

Assessment of Kootenai National Forest Vegetation Types with Potential for *Silene spaldingii* in the Tobacco Plains, Rexford Bench and Salish Range Foothills

Prepared for:

Kootenai National Forest
Supervisor's Office

By:

S. V. Cooper

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S. V. Cooper



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EXECUTIVE SUMMARY

Silene spaldingii (Spalding's catchfly) has relatively recently (October 10, 2001) been listed by the U. S. Fish and Wildlife Service as "Threatened" throughout its entire range. The Tobacco Valley of northwestern Montana harbors the largest known population (on TNC's Dancing Prairie Preserve) as well as several satellite populations of this species. Locating additional populations of this species, especially on Federal lands where appropriate management could be instituted, is a conservation priority. The Montana Natural Heritage Program contracted with the Kootenai National Forest to survey their land having the greatest probability of *S. spaldingii* populations. Putatively appropriate habitat, including mesic grasslands, shrublands, and open woodlands was inventoried, with grasslands receiving the most thorough search. No new populations of *S. spaldingii* were located but, in the course of inventory, a number of plant communities (associations) were sampled and described.

The communities of this landscape (Tobacco Valley vicinity and immediate foothills/mountainous terrain to the south) have not been previously described/ documented, though limited sampling has occurred. A combination of coarse-textured outwash substrates and a relatively dry precipitation regime results in grasslands and shrublands where woodlands and forests might be expected. Environments supporting mesic grasslands where *S. spaldingii* would have the greatest likelihood of occurring have experienced the greatest disturbance (habitat conversion/destruction, alien

species invasion); it is uncertain whether this disturbance could have resulted in population extirpation.

The rough fescue (*Festuca campestris*) grasslands found here are compositionally unlike those occurring anywhere else due to grazing effects and coarse substrates that combine to favor some graminoids more typically associated with the Great Plains. This combination of environment and vegetation has resulted in some unique communities not described elsewhere. New provisionally recognized grassland associations have been described. The presence of antelope bitterbrush (*Purshia tridentata*) in combination with both ponderosa pine (*Pinus ponderosa*) and *F. campestris* was additionally recognized in new shrubland and woodland plant associations (provisional).

Although our inventory was confined to U. S. Forest Service lands, it was abundantly obvious that this is a landscape under siege from alien plant species (whether classed weedy or not) and that Dancing Prairie Preserve and U. S. Forest Service lands will have to be the repositories of native biological diversity. While not explicitly evaluated, we note that a USFS prescribed burning program was achieving its intended effect of removing trees encroaching on grasslands and shrublands. The agency should pay particular attention to invasive species of alien grasses, particularly smooth brome (*Bromus iermis*); these grasses could be as threatening to diversity as noxious weeds.

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INTRODUCTION

The Tobacco Plains, Rexford Bench and northern foothills of the Salish Range constitute an area that has received only cursory botanic/vegetation exploration, though the wetlands and associated peatlands of the adjoining forested landscape have been extensively inventoried and are in the process of being intensively investigated. The Nature Conservancy and others recognized the potential of some grassland habitat in this area to support a declining species, Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) and a preserve, Dancing Prairie, was established to protect this habitat in the face of burgeoning development and incompatible land use. Serendipitously, this preserve contained high quality grasslands and a population of Spalding's catchfly (*Silene spaldingii*), a plant recently listed by the U.S. Fish and Wildlife Service as threatened. If these gems of conservation existed in the center of a disturbed landscape, then what conservation targets might be harbored on National Forest lands at the periphery of this threatened landscape? Regardless of whether these Forest Service lands support sensitive native species, baseline information is needed to effectively manage these grassland and woodland habitats and to guide Forest planning efforts. A primary function of the Montana Natural Heritage Program is to gather, abstract, and provide to users, information on the state's biodiversity at all levels of organization. Therefore, a Challenge Cost-Share Agreement between the Kootenai National Forest and The

Nature Conservancy's Montana Natural Heritage Program was initiated to address both *S. spaldingii* populations and their potential habitat, generally, though not exclusively, perceived to be mesic grasslands.

This study has two goals:

1. Inventory for *Silene spaldingii* in appropriate grassland habitats and contiguous woodlands where trees have ostensibly recently encroached on grassland habitat. This inventory was conducted over two years owing to the ability of *S. spaldingii* to remain dormant under adverse growing conditions.
2. Assess grassland and woodland conservation in the Tobacco Plains, Rexford Bench and Salish Range northern foothills. This will include 1) identifying, describing, and evaluating the habitat quality of surveyed areas, 2) assessing grassland loss and how grassland and *S. spaldingii* habitat can potentially be recovered, 3) ascertaining the biological value and importance of grasslands with emphasis on *S. spaldingii* and other biological elements, including communities, tracked by MTNHP, and 4) identifying stewardship and management opportunities for perpetuating study area grasslands.

ENVIRONMENTAL SETTING

The study area is defined as the Forest Service holdings in the Tobacco Valley, the adjacent Rexford Bench, and the foothills or low mountainous terrain (northernmost Salish Range) immediately to the south of the Tobacco Valley (Figure 1). The whole of the study area landscape has been influenced by glaciation. The Tobacco Valley (Tobacco Plains) portion of the study area is filled with Pleistocene and Holocene age, predominantly coarse textured sediments, mostly outwash and till, with much of the westernmost portion of the plains having a mantle of very fine sandy loam to loamy fine sand. Fine-textured lacustrine deposits are comparatively uncommon within the Tobacco Plains. In the Rexford Bench vicinity there is a heterogeneous mix of materials with areas of fine silts and also extremely well-drained gravelly fine sands. Some of the most interesting features of these landscapes, drumlins, lie just outside Forest Service ownership. Kettleholes are distributed throughout the valley but those in the more western portion intersect a watertable or are lined with relatively impermeable sediments so that they hold water (forming ponds or small lakes). Kettleholes more to the center of the Tobacco Plains, especially those of the Nature Conservancy's preserve, constitute upland habitats supporting unique grassland communities.

Soil map units in the study area that support predominantly grassland and allied types (shrublands, *Pinus ponderosa* woodlands) are in decreasing order of areal extent; 111 (Calcixerollic Xerochrepts; occurring on terraces and composed of loamy fine sands to fine sandy loams); 114 (Typic Xerochrepts; found on terraces their texture is predominantly silty [silt loam and silty clay loam] because they have developed from lacustrine deposits); 109 (Typic Xerochrepts of alluvial terraces, formed from excessively well-drained alluvial deposits comprised of extremely gravelly loamy sands); and 510 (Typic Calcixerolls of south-facing slopes; weathered from metasedimentary rock with soils having extremely gravelly silt loam and calcareous in the subsoil or throughout) (Kuennen and Nielson-Gerhardt 1995).

The southern portion of the study area, in the vicinity of Black Butte and Eureka Hill, constitutes moderately dissected foothills of the Salish Mountains. Grasslands/shrublands and woodlands in this area are found on relatively circumscribed and locally unique soil map units 510 (Typic Calcixerolls of south-facing slopes; weathered from metasedimentary rock with soils having extremely gravelly silt loam and calcareous in the subsoil or throughout), 303 (Lithic Ustochrepts; basically fractured bedrock with thin, rapidly drained soils); these physiognomic types occur to a very minor extent on the prevailing matrix type 324 (Typic Eutrochrepts with very gravelly, fine sandy loam).

The study area lies immediately east and in the rainshadow of the Purcell Mountains; although this range is comparatively low at its southern extremity in the US it apparently still presents an effective barrier to some winter storm tracks. Comparing average precipitation at Eureka (14.83 inches; elevation 2,530 ft.) to that of Libby (17.95 inches; 2,100 ft.) indicates that Libby, even though 400 + feet lower than Eureka and thus predicted (in typical models of precipitation/elevation) to receive less precipitation, in fact receives about 3.1 in. more precipitation. Most of this differential is received in December and January (as snow). A much greater differential in average yearly precipitation (almost 6 inches more at Libby) can be observed by comparing the period 1951-80 for the two stations. Thus, the landscape in the immediate vicinity of Libby is well within the *Pseudotsuga menziesii* (Douglas-fir) Series and transitional to the *Thuja plicata* (western red cedar) and *Tsuga heterophylla* (western hemlock) Series, whereas the immediate Eureka area is just marginal for supporting the yet drier *Pinus ponderosa* (ponderosa pine) Series (on swales and north slopes in the most arid portion of Tobacco Plains). The overall precipitation pattern for these two northwestern Montana locations is also quite different with Eureka receiving the bulk of precipitation in the late spring/early summer and Libby receiving the bulk of precipitation in the winter months; in fact Libby winter (Nov., Dec., Jan.) precipitation is nearly twice that of Eureka.

Thus, the decreased precipitation, coupled with the coarse-textured soils thinly mantled over coarse glacial drift and possibly a fire regime with short return intervals have created an environment conducive to grasslands and open *Pinus ponderosa*-dominated woodlands, which is a considerable anomaly compared to the surrounding upland landscape. The overall matrix for the Tobacco Plains is a mosaic of forested types with

Pseudotsuga menziesii, *Thuja plicata*, *Tsuga heterophylla* and *Abies grandis* constituting the lower elevation (montane) climax series and *Abies lasiocarpa* and *Picea engelmannii* the subalpine climax series. However, past disturbance (logging and fire) maintain the landscape in seral forests dominated by *P. menziesii*, *P. ponderosa*, *Pinus contorta*, and *Larix occidentalis* (Leavell 2000).

METHODS

COMMUNITY LEVEL INVENTORY

Digital orthophotographs for USFS managed lands were assembled in an ArcView file to enable the identification of grassland and woodland habitat in the Tobacco Plains and Rexford Bench region. Photography was visually examined and areas of appropriate habitat were delineated and scheduled for field inventory. We also consulted with Dan Leavell, Forest Ecologist for the Kootenai N. F., Jerry Tande, District Botanist, and Toby Spribille, Seasonal Botanist, to obtain further suggestions of appropriate sampling locations. For general orientation we obtained a list of ECODATA plots (vegetation samples) that had been established within or in the near vicinity of potential sampling sites. The Nature Conservancy's Dancing Prairie Preserve in the heart of the Tobacco Valley served as a reference location to evaluate other grasslands/woodlands.

To estimate loss, evaluate recovery potential, and gauge habitat value for *Silene spaldingii* presented a more complex problem. To assess grassland loss/recovery one must have a relatively detailed review of preexisting conditions. A time-sequence of aerial photographs can show in a general way structural shifts, e.g., increasing density and size of trees (species identification strongly dependent on scale of photography) as they invade a grassland or meadow; however, it cannot reveal changes in a grassland's composition, although composition changes can sometimes be inferred from the structural changes. We did not attempt an interpretation of aerial photographs to ascertain community structural change, deeming it logistically impracticable.

A second approach is the use of General Land Office (GLO) records to evaluate the "pre-settlement" composition at those section corners now in the proximity of grassland or woodland. Habeck (1994) used this approach effectively to document succession in ponderosa pine/Douglas-fir forests in western Montana. This approach is very time-consuming and not practicable within the financial scope of the project. Difficulties include 1) obtaining the GLO records, 2) ascertaining that

there are enough section corners within the Forest Service holdings in the Tobacco Plains landscape to permit a valid comparison with extant vegetation patterns (the section corner requirement might be less of a consideration if surveyors followed given directions to note all trees intersecting the survey line), 3) ensuring that the observations made at section corners are sufficiently detailed to yield information that can be compared with today's composition (GLO surveyors primarily described tree composition, not grasses and forbs), 4) finding the section corners on the ground in a landscape that has been physically disturbed.

Standardized forms were employed in the 2002 field season to collect vegetation and abiotic site data from prospective grassland and woodland sites as well as to document rare plant and animal occurrences. The assessment of areas inventoried used criteria such as size (indication of woodland encroachment or intrinsic limitations), condition (land use activities, presence of exotic and weedy species) and landscape context (adjacent land use, habitat connectivity).

SPECIES LEVEL INVENTORY

A search of the Heritage Program's Biological Conservation Database (BCD) was conducted for the general area encompassing the Forest Service grassland parcels. Sixteen plant or lichen species and 12 animal species of concern occur within the study area (Table 1); only two plant species, Latah tule pea (*Lathyrus bijugatus*) and *Silene spaldingii* were likely to be possibly found within these grassland, shrubland or woodland ecosystems. *Silene spaldingii*, recently federally listed as "threatened", is the primary plant species of concern and target of this inventory. The primary animal target species was the Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*), which has been re-introduced to the Tobacco Valley, specifically at the Dancing Prairie Preserve, through the efforts of The Nature Conservancy. We watched for any sign of their presence, including leks. To aid in future searching we first located both Spalding's catchfly and Columbian Sharp-tailed Grouse on The Nature

Conservancy's Dancing Prairie Preserve, which supports an extensive population for the plant and several grouse leks. A rapid reconnaissance of Tobacco Valley grasslands, aided by helpful tips

from local botanists about potential sites of native vegetation, and especially a deliberate examination of Dancing Prairie's vegetation prepared us to inventory U. S. Forest Service holdings.

Table 1. Plant, lichen, and animal species of special concern potentially occurring within the greater Tobacco Plains, Rexford Bench, Salish Range foothills landscape. Species likely to occur in grassland or woodland habitats are shown in bold.

Scientific Name	Common Name	G-Rank	S-Rank	USFS Status
Animal Species				
<i>Canis lupus</i>	Gray wolf	G4	S2S3	Endangered
<i>Felis lynx</i>	Canada lynx	G5	S3	Threatened
<i>Gavia immer</i>	Common Loon	G5	S2B	Sensitive
<i>Haliaeetus leucocephalus</i>	Bald Eagle	G4	S3B,S3N	Threatened
<i>Histrionicus histrionicus</i>	Harlequin Duck	G4	S2B	Sensitive
<i>Oncorhynchus clarki lewisi</i>	Westslope cutthroat trout	G4T3	S3	--
<i>Otus flammeolus</i>	Flammulated Owl	G4	S3B	Sensitive
<i>Salvelinus confluentus</i>	Bull Trout (Columbia River)	G3T2Q	S?	Threatened
<i>Tympanuchus phasianellus</i>	Columbian Sharp-tailed Grouse	G4T3	S1	Sensitive
<i>Ursus arctos horribilis</i>	Grizzly bear	G4T3T4	S2S3	Threatened
Plant and Lichen Species				
<i>Aloina brevirostris</i>		G3G5	S1	
<i>Botrychium ascendens</i>	Upward-lobed moonwort	G2G3	S1	Sensitive
<i>Botrychium crenulatum</i>	Wavy moonwort	G2G3	S2	Sensitive
<i>Botrychium montanum</i>	Mountain moonwort	G3	S3	Sensitive
<i>Botrychium pedunculatum</i>	Stalked moonwort	G2G3	S2	Sensitive
<i>Carex sychnocephala</i>	Many-headed sedge	G4	S1	--
<i>Cetraria subalpina</i>	"A lichen species"	G3?	S2	Sensitive
<i>Cypripedium parviflorum</i>	Small yellow lady's-slipper	G5	S3	Sensitive
<i>Cypripedium passerinum</i>	Sparrow's-egg lady's-slipper	G4G5	S2	Sensitive
<i>Lathyrus bijugatus</i>	Latah tulle pea	G4	S1	Sensitive
<i>Lesquerella douglasii</i>	Douglas bladderpod	G4?	S1	--
<i>Lycopodium sitchense</i>	Alaska clubmoss	G5	S3	--
<i>Meesia triquetra</i>	"A moss species"	G5	S2	Sensitive
<i>Scirpus subterminalis</i>	Water bulrush	G4G5	S2	Sensitive
<i>Scorpidium scorpioides</i>	Scorpidium moss	G4G5	S2	Sensitive
<i>Silene spaldingii</i>	Spalding's campion	G2	S1	Threatened
<i>Viola selkirkii</i>	Great-spurred violet	G5?	S1	--

RESULTS

PLANT SPECIES

A July 16, 2002 visit to the Nature Conservancy's Dancing Prairie Preserve, which supports a large and well protected population of Spalding's catchfly, ascertained that conditions were favorable for the appearance and blooming of at least a portion of the catchfly population. In a return visit to Dancing Prairie Preserve on July 16, 2003, after another year of drought (annual precipitation down 2.5 inches from the long-term average) it was obvious that the number of plants with flowering stems was much reduced compared to the previous July. It was also determined that the species' prime habitat in this portion of its range is mesic grassland, often associated with swales and kettle holes and dominated by a variable combination of *Festuca campestris* (rough fescue), *F. idahoensis* (Idaho fescue), *Achnatherum richardsonii* (Richardson's needlegrass), and *Achnatherum nelsonii* (Nelson's needlegrass). Where grasslands transition to a more xeric habitat, *Hesperostipa comata* (needle-and-thread) becomes a dominant element, the cover of *F. campestris* and other mesic grasses (except *F. idahoensis*) is much reduced (if they are present at all), and Spalding's catchfly has a very low probability of occurring, or at least blooming. Bonnie Heidel (pers. comm. 2001), former MNHP botanist and veteran of several *S. spaldingii* inventories, suggested that open woodland was a high potential search location.

