-femina (L.) Roth.	Lady-fern
PTAQ	Pteridium aquilinum (L.) Kuhn.	Bracken
PINACEAE (Pine Family)		
ABGR	Abies grandis (Dougl.) Forbes	Grand fir
LAOC	Larix occidentalis	Tamarack
PIPO	Pinus ponderosa Dougl.	Ponderosa pine
PIEN	Picea engelmannii Parry	Engelmann spruce
PICO	Pinus contorta Dougl.	Lodgepole pine
PSME	Pseudotsuga menziesii (Mirbel) Franco	Douglas-fir
TAXACEAE (Yew Family)		
TABR	Taxus brevifolia Nutt.	Pacific yew
ACERACEAE (Maple Family)		
ACGL	Acer glabrum Torr.	Rocky mountain maple
ANACARDIACEAE (Sumac Family)		
RHGL	Rhus glabra L.	Sumac
RHRA	Rhus radicans L.	Poison-ivy
APIACEAE (Parsley Family)		
CIDO	Cicuta douglasii (DC.) Coult. & Rose	Western water-hemlock
LODI2	Lomatium dissectum (Nutt.) Math. & const.	Fernleaf lomatium
LOGE	Lomatium geyeri (Wats.) Coult. & Rose	Geyer's lomatium
LOTR	Lomatium triternatum (Pursh) Coult. & Rose	Nineleaf lomatium
LOMAT	Lomatium spp.	Lomatium
OSPU	Osmorhiza purpurea (Doult. & Rose) Suksd.	Purple sweet-cicely
PEGA2	Perideridia gairdneri (H. & A.) Math.	Gairdner's yampah
APOCYNACEAE (Dogbane Family)		
APAN	Apocynum androsaemifolium L.	Spreading dogbane
ARALIACEAE (Ginseng Family)		
OPHO	Oplopanax horridum (Smith) Miq.	Devil's club

CODE	SCIENTIFIC NAME	COMMON NAME
ASTERACEAE (Aster Family)		
ACMI	Achillea millefolium L.	Yarrow
ADBI	Adenocaulon bicolor Moor.	Pathfinder
ANMA	Anaphalis margaritacea (L.) B. & H.	Common pearlyeverlastin
ANDI	Antennaria dimorpha (Nutt.) T. & G.	Low pussytoes
ANMI	Antennaria microphylla Rydb.	Rosy pussytoes
ANNE2	Antennaria neglecta Greene	Field pussytoes
ANRA	Antennaria racemosa Hook.	Raceme pussytoes
ARCO	Arnica cordifolia Hook.	Heartleaf arnica
ARLA	Arnica latifolia Bong	Mountain arnica
ARAB	Artemisia absinthium L.	Wormwood
ARDR	Artemisia dracunculus L.	Tarragon
ARTR2	Artemisia tripartita Rydb.	Threetip sagebrush
ASCA2	Aster campestris Nutt.	Western meadow aster
ASCH	Aster chilensis Nees ssp. adsendens (Lindl.) Cronq.	Long-leaved aster
ASCO	Aster conspicuus Lindl.	Showy aster
ASEA	Aster eatonii (Gray) Howell	Eaton's aster
ASMO	Aster modestus Lindl.	Few-flowered aster
ASOCI	Aster occidentalis (Nutt.) T. & G. var. intermedius Gray	Western mountain aster
ASPA4	Aster pansus (Blake) Cronq.	Tufted white prairie astor
ASTER	Aster spp.	Aster
BASA	Balsamorhiza sagittata (Pursh) Nutt.	Arrowleaf balsamroot
BICE	Bidens cernua L.	Nodding beggar-ticks
CECY	Centaurea cyanus L.	Batchelor button
CEMA	Centaurea maculosa Lam.	Spotted knapweed
CHDO	Chaenactis douglasii (Hook.) H. & A.	Douglas chaenactis
CHVI2	Chrysopsis villosa (Pursh) Nutt.	Hairy golden-aster
CHNA	Chrysothamnus nauseosus (Pall.) Britt.	Gray rabbitbrush
CHVI	Chrysothamnus viscidiflorus (Hook.) Nutt.	Green rabbitbrush
CIAR	Cirsium arvense (L.) Scop.	Canadian thistle
CIVU	Cirsium vulgare (Savi) Tenore	Bull thistle
COCA2	Conyza canadensis (L.) Cronq.	Horseweed
ERDI	Erigeron divergens T. & G.	Spreading fleabane
ERFIF	Erigeron filifolius Nutt. var. filifolius	Thread-leaf fleabane
ERPH	Erigeron philadelphicus L.	Philadelphia fleabane
ERPU	Erigeron pumilus Nutt.	Shaggy fleabane
ERST4	Erigeron strigosus Muhl.	Daisy fleabane
ERSUC	Erigeron subtrinervis Rydb. var. conspicuus (Rydb.) Cronq.	Three-veined fleabane
ERIGE	Erigeron spp.	Daisy
ERLA	Eriophyllum lanatum (Pursh) Forbes	Woolly eriophyllum
GAAR	Gaillardia aristata Pursh	Gaillardia
GNPA	Gnaphalium palustre Nutt.	Lowland cudweed
GRSQ	Grindelia squarrosa (Pursh) Dunal.	Curley-cup gumweed
HEAN	Helianthus annuus L.	Common sunflower
HIAL	Hieracium albiflorum Hook.	White-flowered hawkweed
HICY	Hieracium cynoglossoides Arv.-Touv.	Houndstongue hawkweed
LAPU	Lactuca pulchella (Pursh) DC.	Blue lettuce
LASE	Lactuca serriola L.	Prickly lettuce
MACA2	Machaeranthera canescens (Pursh) Gray	Hoary aster
MACI	Madia citriodora Greene	Sweet-scented tarweed
MAEX	Madia exigua (J.E. Smith) Gray	Little tarweed
MAGR	Madia gracilis (J.E. Smith) Keck	Gum-weed
MAMI	Madia minima (Gray) Keck	Small-head tarweed
MINU	Microseris nutans (Geyer) Schultz-Bip.	Nodding microseris
SEINE	Senecio integerrimus (Nutt.) Cronq. var. exaliatus	Western groundsel
SEVU	Senecio vulgaris L.	Common groundsel
SENEC	Senecio spp.	Groundsel

