STATUS AND CONSERVATION OF THE PALOUSE GRASSLAND IN IDAHO

by

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ABSTRACT

The Palouse Grassland is recognized as an ecologically distinct element of the Pacific Northwest Bunchgrass biome. The area once occupied by Palouse Grassland has seen nearly 100% conversion to cultivated agriculture, making it an imperiled ecosystem. Remnants of Palouse Grassland vegetation are now restricted to small areas on the edge of cultivated fields, or rocky slopes along the margin of the former prairie. The easternmost extent of the prairie region extends into Idaho, where three climax grassland associations have been described: *Festuca idahoensis-Symphoricarpos albus* (Idaho fescue–common snowberry), *Festuca idahoensis–Rosa nutkana* (Idaho fescue-Nootka rose), and *Festuca scabrella–F. idahoensis* (rough fescue–Idaho fescue). These communities in turn, are habitat for six, globally rare plant species endemic to the region. This report documents the results of a 1996 survey of Palouse Grassland remnants in Idaho. Grassland communities were sampled, rare plant populations were documented, and grassland remnants were evaluated for their conservation value. Canopy cover data from plot sampling are summarized in a releve table. Stand composition is then evaluated in the context of plant associations recognized in the Western Regional Vegetation Classification (WRVC) for the study area. Our data do not support the existence of two distinct vegetation zones in Idaho portions of the prairie. Fourteen grassland sites with conservation value were identified and documented, noting their location, size, condition, biodiversity values, ownership and threats. This information was entered into site basic records (SBR), in the Conservation Data Center's Biological and Conservation Database, and the records appended to this report.

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INTRODUCTION

Grasslands of the Pacific Northwest constitute one of the major vegetation types or biomes in North America (Sims 1988). These grasslands are often called Palouse Prairie, even though they extend far beyond the Palouse region of eastern Washington and adjacent Idaho (Caldwell 1961). To remedy this confusion between an ecological and a geographic name, Tisdale (1983) recommended changing the name of the grasslands to Pacific Northwest Bunchgrass, which indicates both the area occupied and the life form of the dominant species. Unfortunately, this nomenclatural innovation has not been widely accepted yet. A study of Pacific Northwest Bunchgrass grasslands in Idaho, Oregon, and Washington subdivided the biome into several ecological divisions and subdivisions based on the composition and structure of the vegetation, and on physical features (Idaho Natural Heritage Program et al. 1986; The Nature Conservancy et al. 1987). Two of these divisions occur in Idaho: Canyon Grasslands and Palouse Grasslands (Tisdale 1986a).

Canyon Grasslands occur in the deep canyon systems that dissect the Columbia Plateau. They are characterized by steep slopes, high relief, and grassland vegetation punctuated by isolated stands of shrubs and trees. Although many of the same bunchgrasses that dominate Canyon Grasslands also dominate Palouse Grasslands, vegetation studies have described different plant associations in the two areas (Daubenmire 1970; Tisdale 1986b; Johnson and Simon 1987). The best examples of these grasslands occur in the Snake, Salmon, Grande Ronde, and Imnaha river canyons of west-central Idaho and adjacent Oregon and Washington. To a large extent these grasslands are intact, never having been extensively converted to other uses (Tisdale 1986a). The major exceptions are the development of the urban center of Lewiston, Idaho, and Clarkston, Washington, and the widespread invasion of noxious weeds resulting from heavy livestock grazing (Tisdale 1983; Mancuso and Moseley 1994). See Tisdale (1986b), Johnson and Simon (1987), and Mancuso and Moseley (1994) for more extensive ecological descriptions of Canyon Grasslands.

In contrast to the Canyon Grasslands, we define the Palouse Grasslands as the native steppe vegetation occurring on the gently rolling basalt plateaus and adjacent mountain foothills that are covered with wind-deposited loess (Idaho Natural Heritage Program et al. 1986). Palouse Grasslands are the focus of this report.

The word “Palouse”, which is affixed to the region, the river whose basin encompasses most of the area, and the original inhabitants, has been attributed to both French and Indian origins meaning a “sea of grass” or “grassland plains” (Caldwell 1961). In ecological usage, the term Palouse has had a much broader meaning. It has been used for grasslands as far south as Utah (Stoddard 1941), east to Montana, and north into British Columbia (Weaver and Clements 1938; Humphrey 1945; Caldwell 1961; Tisdale 1983; Sims 1988). Daubenmire, in his extensive ecological investigations of the region, refrained from using Palouse to describe the Pacific Northwest Bunchgrass grasslands. He instead chose to name vegetation zones after the dominant species, such as wheatgrass-bluegrass zone and fescue-wheatgrass zone (e.g., Daubenmire 1942; 1946; 1952; 1956; 1970; Franklin and Dyrness 1988; Tisdale 1994).

The term Palouse is also used in many broad-scale classification schemes that group areas with homogeneous physical and climatic conditions into physiographic provinces, geomorphic provinces, or, more recently, ecoregions. Older schemes based the classification primarily on landform characteristics. In Idaho, the Pacific Northwest Bunchgrass biome occurs in Fenneman's (1931) Palouse District of the Columbia Plateau Physiographic Province. Under another classification, it occurs in the Palouse Hills and Tri-state Uplands sections of the Columbia Intermontane Geomorphic Province of Ross and Savage (1967).

More recent classifications have taken broad-scale climatic and biological patterns into consideration, in addition to landform. Under three commonly used schemes, Pacific Northwest Bunchgrass grasslands occur in the Columbia Floristic Division (Ertter and Moseley 1992), Omernik's Columbia Plateau Ecoregion (Omernik and Gallant 1986; Thiele and Omernik 1993), and Bailey's Palouse Prairie Section of the Great Plains-Palouse Dry Steppe Province (McNab and Avers 1994; Bailey 1995). These classifications have been further divided into subunits, which better circumscribe the distribution of Palouse Grasslands in Idaho (Table 1). All three schemes delineate two units that are separated by the Clearwater River canyon. The unit north of the canyon is generally referred to by the residents of northern Idaho as "The Palouse," while the southern unit is often called the "Camas Prairie" (Appendix 1, Map 1).

Table 1. Areas of Idaho containing Palouse Grasslands and their correspond- ing subdivisions of floristic and ecoregional classifications.

Area	Floristic Regions (Ertter and Moseley 1992)	Omernik's Ecoregions (Thiele and Omernik 1993)	Bailey's Ecoregions (U.S. Forest Service, unpublished data)
The Palouse	Palouse Unit	Palouse Hills Subregion	Palouse Hills Subsection
Camas Prairie	Grangeville Unit	Nez Perce Prairie	Camas/Weippe Basalt Plateaus Subsection
Rathdrum Prairie	Rathdrum Unit	N/A	North Idaho Valleys Subsection

The native vegetation of the Rathdrum Prairie, in the Spokane River valley near Post Falls, Idaho, was presumably Pacific Northwest Bunchgrass grassland. Only one small grassland remnant is known and the relationship of this vegetation to the Palouse Grasslands is not well understood. We have included this small remnant in our treatment of Palouse Grasslands because it appears similar to a community found in the northern portion of the Palouse area. It is treated as a unit of the Panhandle Floristic Division (Appendix 1, Map 1; Ertter and

Moseley 1992) and as a subsection of the Bailey's Okanogan Highlands Section of the Northern Rocky Mountain Province (McNab and Avers 1994; Bailey 1995; Table 1). This report deals primarily with the Palouse and Camas Prairie regions.

