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Bunchgrass Plant Communities of the Blue and Ochoco Mountains: A Guide for Managers

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Cover photograph: Bluebunch wheatgrass near Bean Creek, Hells Canyon National Recreation Area.

Unless otherwise noted, all photographs were taken by Charles G. Johnson.

Abstract

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A classification of bunchgrass vegetation is presented for the Malheur, Ochoco, Umatilla, and part of the Wallowa-Whitman National Forests. It includes grassland vegetation as well as shrubland and forest land where the herbaceous layer is dominated by bunchgrasses. It is based on potential vegetation, with the plant association as the basic unit. Diagnostic keys and descriptions are presented for each type. Descriptions include information about plant species occurrence, environment and soils, states and transitions, forage productivity, management considerations, and relationships to other classifications.

Keywords: Blue Mountains, Ochoco Mountains, plant association, plant ecology, range management, steppe.

Contents

1	Introduction
1	What Is a Bunchgrass?
1	History of Bunchgrasses and Livestock Grazing in the Pacific Northwest
2	Study Area
2	Physiography and Geology
2	Climate
4	Soils
4	Vegetation Overview
4	Plant Association Concept
5	State-and-Transition Concept
5	Phases and States
6	Fire Regimes and Fire Effects
6	Ponderosa Pine Forest
6	Juniper Woodlands
6	Shrublands
7	Grasslands
8	The Spread or Decline of Woody Plants
8	Newcomers to Bunchgrass Communities
9	Indicator Species
9	Sampling and Field Methods
10	Classification and Data Analysis Methods
10	Use of the Management Guide
10	Cover Percentages
10	Estimating Cover
11	Format of the Vegetation Type Descriptions
12	Keys for Determining the Bunchgrass Plant Associations and Plant Community Types
12	Limitations in the Use of the Keys
12	Rules for Use of the Keys
12	Key to Series
13	Key to Ponderosa Pine Series Vegetation
13	Key to Western Juniper Series Vegetation
14	Key to Shrubland Vegetation
16	Key to Grassland Vegetation
18	Ponderosa Pine Series
18	PIPO/CELE3/FEID-AGSP Plant Association (CPS234)
20	PIPO/CELE3/PONEW Plant Association (CPS233)
21	PIPO/PUTR2/FEID-AGSP Plant Association (CPS226)
22	PIPO/PUTR2/AGSP-POSA12 Plant Association (CPS229)
24	PIPO/ARTRV/FEID-AGSP Plant Association (CPS131)
26	PIPO/FEID Plant Association (CPG112)
28	PIPO/AGSP Plant Association (CPG111)
29	PIPO/PERA4 Plant Community Type (CPS8)
29	PIPO-JUOC/CELE3-SYOR2 Plant Community Type (CPC212)
30	Western Juniper Series
30	JUOC/CELE3/FEID-AGSP Plant Association (CJS41)
32	JUOC/PUTR2/FEID-AGSP Plant Association (CJS321)
34	JUOC/ARAR8/FEID Plant Association (CJS112)
35	JUOC/FEID-AGSP Plant Association (CJG111)
36	JUOC/ARRI2 Plant Community Type (CJS811)
36	JUOC/AGSP Plant Community Type (CJG113)

- 37 **Shrubland Series**
- 37 CELE3/FEID-AGSP Plant Association (SD4111)
- 38 CELE3-PUTR2/AGSP Plant Community Type (SD4115)
- 38 CELE3/AGSP Plant Community Type (SD4112)
- 39 CELE3/PONEW Plant Community Type (SD4114)
- 39 PUTR2-ARTRV/FEID-AGSP Plant Association (SD3124)
- 41 PUTR2/FEID-AGSP Plant Association (SD3111)
- 42 PUTR2-ARTRV/FEID Plant Community Type (SD3125)
- 42 PUTR2/ERDO Plant Community Type (SD3126)
- 43 ARTRV/FEID-KOCR Plant Association (SD2929)
- 45 ARTRV/FEID-AGSP Plant Association (SD2911)
- 47 ARTRV/AGSP-POSA12 Plant Association (SD2918)
- 48 ARTRV-SYOR2/BRCA5 Plant Community Type (SD2917)
- 48 ARTRV-SYOR2 Plant Community Type (SD2919)
- 49 ARTRV/BRCA5 Plant Community Type (SS4914)
- 49 ARTRV-PERA4 Plant Community Type (SD3010)
- 49 ARTRV/ELCI2 Plant Community Type (SD3011)
- 50 ARAR8/FEID-AGSP Plant Association (SD1911)
- 52 ARAR8/AGSP Plant Association (SD1924)
- 54 ARAR8/POSA12 Plant Association (SD9221)
- 55 ARRI2/POSA12 Plant Association (SD9111)
- 57 ARRI2/PEGA Plant Community Type (SD9141)
- 57 ARTRT4/POSA12-DAUN Plant Community Type (SD2401)
- 57 SYOR2 Plant Community Type (SM32)
- 57 BERE/AGSP-APAN2 Plant Community Type (GB4915)
- 58 **Grassland Series**
- 58 Green Fescue Communities (FEVI-LULA3, FEVI-JUPA, FEVI-PENST)
- 58 FEID-GETR Plant Community Type (GB5923)
- 59 FEID-AGSP-CYTEF Plant Association (GB5925)
- 60 FEID-AGSP-FRALC2 Plant Association (GB5926)
- 61 MEBU-STOC2 Plant Community Type (GB5011)
- 61 STOC2-SIHY (Alpine) Plant Community Type (GS50)
- 62 FEID-KOCR (Mound) Plant Association (GB5912)
- 64 FEID-KOCR (Ridge) Plant Association (GB5911)
- 66 FEID-AGSP-LUPIN Plant Association (GB5916)
- 67 FEID-AGSP-BASA3 Plant Association (GB5917)
- 69 FEID-AGSP-PHLOX Plant Association (GB5931)
- 71 FEID-AGSP Plant Association (GB59)
- 72 FEID-DAUN Plant Community Type (GB5932)
- 73 AGSP-POSA12-LUPIN Plant Association (GB4119)
- 75 AGSP-POSA12-BASA3 Plant Association (GB4123)
- 77 AGSP-POSA12-ERHE2 Plant Association (GB4124)
- 78 AGSP-POSA12-ASRE5 Plant Association (GB4125)
- 80 AGSP-POSA12-TRMA3 Plant Association (GB4126)
- 82 AGSP-POSA12-SCAN3 Plant Association (GB4112)
- 83 AGSP-POSA12-APAN2 Plant Association (GB4127)
- 84 AGSP-POSA12-DAUN Plant Association (GB4911)
- 86 AGSP-POSA12 Plant Association (GB4121)
- 87 AGSP-BRCA5 Plant Community Type (GB4131)
- 88 AGSP-ERUM Plant Community Type (GB4132)
- 88 AGSP-CYTEF Plant Community Type (GB4133)
- 88 ERDO-POSA12 Plant Community Type (FM9111)
- 88 POBU-MAGL2 Plant Community Type (GB4411)

89	DAUN-LOLE2 Plant Association (GB9114)
91	POSA12-DAUN Plant Association (GB9111)
93	Glossary
94	Acknowledgments
94	Metric and English Equivalent
94	References
98	Appendix A: Plants Listed by Life Form and Scientific Name
108	Appendix B: Plants Listed by Common Name
118	Appendix C: Vegetation Types by Ecoclass Code

Introduction

This management guide is provided for use in determining the bunchgrass plant associations and plant community types encountered on lands administered by the Malheur, Ochoco, Umatilla, and Wallowa-Whitman National Forests (NF) within the Pacific Northwest Region (Region 6). Classification of new plots along with bunchgrass plots included in *Plant Associations of the Blue and Ochoco Mountains* (Johnson and Clausnitzer 1992) provide the basis of this study. The purpose of this publication is to provide the field investigator with floristic indicator species that are diagnostic of a particular environment and potential vegetation.

Successional relationships and disturbance effects are portrayed by using the state-and-transition approach (Westoby et al. 1989), following the current trend in scientific thinking. This way of describing vegetation change on rangelands has largely replaced the successional model, in which ecological status was described as late seral, mid seral, or early seral based on an assumed successional pathway toward potential natural vegetation. The successional model in turn provided an alternative to the earlier condition classes of “good,” “fair,” and “poor” based on suitability for domestic livestock grazing. To assist in conversion to the state-and-transition model, the user might consider the phases in a state-and-transition model as analogous to seral stages or condition classes, and the transitions as multiple pathways between them resulting from succession or disturbance by grazing, fire, and so forth.

What Is a Bunchgrass?

Grasses belong to the grass family Poaceae (Gramineae). Bunchgrasses are those grasses that have the characteristic growth habit of a clump, tuft, or bunch, in contrast to sod-forming grasses that spread via stolons or rhizomes. Bunchgrasses have fibrous root systems that occupy a belowground area approximating the aboveground foliar canopy. Studies by John Ernst Weaver (1915) gave us the first overall picture of the bunchgrass plant—above and below ground—by exhuming them carefully. The rooting depths of our principal bunchgrasses are linked to the environments they occupy. Following are key bunchgrasses (see apps. A and B for a full list of scientific and common names of species) and a description of their adaptations to some of the harshest sites in eastern Oregon:

Sandberg’s bluegrass (*Poa sandbergii*, syn. *P. secunda*)—This plant relies on lateral roots (3 to 5 in long) to utilize surface soil moisture, with deep roots extending down only 8 in. The root structure explains the plant’s ability to occupy droughty scabland sites. Surface soil moisture is depleted more rapidly than moisture in deeper layers, and thus Sandberg’s bluegrass usually matures and dries up earlier than more deep-rooted bunchgrasses (Sauer and Uresk 1976).

Short stature and a brief green period make this grass highly resistant to grazing.

Idaho fescue (*Festuca idahoensis*)—This deep-rooted bunchgrass extends to an average depth of 18 in. Because this is not a great depth for bunchgrass, Idaho fescue requires relatively moist sites.

Prairie junegrass (*Koeleria cristata* syn. *K. macrantha*)—Similar to Idaho fescue in site requirements, the roots of this grass extend downward about 15 in.

Bluebunch wheatgrass (*Agropyron spicatum*, syn. *Pseudoroegneria spicata*)—This tenacious bunchgrass has roots that extend to an average depth of 4 ft, allowing it to occupy some of the driest and hottest sites in eastern Oregon. Bluebunch wheatgrass is a very nutritious grass that is relished by livestock and wildlife. It is, however, easily damaged if grazed heavily during its period of active growth (Blaisdell and Pechanec 1949, Miller et al. 1986).

Most bunchgrasses in our region are cool-season grasses; they accomplish most of their growth during cooler, moister weather before the summer drought. Most cool-season grasses are able to grow in the fall if rains occur, go dormant during the winter, then resume growth in early spring. They complete their yearly growth and go to seed before the extreme drought of late summer begins. Warm-season grasses, which grow mainly during midsummer, occur at low elevations in the Hells Canyon region (see Johnson and Simon 1987) but were not recorded on the plots used in this study.

History of Bunchgrasses and Livestock Grazing in the Pacific Northwest

Early European explorers gave vivid accounts of the bunchgrass landscape they encountered prior to the arrival of European settlers (the following quotes are from McArdle and Costello 1936). In 1841 Commander Wilkes wrote from north central Oregon: “These hills, as well as the country nearer at hand, were covered with a natural hay or bunchgrass, which affords very nutritious food for cattle.” Captain Fremont wrote when passing through eastern Oregon in 1843: “The mountains were covered with good bunchgrass.” Granville Stuart wrote

We crossed the Rocky Mountain Divide on the 10th day of October, 1857. As soon as we had crossed the divide a wonderful change appeared in the country. Instead of the gray sagebrush covered plains of Snake River, we saw smooth rounded hills and sloping benchland covered with yellow bunchgrass that waved in the wind like a field of grain.

Grazing by domesticated livestock in the Blue Mountains began with Indian horses in the 1700s, but widespread impacts began with expansion of cattle and sheep ranching after 1870 (Galbraith and Anderson 1971, Humphrey 1943). Numbers of cattle and sheep peaked around 1900. This was a time of true open range, with no government regulation of numbers of animals, season of use, or which livestock owners were entitled to use the land. Today we still observe areas with grazing-resistant and invasive weedy species on sites that we believe should support bunchgrass vegetation; these are former livestock driveways or bedding areas from the early 1900s. Livestock numbers declined after 1906 as the USDA Forest Service began to regulate grazing through its allotment system. Livestock grazing, primarily by cattle, continues to this day on most bunchgrass-dominated plant communities in the Blue Mountains.

Study Area

The Blue and Ochoco Mountains of eastern Oregon are part of the Blue Mountains physiographic province (Orr and Orr 1999). This broad area includes the Ochoco Mountains to the west; the Strawberry, Aldrich, and Greenhorn Mountains in the southern part of the Blue Mountains; the Elkhorn Mountains and the tristate uplands of the northern Blue Mountains; and the Wallowa Mountains on the east end of the province (fig. 1). The Blue Mountains segment is a northeast- to southwest-trending axis of geologically old mountains that extend south from Pomeroy, Washington, 200 mi to the south near Burns, Oregon. A 50-mile-long spur begins west of Ukiah, Oregon, with an east-west axis toward Fossil, Oregon. The Ochoco Mountains are another east-west trending axis of ridges that begin west of the Aldrich Mountains near Dayville, Oregon, and culminate north of Prineville, Oregon. The study was conducted on USDA Forest Service-administered land, including the mountains and intervening canyons in the Malheur, Ochoco, Umatilla, and Wallowa-Whitman NF. Additional plots were installed on the Crooked River National Grasslands between Prineville and Madras, Oregon.

The study area was divided into four segments to assist in portraying the distribution of vegetation as described in this management guide. These segments are as follows with key physiographic features listed:

1. Northern Blue Mountains—North of Interstate 84 (running between La Grande and Pendleton)
 - High points—Oregon Butte (6,401 ft) and Mount Emily (6,064 ft)
 - Low points—Tucannon River, Umatilla River, Wenaha River
2. Central Blue Mountains—South of Interstate 84 and north of U.S. Highway 26 (running between Unity and John Day).

- High points—Vinegar Hill (8,131 ft) and Rock Creek Butte (9,106 ft)
 - Low points—Powder River, Grande Ronde River, North Fork John Day River
3. Southern Blue Mountains—South of U.S. Highway 26
 - High points—Strawberry Mountain (9,038 ft) and Fields Peak (7,363 ft)
 - Low points—South Fork John Day River, Malheur River
 4. Ochoco Mountains
 - High points—Round Mountain (6,753 ft) and Spanish Peak (6,885 ft)
 - Low points—Crooked River

Physiography and Geology

The study area is dominantly an extensive lava plateau at elevations of 3,500 to 6,500 ft, punctuated by a few deep canyons, with elevations as low as 2,000 ft, and mountains rising to about 9,000 ft. Most bunchgrass communities here occur over volcanic rocks that erupted during the Cenozoic Era—primarily basalt, but also andesite and rhyolite. Interbedded in these volcanic rocks are some relatively thin layers of tuffaceous sedimentary rocks. Locally in the southern half of the study area, the older sedimentary and metasedimentary rocks that occur beneath the volcanics are exposed. These consist mostly of graywacke, shale, and argillite deposited in a marine environment. Included with these sedimentary rocks in a few places are ultramafic rocks, including serpentine, that originated as deep ocean crust. These ultramafic rocks occur in environments with bunchgrass vegetation in the Strawberry Mountains and in the vicinity of Mine Ridge southwest of Unity, Oregon. One large area of granitic rock also occurs in the study area—the Bald Mountain batholith—which is centered in the vicinity of Anthony Lakes, northwest of Baker City, Oregon. This high-elevation area has only incidental occurrences of bunchgrass vegetation. (This section is based on Orr and Orr 1999 and Walker and McLeod 1991.)

Climate

The climate of bunchgrass plant communities in the Blue Mountain region is temperate and semiarid (USDA NRCS 2004a, Western Regional Climate Center 2004). Precipitation is highly seasonal, with most arriving between November and June; drought conditions are common in late summer. Temperatures generally decrease with increasing elevation, although low temperature extremes in all seasons tend to occur at moderate elevations on valley bottoms surrounded by higher terrain. Summer highs are typically in the high 70s and 80s °F, and lows in the 40s. Winter highs average in the 30s °F and lows in the teens. Summer

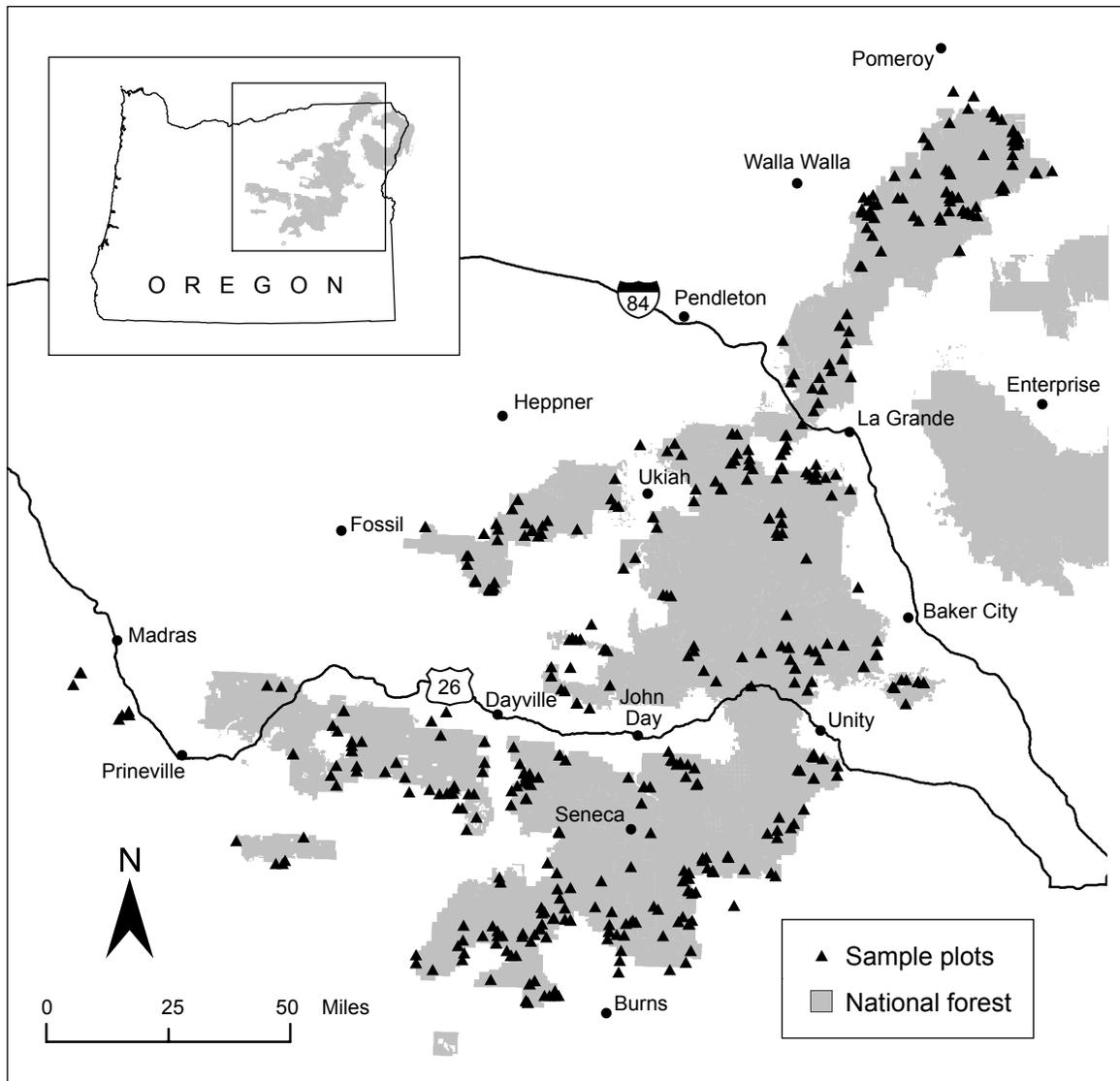


Figure 1—Location of the study area.

temperatures in the 90s °F are not unusual, and winter temperatures occasionally fall below 0 °F. The lowest temperature ever recorded in Oregon or Washington (-54 °F) was recorded at both Seneca and Ukiah, not far from our bunchgrass study plots. Precipitation is generally lower in the south and at lower elevations in our study area. At lower elevations (2,000 to 3,000 ft in the north and 4,500 to 5,000 ft in the south), where bunchgrass communities occur on a variety of sites, annual precipitation averages between 10 and 20 in. Stations at higher elevations in the vicinity of bunchgrass communities have annual precipitation of 20 to 40 in, but effective precipitation on sites where bunchgrass communities actually occur is typically reduced by wind, which removes snow in winter, and intense solar radiation on steep southerly aspects, which greatly increases evaporation.

Daubenmire (1956) investigated in detail the relationship of climate to several of the vegetation series that are classified here. The zone dominated by sagebrush with bluebunch wheatgrass is generally drier and has colder winters than bluebunch wheatgrass areas without sagebrush, although no simple statistic defines that boundary. The transition from the sagebrush to ponderosa pine zone occurs at mean annual precipitation values of about 15 in. The bluebunch wheatgrass and Idaho fescue zones show considerable overlap in precipitation, but the latter are consistently cooler (which reduces drought severity) and in some cases have higher precipitation also. The July mean temperature in all of Daubenmire's bluebunch wheatgrass zone stations was greater than 70 °F, as opposed to less than 70 °F in the fescue zone. Note that local site characteristics often allow a vegetation type to occur outside of its zone as determined by the macroclimate.

Soils

Soils of bunchgrass plant communities are a mixture of loess, volcanic ash, and weathered bedrock. The parent materials are noncalcareous, and basalt is the most common lithology. Most soils have little or no stone-free loamy material at the surface, and coarse fragments increase with depth, reaching bedrock or extremely gravelly/cobbly material within about 2 ft of the surface. A common soil class is Lithic Argixerolls, which are soils with a brown surface layer rich in organic matter from herbaceous understory plants (a mollic epipedon), a seasonally dry (xeric) moisture regime, a clay-enriched subsoil horizon (an argillic horizon), and bedrock near the surface (a lithic contact). Where bedrock is very close to the surface, one or both of the horizons mentioned above may be missing, resulting in Lithic Haploxerolls (soils where the clay subsoil is thin or absent) or Lithic Xerorthents (soils where both the clay subsoil and brown surface layer are thin or absent). For more information on these soil classification terms see USDA NRCS (1998).

On level to gently sloping sites with shallow soils, both the clay-rich subsoil and underlying bedrock retard infiltration of spring meltwater, resulting in temporary soil saturation. However, as a result of the dry summer climate and the low available water capacity of these soils, soil moisture is depleted during the summer. These strongly contrasting soil moisture conditions present a special challenge for plants, and the result is sparse vegetation of stiff or low sagebrush (*Artemisia rigida* or *A. arbuscula*), Sandberg's bluegrass (*Poa sandbergii*), onespikes oatgrass (*Danthonia unispicata*), and occasionally rushes (*Juncus* spp.).

On soils with better drainage, thanks to a sloping surface, well-fractured bedrock, or gravelly colluvial parent material, spring saturation is not a problem, but summer depletion of soil moisture is ubiquitous. Plant communities are strongly dependent on the severity of drought as determined by the interaction between macroclimate (i.e., precipitation and temperature), soil climate/microclimate (as determined by slope aspect and steepness, and wind deflation of snow), and soil moisture-holding capacity. Thus a plant species may be restricted to deeper soils near the climatically dry limit of its range.

Vegetation Overview

Climate, elevation, aspect, soils, and disturbance all influence vegetation. In the Blue and Ochoco Mountains, temperature and moisture are fundamental determinants of where plant species grow. The bunchgrass vegetation series can be arrayed according to their moisture and temperature adaptations from "cool, moist" to "hot, dry" as follows:

FOREST

Ponderosa pine/bunchgrass
Western juniper/bunchgrass

SHRUBLANDS

Mountain mahogany/bunchgrass
Bitterbrush/bunchgrass
Mountain big sagebrush/bunchgrass
Low sagebrush/bunchgrass
Stiff sagebrush/bunchgrass

GRASSLANDS

Green fescue (subalpine)
Idaho fescue (subalpine)
Idaho fescue (montane)
Bluebunch wheatgrass
Onespike oatgrass
Sandberg's bluegrass

The temperature and moisture environment for plant growth is determined by the combination of climate (strongly influenced by elevation) and local soil/site conditions. For example, a site at low elevation with very shallow soils will be dry for most of the growing season and might support stiff sagebrush or Sandberg's bluegrass series vegetation. A site at higher elevation, on a deeper soil, or on north aspects is cooler and moister and may sustain ponderosa pine or Idaho fescue series vegetation.

Plant Association Concept

In this study we sampled existing vegetation and the environmental attributes of each site to help identify the potential natural vegetation, which in turn was used to define plant associations. **Existing vegetation** is the plant cover, floristic composition, and vegetation structure occurring at a given location at the current time (Winthers et al. 2004). **Potential natural vegetation** (PNV) is that plant community that would become established if all successional sequences were completed without human interference under the present environmental and floristic conditions, including those created by man (Winthers et al. 2004). **Historical vegetation** is that vegetation believed to have existed in the study area prior to the impact made by Euro-Americans beginning about 1850 (USDA Forest Service 2003). Prior to the arrival of Euro-Americans, the primary disturbance agents on bunchgrass sites were fire (including fire caused by Native Americans), wild ungulates, small animals, insects, diseases, and slope-driven soil movements. As a result of these disturbance factors, historical vegetation did not consist entirely of late-successional vegetation; in other words, historical vegetation is not synonymous with PNV. Instead the historical vegetation landscape generally contained a mix of vegetation communities resulting from disturbance events. The **historical**

range of variability represents this mix of different seral conditions that are believed to have occurred in the historical vegetation.

This publication uses the conventions for classifying potential vegetation that have been in use in Region 6 of the Forest Service for several decades. The **plant association**, the fundamental unit of classification, is identified by determining the potential vegetation of a site. Plant associations are named by using both dominant late-seral overstory species and other species that indicate environmental conditions such as moisture supply and temperature. A plant association includes the relatively rare pristine late-seral vegetation for which it is named **and** all the disturbed and early seral vegetation that would succeed to it.

This definition differs somewhat from the usage of “plant association” in the National Vegetation Classification System (Jennings et al. 2003) and the USDA Forest Service *Terrestrial Ecological Unit Inventory Technical Guide* (Winthers et al. 2004), where plant associations are units in the classification of existing vegetation. Our concept of a plant association is similar to the “habitat type” concept used in Forest Service Northern Region (Region 1) (Pfister and Arno 1980). The habitat type is a unit of land classified as capable of supporting a specific plant association.

The **plant community type** is a less formal vegetation type, simply an aggregation of plant communities with floristic and structural similarities (Society for Range Management 1989). We established plant community types to describe (1) highly disturbed communities where the PNV could not be determined, and (2) possible plant associations where our sample size was too small to adequately understand the range of variation.

Series are aggregations of plant associations and plant community types based on the dominant overstory plants. For example, bunchgrass vegetation that occurs with an overstory of big sagebrush is placed in the big sagebrush series.

The concept of potential natural vegetation can become confusing where communities have been greatly altered from the historical condition. Two problematic situations are particularly common: (1) juniper invasion and (2) replacement of bunchgrasses by introduced species such as cheatgrass. In the first case, many sites that historically were treeless will succeed to juniper woodland if a seed source is available and they are protected from fire. We classify shrubland or herbland vegetation into shrubland or herbland plant associations if they currently have few or no trees, even if they could theoretically support junipers. Once junipers have become established, we classify the vegetation into a juniper plant association, even if historically junipers were absent (and we note the latter fact in the plant association description). Secondly, in some cases, severe disturbance combined with invasion by nonnative plants has

produced communities that no longer would succeed naturally back to the PNV. If the PNV can be determined, these communities are classified into a plant association. In a few cases where the PNV cannot be identified, we have established plant community types to accommodate them.

State-and-Transition Concept

This study portrays the condition and successional status of vegetation by the state-and-transition model (Westoby et al. 1989). According to this model, the vegetation present on a given site is determined by complex interactions of the history of disturbance, climate, management, and availability of propagules (e.g., seed). Vegetation is modeled as a set of states or phases, and transitions describe how vegetation can change from one state to another. Examples of transition agents include fire, succession, grazing, and invasion by exotic plant species. This model has largely superseded the range succession model (Dyksterhuis 1949) in range management.

In current usage, “phases” are separated from one another by transitions, most of which are reversible. Phases are separated into “states” when a transition crosses an ecological threshold that is nearly irreversible (Laycock 1991, Stringham and Kreuger 2001). For example, overgrazing may reduce cover by native grasses somewhat, but after a change in grazing regime the bunchgrasses might recover their former dominance; the pristine and somewhat degraded communities would then be considered two phases of a single state. If degradation were to proceed to the point where the native grasses were eliminated and were replaced by highly competitive exotic grasses that would persist even if grazing ceased, then a threshold would be crossed and transition to a new state would have occurred.

Phases and States

Plant associations were subdivided into phases and states that represent significantly different cases from the perspective of ecology and management. For a given plant association we typically recognized four phases of vegetation as follows:

- A Relatively pristine vegetation close to the hypothetical PNV. For some shrubland plant associations with adequate data we were able to subdivide the A phase into a transient postfire phase (A1) and a late-successional phase with larger and older shrubs (A2).
- B Vegetation that has been moderately altered by grazing, such that certain grazing-sensitive species have been affected but are still present in substantial amounts.
- C Vegetation that has been greatly altered by grazing but still retains native species in sufficient amounts that they could presumably recover to approximate the PNV phase given sufficient time. Some plant associations had

more than one phase of this kind (C1, C2, etc.): e.g., a phase where bunchgrasses have been partly replaced by exotic annuals vs. a phase where they have been partly replaced by grazing-resistant perennial forbs. The authors believe that C phases represent communities in peril of crossing a threshold into a new state via loss of native species, invasion of other species, or soil erosion.

- D Vegetation that has been altered by loss of native species and invasion of exotics to the point that succession back to the original PNV is now unlikely and a new state has been established. For some plant associations there are more than one of these phases (D1, D2, etc.), depending on what invasive species has gained dominance.

Thus A, B, and C represent different phases within a single state (fig. 2). Transitions between them are caused by heavy grazing, succession, and fire, and are believed to be reversible. The D phases are separated by an ecological threshold from the others and thus belong to a different state. This threshold is formed by loss of native species, invasion of exotic plants, soil erosion, or some combination of these factors. There may also be thresholds separating some of the D phases from one another, but we have not studied these transitions in detail.

Fire Regimes and Fire Effects

Fire has historically been an important natural disturbance process in bunchgrass communities and remains so today. Historical fire frequency is difficult to determine in bunchgrass vegetation because of the lack of trees that could provide a record of fires. Fire effects and postfire succession in this region are fairly well known thanks to local monitoring (see Johnson 1998b, Swanson 2005, and USDA Forest Service 2005 for more information)

Ponderosa Pine Forest

Considerable fire history work has been done in ponderosa pine forests, including locally in the Blue Mountains (Heyerdahl et al. 2001). These studies generally agree that ponderosa pine forests historically had frequent light underburns, with a return interval of about 10 to 20 years (Heyerdahl et al. 2001) or even less (Brown and Smith 2000). However, nearly all of these studies have been in more mesic pine communities, such as those with an understory of pinegrass (*Calamagrostis rubescens*), elk sedge (*Carex geyeri*), or snowberry (*Symphoricarpos* spp.), and not in pine forests with a bunchgrass understory. The exception is Miller and Rose's (1999) study in south-central Oregon of fire scars on scattered pines in bunchgrass ecosystems that were being invaded by juniper. This study showed fire-return intervals of 12 to 15 years, i.e., not unlike the moister pine sites. Note that such short fire-return

intervals would make survival of young pines a very rare event. A few investigators believe that methodological problems have led us to underestimate fire-return intervals in pine, and that they could actually have been much longer (e.g., Baker and Ehle 2001).

The frequent light underburns of pines probably caused little tree mortality except for seedlings and saplings, but consumed much of the understory biomass. Fire effects on the understory vegetation are similar to those of analogous treeless vegetation types discussed below.

Juniper Woodlands

Available evidence suggests that low-severity underburns are not common in these woodlands and that most fires kill the trees (Baker and Shinneman 2004). Juniper woodlands in our study area include (1) woodlands that contain old trees and probably existed before the change in fire regimes that accompanied European settlers and (2) woodlands that are the result of postsettlement juniper invasion (Burkhardt and Tisdale 1969, Miller and Rose 1995, Young and Evans 1981).

The juniper woodlands where juniper has probably been present for many centuries contain old trees and are primarily in environments with little fuel because of shallow, droughty soils. In our classification, these are the JUOC/CELE3/FEID-AGSP, JUOC/ARAR8/FEID, JUOC/ARRI2, and JUOC/AGSP types. Historically, fires in these types were probably not only rare but quite variable in frequency and severity. We presume that fire-return intervals were at least 50 years, because shorter return intervals would have eliminated the junipers (Burkhardt and Tisdale 1976). The juniper types that have resulted from recent invasion are typically on deeper soils with more productive herbaceous layer and hence more fuels: the JUOC/PUTR2/FEID-AGSP and JUOC/FEID-AGSP types. These sites historically had fires frequent enough to exclude junipers; mean fire return intervals may have been as low as 12 to 15 years (Miller and Rose 1999). Reduction of fine fuels by juniper competition may have made the vegetation less able to carry fires today than before juniper invasion (Petersen 2004).

Shrublands

We can subdivide our shrublands into two groups based on their fuel characteristics and historical fire regimes: (1) those with relatively dense herbaceous understory and historically frequent fires and (2) those with light fuels and rare fires. The former group includes most of our bitterbrush and big sagebrush plant associations. Historical fire return intervals as low as 12 to 15 years have been estimated for mountain big sagebrush steppe (Miller and Rose 1999). Given the rate of sagebrush regeneration, this fire frequency would

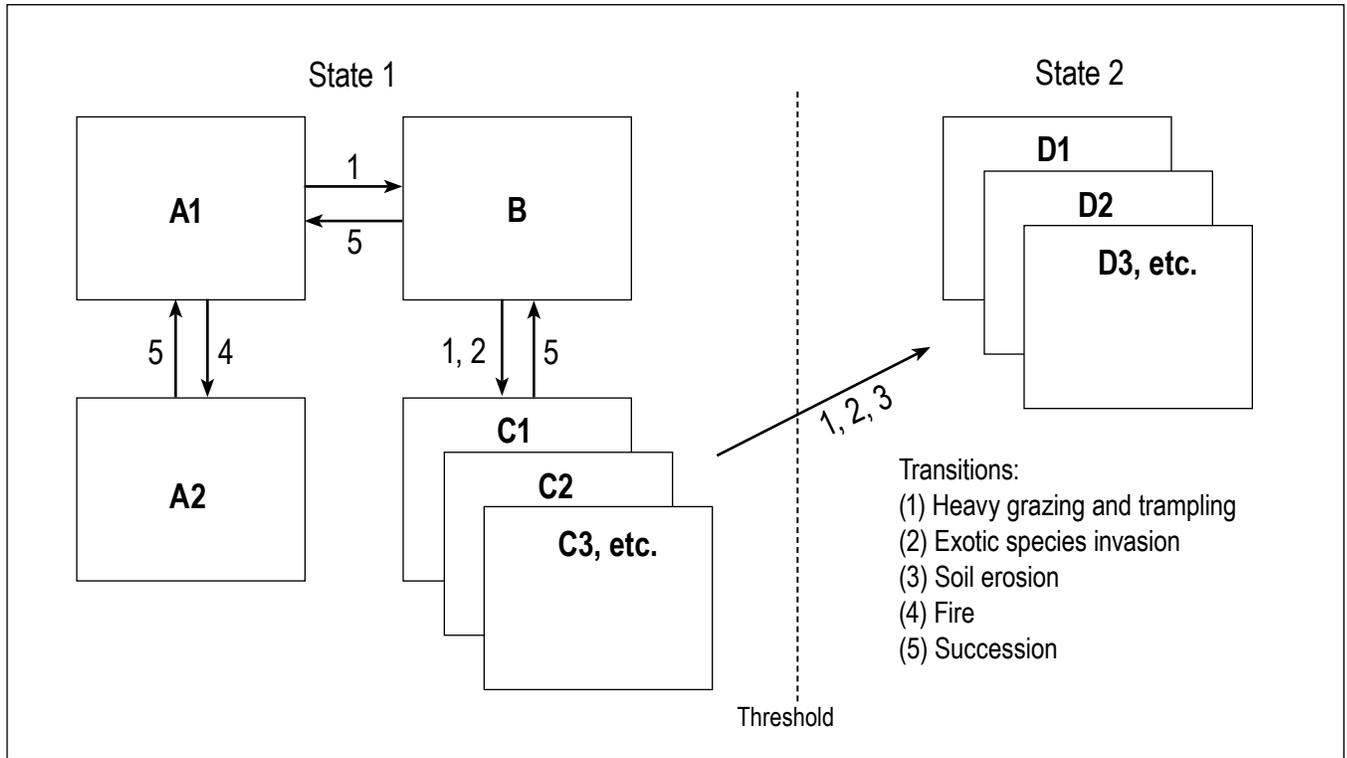


Figure 2—Generalized state-and-transition diagram used in this study. Boxes symbolize phases and arrows are transitions between them. The A, B, and C phases result from increasing grazing-related degradation that is probably reversible by natural succession. The D phases are in a second “state” separated from the first state by an ecologic threshold. Transitions to D phases are caused by loss of native species, invasion of exotic species, and soil erosion; they are probably not reversible by natural succession.

have resulted in widespread grassland communities with little sagebrush. A longer fire return interval of 20 to 70 years has also been suggested for sagebrush steppe (Brown and Smith 2000).

The second group includes all plant associations in the mountain mahogany (CELE3), stiff sagebrush (ARR12), and low sagebrush (ARAR8) series, plus PUTR2/ERDO, ARTRV/AGSP-POSA12, and ARTR4/POSA12-DAUN. Fires were historically (and remain today) infrequent and patchy in these communities because the poor soils produce little fuel.

Mountain mahogany, sagebrush, and bitterbrush are readily killed by fire, although in some environments bitterbrush shows limited ability to resprout (Clark et al. 1982, Driscoll 1963) and mature mountain mahogany can survive some light fires (Arno and Wilson 1986). All three species recolonize burned areas by seed, generally seed carried from surviving plants by wind (mountain mahogany and sagebrush) or by animals (bitterbrush). Thus the rate of shrub recolonization depends on the size and severity of the burn, and weather for seed production and seedling survival in postfire years. Our monitoring of big sagebrush communities after fire shows that under good conditions, this shrub can reestablish 10 percent canopy cover as early as 10 years after complete kill by fire. Our limited observations

of bitterbrush and mountain mahogany suggest much slower recovery of these species.

Response of the herbaceous layer of shrublands to fire is like that of grasslands described below, with one important exception. When the shrub canopy is very dense, e.g., in big sagebrush with canopy cover of 50 percent or more, fires can burn very hot and cause more death of herbaceous plants than would otherwise occur. We have observed Idaho fescue eliminated from a site by severe fire in dense sagebrush, creating openings for weedier grass and forb species to expand.

Grasslands

Historical fire frequencies in grasslands of the study area remain largely unknown. There is consensus that fires were frequent (return intervals less than 35 years) and consumed most aboveground plant parts (Brown and Smith 2000). Our observations of modern fires show that patchy and light fires are not unusual in grasslands, especially on low-biomass types.

Plant associations of the Idaho fescue series contain enough biomass to burn nearly every year, but actual fires were not nearly this frequent because of low flammability of the vegetation early in the season and lack of ignitions (Agee 1996). Our monitoring shows that Idaho fescue is often suppressed for a few years after the fire, after which

it regains its former cover; other species in Idaho fescue communities return to prefire cover in the first postfire season. There is a flush of annual plants on some sites in the first year after fire, but annuals subsequently decline to prefire levels.

Response of bluebunch wheatgrass series vegetation to fire is even weaker, with plants typically regaining their prefire covers in postfire year 1. Occasionally bluebunch wheatgrass is suppressed a little and Sandberg's bluegrass or annual forbs increase after fire, but effects are subtle and transient.

Some grassland types on very poor soils (AGSP-ERUM, AGSP-CYTEF, ERDO-POSA12, DAUN-LOLE2, and POSA12-DAUN) produce little biomass and probably had less continuous and less frequent fires than the other grassland types. Our limited monitoring suggests that, as in the case of the other grassland types, post- and prefire vegetation are very similar.

The Spread or Decline of Woody Plants

As mentioned above, juniper has become more widespread than it was in the past. Juniper expansion in our area began in the late 1800s and continues today (Miller and Rose 1999). The main causes of juniper expansion are exclusion of fire, introduction of domestic livestock (which reduces fuels for fires and reduces vegetation that competes with juniper), and possibly an unusually moist climate during some recent decades. Burkhardt and Tisdale (1969) believe that juniper could potentially colonize any site that currently supports big sagebrush and Idaho fescue. Competition by junipers usually causes thinning of understory vegetation, especially shrubs (Miller et al. 2000). This effect has been linked to increased soil erosion in ecosystems invaded by junipers (Petersen 2004). As mentioned above, our JUOC/PUTR2/FEID-AGSP and JUOC/FEID-AGSP types have resulted from juniper invasion. The presence of a few seedling junipers in several of our big sagebrush types (ARTRV/AGSP-POSA12, ARTRV/FEID-AGSP, and ARTRV/FEID-KOCR) suggests that local juniper invasion of these types is likely in the future.

Big sagebrush is widely believed to be denser today than it was prior to settlement by Europeans. Likely reasons for this increase include fire suppression and removal of grass competition by livestock grazing. Controversy over this issue has been heated (see, e.g., Welch and Criddle 2003). There is little information about presettlement sagebrush densities; however, one study of old photographs in Wyoming and Idaho showed changes since the 1870s in sagebrush abundance to be variable and localized (Johnson 1986). Owing to the lower fire frequency today than in the past, there is probably proportionally less area of low-density, postfire regenerating

sagebrush communities in our study area today than there was historically.

Some woody species of bunchgrass ecosystems have experienced declines owing to browsing by wildlife and livestock, notably bitterbrush (*Purshia tridentata*) and mountain mahogany (*Cercocarpus ledifolius*). Seedlings of these species are quite rare in our study area, and existing plants are often old and severely hedged, or (in the case of mountain mahogany) defoliated up to the height that animals can reach. These species are long lived and quite tolerant of defoliation once they are established (Garrison 1953), but recruitment of new plants is needed because productivity of individual plants drops off (after about 80 years in the case of bitterbrush) and older plants gradually die off (McConnell and Smith 1977). At least a temporary reduction in densities of all the large ungulates that feed on them—livestock, deer, and elk—will probably be needed at some point to ensure the survival of the next generation of these plants.

Newcomers to Bunchgrass Communities

Bunchgrass plant communities in the Western United States have undergone major changes as a result of the introduction of plants from Eurasia. These newcomers are mostly annuals that colonize disturbed soil. Among the most important are the annual brome grasses, including cheatgrass (*Bromus tectorum*) and several other species (*B. japonicus*, *B. mollis*, *B. brizaeformis*, and *B. commutatus*). These grasses were introduced in the late 1800s, and by about 1930 had colonized most of the Pacific Northwest and intermountain region (Mack 1981). They are cool-season grasses with a winter-annual life cycle: seeds germinate in the fall and grow until forced into dormancy by cold weather, then resume growth in the spring, flower, and produce seed before dying in early to mid summer (Klemmedson and Smith 1964). Cheatgrass and its relatives have displaced native annual grasses such as the annual fescues, as well as bluebunch wheatgrass, which was more successful at colonizing disturbed soil without such a strong competitor as cheatgrass (Mack 1981).

Cheatgrass is highly palatable to livestock when green and can be kept in check to some degree by spring grazing (Daubenmire 1940). Unfortunately, heavy spring and early summer grazing will also weaken native perennial bunchgrasses, and if grazing pressure is subsequently decreased, cheatgrass will outcompete the native grasses to fill any new gaps.

Cheatgrass is known to invade sagebrush communities and increase fuels and fire frequency, resulting in annual grasslands that are perpetuated by fire (Young and Evans 1978). We have not observed this cheatgrass-fire cycle in our study area. Flushes of annual plants (including annual bromes like cheatgrass) sometimes occur in the first year

after fires in our bunchgrass communities, but our observations to date show cover by annuals declining back to prefire levels within a year or two after the initial postfire flush without greatly altering the fire regime. Our densest stands of annual bromes occur in communities of the bluebunch wheatgrass and Idaho fescue series that have been highly disturbed by grazing and trampling, or in a few cases, by tillage on abandoned farm fields.

Another aggressive introduced annual grass has appeared in bunchgrass communities of our area, *Ventenata dubia*. We have even observed it to displace cheatgrass on some of our plots. *Ventenata* forms a dense thatch that probably inhibits reestablishment of native bunchgrasses. It is short, wiry, and unpalatable to livestock. *Ventenata* appears to be spreading in our area, and the limits to conditions it can tolerate are still unknown.

Medusahead (*Elymus caput-medusae*) is another invasive annual grass that has infested large areas in the Pacific Northwest but occurs only in a few places in our study area. Medusahead expansion here remains a possibility, at least locally on the disturbed, clay-rich soils that it prefers (Dahl and Tisdale 1975).

Many introduced perennial grasses are also present in our study area, some that were seeded onto burned areas or degraded rangeland, and some that have spread on their own. The only one that occurs widely in bunchgrass communities in our study area is Kentucky bluegrass (*Poa pratensis*). This grass is occasionally present in the more mesic bunchgrass plant associations, i.e., those containing Idaho fescue. This grass is highly tolerant of close grazing and can invade overgrazed sites if sufficient soil moisture is present (Daubenmire 1972, Mack and Thompson 1982). Intermediate or pubescent wheatgrass (*Agropyron intermedium*) is also present at scattered locations in mesic bunchgrass communities, but it does not appear to have spread far beyond where it was originally seeded.

Indicator Species

The habitat needs of plant species are evident by the environments in which they persist. Some species require stable conditions, others thrive on recurring instability. Some species have adapted to a particular locale owing to long-term climatic conditions of the area; others have colonized and thrived owing to changes in the microclimate of a particular site.

Plants that designate thresholds of environmental changes along gradients are called **indicator plants**. The indicator plants selected to define the plant community type or the plant association are those deemed to be the most diagnostic of a particular environment, i.e., those that have a high

fidelity and constancy to the type. Although they do not necessarily indicate the sum of all environmental conditions, they are considered the best candidates of the associated flora within a classified type to indicate the occurrence and distribution of that vegetation unit.

The indicator species selected are those sought by field investigators to help determine proper assignment to a given plant association or plant community type. These indicator plants appear in the keys and in the names of the plant associations and community types. Information on identification of these plants may be found in Johnson (1998a).

Sampling and Field Methods

Sampling of bunchgrass plots used in this study began in 1956 by Fred Hall (Hall 1973) and continued with the senior author's fieldwork from the 1980s until 2004. Beginning in 1993, the rangelands of the Blue Mountains were systematically covered to more adequately sample vegetation of varying types and conditions. In 1999 and 2000, this study was extended to include vegetation in the Ochoco Mountains. To assist in interpreting changes over time (trend), many Parker Three-Step Condition and Trend (Parker 1951) sites were used for plot locations. A total of 487 plots were sampled.

At each sample site a 375-m² (72 ft in diameter) circular reconnaissance plot was established. Within this area, a total plant species list was derived. Next the canopy coverage was estimated to the nearest 5 percent for all species on the list. Additionally ground surface cover was estimated for bare ground, bedrock, rock, gravel, erosion pavement, mosses, lichens, and litter. Site environmental attributes were examined and noted as well. These included elevation (feet), aspect (degrees), slope (percent), lithology, soil depth, position, and slope shape.

Photopoints were established at each plot by locating a steel angle iron stake at the plot center. From this location, varying views were taken by using 35mm single lens reflex cameras employing color slide film and black and white print film.

The plots were intended for repeated monitoring. Therefore, reference markers and information necessary for relocation are provided for each sample location. Plot locations were described on plot cards and marked on U.S. Geological Survey quadrangle maps. Reference signs placed at the site and on adjacent points of access lead the investigator to the plot center stake. In the office, the plot locations were digitized from the topographic maps and the resulting coordinates stored in the plot database and geographic information system.

Classification and Data Analysis Methods

The present study is a refinement of previous studies (Hall 1973, Johnson and Clausnitzer 1992, Johnson and Simon 1987). We incorporated most of the plots used in Hall (1973) and Johnson and Clausnitzer (1992); addition of new data allowed us to more than double the previous sample size. Thirty-seven types defined by the previous publications adequately represented plots from this study and were incorporated unchanged, except that we describe them here by using more data or data specific to this study area. The other 33 types are new and represent either subdivisions of types that were overly broad in Johnson and Clausnitzer (1992) (the FEID-AGSP, AGSP-POSA12, and POSA12-DAUN types) or communities that had not been encountered previously. We used multivariate statistical techniques (nonmetric multidimensional scaling, cluster analysis, and TWINSPLAN; McCune and Grace 2002) to explore subdivision of previous broad types. The groups produced by these objective techniques were controlled by abundant species that had little indicator value (e.g., cheatgrass), and tended to group together plots with disturbed vegetation from a wide variety of environmental conditions. Thus, we found it more useful to define new types subjectively by using species with known environmental requirements as indicators. Knowledge of the indicator species was derived from the senior author's field experience and Johnson and Simon (1987). Association tables were constructed by using tentative indicator plants; the proposed new types were examined for floristic homogeneity, similarity in site conditions (soils and setting), and similarity in response to disturbance. The choice of indicator species and their order in the key was then adjusted to produce types that better met these three criteria; this process was continued iteratively until the resulting types met the criteria to the authors' satisfaction.

After a plant association was defined, it was further subdivided into phases by a similar process: subjective iterative refinement of association tables. We preferred this to multivariate methods both because of the small sample sizes involved and because we could define the phases based on species with a known response to the transition factors involved. For example, because large native bunchgrasses decrease with grazing pressure, we emphasized the sum cover of these grasses in defining many of the phases.

Use of the Management Guide

This management guide is organized with dichotomous keys and vegetation type descriptions for the determination of a plant association or a plant community type in the field.

Cover Percentages

The keys employ foliar cover percentages. This requires the user to accurately estimate the percentage of cover of a particular plant species in a fixed area, or plot. Indicator plant species are used as the best community representatives of the environment within the community. It is therefore critical that the investigator knows the flora and is able to estimate foliar cover.

Trees and shrub indicator plants are generally used to indicate their respective types if present at 10 percent or more cover. Most grass, sedge, rush, and forb indicators are used if present at 5 percent cover or more. Some indicator plants are extremely sensitive representatives of their environment and are used at cover as low as 1 percent.