We encountered no specimens of *Silene spaldingii* in our search of US Forest Service holdings in either field year 2002 or 2003. This finding can have several, not mutually exclusive, explanations.

1. Forest Service lands occur on the periphery of the Tobacco Valley which is the main concentration of mesic grasslands, however environmental conditions on these peripheral lands should still be conducive to the development of mesic grasslands and the occurrence of *Silene spaldingii*.

2. In general, Forest Service lands that constitute favorable habitat (particularly in the vicinity of

Sophie Lake) have been greatly modified in a variety of ways. In particular, they have been converted to non-native pasture grasses. It is uncertain how grazing pressure has influenced the absence of *S. spaldingii*. Schassberger (1988) state this species is tolerant of light to moderate grazing.

Of potentially greater impact is the extent and relative dominance of non-native "pasture" grasses, including *Bromus inermis* (smooth brome), *Poa compressa* (Canada bluegrass), *Dactylis glomerata* (orchard grass), *Agropyron cristatum* (crested wheatgrass) and *Poa pratensis* (Kentucky bluegrass) in formerly supported native grasslands. Some Forest Service lands have clearly been plowed and seeded to pasture grasses (mostly *B. inermis*); we found furrows and an abrupt transition to native grasslands at the edge of plantings. This treatment obviously results in mortality of the native plant population by the mechanical action of plowing and subsequent elimination of surviving natives through competition with the pasture grasses (smooth brome being an especially effective competitor). Other lands appear to have been seeded to non-native grasses without plowing and others (especially woodland environments) appear to have experienced invasions of alien grasses and noxious weeds probably due to livestock or wild ungulate disturbance and seed introduction. We observed, in the few remaining patches of native prairie, woodland and even forest vegetation, that founder populations of smooth brome tended to expand in a centripetal fashion, taking a round to ovoid shape (Appendix C - P); in the areas that they had colonized few other herbaceous species were found and forbs were even rarer. This observation would seem to bode ill for the survival of *S. spaldingii*, even if it had been present in this landscape originally.

3. Failure to find *S. spaldingii* may also be attributable to the difficulty of recognizing first year rosette plants; although we reviewed characteristics of sterile stems and blooming material no rosettes were found in the Dancing

Prairie populations. (It should be noted that positive identification of *S. spaldingii* is attained only with mature flowering material in good condition). Lesica (1997) has observed that above-ground structures may not be produced following a dry spring or autumn. This could mean that in summer field seasons such as 2002 and 2003, both of which followed drier than average autumns and springs, that even mature plants would go undetected. However, in plants with prolonged dormancy, such as *S. spaldingii*, usually less than 25% of a population is dormant in any one year and few individuals are dormant for more than 2 years; the implication is that 95% of the plants will be detected by the second year (Lesica and Steele 1994). This characteristic led us to conduct at least two years of survey work to decrease the probability that dormant plants were not overlooked. The population levels of Dancing Prairie *S. spaldingii* in field seasons 2002 and 2003 should not necessarily be extrapolated to putative populations on Forest Service lands; Dancing Prairie hosts the largest and one of the best-managed *S. spaldingii* populations. In contrast, populations on Forest Service lands are under siege from disturbance, non-native increasers and noxious weeds, additionally, the habitat is probably marginal.

4. Forest Service lands that support seemingly appropriate habitat uniformly have coarse-textured soils, predominantly fine sands and fine sandy loams. Known populations of *S. spaldingii* have been found on loams, predominantly silt loams. Soil texture has not been established as a critical factor in this species' occurrence but it could be a factor in the lack of this species on Forest Service lands.

5. The fact that virtually all the Forest Service lands inventoried had been treated with a prescribed underburn in the immediate past possibly should have served to favor *S. spaldingii* populations. As Lesica (1999) has shown for the close proximity Dancing Prairie populations, prescribed burning stimulates growth, recruitment and flowering. Prescribed burning results from Dancing Prairie should be cautiously extrapolated to Forest Service lands because the Dancing Prairie population is both the largest known and one

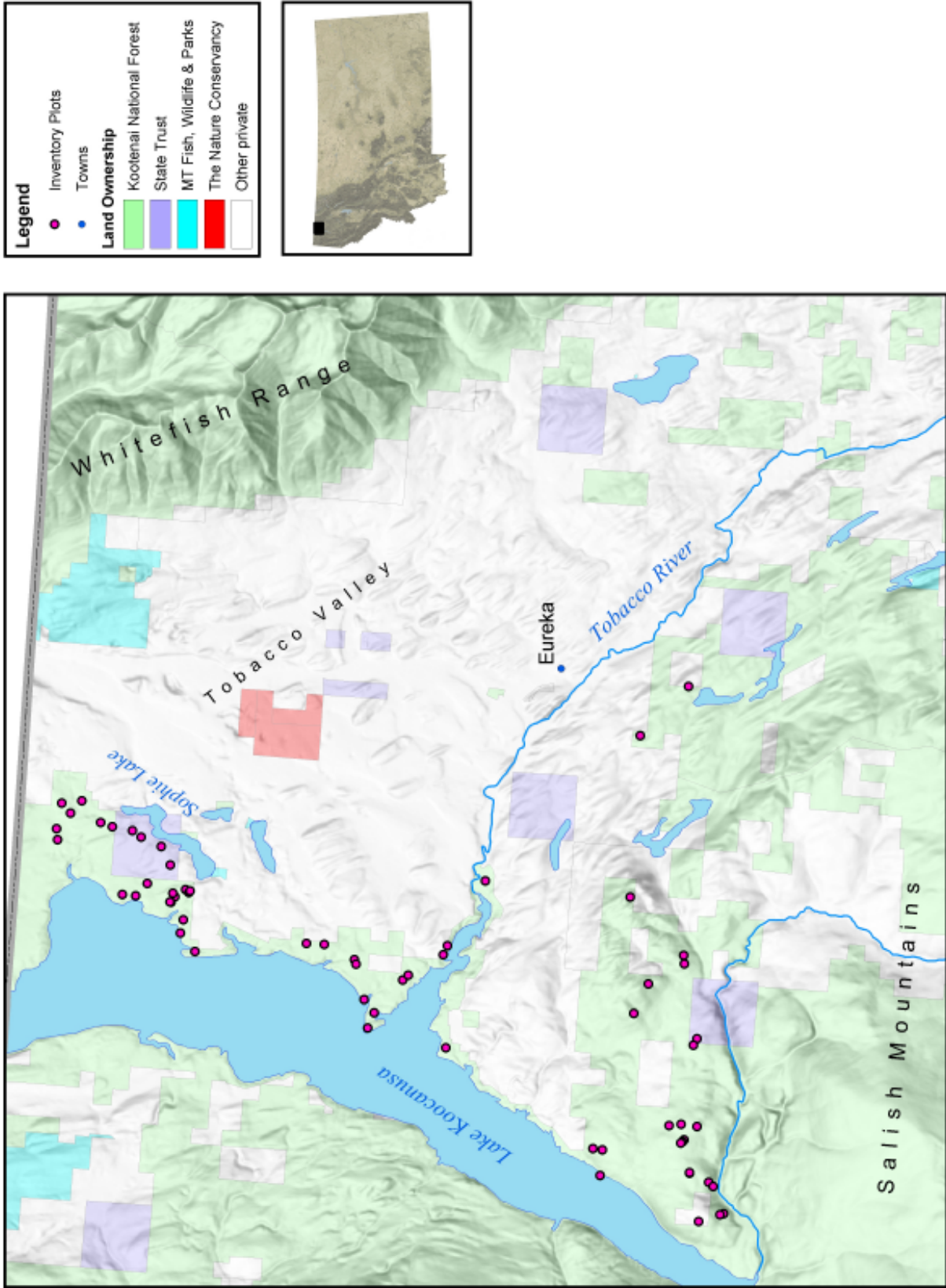
of the best-managed with robust individuals predominating. A prescribed burn of vulnerable plants (as possibly existed on U. S. Forest Service lands) could have resulted in their mortality.

GRASSLAND / WOODLAND LANDSCAPE

Figure 1 indicates vegetation plots established (blue dots). Much more of the landscape was visited and critically inventoried than is indicated by the plot locations. The vegetation plots were placed to represent the composition and coverage of a community covering a more extensive area.

The pre-field season selection of sampling sites based on aerial photographs worked well in targeting appropriate areas for on-the-ground sampling. The grassland inventory results were disturbing on the Forest Service lands north of the Tobacco River, which developed on surfaces somewhat typical of the Tobacco Plains in general. This is a fragmented landscape with numerous roads, fencelines and private inholdings. Not surprisingly, we found none of the sites to be pristine or relict. Noxious weeds are virtually omnipresent, if not actually occurring in a plot they could be found in the immediate vicinity. The most abundant noxious weeds are *Centaurea biebersteinii* (= *C. maculosa*, spotted knapweed), followed by *Bromus tectorum* (cheatgrass, legally not a noxious weed in MT but is in CO), *Potentilla recta* (sulphur cinquefoil), and *Linaria vulgaris* (butter-and-eggs, yellow toadflax). Only one of the plots had a serious infestation, although with the species listed there is frequently only a short delay between their appearance and their dominance. Reconnaissance of the Tobacco Valley offered abundant examples of how quickly a weed can become dominant; there are hundreds of acres (at a minimum) virtually monospecifically dominated by one or another of the above noted weeds (or *Euphorbia esula*, leafy sprurge, not found on Forest Service lands inventoried). The burgeoning of these Tobacco Valley weed populations on private lands have doubtless been expedited by grazing practices, particularly the pasturing of horses on ranchettes with no pasture rotation. So, while these weeds have not yet become dominant, they do constitute a severe threat to U. S. Forest

Figure 1. Study Area, showing locations of vegetation survey plots.



Service lands and with no treatment they will become increasingly threatening.

Of potentially greater threat to natural communities and sensitive species within the study area are a number of “pasture grasses” not currently considered noxious weeds or even threats within Montana. In order of decreasing threat (as evaluated by the author) for the study area, are smooth brome (*Bromus inermis*), Canada bluegrass (*Poa compressa*), Kentucky bluegrass (*Poa pratensis*), timothy (*Phleum pratense*), crested wheatgrass (*Agropyron cristatum*), and orchard grass (*Dactylis glomerata*). These pasture grasses are a threat because once a founder population is established it tends to expand (Moody and Mack 1988) and the most aggressive of these, smooth brome and Kentucky bluegrass, choke out competing native vegetation (Looman 1969, Romo and Grilz 1990). Smooth brome is considered worse than the other pasture grasses because it seems to establish virtual monocultures by rhizomatous expansion. It is equally well adapted to sexual reproduction by abundant seed production, which results in the formation of small foci that can collectively occupy areas more rapidly than one large introduction. Though claimed to be shade-intolerant (Northern Prairie Wildlife Research Center “Species abstracts of highly disruptive exotic plants, *Bromus inermis*”) we have observed *Bromus inermis* to be more shade tolerant (than the other pasture grasses listed above), expanding into denser woodland and forest habitats, beyond the environmental limits of these other grasses. Also contradicting its alleged shade-intolerance are other US sources (e.g. Hansen et al. 1995), which cite it to be the dominant undergrowth in cottonwood gallery forests, and Canadian sources (e.g. Romo and Grilz 1990), which list aspen parkland and boreal forest, two systems associated with considerable tree canopy cover, as systems most prone to invasion.

Of the pasture grasses found at the study area, the only one predominantly non-rhizomatous, crested wheatgrass, is an opportunist only on the most disturbed or bare sites and is probably present only where introduced (seeded). It significantly suppresses native vegetation, by decreasing the

abundance, species diversity and species turnover rates (Wilson 1989, Heidinga and Wilson 2002, Lesica and DeLuca 1996). Another group of non-native grasses represented in the study area include quackgrass (*Agropyron repens*), cheatgrass (*Bromus tectorum*), and Japanese brome (*Bromus japonicus*). These species are not considered as pasture grasses and not knowingly planted for habitat improvement but are also not considered noxious (at least in Montana).

The pasture grasses, with the exception of Kentucky bluegrass, are found most abundantly and constitute the greatest threat in lands north of the Tobacco River. Smooth brome and Canada bluegrass have been planted, in some cases following plowing of the native prairie; the average cover of these two grasses in the plots in which they occurred was 20% and 30% respectively, ranging from trace amounts to 90%. The areas of extensive virtual monocultures of these species probably served as the seed source for the burgeoning populations seen appearing everywhere from xeric grasslands to moderately closed forest. Populations of smooth brome were found expanding centripetally in environments that would classify as the *P. ponderosa* / *Symphoricarpos albus*, *P. ponderosa* / *Calamagrostis rubescens*, or *Pseudotsuga menziesii* / *C. rubescens* habitat types. Kentucky bluegrass competes aggressively on mesic grassland/shrubland sites (supporting rough fescue, Richardson’s needlegrass, Nelson’s needlegrass), though it was more prevalent south of the Tobacco River in the foothill and mountainous terrain. It had the highest frequency of the introduced grasses, present in 40% of the plots with an average cover of 12%.

Cheatgrass and Japanese brome were also more abundant in the southern portion of the study area where they are more associated with antelope bitterbrush communities than the small patches of mesic grasslands found in this locality. These communities occur on open, southerly facing slopes that constitute prime ungulate winter range. The intensive use, including grazing/browsing and general soil disturbance, has resulted in extensive annual brome populations, which in places exceeds 80% cover. A strong reduction in native

bunchgrass cover follows the establishment of these dense annual brome patches. Quackgrass (*Elymus repens*, formerly *Agropyron repens*) typically associated with riparian environments, has been found in mesic grasslands within the study area. The degree of threat is unknown, but it does form locally dense, sward-like patches and appears to have survived recent drought conditions, which one might presume would be limiting to such a moisture-dependent species.