Beginning early in this century, no ecological discussion of the Palouse Grasslands omitted mentioning that a majority of this biome has been converted to agriculture, and most of what remained had been altered by livestock overgrazing (e.g., Weaver 1914; Weaver and Clements 1938; Daubenmire 1940; 1942; 1970; Young 1943; Humphrey 1945; Buechner 1953; Tisdale 1961; 1986a). In fact, a recent vegetation map of Idaho failed to recognize a Palouse Grasslands cover type because of its near total conversion to agricultural and urban uses (Caicco 1989; Caicco et al. 1995). In contrast, the Canyon Grasslands are recognized as a mapping unit that covers 469,410 acres in the state (Caicco et al. 1995). During the initial settlement of the Palouse area in the 1860's, the land was primarily used for grazing. It was quickly recognized, however, that the deep loessal soils characteristic of the region were excellent for growing wheat. Starting about 1880, this new type of land use began to convert the grasslands to row crops, and by about 1910 all areas that could be plowed were brought into cropland (Daubenmire 1940; Buechner 1953; Tisdale 1961). Livestock grazing continued on the larger stands of remaining Palouse Grassland that were too rocky or otherwise impractical to plow. These were eventually converted to non-native vegetation types (Daubenmire 1940; Young 1943). There were, however, small remnants that remained in a relatively unaltered state, mostly as corners of fields or rocky areas that were not incorporated into livestock operations (Weaver 1914; Daubenmire 1940; 1970; Young 1943; Aller et al. 1981; Tisdale 1986a; Thiele and Omernik 1993).

As a consequence of this human alteration, the Palouse Grasslands are considered one of the most endangered ecosystems in the United States. It is estimated that only 0.1% of these grasslands remain in a natural state (Noss 1995; Noss et al. 1995). Several of the Palouse Grassland plant associations described by Daubenmire (1970) are considered globally imperiled by The Nature Conservancy and Natural Heritage/Conservation Data Center network (Grossman et al. 1994).

STUDY AREA

As mentioned in the Introduction, there are two disjunct areas in Idaho that had Palouse Grasslands as their native vegetation. The area north of the Clearwater River canyon is the easternmost extension of the Palouse, the area to the south, called the Camas Prairie, is located entirely within Idaho (Appendix 1, Map 1). Because only a small portion of the Palouse extends into Idaho, the Camas Prairie formed the bulk of the study area. Climatic and geological processes that shaped the two areas were similar, resulting in the same vegetational Formation. However, important distinctions exist. Each area is described individually below following general discussions of climate and geology.

Climate

The region in general has a Mediterranean type climate with cool, moist winters and warm, dry summers. Winters are dominated by wet, Pacific airmasses and summers by a stationary high pressure zone over the northwest coast. Climate of the Camas Prairie is similar to that of the Idaho portion of the Palouse. Basic climatic variables are summarized in Table 2 for weather stations best representing the two parts of the study area (USDA-NRCS 1996). Although there is little difference in total precipitation between the two areas, the Camas Prairie receives more of its precipitation in spring and less in winter.

Table 2. Selected climatic variables for two stations on the margin of the Palouse Grassland (USDA-NRCS 1996).

	Subsection	
	Camas Prairie	Palouse
Station	Grangeville	Moscow
Elevation (ft)	2250	2660
Ave. daily Temp. (•F)	48.3•	47•
Ave. no. of growing degree days	3506	3949
Ave. snowfall (in.)	36.8	51.6
Ave. annual precipitation (in.)	26.17	25.47
December through February	6.01	8.41
March through May	8.97	6.8
Dates	1965-1989	1961-1990

Geology

Underlying the Palouse Grasslands are Columbia River Basalt flows, forming a gently undulating surface over which episodic loess deposition has occurred. Loess deposits tens of meters in thickness are characteristic of the Palouse portion of the study area, with much

shallower deposits on the Camas Prairie. Soils have formed in loess or in a mixture of basalt bedrock and loess. Because of the mesic climate, soils of the Palouse Grassland are Mollisols rather than Aridisols, with higher organic matter and clay contents than other loessal soils of the Columbia Plateau (Thiele and Omernik 1993). Characteristic soils are in the Xeroll subgroup, reflecting the high organic matter accumulation and a climatic regime in which most of the precipitation occurs outside the growing season.

The Palouse

The Palouse as a whole, is an elliptical area ranging from Spokane in the north to the Snake River and Clearwater River canyons in the south. The eastern boundary is determined by the transition in Idaho to the Rocky Mountains, with its resultant increased precipitation, higher elevations, and forest vegetation. Thiele and Omernik (1993) delineated the western boundary in Washington along the transition from mesic Palouse soils to the dryer Walla Walla soil, as interpreted from county soil surveys. Rainfall ranges from 16-23 inches/year, with the Idaho portion receiving the most. The Palouse in Idaho has an average elevation of about 2,500 feet.

The Palouse hills resulted from strong winds picking up mostly silt size particles from south-central Washington and carrying them eastward into Idaho. Palouse soils in Idaho occur in an area that received the most loess, with depths of at least 100 feet being common (Barker et al. 1983). It has been suggested that the shape of the Palouse hills resulted from strong wind action from the southwest, which formed sharp, dune-like crests toward the northeast. On the north and east sides of these dunes, nivation cirques and amphitheaters formed, caused by the accumulation of snowdrifts and subsequent erosion (Thiele and Omernik 1993). Poorly defined drainage patterns are characteristic of the dune-like topography.

In a recent delineation of the subsections of Bailey's (1995) ecoregions by the Forest Service, the Palouse subsection is 1,586,050 acres. Thirty-six percent (571,000 acres) is in Idaho, the remainder in Washington. Not all of this area was Palouse Grasslands; many forested steptoes, foothills and ridges of the adjacent mountains are included in this figure.

Camas Prairie

The Camas Prairie, sometimes called the Nez Perce Prairie, is a rolling plain bounded by the canyons of the Clearwater River and its South Fork on the north and east, and the Salmon River canyon and mountain uplifts on the south and west. Though somewhat similar to the Palouse, it differs primarily in having higher elevations and shallower soils. Because the Camas Prairie was out of the main path of loess deposition, the soils are shallower and lack the dune-like appearance of the Palouse hills (Barker et al. 1983; Thiele and Omernik 1993). The loess mantle is generally less than 1 meter. Because of the shallower loess and higher spring precipitation on the Camas Prairie, weathering of the loess into clays has been accelerated, resulting in soils with a higher clay content than on the Palouse (Barker 1982). The average elevation of the Camas Prairie is about 3,500 feet.

In a recent delineation of the subsections of Bailey's ecoregions by the Forest Service, the Camas Prairie subsection is 573,513 acres, all in Idaho. Similar to the Palouse, this acreage is not all Palouse Grassland; many areas that were previously forested are also included.

Rathdrum Prairie

Because it was called a “prairie,” the Rathdrum Prairie was presumably a grassland during pre-settlement times, although its native vegetation is little studied and not well understood. Boone (1988) defines the Rathdrum Prairie as “an agricultural area 5-15 miles wide that extends northeast from Spokane for 50 miles" (Appendix 1, Map 1). Nearly all of the prairie has been converted to agriculture, residential, or urban uses and its original extent in Idaho is unknown. We found one small remnant of an herb-rich grassland in 1990 (Taylor et al. 1990), from which all ecological information on native vegetation of the Rathdrum Prairie is derived. No other studies of Rathdrum Prairie grassland vegetation are known. Based on this discovery, Ertter and Moseley (1992) delineated the Rathdrum Unit of the otherwise densely forested Panhandle Floristic Division.