Estimating Cover

The table below is provided to help the field investigator in making ocular estimates of abundance (crown canopy cover) of indicator plants for use in determining the proper vegetation type using the keys.

Canopy cover (%)	Plot size ^a			
	375 m ²		1/10 acre	
	x ^b	r ^c	x	r
1	1.94 m (6.36 ft)	1.09 m (3.58 ft)	6.6 ft (2.01 m)	3.72 ft (1.13 m)
5	4.33 m (14.20 ft)	2.44 m (8 ft)	14.76 ft (4.5 m)	8.33 ft (2.54 m)
10	6.12 m (20.07 ft)	3.45 m (11.32 ft)	20.87 ft (6.37 m)	11.78 ft (3.59 m)

^aRadius of 375 m² circular plot is 10.93 m (35.85 ft); radius of 1/10-acre circular plot is 11.32 m (37.24 ft).

^bx is the dimension of one side of a square equal to the coverage in percent.

^cr is the radius of a circular area equal to the coverage in percent.

Format of the Vegetation Type Descriptions

Headings—

Plant associations and plant community types are named by using the dominant species of the PNV followed by the subordinate indicator species of a different life form. An example is “mountain big sagebrush/Idaho fescue-bluebunch wheatgrass.” The life forms of different “layers” are separated by a slash (/). In this example, the sagebrush (a shrub) is differentiated from the fescue-bunchgrass (herb). When plants are used to name a vegetation type from the same layer and life form, a hyphen (-) is employed. In the example, the two bunchgrasses are separated by a hyphen as they are both herbs.

The names of the vegetation types are provided in three formats:

- Common names (mountain big sagebrush/Idaho fescue-bluebunch wheatgrass)
- Scientific names (*Artemisia tridentata* spp. *vaseyana*/*Festuca idahoensis*-*Agropyron spicatum*)
- Database codes (ARTRV/FEID-AGSP)

All scientific names follow Hitchcock and Cronquist (1973). All computer codes follow the PLANTS National Database (USDA NRCS 2004b). All plant species encountered in the study are listed in appendixes A and B with scientific name, common name, PLANTS database code, and the former code from USDA Forest Service Region 6.

Photos—

A representative image of the plant community was selected for most major vegetation types. The reference pole used is 1 m tall and segmented into decimeters to assist in visualizing the size of the vegetation.

Distribution—

The range of the vegetation type in the Blue and Ochoco Mountains.

Environmental features—

The elevation range, slope percentage, aspect, slope shape, slope orientation, and rock type from sampled plots.

Soils—

A brief description of the soils from sampled plots.

Vegetation composition—

A description of the vegetation based on principal plant species found and the percentage composition of those plants from sampled plots.

States and transitions—

A listing of the phases and states derived from the classification process.

Management considerations—

Provides the species response to major disturbance activities (grazing, browsing, fire).

Relationship to other studies—

The relationship of this vegetation type to other similar classified vegetation types published in the Pacific Northwest.

Table of principal species—

A table containing a species list selected from the complete list of species found for a vegetation type. Only the primary species necessary for the description and the keys are listed. Mean cover values in percentages and the range of cover values in percentages are provided for the selected species. Mean cover was computed only for the plots where the plant was present. Constancy is the percentage of plots on which the species was found.

Table of ground surface features—

Mean percentage of cover and the range of cover values are provided for the ground surface features beneath the higher plants. Bare ground, bedrock, rock, gravel, erosion pavement, mosses and lichens, and litter are the ground surface features.

Table of environmental features—

Sample size (e.g., $n = 10$), means, and ranges are given for elevation, aspect, slope, and soils from sampled plots. Geologic information, slope position, and microrelief are summarized. In shrub/grass and grassland communities, herbage productivity is often provided. Soil available water capacity is computed for the upper 40 in of soil.

Keys for Determining the Bunchgrass Plant Associations and Plant Community Types

The keys that follow were derived to assist in determining the plant association or plant community type that best fits a particular site.

Limitations in the Use of the Keys

1. The keys are based on 490 sampled plots located in the Blue and Ochoco Mountains. This large geographic area contains a wide range of plant communities and environments. Not all the environmental variation was sampled. Therefore, the classification may not describe the vegetation occurring on some sites.
2. The natural stands have been, and some continue to be, highly modified. Sites exhibiting severe disturbances have been incorporated into this study. However, the keys are based mainly on less disturbed vegetation exemplified by phases A and B rather than C and D. Highly disturbed communities where introduced species have replaced the native species may be difficult to classify.

Rules for Use of the Keys

1. Select portions of stands demonstrating stability. On sites where disturbances have been severe resulting in vegetation of exotic species or earlier seral stages (phases C and D), try to select an adjacent, less disturbed area with the same soil and site conditions for determining the proper plant association or plant community type.
2. First use the “Key to Series” to determine the series and proceed to the proper key. Then choose the correct alternative by comparing choices 1a and 1b and follow the correct lead. For example, if a shrub community lacks mountain mahogany, 1b is chosen and the user is directed to lead 5. Proceed down through the key until the kind of vegetation encountered on the site is reached. Then turn to the page number provided and review the type description to verify the accuracy of the identification.

Key to Series

1a. Trees present with cover equal to or exceeding 10 percent	2
1b. Trees absent or present with cover less than 10 percent	4
2a. Ponderosa pine (PIPO) present and reproducing with total cover equal to or exceeding 10 percent	See ponderosa pine series key, p. 13
2b. Ponderosa pine absent or present with cover less than 10 percent	3
3a. Western juniper (JUOC) present and reproducing with total cover equal to or exceeding 10 percent	See western juniper series key, p. 13
3b. Western juniper absent or present with cover less than 10 percent	4
4a. Shrubs present with cover equal to or exceeding 10 percent	See shrubland series key, p. 14
4b. Shrubs absent or present with cover less than 10 percent	See grassland series key, p. 16

Key to Ponderosa Pine Series Vegetation

Ponderosa pine (PIPO) must be present and successfully reproducing; total cover must equal or exceed 10 percent.

- 1a. Squaw apple (PERA4) present with cover equal to or exceeding 10 percent **PIPO/PERA4**, p. 29
- 1b. Squaw apple absent or with cover less than 10 percent **2**
 - 2a. Mountain mahogany (CELE3) present with cover equal to or exceeding 10 percent **3**
 - 3a. Mountain snowberry (SYOR2) associated with western juniper (JUOC) **PIPO-JUOC/CELE3-SYOR2**, p. 29
 - 3b. Mountain snowberry absent or with cover less than 10 percent **4**
 - 4a. Idaho fescue and bluebunch wheatgrass present with cover equal to or exceeding 5 percent **PIPO/CELE3/FEID-AGSP**, p. 18
 - 4b. Wheeler’s bluegrass (PONEW) present with cover equal to or exceeding 5 percent **PIPO/CELE3/PONEW**, p. 20
 - 2b. Mountain mahogany absent or with cover less than 10 percent **5**
- 5a. Bitterbrush (PUTR2) present with cover equal to or exceeding 5 percent **6**
 - 6a. Idaho fescue and bluebunch wheatgrass present with cover equal to or exceeding 5 percent **PIPO/PUTR2/FEID-AGSP**, p. 21
 - 6b. Bluebunch wheatgrass cover greater than 5 percent; Idaho fescue absent or with cover less than 5 percent **PIPO/PUTR2/AGSP-POSA12**, p. 22
- 5b. Bitterbrush absent or with cover less than 5 percent **7**
 - 7a. Mountain big sagebrush (ARTRV) present with cover equal to or exceeding 10 percent **PIPO/ARTRV/FEID-AGSP**, p. 24
 - 7b. Mountain big sagebrush absent or with cover less than 10 percent **8**
- 8a. Idaho fescue (FEID) present with cover equal to or exceeding 10 percent **PIPO/FEID**, p. 26
- 8b. Idaho fescue absent or with cover less than 10 percent **PIPO/AGSP**, p. 28

Key to Western Juniper Series Vegetation

Western juniper (JUOC) must be present with cover equal to or exceeding 10 percent.

- 1a. Mountain mahogany (CELE3) present with cover equal to or exceeding 10 percent **JUOC/CELE3/FEID-AGSP**, p. 30
- 1b. Mountain mahogany absent or with cover less than 10 percent **2**
 - 2a. Bitterbrush (PUTR2) present with cover equal to or exceeding 10 percent **JUOC/PUTR2/FEID-AGSP**, p. 32
 - 2b. Bitterbrush absent or with cover less than 10 percent **3**
- 3a. Low sagebrush (ARAR8) present with cover equal to or exceeding 5 percent **JUOC/ARAR8/FEID**, p. 34
- 3b. Low sagebrush absent or with cover less than 5 percent **4**
 - 4a. Stiff sagebrush (ARRI2) present with cover equal to or exceeding 5 percent **JUOC/ARRI2**, p. 36
 - 4b. Stiff sagebrush absent or with cover less than 5 percent **5**
- 5a. Idaho fescue (FEID) present with cover equal to or exceeding 5 percent **JUOC/FEID-AGSP**, p. 35
- 5b. Idaho fescue absent or with cover less than 5 percent **JUOC/AGSP**, p. 36

Key to Shrubland Vegetation

Shrub cover by diagnostic species must equal or exceed 10 percent.

1a. Mountain mahogany (CELE3) present with cover equal to or exceeding 10 percent	2
2a. Idaho fescue (FEID) present with cover equal to or exceeding 5 percent	CELE3/FEID-AGSP, p. 37
2b. Idaho fescue absent or with cover less than 5 percent	3
3a. Bluebunch wheatgrass (AGSP) present with cover equal to or exceeding 5 percent	4
4a. Bitterbrush (PUTR2) present with cover equal to or exceeding 10 percent	CELE3-PUTR2/AGSP, p. 38
4b. Bitterbrush absent or with cover less than 10 percent	CELE3/AGSP, p. 38
3b. Bluebunch wheatgrass absent or with cover less than 5 percent	CELE3/PONEW, p. 39
1b. Mountain mahogany absent or with cover less than 10 percent	5
5a. Mountain snowberry (SYOR2) present on mounds with cover equal to or exceeding 10 percent; Mountain big sagebrush absent	SYOR2, p. 57
5b. Mountain snowberry absent or with cover less than 10 percent	6
6a. Bitterbrush (PUTR2) present with cover equal to or exceeding 10 percent	7
7a. Mountain big sagebrush (ARTRV) present with cover equal to or exceeding 10 percent	8
8a. Idaho fescue (FEID) cover greater than 5 percent; bluebunch wheatgrass (AGSP) absent	PUTR2-ARTRV/FEID, p. 42
8b. Bluebunch wheatgrass codominant with Idaho fescue ..	PUTR2-ARTRV/FEID-AGSP, p. 39
7b. Mountain big sagebrush absent or with cover less than 10 percent	9
9a. Idaho fescue (FEID) and bluebunch wheatgrass (AGSP) cover greater than 5 percent	PUTR2/FEID-AGSP, p. 41
9b. Idaho fescue and bluebunch wheatgrass cover less than 5 percent	PUTR2/ERDO, p. 42
6b. Bitterbrush absent or with cover less than 10 percent	10
10a. Mountain big sagebrush (ARTRV) present with cover equal to or exceeding 5 percent	11
11a. Mountain snowberry (SYOR2) present with cover equal to or exceeding 10 percent	12
12a. Mountain brome (BRCA5) present with cover equal to or exceeding 5 percent	ARTRV-SYOR2/BRCA5, p. 48
12b. Mountain brome absent or with cover less than 5 percent	ARTRV-SYOR2, p. 48
11b. Mountain snowberry absent or with cover less than 5 percent	13
13a. Mountain brome (BRCA5) present with cover equal to or exceeding 5 percent	ARTRV/BRCA5, p. 49
13b. Mountain brome absent or with cover less than 5 percent	14

14a. Squaw apple (PERA4) present with cover greater than 10 percent	ARTRV-PERA4, p. 49
14b. Squaw apple absent or with cover less than 10 percent	15
15a. Giant wild rye (ELCI2) present with cover greater than 5 percent	ARTRV/ELCI2, p. 49
15b. Giant wild rye absent or with cover less than 10 percent	16
16a. Prairie junegrass (KOCR) present with cover equal to or exceeding 5 percent	ARTRV/FEID-KOCR, p. 43
16b. Prairie junegrass absent or with cover less than 5 percent	17
17a. Idaho fescue (FEID) present with cover equal to or exceeding 5 percent	ARTRV/FEID-AGSP, p. 45
17b. Idaho fescue absent or with cover less than 5 percent	ARTRV/AGSP-POSA12, p. 47
10b. Mountain big sagebrush absent or with cover less than 5 percent	18
18a. Low sagebrush (ARAR8) present with cover equal to or exceeding 10 percent	19
19a. Idaho fescue (FEID) present with cover equal to or exceeding 5 percent	ARAR8/FEID-AGSP, p. 50
19b. Idaho fescue absent or with cover less than 5 percent	20
20a. Bluebunch wheatgrass (AGSP) present with cover equal to or exceeding 5 percent	ARAR8/AGSP, p. 52
20b. Bluebunch wheatgrass absent or with cover less than 5 percent	ARAR8/POSA12, p. 54
18b. Low sagebrush absent or with cover less than 10 percent	21
21a. Stiff sagebrush (ARRI2) present with cover equal to or exceeding 10 percent	22
22a. Sandberg's bluegrass (POSA12) present with cover equal to or exceeding 5 percent	ARRI2/POSA12, p. 55
22b. Sandberg's bluegrass absent or with cover less than 5 percent	ARRI2/PEGA, p. 57
21b. Stiff sagebrush absent or with cover less than 10 percent	23
23a. Threetip sagebrush (ARTR4) present with cover equal to or greater than 10 percent	ARTR4/POSA12-DAUN, p. 57
23b. Creeping Oregon-grape (BERE) present with cover equal to or exceeding 10 percent	BERE/AGSP-APAN2, p. 57

Key to Grassland Vegetation

Trees and shrubs are absent or their cover is less than 10 percent.

1a. Grasslands above 6,000 ft in elevation (subalpine grasslands)	2
1b. Grasslands below 6,000 ft in elevation	13
2a. Green fescue (FEVI) present with cover equal to or exceeding 5 percent	3
3a. Parry's rush (JUPA) present with cover equal to or exceeding 5 percent	FEVI-JUPA , p. 58
3b. Parry's rush absent or with cover less than 5 percent	4
4a. Lupines (LUPIN) present with cover equal to or exceeding 10 percent	FEVI-LULA3 , p. 58
4b. Lupines absent or cover is less than 10 percent	5
5a. Penstemons (PENST) present with cover equal to or exceeding 10 percent	FEVI-PENST , p. 58
5b. Penstemons absent or cover is less than 10 percent	6
2b. Green fescue absent or with cover less than 5 percent	7
7a. Idaho fescue (FEID) present with cover equal to or exceeding 5 percent	8
8a. Red avens (GETR) present with cover equal to or exceeding 5 percent	FEID-GETR , p. 58
8b. Red avens absent or with cover less than 5 percent	9
9a. Cymopterus (CYTEF) present with cover equal to or exceeding 1 percent	FEID-AGSP-CYTEF , p. 59
9b. Cymopterus absent	10
10a. Cusick's frasera (FRALC2) present with cover equal to or exceeding 3 percent	FEID-AGSP-FRALC2 , p. 60
10b. Cusick's frasera absent or cover is less than 3 percent	11
7b. Idaho fescue absent or relict (less than 5 percent)	11
11a. Oniongrass (MEBU) present at cover of 5 percent or greater	MEBU-STOC2 , p. 61
11b. Oniongrass absent or cover less than 5 percent; western needlegrass (STOC2) present at a cover of 5 percent or greater	STOC2-SIHY (Alpine) , p. 61
12a. Idaho fescue (FEID) present at cover of 5 percent or greater	13
12b. Idaho fescue absent or with cover less than 5 percent	19
13a. Prairie junegrass (KOCR) present at cover of 1 percent or greater on mounds	FEID-KOCR (Mound) , p. 62
13b. Prairie junegrass present (but not on mounds)	14
14a. Prairie junegrass present at cover of 5 percent or greater	FEID-KOCR (Ridge) , p. 64
14b. Prairie junegrass absent or with cover less than 5 percent	15
15a. Lupines (LUPIN) present at cover of 5 percent or greater	FEID-AGSP-LUPIN , p. 66
15b. Lupines absent or with cover less than 5 percent	16
16a. Arrowleaf balsamroot (BASA3) present with cover of 5 percent or greater	FEID-AGSP-BASA3 , p. 67
16b. Arrowleaf balsamroot absent or with cover less than 5 percent	17
17a. Phloxes (PHLOX) present at cover of 5 percent or greater	FEID-AGSP-PHLOX , p. 69
17b. Phloxes absent or with cover less than 5 percent	18

18a. Bluebunch wheatgrass (AGSP) present with cover greater than 5 percent	FEID-AGSP, p. 71
18b. Bluebunch wheatgrass cover less than 5 percent	FEID-DAUN, p. 72
19a. Bluebunch wheatgrass (AGSP) present at cover of 5 percent or greater	20
19b. Bluebunch wheatgrass absent or with cover less than 5 percent	32
20a. Mountain brome (BRCA5) present with cover of 5 percent or greater	AGSP-BRCA5, p. 87
20b. Mountain brome absent or with cover of less than 5 percent	21
21a. Lupines (LUPIN) present with cover of 5 percent or greater	AGSP-POSA12-LUPIN, p. 73
21b. Lupines absent or with cover of less than 5 percent	22
22a. Arrowleaf balsamroot (BASA3) present with cover of 5 percent or greater	AGSP-POSA12-BASA3, p. 75
22b. Arrowleaf balsamroot absent or with cover less than 5 percent	23
23a. Creamy buckwheat (ERHE2) present with cover of 5 percent or greater	AGSP-POSA12-ERHE2, p. 77
23b. Creamy buckwheat absent or with cover less than 5 percent	24
24a. Blue Mountain milkvetch (ASRE5) present with cover of 5 percent or greater	AGSP-POSA12-ASRE5, p. 78
24b. Blue Mountain milkvetch absent or with cover less than 5 percent	25
25a. Bighead clover (TRMA3) present with cover of 5 percent or greater	AGSP-POSA12-TRMA3, p. 80
25b. Bighead clover absent or with cover less than 5 percent	26
26a. Skullcap (SCAN3) present with cover of 5 percent or greater	AGSP-POSA12-SCAN3, p. 82
26b. Skullcap absent or with cover less than 5 percent	27
27a. Dogbane (APAN2) present with cover of 5 percent or greater	AGSP-POSA12-APAN2, p. 83
27b. Dogbane absent or with cover less than 5 percent	28
28a. Onespikes oatgrass (DAUN) present with cover of 5 percent or greater	AGSP-POSA12-DAUN, p. 84
28b. Onespikes oatgrass absent or with cover less than 5 percent	29
29a. Sandberg's bluegrass (POSA12) present with cover of 5 percent or greater	AGSP-POSA12, p. 86
29b. Sandberg's bluegrass absent or relict (cover less than 5 percent)	30
30a. Sulfur-flower buckwheat (ERUM) present with cover of 5 percent or greater	AGSP-ERUM, p. 88
30b. Sulfur-flower buckwheat absent or with cover of less than 5 percent	31
31a. Cymopterus (CYTEF) present with cover of 5 percent or greater	AGSP-CYTEF, p. 88
31b. Cymopterus absent or with cover of less than 5 percent	32
32a. Douglas' buckwheat (ERDO) present with cover of 5 percent or greater	ERDO-POSA12, p. 88
32b. Douglas' buckwheat absent or with cover of less than 5 percent	33
33a. Bulbous bluegrass (POBU) present with cluster tarweed	POBU-MAGL2, p. 88
33b. Bulbous bluegrass and/or tarweed absent or at cover of less than 5 percent	34
34a. Slenderfruit lomatium (LOLE2) and rushes (JUNCUS) present with onespikes oatgrass dominant	DAUN-LOLE2, p. 89
34b. Slenderfruit lomatium and rushes absent; Sandberg's bluegrass dominant	POSA12-DAUN, p. 91

Ponderosa Pine Series

Ponderosa pine/mountain mahogany/Idaho fescue-bluebunch wheatgrass plant association

Pinus ponderosa/Cercocarpus ledifolius/Festuca idahoensis-Agropyron spicatum

PIPO/CELE3/FEID-AGSP

CPS234

N = 9



Alkali Creek, Emigrant Creek RD, Malheur NF.

Distribution—

Central and southern Blue Mountains; Ochoco Mountains.

Environmental features—

This plant association was found on andesite, basalt, pumice, and tuff. Elevations ranged from 4,250 to 5,950 ft (mean 4,900 ft). Slopes were moderately steep (mean 23 percent). Sample sites were on northerly and southerly aspects on convex and concave surfaces. Positions ranged from shoulders to backslopes to footslopes. Soils had a sandy loam or silt loam surface layer up to 12 in thick (sometimes absent) over very to extremely gravelly loamy soil, with bedrock at a depth of 1 to 2 ft. Soil pH was slightly acid, and available water capacity was low. One study profile had a silty clay loam subsoil over bedrock at 2 ft, and moderate available water capacity.

	Mean	Range
Elevation (feet)	4,900	4,250–5,950
Slope (percent)	23	18–50
Soil pH (n = 5)		6.2–6.8
Soil available water capacity (inches, n = 5)		1.5–6 (low to moderate)
Depth to bedrock (inches, n = 9)		12–25
Herbage (pounds/acre, n = 6)	428	303–740
Aspect (number of plots)	NW (5), NE (0), SE (3), SW (1)	
Lithology	Andesite, basalt, pumice, tuff	
Position	Shoulder, backslope, footslope, summit	
Slope shape	Convex, concave	

Ground surface features—

	Phase			A + B range
	A (n = 5)	B (n = 2)	C (n = 2)	
	Cover (%)			
Bare ground	3	8	4	0–12
Bedrock	3	0	11	0–8
Rock	9	6	20	0–20
Gravel	0	7	0	0–14
Pavement	0	0	11	0
Mosses and lichens	10	9	2	0–11
Litter	75	70	52	

Vegetation composition—

This is the warmest and driest of the PIPO/CELE3 plant associations. The other PIPO/CELE3 plant associations are more mesic, with either elk sedge or Wheeler's bluegrass associated. Ponderosa pine is always present in this association. Western juniper and Douglas-fir may occur as incidental trees. Mountain mahogany is the dominant shrub, with mountain big sagebrush and bitterbrush often associated. Grasses are the most abundant herbaceous plants. Idaho fescue and bluebunch wheatgrass codominate, with Sandberg's bluegrass and bottlebrush squirreltail often present. Forb composition is usually weak with low coverages. Often present are yarrow, pale agoseris, arrowleaf balsamroot, creamy buckwheat, and phlox.

States and transitions—

Three phases were defined as follows:

- A Idaho fescue is dominant over bluebunch wheatgrass. Disturbances have been either minimal or of short duration.
- B Bluebunch wheatgrass has increased to codominance with Idaho fescue. Disturbances from severe burns, ungulate overuse, or climatic change promoting warmer, drier microsite conditions promote this stage.
- C Bluebunch wheatgrass dominates over all other herbaceous plants. Continued site disturbances that are frequent or of long duration promote this phase.

Management considerations—

This type is highly valued as deer winter range. Moderate to severe burns kill mountain mahogany, and ungulate browsing of mountain mahogany may prevent regeneration. The bunchgrasses are promoted by light to moderate burns.

Principal species—

Species	Code	Phase			A + B range
		A (n = 5)	B (n = 2)	C (n = 2)	
		Cover (%)/constancy (%)			Cover (%)
Trees:					
ponderosa pine	PIPO	17/100	34/100	12/100	10–45
Douglas–fir	PSME	2/20	–	3/100	0–2
western juniper	JUOC	8/60	12/100	8/50	0–15
Shrubs:					
mountain mahogany	CELE3	29/100	15/100	15/100	5–60
mountain big sagebrush	ARTRV	8/100	5/50	0	1–15
bitterbrush	PUTR2	3/60	6/100	1/50	0–8
wax currant	RICE	15/20	0	2/50	0–15
Grasses:					
Idaho fescue	FEID	33/100	12/100	2/50	10–38
bluebunch wheatgrass	AGSP	7/100	10/100	25/100	4–15
prairie junegrass	KOCR	4/40	0	0	0–4
Sandberg's bluegrass	POSA12	17/80	4/100	8/100	0–30
bottlebrush squirreltail	SIHY	2/80	0	0	0–5
Forbs:					
common yarrow	ACMIL	2/60	1/100	2/100	0–2
pale agoseris	AGGL	2/60	0	0	0–3
arrowleaf balsamroot	BASA3	2/60	0	0	0–2
hawksbeards	CREPI	13/60	1/50	0	0–35
creamy buckwheat	ERHE2	2/65	1/100	1/50	0–3
phloxes	PHLOX	2/40	1/50	0	0–2

Overgrazing tends to promote creamy buckwheat, squirreltail, and annuals. An excellent community for visualizing the effects of ungulate use in this type may be found on the Emigrant Creek Ranger District (RD) above Devine Canyon at the Larsen Spring cattle enclosure (erected in 1963). Here deer use the bitterbrush inside the enclosure, while seedlings and saplings of mountain mahogany occur abundantly beside the older shrubs inside the enclosure. Few bitterbrush and mountain mahogany are present outside the enclosure, where domestic and wild ungulates browse them heavily.

Relationship to other studies—

This plant association was previously classified in the Blue and Ochoco Mountains (Johnson and Clausnitzer 1992).

Ponderosa pine/mountain mahogany/Wheeler's bluegrass plant association

Pinus ponderosa/Cercocarpus ledifolius/Poa nervosa var. wheeleri

PIPO/CELE3/PONEW

CPS233

N = 7



Fred Hall

Emigrant Butte, Emigrant Creek RD, Malheur NF.

Distribution—

Ochoco Mountains.

Environmental features—

This vegetation type is found on rhyolitic tuffs in the Ochoco Mountains. Elevations ranged from 5,125 to 5,425 ft (mean 5,304 ft). Slopes were usually gentle (mean 5 percent). Sampled sites were on northerly and southerly slopes with either convex or straight shape. Slope positions were ridgetops or shoulders of ridges. Soils were shallow to moderately deep over rhyolite.

	Mean	Range
Elevation (feet)	5,304	5,125–5,425
Slope (percent)	5	2–15
Herbage (pounds/acre, n = 7)	129	60–200
Aspect (number of plots)	NW (3), NE (0), SE (2), SW (2)	
Lithology	Argillite	
Position	Shoulder, ridgetop	
Slope shape	Convex, linear/planar	

Ground surface features—

	Phase		A + B range
	A (n = 3)	B (n = 4)	
			Cover (%)
Bare ground	2	3	0–5
Bedrock	2	0	0–5
Rock	2	2	0–5
Gravel	0	0	0
Pavement	5	5	0–10
Mosses and lichens	1	1	0–5
Litter	88	89	

Vegetation composition—

Western juniper is usually associated in a forest savannah growing above the mountain mahogany and bitterbrush shrubs. Grasses dominate over forbs, with Wheeler's bluegrass the most prominent. Ross' sedge was always found; Idaho fescue and western needlegrass were frequently present. Forb diversity and cover were low. Groundsels, hawkweeds, and lomatiums were the most frequent forbs.

Principal species—

Species	Code	Phase		A + B range
		A (n = 3)	B (n = 4)	
		Cover (%) / constancy (%)		Cover (%)
Trees:				
ponderosa pine	PIPO	28/100	42/100	23–50
western juniper	JUOC	18/67	9/75	0–25
Shrubs:				
mountain mahogany	CELE3	18/100	17/100	10–30
bitterbrush	PUTR2	12/100	6/100	1–25
Grasses and grasslikes:				
Wheeler's bluegrass	PONEW	15/100	10/100	8–15
Idaho fescue	FEID	2/67	2/50	0–2
bottlebrush squirreltail	SIHY	5/33	1/100	0–5
western needlegrass	STOC2	1/100	1/50	0–1
Ross' sedge	CAR05	4/100	7/100	1–15
Forbs:				
lomatiums	LOMAT	1/100	1/50	0–1
groundsels	SENEC	3/100	2/100	1–6
western hawkweed	HAL	2/67	1/25	0–2

States and transitions—

Two phases were defined as follows:

- A Wheeler's bluegrass cover is ≥ 15 percent.
Disturbances minimal or of short duration.
- B Wheeler's bluegrass cover is < 15 percent.
Disturbances of moderate severity or duration.

Management considerations—

Moderate and severe burns may cause extensive mortality to both mountain mahogany and bitterbrush. Disturbances from domestic livestock and fires tend to promote juniper, bottlebrush squirreltail, western needlegrass, and yarrow. Intensive use may severely retard the recruitment of young mountain mahogany plants. This community is heavily used by wild ungulates in winter rangelands. Herbage production is extremely low (mean 129 lb/ac). Bitterbrush and mountain mahogany provide key fall and winter browse.

Relationship to other studies—

This plant association was previously classified and described in the Ochoco Mountains (Johnson and Clausnitzer 1992).

Ponderosa pine/bitterbrush/Idaho fescue-bluebunch wheatgrass plant association

Pinus ponderosa/Purshia tridentata/Festuca idahoensis-Agropyron spicatum

PIPO/PUTR2/FEID-AGSP

CPS226

N = 7



Powder River canyon, Baker RD, Wallowa-Whitman NF.

Distribution—

Central and southern Blue Mountains; Ochoco Mountains.

Environmental features—

This plant association was found on basalts and rhyolites. Elevations ranged from 4,000 to 5,260 ft (mean 4,710 ft). Slopes were gentle to steep (mean 11 percent). Sampled sites were on northerly and southerly aspects on convex, straight, or undulating surfaces and on all slope positions. Soils had 6 to 16 in of loamy surface over very to extremely gravelly or cobbly subsoil. One profile had silty clay loam subsoil over weathered bedrock at 32 in. Soil available water capacity was low to moderate, and pH was nearly neutral except for some acid soil near the surface.

	Mean	Range
Elevation (feet)	4,699	4,000–5,260
Slope (percent)	11	2–30
Soil pH (n = 2)		5.2–6.8
Soil available water capacity (inches, n = 2)		3.5–8 (low to moderate)
Depth to bedrock or extremely gravelly soil (inches, n = 5)		6–32
Herbage (pounds/acre, n = 4)	281	132–545
Aspect (number of plots)	NW (1), NE (1), SE (0), SW (2)	
Lithology	Basalt, rhyolite	
Position	Ridgetops and all slope positions	
Slope shape	Convex, straight, undulating	

Ground surface features—

	Phase		A + B range
	A (n = 5)	C (n = 2)	
	Cover (%)		
Bare ground	9	2	1–25
Bedrock	0	0	0
Rock	4	15	1–5
Gravel	1	1	0
Pavement	6	9	0
Mosses and lichens	5	4	0–5
Litter	75	69	

Vegetation composition—

Ponderosa pine forms an open forest over a shrub layer dominated by bitterbrush. Western juniper may be associated. Herbaceous vegetation is dominated by grasses. Idaho fescue is always present and usually abundant. Other grasses usually present at low coverages in these communities are bluebunch wheatgrass, Sandberg’s bluegrass, and bottlebrush squirreltail. Forbs occur at low coverages.

States and transitions—

Only one phase was defined where vegetation has been relatively undisturbed. More severe or frequent disturbances could provide additional phases where increases would occur by rabbitbrush, needlegrass, squirreltail, annual grasses, and yarrow.

Principal species—

Species	Code	Phase		A + B range
		A (n = 5)	C (n = 2)	
		Cover (%) / constancy (%)		Cover (%)
Trees:				
ponderosa pine	PIPO	19/100	21/100	5–41
western juniper	JUOC	18/40	41/100	0–25
Shrubs:				
bitterbrush	PUTR2	14/100	0	5–25
green rabbitbrush	CHVI8	1/40	0	0–1
creeping Oregon grape	BERE	1/40	0	0–1
mountain mahogany	CELE3	6/40	0	0–10
Grasses:				
Idaho fescue	FEID	29/100	20/100	20–40
bluebunch wheatgrass	AGSP	2/80	4/100	0–4
prairie junegrass	KOCR	2/60	0	0–5
Sandberg’s bluegrass	POSA12	4/80	2/100	0–10
bottlebrush squirreltail	SIHY	1/60	0	0–1
Forbs:				
common yarrow	ACMIL	3/80	0	1–5
basalt milkvetch	ASFI	5/20	12/100	0–5
twin arnica	ARSO2	5/40	0	0–5
western hawkweed	HIAL	1/40	0	0–1
western groundsel	SEIN2	2/40	0	0–3

Management considerations—

These communities are a valuable part of deer winter range in the southern Blue and Ochoco Mountains. Bitterbrush is highly nutritious. Overbrowsing severely hedges bitterbrush shrubs, retards recruitment of juvenile bitterbrush seedlings, and imperils the future existence of bitterbrush. Light- to moderate-severity fires enhance ponderosa pine vitality. Bitterbrush will be retarded if fire occurs when soils are too dry. A good example of this plant association is found in the Sumpter Three-Way Exclosure at the west end of McEwan Valley on the Baker Ranger District of the Wallowa-Whitman NF.

Relationship to other studies—

This is a widespread plant association in the Pacific Northwest first classified by Daubenmire and Daubenmire (1968) in eastern Washington. It was subsequently described by Pfister et al. (1977) in Montana, Steele et al. (1981) in central Idaho, Clausnitzer and Zamora (1987) in northern Washington, Volland (1976) and Hopkins (1979a, 1979b) in central Oregon, and by Johnson and Clausnitzer (1992) in the Blue and Ochoco Mountains.

Ponderosa pine/bitterbrush/bluebunch wheatgrass-Sandberg's bluegrass plant association

Pinus ponderosa/Purshia tridentata/Agropyron spicatum-Poa sandbergii

PIPO/PUTR2/AGSP-POSA12

CPS229

N = 3



Jackie Creek, Emigrant Creek RD, Malheur NF.

Distribution—

Southern Blue Mountains; Ochoco Mountains.

Environmental features—

This plant association was found on basalt, volcanic tuff, and argillite. Elevations ranged from 4,700 to 5,210 ft (mean 4,927 ft). Slopes were moderately steep (mean 32 percent). Sampled sites were on northerly and southerly aspects on convex and concave surfaces. All slope positions were represented. The one soil profile studied consisted of very to extremely gravelly sandy loam, with bedrock at a depth of 16 in. Available water capacity was very low and pH nearly neutral.

	Mean	Range
Elevation (feet)	4,927	4,700–5,210
Slope (percent)	32	20–45
Herbage (pounds/acre, n = 2)	280	150–440
Aspect (number of plots)	NW (0), NE (1), SE (1), SW (1)	
Lithology	Basalt, argillite, tuff	
Position	All slope positions	
Slope shape	Convex, concave	

Ground surface features—

	Phase			A + B range
	A (n = 1)	B (n = 1)	D (n = 1)	
	Cover (%)			
Bare ground	5	1	3	1–5
Bedrock	0	0	0	0
Rock	11	20	1	11–20
Gravel	0	40	3	0–40
Pavement	0	0	0	0
Mosses and lichens	1	0	0	0–1
Litter	83	39	90	

Vegetation composition—

This is the warmest and driest of the PIPO/PUTR2 plant associations. Ponderosa pine is always present and dominant over a shrub layer of bitterbrush. Western juniper is usually present. Grasses dominate the forbs in the herbaceous layer. Bluebunch wheatgrass, fleabanes, and yarrow are prominent.

Principal species—

Species	Code	Phase			A + B range
		A (n = 1)	B (n = 1)	D (n = 1)	
		Cover (%) / constancy (%)			Cover (%)
Trees:					
ponderosa pine	PIPO	12/100	15/100	30/100	12–15
western juniper	JUOC	3/100	—	9/100	0–3
Shrubs:					
bitterbrush	PUTR2	21/100	5/100	15/100	5–21
creeping Oregon grape	BERE	1/100	3/100	0	1–3
Grasses:					
bluebunch wheatgrass	AGSP	31/100	10/100	0	10–31
Sandberg's bluegrass	POSA12	1/100	1/100	5/100	1–1
Forbs:					
common yarrow	ACMIL	2/100	0	1/100	0–2
fleabanes	ERIGE2	8/100	0	1/100	0–8
tailcup lupine	LUCA	0	0	10/100	0–1
penstemons	PENST	0	1/100	1/100	0–1

States and transitions—

Three phases were defined as follows:

- A High cover of bitterbrush and bluebunch wheatgrass (both >15 percent).
- B Bitterbrush cover is <15 percent.
- C Bluebunch wheatgrass <5 percent or absent; bare ground is >10 percent.

Management considerations—

Bitterbrush is highly valued deer winter range in the southern Blue and Ochoco Mountains. Browsing can be severe and impede vitality of the plants. Fire can damage bitterbrush plants if a severe burn occurs when soils are

dry. Overgrazing in this driest of ponderosa pine/bitterbrush associations can eliminate bluebunch wheatgrass. Sandberg's bluegrass, yarrow, lupines, and penstemons will increase with heavy grazing pressure.

Relationship to other studies—

This plant association was first described as an incidental community type in the Wallowa Mountains (Johnson and Simon 1987). It was then described as a plant association by Lillybridge et al. (1995) in the eastern Cascades of Washington. This is the first description of this plant association in the Blue and Ochoco Mountains.

Ponderosa pine/mountain big sagebrush/Idaho fescue-bluebunch wheatgrass plant association

Pinus ponderosa/Artemisia tridentata/Festuca idahoensis-Agropyron spicatum

PIPO/ARTRV/FEID-AGSP

CPS131

N = 7



Lonesome Exclosure, Gilbert Ridge, Emigrant Creek RD, Malheur NF.

Distribution—

Southern Blue Mountains; Ochoco Mountains.

Environmental features—

This plant association was found on basalt, andesite, argillite, and dacite. Elevations ranged from 4,500 to 5,550 ft (mean 5,029 ft). Slopes were gentle to moderately steep (5 to 40 percent). Sampled sites were on northerly and southerly aspects on convex and straight surfaces. Plots were on backslope and footslope locations.

	Mean	Range
Elevation (feet)	5,029	4,500–5,550
Slope (percent)	21	5–40
Herbage (pounds/acre, n = 4)	420	300–620
Aspect (number of plots)	NW (0), NE (4), SE (0), SW (3)	
Lithology	Basalt, andesite, argillite, dacite, rhyolite	
Position	Backslope, footslope, summit	
Slope shape	Convex, straight	

Ground surface features—

	Phase				A + B range
	A (n = 2)	B (n = 3)	C1 (n = 1)	C2 (n = 1)	
	Cover (%)				
Bare ground	6	13	0	0	0–40
Bedrock	0	9	5	5	0–20
Rock	4	12	15	20	0–35
Gravel	0	1	0	0	0–3
Pavement	0	7	0	0	0–15
Mosses and lichens	4	1	0	0	0–8
Litter	86	57	80	75	

Vegetation composition—

These communities are a savannah with ponderosa pine cover of less than 20 percent; western juniper cover generally less than 10 percent; and a shrub layer dominated by sagebrush (generally about 25 percent cover). Bunchgrasses dominate the herbaceous layer. Idaho fescue and bluebunch wheatgrass codominate, with Sandberg's bluegrass usually associated at lower cover levels. Forbs are few, with yarrow, creamy buckwheat, and narrowleaf pussytoes the most common.

States and transitions—

Four phases were defined as follows:

- A Deep-rooted bunchgrasses (Idaho fescue and bluebunch wheatgrass) with combined cover ≥ 25 percent. A balance between sagebrush and these bunchgrasses is maintained by periodic fire and light to moderate grazing pressure.
- B Deep-rooted bunchgrasses with combined cover < 25 percent. This represents an imbalance between sagebrush and the bunchgrasses owing to lack of fire or to overgrazing.
- C1 Dominated by annual bromes (especially cheatgrass). A loss of dominance by Idaho fescue and bluebunch wheatgrass owing to severe overgrazing and ground disturbance.
- C2 Dominated by bluegrasses (*Poa sandbergii* and *Poa nervosa*). Fescue and wheatgrass have lost dominance owing to soil compaction, soil loss, and overgrazing.

Principal species—

Species	Code	Phase				A + B range
		A (n = 2)	B (n = 3)	C1 (n = 1)	C2 (n = 1)	
		<i>Cover (%) / constancy (%)</i>				<i>Cover (%)</i>
Trees:						
ponderosa pine	PIPO	23/100	10/100	18/100	1/100	5–23
western juniper	JUOC	1/50	7/67	13/100	15/100	0–8
Shrubs:						
mountain big sagebrush	ARTRV	18/100	23/100	10/100	25/100	10–30
creeping Oregon grape	BERE	2/50	0	0	0	0–2
mountain mahogany	CELE3	1/50	0	0	1/100	0–1
green rabbitbrush	CHVI8	2/100	3/67	1/100	3/100	0–5
bitterbrush	PUTR2	0	3/67	0	3/100	0–5
wax currant	RICE	6/50	1/33	4/100	0	0–6
Grasses:						
bluebunch wheatgrass	AGSP	8/100	12/100	10/100	1/100	5/20
Idaho fescue	FEID	38/100	9/100	2/100	5/100	8–50
prairie junegrass	KOCR	10/50	1/33	0	0	0–10
Sandberg's bluegrass	POSA12	8/50	8/100	5/100	20/100	0–10
Forbs:						
common arrow	ACMIL	6/50	3/100	1/100	2/100	0–6
narrowleaf pussytoes	ANST2	2/50	2/33	0	2/100	0–2
creamy buckwheat	ERHE2	2/100	1/100	1/100	0	1–2
groundsel	SENEC	2/100	1/33	8/100	2/100	0–2

Management considerations—

Light to moderate fires tend to reduce juniper and big sagebrush without harming ponderosa pine and bunchgrasses. Plants commonly found in this plant association that tend to increase with disturbances to the ground surface are rabbitbrush, creamy buckwheat, yarrow, bluegrasses, and annual bromes. These communities are high in layer diversity with resultant wildlife species habitat diversity. However, heavy use by ungulates (especially cattle and elk) can degrade these communities with compaction to the soils and overuse of bunchgrasses and a resultant loss in plant vigor. Rabbitbrush, cheatgrass, and bluegrasses often increase as a result.

Relationship to other studies—

Volland's (1976) classification in the central Oregon pumice zone contains a PIPO/PUTR2-ARTRV/FEID-AGSP plant association that is floristically similar to this association. Johnson and Clausnitzer (1992) classified and described this plant association for the Blue and Ochoco Mountains.

Ponderosa pine/Idaho fescue plant association

Pinus ponderosa/Festuca idahoensis

PIPO/FEID

CPG112

N = 22



Sugar Creek, Paulina RD, Ochoco NF.

Distribution—

Throughout the Blue and Ochoco Mountains.

Environmental features—

This plant association was found on basalt, andesite, rhyolite, tuff, peridotite, and serpentine rocks. Elevations ranged from 3,800 to 5,300 ft (mean 4,592 ft). Slopes were generally gentle to moderate (mean 15 percent). Sampled sites were found on all aspects. Soils consisted of a loamy surface layer 6 to 18 in thick, over very to extremely gravelly loamy soil. Bedrock occurred in some profiles, at depths as shallow as 12 in but often not within 40 in of the surface. Available water capacity varied greatly, and soil pH was slightly acid to nearly neutral.

	Mean	Range
Elevation (feet)	4,592	3,800–5,300
Slope (percent)	15	1–80
Soil pH (n = 13)		6.2–7.2
Soil available water capacity (inches, n = 14)		2–10 (low to high)
Depth to bedrock or extremely gravelly soil (inches, n = 15)		12–40+
Herbage (pounds/acre, n = 18)	347	200–497
Aspect (number of plots)	NW (5), NE (5), SE (5), SW (7)	
Lithology	Basalt, rhyolite, tuff, andesite, peridotite, serpentine	
Position	Summit and all slope positions	
Slope shape	Convex, concave, straight	

Ground surface features—

	Phase			A + B range
	A (n = 11)	B (n = 9)	C (n = 2)	
	Cover (%)			
Bare ground	7	3	6	0–40
Bedrock	2	2	0	0–12
Rock	4	3	2	0–15
Gravel	1	0	1	0–10
Pavement	2	1	0	0–16
Mosses and lichens	1	2	0	0–10
Litter	83	89	91	0–10

Vegetation composition—

Idaho fescue dominates beneath ponderosa pine. Western juniper may be associated. Shrubs are absent or present at low coverage; mountain big sagebrush and bitterbrush are the most common. Other bunchgrasses frequently found with fescue are bluebunch wheatgrass, prairie junegrass, and Sandberg's bluegrass. As this type approaches Douglas-fir and grand fir forest, elk sedge may occur on moister microsites within the fescue community. The most common forb is yarrow. Also frequent are fleabanes, pussytoes, hawkweeds, and lupines.

States and transitions—

Three phases were defined as follows:

- A Idaho fescue cover >25 percent.
- B Idaho fescue cover 15 to 25 percent; annuals present in minor amount.
- C Idaho fescue cover <15 percent; annuals (e.g., annual bromes) and bulbous bluegrass cover ≥10 percent; perennial forbs (e.g., twin arnica) may be abundant also.

Principal species—

Species	Code	Phase			A + B range
		A (n = 11)	B (n = 9)	C (n = 2)	
		Cover (%)/constancy (%)			Cover (%)
Trees:					
ponderosa pine	PIPO	29/100	32/100	28/100	7–60
western juniper	JUOC	1/55	7/67	0	0–33
Shrubs:					
mountain big sagebrush	ARTRV	2/36	5/11	0	0–7
bitterbrush	PUTR2	1/45	2/56	0	0–4
Grasses and grasslikes:					
Idaho fescue	FEID	36/100	21/100	10/100	15–60
bluebunch wheatgrass	AGSP	10/91	4/67	16/100	0–31
cheatgrass	BRTE	0	1/22	10/50	0–1
prairie junegrass	KOCR	1/55	3/22	2/100	0–4
Sandberg's bluegrass	POSA12	2/55	1/67	1/50	0–15
elk sedge	CAGE2	4/64	6/22	0	0–6
Forbs:					
common yarrow	ACMIL	3/100	2/89	3/100	0–7
hawksbeards	CREPI	1/55	1/33	0	0–2
pussytoes	ANTEN	2/55	1/44	22/100	0–8
fleabanes	ERIGE2	3/55	1/33	1/50	0–5
lupines	LUPIN	2/55	1/44	1/50	0–20

Phase B is probably produced by moderate grazing pressure. Overgrazing can take the association to phase C where weedy annual grasses or perennial forbs increase to the detriment of the bunchgrasses. Fires of light to moderate severity do not harm the pines or Idaho fescue, whereas severe fires can eliminate both.

Management considerations—

Prescribed burns can promote new pines and young bunchgrass plants. These communities are especially valuable to grazing ungulates in the early spring when the fescue plants are preferred because of their succulence.

Relationship to other studies—

PIPO/FEID was first described in eastern Washington by Daubenmire and Daubenmire (1968), in the Blue Mountains by Hall (1973), in Montana by Pfister et al. (1977), in central Idaho by Steele et al. (1981), in northern Idaho by Cooper et al. (1991), in northern Washington by Clausnitzer and Zamora (1987), in the Wallowa and Seven Devils Mountains by Johnson and Simon (1987), and in the Blue and Ochoco Mountains by Johnson and Clausnitzer (1992).

Ponderosa pine/bluebunch wheatgrass plant association

Pinus ponderosa/Agropyron spicatum

PIPO/AGSP

CPG111

N = 10



Deep Creek canyon, Whitman Unit, Wallowa-Whitman NF.

Distribution—

Occurs throughout the Blue Mountains; most prominent in the northern Blues.

Environmental features—

This plant association occurs on basalts, andesites, and volcanic tuff. Elevations ranged from 2,175 to 4,940 ft (mean 4,164 ft). Slopes were moderate (mean 24 percent). Sampled sites were mostly on convex surfaces. Soils consisted of a surface layer of gravelly to very gravelly loamy soil, overlying extremely gravelly soil or weathered bedrock at a depth of 8 to 18 in. Available water capacity was low to moderate, and soil pH slightly acid to neutral.

	Mean	Range
Elevation (feet)	4,164	2,175-4,940
Slope (percent)	24	4-50
Soil pH (n = 3)		6.4-7.0
Soil available water capacity (inches, n = 8)		1-5 (low to moderate)
Depth to bedrock or extremely gravelly soil (inches, n = 8)		8-18
Herbage (pounds/acre, n = 9)	390	200-750
Aspect (number of plots)	NW (0), NE (3), SE (5), SW (2)	
Lithology	Basalt, andesite, tuff	
Position	Summit, all slope positions	
Slope shape	Convex	

Ground surface features—

	Phase
	A + B (n = 10)
	Cover (%)
Bare ground	3
Bedrock	10
Rock	9
Gravel	0
Pavement	2
Mosses and lichens	1
Litter	75

Vegetation composition—

Ponderosa pine occurs in open savannah over a bluebunch wheatgrass-dominated herbaceous layer. Western juniper may be present. Bitterbrush and common snowberry are infrequent and have low cover in this type. Bunchgrasses often associated with the bluebunch wheatgrass are Sandberg's bluegrass and Idaho fescue. Elk sedge may be a component on mesic microsites adjacent to Douglas-fir or grand fir forests. The most common forb is yarrow. Fleabanes, western hawkweed, tailcup lupine, and creamy buckwheat often occur.

Principal species—

Species	Code	Phase
		A + B (n = 10)
		Cover (%) / constancy (%)
Trees:		
ponderosa pine	PIPO	20/100
western juniper	JUOC	3/40
Shrubs:		
bitterbrush	PUTR2	2/40
common snowberry	SYAL	2/40
Grasses and grasslikes:		
bluebunch wheatgrass	AGSP	31/100
Idaho fescue	FEID	4/60
Wheeler's bluegrass	PONEW	4/30
Sandberg's bluegrass	POSA12	7/90
elk sedge	CAGE2	5/50
Forbs:		
common yarrow	ACMIL	5/80
serrate balsamroot	BASE2	2/30
fleabanes	ERIGE2	2/40
creamy buckwheat	ERHE2	1/50
western hawkweed	HIAL	1/40
lomatiums	LOMAT	1/30
tailcup lupine	LUCA	10/40
false agoseris	MITR5	2/30

States and transitions—

- AB The deep-rooted bluebunch wheatgrass dominates over the other bunchgrasses. Perennial forbs occur at coverages of 5 percent or less.
- C Sandberg’s bluegrass, lupines, and yarrow have increased owing to grazing disturbance.

Management considerations—

Fire is often discontinuous in these communities. Fire return intervals are 8 to 10 years. Burning maintains bunchgrass vigor. Ungulates use these communities in spring and early summer for forage and in late summer for shading beneath the trees. Ungulates can degrade these sites if trampling causes displacement of bunchgrass

plants on steep slopes early in the growing season when soils are saturated with rains and snowmelt.