PLANT COMMUNITIES

Plot data (canopy cover by species and abiotic variables) were used as an inventory of plant communities that could be compared post field-season with existing vegetation classifications so that community diversity and distribution could be ascertained. A number of tree-dominated communities were inventoried (and described) because they were considered to be potential habitat for *Silene spaldingii*. There are several classifications to which our plots can be compared. A recent dissertation by Leavell (2000) using techniques of multivariate analysis and based on existing vegetation, as recommended by the National Vegetation Classification System (NVCS, NatureServe 2002), seeks to classify associations and sub-associations of the Kootenai National Forest. Plots were stratified to sample “the entire range in environmental, vegetation, and biophysical gradients throughout the Kootenai National Forest”. Given the immensity and diversity of this forest it is to be expected that some areas would be undersampled or could harbor some unique environments that may have been overlooked in a broad survey; this is apparent from the dot distribution map of Leavell’s inventory plots and the resulting classification. Only two associations (*Pinus ponderosa* / *Balsamorhiza sagittata* / *Pseudoroegneria spicata* – *Festuca campestris* and *Poa pratensis* – *Poa palustris*) sampled and identified by Leavell (2000) for the Kootenai N. F. display a distinct resemblance to communities sampled in this study of the Tobacco Plains vegetation.

The other relevant published classifications with keys are those of Pfister et al. (1977) for forest and woodlands of Montana and Mueggler and

Stewart (1980) for shrublands and grasslands of western Montana. The plant associations (derived from the original Habitat Types) recognized in these two publications have been incorporated into the NVCS as only names with associated rarity ranks and distribution data; the NVCS lacks both a comprehensive key (that would facilitate the identification of plant associations found within the study area) and complete descriptions of these associations. At this time the most authoritative compendium of vegetation type descriptions is EcoArt, an in-house temporary repository/database of Nature Serve; EcoArt also lacks diagnostic keys. Therefore, for identification to plant association level our plots have been compared to the classifications of both Pfister et al. (1977) and Mueggler and Stewart (1980) and then, where matches were not found, to EcoArt listings, trying to find the closest match and ascertaining whether the description fits the study area data.

Evidently the combination of sandy substrates and past (and ongoing?) disturbance patterns have resulted in some study area vegetation types that have not been described in Pfister et al. (1977) or Mueggler and Stewart (1980), classifications which are best applied to mature vegetation. It should be noted that 1) the NVCS stresses that vegetation classification be focused on existing vegetation, not potential vegetation, as exemplified by habitat types of Mueggler and Stewart (1980) and Pfister et al. (1977) and 2) the NVCS is currently biased toward native vegetation with exotic-dominated disturbance types not yet comprehensively covered. This second point means, regarding the disturbance-related communities of the study area, that we will make only a cursory attempt to relate them to a larger ecological context.

Brief descriptions of plant associations as they occur within the study area are in Appendix B; some have been well recognized and described elsewhere while others are apparently more unique in composition and relatively rare or not yet described in the literature. Table 2 provides complete list of inventoried communities, their G- and S-Ranks, and the allocation of plots by communities.

Table 2. Plant Associations/Communities found within Kootenai N. F. study area¹

Plant Association Name, Scientific	Plant Association Name, Common	Elcode ²	G-Rank	State Distribution	Probability of <i>Silene spaldingii</i> ³
Forest and Woodland Plant Associations/Communities					
<i>Pinus ponderosa</i> / <i>Bromus inermis</i> Woodland	Ponderosa pine / Smooth brome	CEGL000185	G3G4	ID, MT, WA	low
<i>Pinus ponderosa</i> / <i>Festuca campestris</i> Woodland	Ponderosa pine / Rough Fescue	None	GW		medium
<i>Pinus ponderosa</i> / <i>Poa pratensis</i> Woodland	Ponderosa pine / Kentucky Bluegrass	None	G4	BC, ID, MT, ND, OR, SD, WA, WY	low
<i>Pinus ponderosa</i> / <i>Pseudoroegneria spicata</i> Woodland	Ponderosa pine / Bluebunch Wheatgrass	CEGL000865			low
<i>Pinus ponderosa</i> / <i>Purshia tridentata</i> / <i>Festuca campestris</i> Woodland	Ponderosa pine / Antelope bitterbrush / Rough Fescue	None			medium
<i>Pinus ponderosa</i> / <i>Purshia tridentata</i> / <i>Hesperostipa comata</i> Woodland	Ponderosa pine / Antelope Bitterbrush / Needle-and-Thread	None			low
<i>Pinus ponderosa</i> / <i>Symphoricarpos occidentalis</i> Forest	Ponderosa pine / Western Snowberry	CEGL000204	G3	MT	low
<i>Pseudotsuga menziesii</i> / <i>Festuca campestris</i> Woodland	Douglas-Fir / Rough Fescue	CEGL000901	G?	MT, UT?	medium
<i>Pseudotsuga menziesii</i> / <i>Achnatherum nelsonii</i> ssp. <i>dorei</i> Woodland	Douglas-Fir / Dore's Needlegrass	None			medium
Shrub and Shrub Herbaceous Plant Associations/Communities					
<i>Purshia tridentata</i> / <i>Festuca campestris</i> Shrub Herbaceous	Antelope bitterbrush / Rough Fescue	CEGL001494	G2?	MT	medium
<i>Purshia tridentata</i> / <i>Hesperostipa comata</i> Shrub Herbaceous	Antelope bitterbrush / Needle-and-thread	CEGL001498	G2?	CO, ID, OR, WA	low
<i>Purshia tridentata</i> / <i>Pseudoroegneria spicata</i> Shrub Herbaceous	Antelope bitterbrush / Bluebunch Wheatgrass	CEGL001495	G3	BC, CA?, ID, MT, OR, WA	low
Herbaceous Plant Associations/Communities					
<i>Achnatherum nelsonii</i> / <i>Eriogonum flavum</i> Herbaceous Vegetation	Dore's needlegrass - Alpine Golden Buckwheat	None			low
<i>Achnatherum nelsonii</i> - <i>Koeleria macrantha</i> Herbaceous Vegetation	Dore's needlegrass - Prairie Junegrass	CEGL001707	G?	UT, MT?	medium
<i>Bromus inermis</i> Herbaceous Vegetation	Smooth brome Herbaceous Vegetation	None	GW		low
<i>Festuca campestris</i> - <i>Festuca idahoensis</i> Herbaceous Vegetation	Rough Fescue - Idaho Fescue	CEGL001628	G3	ID, MT, OR, WA	high
<i>Festuca campestris</i> - <i>Pseudoroegneria spicata</i> Herbaceous Vegetation	Rough Fescue - Bluebunch Wheatgrass	CEGL001629	G4	MT	medium
<i>Festuca idahoensis</i> - <i>Pseudoroegneria spicata</i> Herbaceous Vegetation	Idaho fescue - Bluebunch Wheatgrass	CEGL001624	G4	CA, ID, MT, WA,	low-medium
<i>Hesperostipa comata</i> - <i>Poa secunda</i> Herbaceous Vegetation	Needle-and-thread - Sandberg's Bluegrass	CEGL001704	G1	BC?, MT, OR, WA	low
<i>Poa compressa</i> - Herbaceous Vegetation	Canada bluegrass	None			low
<i>Poa pratensis</i> Herbaceous Vegetation	Kentucky bluegrass	None			low
<i>Pseudoroegneria spicata</i> - <i>Poa secunda</i> Herbaceous Vegetation	Bluebunch wheatgrass - Sandberg's bluegrass.	CEGL001677	G4?	CO, MT, OR, UT, WA, WY	low
¹ Explicitly excludes vegetation types of closed forest, riparian or wetland habitats, those judged to be well outside the environmental limits of <i>Silene spaldingii</i> .					
² Appendix B contains Kootenai specific descriptions of this type and Appendix D contains global descriptions of the association.					
³ A subjective rating (high, medium, low) of the potential of these plant associations as appropriate habitat for <i>Silene spaldingii</i> , based on previously documented populations.					

DISCUSSION/CONCLUSIONS

SILENE SPALDINGII

The search for *Silene spaldingii* on Kootenai National Forest lands proved fruitless in 2002 and 2003, although growing conditions were conducive for this species' appearance and flowering as demonstrated by the Dancing Prairie Preserve populations. Any number of hypotheses can be advanced to explain this negative result (see "Results" Section), but the most parsimonious is that appropriate habitat is not present. Throughout the study area, but most particularly in the Tobacco Plains vicinity, past disturbances have altered the native grasslands. The visual impression is that the grasslands experiencing the greatest alteration are the most mesic, the sites potentially most conducive to *S. spaldingii* (Table 2). The most obvious result has been the replacement of native species with introduced pasture grasses; if *S. spaldingii* were present it could well have suffered the same declining fate as other herbs. It should also be noted that the most impacted type of Forest Service Tobacco Plains grasslands, *Festuca campestris* – *F. idahoensis* and *F. campestris* / *Pseudoroegneria spicata*, though compositionally similar to those of the Dancing Prairie Preserve (based on a non-quantitative assessment), were developed on soils unlike those of Dancing Prairie Preserve (fine sandy loam and fine sands versus silt loam and loams of the Dancing Prairie Preserve).

In the Rexford Bench vicinity the more mesic, rough fescue-dominated grasslands and shrublands (probably *Festuca campestris* – *F. idahoensis* and *Purshia tridentata* / *F. campestris* types) most likely to historically have been occupied by *S. spaldingii*, also occur on coarse-textured substrates. Grasslands in the Salish Range foothills generally occur on sites with a high solar insolation load and thinner soils, though the texture usually is finer than the soils of the valley positions. Foothills locations also had less area, both relative to immediate surroundings and on an absolute basis, of *Festuca campestris* (rough fescue)- and *Achnatherum richardsonii* (Richardson's needlegrass)-dominated communities, which are associated with the presence of *S. spaldingii*, at

least in the valley locations. Foothills grasslands and shrublands are often *Achnatherum nelsonii* (Dore's needlegrass)- and *Purshia tridentata* (antelope bitterbrush)-dominated and though these sites may be considered sufficiently mesic for *S. spaldingii* they have not been demonstrated to be appropriate habitat (i.e. *S. spaldingii* populations have not been found in these environments). Foothills grasslands have less disturbance in general and annual bromes, rather than rhizomatous pasture grasses, are the primary increasers.

PLANT COMMUNITIES

Seven *Pinus ponderosa*- and two *Pseudotsuga menziesii*-dominated woodland communities were identified for the study area (Table 2). The undergrowth of two of these communities (*P. ponderosa* / *Bromus inermis* and *P. ponderosa* / *Poa pratensis*) is dominated by pasture grasses where presumably native bunchgrasses once prevailed. We assume past grazing (and logging?) disturbance fostered these conditions; we cannot rule out the possibility that some of these sites were seeded to exotic grasses. In many instances this rhizomatous grass layer is extensive and nearly continuous. The botanist John Pierce of Missoula when conducting a vegetation survey along a particular stretch at the base of the Rocky Mountain Front could not find a single "wet meadow" (USFS or private ownership) that was not dominated by exotic grasses. A chance encounter with an old rancher proved enlightening; he indicated that these meadows had been plowed and planted to exotic pasture grasses, including *Phleum pratense* (timothy), in the belief that this would increase grass production (and ultimately cattle production). We have also noted small patches of rhizomatous alien grasses (particularly *Bromus inermis*, smooth brome) in woodlands where the undergrowth is native bunchgrass dominated; these patches under the open *P. ponderosa* canopies, by virtue of their size and round to oval shape, we infer to be "recently" established, centripetally expanding founder populations.

Three of these woodlands have a conspicuous shrub component dominated by *Purshia tridentata* (antelope bitterbrush) or *Symphoricarpos occidentalis* (western snowberry), though *Purshia* cover seldom exceeds 20% and it is just barely taller than the bunchgrass layer. It should be noted that the study area is the only locality on the Kootenai N. F. where *P. tridentata* occurs abundantly (Leavell, personal communication 2002). *Purshia* is rather patchily distributed in these communities and always heavily browsed. These communities are probably important ungulate winter range based on the abundant pellet groups and highly hedged condition of *Purshia*. Rhizomatous pasture grasses and noxious weedy forbs pose a threat to diversity where these communities occur on flatter valley locations with coarse soils; on foothill locations annual brome grasses and weedy forbs are the more immediate concern. An appreciable cover of *Festuca campestris* differentiates the more mesic sites from those more xeric and dominated by *Pseudoroegneria spicata* (bluebunch wheatgrass). The vegetation type wherein *F. campestris* is an important component has not been formally recognized in the NVCS, but should be; it represents a condition distinct from that recognized as *P. ponderosa* / *P. tridentata* / *F. idahoensis* (CEGL000195 [See Appendix D for a global description]) for California and Oregon.

Two study area *P. ponderosa* woodland types have only trace amounts of shrubs and are bunchgrass dominated; both communities are well distributed in Montana, Idaho and Washington and one (*P. ponderosa* / *Pseudoroegneria spicata*) is the most broadly distributed of *P. ponderosa*-dominated communities. It is unclear what factors may differentiate woodlands with a *Purshia tridentata* layer from those without (there is virtually a complete overlap between these two conditions regarding the simple environmental parameters we assessed). It is unlikely that a differential fire regime would be the explanation, as *P. tridentata* was noted to effectively survive fire via root crown sprouting, some prescribed burn stands experienced no *Purshia* mortality.

Two *Pseudotsuga menziesii*-dominated communities occur as relatively narrow linear patches and represent ecotonal positions between open shrublands/grasslands and distinctly forested conditions (based on cover of the upper canopy). The provisional community, *P. menziesii* / *Achnatherum nelsonii*, is quite similar in environment and composition to *P. menziesii* / *Festuca campestris*; it was only recognized (and provisionally) due to the NVCS approach focused on existing vegetation. Since it is ecotonal, restricted in size and developed on sites with abiotic parameters duplicated broadly over this landscape (and the community is not) this expression is best noted as a local anomaly not worthy of formal recognition and certainly not to be considered a conservation target at this time.

Three shrub herbaceous plant associations were documented in the study area, all are rated as relatively uncommon on both a state and national perspective, G2 or G3, and one association, *Purshia tridentata* / *Hesperostipa comata*, has not previously been reported from Montana. *P. tridentata* / *H. comata* may conceivably be a product of disturbance. We found it on sites similar (although detailed soil data was lacking) to those occupied by *P. tridentata* / *Pseudoroegneria spicata*. All the shrublands occurred as small patch communities. Several sites examined in the Tobacco Plains vicinity had clearly had prescribed burns and exhibited reduced *P. tridentata* cover; however there was little mortality in the species due to good response via root-crown sprouting. None of the examined shrub stands on Forest Service lands had significant weed problems but all had at least scattered individuals of *Centaurea maculosa* (spotted knapweed), *Potentilla recta* (sulfur cinquefoil), *Verbascum thapsus* (common mullein) or small patches of annual weedy brome grasses.