The Rathdrum Prairie is a glacial outwash plain, lying at 2,200 feet elevation, that has low, undulating relief. The valley that encompasses the Rathdrum Prairie carried outwash from the continental icesheet to the north and the floodwaters of Pleistocene Lake Missoula. Because of the this, the soils are very deep and well-drained, formed in glacial outwash mixed with loess and volcanic ash (Weisel 1981). Virtually no free water occurs on the prairie surface, although a large aquifer flows beneath it (Ertter and Moseley 1992). The average annual precipitation is 24 inches (Weisel 1981).

VEGETATION OF THE PALOUSE GRASSLAND

Native vegetation of the Palouse Grassland was that of a bunchgrass steppe with shrub thickets in draws and on north hillslopes, usually dominated by *Crataegus douglasii* (black hawthorn). Herbaceous cover was dense with a high cover of perennial forbs. Spreading shrubs such as *Symphoricarpos albus* (snowberry) and *Rosa* spp. (wild rose) formed inclusions of shrub thickets within the grassland. At the margins of the grassland relief increases and north slopes support coniferous forest.

Grassland associations

In the most intensive study of Palouse Grassland vegetation to date, Daubenmire (1970) identified three climax vegetation zones: *Agropyron spicatum–Festuca idahoensis* (bluebunch wheatgrass–Idaho fescue), *Festuca idahoensis-Symphoricarpos albus* (Idaho fescue–common snowberry) and *Festuca idahoensis–Rosa nutkana* (Idaho fescue-Nootka rose). Only the latter two occur in Idaho portions of the prairie. Daubenmire called these the "zonal series" and identified a number of phases and inclusions in each. He mapped these associations based on regional climatic patterns, soils, and vegetation sampling, conducted primarily in Whitman county, Washington. Only two stands were actually sampled in Idaho.

Daubenmire described three stands on the margin of the grassland in which *Festuca scabrella* was dominant or codominant, but did not differentiate these from the *F. idahoensis* series. In his overview of the Pacific Northwest Grasslands, Tisdale (1983) recognized a separate *Festuca scabrella–F. idahoensis* association based on the work of Mueggler and Stewart (1980) in western Montana. This association only occurs in a few isolated sites in Idaho.

Conservation ranks

Recognized plant associations are given conservation rankings by the Natural Heritage/ Conservation Data Center network based on the number of documented occurrences of the community and the extent to which they are threatened. Global ranks range from G5 (common) to G1 (most imperiled) and State ranks the same. Heritage Programs in Oregon, Washington, Montana, and Idaho contribute to the current ranks. Because examples of these grassland associations currently exist only as small remnants that are highly susceptible to degradation, they are considered globally rare and occurrences are tracked in the same way as rare plants and animals. *Festuca-Symphoricarpos* is currently ranked G2 (globally imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction) and *Festuca -Rosa* is ranked G3 (globally rare or uncommon but not imperiled). However, a rank of G1 (critically imperiled) has appropriately been proposed for both associations based on the scarcity of their occurrence, historical reduction, and a number of serious threats (Steven Rust pers. comm.). Six rare plant species associated with these communities are also tracked by the Idaho CDC. While *Festuca scabrella–F. idahoensis* is rare in Idaho, it also occurs in Montana and British Columbia, as reflected in a global rank of G4G5.

Festuca idahoensis-Symphoricarpos albus
(Idaho fescue-common snowberry) association

The following information was taken from the Community Characterization Abstract (CCA) stored in the CDC's Biological and Conservation Data System.

Global range: The historical range of *Festuca–Symphoricarpos* was Whitman and part of Spokane counties, Washington, and the adjoining area of Idaho south of Lake Coeur d'Alene.

Idaho range: In Idaho, *Festuca–Symphoricarpos* was confined to prairie areas between the Clearwater River to the south and Lake Coeur d'Alene to the north.

Environment: The *Festuca idahoensis-Symphoricarpos albus* association occurs in the cooler, moister portion of the Palouse Grassland, from 2000 to 4000 feet elevation. Soils evidently dry out to a depth of 50 cm, which is too deep for conifer seedling survival. However, it is enough moisture to support a variety of mesic forb species.

Most abundant species: *Festuca idahoensis, Agropyron spicatum, Koeleria cristata, Achillea millefolium, Balsamorhiza sagittata, Geum triflorum* var. *ciliatum, Hieracium albertinum, Lupinus sericeus, Potentilla gracilis, Symphoricarpos albus, Rosa woodsii*, and *Rosa nutkana*.

Most constant species: *Festuca idahoensis, Agropyron spicatum, Symphoricarpos albus, Achillea millefolium, Balsamorhiza sagittata*, and *Geum triflorum* var. *ciliatum*.

Vegetation: This is a lush meadow-steppe association, dominated by the perennial bunchgrasses *Festuca idahoensis* and *Agropyron spicatum*, with *Koeleria cristata* also abundant. In this vegetation type, *A. spicatum* is an ecotype that is rhizomatous rather than caespitose. This association has a very rich forb component, with many species common to abundant. The deciduous shrub *Symphoricarpos albus* is always present, with up to 20% cover, but is dwarfed (less than 18 inches tall) and does not contribute to the physiognomic structure of this type. *Rosa woodsii* and *R. nutkana* also have a dwarf stature, when present. Species richness is very high. The cryptogam layer is very well-developed on undisturbed sites.

Citation: Daubenmire (1970)

Conservation ranks:

Global: The *Festuca –Symphoricarpos* association is ranked G2 (globally imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction)

Idaho: S1 (critically imperiled because of extreme rarity or because some factor of its biology makes it especially vulnerable to extinction)

Washington: S1

Reason for rank: Most of the area originally supporting this vegetation type has been converted to cultivated agriculture.

Recommendations: The fact that this association has a state rank of S1 in both States of occurrence suggests that a global rank of G1 may be appropriate.

Festuca idahoensis-Rosa nutkana
(Idaho fescue-Nootka rose) association

The following information was taken from the Community Characterization Abstract (CCA) stored in the CDC's Biological and Conservation Data System.

Global range: Daubenmire (1970) considered *Festuca idahoensis-Rosa* to be restricted to areas east of the Blue Mountains in eastern Oregon, southeastern Washington, and Idaho.

Idaho range: In Idaho, *Festuca–Rosa* is confined to the Camas Prairie region east of the Snake River and south of the Clearwater River.

Environment: Occurs from 2000 to 4000 feet elevation on the east flanks, and in the rainshadow, of the Blue Mountains. The climate of this region is colder than in the *Festuca-Symphoricarpos* zone to the north, drier in winter, and wetter in spring. Soils evidently dry out to a depth of 50 cm, which is too deep for conifer seedling survival. However, it is enough moisture to support a diversity of perennial forbs.

Most abundant species: *Festuca idahoensis, Agropyron spicatum, Koeleria cristata, Poa secunda* var. *secunda, Balsamorhiza sagittata*, *Besseya rubra, Geum triflorum,* and *Potentilla gracilis*.

Most constant species: *Festuca idahoensis, Agropyron spicatum, Koeleria cristata, Balsamorhiza sagittata*, *Besseya rubra*, *Calochortus elegans*, *Geum triflorum*, and *Collinsia parviflora*.

Vegetation: This is a lush meadow-steppe association, dominated by the perennial bunchgrasses *Festuca idahoensis* and *Agropyron spicatum* (together averaging from 60% to over 100% cover), with *Koeleria cristata* also abundant. It has a very rich forb component (often with 100% cover), with many species common to abundant. The deciduous shrubs, *Rosa nutkana* and/or *Rosa woodsii* have generally less than 10% cover, are shorter than the dominating bunchgrasses and do not contribute to the physiognomic structure of this type. Species richness is very high. The cryptogam layer is very well-developed on undisturbed sites, also with high species richness. This association has no *Symphoricarpos albus* occurring within it, nor are there thickets of this species within the grassland mosaic.