Relationship to other studies—

This plant association was first described by Daubenmire and Daubenmire (1968) in eastern Washington, in the Blue Mountains by Hall (1973), in Montana by Pfister et al. (1977), in central Idaho by Steele et al. (1981), in north Idaho by Cooper et al. (1991), in northern Washington by Clausnitzer and Zamora (1987), in the Wallowa and Seven Devils Mountains by Johnson and Simon (1987), and in the Blue and Ochoco Mountains by Johnson and Clausnitzer (1992).

Ponderosa pine/squaw apple plant community type

Pinus ponderosa/Peraphyllum ramosissimum

PIPO/PERA4

CPS8

N = 2

This community was found in the central and southern Blue Mountains at relatively low elevations (below 4,500 ft). These are transitional communities between nonforest and forest sites. They contain a rich shrub component beneath a savannah of ponderosa pine and western juniper. Squaw apple is dominant with bitterbrush, snowberries, and mountain

mahogany often associated. Elk sedge and the bunchgrasses occur together as members from adjacent forest and non-forest, respectively. Bluebunch wheatgrass and bottlebrush squirreltail are often prominent. Creamy buckwheat is the most frequent forb. Squaw apple has a relatively restricted and sporadic distribution in northeastern Oregon.

Ponderosa pine-western juniper/mountain mahogany-mountain snowberry plant community type

Pinus ponderosa-Juniperus occidentalis/Cercocarpus ledifolius-Symphoricarpos oreophilus

PIPO-JUOC/CELE3-SYOR2

CPC212

N = 2

This community was found in the southern Blue Mountains at moderate elevations (4,700 to 5,100 ft). The one soil studied was very shallow (4 in of gravelly sandy loam over bedrock), with very low available water capacity and neutral pH. These are transitional communities between open sagebrush-grasslands and forests. Ponderosa pines are scattered (10 percent overstory cover) over a shrubland dominated by

mountain mahogany and mountain snowberry. Three bunchgrasses dominate the herbaceous vegetation: Idaho fescue, bluebunch wheatgrass, and prairie junegrass. Forbs are scant with yarrow and arrowleaf balsamroot the most frequently found. Mule deer (*Odocoileus hemionus*) heavily browse mountain mahogany shrubs.

Western Juniper Series

Western juniper/mountain mahogany/Idaho fescue-bluebunch wheatgrass plant association

Juniperus occidentalis/*Cercocarpus ledifolius*/*Festuca idahoensis*-*Agropyron spicatum*

JUOC/CELE3/FEID-AGSP

CJS41

N = 4



Birch Creek exclosure, Blue Mountain RD, Malheur NF.

Distribution—

Southern Blue and Ochoco Mountains.

Benchmark site—

Birch Creek Three-Way Exclosure, Blue Mountain RD, Malheur NF. Established in 1961.

Environmental features—

This plant association was found on basalt, rhyolite, and argillite. Elevations of sample plots ranged from 4,240 to 5,270 ft (mean 4,903 ft). Slopes were moderate to steep (mean 26 percent). Plots occurred on westerly aspects on convex surfaces. Slope positions were on summits, shoulders, and backslopes. The one soil profile studied in detail had 8 in of very to extremely gravelly sandy loam over bedrock at a depth of 8 in; other brief investigations confirmed that soils were very shallow and had very low available water capacity.

	Mean	Range
Elevation (feet)	4,903	4,240–5,270
Slope (percent)	26	12–40
Herbage (pounds/acre, n = 4)	368	240–540
Aspect (number of plots)	NW (2), NE (0), SE (0), SW (2)	
Lithology	Basalt, rhyolite, argillite	
Position	Summit, shoulder, backslope	
Slope shape	Convex	

Ground surface features—

	Phase			A + B range
	A (n = 1)	B (n = 2)	D (n = 1)	
	Cover (%)			
Bare ground	5	8	17	5–10
Bedrock	3	9	0	3–15
Rock	20	12	4	5–20
Gravel	0	0	0	0
Pavement	60	8	6	0–60
Mosses and lichens	5	14	4	0–30
Litter	7	49	68	

Vegetation composition—

Western juniper forms a savannah over mountain mahogany and bunchgrasses. Idaho fescue requires the shading and moisture retention provided by the overtopping junipers. Forbs are few and have low coverage. Needlegrasses are the dominant invasive species and increase with disturbance. Communities in this association usually contain old-growth juniper and reflect long-term juniper occupancy.

States and transitions—

Three phases were defined as follows:

- A Idaho fescue dominates over other bunchgrasses, with cover >25 percent.
- B Bluebunch wheatgrass dominates over other bunchgrasses, with cover >25 percent; needlegrasses occur and often codominate with fescue.
- D Needlegrasses dominate over other bunchgrasses.

Principal species—

Species	Code	Phase			A + B range
		A (n = 1)	B (n = 2)	D (n = 1)	
		<i>Cover (%) / constancy (%)</i>			<i>Cover (%)</i>
Trees:					
western juniper	JUOC	10/100	25/100	10/100	10–30
Shrubs:					
mountain mahogany	CELE3	35/100	18/100	20/100	15–35
bitterbrush	PUTR2	0	1/50	1/100	0–1
Grasses:					
bluebunch wheatgrass	AGSP	5/100	25/100	0	5–25
soft brome	BRMO2	0	3/50	0	0–3
cheatgrass	BRTE	0	5/100	0	0–5
Idaho fescue	FEID	25/100	8/100	0	5–25
prairie junegrass	KOCR	0	3/100	1/100	0–3
Sandberg's bluegrass	POSA12	5/100	8/100	14/100	5–10
needlegrasses	STIPA	0	13/100	34/100	0–20
Forbs:					
common yarrow	ACMIL	1/100	2/100	2/100	1–3
pussytoes	ANTEN	0	2/100	1/100	0–2
stonecrops	SEDUM	3/100	1/100	29/100	0–3

As the transition occurs from A to B to D, Sandberg's bluegrass increases owing to the effect of disturbances by grazing and drought. Soil surface disturbance promotes the invasion and subsequent increase by needlegrasses. Herb-age levels declined from phase A (450 lb/ac) to B (390 lb/ac) to D (240 lb/ac) on sampled plots. This decline mirrors the change from the larger, denser fescue and wheatgrass plants to the smaller, less dense bluegrass and needlegrass plants prominent in stage D.

Management considerations—

This community is important for providing habitat edge and cover for wildlife (mammals and birds). The juxtaposition of these communities on the landscape increases habitat diversity. Fires may severely damage juniper and mahogany owing to their susceptibility to moderate and severe burns. Wild browsers and livestock have prevented recruitment of young mountain mahogany plants in many places.

Relationship to other studies—

Western juniper/mountain mahogany/Idaho fescue-bluebunch wheatgrass was previously described as an incidental community in the Blue and Ochoco Mountains by Johnson and Clausnitzer (1992). The findings of this study change the status of the vegetation to plant association.

Western juniper/bitterbrush/Idaho fescue-bluebunch wheatgrass plant association

Juniperus occidentalis/Purshia tridentata/Festuca idahoensis-Agropyron spicatum

JUOC/PUTR2/FEID-AGSP

CJS321

N = 13



Skookum Enclosure, Heppner RD, Malheur NF.

Distribution—

Central and southern Blue Mountains; Ochoco Mountains.

Benchmark sites—

Three enclosures contain excellent examples of this plant association:

- Skookum Three-Way Enclosures (established 1945); Heppner RD, Umatilla NF
- Dry Creek Three-Way Enclosures (established 1939); Blue Mountain RD, Malheur NF
- Antelope Springs Enclosure (established 1955); Blue Mountain RD, Malheur NF

Environmental features—

This plant association was found on basalt, andesite, argillite, rhyolite, dacite, and pumice. Elevations ranged from 3,650 to 5,140 ft (mean 4,253 ft). Slopes were gentle to steep (mean 12 percent). Plots occurred on all aspects on convex, straight, and undulating surfaces. Plot locations were on all slope positions. Brief soil investigations suggest that soils have shallow to moderate depth (6 to 22 in, n = 10).

	Mean	Range
Elevation (feet)	4,253	3,650–5,140
Slope (percent)	12	3–45
Herbage (pounds/acre, n = 7)	546	300–813
Aspect (number of plots)	NW (2), NE (4), SE (4), SW (3)	
Lithology	Basalt, andesite, argillite, rhyolite, dacite, pumice	
Position	Summit, shoulder, slopes	
Slope shape	Convex, straight, undulating	

Ground surface features—

Species	Phase					A + B range
	A (n = 4)	B (n = 4)	C1 (n = 2)	C2 (n = 2)	D (n = 1)	
	Cover (%)					
Bare ground	18	24	58	30	25	1–50
Bedrock	0	1	0	0	0	0–3
Rock	2	11	20	8	0	0–30
Gravel	2	3	5	5	10	0–10
Pavement	11	2	0	8	0	0–35
Mosses and lichens	1	2	1	4	0	0–4
Litter	66	57	16	45	65	

Vegetation composition—

These communities consist of a tree-shrub-bunchgrass-forb mosaic beneath an open juniper savannah. Three bunchgrasses are prominent: Idaho fescue, bluebunch wheatgrass, and Sandberg's bluegrass. Forbs are subordinate to the bunchgrasses; yarrow, blepharipappus, and red avens are plants frequently associated in the community. These deeper soil sites may have been free of western juniper prior to the decreased fire frequency and heavy grazing of the postsettlement period.

States and transitions—

Five phases were recognized:

- A Idaho fescue cover of at least 20 percent; bare soil covers <35 percent of the ground surface.
- B Idaho fescue cover of <20 percent or bare ground >35 percent.
- C1 Bitterbrush and Idaho fescue each with cover <5 percent; annual grasses and forbs prominent.
- C2 Bitterbrush still present with 10 percent cover or more, but Idaho fescue is very weak (<5 percent cover) or absent.
- D Introduced perennial grasses have replaced Idaho fescue and bluebunch wheatgrass.

Animal use has determined the composition and cover of bunchgrasses in these communities. Livestock seek shade under the junipers and can destroy the fescue, which is then replaced by annual plants, especially cheatgrass and Japanese brome. Prolonged heavy grazing combined with browsing of the bitterbrush component results in phase C1. Where severity or duration of bitterbrush browsing has been less severe but fescue has been impacted, phase C2 results. Phase D results when the deep-rooted bunchgrasses (FEID, AGSP) are overgrazed to the point where natural recolonization is not possible and land managers have seeded exotic grasses.

Principal species—

Species	Code	Phase					A + B range
		A (n = 4)	B (n = 4)	C1 (n = 2)	C2 (n = 2)	D (n = 1)	
		<i>Cover (%) / constancy (%)</i>					<i>Cover (%)</i>
Trees:							
western juniper	JUOC	13/100	17/100	4/100	8/100	11/100	10–38
Shrubs:							
bitterbrush	PUTR2	14/100	12/100	2/100	18/100	20/100	3–20
Grasses:							
bluebunch wheatgrass	AGSP	14/100	15/100	15/100	12/100	1/100	1–30
annual bromes	BROMU	5/25	4/50	11/100	8/100	1/100	0–15
Idaho fescue	FEID	25/100	18/100	2/100	0	0	10–35
prairie junegrass	KOCR	2/50	2/50	0	3/50	0	0–3
Sandberg's bluegrass	POSA12	8/100	8/100	5/100	4/100	10/100	3–20
Forbs:							
common yarrow	ACMIL	4/100	6/100	5/100	1/100	3/100	1–15
blepharipappus	BLSC	6/50	3/50	22/100	2/100	0	0–10
tall annual willowherb	EPPA2	1/25	0	5/50	10/100	0	0–1
sulphur-flower buckwheat	ERUM	1/50	1/50	0	0	0	0–1
red avens	GETR	3/50	1/25	0	0	0	0–5
phloxes	PHLOX	2/25	4/50	3/50	2/100	1/100	0–5

Management considerations—

The bitterbrush-bunchgrass mix provides for high-quality wildlife habitat. These communities are heavily used by livestock and big game animals for shade. They are also primary deer winter range. Deer use is high for bedding and for browse (bitterbrush and juniper). Retention of viable populations of bitterbrush and bunchgrasses is desirable for biological diversity. Fire usually reduces the fire-sensitive juniper and bitterbrush; fire will promote bunchgrasses if adequate amounts remain to colonize the openings created by the death

of juniper and bitterbrush. Most of these sites probably represent postsettlement juniper invasion, and juniper density may continue to increase in the future. Juniper density could increase to the point where shrubs are nearly eliminated.

Relationship to other studies—

This plant association was originally described by Volland (1976) in the central Oregon pumice area. It was subsequently described by Johnson and Clausnitzer (1992) for the Blue and Ochoco Mountains.

Western juniper/low sagebrush/Idaho fescue plant association

Juniperus occidentalis/*Artemisia arbuscula*/*Festuca idahoensis*

JUOC/ARAR8/FEID

CJS112

N = 3



South Fork of Wind Creek, Paulina RD, Ochoco NF.

Distribution—

Central and southern Blue Mountains; Ochoco Mountains.

Environmental features—

This plant association was found on basalts and andesites at elevations ranging from 4,400 to 4,890 ft (mean 4,588 ft). Slopes were gentle (mean 5 percent). Plots occurred on southerly aspects on convex and straight surfaces. The one soil profile studied consisted of loam and gravelly loam, over bedrock at a depth of 12 in, with low available water capacity and neutral pH.

	Mean	Range
Elevation (feet)	4,588	4,400–4,890
Slope (percent)	5	4–5
Herbage (pounds/acre n = 3)	550	350–800
Aspect (number of plots)	NW (0), NE (0), SE (2), SW (0)	
Lithology	Basalt, andesite	
Position	Summit, shoulder, backslope	
Slope shape	Convex, straight	

Vegetation composition—

Western juniper forms a savannah over low sagebrush and bunchgrasses. The principal bunchgrasses are blue-

bunch wheatgrass, Idaho fescue, and Sandberg's bluegrass. These communities often were adjacent to low sagebrush/Idaho fescue-bluebunch wheatgrass (ARAR8/FEID-AGSP) communities or low sagebrush/Sandberg's bluegrass (ARAR8/POSA12)

communities. These communities usually contain old-growth juniper and reflect long-term occupancy by the species.

Principal species—

Species	Code	Phase	
		A (n = 2)	C (n = 1)
Cover (%)/constancy (%)			
Trees:			
western juniper	JUOC	19/100	19/100
Shrubs:			
low sagebrush	ARAR8	20/100	20/100
Grasses:			
bluebunch wheatgrass	AGSP	25/100	1/100
Idaho fescue	FEID	16/100	15/100
Sandberg's bluegrass	POSA12	18/100	11/100

Ground surface features—

	Phase	
	A (n = 2)	C (n = 1)
Cover (%)		
Bare ground	11	40
Bedrock	3	0
Rock	4	15
Gravel	3	15
Pavement	0	0
Mosses and lichens	1	1
Litter	78	29

States and transitions—

Two phases were recognized:

- A Bluebunch wheatgrass, Idaho fescue, and Sandberg's bluegrass combined cover >50 percent.
- C Combined cover of the three bunchgrasses is <50 percent; bare ground >20 percent.

The transition from phase A to C occurs as a result of heavy grazing by domestic livestock.

Management considerations—

Juniper affords shade to livestock and wild ungulates. The juniper/low sagebrush/fescue community has high value to grazing animals and browsing animals. Deer relish the succulent leaders of the sagebrush. The mix of bunchgrasses provides a diverse offering to grazing animals.

Relationship to other studies—

The JUOC/ARAR8/FEID plant association was first described by Hopkins (1979b) on the Fremont NF in south-central Oregon. This type was previously described as a plant community for the Blue and Ochoco Mountains (Johnson and Clausnitzer 1992).

Western juniper/Idaho fescue-bluebunch wheatgrass plant association

Juniperus occidentalis/Festuca idahoensis-Agropyron spicatum

JUOC/FEID-AGSP

CJG111

N = 8



Shake Table, Blue Mountain RD, Malheur NF.

deeper soil sites may have been free of western juniper prior to the decreased fire frequency and heavy grazing of the postsettlement period.

Ground surface features—

	Phase			A + B range
	A (n = 3)	B (n = 4)	C (n = 1)	
	Cover (%)			
Bare ground	6	12	15	0–20
Bedrock	1	0	0	0–4
Rock	22	18	30	0–65
Gravel	0	5	0	0–10
Pavement	0	0	10	0
Mosses and lichens	14	12	0	3–25
Litter	57	53	45	

Distribution—

Central and southern Blue Mountains; Ochoco Mountains.

Benchmark sites—

Kelly Creek Butte (proposed research natural area), Heppner RD, Umatilla NF; Shaketable (proposed research natural area), Blue Mountain RD, Malheur NF

Environmental features—

This plant association was found on andesite and rhyolite. Elevations ranged from 3,050 to 5,850 ft (mean 4,651 ft). Slopes were gentle to steep (mean 27 percent). Plots occurred primarily on westerly aspects on summits, shoulders, and backslopes. Brief soil investigations suggested shallow to moderately deep soils (10 to 30 in, n = 3).

	Mean	Range
Elevation (feet)	4,651	3,050–5,850
Slope (percent)	27	5–70
Herbage (pounds/acre, n = 7)	619	300–948
Aspect (number of plots)	NW (3), NE (1), SE (0), SW (4)	
Lithology	Andesite, rhyolite	
Position	Summit, shoulder, backslope	
Slope shape	Convex, straight, undulating	

Vegetation composition—

Western juniper forms a savannah with bunchgrasses. The four principal bunchgrasses (Idaho fescue, bluebunch wheatgrass, prairie junegrass, Sandberg’s bluegrass) dominate the herbaceous layer. The most common forbs are yarrow, red avens, and tailcup lupine. Adjacent vegetation is often of thinner soil communities (stiff sage/Sandberg’s bluegrass; Sandberg’s bluegrass-onespike oatgrass). These

Principal species—

Species	Code	Phase			A + B range
		A (n = 3)	B (n = 4)	C (n = 1)	
		Cover (%) / constancy (%)			Cover (%)
Trees:					
western juniper	JUOC	22/100	27/100	8/100	8–45
Shrubs:					
wax currant	RICE	1/33	2/50	0	0–4
Grasses:					
bluebunch wheatgrass	AGSP	16/100	10/100	10/100	3–30
cheatgrass	BRTE	1/33	9/75	3/100	0–15
Idaho fescue	FEID	37/100	20/100	5/100	15–50
prairie junegrass	KOCR	5/33	4/50	0	0–5
Sandberg’s bluegrass	POSA12	6/67	9/100	7/100	0–20
Forbs:					
common yarrow	ACMIL	4/100	1/50	1/100	0–10
arrowleaf balsamroot	BASA3	3/33	2/100	0	0–5
tall annual willowherb	EPPA2	0	2/50	0	0–3
creamy buckwheat	ERHE2	5/33	3/25	0	0–5
red avens	GETR	6/67	0	0	0–10
tailcup lupine	LUCA	6/67	8/75	0	0–20

States and transitions—

Three phases were defined as follows:

- A Idaho fescue, bluebunch wheatgrass, and prairie junegrass cover total ≥ 50 percent.
- B Idaho fescue, bluebunch wheatgrass, and prairie junegrass cover total 20 to 49 percent.
- C Idaho fescue, bluebunch wheatgrass, and prairie junegrass cover total < 20 percent.

Livestock seeking shade and grazing impact the bunchgrasses. In phase B, a reduction in cover of large bunchgrasses and increase in Sandberg’s bluegrass is attributed

to grazing pressure. In phase C, Idaho fescue has been nearly eliminated by grazing. Forbs that tend to increase with disturbance are yarrow, tailcup lupine, and creamy buckwheat.

Management considerations—

Fire usually kills young juniper. Grazing animals use these communities for shade and forage. Deer use the areas beneath juniper trees for rest and shade. Chukar (*Alectoris chukar*) and quail (*Callipepla californica*) use these communities as well. Most of these sites probably

represent postsettlement juniper invasion, and juniper density may continue to increase in the future.

Relationship to other studies—

A juniper/bunchgrass plant association was described by Hall (1973) for the Blue Mountains. Johnson and Simon (1987) described this plant association for the Wallowa Mountains and canyon lands of the Snake and Imnaha Rivers in northeastern Oregon. Johnson and Clausnitzer (1992) described this plant association for the Blue and Ochoco Mountains.

Western juniper/stiff sagebrush plant community type

Juniperus occidentalis/Artemisia rigida

JUOC/ARRI2

CJS811

N = 2

Western juniper is scattered over a xeric shrubland of stiff sagebrush with bunchgrasses strongly associated. Juniper averaged 11 percent cover; sagebrush averaged 13 percent. These communities usually contain old-growth juniper and reflect long-term occupancy by the species. The two principal bunchgrasses are bluebunch wheatgrass and Sandberg's bluegrass. In the plot that was lightly impacted by grazing, the cover of each grass was 20 percent, and with heavier grazing disturbance both bunchgrasses declined. Forbs frequently occurring were narrowleaf stonecrop, low pussytoes, bighead clover, penstemons, and phlox.

These communities were found in the central and southern Blue Mountains on basalt and andesite. Sites were rocky (mean cover 50 percent), with gentle slopes

(mean 6 percent), and convex slope shape. The one soil studied had 10 in of gravelly to very gravelly loamy material over bedrock, very low available water capacity, and slightly acid pH. These are hot, dry sites where spring moisture is slight and drought severely limits plant growth.

Western juniper/stiff sagebrush communities are often ecotonal between ponderosa pine forests or savannahs and stiff sagebrush/Sandberg's bluegrass scablands. Grazing and browsing animals use the juniper for shading and the sagebrush for browse. Heavy use of the sagebrush will cause hedging of the shrub and possible mortality. Heavy traffic and trampling accelerate frost heaving and soil erosion of the scabland soils. Herbage ranged from 75 to 275 lb/ac (mean 175 lb/ac), the lowest of any juniper community type.

Western juniper/bluebunch wheatgrass plant community type

Juniperus occidentalis/Agropyron spicatum

JUOC/AGSP

CJG113

N = 3

Western juniper is scattered over a xeric grassland composed of bluebunch wheatgrass and Sandberg's bluegrass. The juniper cover averages 12 percent. The bunchgrasses are thinly scattered in a rocky-gravelly landscape (bluebunch wheatgrass average cover 17 percent; Sandberg's bluegrass cover 8 percent). Other herbaceous plants are relatively few and have low cover. Sparse fuels suggest rare fires and possibly long-term juniper occupancy of these sites rather than recent juniper invasion.

These communities were found in the southern Blue and Ochoco Mountains. Sites were found on basalt and andesite, where rock cover averaged 33 percent and gravel 12

percent. Elevations ranged from 3,990 to 4,515 ft (mean 4,235 ft). Slopes were moderately steep (mean 24 percent). Plots occurred on southerly aspects on convex surfaces, at shoulder and backslope positions. The one soil investigated was just 4 in thick. These are hot, dry sites where spring moisture is slight and drought strongly limits plant growth.

These communities receive highest use in late winter to early spring when bunchgrasses green up and are available for forage before adjacent grasslands. Elk (*Cervus elaphus*) and deer are attracted to these communities when winter snow is receding from the mountain rangelands. Herbage ranged from 250 to 375 lb/ac (mean 312 lb/ac).

Principal species—

Species	Code	Phase			A + B range
		A (n = 1)	B (n = 2)	D (n = 2)	
		Cover (%)/constancy (%)			Cover (%)
Trees:					
western juniper	JUOC	0	5/50	0	0–5
Shrubs:					
mountain mahogany	CELE3	45/100	40/100	68/100	14–65
gray rabbitbrush	CHNA2	10/100	1/50	0	0–10
Grasses:					
bluebunch wheatgrass	AGSP	20/100	0	6/100	0–20
rattlesnake brome	BRBR7	0	0	7/50	0
cheatgrass	BRTE	5/100	0	32/100	0–5
Idaho fescue	FEID	30/100	32/100	11/100	23–40
prairie junegrass	KOCR	1/100	5/50	4/100	0–5
Wheeler's bluegrass	PONEW	1/100	25/50	1/50	0–25
Sandberg's bluegrass	POSA12	3/100	44/50	10/50	0–3
bottlebrush squirreltail	SIHY	1/100	4/100	5/50	1–8
Forbs:					
common yarrow	ACMIL	1/100	1/100	2/100	1–1
fleabanes	ERIGE2	0	2/50	1/100	0–3
creamy buckwheat	ERHE2	0	2/50	1/50	0–2
western hawkweed	HAL	5/100	0	1/50	0–5
western groundsel	SEIN2	3/100	10/50	4/50	0–10

Management considerations—

These communities add to the overall landscape diversity within the coniferous forest and the sagebrush rangeland of the Blue and Ochoco Mountain landscapes. Mountain mahogany is preferentially browsed by deer, elk, and pronghorns (*Antilocapra americana*). There is very little recruitment of mountain mahogany owing to the heavy use of these stands by browsing ungulates. High lines or skirting of the mature shrub canopies can weaken the mature shrubs and lead to mortality. The dense thickets of mahogany provide excellent winter cover for deer. Moderate and severe fire usually kills mountain mahogany, and then regeneration is often severely curtailed by herbivory. If bunchgrass cover was low before the fire, weedy or invasive species may colonize the site after fire.

Relationship to other studies—

Hall (1973) included CELE3/FEID-AGSP in a mountain mahogany-grass plant community type in the Blue Mountains. Three mountain mahogany plant community types were described in the Snake River canyon by Johnson and Simon (1987). This plant association was previously described in the Blue and Ochoco Mountains by Johnson and Clausnitzer (1992).

Mountain mahogany-bitterbrush/bluebunch wheatgrass plant community type

Cercocarpus ledifolius-Purshia tridentata/Agropyron spicatum

CELE3-PUTR2/AGSP

SD4115

N = 1

This community type was probably more common in the Blue Mountains prior to the introduction of domestic livestock and the high deer populations of the 1950s. Here bitterbrush is dominant beneath an open mahogany stand. It is present today owing to exclusion of ungulates beginning in 1961 at Birch Creek Three-Way Exclosure

on the Blue Mountain RD of the Malheur NF. The xeric site (soil of gravelly sandy loam just 6 in deep) does not support Idaho fescue. The bunchgrasses that codominate here are bluebunch wheatgrass, Thurber's needlegrass, and Sandberg's bluegrass.

Mountain mahogany/bluebunch wheatgrass plant community type

Cercocarpus ledifolius/Agropyron spicatum

CELE3/AGSP

SD4112

N = 3

These communities are found on southerly, steep slopes (mean 63 percent) on basalt and rhyolite outcrops. Extremely gravelly or stoney material occurs within 10 in of the surface. These sites are too dry for fescue establishment. The predominant bunchgrasses are bluebunch wheatgrass and Sandberg's bluegrass. The mountain mahogany stands are

open (mean cover 14 percent). Snowberries (both common and mountain) are usually associated. Common forbs are yarrow, creamy buckwheat, and lanceleaf stonecrop. This community occurs on Chicken Hill in the central Blue Mountains of the La Grande RD, Wallowa-Whitman NF.

Mountain mahogany/Wheeler’s bluegrass plant community type

Cercocarpus ledifolius/Poa nervosa wheeleri

CELE3/PONEW

SD4114

N = 1

This community in the southern Blue Mountains contains a high cover of Wheeler’s bluegrass (60 percent) beneath a dense stand of mountain mahogany (60 percent). Few forbs are represented. The only other bunchgrasses are bluebunch

wheatgrass, western needlegrass, and Sandberg’s bluegrass. The site is high in elevation for mountain mahogany (6,050 ft). The soil consists of very to extremely gravelly silt loam over bedrock at 18 in.

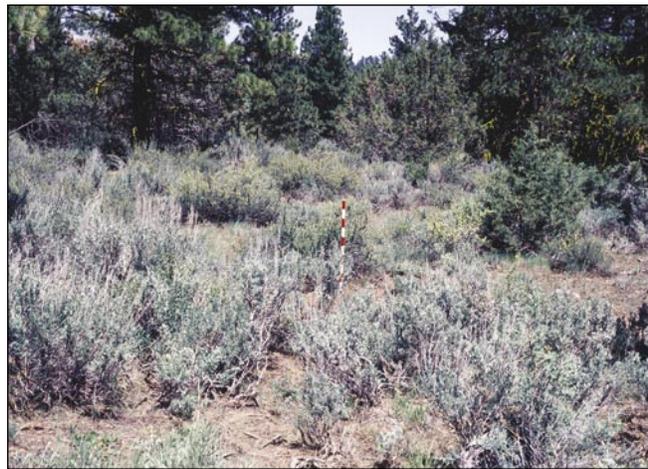
Bitterbrush-mountain big sagebrush/Idaho fescue-bluebunch wheatgrass plant association

Purshia tridentata-Artemisia tridentata var. vaseyana/Festuca idahoensis-Agropyron spicatum

PUTR2-ARTRV/FEID-AGSP

SD3124

N = 6



Cougar Creek Enclosure, Prairie City RD, Malheur NF.

Distribution—

Southern Blue Mountains; Ochoco Mountains.

Environmental features—

This plant association was found on rhyolite and volcanic sandstone. Elevations of sample plots ranged from 4,600 to 5,450 ft (mean 5,103 ft). Slopes were gentle to moderate (mean 7 percent). Plots occurred primarily on southerly slopes on straight surfaces near ridgetops. Soils depths were 9 to 24 in (n = 3). The one profile studied in detail had clay-rich subsoil and neutral pH.

	Mean	Range
Elevation (feet)	5,103	4,600–5,450
Slope (percent)	7	2–20
Herbage (pounds/acre, n = 1)	380	
Aspect (number of plots)	NW (0), NE (0), SE (5), SW (1)	
Lithology	Rhyolite, volcanic sandstone, tuff	
Position	Summit	
Slope shape	Straight	

Ground surface features—

	Phase				
	A (n = 1)	B (n = 2)	C (n = 1)	D (n = 2)	A + B range
	Cover (%)				
Bare ground	15	14	40	18	13–15
Bedrock	0	2	0	0	0–4
Rock	0	8	1	1	0–10
Gravel	0	0	1	5	0–1
Pavement	0	0	0	0	0
Mosses and lichens	2	0	15	0	0–2
Litter	50	40	3	63	

Vegetation composition—

Bitterbrush is always associated with mountain big sagebrush as a codominant. Bunchgrasses dominate the herbaceous layer. Always present in relatively undisturbed vegetation are Idaho fescue, prairie junegrass, bluebunch wheatgrass, and Sandberg’s bluegrass. Prominent forbs are yarrow, creamy buckwheat, and fleabanes. Ponderosa pine and western juniper may occur as incidental species at low cover. These shrublands are often adjacent to mountain big sagebrush communities.

States and transitions—

Three phases were defined as follows:

- A Bitterbrush cover >5 percent; Idaho fescue and bluebunch wheatgrass cover total >25 percent.
- B Bitterbrush cover >5 percent; Idaho fescue and bluebunch wheatgrass cover total <25 percent.
- C Bitterbrush cover >5 percent; Idaho fescue absent; Sandberg’s bluegrass is the dominant bunchgrass; bare ground >30 percent.
- D Bitterbrush cover <5 percent.

Principal species—

Species	Code	Phase				A + B range
		A (n = 1)	B (n = 2)	C (n = 1)	D (n = 2)	
		<i>Cover (%) / constancy (%)</i>				<i>Cover (%)</i>
Trees:						
western juniper	JUOC	0	1/50	1/100	0	0–1
ponderosa pine	PIPO	0	4/50	0	0	0–4
Shrubs:						
mountain big sagebrush	ARTRV	20/100	9/100	30/100	28/100	9–20
mountain mahogany	CELE3	0	3/50	0	0	0–3
bitterbrush	PUTR2	15/100	12/100	25/100	2/100	8–16
mountain snowberry	SYOR2	0	2/50	0	0	0–2
Grasses:						
bluebunch wheatgrass	AGSP	10/100	10/100	10/100	5/100	9–10
Idaho fescue	FEID	25/100	2/100	0	18/100	1–25
prairie junegrass	KOCR	3/100	2/100	0	1/100	1–3
Sandberg's bluegrass	POSA12	5/100	8/100	15/100	10/100	2–15
bottlebrush squirreltail	SIHY	0	2/50	1/100	1/100	0–2
Forbs:						
common yarrow	ACMIL	1/100	4/100	10/100	1/100	1–6
fleabanes	ERIGE2	6/100	5/100	0	1/50	1–6
creamy buckwheat	ERHE2	1/100	2/100	1/100	10/50	1–2

With overgrazing, phase A will shift toward phase B with diminished cover by fescue and wheatgrass. As degradation of the bunchgrass community continues, phase C can be attained where the shallow-rooted Sandberg's bluegrass dominates the deep-rooted bunchgrasses and Idaho fescue is relict or absent. With ungulate overbrowsing, bitterbrush is weakened and juvenile plants are killed resulting in relict PUTR2 as portrayed in phase D.

Management considerations—

Bitterbrush is killed by moderately severe to severe burns when soil moisture is low and roots are consumed. Bitterbrush and mountain big sagebrush can be regenerated by using prescribed fire if burns are accomplished at the time

soil moisture is adequate to protect the roots from extreme heat. Bitterbrush-sagebrush/bunchgrass communities are highly desired as winter-spring range for wildlife (especially deer). Mule deer are principal users of bitterbrush during winter. Domestic livestock use is focused on the bunchgrass component, but bitterbrush is hedged when livestock use is heavy. Regeneration of bitterbrush has been seriously compromised in many areas by combined browsing of livestock and wildlife.

Relationship to other studies—

This is the first description of PUTR2-ARTRV/FEID AGSP as a plant association.

Bitterbrush/Idaho fescue-bluebunch wheatgrass plant association

Purshia tridentata/*Festuca idahoensis*-*Agropyron spicatum*

PUTR2/FEID-AGSP

SD3111

N = 7



Shake Table, Blue Mountain RD, Malheur NF.

Distribution—

Central and southern Blue Mountains; Ochoco Mountains.

Environmental features—

This plant association was found on basalt and rhyolite. Elevations of sample plots ranged from 3,690 to 4,700 ft (mean 4,199 ft). Slopes were gentle to moderately steep (mean 11 percent). Plots occurred primarily on southwesterly slopes on convex surfaces and on all slope positions. Soils consisted of a surface layer of loamy material about 5 in thick over a clay-rich layer (sometimes stoney), with bedrock or extremely gravelly soil 10 to 30 in below the surface. Available water capacity was low to moderate, and soil pH was slightly acid to neutral.

	Mean	Range
Elevation (feet)	4,199	3,690–4,700
Slope (percent)	11	3–35
Soil pH (n = 5)		6.2–7.3
Soil available water capacity (inches, n = 4)		2–7 (low to moderate)
Depth to bedrock or extremely gravelly soil (inches, n = 8)		10–30
Herbage (pounds/acre, n = 2)	470	437–502
Aspect (number of plots)	NW (2), NE (1), SE (0), SW (4)	
Lithology	Basalt, tuff	
Position	Summit, shoulder, backslope, footslope	
Slope shape	Convex, straight	

Ground surface features—

	Phase			A + B range
	A (n = 3)	B (n = 2)	C (n = 2)	
	Cover (%)			
Bare ground	18	45	32	3–50
Bedrock	2	0	0	0–4
Rock	4	2	0	0–5
Gravel	0	0	0	0
Pavement	5	2	0	0–15
Mosses and lichens	2	0	0	0–4
Litter	30	42	28	

Vegetation composition—

Bitterbrush occurs with bunchgrass-dominated herbaceous layer. Idaho fescue, bluebunch wheatgrass, and Sandberg’s bluegrass are always present in relatively undisturbed vegetation. Onespike oatgrass may be a component on shallow soil inclusions within the site. Prominent forbs are yarrow, hawksbeard, blepharipappus, and cryptantha. Ponderosa pine and western juniper may occur at low cover in this association. Bitterbrush/bunchgrass shrublands are often adjacent to scablands, grasslands, juniper/bitterbrush, or pine-juniper/bitterbrush communities.

States and transitions—

Three phases were defined as follows:

- A Idaho fescue and bluebunch wheatgrass cover total >25 percent.
- B Idaho fescue and bluebunch wheatgrass cover total <25 percent or bare ground is >30 percent.
- C Sandberg’s bluegrass is the dominant bunchgrass; bare ground is >30 percent; annuals have >50 percent cover.

With overgrazing, phase A will shift toward phase B with diminished cover by fescue and wheatgrass and an increase in bare ground. As degradation of the bunchgrass community continues, the shallow-rooted Sandberg’s bluegrass and annuals (e.g., blepharipappus, annual bromes) dominate over the deep-rooted bunchgrasses (phase C).

Principal species—

Species	Code	Phase			A + B range
		A (n = 3)	B (n = 2)	C (n = 2)	
		Cover (%)/constancy (%)			Cover (%)
Trees:					
ponderosa pine	PIPO	3/33	1/50	0	0–3
western juniper	JUOC	2/33	8/50	0	0–5
Shrubs:					
bitterbrush	PUTR2	14/100	18/100	6/100	10–25
gray rabbitbrush	CHNA2	0	5/50	0	0–5
Grasses:					
bluebunch wheatgrass	AGSP	23/100	12/100	6/100	10–30
rattlesnake brome	BRBR7	1/33	0	1/50	0–1
hairy brome	BRCO4	1/33	0	0	0–1
Japanese brome	BRJA	0	0	18/100	0
soft brome	BRMO2	0	0	1/50	0
cheatgrass	BRTE	3/33	0	0	0–3
onespike oatgrass	DAUN	6/67	1/50	0	0–10
Idaho fescue	FEID	15/100	12/100	0	3–25
prairie junegrass	KOCR	1/33	1/50	0	0–1
Sandberg's bluegrass	POSA12	9/100	8/100	18/100	1–15
bottlebrush squirreltail	SIHY	1/33	0	10/100	0–1
ventenata	VEDU	0	5/50	0	0–5
Forbs:					
common yarrow	ACMIL	5/100	0	8/100	0–5
tapertip onion	ALAC4	1/33	3/50	0	0–3
blepharipappus	BLSC	10/33	10/50	22/100	0–10
tapertip hawksbeard	CRAC2	8/67	0	3/50	0–10
cryptantha	CRYPT	10/33	2/100	0	0–10
tall annual willowherb	EPPA2	1/33	1/50	22/100	0–1
creamy buckwheat	ERHE2	15/33	0	28/100	0–15
spurred lupine	LULA3	0	0	5/100	0

Management considerations—

Bitterbrush is killed by moderately severe to severe burns when soil moisture is low and roots are consumed. Bitterbrush can be regenerated by using prescribed fire if soil moisture is adequate to protect the roots from extreme heat. Bitterbrush/bunchgrass communities are highly desired as winter-spring range for wildlife (especially deer). Mule deer are principal users of bitterbrush during winter. Domestic livestock use is focused on the bunchgrass component, but bitterbrush is hedged when livestock use is heavy. Regeneration of bitterbrush has been seriously compromised in many areas by combined browsing of livestock and wildlife.

Relationship to other studies—

Daubenmire (1970) was the first ecologist to describe this vegetation with his PUTR2/FEID habitat type in central Washington. Hall (1973) classified a bitterbrush/bunchgrass plant community type in the southern Blue and Ochoco Mountains. Johnson and Simon (1987) described a PUTR2/FEID-AGSP plant association in the Wallowa Mountains. Johnson and Clausnitzer (1992) described the PUTR2/FEID-AGSP plant association of the Blue and Ochoco Mountains.

Bitterbrush-mountain big sagebrush/Idaho fescue plant community type*Purshia tridentata*-*Artemisia tridentata* var. *vaseyana*/*Festuca idahoensis*

PUTR2-ARTRV/FEID

SD3125

N = 1

This mesic bitterbrush community was found below Bald Butte on the old Snow Mountain RD, Ochoco NF (now the Emigrant RD, Malheur NF). Here bitterbrush was codominant with mountain big sagebrush. The bitterbrush was

vigorous, with growth from 4 to 7 ft tall. Associated with the fescue were other mesic graminoids (e.g., mountain brome, giant wildrye, and elk sedge). The only prominent forb was western groundsel.

Bitterbrush/Douglas' buckwheat plant community type*Purshia tridentata*/*Eriogonum douglasii*

PUTR2/ERDO

SD3126

N = 1

The bunchgrasses associated with bitterbrush in this community were relict owing to intense overgrazing over a long time. This community was dominated by Douglas' buckwheat and desert yellow daisy. The site had lost soil

to surface erosion as attested by an erosion pavement of 65 percent. Soil depths averaged only 2.25 in. It was not possible to assign this plot to a bitterbrush plant association.

Mountain big sagebrush/Idaho fescue-prairie junegrass plant association

Artemisia tridentata var. *vaseyana*/*Festuca idahoensis*-*Koeleria cristata*

ARTRV/FEID-KOCR

SD2929

N = 17



Bull Run Rock, Prairie City RD, Malheur NF.

Distribution—

Central and southern Blue Mountains.

Environmental features—

This plant association was found on basalt, andesite, rhyolite, tuff and graywacke. Elevations of sample plots ranged from 4,200 to 5,980 ft (mean 4,995 ft). Slopes were gentle to moderate (mean 16 percent). Plots occurred on all aspects; mainly on summits, shoulders, and backslopes; and primarily on convex or straight surfaces. Soils consisted of a sandy loam or silt loam surface, with increasing gravel content with depth and bedrock at a depth of more than 22 in. Available water capacity was low to moderate and pH slightly acid to neutral.

	Mean	Range
Elevation (feet)	4,995	4,200–5,980
Slope (percent)	16	1–50
Soil pH (n = 6)		6.4–7.2
Soil available water capacity (inches, n = 6)		2–7 (low to moderate)
Depth to bedrock (inches, n = 14)		22–40+
Herbage (pounds/acre, n = 12)	667	275–1,621
Aspect (number of plots)	NW (3), NE (4), SE (4), SW (6)	
Lithology	Basalt, andesite, rhyolite, tuff, graywacke	
Position	Summit, backslope, shoulder, footslope	
Slope shape	Convex, concave, straight	

Ground surface features

	Phase					A + B range
	A1 (n = 3)	A2 (n = 6)	B (n = 3)	C (n = 2)	D (n = 3)	
	Cover (%)					
Bare ground	17	15	20	5	27	3–25
Bedrock	2	0	0	0	2	0
Rock	9	1	5	8	8	0–2
Gravel	0	1	13	2	0	0–5
Pavement	2	5	0	8	3	0–20
Mosses and lichens	4	4	2	0	4	0–11
Litter	36	74	56	73	66	

Vegetation composition—

The bunchgrasses—Idaho fescue, prairie junegrass, and bluebunch wheatgrass—dominated beneath the sagebrush. Frequently associated with them were Sandberg’s bluegrass and bottlebrush squirreltail. A diverse group of forbs occurred within the herbaceous layer. Prominent were yarrow, fleabanes, creamy buckwheat, tailcup lupine, and phlox. This is a highly productive community; herbage production averaged 667 lb/ac (the highest of all big sagebrush/bunchgrass plant associations), with one site producing over 1,600 lb/ac.

States and transitions—

Four phases were defined as follows:

- A1 Sagebrush cover <10 percent; fescue, junegrass, and wheatgrass total cover >35 percent.
- A2 Sagebrush cover >10 percent but <50 percent; fescue, junegrass, and wheatgrass total cover >35 percent; forb cover low to moderate.
- B Sagebrush cover >10 percent and <50 percent; fescue, junegrass, and wheatgrass total cover 20 to 35 percent; rich in forbs (lupines, paintbrushes, balsamroot).
- C Sagebrush cover dense (≥50 percent); fescue, junegrass, and wheatgrass total cover <20 percent.
- D Sagebrush cover low and Idaho fescue with little or no cover, but cover by junegrass and wheatgrass is fairly high (>30 percent).

Sagebrush density increases with lack of periodic fire and overgrazing. Phase A1 represents the community where fire has reduced the sagebrush cover and stimulated bunchgrasses. Phase A2 portrays a fairly dense stand of sagebrush where lack of fire has contributed to an increase in sagebrush but moderate grazing has not reduced the bunchgrass

Principal species—

Species	Code	Phase					A + B range
		A1 (n = 3)	A2 (n = 6)	B (n = 3)	C (n = 2)	D (n = 3)	
		<i>Cover (%) / constancy (%)</i>					<i>Cover (%)</i>
Shrubs:							
mountain big sagebrush	ARTRV	6/100	26/100	32/100	55/100	5/100	6–35
green rabbitbrush	CHVI8	1/100	1/67	1/33	1/50	1/67	0–2
gray horsebrush	TECA2	1/33	1/33	1/33	0	1/33	0–1
Grasses:							
bluebunch wheatgrass	AGSP	8/100	12/50	6/67	12/100	31/100	0–30
Idaho fescue	FEID	26/100	28/100	22/100	6/100	1/33	10–40
prairie junegrass	KOCR	14/100	8/100	11/100	10/100	10/100	1–20
Sandberg's bluegrass	POSA12	23/100	5/83	8/100	5/50	12/67	0–38
bottlebrush squirreltail	SIHY	1/100	9/33	1/33	1/50	2/100	0–10
needlegrasses	STIPA	1/33	2/17	0	5/50	0	0–2
Forbs:							
common yarrow	ACMIL	2/67	2/83	4/100	3/100	3/100	0–5
arrowleaf balsamroot	BASA3	0	2/17	12/67	1/100	1/33	0–15
paintbrushes	CASTI2	0	8/33	25/33	2/100	0	0–25
tapertip hawksbeard	CRAC2	1/33	1/17	1/67	1/50	0	0–1
fleabanes	ERIGE2	5/67	3/67	2/67	4/100	10/33	0–5
creamy buckwheat	ERHE2	2/100	2/100	1/67	13/100	2/100	0–5
tailcup lupine	LUCA	2/67	5/50	16/100	15/50	1/33	0–40
phloxes	PHLOX	4/67	2/67	1/33	0	0	0–6
western groundsel	SEIN2	1/33	10/17	1/67	1/50	0	0–10

cover. Phase B is forb rich from increased grazing pressures. Phase C portrays a more degraded condition where heavy grazing and fire exclusion have tipped the balance further in favor of sagebrush and have further reduced the fescue cover. Phase D is probably caused by grazing or severe fire that nearly eliminated fescue but not bluebunch wheatgrass.

Management considerations—

Mountain big sagebrush is damaged by fires of late summer when moisture is low in the soil. Cool burns when soils are moist allow some sagebrush to survive. Bunchgrasses

are stimulated by light and moderate burns. Severe burns in communities with dense sagebrush can do serious damage to Idaho fescue and allow colonization of the site by more disturbance-adapted species, such as western needlegrass. Needlegrasses are also promoted by overgrazing. Forbs that increase in these communities from disturbance are yarrow, paintbrushes, tailcup lupine, and creamy buckwheat.

Relationship to other studies—

This is the first description of ARTRV/FEID-KOCR as a plant association.

Mountain big sagebrush/Idaho fescue-bluebunch wheatgrass plant association

Artemisia tridentata var. *vaseyana*/*Festuca idahoensis*-*Agropyron spicatum*

ARTRV/FEID-AGSP

SD2911

N = 44



Marking Corrals Basin, Emigrant Creek RD, Malheur NF.

Ground surface features

	Phase							A + B range
	A1 (n = 11)	A2 (n = 1)	B (n = 12)	C1 (n = 3)	C2 (n = 13)	C3 (n = 2)	D (n = 2)	
	<i>Cover (%)</i>							
Bare ground	11	21	15	5	25	38	16	1–35
Bedrock	1	0	0	0	1	0	0	1–5
Rock	5	1	3	3	3	0	1	1–30
Gravel	8	37	8	8	10	34	26	1–40
Pavement	7	0	10	0	2	0	0	0–55
Mosses and lichens	1	2	1	2	1	0	0	0–5
Litter	53	19	50	53	30	5	58	

Vegetation composition—

Mountain big sagebrush forms an open shrubland with bunchgrasses dominating in the herbaceous layer. Green rabbitbrush is often associated. Idaho fescue is the most prominent bunchgrass. Usually present with it are bluebunch wheatgrass, prairie junegrass, and Sandberg’s bluegrass. Forbs associated with high frequency are yarrow, creamy buckwheat, hawksbeards, fleabanes, and lupines. Herbage production is similar to the ARTRV/FEID-KOCR plant association.

States and transitions—

Seven phases were defined as follows:

- A1 Sagebrush cover <20 percent; sum of fescue, wheatgrass, and junegrass cover >25 percent.
- A2 Sagebrush cover <5 percent; bunchgrass cover low (postburn).
- B Sagebrush cover 20 to 50 percent; sum of fescue, wheatgrass, and junegrass cover >25 percent.
- C1 Sagebrush cover dense (>50 percent).
- C2 Sagebrush cover moderately dense (10 to 50 percent); sum of fescue, wheatgrass, and junegrass cover <25 percent; high in forbs or bare ground.
- C3 Sagebrush cover <5 percent; sum of fescue, wheatgrass, and junegrass cover <10 percent; high percentage of bare ground and gravel (60 to 80 percent) after fire in a dense sagebrush stand.
- D Sagebrush cover low (<10 percent); needlegrass and creamy buckwheat dominant over the bunchgrasses (fifth year after a burn of dense sagebrush).

Sagebrush density increases with lack of periodic fire and overgrazing. Phase A1 represents the ARTRV/FEID-AGSP community where fire has periodically reduced sagebrush and favored bunchgrasses. Phase A2 portrays the first

Distribution—

Central and southern Blue Mountains; Ochoco Mountains.

Benchmark sites—

Duck Creek Exclosure (1950), Jake Green Exclosure (1963), and Skookum Spring Exclosure (1963)—all on Emigrant Creek RD, Malheur NF.

Environmental features—

This plant association was found on basalt, andesite, rhyolite, tuff, serpentine, and graywacke. Elevations of sample plots ranged from 4,520 to 7,650 ft (mean 5,615 ft). Slopes were gentle to steep (mean 19 percent). Plots occurred on all aspects (majority on southerly aspects); on summits, shoulders and backslopes; and on mostly convex surfaces. Soils consisted of a sandy loam or silt loam surface, with gravel content increasing with depth and extremely gravelly material at a depth of 12 to 40 in. Available water capacity was moderate and pH slightly acid to neutral.