CODE	SCIENTIFIC NAME	COMMON NAME
ASTERACEAE (Continued)		
SOMI	Solidago missouriensis Nutt.	Missouri goldenrod
STPA	Stephanomeria paniculata Nutt.	Stiff-branch wirelettuce
TAOF	Taraxacum officinale Weber	Common dandelion
TRDU	Tragopogon dubius Scop.	Yellow salsify
BERBERIDACEAE (Barberry Family)		
BEAQ	Berberis aquifolium Pursh	Oregon grape
BETULACEAE (Birch Family)		
ALIN	Alnus incana (L.) Moench	Mountain alder
ALRH	Alnus rhombifolia Nutt.	White alder
ALSI	Alnus sinuata (Regel) Rydb.	Sitka alder
BEOCO	Betula occidentalis Hook. var. occidentalis	Water birch
BEPA	Betula papyrifera Marsh	Paper birch
COCO2	Corylus cornuta Marsh	Hazel
BORAGINACEAE (Borage Family)		
AMLY	Amsinckia lycopsoides Lehm.	Tarweed fiddleneck
AMME	Amsinckia menziesii (Lehm.) Nels. & Macbr.	Menzies' fiddleneck
CRSI	Cryptantha simulans Greene	Pine-woods cryptantha
CRTO	Cryptantha torreyana (Gray) Greene	Torrey's cryptantha
HACI	Hackelia ciliata (Dougl.) Johnst.	Okanogan stickseed
LIRU	Lithospermum ruderale Dougl.	Columbia puccoon
MELO	Mertensia longiflora Greene	Small bluebells
MYMI	Myosotis micrantha Pall.	Blue scorpion-grass
BRASSICACEAE (Mustard Family)		
ARHO	Arabis holboellii Hornem.	Holboell's rockcress
ARLI	Arabis lignifera A. Nels.	Woody-branch rockcress
ARABI	Arabis spp.	Rockcress
CABU	Capsella bursa-pastoris (L.) Medic.	Shepherd's purse
CAPE4	Cardamine pennsylvanica Muhl.	Pennsylvania bittercress
CHTE	Chorispora tenella (Pall.) DC.	Blue mustard
DRNE	Draba nemorosa L.	Woods draba
DRST	Draba stenoloba Ledeb.	Alaska whitlow-grass
DRVE2	Draba verna L.	Spring draba
DRABA	Draba spp.	Draba
ERAS	Erysimum asperum (Nutt.) DC.	Prairie rocket
LECA	Lepidium campestre (L.) R. Br.	Field peppergrass
SIAL	Sisymbrium altissimum L.	Tumblemustard
THAR	Thlaspi arvense L.	Fanweed
CACTACEAE (Cactus Family)		
OPPO	Opuntia polyacantha Haw.	Starvation cactus
CAMPANULACEAE (Harebell Family)		
CAPE6	Campanula persicifolia L.	Harebell
CARO3	Campanula rotundifolia L.	Scotch bluebell
TRPE2	Triodanus perfoliata (L.) Nieowl.	Venus'-looking-glass

CODE	SCIENTIFIC NAME	COMMON NAME
CAPRIFOLIACEAE (Honeysuckle Family)		
LIBO2	Linnaea borealis L.	Western twinflower
SACE	Sambucus cerulea Raf.	Blue elderberry
SYAL	Symphoricarpos albus (L.) Blake	Common snowberry
CARYOPHYLLACEAE (Pink Family)		
ARCO2	Arenaria congesta Nutt.	Capitate sandwort
ARLA2	Arenaria lateriflora L.	Bluntleaf sandwort
ARMA3	Arenaria macrophylla Hook.	Largeleaf sandwort
ARPU3	Arenaria pusilla Wats.	Dwarf sandwort
CENU	Cerastium nutans Raf.	Nodding chickweed
CEVU	Cerastium vulgatum L.	Big cerastium
DIAR	Dianthus armeria L.	Grass pink
HOUM	Holosteum umbellatum L.	Jagged chickweed
SIDO2	Silene douglasii Hook. var. douglasii	Douglas' silene
SPRU	Spergularia rubra (L.) Presl.	Red sandspurry
STCA2	Stellaria calycantha (Ledeb.) Bong.	Northern starwort
STCR	Stellaria crispa Cham. & Schlecht.	Crisped starwort
STME	Stellaria media (L.) Cyrill.	Chickweed
CELASTRACEAE (Staff-tree Family)		
PAMY	Pachistima myrsinites (Pursh) Raf.	Myrtle boxwood
CHENOPODIACEAE (Goosefoot Family)		
CHBO	Chenopodium botrys L.	Jerusalem-oak
SAKA	Salsola kali L.	Russian thistle
CORNACEAE (Dogwood Family)		
COST	Cornus stolonifera Michx.	Red-osier dogwood
CRASSULACEAE (Stonecrop Family)		
SELA2	Sedum lanceolatum Torr.	Lance-leaved sedum
ELAEAGNACEAE (Oleaster Family)		
SHCA	Shepherdia canadensis (L.) Nutt.	Russett buffaloberry
ERICACEAE (Heath Family)		
ARUV	Arctostaphylos uva-ursi (L.) Spreng.	Kinnikinnick
CHUM	Chimaphila umbellata (L.) Bart.	Prince's-pine
PYCH	Pyrola chlorantha Sw.	Wintergreen
PYSE	Pyrola secunda L.	Side-bells pyrola
VAMY	Vaccinium myrtillus L.	Dwarf bilberry
EUPHORBIACEAE (Spurge Family)		
EUGL	Euphorbia glyptosperma Engelm.	Corrugate-seeded spurge

CODE	SCIENTIFIC NAME	COMMON NAME
FABACEAE (Pea Family)		
ASCAM	Astragalus canadensis L. var. mortonii (Nutt.) Wats.	Canada milkvetch
ASPU	Astragalus purshii Dougl.	Woolly-pod milk-vetch
ASSP	Astragalus spauldingii Gray	Spaulding's milk-vetch
LONE2	Lotus nevadensis (Wats.) Greene	Nevada deervetch
LULE	Lupinus leucophyllus Dougl.	Velvet lupine
LUPO	Lupinus polyphyllus Lindl.	Washington lupine
LUWY	Lupinus wyethii Wats.	Wyeth lupine
LUPIN	Lupinus spp.	Lupine
MEAL	Melilotus alba Desr.	White sweetclover
TRDU2	Trifolium dubium Sibth.	Suckling clover
TRIFO	Trifolium spp.	Clover
GENTIANACEAE (Gentian Family)		
FRAL2	Frasera albicaulis Dougl.	White-stemmed frasera
GERANIACEAE (Geranium Family)		
ERCI	Erodium cicutarium L'Her	Filaree
GEDI	Geranium dissectum L.	Cut-leaf geranium
GROSSULARIACEAE (Currant Family)		
RICE	Ribes cereum Dougl.	Wax currant
RIIN	Ribes inerme Rydh.	White-stem gooseberry
RILA	Ribes lacustre (Pers.) Poir.	Prickly currant
RIBES	Ribes spp.	Currant; gooseberry
HYDRANGEACEAE (Hydrangea Family)		
PHLE2	Philadelphus lewisii Pursh	Syringa
HYDROPHYLLACEAE (Waterleaf Family)		
HYCA	Hydrophyllum capitatum Dougl.	Ballhead waterleaf
NEMOP	Nemophila spp.	Nemophila
PHHAL	Phacelia hastata Dougl. var. leucophylla (Torr.) Cronq.	Silverleaf phacelia
PHLI	Phacelia linearis (Pursh) Holz.	Threadleaf Phacelia
LAMIACEAE (Mint Family)		
AGUR	Agastache urticifolia (Benth.) Kuntze	Nettle-leaf horse-mint
MEAR3	Menthe arvensis L.	Field mint
MOOD	Monardella odoratissima Benth.	Mountain mint
NECA	Nepeta cataria L.	Catnip
PRVU	Prunella vulgaris L.	Self-heal
SCAN	Scutellaria angustifolia pursh	Narrow-leaved scullcap
SCGA	Scutellaria galericulata L.	Willoweed scullcap
LOASACEAE (Blazing-star Family)		
MELA2	Mentzelia laevicaulis (Dougl.) T. & E.	Blazing-star mentzelia