Citation: Daubenmire (1970)

Conservation ranks:

Global: The *Festuca idahoensis-Rosa* association is ranked G3 (globally rare or uncommon but not imperiled).
Idaho: S2 (imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction)
Washington: S1

Reasons for rank: This association is confined to a very limited area on the margin of the Palouse Grassland, east of the Blue Mountains. Nearly all of this area has been converted to cultivated agriculture. On rangeland this type has largely become dominated by *Poa pratensis* (Kentucky bluegrass) due to grazing pressures.
Recommendations: A rank of S1 for Idaho is warranted and likewise a global rank of G1.

Festuca scabrella-Festuca idahoensis
(rough fescue-Idaho fescue) association

On the eastern margin of the Palouse Grassland, a *F. scabrella–F. idahoensis* association occurs at several scattered locations near the prairie–forest ecotone. Although widespread in western Montana, this association is very rare in Idaho. Mueggler and Stewart (1980) describe a *F. scabrella–F. idahoensis* association that is dominated by a mixture of *Festuca scabrella* and *F. idahoensis*. Tisdale (1947) recognized a similar association in southern British Columbia, considering it a phase of *Agropyron spicatum–Festuca scabrella*. Further west into Washington, *F. scabrella* occurs as an understory union with *Pinus ponderosa* (Ponderosa pine). The following information is from Mueggler and Stewart (1980):

Global range: Footslopes of the northern Rocky Mountains on both sides of the continental divide, north of 46° latitude, ranging into southwestern Alberta.

Idaho range: Rare, disjunct occurrences of this type in northern Idaho are found at the forest–prairie transition zone, along the eastern margin of the Palouse Grassland and on the Rathdrum Prairie. It's southern extent is ca. 30 miles north of Moscow.

Environment: A community of the forest/grassland ecotone, *F. scabrella–F. idahoensis* occurs on mountain slopes between 3000 to 7000 ft elevation, primarily within the 20- to 30-inch precipitation zone.

Vegetation: This habitat type is dominated by a mixture of *Festuca scabrella* and *F. idahoensis. Agropyron spicatum* and shrubs are less conspicuous than in the *F. scabrella–Agropyron spicatum* type and may be absent. *Koelaria cristata* is highly constant. A *Geranium viscosissimum* (sticky geranium) phase is characterized by the presence and often abundance of *G. viscosissimum* and *Potentilla gracilis* (cinquefoil).

Conservation ranks:

Global: G4G5 (this combination of ranks suggests that, although the association is not considered globally rare, there may be some cause for long-term concern)
Idaho: S1
Montana: S4
Washington: S1
Reason for rank: This association is known from only four sites in Idaho and Washington. It is widespread in Montana but may be threatened there by invasion of exotic forbs.

Threats

Ground cover disturbance in bunchgrass communities of the Palouse Grassland has historically led to increases in exotic grasses, mostly annual bromegrasses (*Bromus* spp.), and/or Kentucky bluegrass (*Poa pratensis)*. Winter-annual grasses displaced the native vegetation over extensive areas. These areas are now becoming dominated by the Eurasian winter-annual, yellow star-thistle (*Centaurea solstitialis*). Although possibly slower to get a foothold in healthy, native bunchgrasses, this weed appears able to invade and out-compete native species. The weed has spread from the lower canyon elevations, up side canyons to upland areas. Wildlife, stock animals, and off-road vehicles are the most likely vectors for introducing this and other aggressive exotics into native vegetation. Soil disturbance of areas as small as a few square feet will almost immediately be colonized.

Along the margins of the grassland region are found some of the largest and least altered remnants, where slopes have prohibited cultivation and the historical use has been for livestock grazing. These sites are threatened by potential increased grazing and by vehicle traffic, both of which hasten weed invasion. Also, some areas have seen a great surge in homesite development in the foothills and shoulder slopes overlooking the prairie. Homesite development often represents a complete conversion of native vegetation to some other land use. So, whereas cultivated agriculture reached its limits decades ago, the conversion of native prairie continues.

Protection

In Washington, *Festuca-Symphoricarpos* is protected at three, very small sites that have each suffered some degree of degradation by weeds. In addition, two occurrences of *Festuca–Symphoricarpos* and one of *Festuca–Rosa* are protected by Washington's registry program which relies on landowner cooperation. All of the sites are small (John Gamon, personal communication).

In Idaho, a small area of Palouse Grassland including *Festuca–Symphoricarpos* and *Festuca scabrella–F. idahoensis* occurs in McCroskey State Park north of Moscow, a portion of which has been proposed for National Natural Landmark designation. During our 1996 survey 13 other grassland sites were identified with significant conservation value.

CHARACTERIZATION OF PALOUSE GRASSLAND COMMUNITIES

Twenty-two stands of Palouse Grassland vegetation in Idaho were sampled between July and September, 1996. Our objective was to locate grassland remnants in as near as possible to pristine condition, to quantitatively describe the bunchgrass communities present, and to evaluate their conservation value. Daubenmire (1970) is the sole source for descriptions of Palouse communities, and he only sampled two stands in Idaho, so we wished to supplement his characterizations with numerous additional plots.

Sampling sites

To locate sampling sites, we began with known, or previously documented grassland remnants. We also visited known populations of rare plants associated with the Palouse Grassland, specifically, *Haplopappus liatriformis* (Palouse goldenweed), *Silene spaldingii* (Spalding's catchfly), and *Aster jessicae* (Jessica's aster). We targeted the best sites identified during previous plant surveys (Lorain 1991; Gamon and Lorain 1991).

General locations of the stands sampled are shown in Appendix 1 (Map 2). Sample sites ranged from the town of Cottonwood at the south end, to 30 miles north of Moscow, with a northern outlier on the Rathdrum Prairie near Post Falls. Within this region, prairie remnants can be found in field corners, on rocky microsites within cultivated rolling upland, on south and west-facing slopes of steptoes, on foothills of adjoining mountains, and at the head of drainages between cultivated fields and the drainage bottom. These canyon heads may be the sites most representative of the original grassland because they sometimes include areas of gentle slopes with a loess mantle. However, the sites most suitable for conservation are probably those of mountain slopes on the margin of the prairie because of their condition, size, and connectivity to other natural communities. Most prairie remnants are very small, and the larger ones generally include some weedy and degraded portions. For place names associated with the sampled stands, see the footnotes of Appendix 3.

Methods

Relatively uniform bunchgrass stands in good condition were subjectively chosen, following Daubenmire (1970), and plots arbitrarily placed within them, avoiding microsites and transition zones to different vegetation types. We evaluated the condition of the vegetation based on the cover of native perennial grasses relative to that of exotic grasses and forbs. The uniform physiognomy of bunchgrass communities presented little opportunity for bias in plot placement. Indicator shrubs were subordinate to the grasses, and, at the season of the year when sampling was done, only the largest perennial forbs, such as *Balsamorhiza* and *Lupinus* were prominent. Where different grass-dominated communities were evident, they were sampled separately.

One, 10 x 10 m plot was used to describe each community. Community and site survey forms (Bourgeron et al. 1991; Appendix 2) were used to record species cover, height by life form, and a number of location and physical site variables. Canopy cover was estimated, by species, using 12 cover classes which are specified in the footnotes of Table 3. Species not

present in the plot, but occurring in its vicinity were also noted. A photo was taken of each plot, and slide transparencies are on file at the CDC office in Boise.

Cover data were first summarized in a raw stand table with stands listed chronologically across the top (Appendix 3). Down the left side of the table, species were listed as they were encountered in plots, within five life form groups. All species recorded in plots are included in Appendix 3.