Grass-dominated communities comprise very little of the study area, usually occurring as small patches. Those having the greatest extent in the Tobacco Plains unfortunately have been compositionally altered to the extent that they must be rated GW, for weedy or ruderal. Rhizomatous alien pasture grasses, though not considered

noxious weeds (Rice 2003) in this state are clearly a threat to native grasslands, woodlands and more open forest communities of this landscape. Smooth brome has been widely employed as a stabilizer of the states roadsides and included in seed mixes used in post-fire reseeding. However, we have noted its aggressive nature in the eastern Montana plains where presumably certain cultivars will invade native midgrass steppe, whether or not disturbed by grazing (Cooper et al. 2001). Its aggressiveness and the concomitant loss of biodiversity are now recognized as a management concern, at least in the Canadian prairies (Weerstra 2000; Romo and Grilz 1990). Though the Tobacco Plains and Rexford Bench constitute unusual habitat for this species, which is better adapted to dark productive prairie soils, it is clear that it is expanding into all but the relatively shaded forest communities. Though there are prescribed burning guidelines to arrest its spread and reverse its invasion of sites (Higgins et al. 1989) it is the experience of Canadian researchers that without selective herbicide treatment that long-term gains will not be made against this invader (Weerstra 2000). We have not seen *Poa compressa* employed elsewhere as a reseeding grass but on the Tobacco Plains grasslands, including those of the National Forest, this grass has been seeded extensively and perhaps has volunteered as well. There are no signs that it will give way to native species without aggressive manipulation (see results of stewardship on Dancing Prairie Preserve). Crested wheatgrass (*Agropyron cristatum*) is of minor importance in this landscape; it has been seeded at a few locations but exhibits no tendency to expand beyond the site of seeding; where seeded it has produced some of the deleterious effects cited by Lesica and DeLuca (1996) for Great Plains ecosystems.

Of the native grasslands, five types have been recognized by the NVCS; of these, three are relatively common (G4 or greater) across the western US; one (*Festuca campestris* – *Festuca idahoensis*, G3) is distributed across Idaho, Oregon, and Washington but only well represented in Montana (S3) and one (*Achnatherum nelsonii* – *Koeleria macrantha*) has been recognized as rare and noted only from Utah, although we will have to

acquire the original literature description to ascertain if our study area stands meet the description. We also recognize a previously undescribed grassland community, tentatively identified as *Achnatherum nelsonii* – *Eriogonum flavum*, that occurs on lithosols with very sparse vascular plant canopy cover and is significantly different from *A. nelsonii* – *K. macrantha*, although they occur together. Both of these communities occur within the foothill region.

It is instructive to compare these Tobacco Valley and vicinity grasslands with those in the proximity of Polebridge, MT on the west side of Glacier National Park. Just north of Polebridge, in the rainshadow of the Whitefish Range, is an isolated (in a sea of conifers), extensive, mostly mesic grassland (Big Prairie) dominated by *Festuca campestris* (rough fescue), *Festuca idahoensis* (Idaho fescue), *Achnatherum richardsonii* (Richardson's needlegrass) and *A. nelsonii* (Dore's needlegrass). Polebridge receives just over 22 in. of precipitation per year in a pattern very similar to that of Libby (peak precipitation in winter). The glacial history of the Tobacco Valley and Big Prairie north of Polebridge are quite similar as well, with the Big Prairie having coarse- to fine-textured soils formed in a variety of alluvium and glacial drift.

Another factor these sites may have in common is past fire regimes. Koterba and Habeck (1971) remark, concerning the Big Prairie grasslands, that fire history is at least as important to their initiation and maintenance as is the abiotic regime; this may also be true for the Tobacco Valley grasslands, although lower precipitation here would definitely be more of a factor. However, Big Prairie grasslands differ from those of the Tobacco Valley both environmentally (being a distinct frost pocket with *Pinus contorta*, rather than *Pinus ponderosa*, invading grasslands in the absence of fire) and compositionally by lacking *Hesperostipa comata* (needle-and-thread) altogether and having *Danthonia intermedia* (timber oatgrass) as an important component. This lack of *H. comata* at Big Prairie is difficult to understand because *H. comata* communities are common in the Tobacco Valley, northeastern Washington (Daubenmire

1970), and British Columbia (in the northernmost portion of this province, Pojar 1982). The lack of *D. intermedia* in the Tobacco Valley and Salish Range foothills (at least it did not occur in sample plots or reconnaissance information) is more attributable to inappropriate habitat (it is primarily subalpine in its affinities), than to accidents of distribution.

The grassland vegetation of both of these sites has been sampled, though not yet formally classified. Both sites have expressions of the wide-ranging *Festuca campestris* – *Festuca idahoensis* plant association, although sites in the Tobacco Valley lack, or have the sparsest representation of, a number of mesic forbs (e.g. *Geranium viscosissimum*, sticky geranium). Both sites also have small patch communities dominated by *Achnatherum nelsonii* and *A. richardsonii*; communities that occurs very infrequently to the south but which are apparently more common to the north (Pojar 1982). These types of the Canadian provinces have not been added to, or crosswalked with, the NVCS so it is difficult to make comparisons, but it would seem that the latitude of Tobacco Valley-Big Prairie may represent the southern extension of these types (the *A. nelsonii* – *Koeleria macrantha* community cited above for Utah is dominated by *A. nelsonii* ssp. *nelsonii* whereas *A. nelsonii* communities of the northern latitudes are dominated by *A. nelsonii* ssp. *dorei*). Thus grasslands in the Tobacco Valley area may represent southern outliers of grasslands still unranked. In terms of conservation value, outliers of even uncommon community types do not have the importance accorded to species at their distributional extremes (Lesica and Allendorf 1992), however on a local or statewide basis these communities are unique and worthy of conservation efforts.

All of the native grasslands occur as small patch communities and all are under threat from naturalized grasses and weeds. Virtually every grassland site visited (though not every plot recorded) had a noxious weed and/or alien grass present. These “nascent foci”, as shown in the

invasion models of Moody and Mack (1988), constitute a much graver threat for the spread of an invader, than a few large foci. Their model has inescapable implications for control measures, namely that these outlying, isolated foci should be destroyed before or simultaneously with the reduction in the area of the main infestation(s).

We observed that an active weed control campaign is being conducted on the National Forest lands, most aggressively applied to grasslands and appearing to target spotted knapweed, while consistently ignoring sulphur cinquefoil (*Potentilla recta*) that may occur in the immediate vicinity of the knapweed. Of paramount concern should be the fact that the privately held portion of the Tobacco Plains is a vast seed bank for all manner of noxious weeds having great mobility and invasive potential, including the two species cited above. A factor further placing Forest Service lands in peril, particularly those under study because of their past and continuing disturbance, is the pattern of development with ranchettes and “horse farms” springing up immediately adjacent to these Forest Service lands. We did note within these grasslands and woodlands the presence of a rhizomatous grass, *Elymus repens* (= *Agropyron repens*, quack grass), that has been recognized as a noxious weed (but not in Montana); we have not heretofore seen it in such dry communities and do not believe it constitutes a significant threat in these drier Tobacco Valley habitats. The extensive infestations of *Potentilla recta* (sulfur cinquefoil) and those of *Centaurea biebersteinii* (= *C. maculosa*, spotted knapweed) rival those seen in the vicinity of Missoula and the Bitterroot Valley, the epicenter of knapweed in Montana. When compared to the threat posed by these two noxious weeds the scattered populations of *Verbascum thapsis* (common mullein), *Hypericum perforatum* (St. Johnswort), *Cirsium arvense* (Canada thistle), *Cardaria draba* (hoary cress) and *Hyoscyamus niger* (black henbane) seem insignificant. The rhizomatous alien grasses will probably constitute almost as great a threat to biodiversity as do the noxious weeds, most of which are forbs.

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APPENDIX A. GLOBAL/STATE RANK DEFINITIONS

HERITAGE PROGRAM RANKS

The international network of Natural Heritage Programs employs a standardized ranking system to denote global (range-wide) and state status. Species are assigned numeric ranks ranging from 1 to 5, reflecting the relative degree to which they are “at-risk”. Rank definitions are given below. A number of factors are considered in assigning ranks — the number, size and distribution of known “occurrences” or populations, population trends (if known), habitat sensitivity, and threat. Factors in a species’ life history that make it especially vulnerable are also considered (e.g., dependence on a specific pollinator).

GLOBAL RANK DEFINITIONS (NatureServe 2003)

- G1 Critically imperiled because of extreme rarity and/or other factors making it highly vulnerable to extinction
- G2 Imperiled because of rarity and/or other factors making it vulnerable to extinction
- G3 Vulnerable because of rarity or restricted range and/or other factors, even though it may be abundant at some of its locations
- G4 Apparently secure, though it may be quite rare in parts of its range, especially at the periphery
- G5 Demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery
- T1-5 **Infraspecific Taxon** (trinomial) —The status of infraspecific taxa (subspecies or varieties) are indicated by a “T-rank” following the species’ global rank

STATE RANK DEFINITIONS

- S1 At high risk because of extremely limited and potentially declining numbers, extent and/or habitat, making it highly vulnerable to extirpation in the state
- S2 At risk because of very limited and potentially declining numbers, extent and/or habitat, making it vulnerable to extirpation in the state
- S3 Potentially at risk because of limited and potentially declining numbers, extent and/or habitat, even though it may be abundant in some areas
- S4 Uncommon but not rare (although it may be rare in parts of its range), and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long-term concern
- S5 Common, widespread, and abundant (although it may be rare in parts of its range). Not vulnerable in most of its range

COMBINATION RANKS

G#G# or S#S# **Range Rank**—A numeric range rank (e.g., G2G3) used to indicate uncertainty about the exact status of a taxon

QUALIFIERS

- NR Not ranked
- Q **Questionable taxonomy that may reduce conservation priority**—Distinctiveness of this entity as a taxon at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority (numerically higher) conservation status rank

- X **Presumed Extinct**—Species believed to be extinct throughout its range. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered
- H **Possibly Extinct**—Species known from only historical occurrences, but may never-the-less still be extant; further searching needed
- U **Unrankable**—Species currently unrankable due to lack of information or due to substantially conflicting information about status or trends
- HYB **Hybrid**—Entity not ranked because it represents an interspecific hybrid and not a species
- ? **Inexact Numeric Rank**—Denotes inexact numeric rank
- C **Captive or Cultivated Only**—Species at present is extant only in captivity or cultivation, or as a reintroduced population not yet established
- A **Accidental**—Species is accidental or casual in Montana, in other words, infrequent and outside usual range. Includes species (usually birds or butterflies) recorded once or only a few times at a location. A few of these species may have bred on the one or two occasions they were recorded
- Z **Zero Occurrences**—Species is present but lacking practical conservation concern in Montana because there are no definable occurrences, although the taxon is native and appears regularly in Montana
- P **Potential**—Potential that species occurs in Montana but no extant or historic occurrences are accepted
- R **Reported**—Species reported in Montana but without a basis for either accepting or rejecting the report, or the report not yet reviewed locally. Some of these are very recent discoveries for which the program has not yet received first-hand information; others are old, obscure reports
- SYN **Synonym**—Species reported as occurring in Montana, but the Montana Natural Heritage Program does not recognize the taxon; therefore the species is not assigned a rank
- * A rank has been assigned and is under review. Contact the Montana Natural Heritage Program for assigned rank
- B **Breeding**—Rank refers to the breeding population of the species in Montana
- N **Nonbreeding**—Rank refers to the non-breeding population of the species in Montana

**APPENDIX B. DESCRIPTIONS OF STUDY AREA PLANT ASSOCIATIONS
WITH THE POTENTIAL OF SUPPORTING *SILENE SPALDINGII* POPULATIONS**

FORESTS/WOODLANDS

(The first two descriptions are of disturbed communities sufficiently altered as to be recognized as GW, weedy or ruderal, within the NatureServe/Heritage Program approach; following these two the communities are arranged alphabetically within lifeform.)

***Pinus ponderosa* / *Bromus inermis* Woodland Community:** [Photograph Appendix C-A] Only one stand of this type was sampled but other small patch communities, were noted in reconnaissance; they occurred on sandy substrates on flat to gently rolling terrain. This community is typified by an open canopy of short-stature *P. ponderosa* (10-40% canopy cover). The undergrowth is dominated by *Bromus inermis* (smooth brome), usually forming a near-monospecific sward. With the exception of *Artemisia frigida* (fringed sage) all other species occurred in trace amounts. This is obviously a disturbance type; we hypothesize *B. inermis* is increasing and other species are being reduced in cover or eliminated by competition with this aggressive exotic grass.

***Pinus ponderosa* / *Poa pratensis* Woodland Community:** This community is much like the foregoing, occurring as very open (10-35% canopy cover), small patches of short-stature *P. ponderosa* at the edge of grasslands or shrublands. It was noted only from sandy substrates occurring along the western margin of the Tobacco Valley. The undergrowth is dominated by exotic grasses of which *Poa pratensis* (Kentucky bluegrass) is dominant; other exotics, often nearly equaling *P. pratensis* in cover, include *Poa compressa* (Canada bluegrass), *Bromus inermis* (smooth brome), *B. japonicus* (Japanese brome) and *Agropyron cristatum* (crested wheatgrass). Of the native grasses the relatively unpalatable *Hesperostipa comata* (= *Stipa comata*, needle-and-thread), *Calamovilfa longifolia* (prairie sandreed) and *Koeleria macrantha* (= *K. cristata*, prairie junegrass) have the greatest cover. The forb composition also reflects disturbance with *Plantago patagonica* (woolly plantain), *Machaeranthera canescens* (hoary tansyaster), *Heterotheca villosa* (hairy false goldenaster), *Cirsium* spp. and other native increaser species having the most cover; the introduced forb *Verbascum thapsus* (common mullein) is also consistently present and reflects past disturbance.

***Pinus ponderosa* / *Festuca campestris* Woodland Plant Association (CEGL000185 [See Appendix D for a global description]):** (= *F. scabrella*) [Photograph Appendix C-B] This is a common type within the study area, occurring predominantly on gently rolling to flat terrain with sandy to sandy loam soils and to a lesser degree on moderate to steep slopes with warm exposures. It has been described from ID, MT, and WA but is relatively uncommon (G3) and its occurrence at lower elevation in proximity to human habitations puts it at risk. Canopy cover of the only tree present in the upper canopy, *P. ponderosa*, ranges from 20 to 50% with mature tree heights in the 55-70 ft. range. *Pseudotsuga menziesii* may be present as seedlings and saplings (this plant association is based on existing vegetation as distinguished from the Habitat Type system wherein several of the sample stands (plots) would typed as being within the *Pseudotsuga menziesii* series or alliance based on potential). The undergrowth component of this type is recognized on the basis of the indicator species *F. campestris* having at least 5% cover (Pfister et al. 1977); under relatively undisturbed conditions it usually has at least 10% cover in the study area stands; however, its average cover is considerably less than that reported for more typical representations of the type (20%, Pfister et al. 1977). However, *F. campestris* is both extremely favored forage and susceptible to overgrazing (Johnson 1961, Willms et al. 1985, Aiken and Darbyshire 1990) and thus this type is at risk throughout its distribution. This association could transition to *P. ponderosa* / *Poa pratensis* and *P. ponderosa* / *Bromus inermis* within the study area. Due to the predominantly sandy soils found in the study area there are a number of graminoid species distinct from the association's typical co-dominant, *Festuca idahoensis*, including *Hesperostipa comata* (formerly *Stipa comata*, needle-and-thread) *Pseudoroegneria spicata* (= *Agropyron spicatum*, bluebunch wheatgrass) and *Calamovilfa longifolia* (prairie sandreed). The total forb cover usually does not exceed 10% with the

most common being *Heterotheca villosa* (hairy false goldenaster), *Phlox hoodii* (spiny phlox), and *Linum lewisii* (prairie flax). Shrubs are a minor component; the only one of appreciable constancy, *Amelanchier alnifolia* (serviceberry), is likely to remain so due to being intensively browsed.

This association is essentially the same as the *P. ponderosa* / *F. idahoensis* habitat type, *Festuca campestris* phase of Pfister et al. (1977) and *P. ponderosa* / *Balsamorhiza sagittata* / *Pseudoroegneria spicata* - *Festuca campestris* plant association of Leavell (2000), but lacks the high constancy and moderate cover of *B. sagittata*. The plots of Leavell (2000) and the current study also differ from those of Pfister et al. (1977) in the low representation of *F. idahoensis*.