CODE	SCIENTIFIC NAME	COMMON NAME
LORANTHACEAE (Mistletoe Family)		
ARCA6	Archeuthobium campylopodum Engelm.	Western dwarf mistletoe
ARDO	Archeuthobium douglasii Engelm.	Douglas dwarf mistletoe
MALVACEAE (Mallow Family)		
ILRID	Iliamna rivularis (Dougl.) Greene var. diversa (Nels.) Hitc.	Streambank globemallow
SIOR	Sidalcea oregana (Nutt.) Gray	Oregon checkermallow
ONAGRACEAE (Evening-primrose Family)		
CIAL	Circaea alpina L.	Enchanter's nightshade
CLPU	Clarkia pulchella Pursh	Elkhorn clarkia
CLRH	Clarkia rhomboidea Dougl.	Rhombic-petaled clarkia
EPAN	Epilobium angustifolium L.	Fireweed
EPPAP	Epilobium paniculatum Nutt. var. paniculatum	Autumn willow-herb
EPWA	Epilobium watsonii Barbry	Watson's willow-herb
EPILO	Epilobium spp.	Willow-weed
GADI	Gayophytum diffusum T. & G.	Spreading groundsmoke
OEPAP	Oenothera pallida Lindl. var. pallida	White-stemmed evening-prim
OERY	Oenothera strigosa Mkze. & Bush	Common evening-primrose
PLANTAGINACEAE (Plantain Family)		
PLMA	Plantago major L.	Nippleseed plantain
PLPA	Plantago patagonica Jacq.	Indian-wheat
POLEMONIACEAE (Phlox Family)		
CODE	Collomia debilis (S. Wats.) Green var. camporum Pays.	Alpine collomia
COGR2	Collomia grandiflora Dougl.	Large-flowered collomia
COLI2	Collomia linearis Nutt.	Narrow-leaf collomia
GIAG	Gilia aggregata (Pursh) Spreng.	Skyrocket gilia
MIGRH	Microsteris gracilis (Hook.) Green var. humilior (Hook.) Cronq.	Pink microsteris
PHCA2	Phlox caespitosa Nutt.	Tufted phlox
PHHO	Phlox hoodii Rich.	Hood's phlox
PHLO	Phlox speciosa Pursh	Showy phlox
POLYGONACEAE (Buckwheat Family)		
ERCO5	Eriogonum compositum Dougl.	Northern buckwheat
ERDO	Eriogonum douglasii Benth.	Douglas' buckwheat
ERHEA	Erigonum heracleoides Nutt. var. angustifolium (Nutt.) T. & G.	Wyeth buckwheat
ERHEM	Erigonum heracleoides Nutt. var. minus Benth.	Wyeth buckwheat
ERST2	Eriogonum strictum Benth.	Strict buckwheat
ERIOG	Eriogonum spp.	Buckwheat
POAV	Polygonum aviculare L.	Doorweed
POSA	Polygonum sawatchense Small	Sawatch knotweed
POLYG	Polygonum spp.	Knotweed
RUAC	Rumex acetosella L.	Sheep sorrel
RUSA	Rumex salicifolius Weinm.	Willow dock
RUMEX	Rumex spp.	Dock; sorrell

CODE	SCIENTIFIC NAME	COMMON NAME
PORTULACACEAE (Purslane Family)		
CLLA	Claytonia lanceolata Pursh	Lanceleaf springbeauty
LERE	Lewisia rediviva Pursh	Bitterroot
MOLI	Montia linearis (Dougl.) Greene	Lineleaf Indianlettuce
MOPE	Montia perfoliata (Donn) Howell	Miner's lettuce
PRIMULACEAE (Primrose Family)		
DOCU	Dodecatheon cusickii Greene	Sticky shooting star
DODE	Dodecatheon dentatum	White shooting star
DOPU2	Dodecatheon pulchellum (Raf.) Merrill	Dark-throat shooting star
DODEC	Dodecatheon spp.	Shooting star
DONI	Douglasia nivalis Lindl.	Snow douglasia
STCI2	Lysimachia ciliata L.	Fringed loosestrife
LYTH	Lysimachia thyrsiflora L.	Tufted loosestrife
RANUNCULACEAE (Buttercup Family)		
ACCOC	Aconitum columbianum Nutt. var. columbianum	Monkshood
ACRU	Actaea rubra (Ait.) Willd.	Western red baneberry
AQFO	Aquilegia formosa Fisch.	Red columbine
CLCOC	Clematis columbiana (Nutt.) T. & G. var. columbiana	Columbia clematis
CLLI	Clematis ligusticifolia Nutt.	Western Clematis
DEBI	Delphinium bicolor Nutt.	Little larkspur
DENU3	Delphinium nuttallianum Pritz	Upland larkspur
RAAQ	Ranunculus aquatilis L.	White water-buttercup
RAGL	Ranunculus glaberrimus Hook.	Sagebrush buttercup
RAUN2	Ranunculus uncinatus D. Don.	Little buttercup
THOC	Thalictrum occidentale Gray	Western meadowrue
RHAMNACEAE (Buckthorn Family)		
CESA	Ceanothus sanguineus Pursh	Redstem ceanothus
CEVE	Ceanothus velutinus Dougl.	Mountain balm
ROSACEAE (Rose Family)		
AMALA	Amelanchier alnifolia Nutt. var. alnifolia	Western serviceberry
CRCO	Crataegus columbiana Howell	Columbia hawthorn
CRDOD	Crataegus douglasii Lind. var. douglasii	Black hawthorn
FRVE	Fragaria vesca L.	Woods strawberry
FRVI	Fragaria virginiana Duchesne	Strawberry
GETR	Geum triflorum Pursh	Old man's whiskers
HODI	Holodiscus discolor (Pursh) Maxim.	Creambush ocean-spray
HODU	Holodiscus dumosus (Hook.) Heller	Gland ocean-spray
OSCE	Oemleria cerasiformis (H.A.) Landon	Indian plum
PHMA	Physocarpus malvaceus (Greene) Kuntze	Mallow ninebark
POGL	Potentilla glandulosa Lindl.	Gland cinquefoil
POTEN	Potentilla spp.	Cinquefoil
PREM	Prunus emarginata (Dougl.) Walp.	Bitter cherry
PRVI	Prunus virginiana L.	Common chokecherry
PUTR	Purshia tridentata (Pursh) DC.	Antelope bitterbrush
RONU	Rosa nutkana Presl.	Nootka rose
ROWO	Rosa woodsii Lindl.	Wood's rose
RUIDP	Rubus idaeus L. var. paramoenus (Greene) Fern.	Red respberry

CODE	SCIENTIFIC NAME	COMMON NAME
ROSACEAE (Continued)		
RUPA	Rubus parviflorus Nutt.	Western thimbleberry
SOSC2	Sorbus scopulina Greene	Mountain-ash
SPBE	Spiraea betulifolia Pall.	Shiney-leaf spiraea
RUBIACEAE (Madder Family)		
GAAPE	Galium aparine L. var. echinosperma (Wallr.) Farw.	Cleavers
GABO	Galium boreale L.	Northern bedstraw
GATR	Galium triflorum Michx.	Fragrant bedstraw
SALICACEAE (Willow Family)		
POAN2	Populus angustifolia James	Mountain cottonwood
POTR	Populus tremuloides Michx.	Quaking aspen
POTR2	Populus trichocarpa T. & G.	Black cottonwood
SAEX	Salix exigua Nutt.	Coyote willow
SASC	Salix scouleriana Barratt	Scouler willow
SALIX	Salix spp.	Willow
SAXIFRAGACEAE (Saxifrage Family)		
HECY	Heuchera cylindrica Dougl.	Roundleaf alumroot
LIGL	Lithophragma glabra Nutt.	Smooth fringecup
LIPA	Lithophragma parviflora (Hook.) Nutt.	Smallflower woodlandstar
MITR2	Mitella trifida Grah.	Threetooth mitrewort
SAINL	Saxifraga integrifolia Hook. var. leptopetala (Suksd.) Engl. & Irmsch.	Swamp saxifrage
TITRU	Tiarella trifoliata L. var. unifoliata (Hook.) Kurtz.	Coolwort foamflower
SCROPHULARIACEAE (Figwort Family)		
BERU	Besseya rubra (Dougl.) Rydb.	Red besseya
CAMIN	Castilleja miniata Dougl. var. miniata	Common paintbrush
CASTI	Castilleja spp.	Indian-paintbrush
COPA	Collinsia parviflora Lindl.	Small-flowered collinsia
COSP	Collinsia sparsiflora Fisch. & Mey.	Few-flowered collinsia
MIGU	Mimulus guttatus DC.	Yellow monkey-flower
PEAC	Penstemon acuminatus Dougl.	Sand-dune penstemon
PEFR3	Penstemon fruticosus (Pursh) Greene	Shrubby penstemon
PERI	Penstemon richardsonii Dougl. var. richardsonii	Richardson's penstemon
PENST	Penstemon spp.	Penstemon
VETH	Verbascum thapsus L.	Flannel mullein
VEAM	Veronica americana Schwein	American speedwell
VEAN	Veronica anagallis-aquatica L.	Water speedwell
VESEH	Veronica serpyllifolia L. var. humifusa (Dickson) Vahl.	Thymeleaf speedwell
VESES	Veronica serpyllifolia L. var. serpyllifolia	Thymeleaf speedwell
SOLANACEAE (Potato Family)		
SODU2	Solanum dulcamara L.	Bittersweet