	Mean	Range
Elevation (feet)	5,615	4,520–7,650
Slope (percent)	19	2–55
Soil pH (n = 8)		6.0–7.0
Soil available water capacity (inches, n = 8)		4–6.5 (moderate)
Depth to bedrock or extremely gravelly soil (inches, n = 20)		12–40
Herbage (pounds/acre, n = 16)	654	256–1,050
Aspect (number of plots)	NW (10), NE (6), SE (11), SW (17)	
Lithology	Basalt, rhyolite, tuff, andesite, serpentine, graywacke	
Position	Backslopes, shoulders, summits	
Slope shape	Mostly convex	

Principal species—

Species	Code	Phase							A + B range
		A1 (n = 11)	A2 (n = 1)	B (n = 12)	C1 (n = 3)	C2 (n = 13)	C3 (n = 2)	D (n = 2)	
		<i>Cover (%) / constancy (%)</i>							<i>Cover (%)</i>
Shrubs:									
mountain big sagebrush	ARTRV	7/100	1/100	29/100	63/100	25/100	0	6/100	1–50
gray rabbitbrush	CHNA2	0	0	1/25	0	3/31	0	1/50	0–1
green rabbitbrush	CHV18	1/82	0	3/67	3/33	12/69	10/50	0	0–15
bitterbrush	PUTR2	2/45	0	2/50	0	1/15	0	0	0–10
mountain snowberry	SYOR2	1/9	0	0	0	0	1/50	2/100	0–1
Grasses:									
bluebunch wheatgrass	AGSP	18/73	5/100	11/92	7/100	7/85	5/100	6/100	0–40
mountain brome	BRCA5	2/27	5/100	0	2/100	2/15	5/50	7/100	0–5
Idaho fescue	FEID	24/100	7/100	29/100	25/100	12/96	3/100	1/100	3–60
prairie junegrass	KOCR	2/73	4/100	2/58	1/67	3/46	0	0	0–5
Sandberg's bluegrass	POSA12	8/91	4/100	10/83	5/100	9/92	6/100	1/50	0–53
bottlebrush squirreltail	SIHY	1/64	0	2/33	1/33	3/38	2/100	0	0–5
western needlegrass	STOC2	1/27	1/100	3/8	0	6/15	3/50	15/100	0–3
Forbs:									
common yarrow	ACMIL	5/91	1/100	2/92	2/67	2/85	4/100	1/100	0–30
pale agoseris	AGGL	1/18	0	0	0	1/15	1/100	1/100	0–1
pussytoes	ANTEN	6/55	2/100	1/42	1/100	1/38	0	0	0–15
arrowleaf balsamroot	BASA3	3/9	0	6/33	35/33	5/23	1/50	2/100	0–20
paintbrushes	CASTI2	3/18	1/100	1/17	10/100	10/31	1/50	1/50	0–3
narrowleaf collomia	COLI2	3/27	2/100	1/17	1/67	1/8	2/50	1/100	0–5
hawksbeards	CREPI	1/91	2/100	1/58	1/33	1/69	1/100	1/100	0–5
fleabanes	ERIGE2	3/91	3/100	2/58	0	2/69	1/100	1/100	0–5
creamy buckwheat	ERHE2	8/100	5/100	4/83	15/100	8/85	3/100	16/100	0–15
wayside gromwell	LIRU4	0	0	1/25	1/33	1/38	1/100	2/100	0–1
lupines	LUPIN	7/64	10/100	13/50	10/100	18/69	8/100	2/100	0–20
wiry knotweed	POMA9	1/18	1/100	0	0	1/8	3/100	2/100	0–1
western groundsel	SEIN2	1/27	1/100	3/58	10/33	3/62	15/50	0	0–5

year after the fire in a phase A1. Phase B portrays a moderate stand of sagebrush where lack of fire and overgrazing have contributed to an increase in sagebrush and a decline in bunchgrasses. Phase C1 portrays the community where the lack of fire and overgrazing have contributed to a dominance by sagebrush over all other plants. In phase C2, overgrazing and trampling by livestock have reduced bunchgrasses and favored forbs and bare ground. Phase C3 portrays the post-burn community (first year after the burn of a C1 community). Phase D is the same community the fifth year following the burn, after several new plants have gained dominance.

Management considerations—

Mountain big sagebrush is damaged by fires of late summer when soil moisture is low. Cool burns when soils are moist allow some sagebrush to survive. Bunchgrasses are stimulated by light and moderate burns. Severe burns in communities with dense sagebrush can do serious damage to Idaho fescue and allow colonization of the site by

more disturbance-adapted species, such as western needlegrass. Sandberg's bluegrass and needlegrasses increase with overgrazing. Forbs that increase in these communities from disturbances are yarrow, paintbrushes, tailcup lupine, and creamy buckwheat.

Relationship to other studies—

Schlatterer (1972) described ARTRV/FEID and ARTRV/AGSP in south-central Idaho, Hopkins (1979b) classified a big sagebrush/bunchgrass plant association in south-central Oregon that is similar to this type, Mueggler and Stewart (1980) described ARTRV/FEID and ARTRV/AGSP habitat types in Montana, Hall (1973) incorporated ARTRV/FEID and ARTRV/AGSP in the ARTRV/bunchgrass plant community type in the Blue Mountains, Hironaka et al. (1983) described the ARTRV/FEID habitat type for southern Idaho, and Johnson and Simon (1987) classified ARTRV/FEID in northeast Oregon. Johnson and Clausnitzer (1992) described this plant association for the Blue and Ochoco Mountains.

Mountain big sagebrush/bluebunch wheatgrass-Sandberg's bluegrass plant community type

Artemisia tridentata var. *vaseyana*/*Agropyron spicatum*-*Poa sandbergii*

ARTRV/AGSP-POSA12

SD2918

N = 8



Capps Mountain, Emigrant Creek RD, Malheur NF.

Distribution—

Central and southern Blue Mountains; Ochoco Mountains.

Environmental features—

This plant community type was found on basalt, rhyolite, and tuff. Elevations of sample plots ranged from 2,730 to 5,290 ft (mean 4,564 ft). Slopes were gentle to steep (mean 17 percent). Plots mainly on southerly aspects; on summits, shoulders, and backslopes; and on mostly convex surfaces. Brief soil investigations (n = 4) suggest shallow soils, with bedrock or very gravelly material within 6 in of the surface.

	Mean	Range
Elevation (feet)	4,564	2,730–5,290
Slope (percent)	17	1–45
Herbage (pounds/acre; n = 2)	650	450–850
Aspect (number of plots)	NW (1), NE (1), SE (3), SW (3)	
Lithology	Basalt, rhyolite, tuff	
Position	Summit, shoulder, backslope, footslope	
Slope shape	Mostly convex	

Ground surface features—

	Phase	
	C1 (n = 1)	C2 (n = 7)
	Cover (%)	
Bare ground	20	25
Bedrock	0	0
Rock	0	10
Gravel	10	10
Pavement	0	4
Mosses and lichens	1	3
Litter	69	58

Vegetation composition—

Mountain big sagebrush forms an open shrubland with bunchgrasses dominating beneath in the herbaceous layer. Green and gray rabbitbrushes are often associated. Severely browsed, decadent bitterbrush was present on several plots, as were juniper seedlings. Bluebunch wheatgrass is the most prominent bunchgrass. Sandberg's bluegrass and bottlebrush squirreltail are associated. Forbs with high frequency are yarrow, creamy buckwheat, and hawksbeards. Idaho fescue is present only as an incidental species. Herbage production appears to be similar to the mountain big sagebrush/bunchgrass plant associations (mean 650 lb/ac; n = 2).

Principal species—

Species	Code	Phase	
		C1 (n = 1)	C2 (n = 7)
Cover (%) / constancy (%)			
Shrubs:			
mountain big sagebrush	ARTRV	65/100	16/100
gray rabbitbrush	CHNA2	0	2/71
green rabbitbrush	CHVI8	1/100	5/51
bitterbrush	PUTR2	0	2/71
Grasses:			
bluebunch wheatgrass	AGSP	20/100	17/100
cheatgrass	BRTE	0	9/43
Idaho fescue	FEID	0	2/57
prairie junegrass	KOCR	0	1/43
Sandberg's bluegrass	POSA12	10/100	6/86
bottlebrush squirreltail	SIHY	0	6/43
Forbs:			
common yarrow	ACMIL	1/100	1/43
hawksbeard	CREPI	1/100	1/43
creamy buckwheat	ERHE2	1/100	2/57

States and transitions—

Two phases were defined as follows:

- C1 Sagebrush cover dense (>50 percent).
- C2 Sagebrush cover less dense (<50 percent);
bluebunch wheatgrass cover <25 percent;
bare ground >20 percent.

Phase C1 portrays the community where overgrazing and lack of fire have contributed to a dominance by sagebrush over all other plants. In phase C2, overgrazing and trampling by ungulates have probably reduced grass cover and increased bare ground, but sagebrush has not expanded into the gaps. Droughty conditions on this type may hinder sagebrush expansion. The amount of wheatgrass cover that is possible under ideal conditions on this type is not yet known. It is possible that our phase C2 may represent a

combination of site limitations (droughty soil) and only moderate degradation by grazing.

Management considerations—

Mountain big sagebrush is damaged by fires of late summer when moisture is low in the soil. Cool burns when soils are moist allow some sagebrush to survive. Bunchgrasses are stimulated by light and moderate burns. With overgrazing, Sandberg's bluegrass and needlegrasses are promoted. Forbs that increase in these communities from disturbances are yarrow, tailcup lupine, and creamy buckwheat.

Relationship to other studies—

Schlatterer (1972) described ARTRV/AGSP in south-central Idaho, Hironaka et al. (1983) described an ARTRV/AGSP habitat type for southern Idaho, Mueggler and Stewart (1980) described an ARTRV/AGSP habitat type in Montana, and Hall (1973) incorporated ARTRV/AGSP in the ARTRV/bunchgrass plant community type in the Blue Mountains. This is the first description of the ARTRV/AGSP plant community type for the Blue and Ochoco Mountains.

Mountain big sagebrush-mountain snowberry/mountain brome plant community type

Artemisia tridentata var. *vaseyana*-*Symphoricarpos oreophilus*/*Bromus carinatus*

ARTRV-SYOR2/BRCA5

SD2917

N = 1

This plant community type was found in the northern Blue Mountains at 5,000 ft elevation on Columbia River basalts. It also occurs in the northern Wallowa Mountains (Johnson and Simon 1987). Mountain snowberry dominated mountain big snowberry. The herbaceous layer was composed of forbs that had increased owing to ungulate disturbance. Creamy

buckwheat, lanceleaf stonecrop, and woodrush pussytoes were the dominant forbs. The prominent grass was mountain brome. Bluebunch wheatgrass was relict. These communities are adjacent to Douglas-fir/mountain snowberry forest on canyon shoulders adjacent to Idaho fescue-bluebunch wheatgrass grasslands.

Mountain big sagebrush-mountain snowberry plant community type

Artemisia tridentata var. *vaseyana*-*Symphoricarpos oreophilus*

ARTRV-SYOR2

SD2919

N = 4

This plant community was found in the central and southern Blue Mountains and in the Ochoco Mountains, on granodiorite, rhyolite, volcanic sandstone, and chert. Elevations of sample plots ranged from 4,100 to 6,400 ft (mean 5,468 ft). Slopes were moderate to steep (mean 31 percent). Plots principally occurred on southerly aspects; on summits and back-slopes; and on convex, straight, and undulating surfaces.

Mountain big sagebrush and mountain snowberry codominate an open shrubland. Bunchgrasses occurring with high frequency are Idaho fescue, mountain brome, bluebunch wheatgrass, and Sandberg's bluegrass. Creamy buckwheat, western hawkweed, and Indian paintbrushes are always

found in the herbaceous layer. Other forbs frequently found are arrowleaf balsamroot, tailcup lupine, sticky cinquefoil, and Bolander's yampah.

Sagebrush density increases with lack of periodic fire and with overgrazing. Mountain big sagebrush is damaged by fires of late summer when moisture is low in the soil. Cool burns when soils are moist allow some sagebrush to survive. Mountain snowberry resprouts vigorously after moderate burns. Bunchgrasses are stimulated by light and moderate burns. With overgrazing, Kentucky bluegrass and bulbous bluegrass invade. Green rabbitbrush also increases following severe grazing in these communities.

Mountain big sagebrush/mountain brome plant community type

Artemisia tridentata var. *vaseyana*/*Bromus carinatus*

ARTRV/BRCA5

SS4914

N = 3

This plant community was found on basalts in the central and southern Blue Mountains, and in the Ochoco Mountains. Elevations of sample plots ranged from 5,090 to 6,800 ft (mean 6,130 ft). Slopes were moderate (mean 17 percent). Aspects were southwesterly. Soils were loamy to gravelly loamy material over bedrock at a depth of 1 to 2 ft and had low water-holding capacity.

Mountain big sagebrush cover averaged 42 percent. Common snowberry was usually associated. The bunchgrass associated on deep soils between the shrubs is mountain brome. Tailcup lupine, western hawkweed, and creamy buckwheat are often associated with the brome. Western needlegrass can increase with ungulate disturbance.

Hironaka et al. (1983) described an ARTRV/BRCA5 habitat type occurring between 7,000 and 9,500 ft elevation in southern Idaho.

Mountain big sagebrush-squaw apple plant community type

Artemisia tridentata var. *vaseyana*/*Peraphyllum ramosissimum*

ARTRV-PERA4

SD3010

N = 1

Squaw apple occurs in plant associations with ponderosa pine in the central Blue Mountains (Johnson and Clausnitzer 1992) and with mountain snowberry in the southern Wallowa Mountains (Johnson and Simon 1987). The sagebrush-squaw apple plant communities occur on the northern edge of the Great Basin at the southern extreme of the Blue Mountains. This plot is on Moffit Table at

4,500 ft elevation on Drinkwater basalt. Here mountain big sagebrush was codominant with squaw apple at 20 percent cover each. Bitterbrush was also well represented (10 percent cover). Bunchgrasses were nicely represented by Idaho fescue, bluebunch wheatgrass, bottlebrush squirreltail, and Sandberg's bluegrass. Spurred lupine was the most prominent forb.

Mountain big sagebrush/giant wildrye plant community type

Artemisia tridentata var. *vaseyana*/*Elymus cinereus*

ARTRV/ELCI2

SD3011

N = 1

This plant community was found on welded tuffs in the southern Blue Mountains. Mountain big sagebrush formed an open shrubland with giant wildrye, bluebunch wheatgrass, and Sandberg's bluegrass. With severe overgrazing, these

communities become weedy, with cheatgrass and western needlegrass increasing. Bluebunch wheatgrass and wildrye will both decline with overuse of these sites.

Low sagebrush/Idaho fescue-bluebunch wheatgrass plant association

Artemisia arbuscula/Idaho fescue-Agropyron spicatum

ARAR8/FEID-AGSP

SD1911

N = 21



Shake Table, Blue Mountain RD, Malheur NF.

Distribution—

Central and southern Blue Mountains; Ochoco Mountains.

Benchmark site—

Shaketable (proposed research natural area), Blue Mountain Ranger District, Malheur NF.

Environmental features—

This plant association was found on basalt, andesite, rhyolite, and volcanic tuff. Elevations of sample plots ranged from 4,060 to 6,900 ft (mean 5,124 ft). Slopes were gentle (mean 5 percent). Plots occurred primarily on southerly slopes on mostly flat surfaces on summits, shoulders, and backslopes. Soils consisted of a loamy surface layer, sometimes gravelly to very gravelly, over a very to extremely gravelly clay loamy subsoil, with bedrock at 8 to 24 in. Soils are prone to perching (pooling) of excess water over the clayey subsoil in the spring, followed by depletion of soil water during the summer drought.

	Mean	Range
Elevation (feet)	5,124	4,060–6,900
Slope (percent)	5	1–15 (40)
Soil pH (n = 9)		6.2–7.6
Soil available water capacity (inches, n = 7)		1.5–4 (very low to low)
Depth to bedrock (inches, n = 16)		8–24
Herbage (pounds/acre, n = 18)	502	100–1,380
Aspect (number of plots)	NW (5), NE (5), SE (4), SW (7)	
Lithology	Basalt, andesite, rhyolite, tuff	
Position	Summit, shoulder, backslope	
Slope shape	Mostly flat, convex	

Ground surface features—

	Phase					A + B range
	A (n = 5)	B (n = 7)	C (n = 5)	D1 (n = 3)	D2 (n = 1)	
	Cover (%)					
Bare ground	9	17	35	3	1	0–25
Bedrock	5	1	1	0	0	0–20
Rock	14	4	14	23	15	0–35
Gravel	0	2	3	7	0	0–5
Pavement	9	6	4	17	0	0–25
Mosses and lichens	3	1	0	2	2	0–10
Litter	55	43	23	25	80	

Vegetation composition—

Low sagebrush shrubs occur with herbaceous vegetation dominated by bunchgrasses. Idaho fescue and Sandberg's bluegrass are always present. Other prominent grasses are bluebunch wheatgrass, prairie junegrass, and bottlebrush squirreltail. Onespike oatgrass may occur as inclusions on thinner soils within the site. Bitterbrush frequently occurs as an incidental species (<5 percent cover). Common forbs found are phlox, fleabanes, yarrow, pussytoes, and serrate balsamroot.

States and transitions—

Five phases were defined as follows:

- A Idaho fescue and bluebunch wheatgrass cover total >35 percent.
- B Idaho fescue and bluebunch wheatgrass cover total 25 to 35 percent; bare ground cover <30 percent.
- C Idaho fescue and bluebunch wheatgrass cover total <25 percent or bare ground cover >30 percent.
- D1 Idaho fescue and bluebunch wheatgrass cover total ≤5 percent; few annuals.
- D2 Idaho fescue relict or absent; the annual grass *Ventenata dubia* dominates.

With overgrazing, phase A will shift toward phase B with diminished cover by Idaho fescue and bluebunch wheatgrass. As degradation of the bunchgrass community continues, phase C is reached where a high percentage of ground surface is nonvegetated. Phase D is attained when overgrazing reduces the deep-rooted bunchgrasses to a stage where restoration of Idaho fescue or bluebunch wheatgrass cannot result without intervention by managers. Idaho fescue is relict or absent in phase D2 and annuals dominate.

Management considerations—

Fires are uncommon in ARAR8/FEID-AGSP communities because of low fuel levels. Low sagebrush plants are killed or severely damaged by fire, and the plant will not

Principal species—

Species	Code	Phase					A + B range
		A (n = 5)	B (n = 7)	C (n = 5)	D1 (n = 3)	D2 (n = 1)	
		<i>Cover (%) / constancy (%)</i>					<i>Cover (%)</i>
Shrubs:							
low sagebrush	ARAR8	21/100	29/100	30/100	23/100	40/100	11–50
bitterbrush	PUTR2	4/60	2/57	2/60	0	5/100	0–7
Grasses:							
bluebunch wheatgrass	AGSP	16/80	13/43	3/80	1/67	5/100	0–25
onespike oatgrass	DAUN	5/20	1/29	1/40	6/67	0	0–5
Idaho fescue	FEID	28/100	24/100	15/100	3/100	1/100	8–40
prairie junegrass	KOCR	1/60	1/43	2/60	1/33	1/100	0–2
Sandberg's bluegrass	POSA12	11/100	14/100	8/100	14/100	1/100	5–30
bottlebrush squirreltail	SIHY	1/40	2/57	4/80	1/33	0	0–1
Forbs:							
common yarrow	ACMIL	1/60	2/71	1/60	1/67	1/100	0–3
narrowleaf pussytoes	ANST2	1/20	7/14	1/40	1/33	1/100	0–7
sandworts	ARENA	1/40	4/43	1/20	1/33	0	0–10
serrate balsamroot	BASE2	2/40	1/43	1/40	1/67	0	0–2
hawksbeards	CREPI	1/40	2/14	1/20	1/33	0	0–2
fleabanes	ERIGE2	3/60	1/43	2/20	0	0	0–3
woolly goldenweed	HALA3	1/20	1/43	2/40	1/33	0	0–1
lupines	LUPIN	1/40	2/29	10/20	0	0	0–2
microseris	MICRO6	2/40	2/29	1/40	1/33	0	0–3
phloxes	PHLOX	6/80	5/43	5/80	2/67	1/100	0–10

sprout from the roots or stem base. Late summer and early fall burns may damage fescue when soils are dry. Burning at this time of the year promotes bluebunch wheatgrass and annuals. These communities are key habitats for sage grouse. Low sagebrush provides important browse for mule deer and pronghorns in spring and fall.

Relationship to other studies—

Hall (1973) described ARAR8/FEID-AGSP as a low sagebrush/bunchgrass plant community type in the Blue and Ochoco Mountains. Volland (1976) described a low sagebrush/Idaho fescue plant community type for the

national forests of central and south-central Oregon; Hopkins (1979a) described a low sagebrush/Idaho fescue-bottlebrush squirreltail plant community type for the Winema NF in south-central Oregon. In Montana, Mueggler and Stewart (1980) described ARAR8/FEID and ARAR8/AGSP habitat types. Hironaka et al. (1983) classified ARAR8/FEID as a habitat type in western Idaho. Johnson and Clausnitzer (1992) described the ARAR8/FEID-AGSP plant association for the Blue and Ochoco Mountains.

Low sagebrush/bluebunch wheatgrass plant association

Artemisia arbuscula/Agropyron spicatum

ARAR8/AGSP

SD1924

N = 8



Fred Hall

Near Bald Butte, Emigrant Creek RD, Malheur NF.

Distribution—

Ochoco Mountains.

Environmental features—

This plant association was found on basalt and andesite. Elevations of sample plots ranged from 4,550 to 5,200 ft (mean 4,906 ft). Slopes were gentle (mean 7 percent). Plots occurred primarily on southwesterly slopes on mostly flat surfaces on summits, shoulders, backslopes, and footslopes. Soils consisted of a loamy surface layer, sometimes gravelly to very gravelly, over an extremely gravelly clay loamy subsoil, with bedrock at 8 to 18 in. Soils are prone to perching of excess water over the clayey subsoil in the spring, followed by depletion of soil water during the summer drought.

	Mean	Range
Elevation (feet)	4,906	4,550–5,200
Slope (percent)	7	2–12
Soil pH (n = 8)		6.3–7.0
Soil available water capacity (inches, n = 8)		1–2.5 (very low to low)
Depth to bedrock (inches, n = 8)		8–18
Herbage (pounds/acre, n = 8)	423	330–520
Aspect (number of plots)	NW (0), NE (1), SE (0), SW (7)	
Lithology	Basalt, andesite	
Position	Summit, shoulder, backslope, footslope	
Slope shape	Convex, flat	

Ground surface features—

	Phase			A + B range
	A (n = 3)	B (n = 3)	C (n = 2)	
	Cover (%)			
Bare ground	13	16	25	9–24
Bedrock	2	15	9	2–16
Rock	12	9	21	4–19
Gravel	0	0	0	0
Pavement	9	4	6	3–12
Mosses and lichens	6	7	14	0–11
Litter	58	49	25	

Vegetation composition—

Low sagebrush shrubs occur with herbaceous vegetation dominated by bunchgrasses. Bluebunch wheatgrass and Sandberg's bluegrass are always present. Idaho fescue is absent or incidental at low cover (<5 percent). Other common grasses are prairie junegrass, and bottlebrush squirreltail. Onespike oatgrass may occur as inclusions on thinner soils within the site. Bitterbrush frequently occurs as an incidental species (<5 percent cover). Forbs commonly found are yarrow, tapertip onion, low pussytoes, sulfur-flower buckwheat, bighead clover, and lomatiums.

States and transitions—

Three phases were defined as follows:

- A Bluebunch wheatgrass cover >30 percent.
- B Bluebunch wheatgrass cover 15 to 30 percent; bare ground usually <20 percent.
- C Bluebunch wheatgrass cover <15 percent; bare ground usually >20 percent.

With overgrazing, phase A will shift toward phase B with diminished cover by wheatgrass. As degradation continues, wheatgrass declines toward 5 percent cover with an increase in bare ground (phase C).

Management considerations—

Fires are uncommon in ARAR8/FEID-AGSP communities because of low fuel levels. Low sagebrush plants are killed or severely damaged by fire, and the plant will not sprout from the roots or stem base. These communities are key habitats for sage grouse. Low sagebrush provides important browse for mule deer and pronghorns in spring and fall.

Principal species—

Species	Code	Phase			A + B range
		A (n = 3)	B (n = 3)	C (n = 2)	
		Cover (%)/constancy (%)			Cover (%)
Shrubs:					
low sagebrush	ARAR8	20/100	23/100	18/100	5–29
bitterbrush	PUTR2	2/67	3/100	5/50	0–4
Grasses:					
bluebunch wheatgrass	AGSP	32/100	20/100	7/100	19–33
onespike oatgrass	DAUN	0	1/67	2/100	0–1
Idaho fescue	FEID	2/33	3/33	2/50	0–3
prairie junegrass	KOCR	1/100	1/67	0	0–1
Sandberg's bluegrass	POSA12	9/100	7/100	6/100	5–12
bottlebrush squirreltail	SIHY	1/33	1/100	2/100	0–2
Forbs:					
common yarrow	ACMIL	3/100	1/67	1/50	0–4
pale agoseris	AGGL	2/33	1/33	2/50	0–2
tapertip onion	ALAC4	2/67	1/100	2/50	0–2
low pussytoes	ANDI2	2/67	2/67	1/50	0–3
scabland fleabane	ERBL	1/33	1/33	1/50	0–1
Sulfur-flower buckwheat	ERUM	1/67	1/33	1/50	0–1
lomatium	LOMAT	4/100	1/33	4/100	0–7
false agoseris	MITR5	1/33	2/67	2/50	0–2
phlox	PHLOX	0	2/100	4/50	0–3
Douglas' campion	SIDO	1/67	1/33	1/50	0–1
bighead clover	TRMA3	2/67	2/67	1/50	0–4

Relationship to other studies—

In Montana, Mueggler and Stewart (1980) described an ARAR8/AGSP habitat type. Hironaka et al. (1983) described an ARAR8/AGSP habitat type in western Idaho. This is the first description of ARAR8/AGSP for the Ochoco Mountains.

Low sagebrush/Sandberg's bluegrass plant association

Artemisia arbuscula/Poa sandbergii

ARAR8/POSA12

SD9221

N = 4



Fred Hall

Aldrich Mountain, Blue Mountain RD, Malheur NF.

Distribution—

Southern Blue and Ochoco Mountains.

Environmental features—

This plant association was found on basalt and andesite. Elevations of sample plots ranged from 4,520 to 6,950 ft (mean 5,455 ft). Slopes were gentle (mean 4 percent). Plots occurred primarily on southwesterly slopes on mostly flat surfaces on summits and shoulders. Brief soil investigations (n = 3) indicate shallow soils, with bedrock at a depth of about 10 in.

	Mean	Range
Elevation (feet)	5,455	4,520–6,950
Slope (percent)	4	1–8
Herbage (pounds/acre, n = 3)	158	100–250
Aspect (number of plots)	NW (0), NE (0), SE (1), SW (3)	
Lithology	Basalt, andesite	
Position	Summit, shoulder	
Slope shape	Flat, convex	

Ground surface features—

	Phase		A + B range
	A + B (n = 3)	D (n = 1)	
	Cover (%)		
Bare ground	13	30	5–20
Bedrock	2	0	0–3
Rock	50	30	30–60
Gravel	0	0	0
Pavement	15	25	0–40
Mosses and lichens	8	2	5–15
Litter	12	10	

Vegetation composition—

Low sagebrush/Sandberg's bluegrass shrublands are rocky sites with herbaceous vegetation in low cover. Bluebunch wheatgrass and Idaho fescue may be present with incidental cover (<5 percent). Sandberg's bluegrass is always present as the dominant herbaceous plant. Other grasses commonly found are bottlebrush squirreltail and onespoke oatgrass. Forbs of common occurrence are dwarf yellow fleabane, bighead clover, and sandworts.

States and transitions—

Two phases were defined as follows:

- AB Sandberg's bluegrass cover >5 percent;
bare ground <25 percent.
- D Sandberg's bluegrass cover <5 percent;
bare ground >25 percent.

With overgrazing of phase AB, Sandberg's bluegrass declines and is replaced by forbs and bare ground. As degradation continues (phase D), Sandberg's bluegrass cover declines to negligible levels such that its regeneration would be difficult, and increase in bare ground leaves the soil vulnerable to erosion.

Principal species—

Species	Code	Phase		A + B range
		A + B (n = 3)	D (n = 1)	
		Cover (%) / constancy (%)		
Shrubs:				
low sagebrush	ARAR8	12/100	3/100	5–20
Grasses:				
bluebunch wheatgrass	AGSP	2/33	1/100	0–2
onespike oatgrass	DAUN	1/33	1/100	0–1
Idaho fescue	FEID	2/67	0	0–3
Sandberg's bluegrass	POSA12	10/100	1/100	6–15
bottlebrush squirreltail	SIHYH	5/67	3/100	0–8
Forbs:				
sandworts	ARENA	2/67	1/100	0–4
dwarf yellow fleabane	ERCH4	2/67	3/100	0–3
phlox	PHLOX	2/67	1/100	0–2
bighead clover	TRMA3	2/67	0	0–2

Management considerations—

Fires rarely impact ARAR8/POSA12 communities because of the rocky site with scattered plant cover. These sites are affected most in spring when soils are saturated from snowmelt and bluegrass is heavily used by wild ungulates. Elk are key users of these sites when early spring provides only bluegrass for available forage. These communities are key habitats for sage grouse. Low sagebrush provides important browse for mule deer and pronghorns in spring and fall.

Relationship to other studies—

Hopkins (1979a) described a low sagebrush/Sandberg's bluegrass-onespike oatgrass plant community type on the Fremont NF in south-central Oregon that is essentially the same as this plant association. Hironaka et al. (1983) described ARAR8/POSA12 as a habitat type found in southern Idaho. This is the first description of ARAR8/POSA12 for the Blue and Ochoco Mountains.

Stiff sagebrush/Sandberg's bluegrass plant association

Artemisia rigida/Poa sandbergii

ARRI2/POSA12

SD9111

N = 30



Rocky Flat, Heppner RD, Umatilla NF.

plots ranged from 4,000 to 5,550 ft (mean 4,729 ft). Slopes were gentle (mean 6 percent). Plots occurred on all aspects (primarily on southerly slopes) and mostly on flat surfaces of summits and shoulders. Soils consisted of a loamy surface layer a few in thick or absent, over gravelly to extremely clay loam, underlain by bedrock within 10 in of the surface. The water-holding capacity of these soils is very low.

	Mean	Range
Elevation (feet)	4,729	4,000–5,550
Slope (percent)	6	0–30
Soil pH (n = 21)		6.0–6.8
Soil available water capacity (inches, n = 19)		0.5–1.5 (very low)
Depth to bedrock (inches, n = 25)		3–9
Herbage (pounds/acre, n = 25)	176	80–303
Aspect (number of plots)	NW (4), NE (2), SE (15), SW (9)	
Lithology	Basalt, andesite, tuff, rhyolite	
Position	Summit, shoulder, backslope	
Slope shape	Flat, convex	

Ground surface features—

	Phase			A + B range
	A (n = 10)	B (n = 15)	C (n = 5)	
	Cover (%)			
Bare ground	12	19	39	0–33
Bedrock	16	5	7	0–45
Rock	22	23	20	8–50
Gravel	2	7	2	0–25
Pavement	8	16	8	0–45
Mosses and lichens	7	9	8	0–20
Litter	10	9	1	

Distribution—

Northern, central, and southern Blue Mountains; Ochoco Mountains.

Environmental features—

This plant association was found primarily on basalt and andesite, but also on tuff and rhyolite. Elevations of sample

Vegetation composition—

Stiff sagebrush/Sandberg's bluegrass shrublands occur on rocky sites where sagebrush is scattered over herbaceous vegetation at low cover levels. Sandberg's bluegrass is always present as the dominant herbaceous plant. Bluebunch wheatgrass, bottlebrush squirreltail, and onespoke oatgrass are commonly found growing with the bluegrass. Idaho fescue may be present at incidental cover (<5 percent). Forbs of common occurrence are tapertip onion, yarrow, low pussytoes, false agoseris, lanceleaf stonecrop, bighead clover, phloxes, and lomatiums. Herbage productivity is lowest of any shrubland type (mean 176 lb/ac).

Principal species—

Species	Code	Phase			A + B range
		A (n = 10)	B (n = 15)	C (n = 5)	
		Cover (%)/constancy (%)			Cover (%)
Shrubs:					
stiff sagebrush	ARRI2	16/100	15/100	20/100	4–25
low sagebrush	ARAR8	2/20	1/13	3/20	0–4
Grasses:					
bluebunch wheatgrass	AGSP	5/40	2/33	0	0–8
onespoke oatgrass	DAUN	5/50	3/73	6/60	0–10
Idaho fescue	FEID	3/30	1/33	1/20	0–4
Sandberg's bluegrass	POSA12	20/100	12/100	14/100	3–30
dwarf squirreltail	SIHYH	1/60	2/73	3/80	0–7
needlegrasses	STIPA	0	1/20	2/60	0–1
Forbs:					
common yarrow	ACMIL	1/30	1/33	2/40	0–1
tapertip onion	ALAC4	2/40	2/33	8/40	0–3
Tolm's onion	ALTO	1/10	3/27	3/40	0–6
low pussytoes	ANDI2	2/50	2/40	3/20	0–3
narrowleaf pussytoes	ANST2	1/20	0	6/40	0–1
serrate balsamroot	BASE2	4/20	2/13	2/40	0–7
Indian paintbrushes	CASTI2	2/30	2/20	1/40	0–3
fleabanes	ERIGE2	1/10	1/40	3/20	0–1
lomatiums	LOMAT	3/70	4/87	4/60	0–19
false agoseris	MITR5	2/80	2/60	1/80	0–3
phloxes	PHLOX	6/40	2/33	1/20	0–20
lanceleaf stonecrop	SELA	3/50	4/40	8/40	0–7
bighead clover	TRMA3	7/90	8/53	9/40	0–20

States and transitions—

Three phases were defined as follows:

- A Sum of cover of bunchgrasses, mosses, and lichens, minus bare ground, is >10 percent.
- B Sum of cover of bunchgrasses, mosses, and lichens, minus bare ground, is between 0 and 10 percent.
- C Sum of cover of bunchgrasses, mosses, and lichens, minus bare ground, is <0 percent.

With overgrazing, bunchgrasses decline and soil cryptogamic crusts are destroyed, exposing bare soil. If the process progresses far enough, there will be less herbaceous vegetative cover than exposed bare soil (phase C).

Management considerations—

Fires are infrequent and light in ARRI2/POSA12 communities owing to the rocky site with scattered plant cover. Deer and elk are key users of these sites in early spring when only bluegrass is available as green forage. Adverse impacts may occur at this time because soils are saturated from snowmelt: ungulate traffic results in trampling damage to the herbaceous plants and soils. Sagebrush is frequently hedged from winter use by mule deer. These communities are key habitats for sage grouse. When stiff sagebrush invades deeper soil sites, fire can be employed to eradicate it.

Relationship to other studies—

Stiff sagebrush/Sandberg's bluegrass has been described by many ecologists. Daubenmire (1942, 1970) was first to classify and describe an ARRI2/POSA12 habitat type in eastern Washington. Others that followed were Hall (1973) in the Blue Mountains, Hironaka et al. (1983) in central Idaho, Tisdale (1986) in the Snake River Canyon of central Idaho, Johnson and Simon (1987) in the Wallowa Mountains and canyons of northeastern Oregon, and Johnson and Clausnitzer (1992) in the Blue and Ochoco Mountains.

Stiff sagebrush/Gairdner's penstemon plant community type

Artemisia rigida/*Penstemon gairdneri*

ARRI2/PEGA

SD9141

N = 2

These communities occur on basalt rock in the southern Blue Mountains at elevations ranging from 5,400 to 5,900 ft elevation. Soils are very shallow, with bedrock just a few inches below the surface. Stiff sagebrush cover ranged from 15 to 20 percent over a flat landscape where rock cover

ranged from 50 to 80 percent. Bunchgrasses were scant with no cover greater than 5 percent. Sandberg's bluegrass and bottlebrush squirreltail were present. Gairdner's penstemon was the herbaceous plant with highest cover (mean 4 percent). Other forbs present were onions, scabland fleabane, sulfur-flower buckwheat, and Hood's phlox.

Threetip sagebrush/Sandberg's bluegrass-onespike oatgrass plant community type

Artemisia tripartita/*Poa sandbergii*-*Danthonia unispicata*

ARTR4/POSA12-DAUN

SD2401

N = 1

This community occurs on Miller Flat in the southern Blue Mountains. It is on andesite at 5,170 ft elevation. Rock and gravel dominated the ground surface (65 percent cover), with threetip sagebrush the most dominant plant (20 percent cover). Two shallow-rooted bunchgrasses, Sandberg's blue-

grass and onespike oatgrass, were the dominant herbaceous plants with a cover of 10 percent each. The only forbs with cover over 5 percent were lomatiums (*L. nudicaule* and *L. macrocarpum*). Sagebrush branches had been browsed by mule deer.

Mountain snowberry mounds plant community type

Symphoricarpus oreophilus

SYOR2

SM32

N = 1

This plant community type occurs in the northern Wallowa Mountains (Johnson and Simon 1987). It was found in the northern Blue Mountains at 4,800 ft elevation on mounds overlying Columbia River basalts. Mountain snowberry dominated over an herbaceous layer composed of forbs that had increased owing to ungulate disturbance. Creamy buckwheat formed large mats and sticky cinquefoil, slender

cinquefoil, foothill daisy, and lupine were present with a "weedy" appearance. Bunchgrasses were relict. Present at low cover were mountain brome and prairie junegrass. Kentucky bluegrass had invaded. These communities are adjacent to Douglas-fir forest and intermediate to mounded/scabland sites where Idaho fescue-prairie junegrass and stiff sagebrush/Sandberg's bluegrass occur.

Creeping Oregon grape/bluebunch wheatgrass-spreading dogbane plant community type

Berberis repens/*Agropyron spicatum*-*Apocynum androsaemifolium*

BERE/AGSP-APAN2

GB4915

N = 1

This community was found on a steep (65 percent), southwest-facing slope in the southern Blue Mountains. Calcareous argillite gravels dominated the site. Plants were sparse with only those deep-rooted species capable of anchoring in a shifting talus slope. Spreading dogbane is well adapted

with rhizomatous roots for shifting gravel slopes. Creeping Oregon grape stabilizes the slope. Bluebunch wheatgrass was able to sink deep roots and to establish on the xeric, hot site. The most common forb was broom buckwheat—a shifting slope dweller of reknown.

Grassland Series

Green Fescue Communities (FEVI-LULA3, FEVI-JUPA, FEVI-PENST)

Green fescue (*Festuca viridula*) is the dominant subalpine fescue in the Willowa Mountains of northeastern Oregon. It has been found in very few isolated locations in the northern Blue Mountains. The description of the plant associations and plant community types to which they pertain can be found in *Alpine and Subalpine Vegetation of the Willowa, Seven Devils and Blue Mountains* (Johnson 2004). The green fescue communities known to occur in the Blue Mountains are:

Green fescue-spurred lupine plant association

Festuca viridula/Lupinus laxiflorus

FEVI-LULA3 GS1112

Location—

Yellowjacket Point, northern Blue Mountains, Walla Walla RD, Umatilla NF.

Green fescue-Parry's rush plant association

Festuca viridula/Juncus parryi

FEVI-JUPA GS1113

Location—

South of Bone Spring Lookout, Walla Walla RD, Umatilla NF.

Green fescue-penstemon plant community type

Festuca viridula/Penstemon spp.

FEVI-PENST GS1115

Location—

Oregon Butte, Pomeroy RD, Umatilla NF.

Idaho Fescue Types

Idaho fescue (*Festuca idahoensis*) occurs at elevations exceeding 6,000 ft in the Blue and Ochoco Mountains. Two plant associations and four plant community types are described below for these subalpine Idaho fescue-dominated plant communities.

Idaho fescue-red avens plant community type

Festuca idahoensis-Geum triflorum

FEID-GETR GB5923 N = 4

The sampled sites represent ridgetop locations high in elevation (mean 7,633 ft) where bluebunch wheatgrass and prairie junegrass are unable to persist. Sites were in the

Willowa Mountains on basaltic substrates on gentle to moderate slopes (mean 18 percent), in the Elkhorn Mountains on argillites, and at Dixie Butte on andesites. No sedges occurred. Only forbs were associated with fescue. Lupines, penstemon, and yarrow represented species that tended to increase with ungulate disturbance. Red avens and western groundsel were prominent associates. On depressions and thinner soil microsites, pussytoes, scabland fleabane, and buckwheat were found. Mosses were abundant. Erosion pavement was always present at 5 to 10 percent. The FEID-GETR plant community type has not been previously described.

Environmental features—

	Mean	Range
Elevation (feet)	7,633	6,620–8,080
Slope (percent)	23	15–20
Aspect (number of plots)	NW (2), NE (0), SE (0), SW (2)	
Lithology	Basalt	
Position	Ridgetop	
Slope shape	Convex	

Ground surface features—

	Mean	Range
	Percent	
Bare ground	7	0–15
Rock	7	5–10
Gravel	2	0–5
Pavement	9	5–10
Moss	11	5–18
Lichen	1	0–1
Litter	5	0–15

Principal species—

Species	Code	Cover/constancy	Range of cover
		Percent	
Grasses:			
Idaho fescue	FEID	44/100	40–50
Forbs:			
lupine	LUPIN	11/75	0–30
western groundsel	SEIN2	5/50	0–10
red avens	GETR	18/100	10–30
common yarrow	ACMIL	8/100	5–20
penstemon	PENST	2/50	0–5
golden buckwheat	ERFL4	1/50	0–1
pussytoes	ANTEN	7/100	1–1
scabland fleabane	ERBL	2/75	0–4
woolly goldenweed	HALA3	1/50	0–1
phlox	PHLOX	4/25	0–15
creamy buckwheat	ERHE2	3/25	0–10

Idaho fescue-bluebunch wheatgrass-Cymopterus plant association

Festuca idahoensis-*Agropyron spicatum*-*Cymopterus terebinthinus foeniculaceus*

FEID-AGSP-CYTEF

GB5925

N = 7



Fields Peak, Blue Mountain RD, Malheur NF.

Distribution—

Sampled sites were in the Aldrich Mountains (southern Blue Mountains) and Wallowa Mountains (outside of the study area).

Environmental features—

The type was found from 6,040 to 8,100 ft elevation (mean 6,963 ft) on moderate to steep slopes (mean 36 percent). All sampled sites were on southwest-facing slopes where solar radiation and warmth were greatest. Sites were located on ridgetops and upper midslope positions on convex to flat surfaces. This type occurred on a broad range of substrates—basalts, dacite, sandstone, and serpentine. The two soils studied were droughty and formed in coarse-grained colluvium over bedrock. Very to extremely gravelly sandy loam was over bedrock at 21 and 39 in, in the two profiles. Available water capacity was very low (1.5 to 2 in), and pH was 6.5 to 7.5.

	Mean	Range
Elevation (feet)	6,963	6,040–8,100
Slope (percent)	36	15–58
Herbage (pounds/acre, n = 1)	3,330	
Aspect (number of plots)	NW (0), NE (0), SE (0), SW (7)	
Lithology	Basalt, sandstone, serpentine, dacite	
Position	Ridgetop; upper and mid slopes	
Slope shape	Convex, flat	

Ground surface features—

	Mean	Range
	Percent	
Bare ground	2	0–10
Rock	5	0–10
Gravel	20	0–55
Moss	8	0–25
Lichen	1	0–1
Litter	22	1–55

Vegetation composition—

Idaho fescue and bluebunch wheatgrass codominate subalpine gravelly sites with turpentine cymopterus. In addition to the two principal bunchgrasses, Sandberg's bluegrass was often present.

The perennial forbs associated with cymopterus were relatively few on these dry, warm sites. Only yarrow and sulfur penstemon were regular community members. Two dry, gravelly site plants (woolly eriophyllum and scabland fleabane) were also found in these communities. Rock and gravel averaged 25 percent of the surface cover.

Principal species—

Species	Code	Cover/constancy	Range of cover
		Percent	
Grasses:			
Idaho fescue	FEID	15/100	3–35
bluebunch wheatgrass	AGSP	16/100	5–25
Sandberg's bluegrass	POSA12	3/57	0–15
Forbs:			
turpentine cymopterus	CYTEF	11/100	1–30
common yarrow	ACMIL	5/100	1–20
yellow salsify	TRDU	1/43	0–1
red avens	GETR	1/43	0–5
scabland fleabane	ERBL	1/43	0–1
sulfur penstemon	PEAT3	5/71	0–15
woolly eriophyllum	ERLA6	4/43	0–20
pussytoes	ANTEN	5/28	0–25

Management considerations—

On steep colluvial slopes, the cymopterus competes well with bunchgrasses by sending the taproot deep into the colluvium to reach available ground water.

Relationship to other studies—

The FED1-AGSP-CYTEF plant association was first described in Johnson (2004).

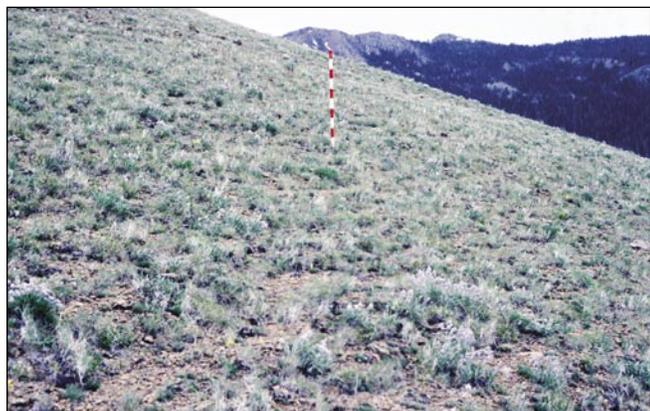
Idaho fescue-bluebunch wheatgrass-Cusick's frasera plant association

Festuca idahoensis-*Agropyron spicatum*-*Frasera albicaulis* var. *cusickii*

FEID-AGSP-FRALC2

GB5926

N = 5



Baldy Mountain, Prairie City RD, Malheur NF.

Distribution—

Strawberry Mountains on serpentine substrates.

Environmental features—

This plant association was found on peridotite, gabbro, and serpentine substrates on the north flank of the Strawberry Mountains. Elevational range was 6,360 to 7,420 ft (mean 7,004 ft). Slopes were gentle to moderately steep (mean 16 percent). Sampled sites were predominantly on northerly aspects. All surfaces were encountered (convex, concave, flat, and undulating). Sample sites were on ridgetops and at upper slope positions.

	Mean	Range
Elevation (feet)	7,004	6,360–7,420
Slope (percent)	16	10–28
Herbage (pounds/acre, n = 1)	2,140	
Aspect (number of plots)	NW (3), NE (1), SE (1), SW (0)	
Lithology	Peridotite, gabbro, serpentine	
Position	Ridgetop, upper third of slope	
Slope shape	Convex, flat, concave, undulating	

Ground surface features—

	Mean	Range
Percent		
Bare ground	3	1–10
Rock	6	0–30
Gravel	44	0–55
Moss	4	0–20
Lichen	5	0–5
Litter	8	0–20

Vegetation composition—

Bunchgrass cover was low owing to the low calcium and high metallic levels of the ultramafic rocks. Idaho fescue and bluebunch wheatgrass were the dominant species on these sites. Onespoke oatgrass was usually present as well. The forbs associated included plants often found on ultramafic sites (e.g., cockscomb cryptantha (*Cryptantha celosioides*) and Nuttall's draba (*Draba densifolia*)). Cusick's frasera was always present as the most abundant forb. Sulfur penstemon (*Penstemon attenuatus* var. *palustris*), serrate balsamroot, and scabland fleabane were other species usually occurring with the bunchgrasses.

Principal species—

Species	Code	Cover/constancy	Range of cover
Percent			
Grasses:			
Idaho fescue	FEID	15/100	5–25
bluebunch wheatgrass	AGSP	10/100	1–20
onespoke oatgrass	DAUN	1/80	0–3
Forbs:			
common yarrow	ACMIL	1/100	1–3
scabland fleabane	ERBL	3/80	0–3
stonecrops	SEDUM	4/40	0–10
sulfur penstemon	PEAT3	3/100	1–5
spurred lupine	LULA3	4/40	0–5
Nuttall's draba	DRDE	2/80	0–3
Cusick's frasera	FRALC2	7/100	3–15
serrate balsamroot	BASE2	1/80	0–1
woolly goldenweed	HALA3	1/40	0–1
cockscomb cryptantha	CRCE	1/40	0–1
prairie lupine	LULEU2	2/40	0–3

Management considerations—

These subalpine sites were used intensively by domestic sheep in the early 1900s. Pedestalled fescue plants, erosion pavement in deflation depressions, and trailing terracettes are all indicative of past soil erosion resulting from overgrazing. On relatively pristine sites, Idaho fescue dominates over bluebunch wheatgrass at a 2:1 ratio. Stands that have been moderately affected by grazing contain the two principal bunchgrasses at a 1:1 ratio. Stands that have been more strongly affected by grazing are dominated by bluebunch wheatgrass.

Relationship to other studies—

The FEDI-AGSP-FRALC2 plant association was first described in Johnson (2004).

Oniongrass-western needlegrass plant community type

Melica bulbosa-Stipa occidentalis

MEBU-STOC2

GB5011

N = 1

A ridgetop community at 7,300 ft elevation in the Strawberry Mountains, which has a history as a sheep livestock driveway, now contains a grass-dominated herbaceous component with perennial and annual forbs capitalizing on secondary site disturbance factors (e.g., pocket gophers, *Thomomys thalpoides*). A very high composition of oniongrass (*Melica bulbosa*) at 20 percent cover and western

needlegrass at 5 percent composed the graminoid component. Perennial forbs present were thread-leaf fleabane and sulfur penstemon. The churning of the soil by pocket gophers left a gravel/bare ground surface of 70 percent. Populating this highly disturbed area were annual forbs (e.g., narrow-leaf collomia, spreading groundsmoke). The substrate was rhyolitic on Strawberry Mountain volcanics.

Western needlegrass-bottlebrush squirreltail plant community type

Stipa occidentalis-Sitanion hystrix

STOC2-SIHY (Alpine)

GS50

N = 3

Severe annual grazing by domestic livestock in subalpine environments has degenerated native plant communities, caused soils to erode extensively, and resulted in plant communities capable of inhabiting a drier, often warmer site, with nutrient-deficient soils. This community represents vegetation found extensively along the subalpine mountain slopes where overgrazing and subsequent erosion have taken the vegetation beyond the threshold where Idaho fescue and elk sedge were once prevalent on the site but can no longer persist. This community was found in the

Strawberry Mountains and the Elkhorn Mountains of the central and southern Blue Mountains. Here two grasses, western needlegrass and bottlebrush squirreltail, codominated with 40 percent cover. An erosion pavement dominated the ground surface averaging 67 percent. Capitalizing on the lithic, warm site were phlox (especially *P. pulvinata*), western hawkweed, and hawksbeard. Elevations averaged 7,700 ft. Sampled sites were on moderate westerly slopes (mean 13 percent). Substrates were basaltic in the Strawberry Mountains, granitic in the Elkhorn Mountains.

Idaho fescue/prairie junegrass-mounds plant association

Festuca idahoensis/Koeleria cristata

FEID-KOCR (Mound)

GB5912

N = 14



Abels Ridge, Pomeroy RD, Umatilla NF.

Distribution—

Northern Blue Mountains.

Benchmark site—

Pataha Bunchgrass Research Natural Area, Pomeroy RD, Umatilla NF.