***Pinus ponderosa* / *Pseudoroegneria spicata* Woodland Plant Association (CEGL000865 [See Appendix D for a global description]):** (= *Agropyron spicatum*, *Elymus spicatus*, *Elytrigia spicata*) [Photograph Appendix C-c] From a national perspective this is probably one of the most common and broadly distributed *P. ponderosa* woodland types but, within the study area, it is uncommon, representing the warmest and driest of sites on moderate to steep southwest-facing slopes. It is unclear what environment factors differentiate these sites from *P. ponderosa* / *P. tridentata* / *P. spicata*; those stands with a significant shrub component may have coarser soils. These sites are too dry to support *F. campestris* and *F. idahoensis*. *Symphoricarpos occidentalis* (western snowberry), *Rosa woodsii* (Woods rose), *Artemisia frigida* (fringed sage) and *Ericameria nauseosa* (= *Chrysothamnus nauseosus*, rubber rabbitbrush) are commonly present in trace amounts. *Pseudoroegneria spicata* (bluebunch wheatgrass) and *Hesperostipa comata* (= *Stipa comata*, needle-and-thread) are the dominant bunchgrasses, with a combined cover generally not exceeding 40 %. *Koeleria macrantha* (prairie junegrass), *Festuca idahoensis* (Idaho fescue), *F. campestris* (rough fescue) and *Poa secunda* (Sandberg's bluegrass) seldom occur in greater than trace amounts. There is no consistent difference in forb composition from other area *P. ponderosa* woodlands with *Heterotheca villosa* (hairy false goldenaster), *Phlox hoodii* (spiny phlox), and *Astragalus miser* (timber milkvetch) having the greatest cover, which seldom exceeds 5%, singly or combined.

This plant association is essentially the same as the *P. ponderosa* / *Pseudoroegneria* habitat type of Pfister et al. (1977), but lacks the high constancy and moderate cover of *B. sagittata*; on the basis of name alone this study area type is at least floristically similar to the *Pinus ponderosa* / *Lomatium dissectum* – *Balsamorhiza sagittata* / *Bromus tectorum* – *Agropyron spicatum* plant association indicated as present on the Kootenai N.F., based on a type defined for the NezPerce N. F. (Leavell 2000)

Note: Throughout the northwestern US, adjacent Canada and into the Great Basin a common woodland type has *Pinus ponderosa* as the dominant tree (only tree species, usually) and *Purshia tridentata* (antelope bitterbrush) as the shrub layer dominant. Stratifying on the basis of the herbaceous layer may allow finer distinctions. In compiling the NVCS the climax plant associations (habitat types) developed for Montana were incorporated but the phase level distinctions were not recognized. In the course of study area inventory it became apparent that the phase level distinctions recognized by Pfister et al. (1977) should be elevated to the plant association level to capture the ecological distinctions that these types represent. These recommended changes in syntaxonomy will be forwarded to the NVCS via NatureServe.

***Pinus ponderosa* / *Purshia tridentata* / *Festuca campestris* Woodland Plant Association (no CEGL designation, a provisional type):** (= *F. scabrella*) [Photograph Appendix C-D] This small patch type is relatively uncommon in the Tobacco Plains vicinity (owing to the comparative scarcity of *F. campestris*, which we hypothesize has been impacted by grazing). *Pinus ponderosa* forms an open canopy with mature trees 55-70 feet tall. Very sparsely dispersed seedlings and saplings of *Pseudotsuga*

menziesii suggest that this is a more mesic habitat than *P. ponderosa* / *P. tridentata* / *P. spicata* or *P. ponderosa* / *P. tridentata* / *F. idahoensis*. Also signaling the mesic nature of these sites is the presence of *Achnatherum nelsonii* (Nelson's needlegrass) and *A. richardsonii* (Richardson's needlegrass). On the sandy study area sites *Hesperostipa comata* and *Calamovilfa longifolia* can comprise a significant component, a condition not seen/documentated elsewhere in this type and attributable to the sandy substrates. Total bunchgrass cover (about 50 % or more) dominated or co-dominated by *Festuca campestris* and *Pseudoroegneria spicata* is typically greater than that of other *P. ponderosa* / *P. tridentata*-dominated vegetation types in the study area. The forb component is generally similar to other *P. tridentata*-dominated stands with *Cirsium hookerianum* (white thistle) and *Crepis* (hawksbeard) spp. somewhat more common.

This association is subsumed within the *P. ponderosa* / *P. tridentata* habitat type, *F. idahoensis* phase in Montana (Pfister et al. 1977) and recognized, according to these authors, by *F. idahoensis* having at least 5% cover or *F. campestris* having 1% or greater cover. We feel there is significant ecological distinction between *F. idahoensis* and *F. campestris* to recognize both *F. idahoensis* and *F. campestris* "phases", the latter representing more mesic environments. The association described herein is similar to the *P. ponderosa* / *P. tridentata* / *F. idahoensis* plant association occurring extensively east of the Cascades in CA, OR and WA but, the importance of *F. campestris* distinguishes Montana sites. Northwestern Montana sites also tend to lack *F. idahoensis* or it is a minor component; thus, these types will be proposed as a separate association level entity.

***Pinus ponderosa* / *Purshia tridentata* / *Hesperostipa comata* Woodland Plant Association:** (= *Stipa comata*) (Note: in Preliminary Report this assemblage of plots was referred to the *P. ponderosa* / *P. tridentata* / *P. spicata* Association; this is a provisional type) [Photograph Appendix C-E] This newly described type generally occurs as small patches on the warmest exposures and/or water-shedding convexities with sandy soils. The canopy of *Pinus ponderosa* is somewhat to very open (10-40% cover) and the trees are relatively short for their age (mostly 55-60 ft. tall at maturity). The cover of *P. tridentata* commonly does not exceed 15% and ranges as low as 3-5%; this species is uniformly heavily browsed. Clearly there is a continuum in *P. tridentata* canopy cover and we have followed Pfister et al. (1977) in using 5% or greater cover as indicative of the type; this approach focuses on site potential and concedes that past and ongoing disturbance may have reduced canopy cover of a very crucial wildlife forage species. The graminoid component is actually dominated by *H. comata* (20-40% cover) but *P. spicata* has at least 3% cover and *Festuca campestris* is present in slightly greater than trace amounts; this condition differentiates study area stands from those described by Pfister et al. (1977) as the *P. ponderosa* / *P. tridentata* habitat type, *P. spicata* phase with no *H. comata*. At least a portion this type may be a degraded/overgrazed representation of the *P. ponderosa* / *P. tridentata* / *F. campestris* association since the environmental parameters and composition (with noted exceptions) overlap considerably. It is quite probable *F. campestris*, and to a lesser degree *P. spicata*, have been significantly reduced in cover by domestic stock or wild ungulates (and that *H. comata* has experienced a concomitant increase). However, most of the occurrences represent warm and excessively-drained sites with sandy soils; as indicated by the *H. comata* dominance and the high constancy of other graminoid psammophytes *Calamovilfa longifolia* (prairie sandreed) and *Achnatherum hymenoides* (= *Oryzopsis hymenoides*, Indian ricegrass). The common forbs are *Astragalus miser* (timber milkvetch), *Phlox hoodii* (spiny phlox), *Gaillardia aristata* (blanket flower) and *Heterotheca villosa* (hairy false goldenaster).

This type bears a similarity, environmental and compositional, to the *P. ponderosa* / *P. tridentata* / *Achnatherum hymenoides* plant association (CEGL000196 [See Appendix D for a global description]) of central Oregon stabilized Pleistocene dune sands; however, the Oregon community lacks *H. comata*

and altogether has much less plant cover than the Kootenai N. F. stands (Volland 1976). Pfister et al. (1977) recognize a *P. spicata* phase of the *P. ponderosa* / *P. tridentata* habitat type and a plant association of identical name (CEGL000197 [See Appendix D for a global description]) has been recognized for CA and OR. These communities are also similar in several respects to this type; the Oregon stands of the Wallowa Mountains (Johnson and Simon 1987) occur on similar terrain and landscape positions and experience the same elk, deer and domestic stock induced depletion of *P. tridentata*, *P. spicata* and other vegetation. On the Modoc Plateau (CA) and central Oregon pumice and extrusive volcanics (Volland 1976) this association occupies a distinctly different environment. Regardless of where it occurs it is a minor type (in areal extent) and subject to invasion by *Bromus tectorum* (cheatgrass). However, all extant types lack the predominance of *H. comata* that distinguishes stands in the Tobacco Valley vicinity. This association stands as one manifestation of the Daubenmire's (1970) observation "it is clear that there exists a broadly defined *Pinus ponderosa* / *Purshia tridentata* habitat type. This habitat type could be divided into different phases, on the basis of differences in the graminoids, wherever such subdivisions might be useful."

***Pinus ponderosa* / *Symphoricarpos occidentalis* Forest Plant Association (CEGL000204 [See Appendix D for a global description]):** This association has been previously described only from central and eastern Montana as a relatively uncommon upland forest type. In the study area it is also an uncommon type occurring on gently rolling sandy sites, usually on slightly protected exposures or swales. The fact that study area site parameters of this association significantly overlap those of other associations, particularly *P. ponderosa* / *Festuca campestris*, leads to the speculation that more frequent fires in the past would have favored the grass component at the expense of the shrubs. Although *S. occidentalis* is well adapted for post-fire sprouting (Romo et al. 1993), it can experience cover loss through frequent fire (Higgins et al. 1989). In the Tobacco Valley vicinity this type is an open woodland (not forest) having 15 to 50% canopy cover of *P. ponderosa*. *Symphoricarpos occidentalis* (western snowberry) is dominant, generally having at least 20% cover, with other shrubs including *Purshia tridentata* (antelope bitterbrush), *Rosa woodsii* (Wood's rose), *Amelanchier alnifolia* (serviceberry), *Ericameria nauseosa* (formerly *Chrysothamnus nauseosus*, rubber rabbitbrush) and *Artemisia frigida* (fringed sage) having less than 10 % cover. *Achnatherum nelsonii* (= *Stipa nelsonii* or *S. columbiana*, Dore's needlegrass), *Koeleria macrantha* (= *K. cristata*, prairie junegrass), and *Pseudoroegneria spicata* (bluebunch wheatgrass) are consistently present with low cover. Native grasses, *Poa pratensis* (Kentucky bluegrass) and *Bromus inermis* (smooth brome) appear as increasers in these relatively mesic sites. Like the rest of the Tobacco Plain sites these sites appear to have been disturbed, as reflected in the absence of *Festuca campestris* (rough fescue) and other palatable grasses that should be present. The forb component is depauperate in species and cover with *Antennaria rosea* (rosy pussytoes, an increaser with disturbance) being the most common and having the highest cover.

***Pseudotsuga menziesii* / *Achnatherum nelsonii* Woodland Plant Association (Provisional):** (= *Stipa nelsonii*, *S. occidentalis* var. *minor*) Only one plot and two reconnaissance observations document this provisional type; it is found in the Salish Mountains foothills near *P. menziesii* / *Festuca campestris* and on sites having considerable environmental overlap with this type. It occurs as small, linear patches adjacent to forest/woodland openings. The stands are relatively open (30% upper canopy cover) and initially look like *P. menziesii* / *F. campestris* with *Pseudotsuga* and *Pinus ponderosa* as canopy dominants; however *Achnatherum nelsonii* (Columbia needlegrass) rather than *F. campestris* (rough fescue) is dominant, though *F. campestris* is consistently present. Similarly *Pseudoroegneria spicata* (bluebunch wheatgrass) is the next most abundant graminoid. The relatively mesic nature of *P. menziesii* / *A. nelsonii* is indicated by the occurrence of *Calamagrostis rubescens* (pine grass) and *Poa pratensis* (Kentucky bluegrass). The forb layer is depauperate in species and cover with only *Geum triflorum*

(prairie smoke), *Lithospermum ruderae* (western stoneseed) and *Lupinus argenteus* (silvery lupine) consistently present in more than trace amounts.

***Pseudotsuga menziesii* / *Festuca campestris* Woodland Plant Association (CEGL000901 [See Appendix D for a global description]):** This community is relatively rare within the study area, though overall in Montana it is a common type (G4) occurring at lower treeline to above the cold limits of *Pinus ponderosa*. Within the study area plots were sampled on both east- and northwest-facing moderate slopes, though the type was noted to occur on both flats and slopes with western and southern exposures. Soils are moderately deep silt loams found in the Salish Mountains foothills. The upper canopy is open, less than 40% cover, with *Pseudotsuga* dominant or co-dominant with *Pinus ponderosa*; the subcanopy is a very scattered mix of these two tree species and following recent prescribed burns this component has been considerably reduced. A very fine environmental distinction (slightly more favorable moisture status) separates a portion of this type from *P. ponderosa* / *F. campestris*; another portion of *P. ponderosa* / *F. campestris* is in fact seral to this type (within the habitat type concept the *P. ponderosa* / *F. campestris* stands we have denoted as seral to this *Pseudotsuga* type would in fact be classed with this type). Several shrub species (*Purshia tridentata*, *Spiraea betulifolia*, *Mahonia repens*, and *Amelanchier alnifolia*) are consistently present but their single or combined cover seldom exceeds 5%. The undergrowth is dominated by *Festuca campestris* closely followed in cover by *Pseudoroegneria spicata*, their combined cover approaches 50%. *Calamagrostis rubescens*, *Achnatherum nelsonii* and *Koeleria macrantha* are consistently present but have low cover values; the first two of these subordinate species are indicative of the relatively mesic nature of these sites, as are several of the forbs. The forb component is generally minimal, usually not exceeding 5% combined cover; those of highest constancy include *Balsamorhiza sagittata* (arrowleaf balsamroot), *Zigadenus venenosus* (meadow deathcamas), *Geum triflorum* (prairie smoke), *Astragalus miser* (timber milkvetch), *Antennaria rosea* (rosy pusseytoes) and *Achillea millefolium* (common yarrow). This association grades to the *P. menziesii* / *Calamagrostis rubescens* forest community that characterizes less exposed positions (more to the interior of forested stands).