CODE	SCIENTIFIC NAME	COMMON NAME
URTICACEAE (Nettle Family)		
URDI	Urtica dioica L.	Stinging nettle
VALERIANACEAE (Valerian Family)		
PLMA3	Plectritis macrocera T. & G.	Longhorn plectritis
VERBENACEAE (Verbena Family)		
VEBR	Verbena bracteata Lag. & Rodr.	Bracted verbena
VIOLACEAE (Violet Family)		
VIADC	Viola adunca Sm. var. cascadensis (Baker) Hitchc.	Cascade violet
VIGL	Viola glabella Nutt.	Pioneer violet
VIMAM	Viola macloskeyi Lloyd var. macloskeyi	Macloskey violet
VINE	Viola nephrophylla Greene var. nephrophylla	Bog violet
ZYGOPHYLLACEAE (Caltrop Family)		
TRTE	Tribulus terrestris L.	Puncture-vine
ARACEAE (Calla-lilly Family)		
LYAM	Lysichitum americanum Hulten & St. John	Yellow skunkcabbage
CYPERACEAE (Sedge Family)		
CABE	Carex bebbii Olney	Bebb's sedge
CAFI	Carex filifolia Nutt.	Thread-leaved sedge
CALA3	Carex lanuginosa Michx.	Woolly sedge
CARE	Carex retrorsa Schw.	Knot-sheath sedge
CAREX	Carex spp.	Sedge
CYAR	Cyperus aristatus Rottb.	Awned flatsedge
ELPA	Eleocharis palustris (L.) R. & S.	Creeping spikerush
JUNCACEAE (Rush Family)		
JUEN	Juncus ensifolius Wikst.	Daggerleaf rush
JUIN	Juncus interior Wieg.	Slender rush
JUTE	Juncus tenuis Willd.	Slender rush
LUCA2	Luzula campestris (L.) DC.	Field woodrush
LILIACEAE (Lilly Family)		
BRDO	Brodiaea douglasii Wats.	Douglas brodiaea
CALOC	Calochortus spp.	Cats-ear
CLUN	Clintonia uniflora (Schult.) Kunth.	Bead lily
DITR	Disporum trachycarpum (Wats.) Benth. & Hook.	Sierra fairy-bell
ERGRG	Erythronium grandiflorum Pursh var. grandiflorum	Lambstongue fawnlily
SMRA	Smilacina racemosa (L.) Desf.	Feather solomonplume
SMST	Smilacina stellata (L.) Desf.	Starry solomonplume

CODE	SCIENTIFIC NAME	COMMON NAME
LILIACEAE (Continued)		
STAM	Streptopus amplexifolius (L.) DC.	Clasping-leaved twistedstalk
TRPE	Trillium petiolatum Pursh.	Idaho trillium
ZIVE	Zigadenus venenosus Wats.	Meadow death camas
ORCHIDACEAE (Orchid Family)		
CABU2	Calypso bulbosa (L.) Oakes	Fairy slipper
CYMO	Cypripedium montanum Dougl.	Mountain lady-slipper
GOOB	Goodyera oblongifolia Raf.	Rattlesnake plantain
POACEAE (Grass Family)		
AGRE	Agropyron repens (L.) Beauv.	Quackgrass
AGSP	Agropyron spicatum Scribn. & Smith	Bluebunch wheatgrass
AGAL	Agrostis alba L. var. alba	Redtop
ALAE	Alopecurus aequalis Sobol.	Short-awn foxtail
ARLO3	Aristida longiseta Steud.	Red threeawn
BRBR	Bromus brizaeformis Fisch. & Mey.	Rattlesnake grass
BRCO	Bromus commutatus Schrad.	Hairy bromegrass
BRJA	Bromus japonicus Thunb.	Japanese brome
BRTE	Bromus tectorum L.	Cheatgrass
CAPU	Calamagrostis purpurascens R. Br.	Purple pinegrass
CARU	Calamagrostis rubescens Buckl.	Pinegrass
CELO	Cenchrus longispinus (Hack.) Fern.	Burr-grass
DAGL	Dactylis glomerata L.	Orchard grass
DEEL	Deschampsia elongata (Hook.) Munro	Slender hairgrass
ELCA	Elymus canadensis L.	Canada wildrye
ELCIC	Elymus cinereus Scribn. & Merr. var. cinereus	Giant wildrye
FEBR	Festuca bromoides L.	Barren fescue
FEID	Festuca idahoensis Elmer	Idaho fescue
FEMI	Festuca microstachys Nutt.	Small fescue
FEOC2	Festuca octoflora Walt.	Six-weeks fescue
GLGR	Glyceria grandis Wats.	Reed mannagrass
HOJU	Hordeum jubatum L.	Squirrel-tail
KOCR	Koeleria cristata Pers.	Prairie junegrass
PACA	Panicum capillare L.	Common witchgrass
PHAR	Phalaris arundinacea L.	Reed canarygrass
PHPR	Phleum pratense L.	Timothy
POAN	Poa annua L.	Annual bluegrass
POBU	Poa bulbosa L.	Bulbous bluegrass
POPA	Poa palustris L.	Blue fowlgrass
POPR	Poa pratensis L.	Kentucky bluegrass
POSA3	Poa sandbergii Vasey	Sandberg's bluegrass
POSC	Poa scabrella (Thurb.) Benth.	Pine bluegrass
PUPA	Puccinellia pauciflora (Presl.) Munz	Alkaligrass
SEVI	Setaria viridis (L.) Beauv.	Green bristlegrass
SPCR	Sporobolus cryptandrus (Torr.) Gray	Sand dropseed
STCO2	Stipa comata Trin. & Rupr.	Needle-and-thread
TYPHACEAE (Cat-tail Family)		
TYLA	Typha latifolia L.	Common cat-tail

APPENDIX A-2. SOME LICHENS AND MOSSES OCCURRING IN THE MOUNT TOLMAN STUDY AREA.

Lichens

Acarospora chlorophana (Wahlenb. ex Ach.) Mass.
Acarospora fuscata (Schrad.) Arn.
Aspicilia caesiocinerea (Nyl.) Arn.
Bryoria sp.
Caloplaca saxicola (Hoffm.) Nordin
Candelariella vitellina (Ehrh.) Muell.-Arg.
Cladonia sp.
Dermatocarpon reticulatum Magn.
Diploschistes scruposus (Schreb.) Norm.
Hypogymnia sp.
Lecanora christoi W. A. Weber
Lecanora rupicola (L.) Zahlbr.
Lecidea atrobrunnea (Ram. ex Lam. & DC.) Schaer.
Lecidea tessellata (Ach.) Flk.
Letharia vulpina (L.) Vain.
Melanelia disjuncta (Erichs.) Essl.
Neofuscelia subhosseana (Essl.) Essl.
Parmelia omphalodes (L.) Ach.
Parmelia saxatilis (L.) Ach.
Phaeophyscia ciliata (Hoffm.) Moberg
Phaeophyscia sciastra (Ach.) Moberg
Physcia magnussonii Frey
Physconia grisea (Lam.) Poelt
Pseudephebe pubescens (L.) Brodo & Hawksw.
Psora novomexicana B. de Lesd.
Rhizocarpon disporum (Naeg. ex Hepp) Muell.-Arg.
Rhizocarpon riparium Ras.
Rhizoplaca chrysoleuca (Sm.) Zopf
Rhizoplaca melanophthalma (Ram. ex Lam & DC.) Leuckert & Poelt
Staurothele clopima (Wahlenb. ex Ach.) Th. Fr.
Umbilicaria hyperborea (Ach.) Hoffm.
Umbilicaria phaea Tuck.
Umbilicaria vellea (L.) Ach.
Xanthoparmelia sp.
Xanthoparmelia taractica (Kremp.) Hale
Xanthoria fallax (Hepp) Arn.