The raw stand table was then examined for similarities among stands and for indicator species, i.e., species of limited occurrence that are part of reoccurring species groups. A new table was then created by eliminating species that were only encountered once, as well as infrequent, exotic species. Stands were then reordered by grouping those of similar composition (Table 3). Species of limited occurrence were given more weight in grouping stands, as were known indicator species such as *Symphoricarpos albus* and *Rosa* spp. In the reordered table species were not placed into life form groups.

Since the clearest distinction among stands was presence or absence of *Festuca scabrella*, the five *F. scabrella* stands were kept in the first five columns, although reordered slightly to reflect the similarity between stands 1 and 5. Species were then ordered by placing those restricted to *Festuca scabrella* stands at the top of the table. The degree of fidelity to these stands diminishes as you go down the table until, near the middle, are species with high overall frequency, and hence little value in grouping stands. Following these, are species that were negatively correlated with *Festuca scabrella*. Ordering species in this way allows you to look for and accentuate recurring species combinations such as those boxed in Table 3.

Results

The twenty-two stands sampled ranged in elevation from 2920 to 4440 feet. Slopes varied from 0 to 50%. Southerly aspects (130° to 230°) are notably missing, represented only by stand 2. It is difficult to find good-condition grassland on warm aspects because they are the most readily invaded by exotics.

Soils are all cold Mollisols (suborder Xeroll) formed in loess and residual bedrock. Among stands, soils differed primarily in geologic parent material (basalt, metasediments, or granite), rockiness, and the amount of loess mixed with residuum.

Species composition. Species with greater than 70% frequency were *Festuca idahoensis*, *Agropyron spicatum*, *Koeleria cristata* (prairie Junegrass), *Achillea millefolium* (yarrow), *Geum triflorum* (red geum), *Potentilla gracilis* (cinquefoil), and *Lupinus* spp. (lupine; Table 3). Forb cover consisted primarily of *Geum triflorum*, *Potentilla gracilis*, *Balsamorhiza sagittata* (arrowleaf balsamroot), and *Hieracium albertinum* (western hawkweed). The forb with the highest importance was *Geum triflorum*. Stands 3,11,12, 13, and 22 would be characterized as forb poor, with both a low diversity and cover of forbs.

The five *Festuca scabrella* stands are tied together only by the presence of *F. scabrella*, *Arenaria congesta*, and several very common species in the middle of Table 3. Stands 1 and 5 are more similar to *F. idahoensis* stands 21, 6, and 17.

Stands 1, 5, 21, 6, and 17 have in common a six-species assemblage consisting of *Gaillardia aristida*, *Castilleja lutescens* (yellow paintbrush), *Geranium viscosissimum*, *Hieracium albertinum*, *Lithospermum ruderale* (puccoon), and *Potentilla gracilis*. Four of these stands also contain *Silene scouleri* (Scouler's catchfly), a species that only occurs in one other stand (20). *Gaillardia* and *Silene* appear to be indicator species for this group, which interestingly includes both *Festuca idahoensis* and *F. scabrella* associations. *Senecio integerrimus* and *Potentilla glandulosa* are restricted to this group. All but one of the stands in this group have both *Symphoricarpos albus* and *Rosa* spp. Stands 6 and 17 share six, highly restricted species.

Stands 19, 7, 14, and 8 form a group based on 100% constancy of nine common species, combined with the presence of *Astragalus sheldonii*, which is nearly restricted to this group. These stands are also characterized by high cover of *Balsamorhiza* and *Geum*.

Table 3. Ordered table of grassland stands sampled. Stands with similar composition have been grouped and species ordered to show recurring groups (boxed). Only selected species appear in the table. Values are cover estimates within twelve cover classes[1]. † marks exotic species.

Stand number[2]:	**2**	**3**	**4**	**1**	**5**	**21**	**6**	**17**	**20**	**19**	**7**	**14**	**8**	**9**	**10**	**11**	**16**	**13**	**18**	**15**	**22**	**12**
Elevation zone[3]:	2	2	2	1	2	3	2	2	1	3	2	2	2	3	1	1	2	1	3	2	2	1
Aspect (°)	190	240	280	0	300	90	100	80	10	90	90	280	260	270	45	265	240	290	110	240	285	240
Slope (%)	25	20	10	0	45	20	50	40	20	35	18	25	8	3	15	20	40	20	35	40	13	35
H.T.[4]	F-F	F-F	F-F	F-F	F-F	F-S	F-S	F-S	F-S	F-R	F-S	F-R	F-R	F-R	F-R	F-S	F-S	F-R	F-S	F-R	F-R	F-R
Species																						
Fritillaria pudica	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Collinsia parviflora	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Spiraea betulifolia	3	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca scabrella	+	60	30	40	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arenaria congesta	1	1	1	3	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sisyrinchium inflatum	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Allium accuminatum	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Commandra umbellata	1	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
†*Draba verna*	.	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Microseris nutans	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dodecatheon pulchellum	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Phlox speciosa	.	1	1	3	1	.	.	.	.	.	.	3	.	.	3	.	.	.	.	.	.	.
Collomia linearis	.	1	1	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.
Brodiaea douglasii	1	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.
Eriogonum heracleoides	3	.	3	3	.	+	.	.	.	.	1	.	.	.	.	.	1	.	.	.	.	.
Habenaria elegans	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erigeron corymbosus	.	.	1	.	1	1	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.
Clarkia pulchella	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Agoseris glauca	.	.	1	1	.	.	.	.	.	.	.	.	.	30	1	.	.	.	.	.	.	.
Senecio integerrimus	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Potentilla glandulosa	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crepis sp.	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Silene douglasii	.	1	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Lomatium triternatum	.	1	.	.	.	.	.	.	.	.	1	1	.	.	+	1	.	.	.	.	.	.
Epilobium paniculatum	.	1	.	.	1	.	.	1	.	.	.	1	1	.	.	.	.	.	.	.	.	1
Microsteris gracilis	1	1	.	.	1	.	.	.	.	.	1	1	.	1	.	.	.	.	1	.	1	.
Arnica sororia	.	.	.	1	.	.	.	.	.	.	1	.	1	1	.	.	.	.	.	.	.	.
Galium boreale	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Lomatium dissectum	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Bromus carinatus	.	.	.	.	.	.	20	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Danthonia intermedia	.	.	.	3	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Stipa occidentalis	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Silene scouleri	.	.	.	1	.	1	1	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Gaillardia aristida	.	.	1	3	1	+	3	3	1	.	.	.	.	.	.	.	1	.	.	.	.	.
Castilleja lutescens	.	.	.	1	1	1	1	1	+	1	.	1	1	.	.	1	.	.	.	.	.	.
Geranium viscosissimum	.	.	.	3	1	+	10	1	.	1	.	.	.	3	1	1	1	.	.	.	.	.
Hieracium albertinum	.	1	.	10	3	1	1	1	.	3	1	.	.	1	.	1	1	.	1	3	3	.
Lithospermum ruderale	.	.	.	3	1	1	1	1	.	1	1	1	.	.	+	1	3	1	.	.	.	1
Potentilla gracilis	.	.	1	3	1	3	1	1	1	1	1	1	3	1	.	.	.	1	1	+	1	.
Besseya rubra	.	.	.	3	.	1	1	.	.	1	1	1	1	1	1	.	.	1	1	.	.	.
Astragalus sheldonii	.	.	.	.	.	.	.	.	1	1	3	1	10	.	.	.	.	.	1	.	.	.
Balsamorhiza sagittata	10	20	1	.	20	+	1	.	.	3	20	10	20	.	.	20	.	.	.	10	.	.
Lupinus sp.	.	.	1	3	3	.	1	.	.	1	1	1	3	1	1	1	3	3	1	1	.	1
Geum triflorum	.	1	1	10	1	20	1	3	20	30	20	3	10	20	.	.	20	1	20	.	1	.
Achillea millefolium	1	1	1	3	1	1	3	1	1	1	1	1	3	1	1	1	1	.	1	1	1	1