SHRUBLAND AND SHRUB HERBACEOUS VEGETATION

***Purshia tridentata* / *Festuca campestris* Shrub Herbaceous Plant Association (CEGL001494 [See Appendix D for a global description]):** [Photograph Appendix C-F] This is a relatively rare association (G2?) known only from western Montana; the stands sampled by Mueggler and Stewart (1980) for type description occurred on steep southerly to easterly slopes at 3,000 to 5,000 ft. elevation. The distribution of this association within the study area expands its known environmental range. It commonly occurs in the western portion of the Tobacco Valley as small stands (< 5 ac) with sandy soils on gently rolling to flat topography at 2,500 to 2,700 ft. elevation; further to the south in foothill locations it occurs on moderate to steep southeast- to southwest-facing slopes. As manifested within the study area this type frequently has scattered *P. ponderosa* seedlings, saplings and even mature specimens (total combined cover < 5%), which leads to the speculation as to what portion of this type is in fact an early succession stage of *P. ponderosa* / *P. tridentata* / *F. campestris*. Two plots were representative of stands that had been entered decades earlier (judging by stump decomposition); estimating by stump size and density these would have been *Pinus ponderosa*-dominated woodlands thus indirectly confirming the current community to be a long-persisting seral stage. According to the latest NVCS standards in order to recognize a “shrub herbaceous” condition, shrub cover should be at least 10% and less than 25%. *Purshia tridentata* has an average cover of approximately 11% within this association and with other shrub species adding about 5-10% cover this type meets the shrub herbaceous criteria. Consistently present shrubs/subshrubs include *Arctostaphylos uva-ursi* (kinnikinnick), *Symphoricarpos occidentalis* (western snowberry), *Amelanchier alnifolia* (serviceberry), *Mahonia repens* (Oregon grape, creeping

barberry) and *Rosa woodsii* (Wood's rose); of these only *A. uva-ursi* consistently exhibits cover greater than 5%. As noted by Mueggler and Stewart (1980) the undergrowth is dominated by a group of bunchgrasses with high constancy including *Festuca campestris*, *F. idahoensis*, *Pseudoroegneria spicata*, *Achnatherum nelsonii* (or *A. richardsonii*) and *Koeleria macrantha* (prairie junegrass); these species vary considerably in their cover, the only constant being *F. campestris* with at least 5% cover (one stand that had obviously been degraded by grazing and recent burning and had only 1 or 2% *F. campestris* cover was also placed in this type). The low cover of *F. campestris* and *P. spicata* (the two most palatable grasses) relative to levels found by Mueggler and Stewart (1980) could result from past grazing pressure or the low productivity capacity of the sandy substrates. Forbs with greatest constancy and abundance are *Lithospermum ruderales* (western stoneseed), *Balsamorhiza sagittata* (arrowleaf balsamroot), *Lupinus sericeus* (silky lupine), and *Achillea millefolium* (common yarrow).

***Purshia tridentata* / *Hesperostipa comata* Shrub Herbaceous Plant Association (CEGL001498**

[See Appendix D for a global description]: (= *Stipa comata*) [Photograph Appendix C-G] This association has been recognized in Colorado, Idaho, Oregon, Washington where it is apparently relatively rare (G2?); until this study it had not been described from Montana. In the study area it is associated with gently rolling to flat landscapes with sandy to sandy loam soils (which also describes the environments it is associated with in the Columbia Basin and Owyhee Uplands of eastern WA and western ID). It also occurs on moderate to steep south- to southwest-facing slopes (with sandy to sandy loam soils). It occurs as small patches, often adjacent to *Pinus ponderosa*-dominated savannas and woodlands (usually having an undergrowth of *P. tridentata*). *P. tridentata*, with 10-20% cover, dominates the shrub layer that also consistently contains seldom more than trace amounts of *Amelanchier alnifolia* (serviceberry), *Ericameria nauseosa* (= *Chrysothamnus nauseosus*, rubber rabbitbrush), *Rosa* spp. (rose) and *Artemisia frigida* (fringed sage). The undergrowth is dominated by bunchgrasses of which *H. comata* and *Koeleria macrantha* (= *K. cristata*, prairie junegrass) have a combined cover that ranges between 30 and 50%; on sandy sites *Calamovilfa longifolia* (prairie sandreed) is a minor component. *Festuca campestris* (rough fescue) and *Pseudoroegneria spicata* (bluebunch wheatgrass) are consistently present in trace amounts; the fact that both these highly palatable species are present, that relatively unpalatable bunchgrasses are dominant and that environmental parameters largely overlap with those for sites dominated by the palatable species leads to the speculation that *P. tridentata* / *H. comata* is a disclimax most likely due to overgrazing (or other disturbance?). Annual brome grasses are a minor component, generally having less than 5% canopy cover. Forb species are those common to other *P. tridentata* communities in the study area: *Heterotheca villosa* (hairy false goldenaster), *Phlox hoodii* (spiny phlox), and *Achillea millefolium* (common yarrow); the individual or combined cover of all forbs seldom exceeds 5%.

***Purshia tridentata* / *Pseudoroegneria spicata* Shrub Herbaceous Plant Association**

(CEGL001495 [See Appendix D for a global description]): [Photograph Appendix C-H] This is a relatively uncommon association (G3) throughout the Pacific Northwest and extending to California, western Montana and Idaho. In the Bitterroot Valley it is extensive (occurs as large patch to matrix type) but elsewhere in western Montana, including the study area, it occurs in small patches mostly less than 20 acres (in study area < 5 acres). It may have received a relatively high G-rank since, though it is relatively extensive, where it does occur it is under threat by domestic stock grazing, wildlife browsing and development (including weed infestations). It is probably the most common shrubland type within the study area, occurring on both gently rolling to flat surfaces with sandy soils and also moderate to steep, southerly-facing slopes with thin soils. This association differs from the *P. tridentata* / *Hesperostipa comata* plant association principally by having at least 5% cover of *P. spicata*; usually this bunchgrass has at least 20% to 50% cover. Grasses associated with sandy substrates are common, including *Hesperostipa comata* (needle-and-thread), *Calamovilfa longifolia* and *Achnatherum hymenoides* (=

Oryzopsis hymenoides, Indian ricegrass). *Koeleria macrantha* (prairie junegrass) is always present, in highly variable amounts (reflecting grazing?); *Festuca idahoensis* (Idaho fescue) and even *F. campestris* (rough fescue) may be present in trace amounts (see disclimax discussion in the preceding association description for *P. tridentata* / *H. comata*). Annual brome grasses (*Bromus tectorum*, *B. japonicus*) are more abundant here than in any of the other shrub communities; their cover may be so great (80% or more in patches) that, if one were classifying on only species cover (dominance type), then a *Purshia* / annual brome type would have to be recognized. The forb component is very similar to the *P. tridentata* / *H. comata* association with *Heterotheca villosa* (hairy false goldenaster), *Phlox hoodii* (spiny phlox) and *Achillea millefolium* (common yarrow) being most common, however *Balsamorhiza sagittata* (arrowleaf balsamroot) and *Lithospermum ruderales* (western stoneseed) are more important here than in other *Purshia*-dominated communities within the study area.

GRASSLANDS

Disturbance Community Types: It is evident that the Forest Service study area grassland/woodland holdings in the Tobacco Plains vicinity have been significantly disturbed in the past. Where the most extensive grasslands are/were located at the edge of the Tobacco Valley we found tillage lines and tillage margins, but the strongest evidence of past disturbance is the dominance of pasture grasses. The most prevalent grassland exotic is *Bromus inermis* (smooth brome [photograph Appendix C-1]), which forms virtual monocultures (following plowing and seeding?) and occurs mixed with *Poa compressa* (Canada bluegrass), *Poa pratensis* (Kentucky bluegrass), and *Agropyron cristatum* (crested wheatgrass). It also occurs with a native component (principally *Hesperostipa comata*, needle-and-thread grass) under lightly to highly disturbed conditions and as minor, founder populations within currently “healthy”, relatively undisturbed grasslands and woodlands. *B. inermis* were noted to form small round to oval patches that appeared to be expanding centripetally from both grassland and woodland founder populations. In the several instances that these patches were closely examined we found that they harbored few, if any, native herbs (scattered bunchgrass tussocks at best).

Poa compressa [photograph Appendix C-J] is the next most prevalent exotic grass in this landscape and undoubtedly has been seeded into some areas where it forms virtual monoculture or is often mixed with *B. inermis*. It forms very dense swards choking out competing vegetation (except other exotic grasses). It is found only in grasslands and does not expand into woodland/forest like *B. inermis* and *Poa pratensis*. Canada bluegrass is an invader of overgrazed rangelands (Van Dyne and Payne 1964) and is both grazing and trampling resistant but may be slow to recover from overgrazing (Stubbenieck et al. 1985). It is generally not recommended for seeding as a pasture grass because of its low productivity, but locally it may be useful as pasture on poor soils. *Poa pratensis* exhibits a preference for more mesic grassland sites but also occurs in woodland environments. It was noted to form small dense patches but does not seem to competitively eliminate native vegetation without excessive grazing pressure. *Agropyron cristatum* is a minor component of the disturbed areas and apparently does not establish into native vegetation (at least in this vicinity).

Both *Bromus tectorum* (cheatgrass) and *B. japonicus* (Japanese brome) were found within the study area in amounts ranging from trace to community dominants: hereafter they will be referenced as “annual bromes” because of their very similar ecology and the fact that they were often similarly combined in the field. Though neither species has been designated a noxious weed within northwestern states, both are noxious weeds in some of the Canadian prairie provinces (Rice 2003). They are probably not considered noxious weeds in the US since they provide some spring forage to domestic stock. In the grasslands at the periphery of the Tobacco Plains annual bromes are a minor component, but on the steeper southwest exposures of the foothills south of the Tobacco River they can form virtual monocultures in small patches,

presumably where wild ungulate disturbance has been intensive. Generally these infestations are in close proximity to habitat supporting *Purshia tridentata* (antelope bitterbrush), a highly preferred winter browse species.

***Achnatherum nelsonii* / *Eriogonum flavum* Herbaceous Vegetation Plant Association (new, provisional Association):** (= *Stipa nelsonii* ssp. *dorei*) [Photograph Appendix C-κ] This community has not been previously described and it is proposed here as a provisional type due to its being based on but two plots and reconnaissance notes. It is considered to be a component of a mosaic of communities that occur on lithosols within predominantly forested environments. In the forested highlands south of the Tobacco River there are small openings (< 2 acres) that are grass-dominated due to the soil mantle being very shallow, approximately 1-4 inches. These openings are a consequence of the geology of this area and can be expected to occur on similar formations that were judged to be fine-textured metamorphics. These openings have scattered shrubs and trees where the bedrock is fractured allowing root penetration along fissures, however they are dominated by a mix of herbaceous communities. One of these communities is characterized by a mostly continuous layer of *Selaginella densa* and bryoids with a low cover of grasses and forbs. Total grass cover does not much exceed 15% and *A. nelsonii* (Columbia or Dore's needlegrass) usually has the greatest cover; it is the most drought resistant grass occurring on these sites. Other graminoids consistently present are *Poa secunda* (Sandberg's needlegrass), *Pseudoroegneria spicata* (bluebunch wheatgrass) and *Festuca idahoensis* (Idaho fescue). Forb cover is generally less than 5 % with *Eriogonum flavum* (alpine golden buckwheat) being the one most abundant and consistently present. Other forbs that tend to occur with high constancy include *Lomatium cous* (cous biscuitroot), *Heuchera parviflora* (littleflower alumroot), and *Collinsia parviflora* (maiden blue-eyed Mary).

***Achnatherum nelsonii* - *Koeleria macrantha* Herbaceous Vegetation Plant Association (CEGL001707 [See Appendix D for a global description]):** (= *Stipa nelsonii* ssp. *dorei*, Dore's needlegrass; = *K. cristata*, prairie junegrass) [Photograph Appendix C-L] Within the study area this community is associated with the foothills landscape where forest openings occur on lithosols (or a similar soil-related limiting feature). This community occurs near the periphery of the forest openings on somewhat shaded sites with deeper soil (than characterizes the more central portion of the openings where *A. nelsonii* / *Eriogonum flavum* may obtain); soils are silty loams. The partially shaded settings, higher elevations (greater precipitation) and higher water holding capacity should make these sites more mesic than those supporting the *Festuca campestris* – *Festuca idahoensis* association. Shrubs are scattered and comprise less than 3% cover. *Achnatherum nelsonii* (Dore's needlegrass) is dominant with cover in the range of 40-60%. Other mesic grasses present, with generally less than 3% cover, include *Festuca campestris* (rough fescue), *Achnatherum richardsonii* (= *Stipa richardsonii*, Richardson's needlegrass) and *Elymus trachycaulus* (= *Agropyron caninum*, slender wheatgrass) and the ubiquitous *Koeleria macrantha* (prairie junegrass). It is unknown why *A. nelsonii* should be dominant in place of other mesic grasses conventionally taking this role, e.g. *A. richardsonii*, *A. occidentale* (= *Stipa occidentalis*, western needlegrass) *F. campestris* or *Elymus trachycaulus*. These sites are grazed as part of secondary rangelands utilization; all these bunchgrasses are rated as having "good" to "very good" palatability for cattle and it seems improbable that differential grazing could result in this composition. *Poa pratensis* (Kentucky bluegrass) is present in variable amounts depending on the intensity of disturbance. Forbs associated with these mesic grasslands include *Perideridia gairdneri* (Gairdner's yampa), *Zigadenus venenosus* (meadow deathcamas), *Potentilla gracilis* (slender cinquefoil), *Geum triflorum* (prairie smoke) and *Lupinus sericeus* (silky lupine); the first three are the forb layer dominants, which contrasts notably with other grasslands inventoried in the Tobacco Plains vicinity.

This community is listed in the NVCS as occurring only in Utah and its status is uncertain (G?); until the sources/descriptions for this plant association can be checked this will remain a provisional name. A somewhat similar community, termed *Stipa columbiana* (= *Achnatherum nelsonii*) – *Poa pratensis* by Tisdale (1947), has been reported from the southern interior of British Columbia where the author describes it as a grazing disclimax of the *Festuca campestris* - *Pseudoroegneria spicata* association. The third most important graminoid in this community is *Koeleria macrantha* which Tisdale (1947) demonstrates is an increaser with grazing across a broad range of grasslands in B.C. Though the B.C. community has only a few forbs in common with the MT stands of this putative type, the compositional similarity in graminoids is sufficiently close that the *A. nelsonii* – *K. macrantha* classification may be appropriate. Within the study area it is not clear that this association has resulted from overgrazing (as in B.C.). Livestock use was not noted at the time of sampling but the surrounding forests, particularly the openings created by silvicultural operations, have clearly experienced past and ongoing livestock use. It should be noted that Root and Habeck (1972) in their study of high-elevation western Montana grasslands described no community even vaguely similar to that described here.

***Festuca campestris* – *Festuca idahoensis* Herbaceous Vegetation Plant Association**

(CEGL001628 [See Appendix D for a global description]): This is a common type throughout the foothills and mountain parklands of northern Montana west of the Rocky Mountain Front. Within the study area it is also associated with forested uplands having small (< 5 acres) parklike openings, often on hilltops or ridgelines. These openings occur on gentle slopes of all aspects, usually with a convex surface and possibly shallow soils (silt loam textures were the most common). On the sandy soils of the Tobacco Valley this association was noted as a narrow ecotone between forest/woodland habitats and larger disturbed openings that had been colonized by pasture grasses. This was probably an important association in the Tobacco Valley and is now comparatively rare because of poor grazing practices and other disturbance. It is not as abundant as the *F. campestris* – *Pseudoroegneria spicata* association, probably due to the coarser-textured soils (sandy loams, fine sands) that predominate in the valley. In forested uplands, these sites may differ from the adjacent forest by having a shallower soil depth; it is unclear how it differs from the *Achnatherum nelsonii* – *Koeleria macrantha* Association which occupies very similar habitat. *Festuca campestris* is usually the dominant grass with cover in excess of 20% (only 5% cover required for type identification) but *Achnatherum richardsonii* (Richardson's needlegrass) and *A. nelsonii* ssp. *dorei* (Dore's needlegrass) can be significant components and even exceed *F. campestris* in cover. *Poa pratensis* (Kentucky bluegrass) and *Bromus inermis* (smooth brome) do well as exotic grasses on these mesic sites; annual bromes are sporadically present and apparently not competitive under these conditions. Shrubs are incidental in this association. *Rosa* spp. and *Symphoricarpos occidentalis* (western snowberry) were the only regularly present shrubs, usually occurring in trace amounts. Forb cover is also minimal, being about one tenth that of graminoids with *Achillea millefolium* (common yarrow), *Eriogonum umbellatum* (sulphur-flowered buckwheat), *Lupinus sericeus* (silky lupine), *Penstemon confertus* (yellow beardtongue) and *Cerastium arvense* (field chickweed) the most abundant. Within the study area, mesic forbs (e.g. *Geranium viscosissimum*, *Potentilla gracilis*, *P. glandulosa*, *Geum triflorum*) indicative of the *Geranium viscosissimum* phase (Mueggler and Stewart 1980) were inexplicably uncommon and low in cover.