Mosses

Grimmia alpestris (Web. & Mohr) Schleich. ex Nees, Hornsch. & Sturm
Grimmia pulvinata (Hedw.) Sm. ex Sm. & Sowerby
Homalothecium nuttallii (Wils.) Jaeg.
Orthotrichum rupestre Schleich. ex Schwaegr.

APPENDIX B-1. TREE POPULATION DATA

Population structure of trees by stand for major forest habitat types (n = no. of sample plots). Figures represent number of individuals per 50 m^2 sample area. Basal area for the stand as m^2/ha is given below stand number. Asterisk (*) indicates present in stand but not on sample plot.

1. Pinus ponderosa/Agropyron spicatum (n = 5)

Stand and b.a.	Spp.	Diameter (at breast height) classes (cm)										
		(<5)	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	>50
5 (12.33)	PIPO	5					1					
13 (29.26)	PIPO									1		
16 (46.80)	PIPO	3	1		1	1					1	
27 (25.51)	PIPO	3	2						1			
43 (27.43)	PIPO	5					2					

APPENDIX B-1 (Continued)

2. *Pinus ponderosa/Festuca idahoensis* (n = 4)

Stand and b.a.	Spp.	Diameter (at breast height) classes (cm)										
		(<5)	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	>50
21 (49.67)	PIPO	1						1			1	
33 (42.76)	PIPO	1	3	3	1					1		
36 (89.96)	PIPO	2						1				1
59 (69.30)	PIPO	1	1			1	1					1

APPENDIX B-1 (Continued).

3. Pinus ponderosa/Purshia tridentata (n = 9)

Stand and b.a.	Spp.	Diameter (at breast height) classes (cm) (<5)	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	>50
10 (22.18)	PIPO		1	1		1		1				
15 (40.44)	PIPO	3										1
18 (1.10)	PIPO	1	1									
19 (0.08)	PIPO	1										
24 (19.05)	PIPO	1						1				
26 (14.90)	PIPO	1		1	1	2						
30 (34.07)	PIPO										1	
28 (11.74)	PIPO	3		1		1						
17	PIPO*											

APPENDIX B-1 (Continued).

4. Pinus ponderosa/Symphoricarpos albus (n = 6)

Stand and b.a.	Spp.	Diameter (at breast height) classes (cm) (<5)	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	>50
2 (23.20)	PIPO	1	1	2	1		1					
4 (21.68)	PIPO			3	1		1					
48 (44.07)	PIPO				2		1		1			
49 (6.91)	PIPO	4	1	3								
60 (58.89)	PIPO						1					1
31 (45.68)	PIPO	3		1	3	1			1			

APPENDIX B-1 (Continued).

5. Pseudotsuga menziesii/Symphoricarpos albus (n = 8)

Stand and b.a.	Spp.	Diameter (at breast height) classes (cm) (<5)	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	>50
1 (97.27)	LAOF*											
	PIPO								1			1
	PSME			1					1			
7 (0.74)	PIPO	3	1									
	PSME	2										
23 (0.70)	PIPO	4	1									
	PSME	2										
35 (50.81)	LAOF*											
	PIPO		1									
	PSME	2	1									
38 (133.94)	LAOF*											
	PIPO	1										1
	PSME	2	1		1	1	1					

APPENDIX B-1 (Continued).

5. Pseudotsuga menziesii/Symphoricarpos albus (n = 8) continued.

Stand and b.a.	Spp.	Diameter (at breast height) classes (cm)										
		(<5)	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	>50
20 (43.36)	PIPO	2	2	3		3						
	PSME	2				1						
25 (33.60)	PIPO	1	3	5	4							
	PSME	3										
44 (105.43)	LAOF*											
	PSME	7	2	2	3	1		1				1

APPENDIX B-1 (Continued).

6. Pseudotsuga menziesii/Physocarpus malvaceus (n = 4)

Stand and b.a.	Spp.	Diameter (at breast height) classes (cm) (<5)	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	>50
37 (38.9)	LAOF*											
	PIPO	3			1							
	PSME	6									1	
40 (5.7)	ABGR		1									
	LAOF*											
	PSME	3		2								
50 (50.1)	PSME	12	1		1							1
51 (34.9)	PSME	5		1	1	1	2					

APPENDIX B-1 (Continued).

7. Abies grandis/Pachistima myrsinites (n = 2)

Stand and b.a.	Spp.	Diameter (at breast height) classes (cm) (<5)	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	>50
32 (54.89)	ABGR	7	2		1							
	PSME							1		1		
34 (32.59)	ABGR	7	2		1							
	PSME	1	2	2		1	1					

APPENDIX B-2. FOREST UNDERGROWTH AND OTHER STAND DATA FOR MAJOR HABITAT TYPES.

Number left of . is percent cover; + indicates cover less than 0.5 %.
Number right of . is density within sample plot of shrub species, percent frequency of herbaceous species.
* indicates present in stand but outside sample plots.

	1. Agropyron spicatum/ Festuca idahoensis		2. Purshia tridentata/ Agropyron spicatum		
Transect Number:	009	008	022	046	047
Township	29N	29N	30N	29N	29N
Range	33E	33E	33E	33E	33E
Section	8	8	31	17	17
Altitude in meters	660	635	1050	560	535
Aspect	ENE	WNW	SSW	WNW	ESE
Percent slope	30	45	65	30	18
SHRUBS					
Purshia tridentata		44.12	3.2	28.10	55.12
Philadelphus lewisii				5.1	
Sambucus cerulea				*	
PERENNIAL GRAMINOIDS					
Agropyron spicatum	10.50	9.30	15.60	21.90	+.10
Dactylis glomerata	2.20				
Festuca bromoides		+.10			

APPENDIX B-2 (Continued).

	1. Agropyron spicatum/ Festuca idahoensis		2. Purshia tridentata/ Agropyron spicatum		
Transect Number:	009	008	022	046	047
Festuca idahoensis	2.10			7.40	
Koeleria cristata				4.10	
Poa sandbergii		+.10			
PERENNIAL FORBS AND SUBSHRUBS					
Achillea millefolium	6.70	1.40	1.30	1.40	2.30
Apocynum androsaemifolium			16.100		
Arabis	+.10				
Balsamorhiza sagittata	*	2.10	*	6.10	*
Brodiaea douglasii		+.10			
Frasera albicaulis	*				
Gaillardia aristata					2.10
Hieracium cynoglossoides	+.10				
Hydrophyllum capitatum		+.10			
Lewisia rediviva			+.10		
Lithophragma	+.10				
Lomatium dissectum			+.10		
Lomatium triternatum	*				
Lomatium				2.10	
Lupinus polyphyllus	4.10	4.20		1.20	*
Polygonum			*		
Potentilla				1.20	
Phlox caespitosa			10.20		
Phlox longifolia				4.10	

APPENDIX B-2 (Continued).