Environmental features—

This plant association occupies deep soil mounds overlying Columbia River basalts. Sampled sites occurred from 3,650 to 5,120 ft elevation (mean 4,440 ft). Slopes were gentle (mean 4 percent) with surfaces flat to convex. Mounded topography occurred on ridgetops. All aspects were represented. Soils consisted of a surface layer of silt loam (loess) over stony clayey soil over bedrock. The silt loam cap was about 2 ft thick on the mound centers, thinning to zero at mound margins where other plant associations were present. The available water capacity of the mound soils was moderate. Herbage production was high, ranging from 627 to 4,120 lb/ac (mean 1,934 lb/ac).

	Mean	Range
Elevation (feet)	4,440	3,650–5,120
Slope (percent)	4	1–5
Soil pH (n = 2)		6.2–7.0
Soil available water capacity (inches, n = 2)		4–7.5 (moderate)
Depth to bedrock (inches, n = 12)		16–30
Herbage (pounds/acre, n = 6)	1,934	627–4,120
Aspect (number of plots)	NW (3), NE (5), SE (3), SW (4)	
Lithology	Basalt	
Position	Summit	
Slope shape	Flat, convex	

Ground surface features—

	Phase						A + B range
	A (n = 1)	B (n = 3)	C1 (n = 1)	C2 (n = 3)	D1 (n = 1)	D2 (n = 2)	
	Cover (%)						
Bare ground	3	5	10	27	24	40	1–15
Bedrock	0	1	0	0	0	0	0
Rock	1	0	0	10	1	8	0–1
Gravel	0	0	0	3	0	8	0
Pavement	2	0	0	0	0	0	0–2
Mosses and lichens	20	1	0	3	17	5	0–20
Litter	74	55	90	10	43	11	

Vegetation composition—

These mounds are dominated by bunchgrasses. Shrubs are virtually absent in these communities, although common snowberry may occur as an incidental species. The bunchgrasses are mainly Idaho fescue, with prairie junegrass always associated at low cover levels in undisturbed communities. Forbs that frequently occur are yarrow, red besseya, deerhorn, creamy buckwheat, lupines, and potentillas. With increased disturbance, annual grasses (soft brome, Japanese brome, hairy brome, ventenata) may become prominent. Perennial forbs that tend to increase with disturbances are creamy buckwheat, yarrow, and red avens. Tarweeds and deerhorn are annual forbs that increase with surface disturbance.

States and transitions—

Six phases were defined as follows:

- A Idaho fescue and bluebunch wheatgrass cover totals >50 percent, perennial forb cover <30 percent.
- B Idaho fescue, bluebunch wheatgrass, and prairie junegrass cover totals 30 to 50 percent; forb cover >30 percent.

Principal species—

Species	Code	Phase						A + B range
		A (n = 1)	B (n = 3)	C1 (n = 1)	C2 (n = 3)	D1 (n = 4)	D2 (n = 2)	
		<i>Cover (%) / constancy (%)</i>						<i>Cover (%)</i>
Grasses:								
bluebunch wheatgrass	AGSP	21/100	30/67	1/100	15/33	1/50	3/100	0–30
mountain brome	BRCA5	0	2/67	0	3/67	3/50	0	0–2
hairy brome	BRCO4	0	20/33	0	20/33	22/75	1/50	0–20
Japanese brome	BRJA	0	0	0	0	0	35/50	0
soft brome	BRMO2	0	0	20/100	0	0	0	0
cheatgrass	BRTE	0	0	1/100	0	2/50	1/100	0
Idaho fescue	FEID	33/100	25/100	20/100	14/100	0	1/100	15–40
prairie junegrass	KOCR	2/100	3/100	0	12/67	12/75	1/50	1–5
Kentucky bluegrass	POPR	0	9/100	0	0	3/50	0	0–20
Sandberg's bluegrass	POSA12	2/100	0	1/100	6/67	25/25	6/100	0–2
ventenata	VEDU	0	0	40/100	0	3/25	0	0
Forbs:								
common yarrow	ACMIL	0	8/100	3/100	10/100	4/75	15/100	0–10
red besseya	BERU	0	3/67	0	0	1/25	0	0–5
deerhorn	CLPU	0	15/87	0	5/100	10/25	0	0–15
creamy buckwheat	ERHE2	3/100	11/67	10/100	22/100	0	38/100	0–15
red avens	GETR	0	7/33	0	8/67	0	0	0–7
cluster tarweed	MAGL2	0	0	0	0	58/50	0	0
slender tarweed	MAGR3	0	0	0	0	5/25	20/50	0
hairy owl-clover	ORHI	0	0	0	3/67	0	1/100	0
potentillas	POTEN	0	7/100	0	0	20/25	0	0–10
yellow salsify	TRDU	0	1/33	0	1/67	1/75	0	0–1
lupines	LUPIN	10/100	13/67	0	15/100	5/25	15/50	0–25

- C1 Idaho fescue and bluebunch wheatgrass cover totals 5 to 30 percent; annual grasses dominant.
- C2 Idaho fescue and bluebunch wheatgrass cover totals 5 to 30 percent; perennial forbs high in cover (creamy buckwheat, yarrow, and red avens); bare ground percentage high (>10 percent).
- D1 Idaho fescue and bluebunch wheatgrass cover <5 percent; annual bromes and tarweeds abundant.
- D2 Idaho fescue and bluebunch wheatgrass cover <5 percent; perennial forbs (yarrow, creamy buckwheat) high in cover; bare ground high (>25 percent).

These phases are the result of disturbances from wild and domestic ungulates. The site depicted by phase A is inside the Pataha Bunchgrass Research Natural Area that has excluded domestic livestock since 1968. As ungulate use increases, the three deep-rooted bunchgrasses (Idaho fescue, bluebunch wheatgrass, and prairie junegrass) decline in vigor and foliar cover (phase B). With further degradation, either annual grasses (phase C1) or perennial forbs and bare ground (phase C2) become dominant. The D phases represent the perennial bunchgrass as either relict or absent, with annuals (especially cluster tarweed, phase D1) or perennial forbs (creamy buckwheat and yarrow, phase D2) dominant.

Management considerations—

To promote or enhance Idaho fescue and bluebunch wheatgrass in these communities, grazing should occur after seed set. Ungulates can promote germination by trampling the seed into the soil after midsummer. Bunchgrasses generally rebound quickly from fires, reaching levels similar to those before the fire in just 1 year. However, fescue is often suppressed by severe burns in late summer, when root crowns are readily damaged or consumed; it usually returns to preburn cover within 5 years after fire. If heavy grazing suppresses bunchgrasses, perennial forbs or annuals expand as discussed above. Observations in the Hell's Canyon region suggest that Kentucky bluegrass may also invade if severe fires reduce the fescue component.

Relationship to other studies—

The FEID-KOCR association was first described by Poulton (1955) on the Deschutes-Umatilla Plateau of north-central Oregon. Tisdale (1979, 1986) subsequently described this vegetation as a FEID-KOCR habitat type. Johnson and Simon (1987) classified FEID-KOCR with topoedaphic breaks. They encountered the FEID-KOCR-Mound plant association in the northern Wallowa Mountains and on ridgetops above the Snake, Imnaha, and Grande Ronde River canyons.

Idaho fescue/prairie junegrass-ridge plant association

Festuca idahoensis-*Koeleria cristata*

FEID-KOCR (Ridge)

GB5911

N = 12



Long Creek Mountain, Blue Mountain RD, Malheur NF.

Distribution—

Northern and Central Blue Mountains.

Environmental features—

This plant association occupies ridgetop sites overlying andesites and basalts. Sampled sites occurred from 3,900 to 6,550 ft elevation (mean 4,690 ft). Slopes were gentle (mean 12 percent) with surfaces flat to convex. Soils consisted of a silt loam layer up to 8 in thick (sometimes absent), over a clay loam layer that usually contained gravel and could be extremely gravelly; bedrock occurred within about 2 ft of the surface. This plant association occurs on nonmounded ridgetops and shoulders. Aspects were mostly westerly. Herbage production ranged from 338 to 1,444 lb/ac (mean 722 lb/ac).

	Mean	Range
Elevation (feet)	4,690	3,900–6,550
Slope (percent)	12	2–30
Soil pH (n = 5)		6.0–6.8
Soil available water capacity (inches, n = 5)		1.5–6 (very low to moderate)
Depth to bedrock (inches, n = 10)		10–26
Herbage (pounds/acre, n = 6)	722	338–1,444
Aspect (number of plots)	NW (6), NE (1), SE (0), SW (5)	
Lithology	Basalt, andesite	
Position	Summit, shoulder	
Slope shape	Flat, convex	

Ground surface features—

	Phase					A + B range
	A (n = 6)	B (n = 3)	C1 (n = 1)	C2 (n = 1)	D (n = 1)	
	Cover (%)					
Bare ground	9	31	5	18	1	3–45
Bedrock	1	2	0	4	0	0–4
Rock	5	2	1	17	1	1–15
Gravel	4	0	0	0	40	0–15
Pavement	2	0	0	0	0	0–10
Mosses and lichens	5	10	18	3	25	0–12
Litter	30	55	70	58	1	

Vegetation composition—

Shrubs are virtually nonexistent in these bunchgrass-dominated communities. Idaho fescue dominates, with prairie junegrass and Sandberg's bluegrass always associated at low cover levels in undisturbed communities. Forbs that frequently occur are pale agoseris, red avens, lupines, yarrow, twin arnica, and creamy buckwheat. The latter three forbs increase with disturbances.

States and transitions—

Five phases were defined as follows:

- A Fescue and wheatgrass cover total >30 percent; bare ground cover 15 percent or less.
- B Fescue and wheatgrass cover >30 percent but Sandberg's bluegrass cover is >15 percent and often greater than fescue.
- C1 Fescue and wheatgrass cover <30 percent; abundant annual grasses.
- C2 Fescue and wheatgrass cover <30 percent; perennial forbs (yarrow, twin arnica, and creamy buckwheat) or Sandberg's bluegrass cover high (over 20 percent).
- D Idaho fescue and bluebunch wheatgrass <5 percent cover or absent; perennial forbs (yarrow and creamy buckwheat) abundant.

Principal species—

Species	Code	Phase					A + B range
		A (n = 6)	B (n = 3)	C1 (n = 1)	C2 (n = 1)	D (n = 1)	
		Cover (%)/constancy (%)					Cover (%)
Grasses:							
bluebunch wheatgrass	AGSP	25/33	20/100	10/100	8/100	1/100	0–30
annual bromes	BROMU	0	3/33	26/100	0	0	0
onespike oatgrass	DAUN	2/33	2/67	0	1/100	5/100	0–3
Idaho fescue	FEID	40/100	18/100	15/100	15/100	0	9–55
prairie junegrass	KOCR	7/100	12/100	5/100	3/100	35/100	1–15
Sandberg's bluegrass	POSA12	6/100	25/100	1/100	25/100	3/100	1–30
Forbs:							
common yarrow	ACMIL	3/100	4/100	3/100	1/100	15/100	1–7
pale agoseris	AGGL	2/33	2/67	0	0	4/100	0–3
pussytoes	ANTEN	1/33	1/33	0	0	1/100	0–1
twin arnica	ARSO2	7/17	1/100	1/100	10/100	1/100	0–7
serrate balsamroot	BASE2	4/50	0	0	0	1/100	0–5
creamy buckwheat	ERHE2	4/33	4/67	1/100	20/100	0	0–6
red avens	GETR	2/50	1/33	0	3/100	0	0–3
lupines	LUPIN	17/50	1/67	0	15/100	0	0–15
pussy clover	TRPL2	4/33	2/33	0	0	7/100	0–7

These phases are the result of disturbances from wild and domestic ungulates. As ungulate use increases, the three deep-rooted bunchgrasses (fescue, wheatgrass, and junegrass) decline in vigor and foliar cover. Phase A represents the least disturbed site. In phase B, disturbance has suppressed fescue and allowed bluegrass to increase. Phase C results from further degradation with either perennial forbs (phase C1) or Sandberg's bluegrass (phase C2) now dominant. In phase D, fescue has been eliminated and replaced by perennial forbs and junegrass.

Management considerations—

Wild ungulates use these ridgetop and ridge shoulder sites heavily before grasses mature. If plant vigor is to be maintained, domestic livestock should not use these sites until after seed maturity. Ungulates can promote germination by trampling the seed into the soil after midsummer. Bunchgrasses generally rebound quickly from fires, reaching levels similar to those before the fire in just 1

year. However, fescue is often suppressed by severe burns in late summer, when root crowns are readily damaged or consumed; it usually returns to preburn cover within 5 years after fire.

Relationship to other studies—

The FEID-KOCR association was first described by Poulton (1955) on the Deschutes-Umatilla Plateau of north-central Oregon. Tisdale (1979, 1986) subsequently described this vegetation as a FEID-KOCR habitat type. Johnson and Simon (1987) classified FEID-KOCR with topoedaphic breaks. They encountered the FEID-KOCR-Ridge plant association in the northern Wallowa Mountains and on ridgetops above the Snake, Imnaha, and Grande Ronde River canyons.

This description confirms the type first described by Poulton and extends the range into the Blue Mountains. It was found as far south as Long Creek Mountain on the northern Malheur NF.

Idaho fescue-bluebunch wheatgrass-lupine plant association

Festuca idahoensis-*Agropyron spicatum*-*Lupinus* spp.

FEID-AGSP-LUPIN

GB5916

N = 8



Mud Spring Ridge, Pomeroy RD, Umatilla NF.

Distribution—

Blue Mountains and Ochoco Mountains.

Environmental features—

This plant association occupies upper ridge slopes on basalts. Sampled sites occurred from 4,110 to 5,540 ft elevation (mean 4,570 ft). Slopes were gentle to steep (mean 26 percent) on mostly convex surfaces. All aspects were represented. Brief soil investigations (n = 4) suggest gravelly soils with bedrock or extremely gravelly material at 1 to 3 ft depth. Herbage production ranged from 650 to 1,970 lb/ac (mean 993 lb/ac).

	Mean	Range
Elevation (feet)	4,570	4,110–5,540
Slope (percent)	26	5–64
Herbage (pounds/acre, n = 7)	993	650–1,970
Aspect (number of plots)	NW (1), NE (3), SE (2), SW (2)	
Lithology	Basalt	
Position	Backslope, shoulders	
Slope shape	Convex	

Ground surface features—

	Phase			A + B range
	A (n = 1)	B (n = 5)	C (n = 2)	
	Cover (%)			
Bare ground	5	15	30	5–30
Bedrock	0	0	2	0
Rock	15	5	8	0–15
Gravel	0	6	10	0–25
Pavement	0	0	0	0
Mosses and lichens	10	3	3	0–11
Litter	20	47	20	3–80

Vegetation composition—

Bunchgrasses dominate and shrubs are nearly absent. Idaho fescue dominates with bluebunch wheatgrass and Sandberg's bluegrass always associated at low cover levels in undisturbed communities. Forbs that frequently occur are yarrow, lupines, and lomatiums.

States and transitions—

Three phases were defined as follows:

- A Fescue and wheatgrass cover total >50 percent; bare ground ≤5 percent.
- B Fescue and wheatgrass cover ≤50 percent; bare ground percentage still low (5 to 20 percent).
- C Fescue and wheatgrass cover <50 percent; bare ground percentage high (over 20 percent).

These phases are the result of disturbances from wild and domestic ungulates. As ungulate use increases, the deep-rooted bunchgrasses (fescue and wheatgrass) decline in vigor and foliar cover. Phase A represents the least disturbed site. Phase B represents vegetation resulting from moderate ungulate disturbance; fescue tends to lose its dominance over bluebunch wheatgrass, and Sandberg's bluegrass increases. Phase C results from further degradation with bare ground becoming dominant. Fescue and wheatgrass may decline below 20 percent cover.

Management considerations—

Wild ungulates use these ridgetop and ridge shoulder sites heavily before grasses mature. If plant vigor is to be maintained, domestic ungulates should not use these sites until after seed maturity. Ungulates can promote germination by trampling the seed into the soil after midsummer. Bunchgrasses generally rebound quickly from fires, reaching levels similar to those before the fire in just 1 year. However, fescue is often suppressed by severe burns in late summer,

Principal species—

Species	Code	Phase			A + B range
		A (n = 1)	B (n = 1)	C (n = 2)	
		Cover (%) / constancy (%)			Cover (%)
Grasses:					
bluebunch wheatgrass	AGSP	10/100	22/100	6/100	1–35
Idaho fescue	FEID	55/100	26/100	22/100	20–35
bulbous bluegrass	POBU	0	0	15/50	0
Sandberg's bluegrass	POSA12	1/100	5/100	10/50	1–10
Forbs:					
common yarrow	ACMIL	3/100	4/100	2/100	1–5
pussytoes	ANTEN	0	3/20	3/50	0–3
deerhorn	CLPU	0	1/20	10/50	0–1
creamy buckwheat	ERHE2	0	1/80	0	0–3
cleavers	GAAP2	0	0	5/50	0
lomatiums	LOMAT	1/100	1/60	8/50	0–10
lupines	LUPIN	5/100	14/100	13/100	5–25
mules' ears	WYAM	0	0	40/50	0

when root crowns are readily damaged or consumed; it usually returns to preburn cover within 5 years after fire.

Relationship to other studies—

The FEID-AGSP habitat type of Daubenmire (1970) is similar. Hall's (1973) plant community type, "bunchgrass on deep soil, steep slopes," is similar to this plant association. Tisdale (1979, 1986) classified a FEID-AGSP habitat type in the Snake River canyon that is similar. Mueggler and Stewart (1980) identified FEID-AGSP vegetation as forming the most common grassland in southwestern Montana. The FEID-AGSP-LUSE4 plant association described by Johnson and Simon (1987) in the Wallowa Mountain-Snake River canyon is similar to this plant association.

Idaho fescue-bluebunch wheatgrass-arrowleaf balsamroot plant association

Festuca idahoensis-Agropyron spicatum-Balsamorhiza sagittata

FEID-AGSP-BASA3

GB5917

N = 3



Smoothing Iron Ridge, Pomeroy RD, Umatilla NF.

Distribution—

Northern Blue Mountains.

Environmental features—

This plant association occupies upper ridge shoulders and slopes on basalts. Sampled sites occurred from 3,930 to 4,280 ft elevation (mean 4,113 ft). Slopes were steep (mean 56 percent) on mostly convex surfaces. Aspects were southerly.

	Mean	Range
Elevation (feet)	4,113	3,930–4,280
Slope (percent)	56	50–64
Aspect (number of plots)	NW (0), NE (0), SE (1), SW (2)	
Lithology	Basalt	
Position	Shoulder, backslope	
Slope shape	Convex	

Ground surface features—

	Phase			A + B range
	A (n = 1)	B (n = 1)	C (n = 2)	
		Cover (%)		
Bare ground	1	20	5	1–20
Bedrock	0	1	0	0–1
Rock	10	25	1	10–25
Gravel	1	5	35	1–5
Pavement	0	0	0	0
Mosses and lichens	6	2	4	2–6
Litter	70	35	55	35–70

Principal species—

Species	Code	Phase			A + B range
		A (n = 1)	B (n = 1)	C (n = 1)	
		Cover (%) / constancy (%)			Cover (%)
Grasses:					
bluebunch wheatgrass	AGSP	20/100	25/100	20/100	20–25
Idaho fescue	FEID	30/100	15/100	10/100	15–30
Sandberg's bluegrass	POSA12	10/100	15/100	5/100	10–15
hairy brome	BRCO4	5/100	10/100	0	5–10
brome fescue	FEBR4	0	5/100	0	0–5
cheatgrass	BRTE	0	3/100	1/100	0–3
soft brome	BRMO2	0	0	20/100	0
rattlesnake brome	BRBR7	1/100	1/100	0	1–1
ventenata	VEDU	0	3/100	0	0–3
Forbs:					
arrowleaf balsamroot	BASA3	10/100	5/100	5/100	5–10
common yarrow	ACMIL	1/100	3/100	1/100	1–3
lupines	LUPIN	1/100	1/100	5/100	1–1
deer horn	CLPU	1/100	0	10/100	0–1
pink microsteris	MIGR	0	0	30/100	0
slender tarweed	MAGR3	0	0	15/100	0

Vegetation composition—

Idaho fescue is associated with bluebunch wheatgrass and Sandberg's bluegrass. The dominant forb is arrowleaf balsamroot. Yarrow and lupines are usually present at low cover. Closely associated to FEID-AGSP-LUPIN, this plant association is more xeric as indicated by rockier sites and higher cover by Sandberg's bluegrass and balsamroot (the latter is more indicative of warm, dry sites than are lupines).

States and transitions—

Three phases were defined as follows:

- A Fescue and wheatgrass total cover \geq 50 percent.
- B Fescue and wheatgrass total cover 30 to 50 percent.
- C Fescue and wheatgrass total cover <30 percent.

These phases are the result of disturbances from wild and domestic ungulates. As ungulate use increases, the

deep-rooted bunchgrasses (fescue and wheatgrass) decline in vigor and foliar cover. Phase A represents the least disturbed site. In phase B, wheatgrass assumes dominance over fescue, and bluegrass increases. Phase C results from further degradation with fescue, wheatgrass, and bluegrass all declining and annuals assuming dominance. Informal observations suggest that severe overgrazing by domestic sheep has produced dense stands of balsamroot and mule's ears (*Wyethia*), a potential phase D for this type.

Management considerations—

Wild ungulates use these ridgetop and ridge shoulder sites heavily before grasses mature. If plant vigor is to be maintained, domestic livestock should not use these sites until after seed maturity. Ungulates can promote germination by trampling the seed into the soil after midsummer. Bunchgrasses generally rebound quickly from fires, reaching levels similar to those before the fire

in just 1 year. However, fescue is often suppressed by severe burns in late summer when root crowns are readily damaged or consumed; it usually returns to preburn cover within 5 years after fire.

Relationship to other studies—

The FEID-AGSP habitat type of Daubenmire (1970) is similar. Hall's (1973) plant community type, "bunchgrass on deep soil, steep slopes," is also similar to this plant association. Tisdale (1979, 1986) classified a FEID-AGSP habitat type in the Snake River canyon that is similar. Mueggler and Stewart (1980) identified FEID-AGSP vegetation as forming the most common grassland in southwestern Montana. The FEID-AGSP-BASA3 plant association described by Johnson and Simon (1987) in the Wallowa Mountain-Snake River canyon is similar to this plant association.

Idaho fescue-bluebunch wheatgrass-phlox plant association

Festuca idahoensis-Agropyron spicatum-Phlox spp.

FEID-AGSP-PHLOX

GB5931

N = 6



Big Ridge, Blue Mountain RD, Malheur NF.

Distribution—

Throughout the Blue Mountains.

Environmental features—

This plant association occupies ridge summits, shoulders, and slopes on basalts. Sampled sites occurred from 4,390 to 5,640 ft elevation (mean 5,001 ft). Slopes were gentle to steep (mean 27 percent) on mostly convex surfaces. Aspects were westerly. Soils consisted of gravelly to very gravelly loamy or clay loamy material, with bedrock or extremely gravelly material within 1 ft of the surface.

	Mean	Range
Elevation (feet)	5,001	4,390–5,640
Slope (percent)	27	6–70
Soil pH (n = 4)		6.0–7.0
Soil available water capacity (inches, n = 3)		1–2 (very low)
Depth to bedrock or extremely gravelly material (inches, n = 5)		0–10
Herbage (pounds/acre, n = 6)	563	286–1,208
Aspect (number of plots)	NW (3), NE (0), SE (0), SW (3)	
Lithology	Basalt	
Position	Summit, shoulder, slopes	
Slope shape	Convex	

Ground surface features—

	Phase		
	A (n = 3)	B (n = 3)	A + B range
	Cover (%)		
Bare ground	7	15	7–15
Bedrock	3	2	2–3
Rock	23	20	20–23
Gravel	3	3	3–3
Pavement	5	3	3–5
Mosses and lichens	3	7	3–7
Litter	50	15	15–50

Vegetation composition—

Idaho fescue is associated with bluebunch wheatgrass and Sandberg’s bluegrass on dry, warm, rocky sites. Idaho fescue is the dominant bunchgrass where vegetation is undisturbed. The dominant forb is phlox. Yarrow and fleabanes are usually present at low cover. This plant association is more xeric than FEID-AGSP-BASA3, as indicated by rockier sites and higher cover by Sandberg’s bluegrass and phloxes.

States and transitions—

Two phases were defined as follows:

- A Fescue and wheatgrass total cover \geq 35 percent.
- B Fescue and wheatgrass total cover < 35 percent.

These phases are the result of disturbances from wild and domestic ungulates. As ungulate use increases, the deep-rooted bunchgrasses (fescue, wheatgrass) decline in vigor and foliar cover. Phase A represents the least disturbed site. Total foliar cover of fescue and wheatgrass has declined, and bare ground increased from ungulate disturbance in phase B.

Principal species—

Species	Code	Phase		A + B range
		A (n = 3)	B (n = 3)	
		Cover (%)/constancy (%)		Cover (%)
Grasses:				
bluebunch wheatgrass	AGSP	25/100	9/100	9–25
Idaho fescue	FEID	16/100	17/100	16–17
Sandberg's bluegrass	POSA12	9/100	11/100	9–11
Forbs:				
common yarrow	ACMIL	2/100	2/100	2–2
fleabanes	ERIGE2	1/67	3/67	1–3
creamy buckwheat	ERHE2	9/100	0	0–9
phloxes	PHLOX	11/100	7/100	7–11
stonecrops	SEDUM	5/33	1/33	1–5

Management considerations—

Wild ungulates use these ridgetop, shoulder, and slope sites heavily before grasses mature. If plant vigor is to be maintained, domestic livestock should not use these sites until after seed maturity. Ungulates can promote germination by trampling the seed into the soil after midsummer.

Bunchgrasses generally rebound quickly from fires, reaching levels similar to those before the fire in just 1 year. However, fescue is often suppressed by severe burns in late summer, when root crowns are readily damaged or consumed; it usually returns to preburn cover within 5 years after fire.

Relationship to other studies—

The FEID-AGSP habitat type of Daubenmire (1970) is similar. Hall's (1973) plant community type, "bunchgrass on deep soil, steep slopes," is also similar to this plant association. Tisdale (1979, 1986) classified a FEID-AGSP habitat type in the Snake River canyon that is similar. Mueggler and Stewart (1980) identified FEID-AGSP vegetation as forming the most common grassland in southwestern Montana. The FEID-AGSP-PHCO2 plant association described by Johnson and Simon (1987) on ridgetops and upper slopes in the canyon lands of the Snake and Imnaha Rivers is the ecological equivalent to this plant association of the Blue Mountains.

Idaho fescue-bluebunch wheatgrass plant association

Festuca idahoensis-*Agropyron spicatum*

FEID-AGSP

GB59

N = 32



Horse Heaven Ridge, Walla Walla RD, Umatilla NF.

Distribution—

Throughout the Blue Mountains; Ochoco Mountains.

Environmental features—

This plant association occupies ridge summits, shoulders, and slopes on basalts. Sampled sites occurred from 3,900 to 6,990 ft elevation (mean 4,784 ft). Slopes were gentle to steep (mean 29 percent) on mostly convex or flat surfaces. All aspects were represented (70 percent of the sites sampled were southwesterly).

	Mean	Range
Elevation (feet)	4,784	3,900–6,990
Slope (percent)	29	0–60
Soil pH (n = 11)		6.2–6.8
Soil available water capacity (inches, n = 12)		1–5 (very low to moderate)
Depth to bedrock (inches, n = 24)		8–26
Herbage (pounds/acre, n = 18)	549	154–1,770 (outlier: 3,630)
Aspect (number of plots)	NW (2), NE (5), SE (3), SW (22)	
Lithology	Basalt	
Position	Summit, shoulder, backslope	
Slope shape	Convex, flat	

Ground surface features—

	Phase					A + B range
	A (n = 10)	B (n = 10)	C1 (n = 5)	C2 (n = 5)	D (n = 2)	
	Cover (%)					
Bare ground	9	11	15	15	17	0–20
Bedrock	1	1	1	0	0	0–5
Rock	19	23	12	7	5	1–56
Gravel	3	8	6	21	10	0–35
Pavement	6	4	2	0	0	0–33
Mosses and lichens	13	8	4	15	10	0–45
Litter	35	35	63	42	58	

Vegetation composition—

Idaho fescue is codominant with bluebunch wheatgrass. Sandberg’s bluegrass is always present at lower cover levels. Prominent forbs are yarrow, creamy buckwheat, phloxes, and lomatiums. This plant association is more xeric than FEID-AGSP-BASA3 and FEID-AGSP-LUPIN as indicated by phloxes and hot rock penstemon. This is the most common bunchgrass plant association in the Blue Mountains. Herbage production ranges are wide owing primarily to the diversity in elevation and latitude. Herbage ranged from 154 to 1,770 lb/ac (mean 549 lb/ac).

States and transitions—

Five phases were defined as follows:

- A Fescue and wheatgrass total cover ≥ 30 percent; little bare soil or annuals.
- B Fescue and wheatgrass total cover minus cover by annuals and bare soil is 0 to 20 percent.
- C1 Bare ground and annuals (forbs, annual brome-grasses, ventenata) collectively have greater cover than bunchgrasses.
- C2 Fescue and wheatgrass total cover <35 percent; bare ground >10 percent; perennial forbs (such as yarrow, creamy buckwheat, milkvetch, and lomatiums) and Sandberg’s bluegrass collectively have cover similar to or greater than bunchgrasses.
- D Fescue relict or absent (<5 percent cover); annual grasses (ventenata) dominant.

These phases are the result of disturbances from wild and domestic ungulates. As ungulate use increases, the deep-rooted bunchgrasses (fescue and wheatgrass) decline in vigor and foliar cover. Phase A represents the least disturbed site. In phase B, total foliar cover of fescue and wheatgrass has declined while annuals and bare ground have increased. Phase C occurs when either annuals (phase

Principal species—

Species	Code	Phase					A + B range
		A (n = 10)	B (n = 10)	C1 (n = 5)	C2 (n = 5)	D (n = 2)	
		Cover (%)/constancy (%)					Cover (%)
Grasses:							
bluebunch wheatgrass	AGSP	18/100	14/100	11/100	12/100	15/50	5–25
rattlesnake brome	BRBR7	0	2/30	10/49	10/20	1/50	0–3
Idaho fescue	FEID	22/100	16/100	19/100	15/100	3/50	5–35
Sandberg's bluegrass	POSA12	6/100	9/100	7/80	13/60	5/50	3–20
ventenata	VEDU	0	0	35/40	1/20	45/100	0
Forbs:							
common yarrow	ACMIL	2/90	2/90	4/80	5/100	24/100	0–5
Blue Mountain milkvetch	ASRE5	1/20	1/30	1/20	8/40	0	0–1
balsamroot	BALSA	3/20	5/80	3/80	15/40	0	0–25
tall annual willowherb	EPPA2	0	5/30	12/60	6/40	0	0–10
creamy buckwheat	ERHE2	12/30	5/80	12/60	18/60	0	0–18
lomatiums	LOMAT	1/60	4/70	3/40	18/50	12/60	0–7
slender tarweed	MAGR3	0	4/20	1/40	3/80	0	0–5
hot rock penstemon	PEDE4	1/10	2/60	0	2/40	0	0–3
phloxes	PHLOX	2/50	2/30	3/40	9/40	0	0–3

C1) or perennial forbs (phase C2) dominate over the bunchgrasses. Phase D results after degradation of the site results in the loss of fescue, the most mesic bunchgrass member.

Management considerations—

Wild ungulates (deer and elk) use these ridgetop, shoulder, and slope sites heavily before grasses mature. Use in late winter to early spring can displace saturated soils on slope sites with detrimental impacts to the bunchgrass plants. If bunchgrass vigor is to be maintained, domestic livestock should not use these sites until after seed maturity. Ungulates can promote germination by trampling the seed into the soil after midsummer. Bunchgrasses generally rebound quickly from fires, reaching levels similar to those before the fire in just 1 year. However, fescue is often suppressed by severe burns in late summer when root crowns are readily damaged or consumed; it usually returns to preburn cover within 5 years after fire. Pocket gophers can cause considerable soil displacement in degenerated FEID-AGSP communities.

Relationship to other studies—

The FEID-AGSP habitat type of Daubenmire (1970) is similar. Hall's (1973) classification of AGSP-FEID differentiated by soil depths and slope steepness included AGSP-POSA12 and FEID-AGSP vegetation as differentiated in this classification. Tisdale (1979, 1986) classified a FEID-AGSP habitat type in the Snake River canyon that is similar. Mueggler and Stewart (1980) identified FEID-AGSP vegetation as forming the most common grassland in southwestern Montana. In the Wallowa Mountains and Snake-Imnaha ridges, Johnson and Simon (1987) differentiated FEID-AGSP potential vegetation into three associations (FEID-AGSP/LUSE4, FEID-AGSP/BASA3, and FEID-AGSP/PHCO2). Several FEID-KOCR plant associations were also differentiated by using prairie junegrass as an indicator of a moister site. The present study generally parallels Johnson and Simon (1987) but retains a FEID-AGSP association that lacks other indicator species and thus is more narrowly defined than the FEID-AGSP in Johnson and Clausnitzer (1992).

Idaho fescue-onespike oatgrass plant community type

Festuca idahoensis-Danthonia unispicata

FEID-DAUN

GB5932

N = 2

This community occurs on scablands where soils are shallow over impervious bedrock of basalt. Onespike oatgrass, serrated balsamroot, pussytoes, bighead clover, and phloxes are all indicative of these site conditions. Idaho fescue, bluebunch wheatgrass, prairie junegrass, and Sandberg's bluegrass are commonly present. The presence of deeper soil bunchgrasses (fescue, wheatgrass, and junegrass) along

with soil erosion indicators suggests that these sites were once able to sustain Idaho-fescue-dominated communities. Bunchgrass plants on soil pedestals attest to past overuse by livestock with accelerated frost heaving and soil erosion. Ventenata can easily invade on these sites. These sites occur throughout the Blue and Ochoco Mountains.

Bluebunch wheatgrass-Sandberg's bluegrass-lupine plant association

Agropyron spicatum-Poa sandbergii-Lupinus spp.

AGSP-POSA12-LUPIN

GB4119

N = 9



Low Ridge, Wehaha-Tucannon Wilderness, Pomeroy RD, Umatilla NF.

Distribution—

Northern Blue Mountains and Ochoco Mountains.

Environmental features—

This plant association occupies shoulders and upper ridge slopes on basalts. Sampled sites occurred from 3,150 ft to 4,720 ft (mean 4,042 ft). Slopes were steep (mean 55 percent) on flat to convex surfaces. Aspects of sampled plots were all southwesterly. Brief soil investigations (n = 5) suggests that soils are rich in coarse fragments, and that bedrock or extremely stoney material occurs between 6 and 20 in of the surface. Herbage production ranged from 430 to 1,450 lb/ac (mean 931 lb/ac).

	Mean	Range
Elevation (feet)	4,042	3,150–4,720
Slope (percent, n = 3)	55	42–65
Herbage (pounds/acre, n = 8)	931	430–1,450
Aspect (number of plots)	NW (0), NE (0), SE (0), SW (9)	
Lithology	Basalt	
Position	Shoulder, backslope	
Slope shape	Flat, convex	

Ground surface features—

	Phase		
	B (n = 8)	C (n = 1)	A + B range
	Cover (%)		
Bare ground	22	50	3–35
Bedrock	0	0	0–1
Rock	23	5	1–60
Gravel	7	15	0–20
Pavement	0	0	0
Mosses and lichens	6	0	0–21
Litter	38	25	20–90

Vegetation composition—

Bluebunch wheatgrass and Sandberg's bluegrass occupy steep colluvial slopes with lupines (mostly *Lupinus sulphureus*). Rattlesnake brome is the most common annual grass. Perennial forbs commonly found are yarrow, brodiaea, hot rock penstemon, and creamy buckwheat. Annuals are common on the shifting colluvium (e.g., deerhorn, slender tarweed, and yellow salsify).

States and transitions—

Two phases were defined as follows:

- B Combined cover of bluebunch wheatgrass and Sandberg's bluegrass >20 percent; bare ground and gravel total <40 percent.
- C Combined cover of wheatgrass and bluegrass >20 percent; bare ground and gravel percentages are high (>40 percent).

These states are the result of disturbances from wild and domestic ungulates. As ungulate use increases, bare ground and gravels increase. No sites were assigned to phase A (hypothetically where bare ground and gravel would total ≤10 percent, and the bunchgrasses would account for a foliar cover of ≥30 percent). Phase B results from ungulate movement on the steep, unstable slopes resulting in increased bare ground and exposed gravels. Phase C results from further degradation where bare ground and gravels become dominant.

Management considerations—

Wild ungulates use these steep, southerly slopes heavily before grasses mature in late winter to early spring. The most degraded sites are a result of combined use by elk and cattle in late spring to early summer. If plant vigor is to be maintained, domestic livestock should not use these sites until after seed maturity. Ungulates can promote germination by trampling the seed into the soil after midsummer.

Principal species—

Species	Code	Phase		A + B range
		B (n = 8)	C (n = 1)	
		Cover (%)/constancy (%)		Cover (%)
Grasses:				
bluebunch wheatgrass	AGSP	25/100	25/100	20–40
rattlesnake brome	BRBR7	4/62	1/100	0–15
soft brome	BRMO2	8/38	0	0–20
cheatgrass	BRTE	5/25	0	0–10
Sandberg's bluegrass	POSA12	3/100	1/100	1–10
Forbs:				
common yarrow	ACMIL	3/88	1/100	0–5
arrowleaf balsamroot	BASA3	6/50	0	0–20
Douglas' brodiaea	BRDO	1/62	0	0–3
harsh paintbrush	CAHI9	4/38	0	0–5
deerhorn	CLPU	8/62	3/100	0–25
creamy buckwheat	ERHE2	1/62	0	0–1
cleavers	GAAP2	9/38	0	0–20
swale desert-parsley	LOAM	12/38	0	0–10
lupines	LUPIN	11/100	6/100	5–20
slender tarweed	MAGR3	2/38	0	0–5
pink microsteris	MIGR	12/38	0	0–20
hot rock penstemon	PEDE4	6/25	1/100	0–10
yellow salsify	TRDU	1/50	0	0–1

Relationship to other studies—

Daubenmire (1970) was the first to define AGSP-POSA12 vegetation as a habitat type in eastern Washington; Hall (1973) included AGSP-POSA12-LUPIN vegetation in the “bunchgrass on deep soil, steep slopes” plant community type for the Blue Mountains. Tisdale (1986) classified an AGSP-POSA12 habitat type in the Snake River canyon in Idaho. Mueggler and Stewart (1980) identified AGSP-POSA12 vegetation in Montana. Johnson and Simon (1987) differentiated AGSP-POSA12 into eight plant associations in the Wallowa Mountains and canyon lands of northeastern Oregon. The AGSP-POSA12-LUPIN plant association has not been previously described.

Bluebunch wheatgrass-Sandberg's bluegrass-arrowleaf balsamroot plant association

Agropyron spicatum-Poa sandbergii-Balsamorhiza sagittata

AGSP-POSA12-BASA3

GB4123

N = 11



Near Crite Spring, Pomeroy RD, Umatilla NF.

Distribution—

Blue Mountains and Ochoco Mountains.

Environmental features—

This plant association occupies upper ridge slopes on basalts. Sampled sites occurred from 2,140 ft elevation in the Crooked River National Grasslands to 4,680 ft elevation in the northern Blue Mountains (mean 3,869 ft). Slopes were moderate to steep (mean 48 percent) on mostly convex surfaces. All aspects were represented (the majority were southerly). Brief soil investigations (n = 6) suggest that soils are rich in coarse fragments and that bedrock or extremely stony material occurs between 5 and 20 in of the surface. Herbage production ranged from 650 to 1,580 lb/ac (mean 1,202 lb/ac).

	Mean	Range
Elevation (feet)	3,869	2,140–4,680
Slope (percent)	48	15–68
Herbage (pounds/acre, n = 5)	1,202	650–1,580
Aspect (number of plots)	NW (1), NE (1), SE (2), SW (7)	
Lithology	Basalt	
Position	Backslope	
Slope shape	Flat, convex	

Ground surface features—

	Phase				A + B range
	A (n = 1)	B (n = 7)	C (n = 1)	D (n = 2)	
	Cover (%)				
Bare ground	7	15	45	42	1–30
Bedrock	3	1	0	0	0–5
Rock	3	18	15	15	1–70
Gravel	0	18	10	6	0–40
Pavement	0	0	0	0	0
Mosses and lichens	0	0	0	0	0
Litter	70	46	10	28	

Vegetation composition—

Bluebunch wheatgrass and Sandberg's bluegrass occupy steep colluvial slopes with arrowleaf balsamroot. Other forbs commonly found are yarrow and annuals that occupy the shifting colluvium (e.g., deerhorn, slender tarweed, and yellow salsify).

States and transitions—

Four phases were defined as follows:

- A Bluebunch wheatgrass cover >50 percent, arrowleaf balsamroot <10 percent; bare ground is 10 percent or less.
- B Bluebunch wheatgrass cover is 20 to 50 percent; balsamroot cover is 10 to 25 percent; bare ground 10 to 40 percent.
- C Bluebunch wheatgrass cover 5 to 25 percent; cover by annuals is greater than that of wheatgrass; bare ground percentage is high (>40 percent).
- D Bluebunch wheatgrass <5 percent cover or absent; cover by annuals >40 percent.

These phases are the result of disturbances from wild and domestic ungulates. As ungulate use increases, bluebunch wheatgrass declines in vigor and foliar cover. Sandberg's bluegrass also declines from increased ungulate use resulting from soil surface movement. Phase A represents

Principal species—

Species	Code	Phase				A + B range
		A (n = 1)	B (n = 7)	C (n = 1)	D (n = 2)	
		Cover (%) / constancy (%)				Cover (%)
Grasses:						
bluebunch wheatgrass	AGSP	65/100	29/100	20/100	1/50	20–65
rattlesnake brome	BRBR7	0	2/43	1/100	4/100	0–1
hairy brome	BRCO4	0	20/14	0	35/50	0–20
Japanese brome	BRJA	0	5/14	0	3/50	0–5
cheatgrass	BRTE	0	14/71	20/100	1/50	0–40
Sandberg's bluegrass	POSA12	20/100	6/71	3/100	8/100	0–20
Forbs:						
common yarrow	ACMIL	1/100	7/100	0	1/100	1–10
large-flowered agoseris	AGGR	0	1/29	1/100	1/100	0–1
arrowleaf balsamroot	BASA3	7/100	12/100	30/100	25/100	5–20
blepharipappus	BLSC	0	2/29	15/100	25/100	0–3
deerhorn	CLPU	0	10/43	3/100	0	0–15
common cryptantha	CRIN8	0	5/14	15/100	4/100	0–5
tall annual willowherb	EPPA2	0	2/29	3/100	3/100	0–2
slender tarweed	MAGR3	0	2/43	1/100	10/50	0
hairy owl-clover	ORHI	0	0	0	10/50	0
narrowleaf skullcap	SCAN3	0	0	0	15/50	0
yellow salsify	TRDU	0	2/57	3/100	0	0–2

the least disturbed site. Phase B represents AGSP-POSA12-BASA3 vegetation resulting from ungulate disturbance where the bunchgrasses decline. Phase C results from further degradation where bare ground and annuals become codominant with the bunchgrasses. Phase D results from sustained severe ungulate disturbance resulting in loss of bluebunch wheatgrass. Annual vegetation increases with soil displacement in phases C and D. Cryptanthas and blepharipappus are common annual forbs in the AGSP-POSA12-BASA3 plant association.

Management considerations—

Wild ungulates use these steep, southerly slopes heavily before grasses mature in late winter to early spring. The most degraded sites are a result of combined use by elk and cattle in late spring to early summer. If plant vigor is to be maintained, domestic ungulates should not use these sites until after seed maturity. Ungulates can promote germination by trampling the seed into the soil after midsummer.

Relationship to other studies—

Daubenmire (1970) was the first to define AGSP-POSA12 vegetation as a habitat type in eastern Washington; Hall (1973) included AGSP-POSA12-BASA3 vegetation in the “bunchgrass on deep soil, steep slopes” plant community type for the Blue Mountains.

Tisdale (1986) classified an AGSP-POSA12 habitat type in the Snake River canyon in Idaho. Mueggler and Stewart (1980) identified AGSP-POSA12 vegetation in Montana. Johnson and Simon (1987) differentiated AGSP-POSA12 into eight plant associations in the Wallowa Mountains and canyon lands of northeastern Oregon. The AGSP-POSA12-BASA3 plant association has not been previously described. It is similar to the AGSP-POSA12 (basalt) plant association found in the Wallowa Mountains.

Bluebunch wheatgrass-Sandberg's bluegrass-creamy buckwheat plant association

Agropyron spicatum-Poa sandbergii-Eriogonum heracleoides

AGSP-POSA12-ERHE2

GB4124

N = 14



Moore Flat, Wehaha-Tucannon Wilderness, Pomeroy RD, Umatilla NF.

Distribution—

Northern Blue Mountains.

Environmental features—

This plant association occupies ridgetops, shoulders, and upper ridge slopes on basalts. Sampled sites occurred from 2,960 to 6,280 ft (mean 4,673 ft). Slopes were gentle to steep (mean 32 percent) on flat to convex surfaces. Aspects of sampled plots were mostly southerly. Brief soil investigations (n = 5) suggest that soils are rich in coarse fragments, and that bedrock or extremely stoney material occurs between 6 and 20 in of the surface. Herbage production ranged from 310 to 1,630 lb/ac (mean 842 lb/ac).

	Mean	Range
Elevation (feet)	4,673	2,960–6,280
Slope (percent)	32	4–72
Herbage (pounds/acre, n = 10)	842	310–1,630
Aspect (number of plots)	NW (0), NE (1), SE (6), SW (7)	
Lithology	Basalt	
Position	Shoulder, backslope	
Slope shape	Flat, convex	

Ground surface features—

	Phase			A + B range
	B (n = 10)	C (n = 3)	D (n = 1)	
	Cover (%)			
Bare ground	14	28	30	1–25
Bedrock	1	1	1	0–5
Rock	19	20	15	1–45
Gravel	8	0	25	5–15
Pavement	0	1	0	0
Mosses and lichens	7	10	11	0–45
Litter	49	38	20	

Vegetation composition—

Bluebunch wheatgrass and Sandberg's bluegrass occupy steep colluvial slopes and gentle ridgetops with creamy buckwheat. Perennial forbs commonly found are yarrow and western groundsel. Prominent annuals are deerhorn and yellow salsify. Species richness is relatively low in this type.

States and transitions—

Three phases were defined as follows:

- B Combined cover of bluebunch wheatgrass and Sandberg's bluegrass >25 percent; bare ground <25 percent.
- C Combined cover of wheatgrass and Sandberg's bluegrass <25 percent; either bare ground percentage is high (>25 percent) or annual bromes (cheatgrass, hairy brome, Japanese brome) cover is high.
- D Combined cover of bluebunch wheatgrass and Sandberg's bluegrass <5 percent; bare ground >25 percent; high coverage of annual plants (e.g., annuals bromes, tarweed).

These phases are the result of disturbances from wild and domestic ungulates. As ungulate use increases, bare ground increases. No sites were assigned to phase A (hypothetically where bare ground and gravel would total ≤10 percent, and bunchgrasses would have a foliar cover ≥30 percent). Phase B has increased bare ground resulting from ungulate grazing and trampling on the steep, unstable slopes. Phase C results from further degradation where bare ground and annuals become dominant. Phase D results from sustained severe ungulate disturbance resulting in loss of the bunchgrasses, increased bare ground, and a high cover by annuals.

Management considerations—

Wild ungulates use these steep, southerly slopes heavily before grasses mature in late winter to early spring. The most degraded sites are a result of combined use by elk and

Principal species—

Species	Code	Phase			A + B range
		B (n = 10)	C (n = 3)	D (n = 1)	
		Cover (%)/constancy (%)			Cover (%)
Grasses:					
bluebunch wheatgrass	AGSP	28/100	18/100	3/100	20–35
hairy brome	BRCO4	0	20/33	0	0
Japanese brome	BRJA	1/10	10/33	0	0–1
soft brome	BRMO2	0	0	15/100	
cheatgrass	BRTE	2/20	40/33	1/100	0–3
Sandberg's bluegrass	POSA12	8/90	6/100	1/100	0–15
Forbs:					
common yarrow	ACMIL	2/100	4/100	3/100	1–10
deerhorn	CLPU	2/20	3/67	3/100	0–3
creamy buckwheat	ERHE2	14/100	27/100	15/100	5–30
slender tarweed	MAGR3	1/10	5/33	20/100	
western groundsel	SEIN2	5/50	0	0	0–15
yellow salsify	TRDU	1/40	5/67	1/100	0–1

cattle in late spring to early summer. If plant vigor is to be maintained, domestic ungulates should not use these sites until after seed maturity. Northern pocket gophers are prominent inhabitants beneath the soil surface in these communities and contribute to the bare ground in degraded communities.

Relationship to other studies—

Daubenmire (1970) was the first to define AGSP-POSA12 vegetation as a habitat type in eastern Washington. Tisdale (1986) classified an AGSP-POSA12 habitat type in the Snake River canyon in Idaho. Mueggler and Stewart (1980) identified AGSP-POSA12 vegetation in Montana. Johnson and Simon (1987) differentiated AGSP-POSA12 into eight plant associations in the Wallowa Mountains and canyon lands of northeastern Oregon. The AGSP-POSA12-ERHE2 plant association has not been previously described.

Bluebunch wheatgrass-Sandberg's bluegrass-blue mountain milkvetch plant association

Agropyron spicatum-Poa sandbergii-Astragalus reventus

AGSP-POSA12-ASRE5

GB4125

N = 5



Alder Gulch, Pomeroy RD, Umatilla NF.

Distribution—

Northern and central Blue Mountains.

Environmental features—

This plant association occupies shoulders and backslopes on basaltic ridges. Sampled sites occurred from 4,500 to 5,960 ft (mean 5,066 ft). Slopes were moderate (mean 20 percent) with convex shape. Aspects were mostly southerly. Brief soil investigations (n = 5) suggests that soils are rich in coarse fragments and that bedrock or extremely stoney material occurs between 6 and 20 in of the surface. Herbage production ranged from 736 to 1,186 lb/ac (mean 961 lb/ac).