- Continued -
Table 3 continued

Stand number:	**2**	**3**	**4**	**1**	**5**	**21**	**6**	**17**	**20**	**19**	**7**	**14**	**8**	**9**	**10**	**11**	**16**	**13**	**18**	**15**	**22**		**12**
H.T.[4]	F-F	F-F	F-F	F-F	F-F	F-S	F-S	F-S	F-S	F-R	F-S	F-R	F-R	F-R	F-R	F-S	F-S	F-R	F-S	F-R	F-R	F-R	
Festuca idahoensis	50	3	10	20	30	80	30	3	80	40	70	70	90	80	90	20	80	20	90	20	70	.	
Agropyron spicatum	3	1	20	.	3	1	40	70	3	30	10	10	10	20	10	10	3	30	10	50	20	40	
Koeleria cristata	.	.	1	3	1	1	10	1	1	1	3	3	10	10	3	.	1	1	1	+	3	.	
Poa secunda	1	1	1	.	1	.	10	.	.	.	.	1	1	.	.	1	.	3	.	1	.	1	
†*Tragopogon dubius*	.	.	1	1	1	.	.	1	.	1	.	1	1	.	+	.	.	1	1	1	1	1	
†*Bromus spp. (annual)*	.	.	1	.	1	.	1	.	.	1	10	.	10	.	1	3	10	1	1	1	3	1	
†*Ventenata dubia*	1	1	30	1	1	.	.	.	+	1	.	.	.	.	.	90	1	30	.	3	10	30	
Lomatium marocarpum	1	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	
Symphoricarpos albus	.	1	.	.	1	+	10	3	1	.	1	.	.	.	1	1	1	+	1	.	.	.	
Rosa sp.	.	.	.	.	1	1	20	10	1	+	.	.	.	.	1	1	1	+	.	1	.	.	
†*Poa pratensis*	.	.	.	.	.	.	3	1	3	1	.	1	.	.	1	1	1	3	1	.	1	.	
Penstemon attenuatus	.	.	.	.	.	1	1	.	.	1	.	1	3	.	.	.	3	.	1	.	.	.	
Haplopappus liatriformis	.	.	.	.	.	20	1	.	.	3	.	.	.	.	.	+	.	+	1	.	.	.	
Solidago missouriensis	.	.	.	.	.	+	1	3	.	1	.	.	3	.	.	1	1	.	.	.	.	.	
Iris missouriensis	.	.	.	.	.	.	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	
Linanthastrum nuttallii	.	.	.	.	.	.	1	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Epilobium angustifolium	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Valeriana edulis	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Fragaria virginiana	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Sidalcea oregana	.	.	.	.	.	.	.	1	1	.	.	.	.	1	.	.	.	1	.	.	.	.	
Perideridia gairdneri	.	.	.	.	.	1	.	1	1	.	.	.	.	1	.	.	.	.	.	.	.	.	
Crataegus douglasii	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	
Helianthella uniflora	.	.	.	.	.	+	.	3	.	.	1	.	.	.	.	+	.	.	.	3	.	.	
Zygodenus venenosus	.	.	.	.	.	1	.	.	.	1	1	.	1	.	.	+	1	.	.	.	.	.	
Prunus virginiana	.	.	.	.	.	.	.	3	.	.	.	.	.	.	+	.	.	.	.	.	.	.	
Amelanchier alnifolia	.	.	.	.	.	.	.	3	.	1	.	.	.	.	.	.	.	.	.	.	.	.	
† *Alysum alysoides*	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	1	.	.	1	1	.	
†*Agrostis interrupta*	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	1	.	.	
Trifolium plumosum amp	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	.	.	.	
†*Arenaria serpylifolia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	1	.	.	
Apocynum androsaemifoium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	3	

1 Cover classes: <1% (1), 1-5% (3), 5-15% (10), 15-25% (20), 25-35% (30), 35-45% (40), 45-55% (50), 55-65% (60), 65-75% (70), 75-85% (80), 85-95% (90), and 95-100% (99). + = present outside plot.

2 Stands were numbered consecutively for the purposes of this report. Place names, and plot i.d. numbers used in data entry are given in the footnotes of Appendix 3.

3 Elevation zones: <3400 ft (1); 3400-4000 ft (2); >4000 ft (3)

4 Habitat types: F-F = Festuca scabrella-F. idahoensis; F-S = Festuca idahoensis-Symphoricarpos albus; F-R = Festuca idahoensis-Rosa nutkana.

Little pattern is evident among species in the lower half of the table, except for the suite of six species that are common to stands 6 and 17, four of which occur nowhere else. *Haplopappus liatriformis* tends to occur with *Penstemon attenuatus* and *Symphoricarpos albus* and *Rosa* spp. tend to occur together, although not exclusively.

Classification of stands

Stands 1 through 5 are all located north of Moscow, and are considered to represent disjunct occurrences of the *Festuca scabrella* (rough fescue) series common in western Montana. Within this series, Mueggler and Stewart (1980) describe a *Festuca scabrella–Festuca idahoensis* association dominated by a mixture of *F. scabrella* and *F. idahoensis*. All but stand 2 are dominated by *F. scabrella.* The Rathdrum Prairie site (stand 1) was unique in the absence of *Agropyron spicatum.* These were the northernmost stands sampled and represent the southernmost extent of *Festuca scabrella* in Idaho. Daubenmire described three stands on the eastern margin of the Palouse, in Washington, in which *Festuca scabrella* was dominant or codominant, but did not differentiate these from the *F. idahoensis* series.

Using the classification of Daubenmire (1970), eight of the twenty-two prairie remnants sampled key to the *Festuca idahoensis-Symphoricarpos albus* (Idaho fescue-common snowberry) habitat type. The presence of dwarf individuals of *Symphoricarpos* in the forb/grass layer is diagnostic of this type. Stems of this rhizomatous shrub should be fairly uniformly, although sparsely, scattered. Daubenmire states that there is always a taller shrub component present as inclusion in the type which he treats as a phase of the association. Colonies of shrubs present as inclusions in our stands generally consisted of *Rosa* spp., *Symphoricarpos*, or *Crataegus douglasii* (black hawthorn), but in many cases shrub thickets were not present, possibly due to the small size of the stands.

The nine remaining stands (nos. 8, 9, 10, 12, 13, 14, 15, 19, and 22) represent Daubenmire's *Festuca idahoensis-Rosa nutkana* (Idaho fescue–Nootka rose) association which is very close in composition to *Festuca-Symphoricarpos* except that *Symphoricarpos* is typically absent and *Rosa* spp. are absent or sparse. Therefore the *Festuca/Rosa* type includes all stands lacking a shrub component .

Daubenmire considered the *Festuca-Symphoricarpos* type to be restricted to areas north of the Clearwater River with *Festuca-Rosa* replacing it to the south due to the rainshadow effects of the Blue Mountains. Few prairie remnants remain north of the Clearwater. Of the two *F. idahoensis* stands sampled north of the river (11 and 15), one contained *Symphoricarpos* and the other did not. These two stands were unique however, in the presence of the forb *Apocynum androsaemifolium* (dogbane) which was abundant in both. At the same time, seven stands sampled on the Camas Prairie, south of the Clearwater, contained *Symphoricarpos,* including stand 10 which was almost certainly one of the two stands sampled by Daubenmire in this area (Table 3). Since precipitation of the Camas Prairie is greater than that of the Palouse, the rainshadow effects proposed by Daubenmire may only apply to the area between the Blue Mountains and the Snake River canyon in Washington.