	1. Agropyron spicatum/ Festuca idahoensis		2. Purshia tridentata/ Agropyron spicatum		
Transect Number:	009	008	022	046	047
Phlox speciosa	2.10	2.10			
Tragopogon dubius					2.10
Penstemon fruiticosus			*		
Sedum lanceolatum			*		
ANNUALS					
Bromus brizaeformis				3.80	
Bromus commutatus				*	
Bromus tectorum	50.100	58.100	4.60	6.30	20.90
Collinsia parviflora	1.20	1.20	2.80		
Cryptantha torreyana			1.20	*	
Galium		+.10			
Holosteum umbellatum	1.20				
Madia minima					+.10
Microsteris gracilis				+.10	
Myosotis micrantha		6.50			
Plantago patagonica				11.40	29.50
Plectritis macrocera			1.20		

APPENDIX B-2 (Continued).

3. *Pinus ponderosa*/*Agropyron spicatum*

Transect Number:	005	013	016	027	043
Township	30N	30N	29N	30N	30N
Range	32E	32E	33E	33E	33E
Section	26	23	9	20	33
Altitude in meters	660	755	465	415	435
Aspect	SSE	WSW	-	-	-
Percent slope	84	68	0	0	0
SHRUBS					
Symphoricarpos albus					*
Amelanchier alnifolia		+.3		*	
Ceanothus velutinus	5.1			*	
Holodiscus discolor	10.5	18.9			
Rosa	+.1	*	2.3		*
Ceanothus sanguineus				*	
PERENNIAL GRAMINOIDS					
Agropyron spicatum	7.40	3.30	7.30	18.60	15.70
Poa scabrella	+.10				
Stipa	*				
PERENNIAL FORBS AND SUBSHRUBS					
Achillea millefolium	2.10	2.20	+.10	8.60	+.10
Antennaria dimorpha			+.10		
Arabis		*			
Balsamorhiza sagittata				*	

APPENDIX B-2 (Continued).

3. Pinus ponderosa/Agropyron spicatum (Continued)

Transect Number:	005	013	016	027	043
Delphinium		*		*	
Eriophyllum lanatum	1.20				
Erysimum asperum		2.10			
Phlox				*	
Fragaria virginiana					2.20
Frasera albicaulis					+.10
Galium			1.30		
Hieracium cynoglossoides	+.10				
Lithospermum ruderale					*
Lomatium dissectum	2.10				
Lupinus leucophyllus	*			5.60	+.10
Lupinus wyethii	1.20				
Penstemon fruiticosus		*			
Potentilla				6.10	
Rumex					2.20
Sedum lanceolatum		+.10			
Senecio integerrimus	2.10				
Smilicina stellata		*			
Taraxacum officinale				1.20	+.10
Tragopogon dubius			4.10		2.10
Zigadenus venenosus	1.20			*	

APPENDIX B-2 (Continued).

3. Pinus ponderosa/Agropyron spicatum (Continued).

Transect Number:	005	013	016	027	043
ANNUALS					
Bromus tectorum		*	22.90	16.70	11.60
Collinsia parviflora				1.20	
Montia perfoliata			1.20	1.20	
Myosotis micrantha		2.20		1.40	
Nemophila	+.10				
Plantago patagonica				2.10	
Senecio vulgaris	*				
Stellaria calycantha					2.20

APPENDIX B-2 (Continued).

4. Pinus ponderosa/Festuca idahoensis

Transect Number:	021	033	036	059
Township	29N	29N	29N	30N
Range	32E	33E	33E	33E
Section	12	18	18	29
Altitude in meters	560	440	465	550
Aspect	-	-	-	-
Percent slope	0	0	0	0
SHRUBS				
Amelanchier alnifolia	*		3.1	1.2
Berberis aquifolium				*
Ceanothus velutinus				*
Crataegus douglasii	*	1.1		
Rosa nutkana			2.3	
Rosa woodsii	*	2.3		
Symphoricarpos albus	*		+.1	+.1
Holodiscus discolor	*			
PERENNIAL GRAMINOIDS				
Agropyron spicatum		*	+.10	*
Festuca idahoensis	*	*	2.10	2.10
Festuca microstachys	*			
Koeleria cristata	*	*	*	
Luzula campestris	6.70			

APPENDIX B-2 (Continued).

4. Pinus ponderosa/Festuca idahoensis (Continued)

Transect Number:	021	033	036	059
PERENNIAL FORBS AND SUBSHRUBS				
Achillea millefolium			+.10	2.10
Antennaria neglecta	3.50			
Apocynum androsaemifolium			2.20	*
Arenaria congesta				3.30
Balsamorhiza sagittata				*
Brodiaea douglasii		*		
Erigeron filifolius				*
Erythronium grandiflorum	2.20			
Fragaria virginiana	3.20	2.10	5.40	7.20
Frasera albicaulis			2.40	
Galium boreale				*
Hieracium cynoglossoides			+.10	
Lomatium dissectum		1.40		
Lomatium triternatum			2.30	
Lupinus leucophyllus		+.10	*	17.60
Lupinus polyphyllus	16.80			
Phlox longifolia	1.50		2.30	
Phlox				+.10
Potentilla		*	7.50	
Rumex				2.20
Selaginella	4.50			
Stellaria calycantha				*
Taraxacum officinale		1.20	3.30	

APPENDIX B-2 (Continued).

4. *Pinus ponderosa*/*Festuca idahoensis* (Continued)

Transect Number:	021	033	036	059
ANNUALS				
Bromus japonicus	*			
Bromus tectorum	11.60	+.10	+.10	19.50
Collinsia parviflora	1.20	1.20	+.10	
Microsteris gracilis			+.10	
Montia linearis	2.90	1.20	2.20	

APPENDIX B-2 (Continued).

5. Pinus ponderosa/Purshia tridentata

Transect No:	010	015	017	018	019	024	026	028	030
Township	29N	30N	29N	29N	29N	29N	29N	29N	29N
Range	33E	32E	32E	32E	32E	33E	32E	32E	33E
Section	8	23	1	1	1	1	1	1	7
Altitude in meters	610	755	670	640	640	660	610	610	660
Aspect	W	SSE	WSW	NE	WSW	ENE	ENE	S	WSW
Pecent slope	45	36	42	49	42	46	50	58	35
SHRUBS									
Amelanchier alnifolia	1.1		+.1			4.2			
Ceanothus sanguineus				3.1		*			
Ceanothus velutinus		18.5	*	21.7			13.3	.1	
Philadelphus lewisii							2.1		
Populus angustifolia							2.1	2.4	
Purshia tridentata	18.11	29.13	36.10	31.20	11.8	29.13	14.10	7.6	48.16
Symphoricarpos albus						*		9.9	6.4
PERENNIAL GRAMINOIDS									
Agropyron spicatum	*		2.20	+.10	19.30	+.10	5.50	2.10	*
Festuca bromoides								+.10	
Festuca idahoensis	2.20						6.50		*
Poa pratensis	5.20								
Poa sandbergii									8.20
Luzula campestris								3.30	

APPENDIX B-2 (Continued).

5. Pinus ponderosa/Purshia tridentata (Continued)

Transect No:	010	015	017	018	019	024	026	028	030
PERENNIAL FORBS AND SUBSHRUBS									
Achillea millefolium	+.10	2.30	4.20		1.20	2.20	2.20	1.30	6.40
Apocynum androsaemifolium				2.20		4.40			
Arenaria congesta						4.10			
Balsamorhiza sagittata	7.30	*	*	4.10	6.10	3.30	8.20	4.20	
Brodiaea douglasii	*				+.10				
Delphinium bicolor						+.10			
Delphinium		*	*					2.10	
Dodecatheon				2.10					
Douglasia nivalis				*					
Erysimum asperum	*	*				+.10			+.10
Erythronium grandiflorum				3.50					
Fragaria virginiana							4.10		
Galium				+.10					+.10
Gaillardia aristata									*
Hieracium cynoglossoides	2.10					1.20	+.10		+.10
Hydrophyllum capitatum						+.10	1.20		2.30
Lithophragma parviflora							1.40	3.60	
Lithophragma	*					1.30			2.10
Lomatium dissectum			*			*	2.20	1.20	*
Lupinus leucophyllus		11.50		1.20		2.30		3.50	5.50
Lupinus polyphyllus	8.20		*	1.30		6.30	5.50	+.10	+.10
Lupinus		1.50	+.10		1.30				+.10

APPENDIX B-2 (Continued).