	Mean	Range
Elevation (feet)	5,066	4,500–5,960
Slope (percent)	20	15–25
Herbage (pounds/acre, n = 2)	961	736–1,186
Aspect (number of plots)	NW (0), NE (1), SE (0), SW (4)	
Lithology	Basalt	
Position	Shoulder, backslope	
Slope shape	Convex	

Principal species—

Species	Code	Phase				A + B range
		A (n = 2)	B (n = 1)	C (n = 1)	D (n = 1)	
		Cover (%)/constancy (%)				Cover (%)
Grasses:						
bluebunch wheatgrass	AGSP	32/100	10/100	25/100	3/100	10–35
rattlesnake brome	BRBR7	1/50	0	1/100	0	0–1
hairy brome	BRCO4	10/50	0	3/100	0	0–10
cheatgrass	BRTE	3/50	0	0	0	0–3
Sandberg's bluegrass	POSA12	5/100	0	3/100	10/100	0–5
western needlegrass	STOC2	10/50	0	0	0	0–10
ventenata	VEDU	0	0	0	55/100	0
Forbs:						
common yarrow	ACMIL	2/100	1/100	3/100	5/100	1–10
Blue Mountain milkvetch	ASRE5	12/100	10/100	15/100	10/100	10–15
serrate balsamroot	BASE2	5/50	0	1/100	0	0–5
creamy buckwheat	ERHE2	8/100	3/100	0	0	1–15
western hawkweed	HAL	3/50	0	0	0	0–3
lomatiums	LOMAT	3/50	15/100	3/100	0	0–15
tailcup lupine	LUCA	10/50	1/100	0	0	0–10
narrowleaf skullcap	SCAN3	5/50	0	0	0	0–5
yellow salsify	TRDU	2/100	0	1/100	1/100	0–3

Ground surface features—

	Phase				A + B range
	A (n = 2)	B (n = 1)	C (n = 1)	D (n = 1)	
		Cover (%)			
Bare ground	8	3	30	10	3–10
Bedrock	0	0	0	0	0
Rock	6	20	10	10	3–20
Gravel	0	10	15	3	0–10
Pavement	25	30	0	0	10–40
Mosses and lichens	2	35	16	6	0–30
Litter	33	1	30	70	1–35

Vegetation composition—

Bluebunch wheatgrass and Sandberg's bluegrass are the prominent perennial bunchgrasses. Annual bromes and needlegrass occupy disturbed areas. The type indicator, Blue Mountain milkvetch, is the most prominent perennial forb. Other forbs commonly found are yarrow, creamy buckwheat, lomatiums, tailcup lupine, and yellow salsify.

States and transitions—

Four phases were defined as follows:

- A Combined cover of bluebunch wheatgrass and Sandberg's bluegrass >35 percent.
- B Combined cover of bluebunch wheatgrass and Sandberg's bluegrass <35 percent; bare ground percentage is low (<10 percent).
- C Combined cover of bluebunch wheatgrass and Sandberg's bluegrass <35 percent; bare ground percentage is high (>25 percent).
- D Bluebunch wheatgrass is absent or relict (<5 percent); bare ground >25 percent; cover by annuals is high.

These phases are the result of disturbances from wild and domestic ungulates. As ungulate use increases, bare ground increases. Phase A is the least disturbed with high cover by bunchgrasses. Phase B results from increased ungulate use of the bunchgrasses. Phase C results from further degradation where bare ground becomes dominant. Phase D results from sustained severe ungulate disturbance resulting in loss of bluebunch wheatgrass, increased bare ground, and a high cover by annuals.

Management considerations—

Wild ungulates (especially elk) use these steep, southerly slopes heavily before grasses mature in late winter to early spring. The most degraded sites are a result of combined use by elk and cattle in late spring to early summer. If plant vigor is to be maintained, domestic ungulates should not use these sites until after seed maturity. Ungulates can promote germination by trampling the seed into the soil after mid-summer.

Relationship to other studies—

Daubenmire (1970) was the first to define AGSP-POSA12 vegetation as a habitat type in eastern Washington. Tisdale (1986) classified an AGSP-POSA12 habitat type in the Snake River canyon in Idaho. Mueggler and Stewart (1980) identified AGSP-POSA12 vegetation in Montana. Johnson and Simon (1987) differentiated AGSP-POSA12 into eight plant associations in the Wallowa Mountains and canyon lands of northeastern Oregon. The AGSP-POSA12-ASRE5 plant association has not been previously described.

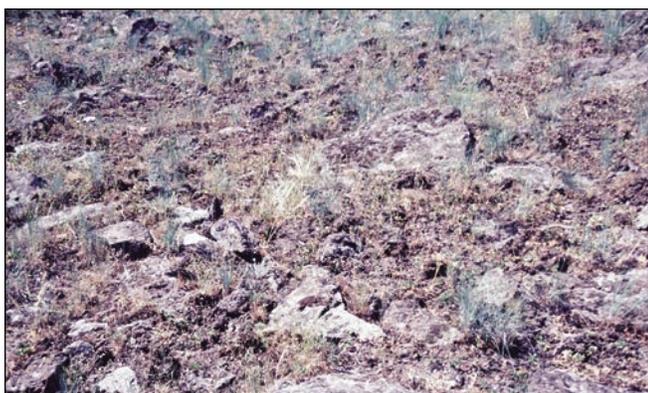
Bluebunch wheatgrass-Sandberg's bluegrass-bighead clover plant association

Agropyron spicatum-Poa sandbergii-Trifolium macrocephalum

AGSP-POSA12-TRMA3

GB4126

N = 4



Near Rager Spring, Paulina RD, Ochoco NF.

Distribution—

Blue and Ochoco Mountains.

Environmental features—

This plant association occupies ridgetop shoulders and backslopes. Sampled sites occurred from 3,460 to 4,000 ft (mean 3,980 ft). This type was found on basalts and andesites. Slopes varied from gentle to steep (mean 27 percent) on convex, undulating, and flat surfaces. Aspects were mostly southwesterly. Soils consisted of about 5 in of gravelly to very gravelly loamy soil over very to extremely gravelly clay loam, with bedrock at a depth of 10 to 20 in. Herbage production ranged from 203 to 620 lb/ac (mean 428 lb/ac).

	Mean	Range
Elevation (feet)	3,980	3,460–4,000
Slope (percent)	27	5–80
Soil pH (n = 3)		6.2–7.0
Soil available water capacity (inches, n = 3)		1–3 (very low to low)
Depth to bedrock or extremely gravelly material (inches, n = 5)		10–20
Herbage (pounds/acre, n = 4)	428	203–620
Aspect (number of plots)	NW (0), NE (1), SE (0), SW (4)	
Lithology	Basalt, andesite	
Position	Shoulder, backslope	
Slope shape	Convex, flat, undulating	

Ground surface features—

	Phase		
	A (n = 2)	B (n = 2)	A + B range
	Cover (%)		
Bare ground	8	11	7–15
Bedrock	4	2	0–5
Rock	36	40	29–50
Gravel	0	8	0–15
Pavement	6	4	0–12
Mosses and lichens	13	23	10–31
Litter	33	1	

Vegetation composition—

Bluebunch wheatgrass and Sandberg's bluegrass are the prominent perennial bunchgrasses. Idaho fescue may occur as an incidental species at low cover. Bottlebrush squirreltail frequently occurs and increases on disturbed areas. Bighead clover is the dominant perennial forb. Other forbs commonly found are yarrow, low pussytoes, creamy buckwheat, phloxes, and lomatiums.

States and transitions—

Three phases were defined as follows:

- A Combined cover of bluebunch wheatgrass and Sandberg's bluegrass >40 percent.
- B Combined cover of bluebunch wheatgrass and Sandberg's bluegrass 20 to 40 percent.

These phases are the result of disturbances from wild and domestic ungulates. As ungulate use increases, the bluebunch wheatgrass declines and bare ground increases. Phase A is the least disturbed with high cover by bunchgrasses. Phase B results from increased ungulate use of the bunchgrasses.

Principal species—

Species	Code	Phase		A + B range
		A (n = 2)	B (n = 2)	
		Cover (%)/constancy (%)		Cover (%)
Grasses:				
bluebunch wheatgrass	AGSP	30/100	16/100	13–30
Idaho fescue	FEID	2/50	1/50	0–2
Sandberg's bluegrass	POSA12	16/100	12/100	3–20
bottlebrush squirreltail	SIHY	1/50	0	0–1
ventenata	VEDU	0	3/50	0–3
Forbs:				
common yarrow	ACMIL	2/100	0	0–3
pale agoseris	AGGL	1/50	1/50	0–1
tapertip onion	ALAC4	1/50	3/50	0–3
low pussytoes	ANDI2	2/100	0	0–2
serrate balsamroot	BASE2	2/50	3/50	0–3
blepharipappus	BLSC	0	10/50	0–10
hawksbeards	CREPI	1/50	0	0–1
creamy buckwheat	ERHE2	10/50	0	0–10
lomatiums	LOMAT	2/100	6/100	1–10
lupines	LUPIN	5/50	1/50	0–5
phlox	PHLOX	8/50	1/50	0–8
bighead clover	TRMA3	8/100	16/100	6–20

Management considerations—

The most degraded sites are a result of combined use by elk and cattle in late spring to early summer. If plant vigor is to be maintained, domestic ungulates should not use these sites until after seed maturity. Ungulates can promote germination by trampling the seed into the soil after mid-summer. Fire is a stimulant to the bunchgrasses. Highly degraded AGSP-POSA12 sites are prime locations for invasive colonization by medusahead (*Elymus caput-medusae*).

Relationship to other studies—

Daubenmire (1970) was the first to define AGSP-POSA12 vegetation as a habitat type in eastern Washington. Hall (1973) included AGSP-POSA12 vegetation in his “bunchgrasses on steep, gentle, deep and shallow” plant community types of the Blue Mountains. Tisdale (1986) classified an AGSP-POSA12 habitat type in the Snake River canyon in Idaho. Mueggler and Stewart (1980) identified AGSP-POSA12 vegetation in Montana. Johnson and Simon (1987) differentiated AGSP-POSA12 into eight plant associations in the Wallowa Mountains and canyon lands of northeastern Oregon. Johnson and Clausnitzer (1992) described the AGSP-POSA12 plant association in the Blue and Ochoco Mountains. The AGSP-POSA12-TRMA3 plant association has not been previously described.

Bluebunch wheatgrass-Sandberg's bluegrass-narrowleaf skullcap plant association

Agropyron spicatum-Poa sandbergii-Scutellaria angustifolia

AGSP-POSA12-SCAN3

GB4112

N = 3



Wenaha River Canyon, Wenaha-Tucannon Wilderness, Pomeroy RD, Umatilla NF.

Distribution—

Northern Blue Mountains.

Environmental features—

This plant association occurs on steep basaltic slopes where shifting gravels make plant occupancy difficult. Sampled sites occurred from 2,000 ft to 4,920 ft (mean 3,070 ft). Slopes were steep (mean 54 percent) on flat surfaces. Aspects were mostly southwesterly. Herbage production ranged from 1,000 to 1,270 lb/ac (mean 1,100 lb/ac). Herbage was among the highest of the bluebunch wheatgrass plant associations owing to the rank growth afforded by low-elevation, warm sites in the Wenaha River canyon.

	Mean	Range
Elevation (feet)	3,070	2,000–4,920
Slope (percent)	54	50–58
Herbage (pounds/acre, n = 3)	1,100	1,000–1,270
Aspect (number of plots)	NW (0), NE (0), SE (1), SW (2)	
Lithology	Basalt	
Position	Steep slopes	
Slope shape	Flat	

Vegetation composition—

Bluebunch wheatgrass is the prominent perennial bunchgrass. Sandberg's bluegrass is usually present at low cover owing to the instability of the site. Skullcap is the indicative forb owing to its ability to anchor in the talus with long rhizomes that extend deep to

Ground surface features—

	Phase A (n = 3)	A + B range
		Cover (%)
Bare ground	5	1–10
Bedrock	1	0–3
Rock	15	10–20
Gravel	33	10–50
Pavement	0	0
Mosses and lichens	1	0–1
Litter	42	25–70

tap subsurface moisture. Other perennial forbs commonly found are yarrow, arrowleaf balsamroot, swale desert-parsley, and large-flowered agoseris. Annuals that thrive on the disturbance are tall annual willowherb and deerhorn.

States and transitions—

Only one phase was identified (phase A). Our sample plots probably approximate the PN of the plot with light grazing impacts.

As these communities degenerate from natural or animal-induced surface movements, bluebunch wheatgrass will decline. Skullcap and deerhorn typically increase as bare ground increases.

Principal species—

Species	Code	Phase A (n = 3)	A + B range
		Cover (%)/ constancy (%)	Cover (%)
Grasses:			
bluebunch wheatgrass	AGSP	37/100	20–65
Sandberg's bluegrass	POSA12	4/67	0–5
Forbs:			
common yarrow	ACMIL	2/67	0–3
large-flowered agoseris	AGGR	2/67	0–3
spreading dogbane	APAN2	3/33	0–3
arrowleaf balsamroot	BASA3	4/67	0–5
deerhorn	CLPU	10/33	0–10
tall annual willowherb	EPPA2	4/100	1–10
swale desert-parsley	LOAM	14/100	1–25
narrowleaf skullcap	SCAN3	5/100	5–5
bighead clover	TRMA3	10/33	0–10

Management considerations—

The most degraded sites are a result of combined use by elk and cattle in late spring to early summer. If plant vigor is to be maintained, domestic ungulates should not use these sites until after seed maturity. Fires do not carry well in these communities owing to lack of fuel. Burns tend to be light in severity.

Relationship to other studies—

Daubenmire (1970) was the first to define AGSP-POSA12 vegetation as a habitat type in eastern Washington. Tisdale (1986) classified an AGSP-POSA12 habitat type in the Snake River canyon in Idaho. Mueggler and Stewart (1980) identified AGSP-POSA12 vegetation in Montana. Johnson and Simon (1987) differentiated AGSP-POSA12 into eight plant associations in the Wallowa Mountains and canyon lands of northeastern Oregon. One of these was the AGSP-POSA12-SCAN3 plant association. The AGSP-POSA12-SCAN3 plant association has not been previously described in the Blue Mountains.

Bluebunch wheatgrass-Sandberg's bluegrass-spreading dogbane plant association

Agropyron spicatum-Poa sandbergii-Apocynum androsaemifolium

AGSP-POSA12-APAN2

GB4127

N = 4



Low Ridge, Wenaha-Tucannon Wilderness, Pomeroy RD, Umatilla NF.

Distribution—

Northern Blue Mountains.

Environmental features—

This plant association occurs on steep basaltic slopes where shifting gravels make plant occupancy difficult. Sampled sites occurred from 3,200 to 3,870 ft (mean 3,493 ft). Slopes varied from moderate to steep (mean 53 percent) on convex and flat surfaces. Aspects were mostly southwesterly. Soil data were not available, but we can infer that soils are high in coarse fragments and have very low to low available water capacity. Herbage production ranged from 700 to 1,250 lb/ac (mean 975 lb/ac).

	Mean	Range
Elevation (feet)	3,493	3,200–3,870
Slope (percent)	53	35–65
Herbage (pounds/acre, n = 2)	975	700–1,250
Aspect (number of plots)	NW (0), NE (0), SE (1), SW (3)	
Lithology	Basalt	
Position	Steep slopes	
Slope shape	Convex, flat	

Vegetation composition—

Bluebunch wheatgrass is the prominent perennial bunchgrass. Sandberg's bluegrass is usually present at low cover owing to the instability of the site. Spreading dogbane is the dominant forb owing to its ability to anchor in the talus with long rhizomes. Other perennial forbs commonly found are yarrow, arrowleaf balsamroot, harsh paintbrush, and silverleaf phacelia. Annuals that thrive on the disturbance are pale allysum, thymeleaf sandwort, cluster tarweed, and cryptanthas.

Ground surface features—

	Phase		A + B range
	B (n = 3)	D (n = 1)	
			Cover (%)
Bare ground	8	30	5–15
Bedrock	1	0	0–1
Rock	17	10	15–20
Gravel	18	45	10–30
Pavement	0	0	0
Mosses and lichens	0	0	0–1
Litter	52	15	40–65

Principal species—

Species	Code	Phase		A + B range
		B (n = 3)	D (n = 1)	
				Cover (%) / constancy (%)
Grasses:				
bluebunch wheatgrass	AGSP	33/100	3/100	30–40
rattlesnake brome	BRBR7	3/33	15/100	0–3
Japanese brome	BRJA	5/33	0	0–5
cheatgrass	BRTE	1/33	25/100	0–1
Sandberg's bluegrass	POSA12	2/100	0	1–3
Forbs:				
common yarrow	ACMIL	2/100	3/100	1–3
pale allysum	ALAL3	0	35/100	0
spreading dogbane	APAN2	18/100	15/100	10–25
thymeleaf sandwort	ARSE2	30/33	0	0–30
arrowleaf balsamroot	BASA3	1/100	1/100	1–3
harsh paintbrush	CAHI9	8/100	1/100	1–20
deerhorn	CLPU	1/67	1/100	0–1
Torrey's cryptantha	CRT04	1/67	3/100	0–1
cluster tarweed	MAGL2	1/33	25/100	0–1
nodding microseris	MINU	1/67	1/100	0–1
silverleaf phacelia	PHHA	1/33	5/100	0–1

States and transitions—

Two phases were defined as follows:

- B Bluebunch wheatgrass cover >30 percent.
- D Bluebunch wheatgrass absent or relict (<5 percent).

These phases are the result of disturbances from wild and domestic ungulates as well as natural slope movement. As disturbances increase, the bunchgrasses decline with an increase in gravels and bare ground. Phase B is the least disturbed with high cover by bluebunch wheatgrass. Phase D results from increased ungulate use of the bunchgrasses and movement of the ground surface owing to animal trampling on the steep, unstable slopes.

Management considerations—

The most degraded sites are a result of use by elk and cattle in late spring to early summer. If plant vigor is to be

maintained, domestic ungulates should not use these sites until after seed maturity. Fires do not carry well in these communities owing to lack of fuel. Burns tend to be light in severity.

Relationship to other studies—

Daubenmire (1970) was the first to define AGSP-POSA12 vegetation as a habitat type in eastern Washington. Tisdale (1986) classified an AGSP-POSA12 habitat type in the Snake

River canyon in Idaho. Mueggler and Stewart (1980) identified AGSP-POSA12 vegetation in Montana. Johnson and Simon (1987) differentiated AGSP-POSA12 into eight plant associations in the Wallowa Mountains and canyon lands of northeastern Oregon. Johnson and Clausnitzer (1992) described the AGSP-POSA12 plant association in the Blue and Ochoco Mountains. The AGSP-POSA12-APAN2 plant association has not been previously described.

Bluebunch wheatgrass-Sandberg's bluegrass-onespike oatgrass plant association

Agropyron spicatum-Poa sandbergii-Danthonia unispicata

AGSP-POSA12-DAUN

GB4911

N = 4



Near Huckleberry Mountain, Walla Walla RD, Umatilla NF.

Distribution—

Blue and Ochoco Mountains.

Environmental features—

This plant association occupies ridgetop summits and plateau flats. Sampled sites occurred from 3,500 to 5,150 ft (mean 4,297 ft). This type was found on basalts and volcanic tuffs. Slopes varied from gentle to moderate (mean 10 percent) on convex and flat surfaces. Aspects were southerly. Soils consisted of about 5 in of gravelly loamy soil over very to extremely gravelly clay loam, with bedrock at a depth of 6 to 20 in. Herbage production ranged from 250 to 548 lb/ac (mean 408 lb/ac).

	Mean	Range
Elevation (feet)	4,297	3,500–5,150
Slope (percent)	10	3–15
Soil pH (n = 2)		6.2–7.0
Soil available water capacity (inches, n = 2)		1–3 (very low to low)
Depth to bedrock or extremely gravelly material (inches, n = 4)		6–20
Herbage (pounds/acre, n = 3)	408	250–548
Aspect (number of plots)	NW (0), NE (0), SE (3), SW (1)	
Lithology	Basalt, tuff	
Position	Summit	
Slope shape	Convex	

Ground surface features—

	Phases B + C (n = 4)
	Cover (%)
Bare ground	14
Bedrock	1
Rock	24
Gravel	8
Pavement	2
Mosses and lichens	9
Litter	28

Vegetation composition—

Bluebunch wheatgrass, Sandberg’s bluegrass, and one-spike oatgrass are the prominent perennial bunchgrasses. The bluegrass and oatgrass occupy shallow soils (scabland) with bluebunch wheatgrass penetrating deeper soils through fractures in the underlying bedrock. Perennial forbs commonly found are yarrow, tapertip onion, serrate balsamroot, scabland fleabane, bighead clover, phloxes, and lomatiums.

Principal species—

Species	Code	Phases B + C (n = 4)
		Cover (%)/constancy (%)
Grasses:		
bluebunch wheatgrass	AGSP	22/100
onespike oatgrass	DAUN	8/100
prairie junegrass	KOCR	5/25
Sandberg’s bluegrass	POSA12	15/100
Forbs:		
common yarrow	ACMIL	2/75
tapertip onion	ALAC4	3/50
fringed onion	ALFI	5/25
basalt milkvetch	ASFI	10/25
serrate balsamroot	BASE2	2/50
western hawksbeard	CROC	5/25
scabland fleabane	ERBL	1/50
dwarf yellow fleabane	ERCH4	1/25
golden buckwheat	ERFL4	3/25
lomatiums	LOMAT	2/100
false agoseris	MITR5	6/25
phloxes	PHLOX	5/50
lanceleaf stonecrop	SELA	7/25
wormleaf stonecrop	SEST2	3/25
bighead clover	TRMA3	8/50

States and transitions—

No phases were defined because of the small sample size and our lack of knowledge of the potential for these sites. All four plots sampled were judged to have some grazing-related degradation. The AGSP-POSA12-DAUN plant association occupies sites with shallow soils overlying fractured bedrock permitting bluebunch wheatgrass to exist. Some of the communities with this composition have resulted from degradation of FEID-AGSP and AGSP-POSA12 sites by severe overgrazing and trampling. Soil loss and compaction make the effects of drought more severe; Idaho fescue can no longer be sustained and bluebunch wheatgrass is reduced, allowing establishment of onespike oatgrass.

Management considerations—

Trampling is the principal cause of degradation in these communities. It reduces the grass-forb-moss/lichen cover and promotes compaction, soil loss, and erosion pavement. Use by livestock has less of an impact after soils have lost moisture saturation from the late winter snowmelt and spring precipitation. Ideally flowering and seed set by the bunchgrasses should have culminated prior to domestic grazing.

Relationship to other studies—

Daubenmire (1970) was the first to define AGSP-POSA12 vegetation as a habitat type in eastern Washington. Hall (1973) included AGSP-POSA12-DAUN vegetation in his “bunchgrasses on gentle slopes and shallow soils” plant community type of the Blue Mountains. Johnson and Clausnitzer (1992) described an AGSP-POSA12-DAUN plant community type in the Blue and Ochoco Mountains. This work now elevates the type to plant association status.

Bluebunch wheatgrass-Sandberg's bluegrass plant association

Agropyron spicatum-Poa sandbergii

AGSP-POSA12

GB4121

N = 29



South Fork of Spring Creek, La Grande RD, Wallowa-Whitman NF.

Distribution—

Blue and Ochoco Mountains.

Environmental features—

This plant association occupies ridgetop shoulders, backslopes, and footslopes. Sampled sites occurred from 2,540 to 5,850 ft (mean 4,153 ft). This type was found on basalts, andesites, and rhyolites. Slopes varied from gentle, moderate, to steep (mean 44 percent) on convex and flat surfaces. Soils consisted of 5 to 10 in of silt loam or loam (usually gravelly), over gravelly to very gravelly clay loam or silty clay loam. Bedrock or extremely gravelly material occurred at a depth of 6 to 30 in, and available water capacity was low or very low. Aspects were mostly southerly. Herbage production ranged from 100 to 1,460 lb/ac (mean 592 lb/ac).

	Mean	Range
Elevation (feet)	4,153	2,540–5,850
Slope (percent)	44	1–80
Soil pH (n = 16)		6.2–7.2
Soil available water capacity (inches, n = 15)		1–4 (very low to low)
Depth to bedrock or extremely gravelly material (inches, n = 22)		6–30
Herbage (pounds/acre, n = 24)	592	100–1,460
Aspect (number of plots)	NW (0), NE (2), SE (11), SW (16)	
Lithology	Basalt, andesite, rhyolite	
Position	Backslope, footslopes, shoulders	
Slope shape	Convex, flat	

Ground surface features—

	Phase				A + B range
	A (n = 8)	B (n = 9)	C (n = 9)	D (n = 3)	
	Cover (%)				
Bare ground	12	11	26	10	1–30
Bedrock	3	1	2	0	0–5
Rock	13	38	18	10	0–60
Gravel	3	8	18	2	1–50
Pavement	7	6	7	3	0–29
Mosses and lichens	7	3	12	5	0–26
Litter	30	32	22	60	20–60

Vegetation composition—

Bluebunch wheatgrass and Sandberg's bluegrass are the prominent perennial bunchgrasses. Annual bromes (especially soft brome and cheatgrass) occupy disturbed areas. Perennial forbs commonly found are yarrow, creamy buckwheat, lomatiums, and yellow salsify. Forbs are scattered or sparse in this plant association.

States and transitions—

Four phases were defined as follows:

- A Combined cover of bluebunch wheatgrass and Sandberg's bluegrass >40 percent.
- B Combined cover of bluebunch wheatgrass and Sandberg's bluegrass 20 to 40 percent.
- C Cover by bare ground or annuals is high (>25 percent).
- D Bluebunch wheatgrass is absent or relict (<5 percent cover); annuals dominate.

Principal species—

Species	Code	Phase				A + B range
		A (n = 8)	B (n = 9)	C (n = 9)	D (n = 3)	
		Cover (%)/constancy (%)				Cover (%)
Shrubs:						
gray rabbitbrush	CHNA2	0	1/22	2/11	2/67	0–1
Grasses:						
bluebunch wheatgrass	AGSP	39/100	21/100	20/100	2/100	15–65
rattlesnake brome	BRBR7	0	2/33	1/11	5/33	0–3
soft brome	BRMO2	0	0	0	25/33	0
cheatgrass	BRTE	0	3/33	3/22	30/67	0–5
medusahead	ELCA13	0	0	0	2/67	0
prairie junegrass	KOCR	8/50	3/11	2/22	0	0–20
Sandberg's bluegrass	POSA12	11/100	6/100	5/100	1/67	1–20
bottlebrush squirreltail	SIHY	1/12	1/11	1/22	10/33	0–1
Forbs:						
common yarrow	ACMIL	2/75	2/78	1/22	1/33	0–5
low pussytoes	ANDI2	1/38	1/11	3/11	0	0–1
serrate balsamroot	BASE2	3/12	2/33	0	1/33	0–3
creamy buckwheat	ERHE2	2/75	2/22	3/11	0	0–3
lomatiums	LOMAT	4/38	5/44	3/56	4/33	0–5
lanceleaf stonecrop	SELA	2/25	2/22	1/11	1/33	0–3
yellow salsify	TRDU	0	1/11	1/22	1/67	0–1

These phases are the result of disturbances from wild and domestic ungulates. As ungulate use increases, the bunchgrasses decline and bare ground increases. Phase A is the least disturbed with high cover by bunchgrasses. Phase B results from increased ungulate use. Phase C results from further degradation where bare ground and annuals become prominent. Phase D results from sustained severe ungulate disturbance resulting in the loss of bluebunch wheatgrass and complete takeover of the site by annual weeds.

Management considerations—

Wild ungulates (especially elk) use these steep, southerly slopes heavily before grasses mature in late winter to early

spring. The most degraded sites are a result of combined use by elk and cattle in late spring to early summer. The southerly slopes, commonly frequented by elk concentrations in early spring when soils are saturated with moisture, are prone to increase of bare ground from trampling. Plant loss from uprooting owing to use by animals and slope movement is especially high at this time. If plant vigor is to be maintained, domestic ungulates should not use these sites until after seed maturity. Ungulates can promote germination by trampling the seed into the soil after midsummer. Highly degraded AGSP-POSA12 sites are prime locations for invasive colonization by yellow starthistle (*Centaurea solstitialis*).

Relationship to other studies—

Daubenmire (1970) was the first to define AGSP-POSA12 vegetation as a habitat type in eastern Washington. Hall (1973) included AGSP-POSA12 vegetation in his “bunchgrasses on steep, gentle, deep and shallow” plant community types of the Blue Mountains. Tisdale (1986) classified an AGSP-POSA12 habitat type in the Snake River canyon in Idaho. Mueggler and Stewart (1980) identified AGSP-POSA12 vegetation in Montana. Johnson and Simon (1987) differentiated AGSP-POSA12 into eight plant associations in the Wallowa Mountains and canyon lands of northeastern Oregon. Johnson and Clausnitzer (1992) described the AGSP-POSA12 plant association in the Blue and Ochoco Mountains.

Bluebunch wheatgrass-mountain brome plant community type

Agropyron spicatum-Bromus carinatus

AGSP-BRCA5

GB4131

N = 2

These plant communities occur in the Blue Mountains on Columbia River basalts at elevations above 4,000 ft. Brief soil investigations suggest a higher moisture-holding capacity than on most sites in the bluebunch wheatgrass series. Bluebunch wheatgrass is the dominant bunchgrass with Sandberg's bluegrass and mountain brome usually associated at lower cover levels. Annual bromes also are

found on disturbed sites within the community. The most prominent are rattlesnake brome and hairy brome. Forbs that are often associated are yarrow, large-flowered agoseris, arrowleaf balsamroot, creamy buckwheat, and Cusick's peavine. The common annual forb that increases with disturbances is blepharipappus.

Bluebunch wheatgrass-sulfur-flower buckwheat plant community type

Agropyron spicatum-Eriogonum umbellatum

AGSP-ERUM

GB4132

N = 3

These plant communities occur in the northern Blue Mountains on Columbia River basalts at elevations above 5,000 ft. The sites are on moderate to steep slopes. Herbage production is low (350 to 600 lb/ac) owing to the rocky-gravelly nature of the sites. Rock-gravel cover ranged from 45 to 75 percent. Because of the instability of these steep slopes, Sandberg's bluegrass is unable to establish. Blue-

bunch wheatgrass is the sole bunchgrass. Plants adapted for hot, dry sites are found with the sulfur-flower buckwheat. These perennials are yarrow, scarlet gilia, mountain monardella, Blue Mountain penstemon, and silverleaf phacelia. The annual plant increasing on disturbed sites in these communities is common cryptantha.

Bluebunch wheatgrass-turpentine cymopterus plant community type

Agropyron spicatum-Cymopterus terebinthinus var. foeniculaceus

AGSP-CYTEF

GB4133

N = 2

These plant communities occur in the northern Blue Mountains on Columbia River basalts at elevations ranging from 3,000 to 5,000 ft. The sites are on steep to moderately steep slopes (mean 55 percent) where rock and gravels dominate. Rock-gravel averaged 60 percent. Owing to the instability of these gravelly slopes, Sandberg's bluegrass was only able

to persist on stable patches behind large rocks. The dominant bunchgrass was bluebunch wheatgrass. Forbs were few. *Cymopterus* dominated with penstemons, lomatiums, and Douglas' knotweed also associated.

Douglas' buckwheat-Sandberg's bluegrass plant community type

Eriogonum douglasii-Poa sandbergii

ERDO-POSA12

FM9111

N = 1

This plant community type occurs on the ridgetops north of the Wallowa Mountains on Columbia River basalts between 4,400 and 5,400 ft elevation. The type was also found in the northern Blue Mountains (near Oregon Butte) on the Wenaha Basalt Formation at 5,300 ft elevation. Erosion pavement dominated (60 percent) over a shallow

soil. The dominant plant was Douglas' buckwheat. Other dry, scabland perennial plants associated were bighead clover, ballhead sandwort, lanceleaf stonecrop, and serrate balsamroot. Bluebunch wheatgrass and Sandberg's bluegrass were low in cover (<5 percent each).

Bulbous bluegrass-cluster tarweed plant community type

Poa bulbosa-Madia glomerata

POBU-MAGL2

GB4411

N = 1

This highly disturbed site was found in the northern Blue Mountains on Columbia River basalts. In 1962, bluebunch wheatgrass and Sandberg's bluegrass were present on the site. By 2003, all vestiges of the bunchgrasses were gone. Now dominating were bulbous

bluegrass (60 percent cover), cluster tarweed (40 percent cover), yarrow (25 percent cover), and mountain brome (10 percent cover). These highly degraded sites occur in the northern Blue Mountains on old domestic sheep driveways and bedding areas.

Onespike oatgrass-slenderfruit lomatium plant association

Danthonia unispicata-*Lomatium leptocarpum*

DAUN-LOLE2

GB9114

N = 9



Near Heister Creek, Paulina RD, Ochoco NF.

	Mean	Range
Elevation (feet)	4,853	4,440–5,670
Slope (percent)	5	0–12
Soil pH (n = 3)		6.0–7.2
Soil available water capacity (inches, n = 3)		0.5–2 (very low)
Depth to bedrock or extremely gravelly material (inches, n = 7)		5–12
Herbage (pounds/acre, n = 2)	325	200–450
Aspect (number of plots)	NW (2), NE (2), SE (2), SW (3)	
Lithology	Basalt, andesite	
Position	Summit	
Slope shape	Flat, convex	

Vegetation composition—

Onespike oatgrass and Sandberg’s bluegrass are the prominent perennial bunchgrasses. The bluegrass and oatgrass occupy shallow soils (scabland) with rushes (primarily slender rush, *Juncus tenuis*) occupying seepage areas of greater moisture abundance. Hummocks are often abundant from frost heaving. Along with the rushes, common camas is frequently found owing to the perched water table in early spring. Other scabland forbs of prominence are serrate balsamroot, lanceleaf stonecrop, bighead clover, and slenderfruit lomatium. Rushes and slenderfruit lomatium are key indicators of this mesic scabland type.

Distribution—

Central Blue and Ochoco Mountains.

Environmental features—

This plant association occupies ridgetop summits and plateau flats. Sampled sites occurred from 4,440 ft to 5,670 ft (mean 4,853 ft). This type was found on basalts and andesites. Slopes were gentle (mean 5 percent) on convex and flat surfaces. All aspects were represented. Soils consisted of cobbly to very cobbly loamy or clay loamy material just 5 to 12 in thick, over bedrock. These soils are often saturated in spring owing to perching of water over bedrock and clay, but their capacity to store water is very low. Herbage production ranged from 200 to 450 lb/ac (mean 325 lb/ac).

Ground surface features—

	Phase						A + B range
	A (n = 2)	B (n = 2)	C1 (n = 1)	C2 (n = 1)	D1 (n = 2)	D2 (n = 1)	
	Cover (%)						
Bare ground	15	22	1	—	0	50	5–39
Bedrock	0	1	0	—	0	0	0–2
Rock	12	28	5	—	22	3	5–50
Gravel	10	2	0	—	0	5	0–20
Pavement	2	0	0	—	0	5	0–5
Mosses and lichens	19	12	36	—	30	25	2–35
Litter	38	1	1	—	42	1	

— = no data.

Principal species—

Species	Code	Phase						A + B range
		A (n = 2)	B (n = 2)	C1 (n = 1)	C2 (n = 1)	D1 (n = 2)	D2 (n = 1)	
		<i>Cover (%) / constancy (%)</i>						<i>Cover (%)</i>
Grasses:								
onespike oatgrass	DAUN	68/100	22/100	45/100	5/100	35/100	0	20–70
bulbous bluegrass	POBU	0	0	0	0	0	30/100	0
Sandberg's bluegrass	POSA12	3/100	15/100	5/100	15/100	2/100	10/100	1–20
bottlebrush squirreltail	SIHYH	2/100	0	0	0	0	0	0–3
western needlegrass	STOC2	0	0	0	5/100	0	15/100	0
ventenata	VEDU	0	1/50	20/100	0	30/100	0	0–1
Grasslikes:								
rushes	JUNCU	1/50	1/100	1/100	0	1/100	0	0–1
Forbs:								
agoseric	AGOSE	1/50	1/50	1/100	1/100	1/50	1/100	0–1
serrate balsamroot	BASE2	9/100	1/50	0	0	1/50	1/100	0–15
common camas	CAQU2	15/50	2/100	3/100	1/100	0	3/100	0–15
slenderfruit lomatium	LOLE2	6/100	5/50	3/100	10/100	1/50	1/100	0–10
lomatiums	LOMAT	0	8/50	0	0	1/50	0	0–7
slender tarweed	MAGR3	0	0	0	0	5/50	0	0
western burnet	SAOC2	0	1/50	1/100	1/100	0	10/100	0–1
lanceleaf stonecrop	SELA	1/100	3/50	0	3/100	0	0	0–3
bighead clover	TRMA3	5/50	20/50	0	5/100	1/100	1/100	0–20

States and transitions—

Six phases were defined:

- A Onespike oatgrass cover >50 percent; Sandberg's bluegrass subordinate to oatgrass.
- B Oatgrass and bluegrass cover total 30 to 50 percent; bluegrass and oatgrass codominant.
- C1 Oatgrass dominant; ventenata invasive.
- C2 Oatgrass and bluegrass cover total <30 percent; perennial forbs dominant.
- D1 Oatgrass dominant; bluegrass relict to absent; ventenata invasive.
- D2 Oatgrass relict to absent; bulbous bluegrass and western needlegrass invasive.

The phases are based on the dominance of onespike oatgrass when moisture is abundant and retained during the summer months to support it (phase A), the emergence of Sandberg's bluegrass as the site loses its ability to retain adequate moisture for oatgrass (phase B), the decrease of both bunchgrasses as site deterioration continues (phase C), and the loss of the bunchgrasses as the site loses its ability to sustain them (phase D). Transition from phase A to B and so forth is due primarily to grazing ungulates when soils are saturated and the community is most vulnerable.

Management considerations—

Trampling and use of the early greening bluegrass in late winter to early spring are the primary causes of site degradation in this plant association. Elk and deer use can reduce the grass-rock-moss/lichen cover and promote compaction, soil loss, erosion pavement, and increased bare ground. Use by livestock has less of an impact after soils have lost moisture saturation from the late winter snowmelt and spring precipitation. Ideally flowering and seed set by the bunchgrasses should have culminated prior to the onset of domestic grazing. When the cover by grass, mosses, and lichens is reduced and bare ground is exposed, ventenata, bulbous bluegrass, and western needlegrass readily colonize.

Relationship to other studies—

Hall (1973) described this vegetation as part of his "bluegrass scabland plant community type" in the Blue Mountains. Volland (1976) also described "bluegrass scabland plant community type" on the pumice of central Oregon with similar characteristics. Johnson and Simon (1987) incorporated this more mesic vegetation type into their POSA12-DAUN plant association in the Wallowa Mountains of northeast Oregon. Johnson and Clausnitzer (1992) retained the DAUN-LOLE2 vegetation as part of POSA12-DAUN for the Blue and Ochoco Mountains. This work differentiates the more mesic DAUN-LOLE2 as a plant association for the Blue and Ochoco Mountains.

Sandberg's bluegrass-onespike oatgrass plant association

Poa sandbergii-*Danthonia unispicata*

POSA12-DAUN

GB9111

N = 13



Fred Hall



Fred Hall

Above Cougar Canyon, La Grande RD, Wallowa-Whitman NF.

Distribution—

Blue and Ochoco Mountains.

Environmental features—

This plant association occupies scabland ridgetops and shoulders as well as plateau flats. Sampled sites occurred from 3,800 to 6,950 ft (mean 5,157 ft). This type was found on basalts and andesites. Slopes were gentle (mean 6 percent) on convex and flat surfaces. All aspects were represented. Soils consisted of cobbly to very cobbly loamy or clay loamy material just 4 to 10 in thick, over bedrock. These soils are often saturated in spring owing to perching of water over bedrock and clay, but their capacity to store water is very low. Herbage production ranged from 45 to 486 lb/ac (mean 184 lb/ac).

	Mean	Range
Elevation (feet)	5,157	3,800–6,950
Slope (percent)	6	1–15
Soil pH (n = 9)		6.0–7.0
Soil available water capacity (inches, n = 7)		0.5–1.5 (very low)
Depth to bedrock or extremely gravelly material (inches, n = 7)		4–10
Herbage (pounds/acre, n = 11)	184	45–486
Aspect (number of plots)	NW (1), NE (2), SE (6), SW (4)	
Lithology	Basalt, andesite	
Position	Summit, shoulder	
Slope shape	Convex, flat	

Ground surface features—

	Phase			A + B range
	A (n = 2)	B (n = 3)	D (n = 8)	
	Cover (%)			
Bare ground	14	23	35	7–38
Bedrock	2	1	1	0–3
Rock	20	22	16	5–35
Gravel	0	3	6	0–10
Pavement	0	2	11	0–5
Mosses and lichens	40	20	10	20–60
Litter	24	5	21	

Vegetation composition—

Onespike oatgrass and Sandberg's bluegrass occupy shallow soils over impervious, nonfractured bedrock. Bottlebrush squirreltail is the other bunchgrass that frequently occurs at low coverage. Scabland forbs of prominence are yarrow, low pussytoes, serrate balsamroot, stonecrops, and lomatiums.

States and transitions—

Four phases were defined:

- A—Sandberg's bluegrass, onespike oatgrass, and moss cover total >75 percent.
- B—Sandberg's bluegrass, onespike oatgrass, and moss cover total 50 to 75 percent.
- D—Sandberg's bluegrass, onespike oatgrass, and moss cover total <50 percent; DAUN relict to absent.

Phase A is based on the dominance of Sandberg's bluegrass and onespike oatgrass with high moss cover retarding soil desiccation during the summer months. As surface disturbance increases from ungulate trampling, bare ground

Principal species—

Species	Code	Phase			A + B range
		A (n = 2)	B (n = 3)	D (n = 8)	
		Cover (%)/constancy (%)			Cover (%)
Grasses:					
onespike oatgrass	DAUN	32/100	15/67	1/50	0–60
Sandberg's bluegrass	POSA12	19/100	22/100	11/100	3–35
bottlebrush squirreltail	SIHYH	0	1/67	2/50	0–1
western needlegrass	STOC2	0	7/33	3/12	0–7
Forbs:					
common yarrow	ACMIL	2/100	2/100	3/50	1–3
low pussytoes	ANDI2	0	3/67	6/50	0–3
serrate balsamroot	BASE2	0	10/67	13/38	0–20
lomatiums	LOMAT	1/100	4/67	8/60	0–5
stonecrops	SEDUM	2/50	4/100	2/50	0–10
bighead clover	TRMA3	0	0	16/25	0

increases, soil loss occurs, and bunchgrasses become “pedestalled” with a resultant decline in the bunchgrass and moss cover (phase B). In phase D, the bunchgrasses can no longer survive the drought of the hot, dry summer months. They are relict as the plant-moss-rock matrix is lost to bare ground dominance from ungulate trampling in the saturated soil period of the year.

Management considerations—

Trampling and use of the early greening bluegrass in late winter to early spring are the primary causes of site degradation in this plant association. Elk and deer use can reduce the grass-rock-moss/lichen cover and promote compaction, soil loss, erosion pavement, and increased bare ground. Use by livestock has less of an impact after soils have lost moisture saturation from the late winter snow-melt and spring precipitation. Ideally flowering and seed set by the bunchgrasses should have culminated prior to domestic grazing. When the cover by grass, mosses, and lichens is reduced and bare ground is exposed, these sites may be irreparably damaged.

Relationship to other studies—

Hall (1973) described this vegetation as part of his “bluegrass scabland plant community type” in the Blue Mountains. Volland (1976) also described “bluegrass scabland plant community type” on the pumice of central Oregon with similar characteristics. Johnson and Simon (1987) described a POSA12-DAUN plant association in the Wallowa Mountains of northeast Oregon. Johnson and Clausnitzer (1992) also classified a POSA12-DAUN plant association for the Blue and Ochoco Mountains.

Glossary

andesite—A fine-grained igneous rock of intermediate composition between rhyolite and basalt.

argillite—A sedimentary rock resembling shale but hardened by heat, pressure, or chemical cementing agents.

ash (volcanic)—Fine-grained material deposited from volcanic eruption by airfall.

aspect (slope)—The horizontal direction that a slope faces, usually expressed in a compass azimuth or cardinal direction.

basalt—A dark-colored, fine-grained igneous rock rich in magnesium and iron.

batholith—A large body of intruded igneous rock.

bunchgrass—A grass (member of the family Poaceae) with tufted growth form, as opposed to a sod-forming grass.

climax (community)—The stable community, in an ecological succession, that is able to reproduce itself indefinitely under existing environmental conditions in the absence of disturbance. The final stage of succession.

climax (species)—Species that are self-perpetuating in the absence of disturbance.

colluvium—Unconsolidated earth material deposited on or at the base of slopes by mass wasting (direct gravitational action) or local unconcentrated runoff.

constancy—The percentage of plots on which the species occurred in the sampled population.

cover—The percentage of ground area included in a vertical projection of individual plant canopies by a given species.

disclimax—A stable community that differs from the theoretical climax for the site as a result of ongoing disturbance or severe disturbance in the past followed by invasion of exotic species.

dominant—A plant or group of plants which by their collective size, mass, or number exert the most influence on other components of the ecosystem.

forb—A herbaceous plant other than a sedge, grass, or other plant with similar grasslike foliage.

graminoid—An herbaceous grass or grasslike plant.

granite—A coarse-grained igneous rock rich in quartz, feldspar, and mica.

grass—A plant of the family Poaceae (formerly Gramineae), characterized by jointed stems, sheathing leaves, flower spikelets, and fruit consisting of a seedlike grain or caryopsis.

grassland—vegetation dominated by grasses (Poaceae) and lacking either a tree or shrub cover of 10 percent or more.

graywacke—A sandstone rich in feldspar or rock fragments.

habitat type—An aggregation of all land areas capable of supporting similar plant associations at climax.

herb—A plant that dies back to the ground surface each year.

igneous rock—A rock formed by the eruption or subsurface intrusion of molten rock.

indicator species—A plant species that is sensitive to environmental features of a site and has a high fidelity and constancy to a type.

layer (vegetation)—A plant physiognomic level such as overstory tree or shrub.

lithology—Rock type.

loess—Fine-grained, wind-deposited material predominantly of silt-sized particles.

metasedimentary—Sedimentary rock that has been altered by heat and pressure.

noncalcareous—Soil or sediment that lacks measurable quantities of calcium carbonate.

perching—Water pooling over impenetrable rock or soil layer.

phase (plant community)—A plant community, often one of several, that is an identifiable component of a state. Transitions between phases within a state are readily reversible.

plant association—A unit of vegetation classification based on the projected late-seral community. Plant associations have a characteristic range in species composition, specific diagnostic species, and a defined range in habitat conditions, physiognomy, and structure.

plant community—An assemblage of plants living together and interacting among themselves in a common spatial arrangement.

plant community type—An aggregation of all plant communities with similar structure and floristic composition placed in a classification unit.

rhyolite—A fine-grained igneous rock rich in silica.

savanna—A type of vegetation in which widely spaced trees are scattered over a landscape otherwise covered by low-growing plants.

sedimentary rock—A rock formed by deposition of particles in the air or water or by precipitation from solution in surface bodies of water.

seral—A stage of temporary communities in a successional sequence.

series—An aggregation of taxonomically related plant communities that takes the name of the climax species that dominates the uppermost layer.

shale—A sedimentary rock composed of small (silt- and clay-sized) particles.

shrubland—vegetation where total canopy cover of shrubs is 10 percent or more and tree cover is less than 10 percent.

state—A recognizable, resilient complex of soil and vegetation. One or more vegetation communities (phases), connected by reversible transitions, may occur within a state. Transitions between states involve crossing ecologic thresholds and are typically difficult to reverse.

succession—The change in species composition resulting from the replacement of one community with another, driven by internal processes in the ecosystem such as plant competition and soil development.

transition—Change in ecosystems between states or phases, driven by natural events such as succession or by management actions such as grazing or seeding.

tuff—An igneous rock composed of volcanic ash and other volcanic material deposited by airfall.

ultramafic—Refers to rock that is very high in magnesium and iron; examples are serpentinite and peridotite.

ungulate—Cloven-hoofed animal.

zone—A geographic area of uniform macroclimate where the plant associations share the same dominant species.