NOTE: We suggest that the *Achnatherum richardsonii* phase of *F. campestris* – *F. idahoensis* of Mueggler and Stewart (1980) be elevated to association level based on the 15 stands they collected, at least 5 stands sampled in Glacier National Park and the 2 documented in this study. The new syntaxon would be most appropriately named ***F. campestris* – *A. richardsonii* Herbaceous Vegetation** and recognized by either *A. richardsonii* or *A. nelsonii* having at least 3 % canopy cover. It represents a significantly more mesic environment than denoted by *F. campestris* – *F. idahoensis*; it relates to the *Geranium viscosissimum* (sticky geranium) phase of this association, being at least as mesic.

***Festuca campestris* – *Pseudoroegneria spicata* Herbaceous Vegetation Plant Association (CEGL001629 [See Appendix D for a global description]):** (= *F. scabrella*; = *Agropyron spicatum*, *Elytrigia spicata* or *Elymus spicatus*) [Photograph Appendix C-M] This is probably the most common of *F. campestris*-dominated communities in Montana though it is relatively uncommon within the study area, occurring as small patches on gently rolling topography of moderate slopes lacking a strong insolation load and also on outwash benches with relatively coarse soils (sandy loams and fine sands). Several stands were the product of recent prescribed fires where the seedling/sapling tree component (*Pinus ponderosa* and *Pseudotsuga menziesii*) had experienced nearly complete mortality (this mortality was the exceptional outcome of prescribed burning); these stands represent seral stages of the *P. ponderosa* / *F. campestris* or *P. menziesii* / *F. campestris* plant associations. These prescribed fires also adversely impacted *F. campestris* in some instances, though for the most part they just removed thatch and provided a fertilizer effect. *Festuca idahoensis* and *Pseudoroegneria spicata* tend to be stand dominants with *F. campestris* having just enough cover to be diagnostic (> 3 %). *Koeleria macrantha* (prairie junegrass) and *Hesperostipa comata* (= *Stipa comata*, needle-and-thread) are consistently present, with the latter species denoting what has been recognized as the *H. comata* phase (Mueggler and Stewart 1980). Both *K. macrantha* and *H. comata* are increasers with grazing; their importance in this type and the low cover of *F. campestris* could reflect past grazing intensity as well as a drier microclimate. Forbs with the highest constancy and cover include *Heterotheca villosa* (hairy false goldenaster), *Eriogonum umbellatum* (sulphur-flowered buch wheat), *Lupinus sericeus* (silky lupine) and *Cerastium arvense* (field chickweed).

***Festuca idahoensis* – *Pseudoroegneria spicata* Herbaceous Vegetation Plant Association (CEGL001624 [See Appendix D for a global description]):** (= *Agropyron spicatum*, *Elytrigia spicata* or *Elymus spicatus*) [Photograph Appendix C-N] This community was encountered only once within the study area in contrast to its general prevalence in Montana (probably the most ubiquitous of bunchgrass types) and throughout the western states and provinces from California to British Columbia and Alberta. In terms of abiotic parameters there was no difference between this site and many others supporting *F. campestris* / *P. spicata*; there is no clear reason for the total absence of *F. campestris* (or other graminoids indicating a more mesic site). There were no shrubs represented and the herbaceous component was dominated by bunchgrasses in excess of 50% total cover, including the indicators *F. idahoensis* and *P. spicata* as well as *Koeleria macrantha* and *Poa secunda*. The forb layer was comparatively rich and abundant with *Balsamorhiza sagittata* and *Lupinus sericeus* comprising nearly 30% cover.

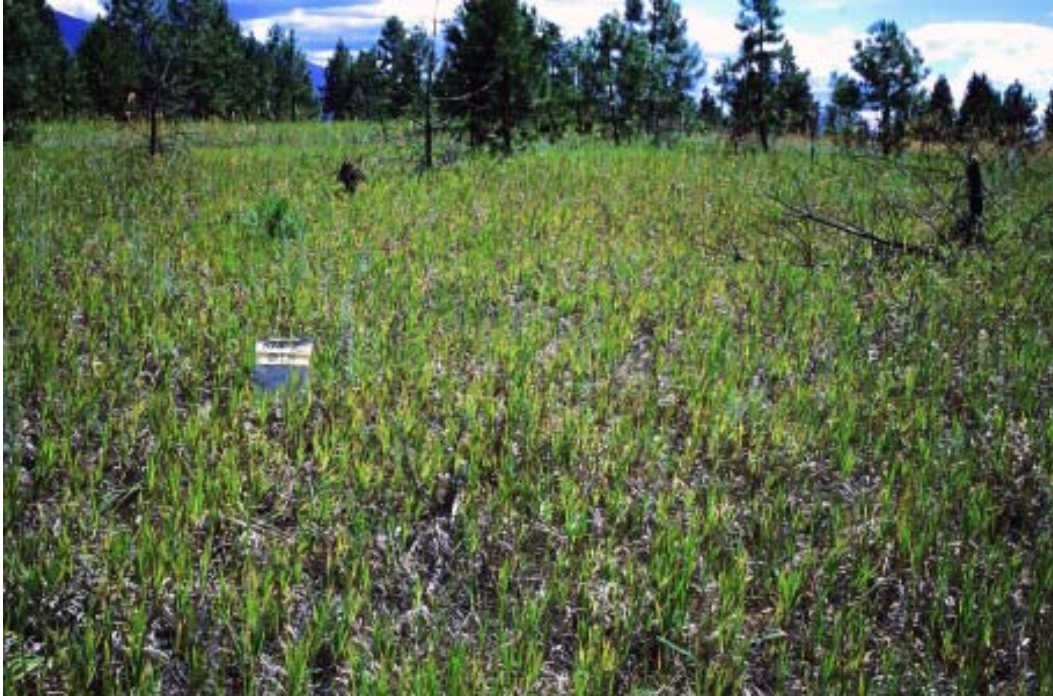
***Hesperostipa comata* – *Poa secunda* Herbaceous Community (CEGL001704 [See Appendix D for a global description]):** (= *Stipa comata*; = *Poa sandbergii*) [Photograph C-o] The plots assigned to this association are only tentatively assigned to this type; there have been no *H. comata* communities inventoried in Montana west of the Continental Divide and the descriptions of existing ones in the eastern Montana Great Plains do not match the composition of *H. comata*-dominated stands on the study area. The Tobacco Valley sites are probably closest to the *H. comata* – *P. secunda* association identified as endemic to the Palouse Prairie of Washington and Oregon (Daubenmire 1970). There are many site and vegetation similarities; only the lack of *Poa secunda* on the Tobacco Valley sites is puzzling (this species is broadly distributed in the Tobacco Valley, it was just not recorded for these sites). Pojar's (1982) classification of boreal and subalpine grasslands of northern British Columbia recognizes a "*Stipa comata* – *Koeleria macrantha* Association" that in terms of dominants and some environmental properties (coarse soils, well-drained, xeric) approximates the conditions found within the Tobacco Valley plots assigned to this type. However, Pojar also lists species such as *Elymus trachycaulus*, *Achnatherum occidentale*, *Carex pensylvanica*, *Nasella viridula*, and rhizomatous wheatgrasses as frequent and

occasionally abundant, a composition that does not accord with the Tobacco Valley plots. Occurrences are generally small patches on flat to gently rolling terrain with fine sands to sandy loam soils. Native graminoid diversity is low with *H. comata* (needle-and-thread, 25-40 % cover) being diagnostic and dominant and *Koeleria macrantha* (prairie junegrass, 5-15% cover) being highly constant and occasionally codominant; other sandy site-associated graminoids present include *Calamovilfa longifolia* (prairie sandreed) and *Aristida purpurea* (= *A. longiseta*, purple threeawn). A number of introduced grasses including *Bromus inermis*, *Poa pratensis*, and *Poa compressa* generally constitute a minor component. Forb cover and diversity is relatively depauperate with *Machaeranthera canescens* (hoary tansyaster), *Heterotheca villosa* (hairy goldenaster), *Cirsium* spp (thistle), and *Plantago patagonica* (woolly plantain) having the greatest cover and constancy. The dominance of native species that are low in palatability and increasers with grazing, the absence of palatable native grass species (including *P. secunda*) and the close proximity to extensive areas of pasture grasses where livestock may have been intensively pastured (on private land) are factors pointing to past and perhaps ongoing disturbance, probably intensive grazing. Thus this type may partially or wholly be a grazing-induced disclimax. Alternatively, there is the common observation that sandy soil textures are consistently associated with *H. comata* presence and occasional dominance (Jensen et al. 1992, DeVelice et al. 1995, Daubenmire 1970) and these sites could therefore represent native vegetation in some of the driest of Tobacco Valley environments (except for shallow soils over bedrock).

***Pseudoroegneria spicata* – *Poa secunda* Herbaceous Vegetation Plant Association**

(CEGL001677 [See Appendix D for a global description]): (= *Agropyron spicatum*, *Elytrigia spicata* or *Elymus spicatus*, bluebunch wheatgrass; = *Poa sandbergii*, Sandberg's bluegrass) This association is characteristic of the warmest exposures within the study area, generally south-facing and steep (> 30%); thin soils may add to the xeric nature of these sites. Shrub cover is less than 1 or 2%, consisting of very scattered *Purshia tridentata* (antelope bitterbrush), *Artemisia tridentata* (big sagebrush) or *Ericameria nauseosa* (formerly *Chrysothamnus nauseosus*, rubber rabbitbrush). *Pseudoroegneria spicata* (bluebunch wheatgrass) exhibits 30-40% cover; other grasses generally are present in not much more than trace amounts. *Poa secunda* (Sandberg's bluegrass) is present in this association and virtually no other within the study area. Forbs consistently present include *Balsamorhiza sagittata* (arrowleaf balsamroot), *Eriogonum umbellatum* (sulphur-flower buch wheat), *Cryptantha* spp. (cryptantha), *Heterotheca villosa* (hairy false goldenaster), and *Lupinus sericeus* (silky lupine).

**APPENDIX C. PHOTOGRAPHS OF REPRESENTATIVE VEGETATION TYPES
(ASSOCIATIONS) ON STUDY AREA SITES**



C - A. A bright green sward of *Bromis inermis* dominates a canopy opening in the disturbance-associated *Pinus ponderosa* / *Bromus inermis* community.



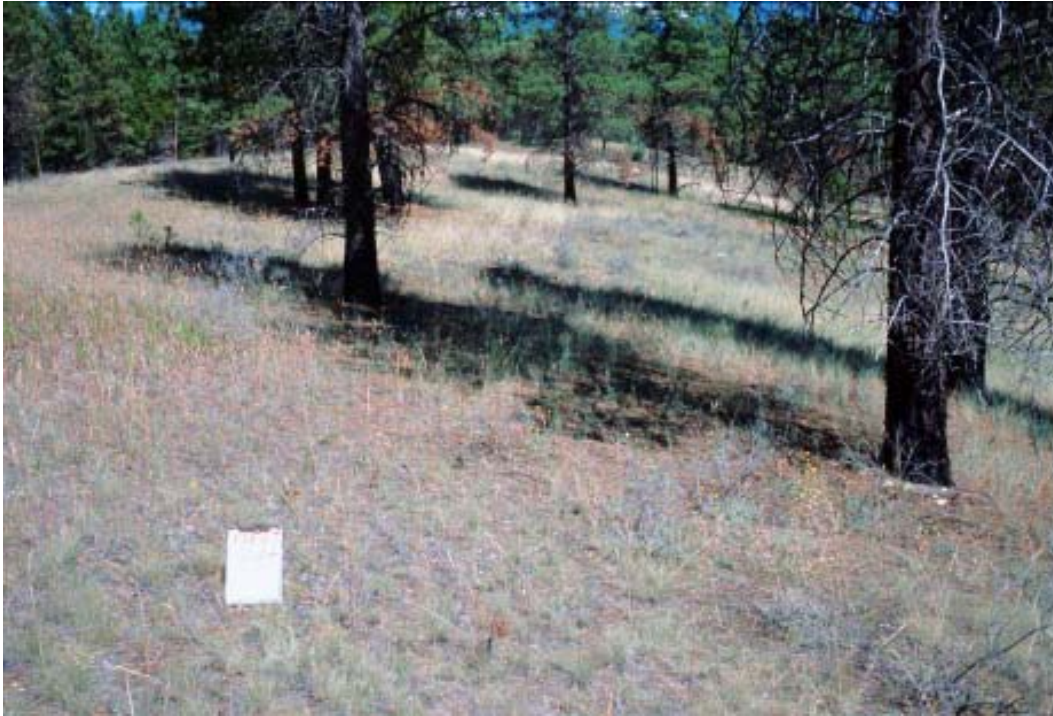
C - B. This stand of *Pinus ponderosa* / *Festuca campestris* exhibits a very open canopy and number of seedlings/saplings that survived a prescribed burn.



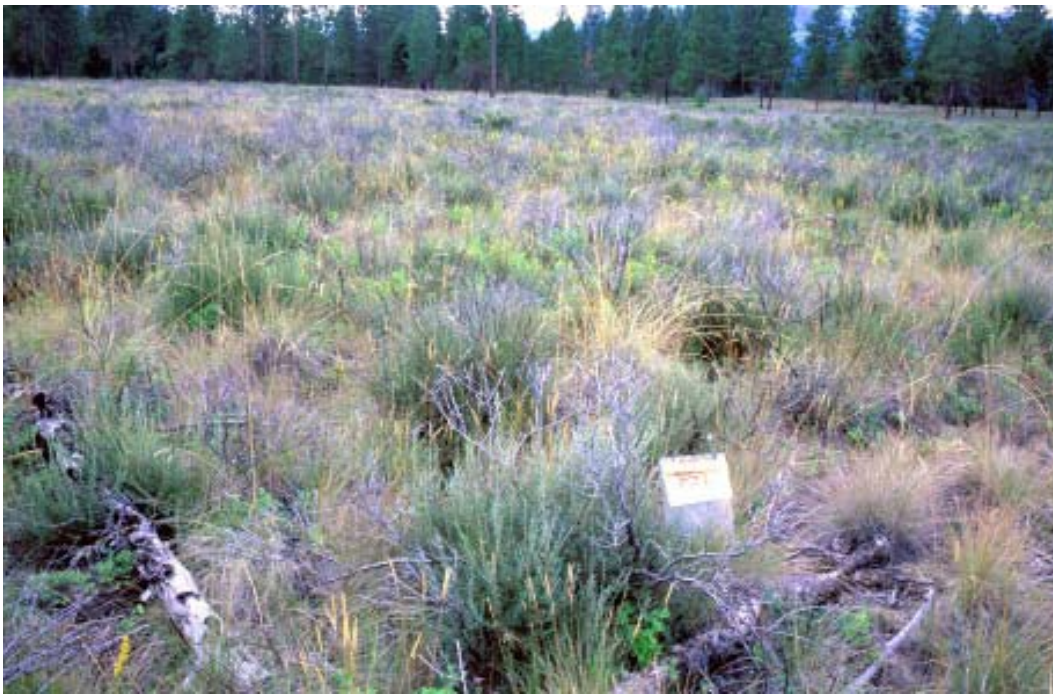
C - c. *Pinus ponderosa* / *Pseudoroegneria spicata*, perhaps the most extensive and common of bunchgrass-dominated *Pinus ponderosa* woodland associations in the west, is uncommon in the Tobacco Plains vicinity of the Kootenai N. F.