Daubenmire's Stand 162

Two Idaho sites were sampled by Daubenmire as part of his vegetation classification of eastern Washington, both on the Camas Prairie. The site of stand 162, which he sampled sometime prior to 1955, was relocated and resampled during our survey using a much less rigorous method. The site is a rocky knoll less than 1 ac in size and is entirely surrounded by cultivated ground, allowing us to identify it from the legal description with a high degree of certainty. We placed our plot on the same aspect specified for stand 162, so it should have been close to the original position. A comparison of stand composition between the 1950s and 1996 is made in Table 4.

Daubenmire did not observe *Symphoricarpos* as in the stand, thus classifying it as *Festuca-Rosa*. However, in 1996 *Symphoricarpos* was present, along with *Rosa* sp. and *Prunus virginiana*, all species that were not detected in Daubenmire's sample.

The most notable change has been the disappearance of *Balsamorhiza sagittata* (arrow-leaf balsamroot) and *Geum triflorum* (red geum), forbs that were prominent in the stand in 1954 and should have easily been detected at the time of our sampling. Forbs in the stand showed obvious signs of having been sprayed by herbicides. A history of herbicide impacts from aerial spraying may have altered the composition of the stand, although many forbs have persisted. Daubenmire also recorded a large variety of early-spring annuals and perennials that may not have been in evidence during our late-summer sampling.

Table 4. Comparison of community composition of Daubenmire's stand 162 sampled in 1954, and again in 1996. Values for 1954 are means of 40 microplots, to the nearest 1%. For 1996, percent cover is given as a range. "P" indicates that the species was observed in the stand but did not occur in the plot.

	'54	'96
SHRUBS		
Phlox speciosa	7	1-5
Prunus virginiana	.	P
Rosa sp.	.	<1
Symphoricarpos albus	.	<1
PERENNIAL GRASSES		
Agropyron spicatum	14	5-15
Festuca idahoensis	79	85-95
Koeleria cristata	19	1-5
Poa pratensis	.	<1
Poa secunda	5	.
PERENNIAL FORBS		
Achillea millefolium	1	<1
Agoseris glauca	.	<1
Balsamorhiza sagittata	6	.
Besseya rubra	1	<1
Calochortus elegans	2	<1
Castilleja lutescens	1	.
Claytonia lanceolata	1	.
Crepis spp.	3	.
Delphinium nuttallianum	1	.
Dodecatheon pauciflorum	3	
Erigeron corymbosus	4	.
Erythronium grandiflorum	<.5	.
Galium boreale	.	<1
Geranium viscosissimum	.	<1
Geum triflorum	21	.
Hieracium cynoglossoides	P	.
Lithophragma bulbifera	2	.
Lithophragma parviflora	<.5	.
Lithospermum ruderale	P	P
Lomatium dissectum	9	<1
Lomatium triternatum	1	P
Lupinus sp.	10	<1
Mertensia longiflora	<.5	.

	'54	'96
ANNUALS		
Agrostemma githago	.	P
Agrostis interrupta	.	<1
Arenaria serpyllifolia	3	<1
Bromus brizaeformis	2	<1
Bromus japonicus	<.5	<1
Bromus mollis	3	.
Bromus tectorum	.	P
Cerastium viscosum	<.5	.
Collinsia parviflora	1	.
Draba verna	2	.
Epilobium paniculatum	1	.
Lactuca serriola	<.5	.
Microsteris gracilis	<.5	.
Montia linearis	<.5	.
Myosotis micrantha	1	.
Stellaria nitens	<.5	.
Veronica arvensis	<.5	.

Sisyrinchium inflatum	2	.
Tragopogon dubius	<.5	P
Wyethia amplexicaulis	14	5-15

Six rare plant taxa endemic, or nearly so, to the Palouse Grassland are tracked by the Idaho Conservation Data Center or the Washington Natural Heritage Program, or both (Table 5). *Silene spaldingii* (Spalding's silene) also has disjunct ranges in northwestern Montana and northeastern Oregon, and the range of *Trifolium plumosum* var. *amplifolium* (plumed clover) extends south somewhat from the grassland into the sagebrush steppe. *Cirsium brevifolium* (Palouse thistle), although not considered rare in Idaho or Washington, is included in Table 5 because it is endemic to the Palouse region. Where available, the historical ranges of these taxa are shown in Appendix 4 along with line drawings. Although ranges overlap, each taxon is somewhat unique in terms of optimum habitat and the nature of its distribution within the region.

Table 5. Plant taxa that are endemic, or nearly endemic, to the Palouse Grassland, and their conservation ranks (Conservation Data Center 1994; Washington Natural Heritage Program 1994).

		Conservation Rank			
		Federal[1]	CDC/Heritage Network[2]		
Latin name	Common name		Global	ID	WA
Aster jessicae	Jessica's aster	SOC	G2	S2	S2
Astragalus arrectus	Palouse milkvetch	none	G2G3	none	S1S2
Calochortus nitidus	broad-fruit mariposa lily	C3	G3	S3	([3])
Cirsium brevifolium	Palouse thistle	none	G3	none	monitor
Haplopappus liatriformis	Palouse goldenweed	SOC	G2	S1	S2
Silene spaldingii	Spalding's silene	SOC	G2	S1	S2
Trifolium plumosum var. *amplifolium*	plumed clover	none	G3T2	S2	none

1 SOC = Species of concern

2 Explanation of global (G), state (S), and infraspecific (T) ranks: 1 = critically imperiled because of extreme rarity or because some factor of it biology makes it especially vulnerable to extinction (typically 5 or fewer occurrences); 2 = imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (typically 6 to 20 occurrences); 3 = rare or uncommon but not imperiled (typically 21 to 100 occurrences).

3 Has not been verified in WA.

Aster jessicae inhabits both grassland communities and open, *Pinus ponderosa* woodland in the forest–grassland transition zone. It is more a plant of banks and draws than of the open grassland and occurs primarily in the breaklands of the Potlatch and Clearwater Rivers, at the eastern extreme of the Palouse Grassland. Its Idaho range adjoins that of *Silene spaldingii* to

the west but the two do not overlap. It is much more tolerant of disturbance than the other Palouse species and often persists along hedgerows and in old cemeteries.

Astragalus arrectus is not considered rare in Idaho, although much of its remaining habitat is rapidly being converted to exotic weeds. It occupies moister aspects within the prairie.

Calochortus nitidus has the widest range of the four, Federally ranked species, and the most known occurrences. It has a wider ecological amplitude than the other grassland taxa, ranging from the canyon grasslands, to forest openings well into the mountains. Although it once occupied more mesic sites in the grassland, it is now restricted to grassy ridgecrests, canyon rims, and openings in dry conifer woodlands. It often occurs on very shallow soils. Because it extends into the lower, montane grasslands, its range overlaps public lands more than those of the other taxa.

Cirsium brevifolium is a white-flowered thistle endemic to the Columbia Basin where it occurs in *Festuca idahoensis* communities. It appears to be more characteristic of the Palouse than the Canyon Grassland, but has been only scantily collected. Because it is not tracked in Idaho, little is known of its current status. It occurs in prairie remnants but is not usually abundant. It occurred in only one of the 19 *F. idahoensis* stands sampled by Daubenmire.

Haplopappus liatriformis is endemic to the Palouse prairie and commonly occurs in even very small remnants if they are in excellent condition. Its range extends into the canyon grassland of the Snake River, but not into the mountains. Its frequency of occurrence indicates that it was a common component of the Palouse grassland. Along with *Silene spaldingii*, it appears to rapidly disappear with increased disturbance or weed encroachment.