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Metric and English Equivalents

When you know:	Multiply by:	To find:
Inches (in)	2.54	Centimeters (cm)
Inches (in)	.254	Decimeters (dm)
Feet (ft)	.3048	Meters (m)
Miles (mi)	1.609	Kilometers (km)
Square feet (ft ²)	.093	Square meters (m ²)
Acres (ac)	.405	Hectares (ha)
Pounds (lb)	.454	Kilograms (kg)
Pounds per acre (lb/ac)	1.12	Kilograms per hectare (kg/ha)

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Appendix A: Plants Listed by Life Form and Scientific Name

Scientific name ¹	PLANTS code ²	R6 code ³	Common name
Trees:			
<i>Abies lasiocarpa</i>	ABLA	ABLA2	Subalpine fir
<i>Juniperus occidentalis</i>	JUOC	JUOC	Western juniper
<i>Pinus albicaulis</i>	PIAL	PIAL	Whitebark pine
<i>Pinus contorta</i>	PICO	PICO	Lodgepole pine
<i>Pinus ponderosa</i>	PIPO	PIPO	Ponderosa pine
<i>Pseudotsuga menziesii</i>	PSME	PSME	Douglas-fir
Shrubs:			
<i>Amelanchier alnifolia</i>	AMAL2	AMAL	Western serviceberry
<i>Artemisia arbuscula</i>	ARAR8	ARAR	Low sagebrush
<i>Artemisia rigida</i>	ARRI2	ARRI	Stiff sagebrush
<i>Artemisia tridentata</i> var. <i>vaseyana</i>	ARTRV	ARTRV	Mountain big sagebrush
<i>Artemisia tripartita</i>	ARTR4	ARTR2	Threetip sagebrush
<i>Berberis repens</i>	BERE	BERE	Creeping Oregon grape
<i>Ceanothus velutinus</i>	CEVE	CEVE	Snowbrush ceanothus
<i>Cercocarpus ledifolius</i>	CELE3	CELE	Curleaf mountain mahogany
<i>Chrysothamnus nauseosus</i>	CHNA2	CHNA	Gray rabbitbrush
<i>Chrysothamnus nauseosus</i> var. <i>nanus</i>	CHNAN2	CHNAN	Gray rabbitbrush
<i>Chrysothamnus viscidiflorus</i>	CHVI8	CHVI	Green rabbitbrush
<i>Holodiscus discolor</i>	HODI	HODI	Creambush ocean-spray
<i>Leptodactylon pungens</i>	LEPU	LEPU2	Leptodactylon
<i>Peraphyllum ramosissimum</i>	PERA4	PERA3	Squaw apple
<i>Philadelphus lewisii</i>	PHLE4	PHLE2	Lewis' mock-orange
<i>Physocarpus malvaceus</i>	PHMA5	PHMA	Mallow ninebark
<i>Prunus</i>	PRUNU	PRUNU	Cherry
<i>Prunus virginiana</i>	PRVI	PRVI	Common chokecherry
<i>Purshia tridentata</i>	PUTR2	PUTR	Bitterbrush
<i>Rhamnus purshiana</i>	RHPU	RHPU	Cascara
<i>Ribes</i>	RIBES	RIBES	Currant or gooseberry
<i>Ribes aureum</i>	RIAU	RIAU	Golden currant
<i>Ribes cereum</i>	RICE	RICE	Wax currant
<i>Ribes montigenum</i>	RIMO2	RIMO	Mountain gooseberry
<i>Ribes viscosissimum</i>	RIVI3	RIVI	Sticky currant
<i>Rosa</i>	ROSA5	ROSA	Rose
<i>Rosa gymnocarpa</i>	ROGY	ROGY	Baldhip rose
<i>Rosa nutkana</i>	RONU	RONU	Nootka rose
<i>Sambucus cerulea</i>	SACE3	SACE	Blue elderberry
<i>Spiraea betulifolia</i>	SPBE2	SPBE	Birchleaf spiraea
<i>Symphoricarpos albus</i>	SYAL	SYAL	Common snowberry
<i>Symphoricarpos oreophilus</i>	SYOR2	SYOR	Mountain snowberry
<i>Tetradymia canescens</i>	TECA2	TECA	Gray horsebrush
<i>Tetradymia glabrata</i>	TEGL	TEGL	Littleleaf horsebrush
Grasses:			
<i>Agropyron cristatum</i>	AGCR	AGCR	Crested wheatgrass
<i>Agropyron intermedium</i>	AGIN2	AGIN2	Intermediate wheatgrass
<i>Agropyron spicatum</i>	AGSP	AGSP	Bluebunch wheatgrass
<i>Agropyron trichophorum</i>	AGTR6	AGTR2	Pubescent wheatgrass
<i>Agrostis</i>	AGROS2	AGROS	Bentgrass
<i>Agrostis exarata</i>	AGEX	AGEX	Spike bentgrass
<i>Agrostis interrupta</i>	AGIN4	AGIN3	Interrupted bentgrass
<i>Alopecurus pratensis</i>	ALPR3	ALPR	Meadow foxtail
<i>Bromus</i>	BROMU	BROMU	Brome

Scientific name ¹	PLANTS code ²	R6 code ³	Common name
<i>Bromus brizaeformis</i>	BRBR7	BRBR	Rattlesnake brome
<i>Bromus carinatus</i>	BRCA5	BRCA	Mountain brome
<i>Bromus commutatus</i>	BRCO4	BRCO	Hairy brome
<i>Bromus inermis</i>	BRIN2	BRIN	Smooth brome
<i>Bromus japonicus</i>	BRJA	BRJA	Japanese brome
<i>Bromus mollis</i>	BRMO2	BRMO	Soft brome
<i>Bromus secalinus</i>	BRSE	BRSE	Ryebrome
<i>Bromus tectorum</i>	BRTE	BRTE	Cheatgrass
<i>Calamagrostis</i>	CALAM	CALAM	Reedgrass or pinegrass
<i>Calamagrostis rubescens</i>	CARU	CARU	Pinegrass
<i>Dactylis glomerata</i>	DAGL	DAGL	Orchardgrass
<i>Danthonia</i>	DANTH	DANTH	Oatgrass
<i>Danthonia californica</i>	DACA3	DACA	California oatgrass
<i>Danthonia unispicata</i>	DAUN	DAUN	Onespike oatgrass
<i>Deschampsia danthonioides</i>	DEDA	DEDA	Annual hairgrass
<i>Elymus caput-medusae</i>	ELCA13	ELCA2	Medusahead
<i>Elymus cinereus</i>	ELCI2	ELCI	Basin wildrye
<i>Elymus glaucus</i>	ELGL	ELGL	Blue wildrye
<i>Festuca bromoides</i>	FEBR4	FEBR	Brome fescue
<i>Festuca idahoensis</i>	FEID	FEID	Idaho fescue
<i>Festuca megalura</i>	FEME	FEME	Foxtail fescue
<i>Festuca microstachys</i>	FEMI2	FEMI	Small fescue
<i>Festuca myuros</i>	FEMY2	FEMY	Rat-tail fescue
<i>Festuca ovina</i>	FEOV	FEOV	Sheep fescue
<i>Festuca ovina</i> var. <i>rydbergii</i>	FEOVR	FEOVR	Sheep fescue
<i>Festuca viridula</i>	FEVI	FEVI	Green fescue
<i>Hordeum jubatum</i>	HOJU	HOJU	Foxtail barley
<i>Koeleria cristata</i>	KOCR	KOCR	Prairie junegrass
<i>Melica</i>	MELIC	MELIC	Oniongrass
<i>Melica bulbosa</i>	MEBU	MEBU	Oniongrass
<i>Melica fugax</i>	MEFU	MEFU	Little oniongrass
<i>Melica spectabilis</i>	MESP	MESP	Showy oniongrass
<i>Muhlenbergia mexicana</i>	MUME2	MUME	Wirestem muhly
<i>Oryzopsis webberi</i>	ORWE	ORWE	Webber's ricegrass
<i>Phleum pratense</i>	PHPR3	PHPR	Common timothy
<i>Poa</i>	POA	POA	Bluegrass
<i>Poa bulbosa</i>	POBU	POBU	Bulbous bluegrass
<i>Poa cusickii</i>	POCU3	POCU	Cusick's bluegrass
<i>Poa cusickii</i> var. <i>cusickii</i>	POCUC4	POCUC	Cusick's bluegrass
<i>Poa nervosa</i>	PONE2	PONE	Wheeler's bluegrass
<i>Poa nervosa</i> var. <i>wheeleri</i>	PONEW	PONEW	Wheeler's bluegrass
<i>Poa pratensis</i>	POPR	POPR	Kentucky bluegrass
<i>Poa sandbergii</i>	POSA12	POSA3	Sandberg's bluegrass
<i>Poa scabrella</i>	POSC	POSC	Pine bluegrass
<i>Poa secunda</i>	POSE	POSE	Sandberg's bluegrass
<i>Poa secunda</i> var. <i>juncifolia</i>	POSEJ	POSEJ	Alkali bluegrass
<i>Poa vaseyochloa</i>	POVA	POVA	Leiberg's bluegrass
<i>Sitanion hystrix</i>	SIHY	SIHY	Bottlebrush squirreltail
<i>Sitanion hystrix</i> var. <i>hordeoides</i>	SIHYH	SIHYH	Bottlebrush squirreltail
<i>Sitanion jubatum</i>	SIJU	SIJU	Big squirreltail
<i>Stipa</i>	STIPA	STIPA	Needlegrass
<i>Stipa lemmonii</i>	STLE2	STLE2	Lemmon's needlegrass
<i>Stipa lettermanii</i>	STLE4	STLE	Letterman's needlegrass
<i>Stipa occidentalis</i>	STOC2	STOC	Western needlegrass
<i>Stipa occidentalis</i> var. <i>occidentalis</i>	STOC2	STOCO	Western needlegrass

Scientific name ¹	PLANTS code ²	R6 code ³	Common name
<i>Stipa thurberiana</i>	STTH2	STTH	Thurber's needlegrass
<i>Ventenata dubia</i>	VEDU	VEDU	Ventenata
Sedges and rushes:			
<i>Carex</i>	CAREX	CAREX	Sedge
<i>Carex eurycarpa</i>	CAEU2	CAEU	Widefruit sedge
<i>Carex filifolia</i>	CAFI	CAFI	Threadleaf sedge
<i>Carex geyeri</i>	CAGE2	CAGE	Elk sedge
<i>Carex hoodii</i>	CAHO5	CAHO	Hood's sedge
<i>Carex multicosata</i>	CAMU6	CAMU	Many-ribbed sedge
<i>Carex phaeocephala</i>	CAPH2	CAPH	Dunhead sedge
<i>Carex praeegracilis</i>	CAPR5	CAPR5	Clustered field sedge
<i>Carex pyrenaica</i>	CAPY3	CAPY	Pyrenaean sedge
<i>Carex raynoldsii</i>	CARA6	CARA	Raynolds' sedge
<i>Carex rossii</i>	CARO5	CARO	Ross' sedge
<i>Juncus</i>	JUNCU	JUNCU	Rush
<i>Juncus balticus</i>	JUBA	JUBA	Baltic rush
<i>Juncus confusus</i>	JUCO2	JUCO	Colorado rush
<i>Juncus drummondii</i>	JUDR	JUDR	Drummond's rush
<i>Juncus parryi</i>	JUPA	JUPA	Parry's rush
<i>Juncus tenuis</i>	JUTE	JUTE	Slender rush
<i>Juncus tenuis</i> var. <i>tenuis</i>	JUTE	JUTET	Slender rush
Forbs:			
<i>Achillea millefolium</i> var. <i>lanulosa</i>	ACMIL	ACMIL	Common yarrow
<i>Agastache urticifolia</i>	AGUR	AGUR	Nettleleaf horsemint
<i>Agoseris</i>	AGOSE	AGOSE	Agoseris
<i>Agoseris glauca</i>	AGGL	AGGL	Pale agoseris
<i>Agoseris glauca</i> var. <i>laciniata</i>	AGGLL	AGGLL	Pale agoseris
<i>Agoseris grandiflora</i>	AGGR	AGGR	Large-flowered agoseris
<i>Agoseris heterophylla</i>	AGHE2	AGHE	Annual agoseris
<i>Allium</i>	ALLIU	ALLIU	Wild onion
<i>Allium acuminatum</i>	ALAC4	ALAC	Tapertip onion
<i>Allium brandegei</i>	ALBR	ALBR	Brandegee's onion
<i>Allium fibrillum</i>	ALFI	ALFI	Fringed onion
<i>Allium tolmiei</i>	ALTO	ALTO	Tolm's onion
<i>Alyssum alyssoides</i>	ALAL3	ALAL	Pale alyssum
<i>Amsinckia</i>	AMSIN	AMSIN	Fiddleneck
<i>Amsinckia retrorsa</i>	AMRE2	AMRE2	Rigid fiddleneck
<i>Amsinckia tessellata</i>	AMTE3	AMTE	Bristly fiddleneck
<i>Angelica arguta</i>	ANAR3	ANAR2	Sharptooth angelica
<i>Antennaria</i>	ANTEN	ANTEN	Pussytoes
<i>Antennaria alpina</i>	ANAL4	ANAL	Alpine pussytoes
<i>Antennaria anaphaloides</i>	ANAN2	ANAN	Tall pussytoes
<i>Antennaria dimorpha</i>	ANDI2	ANDI	Low pussytoes
<i>Antennaria luzuloides</i>	ANLU2	ANLU	Woodrush pussytoes
<i>Antennaria microphylla</i>	ANMI3	ANMI2	Rosy pussytoes
<i>Antennaria rosea</i>	ANRO2	ANRO	Rosy pussytoes
<i>Antennaria stenophylla</i>	ANST2	ANST	Narrowleaf pussytoes
<i>Antennaria umbrinella</i>	ANUM	ANUM	Brown pussytoes
<i>Anthriscus scandicina</i>	ANSC8	ANSC2	Chervil
<i>Apocynum androsaemifolium</i>	APAN2	APAN	Spreading dogbane
<i>Apocynum androsaemifolium</i> var. <i>pumilum</i>	APANP	APANP	Spreading dogbane
<i>Arabis</i>	ARABI2	ARABI	Rockcross
<i>Arabis aculeolata</i>	ARAC4	ARAC	Wall rockcross
<i>Arabis hirsuta</i>	ARHI	ARHI	Hairy rockcross

Scientific name ¹	PLANTS code ²	R6 code ³	Common name
<i>Arabis holboellii</i>	ARHO2	ARHO	Holboell's rockcress
<i>Arabis holboellii</i> var. <i>retrofracta</i>	ARHOR	ARHOR	Holboell's rockcress
<i>Arabis perelegans</i>	ARPE11	ARPE	Hairystem rockcress
<i>Arabis sparsiflora</i>	ARSP	ARSP2	Elegant rockcress
<i>Arenaria</i>	ARENA	ARENA	Sandwort
<i>Arenaria aculeata</i>	ARAC2	ARAC2	Prickly sandwort
<i>Arenaria capillaris</i>	ARCA7	ARCA2	Threadleaf sandwort
<i>Arenaria congesta</i>	ARCO5	ARCO2	Ballhead sandwort
<i>Arenaria macrophylla</i>	ARMA18	ARMA3	Bigleaf sandwort
<i>Arenaria nuttallii</i> var. <i>fragilis</i>	ARNUF	ARNUF	Nuttall's sandwort
<i>Arenaria serpyllifolia</i>	ARSE2	ARSE	Thymeleaf sandwort
<i>Arnica cordifolia</i>	ARCO9	ARCO	Heartleaf arnica
<i>Arnica fulgens</i>	ARFU3	ARFU	Orange arnica
<i>Arnica sororia</i>	ARSO2	ARSO	Twin arnica
<i>Artemisia ludoviciana</i>	ARLU	ARLU	Western mugwort
<i>Asclepias fascicularis</i>	ASFA	ASFA2	Mexican milkweed
<i>Aspidotis densa</i>	ASDE6	ASDE	Podfern
<i>Aster</i>	ASTER	ASTER	Aster
<i>Aster alpigenus</i> var. <i>haydenii</i>	ASALH2	ASALH	Alpine aster
<i>Aster conspicuus</i>	ASCO3	ASCO	Showy aster
<i>Aster integrifolius</i>	ASIN3	ASIN	Thickstem aster
<i>Astragalus</i>	ASTRA	ASTRA	Locoweed or milkvetch
<i>Astragalus conjunctus</i>	ASCO11	ASCO3	Stiff milkvetch
<i>Astragalus filipes</i>	ASFI	ASFI	Basalt milkvetch
<i>Astragalus purshii</i>	ASPU9	ASPU	Woollypod milkvetch
<i>Astragalus purshii</i> var. <i>lagopinus</i>	ASPUL	ASPUL	Woollypod milkvetch
<i>Astragalus reventus</i>	ASRE5	ASRE	Blue Mountain milkvetch
<i>Astragalus reventus</i> var. <i>reventus</i>	ASRE5	ASRER	Longleaf milkvetch
<i>Astragalus reventus</i> var. <i>sheldonii</i>	ASRES	ASRES	Sheldon's milkvetch
<i>Astragalus whitneyi</i>	ASWH	ASWH	Balloon milkvetch
<i>Astragalus whitneyi</i> var. <i>sonneanus</i>	ASWHS2	ASWHS	Balloon milkvetch
<i>Balsamorhiza</i>	BALSA	BALSA	Balsamroot
<i>Balsamorhiza hirsuta</i>	BAHI	BAHI	Hairy balsamroot
<i>Balsamorhiza incana</i>	BAIN	BAIN	Hoary balsamroot
<i>Balsamorhiza sagittata</i>	BASA3	BASA	Arrowleaf balsamroot
<i>Balsamorhiza serrata</i>	BASE2	BASE	Serrate balsamroot
<i>Besseya rubra</i>	BERU	BERU	Red besseya
<i>Blepharipappus scaber</i>	BLSC	BLSC	Blepharipappus
<i>Brassica hirta</i>	BRHI2	BRHI	White mustard
<i>Brodiaea</i>	BRODI	BRODI	Brodiaea
<i>Brodiaea douglasii</i>	BRDO	BRDO	Douglas' brodiea
<i>Calochortus</i>	CALOC	CALOC	Sego lily
<i>Calochortus eurycarpus</i>	CAEU	CAEU2	Wide fruit mariposa
<i>Calochortus macrocarpus</i>	CAMA5	CAMA	Sagebrush mariposa
<i>Camassia</i>	CAMAS	CAMAS	Camas
<i>Camassia cusickii</i>	CACU2	CACU	Cusick's camas
<i>Camassia quamash</i>	CAQU2	CAQU	Common camas
<i>Cardamine pulcherrima</i>	CAPU4	CAPU2	Slender toothwort
<i>Castilleja</i>	CASTI2	CASTI	Paintbrush
<i>Castilleja applegatei</i>	CAAP4	CAAP2	Wavy-leaved paintbrush
<i>Castilleja cusickii</i>	CACU7	CACU3	Cusick's paintbrush
<i>Castilleja hispida</i>	CAHI9	CAHI2	Harsh paintbrush
<i>Castilleja hispida</i> var. <i>acuta</i>	CAHIA2	CAHIA	Harsh paintbrush
<i>Castilleja linariaefolia</i>	CALI4	CALI2	Wyoming Indian paintbrush
<i>Castilleja miniata</i>	CAMI12	CAMI2	Scarlet paintbrush

Scientific name ¹	PLANTS code ²	R6 code ³	Common name
<i>Castilleja oresbia</i>	CAOR4	CAOR3	Pale Wallowa paintbrush
<i>Castilleja pilosa</i>	CAPI3	CAPI2	Hairy penstemon
<i>Castilleja pruinosa</i>	CAPR14	CAPR4	Frosted Indian paintbrush
<i>Centaurea solstitialis</i>	CESO3	CESO	Yellow star-thistle
<i>Cerastium arvense</i>	CEAR4	CEAR	Field chickweed
<i>Chaenactis douglasii</i>	CHDO	CHDO	Hoary chaenactis
<i>Chaenactis douglasii</i> var. <i>achilleaeifolia</i>	CHDOA	CHDOA	Hoary chaenactis
<i>Cirsium</i>	CIRSI	CIRSI	Thistle
<i>Cirsium brevifolium</i>	CIBR	CIBR	Palouse thistle
<i>Cirsium canovirens</i>	CICA6	CICA2	Gray-green thistle
<i>Cirsium utahense</i>	CIUT	CIUT	Utah thistle
<i>Cirsium vulgare</i>	CIVU	CIVU	Bull thistle
<i>Clarkia pulchella</i>	CLPU	CLPU	Deerhorn
<i>Clematis hirsutissima</i>	CLHI	CLHI	Sugar bowls
<i>Collinsia parviflora</i>	COPA3	COPA	Small flowered blue-eyed Mary
<i>Collomia grandiflora</i>	COGR4	COGR2	Large-flowered collomia
<i>Collomia linearis</i>	COLI2	COLI2	Narrow-leaved collomia
<i>Collomia tenella</i>	COTE	COTE	Diffuse collomia
<i>Cordylanthus ramosus</i>	CORA5	CORA	Bushy birdbeak
<i>Crepis</i>	CREPI	CREPI	Hawksbeard
<i>Crepis acuminata</i>	CRAC2	CRAC	Tapertip hawksbeard
<i>Crepis atrabarba</i>	CRAT	CRAT	Slender hawksbeard
<i>Crepis atrabarba</i> var. <i>originalis</i>	CRATO	CRATO	Slender hawksbeard
<i>Crepis bakeri</i>	CRBA2	CRBA	Baker's hawksbeard
<i>Crepis intermedia</i>	CRIN4	CRIN	Gray hawksbeard
<i>Crepis modocensis</i>	CRMO4	CRMO3	Siskiyou hawksbeard
<i>Crepis occidentalis</i>	CROC	CROC	Western hawksbeard
<i>Crepis occidentalis</i> var. <i>costata</i>	CROCC2	CROCC	Western hawksbeard
<i>Cryptantha</i>	CRYPT	CRYPT2	Cryptantha
<i>Cryptantha affinis</i>	CRAF	CRAF	Slender cryptantha
<i>Cryptantha ambigua</i>	CRAM3	CRAM	Obscure cryptantha
<i>Cryptantha celosioides</i>	CRCE	CRCE	Cockscomb cryptantha
<i>Cryptantha intermedia</i>	CRIN8	CRIN2	Common cryptantha
<i>Cryptantha torreyana</i>	CRT04	CRT0	Torrey's cryptantha
<i>Cryptogramma crispa</i>	CRCRA2	CRCR	Rockbrake
<i>Cymopterus nivalis</i>	CYNI3	CYNI	Snowline cymopterus
<i>Cymopterus terebinthinus</i>	CYTE9	CYTE	Turpentine cymopterus
<i>Cymopterus terebinthinus</i> var. <i>foeniculaceus</i>	CYTEF	CYTEF	Turpentine cymopterus
<i>Cynoglossum officinale</i>	CYOF	CYOF	Common houndstongue
<i>Cystopteris fragilis</i>	CYFR2	CYFR	Brittle bladderfern
<i>Delphinium</i>	DELPH	DELPH	Larkspur
<i>Delphinium depauperatum</i>	DEDE2	DEDE	Slim larkspur
<i>Delphinium menziesii</i>	DEME	DEME	Menzies larkspur
<i>Delphinium nuttallianum</i>	DENU2	DENU3	Upland larkspur
<i>Descurainia</i>	DESCU	DESCU	Tansymustard
<i>Dodecatheon</i>	DODEC	DODEC	Shootingstar
<i>Dodecatheon conjugens</i>	DOCO	DOCO	Slimpod shootingstar
<i>Dodecatheon cusickii</i>	DOCU2	DOCU	Cusick's shootingstar
<i>Draba densifolia</i>	DRDE	DRDE	Nuttall's draba
<i>Epilobium</i>	EPILO	EPILO	Willowherb
<i>Epilobium angustifolium</i>	EPAN2	EPAN	Fireweed
<i>Epilobium glandulosum</i>	EPGL4	EPGL2	Common willowherb
<i>Epilobium minutum</i>	EPMI	EPMI	Small-flowered willowherb
<i>Epilobium paniculatum</i>	EPPA2	EPPA	Tall annual willowherb
<i>Erigeron</i>	ERIGE2	ERIGE	Fleabane

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<i>Erigeron acris</i>	ERAC13	ERAC	Bitter fleabane
<i>Erigeron aphanactis</i>	ERAP	ERAP	Rayless fleabane
<i>Erigeron bloomeri</i>	ERBL	ERBL	Scabland fleabane
<i>Erigeron chrysopsidis</i>	ERCH4	ERCH	Dwarf yellow fleabane
<i>Erigeron chrysopsidis</i> var. <i>brevifolius</i>	ERCHB	ERCHB	Alpine dwarf yellow fleabane
<i>Erigeron compositus</i>	ERCO4	ERCO	Cutleaf daisy
<i>Erigeron corymbosus</i>	ERCO5	ERCO3	Foothill daisy
<i>Erigeron divergens</i>	ERDI4	ERDI	Spreading fleabane
<i>Erigeron eatonii</i>	EREA	EREA	Eaton's daisy
<i>Erigeron filifolius</i>	ERFI2	ERFI	Threadleaf fleabane
<i>Erigeron linearis</i>	ERLI	ERLI	Desert yellow daisy
<i>Erigeron poliospermus</i>	ERPO2	ERPO	Cushion fleabane
<i>Erigeron pumilus</i>	ERPU2	ERPU	Shaggy fleabane
<i>Erigeron pumilus</i> var. <i>intermedius</i>	ERPUI	ERPUI	Shaggy fleabane
<i>Erigeron pumilus</i> ssp. <i>intermedius</i> var. <i>gracilior</i>	ERPUG	ERPUG	Shaggy fleabane
<i>Erigeron speciosus</i>	ERSP4	ERSP	Showy fleabane
<i>Eriogonum</i>	ERIOG	ERIOG	Eriogonum
<i>Eriogonum caespitosum</i>	ERCA8	ERCA	Cushion buckwheat
<i>Eriogonum compositum</i>	ERCO12	ERCO5	Heart-leaved buckwheat
<i>Eriogonum douglasii</i>	ERDO	ERDO	Douglas' buckwheat
<i>Eriogonum flavum</i>	ERFL4	ERFL	Golden buckwheat
<i>Eriogonum flavum</i> var. <i>piperi</i>	ERFLP	ERFLP	Golden buckwheat
<i>Eriogonum heracleoides</i>	ERHE2	ERHE	Creamy buckwheat
<i>Eriogonum heracleoides</i> var. <i>angustifolium</i>	ERHEA2	ERHEA	Creamy buckwheat
<i>Eriogonum microthecum</i> var. <i>laxiflorum</i>	ERMIL5	ERMIL	Slender buckwheat
<i>Eriogonum ovalifolium</i>	EROV	EROV	Oval-leaved eriogonum
<i>Eriogonum sphaerocephalum</i>	ERSP7	ERSP3	Rock buckwheat
<i>Eriogonum strictum</i>	ERST4	ERST2	Strict buckwheat
<i>Eriogonum strictum</i> var. <i>proliferum</i>	ERSTP	ERSTP	Strict buckwheat
<i>Eriogonum strictum</i> ssp. <i>proliferum</i> var. <i>anserinum</i>	ERSTA3	ERSTA3	Strict buckwheat
<i>Eriogonum umbellatum</i>	ERUM	ERUM	Sulfur-flower buckwheat
<i>Eriogonum umbellatum</i> var. <i>polyanthum</i>	ERUMP3	ERUMP	Sulfur-flower buckwheat
<i>Eriogonum umbellatum</i> var. <i>stellatum</i>	ERUMS5	ERUMS	Sulfur-flower buckwheat
<i>Eriogonum umbellatum</i> var. <i>umbellatum</i>	ERUMU2	ERUMU	Sulfur-flower buckwheat
<i>Eriogonum vimineum</i>	ERV15	ERVI	Broom buckwheat
<i>Eriophyllum lanatum</i>	ERLA6	ERLA	Woolly eriophyllum
<i>Erodium cicutarium</i>	ERCI6	ERCI	Crane's-bill
<i>Erysimum asperum</i>	ERAS2	ERAS	Rough wallflower
<i>Erythronium grandiflorum</i>	ERGR9	ERGR	Dogtooth violet
<i>Fragaria virginiana</i>	FRVI	FRVI	Virginia strawberry
<i>Fragaria virginiana</i> var. <i>platypetala</i>	FRVIP2	FRVIP	Virginia strawberry
<i>Frasera albicaulis</i>	FRAL2	FRAL2	Whitestem frasera
<i>Frasera albicaulis</i> var. <i>cusickii</i>	FRALC2	FRALC	Cusick's frasera
<i>Frasera albicaulis</i> var. <i>nitida</i>	FRALN2	FRALN	Shiny frasera
<i>Gaillardia aristata</i>	GAAR	GAAR	Blanket flower
<i>Galium aparine</i>	GAAP2	GAAP	Cleavers
<i>Galium multiflorum</i>	GAMU2	GAMU	Shrubby bedstraw
<i>Gayophytum</i>	GAYOP	GAYOP	Groundsmoke
<i>Gayophytum diffusum</i>	GADI2	GADI	Spreading groundsmoke
<i>Gayophytum ramosissimum</i>	GARA2	GARA	Hairstem groundsmoke
<i>Geranium viscosissimum</i>	GEVI2	GEVI	Sticky geranium
<i>Geum triflorum</i>	GETR	GETR	Red avens
<i>Geum triflorum</i> var. <i>ciliatum</i>	GETRC2	GETRC2	Red avens
<i>Gilia aggregata</i>	GIAG	GIAG	Scarlet gilia
<i>Gilia congesta</i>	GICO2	GICO	Ballhead gilia

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<i>Gnaphalium microcephalum</i>	GNMI	GNMI	Slender cudweed
<i>Grindelia nana</i>	GRNA	GRNA	Low gumweed
<i>Grindelia squarrosa</i>	GRSQ	GRSQ	Curlycup gumweed
<i>Hackelia floribunda</i>	HAFL2	HAFL	Manyflower stickseed
<i>Hackelia jessicae</i>	HAJE	HAJE	Blue stickseed
<i>Haplopappus acaulis</i>	HAAC	HAAC	Stemless goldenweed
<i>Haplopappus carthamoides</i>	HACA5	HACA	Largeflower goldenweed
<i>Haplopappus greenei</i>	HAGR6	HAGR	Green's goldenweed
<i>Haplopappus lanuginosus</i>	HALA3	HALA	Woolly goldenweed
<i>Haplopappus stenophyllus</i>	HAST	HAST2	Narrowleaf goldenweed
<i>Helianthella uniflora</i>	HEUN	HEUN	Little sunflower
<i>Hesperochiron pumilis</i>	HEPU6	HEPU	Dwarf hesperochiron
<i>Heuchera cylindrica</i>	HECY2	HECY	Roundleaf alumroot
<i>Heuchera cylindrica alpina</i>	HECYA	HECYA	Alpine roundleaved alumroot
<i>Heuchera grossulariifolia</i>	HEGR8	HEGR	Gooseberryleaf alumroot
<i>Heuchera grossulariifolia</i> var. <i>grossulariifolia</i>	HEGRG	HEGRG	Gooseberryleaf alumroot
<i>Hieracium</i>	HIERA	HIERA	Hawkweed
<i>Hieracium albertinum</i>	HIAL	HIAL2	Western hawkweed
<i>Hieracium albiflorum</i>	HIAL2	HIAL	White hawkweed
<i>Hieracium scouleri</i>	HISC2	HISC	Woolly-weed
<i>Hydrophyllum capitatum</i>	HYCA4	HYCA	Waterleaf
<i>Hymenoxys grandiflora</i>	HYGR5	HYGR	Old man of the mountains
<i>Hypericum perforatum</i>	HYPE	HYPE	Common St. John's wort
<i>Iris missouriensis</i>	IRMI	IRMI	Rocky Mountain iris
<i>Lactuca serriola</i>	LASE	LASE	Prickly lettuce
<i>Lagophylla ramosissima</i>	LARA	LARA	Hareleaf
<i>Lathyrus</i>	LATHY	LATHY	Peavine
<i>Lathyrus lanszwertii</i>	LALA3	LALA2	Thick-leaved peavine
<i>Lathyrus nevadensis</i>	LANE3	LANE	Sierran peavine
<i>Lathyrus nevadensis</i> ssp. <i>cusickii</i>	LANEC	LANEC	Cusick's peavine
<i>Lathyrus pauciflorus</i>	LAPA5	LAPA2	Fewflower peavine
<i>Lathyrus rigidus</i>	LARI	LARI	Rigid peavine
<i>Leucocrinum montanum</i>	LEMO4	LEMO	Sand lily
<i>Lewisia rediviva</i>	LERE7	LERE	Bitterroot
<i>Ligusticum</i>	LIGUS	LIGUS	Lovage
<i>Ligusticum canbyi</i>	LICA2	LICA2	Canby's lovage
<i>Ligusticum filicinum</i>	LIFI	LIFI	Fernleaf lovage
<i>Linanthastrum nuttallii</i>	LINU4	LINU	Nuttall's linanthastrum
<i>Linanthus harknessii</i>	LIHA	LIHA	Harkness' linanthus
<i>Linanthus septentrionalis</i>	LISE	LISE	Northern linanthus
<i>Linum perenne</i> var. <i>lewisii</i>	LIPEL3	LIPEL	Wild blue flax
<i>Lithophragma bulbifera</i>	LIBU2	LIBU	Bulbiferous fringecup
<i>Lithophragma parviflora</i>	LIPAP3	LIPA	Smallflower fringecup
<i>Lithospermum ruderales</i>	LIRU4	LIRU	Wayside gromwell
<i>Lomatium</i>	LOMAT	LOMAT	Biscuitroot
<i>Lomatium ambiguum</i>	LOAM	LOAM	Swale desert-parsley
<i>Lomatium cous</i>	LOCO4	LOCO2	Cous biscuitroot
<i>Lomatium dissectum</i>	LODI	LODI2	Fern-leaved lomatium
<i>Lomatium dissectum</i> var. <i>eatonii</i>	LODIE	LODIE	Fern-leaved lomatium
<i>Lomatium dissectum</i> var. <i>multifidum</i>	LODIM	LODIM	Fern-leaved lomatium
<i>Lomatium donnellii</i>	LODO2	LODO	Donnell's lomatium
<i>Lomatium gormanii</i>	LOGO	LOGO	Gorman's biscuitroot
<i>Lomatium grayi</i>	LOGR	LOGR	Gray's lomatium
<i>Lomatium hendersonii</i>	LOHE2	LOHE	Henderson's lomatium
<i>Lomatium leptocarpum</i>	LOLE2	LOLE	Slenderfruit lomatium

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<i>Lomatium macrocarpum</i>	LOMA3	LOMA	Large-fruited lomatium
<i>Lomatium nudicaule</i>	LONU2	LONU	Barestem lomatium
<i>Lomatium triternatum</i>	LOTR2	LOTR	Nineleaf lomatium
<i>Lomatium triternatum</i> var. <i>platycarpum</i>	LOTRP	LOTRP	Nineleaf lomatium
<i>Lomatium triternatum</i> var. <i>triternatum</i>	LOTRT	LOTRT	Nineleaf lomatium
<i>Lomatium vaginatum</i>	LOVA	LOVA	Broadsheath lomatium
<i>Lupinus</i>	LUPIN	LUPIN	Lupine
<i>Lupinus caudatus</i>	LUCA	LUCA	Tailcup lupine
<i>Lupinus holosericeus</i>	LUHO2	LUHO	Little-flowered lupine
<i>Lupinus laxiflorus</i>	LULA3	LULA2	Spurred lupine
<i>Lupinus laxiflorus</i> var. <i>laxiflorus</i>	LULAA	LULAL3	Spurred lupine
<i>Lupinus laxiflorus</i> var. <i>pseudoparviflorus</i>	LULAP5	LULAP	Spurred lupine
<i>Lupinus lepidus</i>	LULE2	LULE2	Prairie lupine
<i>Lupinus lepidus</i> var. <i>utahensis</i>	LULEU2	LULEU	Prairie lupine
<i>Lupinus leucophyllus</i>	LULE3	LULE	Velvet lupine
<i>Lupinus leucophyllus</i> var. <i>leucophyllus</i>	LULEL4	LULEL	Velvet lupine
<i>Lupinus leucophyllus</i> var. <i>tenuispicus</i>	LULET	LULET	Velvet lupine
<i>Lupinus saxosus</i>	LUSA2	LUSA	Rock lupine
<i>Lupinus sericeus</i>	LUSE4	LUSE	Silky lupine
<i>Lupinus sericeus</i> var. <i>sericeus</i>	LUSES2	LUSES	Silky lupine
<i>Lupinus sulphureus</i>	LUSU5	LUSU	Sulphur lupine
<i>Lupinus wyethii</i>	LUWY	LUWY	Wyeth's lupine
<i>Madia</i>	MADIA	MADIA	Tarweed
<i>Madia citriodora</i>	MACI2	MACI	Lemon-scented tarweed
<i>Madia glomerata</i>	MAGL2	MAGL	Cluster tarweed
<i>Madia gracilis</i>	MAGR3	MAGR	Slender tarweed
<i>Madia minima</i>	MAMI	MAMI	Small-head tarweed
<i>Medicago sativa</i>	MESA	MESA	Alfalfa
<i>Mentzelia albicaulis</i>	MEAL6	MEAL2	Whitestem mentzelia
<i>Mentzelia dispersa</i>	MEDI	MEDI	Bush mentzelia
<i>Microseris</i>	MICRO6	MICRO3	Microseris
<i>Microseris linearifolia</i>	MILI	MILI	Lindley's microseris
<i>Microseris nutans</i>	MINU	MINU	Nodding microseris
<i>Microseris troximoides</i>	MITR5	MITR	False agoseris
<i>Microsteris gracilis</i>	MIGR	MIGR	Pink microsteris
<i>Mimulus guttatus</i>	MIGU	MIGU	Yellow monkeyflower
<i>Mimulus nanus</i>	MINA	MINA	Dwarf purple monkeyflower
<i>Mitella stauropetala</i>	MIST3	MIST2	Side-flowered mitrewort
<i>Monardella odoratissima</i>	MOOD	MOOD	Mountain monardella
<i>Montia linearis</i>	MOLI4	MOLI	Narrowleaf miner's lettuce
<i>Montia perfoliata</i>	MOPE3	MOPE	Miner's lettuce
<i>Myosotis micrantha</i>	MYMI	MYMI	Blue scorpion grass
<i>Navarretia intertexta</i>	NAIN2	NAIN	Needleleaf navarretia
<i>Navarretia intertexta</i> var. <i>propinqua</i>	NAINP3	NAINP	Pin cushion plant
<i>Nemophila breviflora</i>	NEBR	NEBR	Great Basin nemophila
<i>Nemophila parviflora</i>	NEPA	NEPA	Smallflower nemophila
<i>Oenothera heterantha</i>	OEHE	OEHE	Longleaf evening-primrose
<i>Orobanche uniflora</i>	ORUN	ORUN	Naked broomrape
<i>Orobanche uniflora purpurea</i>	ORUNP	ORUNP	Naked broomrape
<i>Orthocarpus hispidus</i>	ORHI	ORHI	Hairy owl-clover
<i>Orthocarpus tenuifolius</i>	ORTE2	ORTE	Thinleaf owl-clover
<i>Osmorhiza</i>	OSMOR	OSMOR	Sweet-cicely
<i>Osmorhiza chilensis</i>	OSCH	OSCH	Mountain sweet-cicely
<i>Osmorhiza occidentalis</i>	OSOC	OSOC	Western sweetroot
<i>Paeonia brownii</i>	PABR	PABR	Brown's peony

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<i>Pedicularis contorta</i>	PECO	PECO2	Coiled lousewort
<i>Penstemon</i>	PENST	PENST	Penstemon
<i>Penstemon attenuatus</i>	PEAT3	PEAT	Sulfur penstemon
<i>Penstemon attenuatus</i> var. <i>militaris</i>	PEATM	PEATM	Sulfur penstemon
<i>Penstemon attenuatus</i> var. <i>pseudoprocerus</i>	PEATP2	PEATP	Sulfur penstemon
<i>Penstemon davidsonii</i> var. <i>menziesii</i>	PEDAM	PEDAM	Davidson's penstemon
<i>Penstemon deustus</i>	PEDE4	PEDE	Hot rock penstemon
<i>Penstemon deustus</i> var. <i>variabilis</i>	PEDEV	PEDEV	Hot rock penstemon
<i>Penstemon gairdneri</i>	PEGA	PEGA	Gairdner's penstemon
<i>Penstemon gairdneri</i> var. <i>oreganus</i>	PEGAO2	PEGAO	Gairdner's penstemon
<i>Penstemon humilis</i>	PEHU	PEHU	Low penstemon
<i>Penstemon pennellianus</i>	PEPE11	PEPE3	Blue Mountain penstemon
<i>Penstemon rydbergii</i>	PERY	PERY	Rydberg's penstemon
<i>Penstemon speciosus</i>	PESP	PESP	Showy penstemon
<i>Penstemon venustus</i>	PEVE2	PEVE	Blue Mountain penstemon
<i>Perideridia</i>	PERID	PERID	Yampah
<i>Perideridia bolanderi</i>	PEBO2	PEBO	Bolander's yampah
<i>Perideridia gairdneri</i>	PEGA3	PEGA2	Gairdner's yampah
<i>Phacelia</i>	PHACE	PHACE	Phacelia
<i>Phacelia hastata</i>	PHHA	PHHA	Silverleaf phacelia
<i>Phacelia hastata</i> var. <i>alpina</i>	PHHAA	PHHAA	Silverleaf phacelia
<i>Phacelia hastata</i> var. <i>leucophylla</i>	PHHAL	PHHAL	Silverleaf phacelia
<i>Phacelia heterophylla</i>	PHHE2	PHHE	Varileaf phacelia
<i>Phacelia linearis</i>	PHLI	PHLI	Threadleaf phacelia
<i>Phacelia sericea</i>	PHSE	PHSE	Silky phacelia
<i>Phlox</i>	PHLOX	PHLOX	Phlox
<i>Phlox austromontana</i>	PHAU3	PHAU	Mountain phlox
<i>Phlox caespitosa</i>	PHCA7	PHCA2	Tufted phlox
<i>Phlox diffusa</i>	PHDI3	PHDI	Spreading phlox
<i>Phlox hoodii</i>	PHHO	PHHO	Hood's phlox
<i>Phlox longifolia</i>	PHLO2	PHLO	Longleaf phlox
<i>Phlox multiflora</i>	PHMU3	PHMU	Many-flowered phlox
<i>Phlox pulvinata</i>	PHPU5	PHPU	Cushion phlox
<i>Phoenicaulis cheiranthoides</i>	PHCH	PHCH	Daggerpod
<i>Physaria oregana</i>	PHOR2	PHOR	Oregon twinpod
<i>Plectritis macrocera</i>	PLMA4	PLMA3	White plectritis
<i>Polygonum</i>	POLYG4	POLYG	Knotweed
<i>Polygonum bistortoides</i>	POBI6	POBI	American bistort
<i>Polygonum douglasii</i>	PODO4	PODO	Douglas' knotweed
<i>Polygonum majus</i>	POMA9	POMA2	Wiry knotweed
<i>Polygonum phytolaccaefolium</i>	POPH	POPH	Alpine fleeceflower
<i>Polygonum polygaloides</i>	POPO4	POPO	White-margined knotweed
<i>Potentilla</i>	POTEN	POTEN	Cinquefoil
<i>Potentilla glandulosa</i>	POGL9	POGL	Sticky cinquefoil
<i>Potentilla gracilis</i>	POGR9	POGR	Slender cinquefoil
<i>Potentilla gracilis</i> var. <i>glabrata</i>	POGRG	POGRG	Slender cinquefoil
<i>Ranunculus populago</i>	RAPO	RAPO	Blue Mountain buttercup
<i>Rigiopappus leptocladus</i>	RILE2	RILE	Rigiopappus
<i>Rumex acetosella</i>	RUAC3	RUAC	Sheep sorrel
<i>Sanguisorba occidentalis</i>	SAOC2	SAOC	Annual burnet
<i>Sanicula graveolens</i>	SAGR5	SAGR	Sierra sanicle
<i>Saxifraga fragosa</i>	SAFR7	SAFR	Swamp saxifrage
<i>Saxifraga integrifolia</i>	SAIN4	SAIN	Swamp saxifrage
<i>Saxifraga integrifolia</i> var. <i>columbiana</i>	SAINC2	SAINC	Swamp saxifrage
<i>Saxifraga rhomboidea</i>	SARH2	SARH	Diamondleaf saxifrage

Scientific name ¹	PLANTS code ²	R6 code ³	Common name
<i>Scutellaria angustifolia</i>	SCAN3	SCAN	Narrowleaf skullcap
<i>Sedum</i>	SEDUM	SEDUM	Stonecrop
<i>Sedum douglasii</i>	SEDO3	SEDO	Wormleaf stonecrop
<i>Sedum lanceolatum</i>	SELA	SELA2	Lanceleaf stonecrop
<i>Sedum stenopetalum</i>	SEST2	SEST	Wormleaf stonecrop
<i>Senecio</i>	SENEC	SENEC	Groundsel
<i>Senecio canus</i>	SECA2	SECA	Woolly groundsel
<i>Senecio integerrimus</i>	SEIN2	SEIN	Western groundsel
<i>Senecio integerrimus</i> var. <i>exaltatus</i>	SEINE	SEINE	Western groundsel
<i>Senecio streptanthifolius</i>	SEST3	SEST2	Rocky Mountain butterweed
<i>Sidalcea oregana</i>	SIOR	SIOR	Oregon checker-mallow
<i>Silene</i>	SILEN	SILEN	Campion
<i>Silene douglasii</i>	SIDO	SIDO2	Douglas' campion
<i>Silene oregana</i>	SIOR3	SIOR2	Oregon catchfly
<i>Silene scaposa</i>	SISC	SISC2	Scapose silene
<i>Sisyrinchium inflatum</i>	SIIN15	SIIN2	Grasswidow
<i>Smilacina racemosa</i>	SMRA	SMRA	Western false solomon's seal
<i>Solidago canadensis</i>	SOCA6	SOCA	Canada goldenrod
<i>Solidago missouriensis</i>	SOMI2	SOMI	Missouri goldenrod
<i>Spraguea umbellata</i>	SPUM	SPUM	Pussypaws
<i>Taraxacum officinale</i>	TAOF	TAOF	Common dandelion
<i>Thalictrum occidentale</i>	THOC	THOC	Western meadowrue
<i>Thysanocarpus curvipes</i>	THCU	THCU	Lacepod
<i>Tragopogon</i>	TRAGO	TRAGO	Salsify
<i>Tragopogon dubius</i>	TRDU	TRDU	Yellow salsify
<i>Trifolium</i>	TRIFO	TRIFO	Clover
<i>Trifolium eriocephalum</i> var. <i>piperi</i>	TRERP2	TRERP	Woollyhead clover
<i>Trifolium longipes</i>	TRLO	TRLO	Longstalk clover
<i>Trifolium macrocephalum</i>	TRMA3	TRMA	Bighead clover
<i>Trifolium plumosum</i>	TRPL2	TRPL	Pussy clover
<i>Valerianella locusta</i>	VALO	VALO	Valerianella
<i>Veratrum californicum</i>	VECA2	VECA	California false hellebore
<i>Veronica arvensis</i>	VEAR	VEAR	Common speedwell
<i>Vicia americana</i>	VIAM	VIAM	American vetch
<i>Vicia cracca</i>	VICR	VICR	Cracca's vetch
<i>Viola</i>	VIOLA	VIOLA	Violet
<i>Viola purpurea</i>	VIPU4	VIPU	Goosefoot violet
<i>Woodsia oregana</i>	WOOR	WOOR	Oregon cliff fern
<i>Wyethia amplexicaulis</i>	WYAM	WYAM	Northern mule's ears
<i>Zigadenus</i>	ZIGAD	ZIGAD	Deathcamas
<i>Zigadenus paniculatus</i>	ZIPA2	ZIPA	Panicled deathcamas
<i>Zigadenus venenosus</i>	ZIVE	ZIVE	Meadow deathcamas
<i>Zigadenus venenosus</i> var. <i>gramineus</i>	ZIVEG	ZIVEG	Meadow deathcamas

¹Hitchcock and Cronquist 1973.²USDA, NRCS 2004b.³Garrison and Skovlin 1976.