5. Pinus ponderosa/Purshia tridentata (Continued)

Transect No:	010	015	017	018	019	024	026	028	030
Phlox speciosa	*								
Potentilla							2.10		
Saxifraga integrifolia									
Sedum lanceolatum		+.10							
Spiraea betulifolia				16.30			15.70	9.50	
Zigadenus venenosus		3.20	2.10				*		
ANNUALS									
Bromus tectorum	1.40	+.10	33.100	1.30	16.80	1.40	4.10	1.20	20.80
Collinsia parviflora	1.20		1.20		+.10	1.30	2.40	1.40	
Cryptantha torreyana									+.10
Draba verna								2.20	
Microsteris gracilis				+.10					
Montia perfoliata	3.60			1.20		+.10		1.20	
Myosotis micrantha	5.20	1.40	13.70	+.10	2.30				
Plectritis macrocera							+.10		

APPENDIX B-2 (Continued).

6. *Pinus ponderosa/Symphoricarpos albus*

Transect Number:	002	004	031	048	049	060
Township	30N	30N	30N	30N	29N	30N
Range	33E	33E	33E	33E	32E	33E
Section	20	28	30	19	13	29
Altitude in meters	490	415	560	555	535	555
Aspect	WNW	-	NNE	-	SSW	-
Percent slope	10	0	18	0	10	0
SHRUBS						
Amelanchier alnifolia	7.3	10.7			2.3	12.7
Berberis aquifolium		1.3	*			4.3
Ceanothus velutinus	48.17					1.1
Prunus virginiana						9.7
Purshia tridentata					+.1	
Rosa woodsii			3.5		1.1	1.3
Rosa		3.4	1.1	3.6		+.1
Symphoricarpos albus	22.20	1.1	*	4.8	1.2	6.6
PERENNIAL GRAMINOIDS						
Agropyron spicatum			*			
Poa pratensis						*
Puccinellia pauciflora				*		

APPENDIX B-2 (Continued).

6. Pinus ponderosa/Symphoricarpos albus (Continued)

Transect Number:	002	004	031	048	049	060
PERENNIAL FORBS AND SUBSHRUBS						
Achillea millefolium		+.10	3.30	8.40	+.10	2.20
Antennaria dimorpha	2.10					
Antennaria neglecta				6.40		*
Apocynum androsaemifolium				*		
Arctostaphylos uva-ursi				*		
Arenaria congesta			3.30			
Balsamorhiza sagittata			*			*
Brodiaea douglasii			*			
Claytonia lanceolata	1.20					
Fragaria virginiana	2.20		+.10	2.20	5.40	2.20
Hieracium cynoglossoides			+.10			
Lithospermum ruderale					*	
Lupinus leucophyllus	17.60	4.40	22.80	4.70		21.80
Lupinus polyphyllus		26.80	3.30	2.10		
Penstemon				5.40		
Phlox longifolia					+.10	
Phlox speciosa		*				
Potentilla				2.30	*	
Rumex					*	
Spiraea betulifolia				34.80		1.10
Stellaria crispa					2.10	
Taraxacum officinale			+.10	2.10	2.30	
Tragopogon dubius					2.10	
Verbascum thapsis					*	
Zigadenus venenosus				*		*

APPENDIX B-2 (Continued).

6. *Pinus ponderosa*/*Symphoricarpos albus* (Continued)

Transect Number:	002	004	031	048	049	060
ANNUALS						
Bromus tectorum			8.70	1.20	4.30	26.90
Collinsia parviflora	1.20		+.10	+.10		
Cryptantha torreyana					+.10	
Microsteris gracilis				1.30		
Montia linearis					1.20	
Montia perfoliata			+.10		+.10	
Myosotis micrantha	5.50	+.10			1.40	
Plantago patagonica					+.10	

APPENDIX B-2 (Continued).

7. Pseudotsuga menziesii/Symphoricarpos albus

Transect Number:	001	007	020	023	025	035	038	044
Township	29N	30N	29N	29N	29N	29N	29N	30N
Range	32E	32E	32E	32E	32E	32E	32E	33E
Section	11	26	12	3	3	10	14	31
Altitude in meters	540	610	560	865	765	670	640	805
Aspect	-	-	NNW	E	ESE	NE	NNW	NNW
Percent slope	0	0	49	15	25	45	40	65
SHRUBS								
Acer glabrum	1.1							1.1
Amelanchier alnifolia		15.2	2.2	3.2	5.7		6.7	
Berberis aquifolium	1.2						3.3	
Ceanothus sanguineus						6.1		
Ceanothus velutinus			4.4					
Holodiscus discolor		2.1					5.2	
Philadelphus lewisii						3.1	5.4	1.1
Purshia tridentata				5.5				1.1
Ribes	2.2							
Rosa woodsii		+.1						
Rosa				2.3			5.7	2.2
Salix			1.3				1.1	
Symphoricarpos albus	3.4	9.6		1.1	1.1	5.4	14.11	4.3

APPENDIX B-2 (Continued).

7. *Pseudotsuga menziesii/Symphoricarpos albus* (Continued)

Transect Number:	001	007	020	023	025	035	038	044
PERENNIAL GRAMINOIDS								
Calamagrostis rubescens								13.40
Festuca idahoensis			*	+.10		2.10		6.30
Koeleria cristata			*					
Luzula campestris			2.30			*	+.10	
PERENNIAL FORBS AND SUBSHRUBS								
Achillea millefolium	+.20		4.30	2.40	*	2.10		
Anaphalis margaritacea				6.30	1.30			
Antennaria racemosa			+.10				3.20	2.20
Arctostaphylos uva-ursi				11.50				
Arnica cordifolia	+.10		7.80				9.50	10.70
Arnica latifolia		2.30						
Arenaria pusilla	2.10							
Athyrium filix-femina			+.10			12.80	14.60	
Besseya rubra	*							
Brodiaea douglasii		+.10				*		
Claytonia lanceolata	1.40		+.10					
Delphinium bicolor						2.10		2.20
Douglasia nivalis						*		
Erysimum asperum		*						
Erythronium grandiflorum	5.50		2.10	4.70	2.30		+.10	1.30
Fragaria vesca		12.20						
Fragaria virginiana	7.50	2.10	2.40	8.30				

APPENDIX B-2 (Continued).

7. Pseudotsuga menziesii/Symphoricarpos albus (Continued)

Transect Number:	001	007	020	023	025	035	038	044
Galium	+.10	2.10				1.50	+.10	+.10
Heuchera cylindrica			+.20			2.10	+.10	+.20
Hydrophyllum capitatum	+.10	*				*	+.10	
Lithophragma parviflora							1.40	
Lupinus leucophyllus			+.20		11.40			2.30
Lupinus polyphyllus						6.40		2.20
Mitella trifida	*							
Phlox speciosa			+.10					
Sedum lanceolatum						1.40	+.10	
Smilacina racemosa								4.10
Smilacina stellata		+.10	+.10					2.20
Spiraea betulifolia			8.60				3.30	5.60
Stellaria calycantha	+.20	+.10						
Taraxacum officinale	2.10	4.40					+.10	+.10
Trillium petiolatum		2.20						
Vaccinium myrtillus	4.10							
Veronica		+.10						
Viola adunca var. cascadensis	*	*						
Viola glabella	*	*						
Zigadenus venenosus					*			

APPENDIX B-2 (Continued).