Silene spaldingii is the rarest plant in the above list. Although not strictly limited to the Palouse Grassland, it is endemic to the Pacific Northwest Bunchgrass biome. It is restricted to slightly more mesic microsites within the grassland than *H. liatriformis* which always occurs with it in Idaho. In the native landscape *S. spaldingii* probably occupied draws and north hillslopes because it is always associated with shrubs. It occupies a slightly different community in the Canyon Grasslands (Lichthardt 1996). *S. spaldingii* has disjunct occurrences, one in northwestern Montana, extending just barely into British Columbia, and another in northeastern Oregon near Wallowa Lake. Most populations remaining in the Palouse and Camas Prairie areas are too small to be considered viable.

Trifolium plumosum* var. *amplifolium is sympatric with *Haplopappus liatriformis*, but more common and abundant, possibly due to a higher tolerance for disturbance. It occurs as far south as Washington County, Idaho, spilling over into the sagebrush steppe. The type variety (*T. plumosum var. plumosum*) replaces it in Washington and Oregon and is also considered rare.

Threats

With a couple of exceptions noted above, the rare plants associated with the Pacific Northwest Bunchgrass grassland are mostly intolerant of disturbance and are found only in relatively unaltered bunchgrass communities. Both natural and human disturbances can lead to weed invasion and eventual loss of the native community. Populations of rare species occurring in prairie remnants are especially threatened by herbicide drift from aerial spraying of adjoining fields. Some of the best remaining populations of these plants remain on footslopes of mountains adjoining the prairie where they are threatened by conversion of the prairie for home construction. Isolated, small populations may also be subject to decreased fitness due to inbreeding.

Protection

Because nearly all of the area which comprised the Palouse Grassland in Idaho is in private or tribal ownership, and no grassland preserves exist, protection is only afforded these rare prairie species where they occur in the canyon grasslands. The canyon grasslands ecosystem, which is largely unsuitable for cultivated agriculture, affords several important conservation sites. These include BLM lands on which rare plants are protected, Fish and Game Department lands managed for wildlife, and The Nature Conservancy's Garden Creek Preserve. Non-ranked species such as *Cirsium brevifolium* are not protected or managed on public (Federal or State) lands.

Only *Calochortus* has significant populations on Federal lands, including National Forest and Bureau of Land Management (BLM) lands. Palouse Grassland endemics with no protected populations in Idaho are *Aster jessicae, Astragalus arrectus,* and *Cirsium brevifolium.*

CONSERVATION SITES

Palouse Grassland remnants with significant conservation value were documented using a Site Survey Form (Appendix 4). This form was designed by the CDC to facilitate entry of information into a site basic record (SBR). SBRs document location, boundaries, biological elements, threats, and ranks for established and potential conservation sites (e.g., Research Natural Areas, Areas of Critical Environmental Concern, and preserves of The Nature Conservancy). Thirteen conservation sites for grassland associations were identified during 1996 surveys. General locations are shown in Appendix 1 (Map 3). Each site is given a biodiversity rank based on rarity of the biological elements represented, size, condition, and connectivity to other natural vegetation. A rank of "B1" indicates the highest biodiversity value, "B5" the lowest. Biodiversity ranks are given in Table 6 for each grassland site, along with the plant communities and rare plant elements represented. The plant communities represented are also ranked for their size and condition. A rank of "A" indicates the highest conservation value, and "D" is lowest. SBRs for the sites are included in Appendix 5. Most of the sites are in private ownership. The exceptions included about 60 acres of the Cold Spring Creek site that are in State ownership; Upper Meadow Creek, which is in Nez Perce Tribal ownership; and McCroskey State Park.

The Palouse Grassland is dissected by breaklands of the Clearwater River and its major tributaries. Moister aspects in drainages as well as on north slopes, support conifer woodland of *Pinus ponderosa* (Ponderosa pine) and *Pseudotsuga menziesii* (Douglas-fir). These conifer communities are often quite open with grassy understories and grassland inclusions. Many of the rare plants associated with the Palouse Grassland range into this grassland/woodland ecotone. During our survey, we identified four such sites as conservation sites due primarily to the presence of rare plant populations. These sites are most appropriately considered woodland types and are tabled separately (Table 7). All of the woodland conservation sites are in private ownership.

Table 6. Proposed grassland conservation sites documented during a 1996 survey of remnant Palouse vegetation. Further information is stored in site basic records (SBR) in the CDC's Biological and Conservation Data System (BCD; Appendix 6). See text for explanation of ranks.

SBR #	Site name	Plant associations present*	Rank	Stand nos.	Rare plant elements	Size (ac)	Biodiversity Rank
064	Cold Spring Creek	Feid–Syal	C	6, 7, 16, 17	*Haplopappus liatriformis* *Silene spaldingii* *Calochortus nitidus* *Trifolium plumosum amplifolium*	70	B1
170	Ferdinand Antennas	Feid–Ronu	B	18	*Haplopappus liatriformis* *Trifolium plumosum amplifolium*	90	B2
196	Ferdinand Butte	Feid–Syal	A	19	*Haplopappus liatriformis* *Silene spaldingii*	85	B1
143	Liberty Butte	Fesc–Feid	A	4, 5	-	500	B1
155	McCroskey State Park	Feid–Syal Fesc–Feid	B BC	2, 3	-	400	B2
2966	Rathdrum Prairie	Fesc–Feid	C	1	-	40	B3
204	Redbird Road	Feid–Ronu	C	13	*Haplopappus liatriformis*	10	B3
186	Reservation Road	Feid–Syal	BC	21	*Haplopappus liatriformis*	5	B3
212	South End Paradise Ridge	Feid–Ronu Pipo/Feid	A A	15	*Haplopappus liatriformis* *Calochortus nitidus*	160	B2
135	Talmaks East	Feid–Ronu	BC	9	*Haplopappus liatriformis* *Calochortus nitidus*	2	B3
218	Upper Meadow Creek	Feid–Ronu Feid–Syal	B B	22	*Haplopappus liatriformis* *Calochortus nitidus*	30	B2
213	Westside Tomer Butte	Feid–Syal	C	11, 12	*Haplopappus liatriformis*	150	B3
128	Windy Ridge	Feid–Ronu	BC	8	-	1	B3

* Abreviations use first two letters of genus name followed by first two letters of species name.

Table 7. Proposed woodland, rare plant conservation sites documented during a 1996 survey of remnant Palouse vegetation. Further information is stored in the site basic records (SBR) in the CDC's Biological and Conservation Data System (BCD; Appendix 6). See text for explanation of ranks.

SBR #	Site name	Plant associations present*	Stand nos.	Rare plant elements	Size (ac)	Biodiversity Rank
154	American Ridge	Feid–Pose Pipo/Feid	-	*Haplopappus liatriformis*	5	B3
141	Cedar Creek	Pipo/Feid	-	*Aster jessicae*	1100	B4
200	Chesley Railroad	Feid–Pose Pipo/Feid	-	*Haplopappus liatriformis* *Aster jessicae* *Calochortus nitidus* *Lomatium dissectum dissectum*	5	B2
163	Tschantz Road (Southwick)	Feid–Syal	-	*Haplopappus liatriformis* *Aster jessicae*	2	B3

* Abreviations use first two letters of genus name followed by first two letters of species name.

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APPENDICES NOT AVAILABLE ON THE WEB PAGE
CONTACT THE IDAHO DEPT. OF FISH AND GAME, CONSERVATION DATA CENTER FOR THIS INFORMATION