Appendix B: Plants Listed by Common Name

Common name	Scientific name ¹	PLANTS code ²	R6 code ³
Agoseris	<i>Agoseris</i>	AGOSE	AGOSE
Alfalfa	<i>Medicago sativa</i>	MESA	MESA
Alkali bluegrass	<i>Poa secunda</i> var. <i>juncifolia</i>	POSEJ	POSEJ
Alpine aster	<i>Aster alpigenus</i> var. <i>haydenii</i>	ASALH2	ASALH
Alpine dwarf yellow fleabane	<i>Erigeron chrysopsidis</i> var. <i>brevifolius</i>	ERCHB	ERCHB
Alpine fleecflower	<i>Polygonum phytolaccaefolium</i>	POPH	POPH
Alpine pussytoes	<i>Antennaria alpina</i>	ANAL4	ANAL
Alpine roundleaved alumroot	<i>Heuchera cylindrica</i> var. <i>alpina</i>	HECYA	HECYA
American bistort	<i>Polygonum bistortoides</i>	POBI6	POBI
American vetch	<i>Vicia americana</i>	VIAM	VIAM
Annual agoseris	<i>Agoseris heterophylla</i>	AGHE2	AGHE
Annual burnet	<i>Sanguisorba occidentalis</i>	SAOC2	SAOC
Annual hairgrass	<i>Deschampsia danthonioides</i>	DEDA	DEDA
Arrowleaf balsamroot	<i>Balsamorhiza sagittata</i>	BASA3	BASA
Aster	<i>Aster</i>	ASTER	ASTER
Baker's hawkbeard	<i>Crepis bakeri</i>	CRBA2	CRBA
Baldhip rose	<i>Rosa gymnocarpa</i>	ROGY	ROGY
Ballhead gilia	<i>Gilia congesta</i>	GICO2	GICO
Ballhead sandwort	<i>Arenaria congesta</i>	ARCO5	ARCO2
Balloon milkvetch	<i>Astragalus whitneyi</i>	ASWH	ASWH
Balloon milkvetch	<i>Astragalus whitneyi</i> var. <i>sonneanus</i>	ASWHS2	ASWHS
Balsamroot	<i>Balsamorhiza</i>	BALSA	BALSA
Baltic rush	<i>Juncus balticus</i>	JUBA	JUBA
Barestem lomatium	<i>Lomatium nudicaule</i>	LONU2	LONU
Basalt milkvetch	<i>Astragalus filipes</i>	ASFI	ASFI
Basin wildrye	<i>Elymus cinereus</i>	ELCI2	ELCI
Bentgrass	<i>Agrostis</i>	AGROS2	AGROS
Big squirreltail	<i>Sitanion jubatum</i>	SIJU	SIJU
Bighead clover	<i>Trifolium macrocephalum</i>	TRMA3	TRMA
Bigleaf sandwort	<i>Arenaria macrophylla</i>	ARMA18	ARMA3
Birchleaf spiraea	<i>Spiraea betulifolia</i>	SPBE2	SPBE
Biscuitroot	<i>Lomatium</i>	LOMAT	LOMAT
Bitter fleabane	<i>Erigeron acris</i>	ERAC13	ERAC
Bitterbrush	<i>Purshia tridentata</i>	PUTR2	PUTR
Bitterroot	<i>Lewisia rediviva</i>	LERE7	LERE
Blanket flower	<i>Gaillardia aristata</i>	GAAR	GAAR
Blepharipappus	<i>Blepharipappus scaber</i>	BLSC	BLSC
Blue elderberry	<i>Sambucus cerulea</i>	SACE3	SACE
Blue Mountain buttercup	<i>Ranunculus populago</i>	RAPO	RAPO
Blue Mountain milkvetch	<i>Astragalus reventus</i>	ASRE5	ASRE
Blue Mountain penstemon	<i>Penstemon venustus</i>	PEVE2	PEVE
Blue Mountain penstemon	<i>Penstemon pennellianus</i>	PEPE11	PEPE3
Blue scorpion grass	<i>Myosotis micrantha</i>	MYMI	MYMI
Blue stickseed	<i>Hackelia jessicae</i>	HAJE	HAJE
Blue wildrye	<i>Elymus glaucus</i>	ELGL	ELGL
Bluebunch wheatgrass	<i>Agropyron spicatum</i>	AGSP	AGSP
Bluegrass	<i>Poa</i>	POA	POA
Bolander's yampah	<i>Perideridia bolanderi</i>	PEBO2	PEBO
Bottlebrush squirreltail	<i>Sitanion hystrix</i>	SIHY	SIHY
Bottlebrush squirreltail	<i>Sitanion hystrix</i> var. <i>hordeoides</i>	SIHYH	SIHYH
Brandegge's onion	<i>Allium brandegei</i>	ALBR	ALBR
Bristly fiddleneck	<i>Amsinckia tessellata</i>	AMTE3	AMTE
Brittle bladderfern	<i>Cystopteris fragilis</i>	CYFR2	CYFR

Common name	Scientific name ¹	PLANTS code ²	R6 code ³
Broadsheath lomatium	<i>Lomatium vaginatum</i>	LOVA	LOVA
Brodiaea	<i>Brodiaea</i>	BRODI	BRODI
Brome	<i>Bromus</i>	BROMU	BROMU
Brome fescue	<i>Festuca bromoides</i>	FEBR4	FEBR
Broom buckwheat	<i>Eriogonum vimineum</i>	ERV15	ERVI
Brown pussytoes	<i>Antennaria umbrinella</i>	ANUM	ANUM
Brown's peony	<i>Paeonia brownii</i>	PABR	PABR
Bulbiferous fringecup	<i>Lithophragma bulbifera</i>	LIBU2	LIBU
Bulbous bluegrass	<i>Poa bulbosa</i>	POBU	POBU
Bull thistle	<i>Cirsium vulgare</i>	CIVU	CIVU
Bush mentzelia	<i>Mentzelia dispersa</i>	MEDI	MEDI
Bushy birdbeak	<i>Cordylanthus ramosus</i>	CORA5	CORA
California false hellebore	<i>Veratrum californicum</i>	VECA2	VECA
California oatgrass	<i>Danthonia californica</i>	DACA3	DACA
Camas	<i>Camassia</i>	CAMAS	CAMAS
Campion	<i>Silene</i>	SILEN	SILEN
Canada goldenrod	<i>Solidago canadensis</i>	SOCA6	SOCA
Canby's lovage	<i>Ligusticum canbyi</i>	LICA2	LICA2
Cascara	<i>Rhamnus purshiana</i>	RHPU	RHPU
Cheatgrass	<i>Bromus tectorum</i>	BRTE	BRTE
Cherry	<i>Prunus</i>	PRUNU	PRUNU
Chervil	<i>Anthriscus scandicina</i>	ANSC8	ANSC2
Cinquefoil	<i>Potentilla</i>	POTEN	POTEN
Cleavers	<i>Galium aparine</i>	GAAP2	GAAP
Clover	<i>Trifolium</i>	TRIFO	TRIFO
Cluster tarweed	<i>Madia glomerata</i>	MAGL2	MAGL
Clustered field sedge	<i>Carex praegracilis</i>	CAPR5	CAPR5
Cockscomb cryptantha	<i>Cryptantha celosiooides</i>	CRCE	CRCE
Coiled lousewort	<i>Pedicularis contorta</i>	PECO	PECO2
Colorado rush	<i>Juncus confusus</i>	JUCO2	JUCO
Common camas	<i>Camassia quamash</i>	CAQU2	CAQU
Common chokecherry	<i>Prunus virginiana</i>	PRVI	PRVI
Common cryptantha	<i>Cryptantha intermedia</i>	CRIN8	CRIN2
Common dandelion	<i>Taraxacum officinale</i>	TAOF	TAOF
Common houndstongue	<i>Cynoglossum officinale</i>	CYOF	CYOF
Common snowberry	<i>Symphoricarpos albus</i>	SYAL	SYAL
Common speedwell	<i>Veronica arvensis</i>	VEAR	VEAR
Common St. John's wort	<i>Hypericum perforatum</i>	HYPE	HYPE
Common timothy	<i>Phleum pratense</i>	PHPR3	PHPR
Common willowherb	<i>Epilobium glandulosum</i>	EPGL4	EPGL2
Common yarrow	<i>Achillea millefolium</i> var. <i>lanulosa</i>	ACMIL	ACMIL
Cous biscuitroot	<i>Lomatium cous</i>	LOCO4	LOCO2
Cracca's vetch	<i>Vicia cracca</i>	VICR	VICR
Crane's-bill	<i>Erodium cicutarium</i>	ERCI6	ERCI
Creambush ocean-spray	<i>Holodiscus discolor</i>	HODI	HODI
Creamy buckwheat	<i>Eriogonum heracleoides</i>	ERHE2	ERHE
Creamy buckwheat	<i>Eriogonum heracleoides</i> var. <i>angustifolium</i>	ERHEA2	ERHEA
Creeping Oregon grape	<i>Berberis repens</i>	BERE	BERE
Crested wheatgrass	<i>Agropyron cristatum</i>	AGCR	AGCR
Cryptantha	<i>Cryptantha</i>	CRYPT	CRYPT2
Curlleaf mountain mahogany	<i>Cercocarpus ledifolius</i>	CELE3	CELE
Curlycup gumweed	<i>Grindelia squarrosa</i>	GRSQ	GRSQ
Currant or gooseberry	<i>Ribes</i>	RIBES	RIBES
Cushion buckwheat	<i>Eriogonum caespitosum</i>	ERCA8	ERCA
Cushion fleabane	<i>Erigeron poliospermus</i>	ERPO2	ERPO

Common name	Scientific name ¹	PLANTS code ²	R6 code ³
Cushion phlox	<i>Phlox pulvinata</i>	PHPU5	PHPU
Cusick's bluegrass	<i>Poa cusickii</i>	POCU3	POCU
Cusick's bluegrass	<i>Poa cusickii</i> var. <i>cusickii</i>	POCUC4	POCUC
Cusick's camas	<i>Camassia cusickii</i>	CACU2	CACU
Cusick's frasera	<i>Frasera albicaulis</i> var. <i>cusickii</i>	FRALC2	FRALC
Cusick's paintbrush	<i>Castilleja cusickii</i>	CACU7	CACU3
Cusick's peavine	<i>Lathyrus nevadensis</i> spp. <i>cusickii</i>	LANEC	LANEC
Cusick's shootingstar	<i>Dodecatheon cusickii</i>	DOCU2	DOCU
Cutleaf daisy	<i>Erigeron compositus</i>	ERCO4	ERCO
Daggerpod	<i>Phoenicaulis cheiranthoides</i>	PHCH	PHCH
Davidson's penstemon	<i>Penstemon davidsonii</i> var. <i>menziesii</i>	PEDAM	PEDAM
Deathcamas	<i>Zigadenus</i>	ZIGAD	ZIGAD
Deerhorn	<i>Clarkia pulchella</i>	CLPU	CLPU
Desert yellow daisy	<i>Erigeron linearis</i>	ERLI	ERLI
Diamondleaf saxifrage	<i>Saxifraga rhomboidea</i>	SARH2	SARH
Diffuse collomia	<i>Collomia tenella</i>	COTE	COTE
Dogtooth violet	<i>Erythronium grandiflorum</i>	ERGR9	ERGR
Donnell's lomatium	<i>Lomatium donnellii</i>	LODO2	LODO
Douglas' brodiaea	<i>Brodiaea douglasii</i>	BRDO	BRDO
Douglas' buckwheat	<i>Eriogonum douglasii</i>	ERDO	ERDO
Douglas' campion	<i>Silene douglasii</i>	SIDO	SIDO2
Douglas' knotweed	<i>Polygonum douglasii</i>	PODO4	PODO
Douglas-fir	<i>Pseudotsuga menziesii</i>	PSME	PSME
Drummond's rush	<i>Juncus drummondii</i>	JUDR	JUDR
Dunhead sedge	<i>Carex phaeocephala</i>	CAPH2	CAPH
Dwarf hesperochiron	<i>Hesperochiron pumilis</i>	HEPU6	HEPU
Dwarf purple monkeyflower	<i>Mimulus nanus</i>	MINA	MINA
Dwarf yellow fleabane	<i>Erigeron chrysopsidis</i>	ERCH4	ERCH
Eaton's daisy	<i>Erigeron eatonii</i>	EREA	EREA
Elegant rockcress	<i>Arabis sparsiflora</i>	ARSP	ARSP2
Elk sedge	<i>Carex geyeri</i>	CAGE2	CAGE
Eriogonum	<i>Eriogonum</i>	ERIOG	ERIOG
False agoseris	<i>Microseris troximoides</i>	MITR5	MITR
Fernleaf lovage	<i>Ligusticum filicinum</i>	LIFI	LIFI
Fern-leaved lomatium	<i>Lomatium dissectum</i>	LODI	LODI2
Fern-leaved lomatium	<i>Lomatium dissectum</i> var. <i>eatonii</i>	LODIE	LODIE
Fern-leaved lomatium	<i>Lomatium dissectum</i> var. <i>multifidum</i>	LODIM	LODIM
Fewflower peavine	<i>Lathyrus pauciflorus</i>	LAPA5	LAPA2
Fiddleneck	<i>Amsinckia</i>	AMSIN	AMSIN
Field chickweed	<i>Cerastium arvense</i>	CEAR4	CEAR
Fireweed	<i>Epilobium angustifolium</i>	EPAN2	EPAN
Fleabane	<i>Erigeron</i>	ERIGE2	ERIGE
Foothill daisy	<i>Erigeron corymbosus</i>	ERCO5	ERCO3
Foxtail barley	<i>Hordeum jubatum</i>	HOJU	HOJU
Foxtail fescue	<i>Festuca megalura</i>	FEME	FEME
Fringed onion	<i>Allium fibrillum</i>	ALFI	ALFI
Frosted Indian paintbrush	<i>Castilleja pruinosa</i>	CAPR14	CAPR4
Gairdner's penstemon	<i>Penstemon gairdneri</i>	PEGA	PEGA
Gairdner's penstemon	<i>Penstemon gairdneri</i> var. <i>oreganus</i>	PEGAO2	PEGAO
Gairdner's yampah	<i>Perideridia gairdneri</i>	PEGA3	PEGA2
Golden buckwheat	<i>Eriogonum flavum</i>	ERFL4	ERFL
Golden buckwheat	<i>Eriogonum flavum</i> var. <i>piperi</i>	ERFLP	ERFLP
Golden currant	<i>Ribes aureum</i>	RIAU	RIAU
Gooseberryleaf alumroot	<i>Heuchera grossulariifolia</i>	HEGR8	HEGR
Gooseberryleaf alumroot	<i>Heuchera grossulariifolia</i> var. <i>grossulariifolia</i>	HEGRG	HEGRG

Common name	Scientific name ¹	PLANTS code ²	R6 code ³
Goosefoot violet	<i>Viola purpurea</i>	VIPU4	VIPU
Gorman's biscuitroot	<i>Lomatium gormanii</i>	LOGO	LOGO
Grasswidow	<i>Sisyrinchium inflatum</i>	SIIN15	SIIN2
Gray hawkbeard	<i>Crepis intermedia</i>	CRIN4	CRIN
Gray horsebrush	<i>Tetradymia canescens</i>	TECA2	TECA
Gray rabbitbrush	<i>Chrysothamnus nauseosus</i>	CHNA2	CHNA
Gray rabbitbrush	<i>Chrysothamnus nauseosus var. nanus</i>	CHNAN2	CHNAN
Gray-green thistle	<i>Cirsium canovirens</i>	CICA6	CICA2
Gray's lomatium	<i>Lomatium grayi</i>	LOGR	LOGR
Great Basin nemophila	<i>Nemophila breviflora</i>	NEBR	NEBR
Green fescue	<i>Festuca viridula</i>	FEVI	FEVI
Green rabbitbush	<i>Chrysothamnus viscidiflorus</i>	CHVI8	CHVI
Green's goldenweed	<i>Haplopappus greenei</i>	HAGR6	HAGR
Groundsel	<i>Senecio</i>	SENEC	SENEC
Groundsmoke	<i>Gayophytum</i>	GAYOP	GAYOP
Hairstem groundsmoke	<i>Gayophytum ramosissimum</i>	GARA2	GARA
Hairy balsamroot	<i>Balsamorhiza hirsuta</i>	BAHI	BAHI
Hairy brome	<i>Bromus commutatus</i>	BRCO4	BRCO
Hairy owl-clover	<i>Orthocarpus hispidus</i>	ORHI	ORHI
Hairy penstemon	<i>Castilleja pilosa</i>	CAPI3	CAPI2
Hairy rockcress	<i>Arabis hirsuta</i>	ARHI	ARHI
Hairystem rockcress	<i>Arabis perelegans</i>	ARPE11	ARPE
Hareleaf	<i>Lagophylla ramosissima</i>	LARA	LARA
Harkness' linanthus	<i>Linanthus harknessii</i>	LIHA	LIHA
Harsh paintbrush	<i>Castilleja hispida</i>	CAHI9	CAHI2
Harsh paintbrush	<i>Castilleja hispida var. acuta</i>	CAHIA2	CAHIA
Hawksbeard	<i>Crepis</i>	CREPI	CREPI
Hawkweed	<i>Hieracium</i>	HIERA	HIERA
Heartleaf arnica	<i>Arnica cordifolia</i>	ARCO9	ARCO
Heart-leaved buckwheat	<i>Eriogonum compositum</i>	ERCO12	ERCO5
Henderson's lomatium	<i>Lomatium hendersonii</i>	LOHE2	LOHE
Hoary balsamroot	<i>Balsamorhiza incana</i>	BAIN	BAIN
Hoary chaenactis	<i>Chaenactis douglasii</i>	CHDO	CHDO
Hoary chaenactis	<i>Chaenactis douglasii var. achilleaefolia</i>	CHDOA	CHDOA
Holboell's rockcress	<i>Arabis holboellii</i>	ARHO2	ARHO
Holboell's rockcress	<i>Arabis holboellii var. retrofracta</i>	ARHOR	ARHOR
Hood's phlox	<i>Phlox hoodii</i>	PHHO	PHHO
Hood's sedge	<i>Carex hoodii</i>	CAHO5	CAHO
Hot rock penstemon	<i>Penstemon deustus</i>	PEDE4	PEDE
Hot rock penstemon	<i>Penstemon deustus var. variabilis</i>	PEDEV	PEDEV
Idaho fescue	<i>Festuca idahoensis</i>	FEID	FEID
Intermediate wheatgrass	<i>Agropyron intermedium</i>	AGIN2	AGIN2
Interrupted bentgrass	<i>Agrostis interrupta</i>	AGIN4	AGIN3
Japanese brome	<i>Bromus japonicus</i>	BRJA	BRJA
Kentucky bluegrass	<i>Poa pratensis</i>	POPR	POPR
Knotweed	<i>Polygonum</i>	POLYG4	POLYG
Lacepod	<i>Thysanocarpus curvipes</i>	THCU	THCU
Lanceleaf stonecrop	<i>Sedum lanceolatum</i>	SELA	SELA2
Largeflower goldenweed	<i>Haplopappus carthamoides</i>	HACA5	HACA
Large-flowered agoseris	<i>Agoseris grandiflora</i>	AGGR	AGGR
Large-flowered collomia	<i>Collomia grandiflora</i>	COGR4	COGR2
Large-fruited lomatium	<i>Lomatium macrocarpum</i>	LOMA3	LOMA
Larkspur	<i>Delphinium</i>	DELPH	DELPH
Leiberg's bluegrass	<i>Poa vaseyochloa</i>	POVA	POVA
Lemmon's needlegrass	<i>Stipa lemmonii</i>	STLE2	STLE2

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Lemon-scented tarweed	<i>Madia citriodora</i>	MACI2	MACI
Leptodactylon	<i>Leptodactylon pungens</i>	LEPU	LEPU2
Letterman's needlegrass	<i>Stipa lettermanii</i>	STLE4	STLE
Lewis' mock-orange	<i>Philadelphus lewisii</i>	PHLE4	PHLE2
Lindley's microseris	<i>Microseris linearifolia</i>	MILI	MILI
Little oniongrass	<i>Melica fugax</i>	MEFU	MEFU
Little sunflower	<i>Helianthella uniflora</i>	HEUN	HEUN
Little-flowered lupine	<i>Lupinus holosericeus</i>	LUHO2	LUHO
Littleleaf horsebrush	<i>Tetradymia glabrata</i>	TEGL	TEGL
Locoweed or milkvetch	<i>Astragalus</i>	ASTRA	ASTRA
Lodgepole pine	<i>Pinus contorta</i>	PICO	PICO
Longleaf evening-primrose	<i>Oenothera heterantha</i>	OEHE	OEHE
Longleaf milkvetch	<i>Astragalus reventus</i> var. <i>reventus</i>	ASRE5	ASRER
Longleaf phlox	<i>Phlox longifolia</i>	PHLO2	PHLO
Longstalk clover	<i>Trifolium longipes</i>	TRLO	TRLO
Lovage	<i>Ligusticum</i>	LIGUS	LIGUS
Low gumweed	<i>Grindelia nana</i>	GRNA	GRNA
Low penstemon	<i>Penstemon humilis</i>	PEHU	PEHU
Low pussytoes	<i>Antennaria dimorpha</i>	ANDI2	ANDI
Low sagebrush	<i>Artemisia arbuscula</i>	ARAR8	ARAR
Lupine	<i>Lupinus</i>	LUPIN	LUPIN
Mallow ninebark	<i>Physocarpus malvaceus</i>	PHMA5	PHMA
Manyflower stickseed	<i>Hackelia floribunda</i>	HAFL2	HAFL
Many-flowered phlox	<i>Phlox multiflora</i>	PHMU3	PHMU
Many-ribbed sedge	<i>Carex multicosata</i>	CAMU6	CAMU
Meadow deathcamus	<i>Zigadenus venenosus</i>	ZIVE	ZIVE
Meadow deathcamus	<i>Zigadenus venenosus</i> var. <i>gramineus</i>	ZIVEG	ZIVEG
Meadow foxtail	<i>Alopecurus pratensis</i>	ALPR3	ALPR
Medusahead	<i>Elymus caput-medusae</i>	ELCA13	ELCA2
Menzies larkspur	<i>Delphinium menziesii</i>	DEME	DEME
Mexican milkweed	<i>Asclepias fascicularis</i>	ASFA	ASFA2
Microseris	<i>Microseris</i>	MICRO6	MICRO3
Miner's lettuce	<i>Montia perfoliata</i>	MOPE3	MOPE
Missouri goldenrod	<i>Solidago missouriensis</i>	SOMI2	SOMI
Mountain big sagebrush	<i>Artemisia tridentata</i> var. <i>vaseyana</i>	ARTRV	ARTRV
Mountain brome	<i>Bromus carinatus</i>	BRCA5	BRCA
Mountain gooseberry	<i>Ribes montigenum</i>	RIMO2	RIMO
Mountain monardella	<i>Monardella odoratissima</i>	MOOD	MOOD
Mountain phlox	<i>Phlox austromontana</i>	PHAU3	PHAU
Mountain snowberry	<i>Symphoricarpos oreophilus</i>	SYOR2	SYOR
Mountain sweet-cicely	<i>Osmorhiza chilensis</i>	OSCH	OSCH
Naked broomrape	<i>Orobanche uniflora</i>	ORUN	ORUN
Naked broomrape	<i>Orobanche uniflora</i> var. <i>purpurea</i>	ORUNP	ORUNP
Narrowleaf goldenweed	<i>Haplopappus stenophyllus</i>	HAST	HAST2
Narrowleaf miner's lettuce	<i>Montia linearis</i>	MOLI4	MOLI
Narrowleaf pussytoes	<i>Antennaria stenophylla</i>	ANST2	ANST
Narrowleaf skullcap	<i>Scutellaria angustifolia</i>	SCAN3	SCAN
Narrow-leaved collomia	<i>Collomia linearis</i>	COLI2	COLI2
Needlegrass	<i>Stipa</i>	STIPA	STIPA
Needleleaf navarretia	<i>Navarretia intertexta</i>	NAIN2	NAIN
Nettleleaf horsemint	<i>Agastache urticifolia</i>	AGUR	AGUR
Nineleaf lomatium	<i>Lomatium triternatum</i>	LOTR2	LOTR
Nineleaf lomatium	<i>Lomatium triternatum</i> var. <i>platycarpum</i>	LOTRP	LOTRP
Nineleaf lomatium	<i>Lomatium triternatum</i> var. <i>triternatum</i>	LOTRT	LOTRT
Nodding microseris	<i>Microseris nutans</i>	MINU	MINU

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Nootka rose	<i>Rosa nutkana</i>	RONU	RONU
Northern linanthus	<i>Linanthus septentrionalis</i>	LISE	LISE
Northern mule's ears	<i>Wyethia amplexicaulis</i>	WYAM	WYAM
Nuttall's draba	<i>Draba densifolia</i>	DRDE	DRDE
Nuttall's linanthastrum	<i>Linanthastrum nuttallii</i>	LINU4	LINU
Nuttall's sandwort	<i>Arenaria nuttallii</i> var. <i>fragilis</i>	ARNUF	ARNUF
Oatgrass	<i>Danthonia</i>	DANTH	DANTH
Obscure cryptantha	<i>Cryptantha ambigua</i>	CRAM3	CRAM
Old man of the mountains	<i>Hymenoxys grandiflora</i>	HYGR5	HYGR
Onespike oatgrass	<i>Danthonia unispicata</i>	DAUN	DAUN
Oniongrass	<i>Melica</i>	MELIC	MELIC
Oniongrass	<i>Melica bulbosa</i>	MEBU	MEBU
Orange arnica	<i>Arnica fulgens</i>	ARFU3	ARFU
Orchardgrass	<i>Dactylis glomerata</i>	DAGL	DAGL
Oregon catchfly	<i>Silene oregana</i>	SIOR3	SIOR2
Oregon checker-mallow	<i>Sidalcea oregana</i>	SIOR	SIOR
Oregon cliff fern	<i>Woodsia oregana</i>	WOOR	WOOR
Oregon twinpod	<i>Physaria oregana</i>	PHOR2	PHOR
Oval-leaved eriogonum	<i>Eriogonum ovalifolium</i>	EROV	EROV
Paintbrush	<i>Castilleja</i>	CASTI2	CASTI
Pale agoseris	<i>Agoseris glauca</i>	AGGL	AGGL
Pale agoseris	<i>Agoseris glauca</i> var. <i>laciniata</i>	AGGLL	AGGLL
Pale alyssum	<i>Alyssum alyssoides</i>	ALAL3	ALAL
Pale Wallowa paintbrush	<i>Castilleja oresbia</i>	CAOR4	CAOR3
Palouse thistle	<i>Cirsium brevifolium</i>	CIBR	CIBR
Panicled deathcamas	<i>Zigadenus paniculatus</i>	ZIPA2	ZIPA
Parry's rush	<i>Juncus parryi</i>	JUPA	JUPA
Peavine	<i>Lathyrus</i>	LATHY	LATHY
Penstemon	<i>Penstemon</i>	PENST	PENST
Phacelia	<i>Phacelia</i>	PHACE	PHACE
Phlox	<i>Phlox</i>	PHLOX	PHLOX
Pin cushion plant	<i>Navarretia intertexta</i> var. <i>propinqua</i>	NAINP3	NAINP
Pine bluegrass	<i>Poa scabrella</i>	POSC	POSC
Pinegrass	<i>Calamagrostis rubescens</i>	CARU	CARU
Pink microsteris	<i>Microsteris gracilis</i>	MIGR	MIGR
Podfern	<i>Aspidotis densa</i>	ASDE6	ASDE
Ponderosa pine	<i>Pinus ponderosa</i>	PIPO	PIPO
Prairie junegrass	<i>Koeleria cristata</i>	KOCR	KOCR
Prairie lupine	<i>Lupinus lepidus</i>	LULE2	LULE2
Prairie lupine	<i>Lupinus lepidus</i> var. <i>utahensis</i>	LULEU2	LULEU
Prickly lettuce	<i>Lactuca serriola</i>	LASE	LASE
Prickly sandwort	<i>Arenaria aculeata</i>	ARAC2	ARAC2
Pubescent wheatgrass	<i>Agropyron trichophorum</i>	AGTR6	AGTR2
Pussy clover	<i>Trifolium plumosum</i>	TRPL2	TRPL
Pussypaws	<i>Spraguea umbellata</i>	SPUM	SPUM
Pussytoes	<i>Antennaria</i>	ANTEN	ANTEN
Pyrenaean sedge	<i>Carex pyrenaica</i>	CAPY3	CAPY
Rat-tail fescue	<i>Festuca myuros</i>	FEMY2	FEMY
Rattlesnake brome	<i>Bromus brizaeformis</i>	BRBR7	BRBR
Rayless fleabane	<i>Erigeron aphanactis</i>	ERAP	ERAP
Raynolds' sedge	<i>Carex raynoldsii</i>	CARA6	CARA
Red avens	<i>Geum triflorum</i>	GETR	GETR
Red avens	<i>Geum triflorum</i> var. <i>ciliatum</i>	GETRC2	GETRC2
Red besseyia	<i>Besseyia rubra</i>	BERU	BERU
Reedgrass or pinegrass	<i>Calamagrostis</i>	CALAM	CALAM

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Rigid fiddleneck	<i>Amsinckia retrorsa</i>	AMRE2	AMRE2
Rigid peavine	<i>Lathyrus rigidus</i>	LARI	LARI
Rigiopappus	<i>Rigiopappus leptocladus</i>	RILE2	RILE
Rock buckwheat	<i>Eriogonum sphaerocephalum</i>	ERSP7	ERSP3
Rock lupine	<i>Lupinus saxosus</i>	LUSA2	LUSA
Rockbrake	<i>Cryptogramma crispa</i>	CRCRA2	CRCR
Rockcress	<i>Arabis</i>	ARABI2	ARABI
Rocky Mountain butterweed	<i>Senecio streptanthifolius</i>	SEST3	SEST2
Rocky Mountain iris	<i>Iris missouriensis</i>	IRMI	IRMI
Rose	<i>Rosa</i>	ROSA5	ROSA
Ross' sedge	<i>Carex rossii</i>	CARO5	CARO
Rosy pussytoes	<i>Antennaria microphylla</i>	ANMI3	ANMI2
Rosy pussytoes	<i>Antennaria rosea</i>	ANRO2	ANRO
Rough wallflower	<i>Erysimum asperum</i>	ERAS2	ERAS
Roundleaf alumroot	<i>Heuchera cylindrica</i>	HECY2	HECY
Rush	<i>Juncus</i>	JUNCU	JUNCU
Rydberg's penstemon	<i>Penstemon rydbergii</i>	PERY	PERY
Ryebrome	<i>Bromus secalinus</i>	BRSE	BRSE
Sagebrush mariposa	<i>Calochortus macrocarpus</i>	CAMA5	CAMA
Salsify	<i>Tragopogon</i>	TRAGO	TRAGO
Sand lily	<i>Leucocrinum montanum</i>	LEMO4	LEMO
Sandberg's bluegrass	<i>Poa sandbergii</i>	POSA12	POSA3
Sandberg's bluegrass	<i>Poa secunda</i>	POSE	POSE
Sandwort	<i>Arenaria</i>	ARENA	ARENA
Scabland fleabane	<i>Erigeron bloomeri</i>	ERBL	ERBL
Scapose silene	<i>Silene scaposa</i>	SISC	SISC2
Scarlet gilia	<i>Gilia aggregata</i>	GIAG	GIAG
Scarlet paintbrush	<i>Castilleja miniata</i>	CAMI12	CAMI2
Sedge	<i>Carex</i>	CAREX	CAREX
Sego lily	<i>Calochortus</i>	CALOC	CALOC
Serrate balsamroot	<i>Balsamorhiza serrata</i>	BASE2	BASE
Shaggy fleabane	<i>Erigeron pumilus</i>	ERPU2	ERPU
Shaggy fleabane	<i>Erigeron pumilus</i> var. <i>intermedius</i>	ERPUI	ERPUI
Shaggy fleabane	<i>Erigeron pumilus</i> ssp. <i>intermedius</i> var. <i>gracilior</i>	ERPUG	ERPUG
Sharptooth angelica	<i>Angelica arguta</i>	ANAR3	ANAR2
Sheep fescue	<i>Festuca ovina</i>	FEOV	FEOV
Sheep fescue	<i>Festuca ovina</i> var. <i>rydbergii</i>	FEOVR	FEOVR
Sheep sorrel	<i>Rumex acetosella</i>	RUAC3	RUAC
Sheldon's milkvetch	<i>Astragalus reventus</i> var. <i>sheldonii</i>	ASRES	ASRES
Shiny fraseria	<i>Frasera albicaulis</i> var. <i>nitida</i>	FRALN2	FRALN
Shootingstar	<i>Dodecatheon</i>	DODEC	DODEC
Showy aster	<i>Aster conspicuus</i>	ASCO3	ASCO
Showy fleabane	<i>Erigeron speciosus</i>	ERSP4	ERSP
Showy oniongrass	<i>Melica spectabilis</i>	MESP	MESP
Showy penstemon	<i>Penstemon speciosus</i>	PESP	PESP
Shrubby bedstraw	<i>Galium multiflorum</i>	GAMU2	GAMU
Side-flowered mitrewort	<i>Mitella stauropetala</i>	MIST3	MIST2
Sierra sanicle	<i>Sanicula graveolens</i>	SAGR5	SAGR
Sierran peavine	<i>Lathyrus nevadensis</i>	LANE3	LANE
Silky lupine	<i>Lupinus sericeus</i>	LUSE4	LUSE
Silky lupine	<i>Lupinus sericeus</i> var. <i>sericeus</i>	LUSES2	LUSES
Silky phacelia	<i>Phacelia sericea</i>	PHSE	PHSE
Silverleaf phacelia	<i>Phacelia hastata</i>	PHHA	PHHA
Silverleaf phacelia	<i>Phacelia hastata</i> var. <i>alpina</i>	PHHAA	PHHAA
Silverleaf phacelia	<i>Phacelia hastata</i> var. <i>leucophylla</i>	PHHAL	PHHAL

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Siskiyou hawksbeard	<i>Crepis modocensis</i>	CRMO4	CRMO3
Slender buckwheat	<i>Eriogonum microthecum</i> var. <i>laxiflorum</i>	ERMIL5	ERMIL
Slender cinquefoil	<i>Potentilla gracilis</i>	POGR9	POGR
Slender cinquefoil	<i>Potentilla gracilis</i> var. <i>glabrata</i>	POGRG	POGRG
Slender cryptantha	<i>Cryptantha affinis</i>	CRAF	CRAF
Slender cudweed	<i>Gnaphalium microcephalum</i>	GNMI	GNMI
Slender hawksbeard	<i>Crepis atrabarba</i>	CRAT	CRAT
Slender hawksbeard	<i>Crepis atrabarba</i> var. <i>originalis</i>	CRATO	CRATO
Slender rush	<i>Juncus tenuis</i>	JUTE	JUTE
Slender rush	<i>Juncus tenuis</i> var. <i>tenuis</i>	JUTE	JUTET
Slender tarweed	<i>Madia gracilis</i>	MAGR3	MAGR
Slender toothwort	<i>Cardamine pulcherrima</i>	CAPU4	CAPU2
Slenderfruit lomatium	<i>Lomatium leptocarpum</i>	LOLE2	LOLE
Slim larkspur	<i>Delphinium depauperatum</i>	DEDE2	DEDE
Slimpod shootingstar	<i>Dodecatheon conjugens</i>	DOCO	DOCO
Small fescue	<i>Festuca microstachys</i>	FEMI2	FEMI
Small flowered blue-eyed Mary	<i>Collinsia parviflora</i>	COPA3	COPA
Smallflower fringecup	<i>Lithophragma parviflora</i>	LIPAP3	LIPA
Smallflower nemophila	<i>Nemophila parviflora</i>	NEPA	NEPA
Small-flowered willowherb	<i>Epilobium minutum</i>	EPMI	EPMI
Small-head tarweed	<i>Madia minima</i>	MAMI	MAMI
Smooth brome	<i>Bromus inermis</i>	BRIN2	BRIN
Snowbrush ceanothus	<i>Ceanothus velutinus</i>	CEVE	CEVE
Snowline cymopterus	<i>Cymopterus nivalis</i>	CYN13	CYNI
Soft brome	<i>Bromus mollis</i>	BRMO2	BRMO
Spike bentgrass	<i>Agrostis exarata</i>	AGEX	AGEX
Spreading dogbane	<i>Apocynum androsaemifolium</i>	APAN2	APAN
Spreading dogbane	<i>Apocynum androsaemifolium</i> var. <i>pumilum</i>	APANP	APANP
Spreading fleabane	<i>Erigeron divergens</i>	ERDI4	ERDI
Spreading groundsmoke	<i>Gayophytum diffusum</i>	GADI2	GADI
Spreading phlox	<i>Phlox diffusa</i>	PHDI3	PHDI
Spurred lupine	<i>Lupinus laxiflorus</i>	LULA3	LULA2
Spurred lupine	<i>Lupinus laxiflorus</i> var. <i>laxiflorus</i>	LULAA	LULAL3
Spurred lupine	<i>Lupinus laxiflorus</i> var. <i>pseudoparviflorus</i>	LULAP5	LULAP
Squaw apple	<i>Peraphyllum ramosissimum</i>	PERA4	PERA3
Stemless goldenweed	<i>Haplopappus acaulis</i>	HAAC	HAAC
Sticky cinquefoil	<i>Potentilla glandulosa</i>	POGL9	POGL
Sticky currant	<i>Ribes viscosissimum</i>	RIVI3	RIVI
Sticky geranium	<i>Geranium viscosissimum</i>	GEVI2	GEVI
Stiff milkvetch	<i>Astragalus conjunctus</i>	ASCO11	ASCO3
Stiff sagebrush	<i>Artemisia rigida</i>	ARRI2	ARRI
Stoncrop	<i>Sedum</i>	SEDUM	SEDUM
Strict buckwheat	<i>Eriogonum strictum</i>	ERST4	ERST2
Strict buckwheat	<i>Eriogonum strictum</i> var. <i>proliferum</i>	ERSTP	ERSTP
Strict buckwheat	<i>Eriogonum strictum</i> ssp. <i>proliferum</i> var. <i>anserinum</i>	ERSTA3	ERSTA3
Subalpine fir	<i>Abies lasiocarpa</i>	ABLA	ABLA2
Sugar bowls	<i>Clematis hirsutissima</i>	CLHI	CLHI
Sulfur penstemon	<i>Penstemon attenuatus</i>	PEAT3	PEAT
Sulfur penstemon	<i>Penstemon attenuatus</i> var. <i>militaris</i>	PEATM	PEATM
Sulfur penstemon	<i>Penstemon attenuatus</i> var. <i>pseudoprocerus</i>	PEATP2	PEATP
Sulfur-flower buckwheat	<i>Eriogonum umbellatum</i>	ERUM	ERUM
Sulfur-flower buckwheat	<i>Eriogonum umbellatum</i> var. <i>polyanthum</i>	ERUMP3	ERUMP
Sulfur-flower buckwheat	<i>Eriogonum umbellatum</i> var. <i>stellatum</i>	ERUMS5	ERUMS
Sulfur-flower buckwheat	<i>Eriogonum umbellatum</i> var. <i>umbellatum</i>	ERUMU2	ERUMU
Sulphur lupine	<i>Lupinus sulphureus</i>	LUSU5	LUSU

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Swale desert-parsley	<i>Lomatium ambiguum</i>	LOAM	LOAM
Swamp saxifrage	<i>Saxifraga fragosa</i>	SAFR7	SAFR
Swamp saxifrage	<i>Saxifraga integrifolia</i>	SAIN4	SAIN
Swamp saxifrage	<i>Saxifraga integrifolia</i> var. <i>columbiana</i>	SAINC2	SAINC
Sweet-cicely	<i>Osmorhiza</i>	OSMOR	OSMOR
Tailcup lupine	<i>Lupinus caudatus</i>	LUCA	LUCA
Tall annual willowherb	<i>Epilobium paniculatum</i>	EPPA2	EPPA
Tall pussytoes	<i>Antennaria anaphaloides</i>	ANAN2	ANAN
Tansymustard	<i>Descurainia</i>	DESCU	DESCU
Tapertip hawksbeard	<i>Crepis acuminata</i>	CRAC2	CRAC
Tapertip onion	<i>Allium acuminatum</i>	ALAC4	ALAC
Tarweed	<i>Madia</i>	MADIA	MADIA
Thick-leaved peavine	<i>Lathyrus lanszwertii</i>	LALA3	LALA2
Thickstem aster	<i>Aster integrifolius</i>	ASIN3	ASIN
Thinleaf owl-clover	<i>Orthocarpus tenuifolius</i>	ORTE2	ORTE
Thistle	<i>Cirsium</i>	CIRSI	CIRSI
Threadleaf fleabane	<i>Erigeron filifolius</i>	ERFI2	ERFI
Threadleaf phacelia	<i>Phacelia linearis</i>	PHLI	PHLI
Threadleaf sandwort	<i>Arenaria capillaris</i>	ARCA7	ARCA2
Threadleaf sedge	<i>Carex filifolia</i>	CAFI	CAFI
Threetip sagebrush	<i>Artemisia tripartita</i>	ARTR4	ARTR2
Thurber's needlegrass	<i>Stipa thurberiana</i>	STTH2	STTH
Thymeleaf sandwort	<i>Arenaria serpyllifolia</i>	ARSE2	ARSE
Tolm's onion	<i>Allium tolmiei</i>	ALTO	ALTO
Torrey's cryptantha	<i>Cryptantha torreyana</i>	CRTO4	CRTO
Tufted phlox	<i>Phlox caespitosa</i>	PHCA7	PHCA2
Turpentine cymopterus	<i>Cymopterus terebinthinus</i>	CYTE9	CYTE
Turpentine cymopterus	<i>Cymopterus terebinthinus</i> var. <i>foeniculaceus</i>	CYTEF	CYTEF
Twin arnica	<i>Arnica sororia</i>	ARSO2	ARSO
Upland larkspur	<i>Delphinium nuttallianum</i>	DENU2	DENU3
Utah thistle	<i>Cirsium utahense</i>	CIUT	CIUT
Valerianella	<i>Valerianella locusta</i>	VALO	VALO
Varileaf phacelia	<i>Phacelia heterophylla</i>	PHHE2	PHHE
Velvet lupine	<i>Lupinus leucophyllus</i>	LULE3	LULE
Velvet lupine	<i>Lupinus leucophyllus</i> var. <i>leucophyllus</i>	LULEL4	LULEL
Velvet lupine	<i>Lupinus leucophyllus</i> var. <i>tenuispicus</i>	LULET	LULET
Ventenata	<i>Ventenata dubia</i>	VEDU	VEDU
Violet	<i>Viola</i>	VIOLA	VIOLA
Virginia strawberry	<i>Fragaria virginiana</i>	FRVI	FRVI
Virginia strawberry	<i>Fragaria virginiana</i> var. <i>platypetala</i>	FRVIP2	FRVIP
Wall rockcress	<i>Arabis aculeolata</i>	ARAC4	ARAC
Waterleaf	<i>Hydrophyllum capitatum</i>	HYCA4	HYCA
Wavy-leaved paintbrush	<i>Castilleja applegatei</i>	CAAP4	CAAP2
Wax currant	<i>Ribes cereum</i>	RICE	RICE
Wayside gromwell	<i>Lithospermum ruderales</i>	LIRU4	LIRU
Webber's ricegrass	<i>Oryzopsis webberi</i>	ORWE	ORWE
Western false solomon's seal	<i>Smilacina racemosa</i>	SMRA	SMRA
Western groundsel	<i>Senecio integerrimus</i>	SEIN2	SEIN
Western groundsel	<i>Senecio integerrimus</i> var. <i>exaltatus</i>	SEINE	SEINE
Western hawksbeard	<i>Crepis occidentalis</i>	CROC	CROC
Western hawksbeard	<i>Crepis occidentalis</i> var. <i>costata</i>	CROCC2	CROCC
Western hawkweed	<i>Hieracium albertinum</i>	HIAL	HIAL2
Western juniper	<i>Juniperus occidentalis</i>	JUOC	JUOC
Western meadowrue	<i>Thalictrum occidentale</i>	THOC	THOC
Western mugwort	<i>Artemisia ludoviciana</i>	ARLU	ARLU

Common name	Scientific name ¹	PLANTS code ²	R6 code ³
Western needlegrass	<i>Stipa occidentalis</i>	STOC2	STOC
Western needlegrass	<i>Stipa occidentalis</i> var. <i>occidentalis</i>	STOC2	STOCO
Western serviceberry	<i>Amelanchier alnifolia</i>	AMAL2	AMAL
Western sweetroot	<i>Osmorhiza occidentalis</i>	OSOC	OSOC
Wheeler's bluegrass	<i>Poa nervosa</i>	PONE2	PONE
Wheeler's bluegrass	<i>Poa nervosa</i> var. <i>wheeleri</i>	PONEW	PONEW
White hawkweed	<i>Hieracium albiflorum</i>	HIAL2	HIAL
White mustard	<i>Brassica hirta</i>	BRHI2	BRHI
White plectritis	<i>Plectritis macrocera</i>	PLMA4	PLMA3
Whitebark pine	<i>Pinus albicaulis</i>	PIAL	PIAL
White-margined knotweed	<i>Polygonum polygaloides</i>	POPO4	POPO
Whitestem frasera	<i>Frasera albicaulis</i>	FRAL2	FRAL2
Whitestem mentzelia	<i>Mentzelia albicaulis</i>	MEAL6	MEAL2
Wide fruit mariposa	<i>Calochortus eurycarpus</i>	CAEU	CAEU2
Widefruit sedge	<i>Carex eurycarpa</i>	CAEU2	CAEU
Wild blue flax	<i>Linum perenne</i> var. <i>lewisii</i>	LIPEL3	LIPEL
Wild onion	<i>Allium</i>	ALLIU	ALLIU
Willowherb	<i>Epilobium</i>	EPILO	EPILO
Wirestem muhly	<i>Muhlenbergia mexicana</i>	MUME2	MUME
Wiry knotweed	<i>Polygonum majus</i>	POMA9	POMA2
Woodrush pussytoes	<i>Antennaria luzuloides</i>	ANLU2	ANLU
Woolly eriophyllum	<i>Eriophyllum lanatum</i>	ERLA6	ERLA
Woolly goldenweed	<i>Haplopappus lanuginosus</i>	HALA3	HALA
Woolly groundsel	<i>Senecio canus</i>	SECA2	SECA
Woollyhead clover	<i>Trifolium eriocephalum</i> var. <i>piperi</i>	TRERP2	TRERP
Woollypod milkvetch	<i>Astragalus purshii</i>	ASPU9	ASPU
Woollypod milkvetch	<i>Astragalus purshii</i> var. <i>lagopinus</i>	ASPUL	ASPUL
Woolly-weed	<i>Hieracium scouleri</i>	HISC2	HISC
Wormleaf stonecrop	<i>Sedum douglasii</i>	SEDO3	SEDO
Wormleaf stonecrop	<i>Sedum stenopetalum</i>	SEST2	SEST
Wyeth's lupine	<i>Lupinus wyethii</i>	LUWY	LUWY
Wyoming Indian paintbrush	<i>Castilleja linariaefolia</i>	CALI4	CALI2
Yampah	<i>Perideridia</i>	PERID	PERID
Yellow monkeyflower	<i>Mimulus guttatus</i>	MIGU	MIGU
Yellow salsify	<i>Tragopogon dubius</i>	TRDU	TRDU
Yellow star-thistle	<i>Centaurea solstitialis</i>	CESO3	CESO

¹Hitchcock and Cronquist 1973.²USDA, NRCS 2004b.³Garrison and Skovlin 1976.

Appendix C: Vegetation Types by Ecoclass Code

Ecoclass code	Short name	Long name	Level ¹	PAG ²
CJG111	JUOC/FEID-AGSP	Western juniper/Idaho fescue-bluebunch wheatgrass	PA	Hot moist UW
CJG113	JUOC/AGSP	Western juniper/bluebunch wheatgrass	PCT	Hot dry UW
CJS112	JUOC/ARAR8/FEID	Western juniper/low sagebrush/Idaho fescue	PA	Hot dry UW
CJS321	JUOC/PUTR2/FEID-AGSP	Western juniper/bitterbrush/Idaho fescue-bluebunch wheatgrass	PA	Hot moist UW
CJS41	JUOC/CELE3/FEID-AGSP	Western juniper/mountain mahogany/Idaho fescue-bluebunch wheatgrass	PA	Hot moist UW
CJS811	JUOC/ARRI2-Scab	Western juniper/stiff sagebrush	PCT	Hot dry UW
CPC212	PIPO-JUOC/CELE3-SYOR2	Ponderosa pine-western juniper/mountain mahogany-mountain snowberry	PCT	Hot dry UF
CPG111	PIPO/AGSP	Ponderosa pine/bluebunch wheatgrass	PA	Hot dry UF
CPG112	PIPO/FEID	Ponderosa pine/Idaho fescue	PA	Hot dry UF
CPS131	PIPO/ARTRV/FEID-AGSP	Ponderosa pine/mountain big sagebrush/Idaho fescue-bluebunch wheatgrass	PA	Hot dry UF
CPS226	PIPO/PUTR2/FEID-AGSP	Ponderosa pine/bitterbrush/Idaho fescue-bluebunch wheatgrass	PA	Hot dry UF
CPS229	PIPO/PUTR2/AGSP-POSA12	Ponderosa pine/bitterbrush/bluebunch wheatgrass-Sandberg's bluegrass	PA	Hot dry UF
CPS233	PIPO/CELE3/PONEW	Ponderosa pine/mountain mahogany/Wheeler's bluegrass	PA	Hot dry UF
CPS234	PIPO/CELE3/FEID-AGSP	Ponderosa pine/mountain mahogany/Idaho fescue-bluebunch wheatgrass	PA	Hot dry UF
CPS8	PIPO/PERA4	Ponderosa pine/squaw apple	PCT	Hot dry UF
FM9111	ERDO-POSA12	Douglas' buckwheat-Sandberg's bluegrass	PCT	Hot dry UH
GB4112	AGSP-POSA12-SCAN3	Bluebunch wheatgrass-Sandberg's bluegrass-narrowleaf skullcap	PA	Hot dry UH
GB4119	AGSP-POSA12-LUPIN	Bluebunch wheatgrass-Sandberg's bluegrass-lupine	PA	Hot dry UH
GB4121	AGSP-POSA12	Bluebunch wheatgrass-Sandberg's bluegrass	PA	Hot dry UH
GB4123	AGSP-POSA12-BASA3	Bluebunch wheatgrass-Sandberg's bluegrass-arrowleaf balsamroot	PA	Hot dry UH
GB4124	AGSP-POSA12-ERHE2	Bluebunch wheatgrass-Sandberg's bluegrass-creamy buckwheat	PA	Hot dry UH
GB4125	AGSP-POSA12-ASRE5	Bluebunch wheatgrass-Sandberg's bluegrass-Blue Mountain milkvetch	PA	Hot dry UH
GB4126	AGSP-POSA12-TRMA3	Bluebunch wheatgrass-Sandberg's bluegrass-bighead clover	PA	Hot dry UH
GB4127	AGSP-POSA12-APAN2	Bluebunch wheatgrass-Sandberg's bluegrass-spreading dogbane	PA	Hot dry UH
GB4131	AGSP-BRCA5	Bluebunch wheatgrass-mountain brome	PCT	Warm moist UH
GB4132	AGSP-ERUM	Bluebunch wheatgrass-sulfur-flower buckwheat	PCT	Hot dry UH
GB4133	AGSP-CYTEF	Bluebunch wheatgrass-turpentine cymopterus	PCT	Hot dry UH
GB4411	POBU-MAGL2	Bulbous bluegrass-cluster tarweed	PCT	Hot dry UH
GB4911	AGSP-POSA12-DAUN	Bluebunch wheatgrass-Sandberg's bluegrass-onespike oatgrass	PA	Hot dry UH
GB4915	BERE/AGSP-APAN2	Creeping Oregon grape/bluebunch wheatgrass-spreading dogbane	PCT	Warm dry US
GB5011	MEBU-STOC2	Oniongrass-western needlegrass	PCT	Warm dry UH
GB59	FEID-AGSP	Idaho fescue-bluebunch wheatgrass	PA	Warm moist UH
GB5911	FEID-KOCR (Ridge)	Idaho fescue-prairie junegrass (ridge)	PA	Cool moist UH
GB5912	FEID-KOCR (Mound)	Idaho fescue-prairie junegrass (mound)	PA	Cool moist UH
GB5916	FEID-AGSP-LUPIN	Idaho fescue-bluebunch wheatgrass-lupine	PA	Warm moist UH
GB5917	FEID-AGSP-BASA3	Idaho fescue-bluebunch wheatgrass-arrowleaf balsamroot	PA	Warm moist UH
GB5923	FEID-GETR	Idaho fescue-red avens	PCT	Cool moist UH

Ecoclass code	Short name	Long name	Level ¹	PAG ²
GB5925	FEID-AGSP-CYTEF	Idaho fescue-bluebunch wheatgrass-cymopterus	PA	Warm dry UH
GB5926	FEID-AGSP-FRALC2	Idaho fescue-bluebunch wheatgrass-Cusick's frasera	PA	Cool moist UH
GB5931	FEID-AGSP-PHLOX	Idaho fescue-bluebunch wheatgrass-phlox	PA	Warm moist UH
GB5932	FEID-DAUN	Idaho fescue-onespike oatgrass	PCT	Warm dry UH
GB9111	POSA12-DAUN	Sandberg's bluegrass-onespike oatgrass	PA	Hot dry UH
GB9114	DAUN-LOLE2	Onespike oatgrass-slenderfruit lomatium	PA	Hot moist UH
GS1112	FEVI-LULA3	Green fescue-spurred lupine	PA	Cold moist UH
GS1113	FEVI-JUPA	Green fescue-Parry's rush	PA	Cold dry UH
GS1115	FEVI-PENST	Green fescue-penstemon	PCT	Cold moist UH
GS50	STOC2-SIHY (Alpine)	Western needlegrass-squirreltail	PCT	Warm dry UH
SD1911	ARAR8/FEID-AGSP	Low sagebrush/Idaho fescue-bluebunch wheatgrass	PA	Warm moist US
SD1924	ARAR8/AGSP	Low sagebrush/bluebunch wheatgrass	PA	Warm dry US
SD2401	ARTR4/POSA12-DAUN	Threetip sagebrush/Sandberg's bluegrass-onespike oatgrass	PCT	Warm dry US
SD2911	ARTRV/FEID-AGSP	Mountain big sagebrush/Idaho fescue-bluebunch wheatgrass	PA	Warm moist US
SD2917	ARTRV-SYOR2/BRCA5	Mountain big sagebrush-mountain snowberry/mountain brome	PCT	Warm moist US
SD2918	ARTRV/AGSP-POSA12	Mountain big sagebrush/bluebunch wheatgrass-Sandberg's bluegrass	PA	Warm dry US
SD2919	ARTRV-SYOR2	Mountain big sagebrush-mountain snowberry	PCT	Warm moist US
SD2929	ARTRV/FEID-KOCR	Mountain big sagebrush/Idaho fescue-prairie junegrass	PA	Warm moist US
SD3010	ARTRV-PERA4	Mountain big sagebrush-squaw apple	PCT	Warm moist US
SD3011	ARTRV/ELCI2	Mountain big sagebrush/giant wildrye	PCT	Warm moist US
SD3111	PUTR2/FEID-AGSP	Bitterbrush/Idaho fescue-bluebunch wheatgrass	PA	Warm moist US
SD3124	PUTR2-ARTRV/FEID-AGSP	Bitterbrush-mountain big sagebrush/Idaho fescue-bluebunch wheatgrass	PA	Warm moist US
SD3125	PUTR2-ARTRV/FEID	Bitterbrush-mountain big sagebrush/Idaho fescue	PCT	Warm moist US
SD3126	PUTR2/ERDO	Bitterbrush/Douglas' buckwheat	PCT	Warm dry US
SD4111	CELE3/FEID-AGSP	Mountain mahogany/Idaho fescue-bluebunch wheatgrass	PA	Warm moist US
SD4112	CELE3/AGSP	Mountain mahogany/bluebunch wheatgrass	PCT	Warm dry US
SD4115	CELE3-PUTR2/AGSP	Mountain mahogany-bitterbrush/bluebunch wheatgrass	PCT	Warm moist US
SD4114	CELE3/PONEW	Mountain mahogany/Wheeler's bluegrass	PCT	Warm dry US
SD9111	ARRI2/POSA12	Stiff sagebrush/Sandberg's bluegrass	PA	Warm dry US
SD9141	ARRI2/PEGA	Stiff sagebrush/Gairdner's penstemon	PCT	Warm dry US
SD9221	ARAR8/POSA12	Low sagebrush/Sandberg's bluegrass	PA	Warm dry US
SM32	SYOR2	Mountain snowberry	PCT	Warm moist US
SS4914	ARTRV/BRCA5	Mountain big sagebrush/mountain brome	PCT	Warm moist US

¹PA = plant association, PCT = plant community type.

²Plant association group: UW = upland woodland, UF = upland forest, UH = upland herbland, US = upland shrubland.

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