7. Pseudotsuga menziesii/Symphoricarpos albus (Continued)

Transect Number:	001	007	020	023	025	035	038	044
ANNUALS								
Bromus tectorum				4.60	1.20	27.90	4.10	
Capsella bursa-pastoris	*	+.10						
Cerastium vulgare		18.90						
Collinsia parviflora	1.50	3.60		2.60	+.10	8.30	2.30	1.30
Cryptantha torreyana								1.30
Draba nemorosa	*							
Draba verna							6.10	
Microsteris gracilis							+.20	
Montia linearis		2.60	+.20	2.30	*	3.50		
Montia perfoliata	+.10	4.50			1.20	*	2.40	
Myosotis micrantha	*					4.10		

APPENDIX B-2 (Continued).

8. Pseudotsuga menziesii/Physocarpus malvaceus

Transect Number:	037	040	050	051
Township	30N	29N	30N	30N
Range	32E	32E	32E	32E
Section	35	35	30	30
Altitude in meters	780	755	585	640
Aspect	WNW	NNE	N	NNW
Percent slope	40	47	10	40
SHRUBS				
Acer glabrum				*
Amelanchier alnifolia	8.5	6.4		9.14
Berberis aquifolium			2.2	1.2
Ceanothus sanguineus	1.1			
Holodiscus discolor	3.1	16.6	15.5	13.7
Oemleria cerasiformis			1.3	
Physocarpus malvaceus			26.13	12.6
Purshia tridentata	2.1			
Rosa woodsii	4.5	*	5.7	12.13
Rosa	7.8			
Rubus parviflorus			20.4	
Salix			7.1	
Symphoricarpos albus		10.7	18.17	8.9

APPENDIX B-2 (Continued).

8. Pseudotsuga menziesii/Physocarpus malvaceus (Continued)

Transect Number:	037	040	050	051
PERENNIAL FORBS AND SUBSHRUBS				
Achillea millefolium	+.10			
Anaphalis margaritacea		*		
Antennaria neglecta				12.6
Antenneria racemosa	*	8.20	*	
Arnica cordifolia	2.20	27.80	7.50	6.40
Athyrium filix-femina		7.20		1.30
Calypso bulbosa			*	
Chimaphila umbellata			*	*
Clematis columbiana			*	*
Clintonia uniflora			*	*
Cypripedium montanum			*	
Delphinium nuttallianum		2.20		
Disporum			*	*
Erysimum asperum	+.10			
Fragaria vesca			4.20	11.40
Fragaria virginiana	2.10	4.10	+.10	
Galium	1.20	2.20	3.60	1.50
Gilia aggregata	+.10			
Heuchera cylindrica	2.10	1.20		+.10
Hydrophyllum capitatum	1.20			
Linnaea borealis			24.50	2.20
Lupinus polyphyllus	8.60			
Osmorhiza			*	
Pyrola chlorantha			*	*
Sedum lanceolatum	7.70			

APPENDIX B-2 (Continued).

8. Pseudotsuga menziesii/Physocarpus malvaceus (Continued)

Transect Number:	037	040	050	051
Smilacina racemosa	*	+.10	1.20	6.40
Spiraea betulifolia	9.30	5.20	+.10	
Streptopus amplexifolius				*
Taraxacum officinale		*		*
Thalictrum occidentale			9.60	4.10
ANNUALS				
Bromus tectorum	2.40			
Collinsia parviflora	2.70	+.10		+.10
Cryptantha torreyana	+.10			
Montia perfoliata	1.30	1.20		+.10

APPENDIX B-2 (Continued).

9. Abies grandis/Pachistima myrsinites

Transect Number:	032	034
Township	30N	30N
Range	32E	32E
Section	22	22
Altitude in meters	800	768
Aspect	NW	NNW
Percent slope	45	62
SHRUBS		
Acer glabrum	32.2	19.2
Berberis aquifolium		+.1
Cornus stolonifera	1.1	
Holodiscus discolor	3.3	
Pachistima myrsinites	6.5	21.8
Ribes inerme	5.4	3.5
Ribes lacustre	3.3	
Rosa	8.4	8.6
Symphoricarpos albus	6.5	5.3
PERENNIAL FORBS AND SUBSHRUBS		
Disporum		2.10
Galium	2.10	
Heuchera cylindrica		2.10
Linnaea borealis	5.20	
Mitella trifida	2.10	
Rubus parviflorus	2.10	
Smilacina stellata	1.20	

APPENDIX B-2 (Continued).

10. *Bromus tectorum* Disclimax Communities

Transect Number:	011	014	029	045	054	056
Township	29N	29N	30N	30N	29N	29N
Range	33E	33E	33E	33E	33E	33E
Section	8	9	20	33	17	17
Altitude in meters	580	415	415	435	415	425
Aspect	ENE	-	-	-	SE	E
Percent slope	30	0	0	0	30	30
SHRUBS						
Chrysothamnus nauseosus					47.16	12.5
PERENNIAL GRAMINOIDS						
Agropyron spicatum			2.10			
Poa pratensis		5.20				
Poa sandbergii		*				
PERENNIAL FORBS AND SUBSHRUBS						
Achillea millefolium		11.70			1.20	
Balsamorhiza sagittata	9.20					
Gaillardia aristata				*		
Lithospermum ruderale					2.20	
Lupinus leucophyllus		9.40	1.20	+.10		
Lupinus polyphyllus	*					
Rumex				4.10		

APPENDIX B-2 (Continued).

10. *Bromus tectorum* Disclimax Communities (Continued)

Transect Number:	011	014	029	045	054	056
Taraxacum officinale	2.10	+.10				
Tragopogon dubius		2.30	*		2.10	
Trifolium dubium		4.10				
ANNUALS						
Bromus tectorum	66.90	76.100	77.100	83.100	72.100	64.100
Erodium cicutarium						1.20
Microsteris gracilis		1.20				
Montia linearis		+.10				
Montia perfoliata		+.10				
Myosotis micrantha		1.20	2.80			
Plantago patagonica			3.50	5.90		

APPENDIX B-2 (Continued).

11. *Purshia tridentata*/*Bromus tectorum* Disclimax Communities

Transect Number:	012	039	041	042
Township	29N	30N	29N	29N
Range	33E	33E	33E	33E
Section	9	33	17	17
Altitude in meters	490	415	520	490
Aspect	WNW	WSW	-	E
Percent slope	22	30	0	32
SHRUBS				
Artemisia tripartita	*			
Amelanchier alnifolia		*		
Chrysothamnus nauseosus				22.10
Prunus emarginata				18.4
Prunus virginiana		11.5		
Purshia tridentata	7.3	35.14	*	6.3
Rosa		*		
Symphoricarpos albus	*			
PERENNIAL GRAMINOIDS				
Agropyron spicatum		*		

APPENDIX B-2 (Continued).

11. *Purshia tridentata*/*Bromus tectorum* Disclimax Communities (Continued)

Transect Number:	012	039	041	042
PERENNIAL FORBS AND SUBSHRUBS				
Achillea millefolium		1.50		
Balsamorhiza sagittata		*		
Gaillardia aristata		+.10	2.20	2.10
Galium				+.10
Lithospermum ruderale	*			
Lomatium dissectum	*			
Lomatium		*		
Lupinus leucophyllus			17.40	1.20
Polygonum				+.10
Tragopogon dubius	2.10		*	
ANNUALS				
Bromus brizaeformis				+.10
Bromus tectorum	80.100	63.100	64.100	87.100
Montia perfoliata	1.20			
Myosotis micrantha	1.30			
Plantago patagonica			5.90	6.10