C - d. *Festuca campestris* clearly dominates the undergrowth and *Purshia tridentata* is very scattered, barely 5% cover, in this *Pinus ponderosa* / *Purshia tridentata* / *Festuca campestris* community.



C - E. A typically open stand of *Pinus ponderosa* / *Purshia tridentata* / *Hesperostipa comata* with approximately 10% cover of *P. tridentata* that is barely perceptible due to its highly browsed condition.



C - F. This stand of *Purshia tridentata* / *Festuca campestris* has been recently burned with virtually no *Purshia* mortality and high mortality for the encroaching *Pinus ponderosa* seedlings and saplings.



C - G. A stand of *Purshia tridentata* / *Hesperostipa comata* community type on a moderate slope with a substrate of unstable outwash sands; *H. comata* is very robust on this site almost obscuring the highly grazed *Purshia*.



C - H. The *Purshia tridentata* / *Pseudoroegneria spicata* community type occurs as both small and large patch communities primarily on moderate to steep slopes with southerly aspects; *P. tridentata* cover (15-20%) on this stand is among the highest in plots of this type.



C - i. *Bromus inermis* (smooth brome) occurs throughout the study area in stands of varying size; from sites of nucleation it tends to expand centripetally, suppressing the herbaceous component that once characterized these sites.



C - j. Stands characterized by a near monoculture of *Poa compressa* occur throughout the study area though they appear to be much more prevalent on private lands.



C - κ. This small-patch depauperate community type, *Achnatherum nelsonii* / *Eriogonum flavum*, which occurs on shallow-to-bedrock soils, has not been described outside the study area.



C - L. This community, *Achnatherum nelsonii* – *Koeleria macrantha*, occurs in shaded forest openings; depth to bedrock is shallow, though not so shallow as that of the frequently associated *A. nelsonii* / *Eriogonum flavum* association.



C - M. The interstices between clumps of the taller *Festuca campestris*, *Pseudoroegneria spicata* and *Achnatherum nelsonii* are filled with *F. idahoensis* and a few forbs in this *Festuca campestris* – *Pseudoroegneria spicata* community.



C - N. This *Festuca idahoensis* / *Pseudoroegneria spicata* community is uncommon to rare within the study area (due to scarcity of *F. idahoensis*); very scattered *F. campestris* plants allude to the possibility that site potential is not being reflected here due to grazing impacts on the *F. campestris*.



C - o. Small patches of *Hesperostipa comata* – *Poa secunda* community type occur on sandier sites within the Tobacco Plains; this oblique view presents an optimistically high view of grass cover which is generally in the 20-40% range.



C - p. *Bromus inermis* (smooth brome) expanding centrifugally from an initiation site under a *Pinus ponderosa* canopy.

APPENDIX D. DESCRIPTIONS OF ALLIANCES AND PLANT ASSOCIATIONS FROM ECOART (ECOLOGY ACCESS REPORTING TOOL)

Note: The following report is ordered by lifeform from tree-dominated, to shrublands to herb-dominated. All associations are ordered alphabetically within lifeform. In developing descriptions priority has generally been given to the rarer types, therefore some types, although very common, have rather limited descriptions and the reader may want to refer to the original references for more information.

I. FOREST

I.A.8.N.b. Rounded-crowned temperate or subpolar needle-leaved evergreen forest

I.A.8.N.b.10. PINUS PONDEROSA FOREST ALLIANCE

Ponderosa Pine Forest Alliance

ALLIANCE CONCEPT

Summary: Forests dominated by *Pinus ponderosa* occur in mountainous regions of the western United States, from the Cascades and Black Hills, throughout the Rocky Mountains, southeast to the mountains of Arizona, New Mexico, and western Texas. This alliance may range into southern British Columbia, and although *Pinus ponderosa* is found in Mexico, it is uncertain whether this alliance ranges into that country. This alliance can be found on slopes of a variety of aspects and pitches, but is most often on gentle to moderate, northeast- to northwest-facing slopes. It can be on slopes of other aspects where the soil is heavier and retains more moisture or if other conditions make the site relatively mesic. Periodic ground fires are important in maintaining *Pinus ponderosa* forests. In the prolonged absence of fires, some stands will succeed to other communities. Throughout its range, *Pinus ponderosa* is found at elevations from sea level to 3050 m (10,000 feet). Within the central Rocky Mountains, *Pinus ponderosa* grows at elevations between 1800-2600 m (6000-8500 feet). In the Black Hills and northeastern Wyoming, it can be found from 1080-2100 m (3600-7000 feet). In the southeastern United States, these forests are restricted to the high elevations (over 1800 m, 6000 feet) of the Guadalupe, Davis, and Chisos mountains in western Texas, where associations are dominated by *Pinus ponderosa* var. *scopulorum*. Associated species vary with elevation and geography, but consistently include *Quercus gambelii*, *Pinus strobiformis*, *Juniperus deppeana*, *Quercus grisea*, *Quercus muehlenbergii*, *Pinus arizonica* var. *stormiae*, *Cupressus arizonica*, *Juniperus flaccida*, *Festuca arizonica*, *Schizachyrium scoparium* var. *scoparium* (= *Schizachyrium scoparium* ssp. *neomexicanum*), *Panicum bulbosum*, and *Piptochaetium pringlei* (= *Stipa pringlei*).

Environment: These forests typically occur at the lowest elevations of the coniferous forest zone in western ranges. They range over 20 degrees of latitude, from Canada well into northwestern Mexico. These are among the driest forested habitats in the western United States, but quantity and timing of precipitation vary greatly across the range of this vegetation. Generally, these woodlands occur in areas which receive 25-60 cm of precipitation annually, with at least some seasonal drought, but they receive up to 150 cm in foothills of the Sierra Nevada and southern Cascades where summer drought is extreme. East of the Continental Divide and in the Southwest, summer precipitation predominates, whereas western stands receive most of their precipitation from westerly winter storms. Fire is a key factor in maintaining the relatively open canopies characteristic of these stands, but soil drought or infertility may be equally important in some areas. In the absence of fire some of these stands will succeed to other forest types. Elevations decrease with increasing latitude, from less than 1000 m in eastern Washington to over 2500 m in southern Arizona and New Mexico. Within the central Rocky Mountains, *Pinus ponderosa* grows at elevations between 1800 and 2600 m (6000 and 8500 feet) (Mehl 1992). In the Black Hills and northeastern Wyoming, it can be found from 1080-2100 m (3600-7000 feet). With increasing precipitation, these forests can occur at lower elevations, and lowland (<1000 m) stands exist in the eastern Great Plains and west of the Cascade-Sierra axis.

Soils are highly variable across the range of this type, and derived from igneous, metamorphic, and sedimentary materials. The most characteristic soil features are good aeration and drainage, circumneutral to slightly acid pH, an abundance of mineral material, and periods of drought during the growing season. Some stands may occur as edaphic climax communities on very skeletal, infertile, and/or excessively drained soils, such as cinder or lava fields. Adjacent vegetation is highly varied across the range of this type, but most commonly these communities grade into semi-arid *Pinus* - *Juniperus*, *Pinus* - *Quercus*, or *Pinus ponderosa* woodlands at the lower elevation margins and closed *Abies concolor*, *Picea engelmannii*, or *Pseudotsuga menziesii* forests at the upper elevation margins.

Vegetation: The *Pinus ponderosa* Forest Alliance (A.124) is not as widespread as the *Pinus ponderosa* Woodland Alliance (A.530). Associations dominated by either of the varieties, *Pinus ponderosa* var. *ponderosa* and *Pinus ponderosa* var. *scopulorum*, are included in this alliance. The overstory can be closed to moderately open depending

upon geographic location and disturbance history. The alliance is characterized by the dominance of *Pinus ponderosa* in the overstory, and in some cases it can be the only mature tree present in the canopy. It may be the only tree species successfully regenerating, but in some stands there can be significant amounts of *Pseudotsuga menziesii* occurring as seedlings and saplings. Other conifers can be present in the canopy, but rarely with any abundance. Associated trees and understory species vary across the range of this alliance.

In the northern Rockies, Blue Mountains and as far east and south as northwestern Montana, central Utah, northern Colorado, and Wyoming, associated tree species may include *Populus tremuloides*, *Betula papyrifera*, *Quercus macrocarpa*, *Juniperus scopulorum*, *Picea glauca*, *Pinus flexilis*, and *Pseudotsuga menziesii*. Most associations have a well-developed shrub layer. Important to dominant shrubs include *Arctostaphylos patula*, *Arctostaphylos viscida* (these two only in southwestern Oregon), *Mahonia repens*, *Physocarpus malvaceus*, *Ribes cereum*, *Spiraea betulifolia*, *Symphoricarpos albus*, *Symphoricarpos occidentalis*, *Amelanchier alnifolia*, *Philadelphus lewisii*, *Holodiscus discolor*, and *Symphoricarpos oreophilus*. The herbaceous layer in associations with shrubby understories is typically a mix (sometimes species-rich) of perennial forbs and graminoids, averaging 25-30% cover, sometimes more. Important graminoids include *Festuca idahoensis*, *Leucopoa kingii* (= *Festuca kingii*), *Balsamorhiza rubescens*, and *Carex geyeri*. Forbs can include *Achillea millefolium*, *Campanula rotundifolia*, *Balsamorhiza sagittata*, *Galium boreale*, *Clematis columbiana*, *Lupinus argenteus*, *Moehringia macrophylla* (= *Arenaria macrophylla*), *Osmorhiza berteroi* (= *Osmorhiza chilensis*), *Erythronium grandiflorum*, and *Maianthemum racemosum* (= *Smilacina racemosa*). Nonvascular species are present, but not abundant. One association in this alliance has an understory with no shrub layer, that is dominated by *Carex rossii*, with lesser amount of *Leucopoa kingii*, *Koeleria macrantha*, *Muhlenbergia montana*, *Achillea millefolium*, *Cerastium arvense*, and *Mertensia lanceolata*.

Forests of the Black Hills and the surrounding region have many similarities with Rocky Mountain stands, but contain unique species assemblages not found elsewhere. Tree associates include *Picea glauca*, *Quercus macrocarpa*, *Populus tremuloides*, *Betula papyrifera*, *Fraxinus pennsylvanica*, and *Juniperus scopulorum*. There is usually a well-developed shrub layer, often 1-2 m tall, with a layer of shorter shrubs underneath. Characteristic shrubs in these eastern stands include *Physocarpus monogynus*, *Amelanchier alnifolia*, *Juniperus communis*, *Spiraea betulifolia*, *Symphoricarpos albus*, *Symphoricarpos occidentalis*, *Shepherdia canadensis*, *Prunus virginiana*, *Arctostaphylos uva-ursi* (= *Arctostaphylos adenotricha*), and species of *Ribes* and *Rosa*. Many stands have an herbaceous understory composed of species from the adjacent mixedgrass prairie, including *Carex filifolia*, *Hesperostipa comata* (= *Stipa comata*), *Andropogon gerardii*, *Calamovilfa longifolia*, *Schizachne purpurascens*, *Danthonia* spp., and *Schizachyrium scoparium*. Forbs, such as *Balsamorhiza sagittata*, *Maianthemum stellatum*, *Achillea millefolium*, *Campanula rotundifolia*, *Galium boreale*, *Euthamia occidentalis* (= *Solidago occidentalis*) or *Apocynum* spp. may be locally abundant. Mosses and lichens do occur on the forest floor in some stands.

In western Texas, these forests are characterized by a canopy of *Pinus ponderosa* var. *scopulorum* and *Pinus strobiformis*. Other canopy species sometimes present include *Pseudotsuga menziesii* var. *glauca* and *Pinus edulis*. There may be a subcanopy of the broad-leaved deciduous *Quercus gambelii*. Herbs and shrubs are sparse, but may include *Piptochaetium fimbriatum*, *Lonicera albiflora*, *Holodiscus discolor*, *Carex geophila*, *Bromus anomalus*, *Amelanchier utahensis*, and *Mahonia repens*. In grassy openings, typical species include *Muhlenbergia dubia*, *Koeleria macrantha*, *Festuca arizonica*, and *Bouteloua curtipendula*.

Dynamics: *Pinus ponderosa* is a drought-resistant, shade-intolerant conifer which usually occurs at lower treeline in the major ranges of the western United States. Historically, ground fires and drought were influential in maintaining open canopy conditions in these forests, and many may have actually been woodlands. With settlement and subsequent fire suppression, stands have become denser than they once were. Presently, many stands contain understories of more shade-tolerant species, such as *Pseudotsuga menziesii* and/or *Abies* spp., which may be affecting fuel loads and may alter future fire regimes.

Establishment is erratic and believed to be linked to periods of adequate soil moisture, good seed crops, and the availability of bare, unshaded mineral substrate. At drier sites, competition from adjacent grassland or shrubland vegetation can strongly affect seedling survival (Burns and Honkala 1990a). In the Black Hills and western Sierra Nevada, conditions permit annual regeneration of these trees, and stands tend to be more densely stocked than elsewhere.

Similar Alliances:

- PINUS PONDEROSA WOODLAND ALLIANCE (A.530)

Data current as of 17 Apr 2003.

- PINUS PONDEROSA - PSEUDOTSUGA MENZIESII FOREST ALLIANCE (A.134)
- PINUS PONDEROSA WOODED TALL HERBACEOUS ALLIANCE (A.1488)
- PINUS PONDEROSA SPARSELY VEGETATED ALLIANCE (A.1859)
- PINUS PONDEROSA - POPULUS TREMULOIDES FOREST ALLIANCE (A.399)
- PINUS PONDEROSA - PSEUDOTSUGA MENZIESII WOODLAND ALLIANCE (A.533)
- PINUS PONDEROSA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.565)
- PINUS PONDEROSA - QUERCUS GARRYANA WOODLAND ALLIANCE (A.689)

Similar Alliance Comments: The *Pinus ponderosa* Forest Alliance (A.124) is distinguished from other *Pinus ponderosa* alliances by the singular dominance of *Pinus ponderosa* in closed stands (>60% cover) occurring in non-wetland habitats.

Synonymy:

- Interior Ponderosa Pine: 237, in part (Eyre 1980)
- Pacific Ponderosa Pine: 245, in part (Eyre 1980)
- Westside Ponderosa Pine Forest, in part (Holland 1986b)
- Ponderosa Pine Series, in part (Sawyer and Keeler-Wolf 1995)
- Interior Ponderosa Pine - Front Range, in part (Mehl 1992)
- Interior Ponderosa Pine - Black Hills, in part (Mehl 1992)
- IA1b. Ponderosa Pine Forest, in part (Allard 1990)
- Ponderosa Pine Series, in part (Diamond 1993)

Comments: Open stands of this alliance can be difficult to distinguish from *Pinus ponderosa* Woodland Alliance (A.530). The woodlands tend to be drier. This is reflected in lesser amounts of mesophytic shrubs, such as *Prunus virginiana*, *Mahonia repens*, *Spiraea betulifolia*, and *Symphoricarpos* spp., and an increase in graminoids typical of dry or dry-mesic prairies, such as *Schizachyrium scoparium*, *Bouteloua gracilis*, *Pseudoroegneria spicata*, and *Festuca idahoensis*. A few relatively mesic woodland associations can be very difficult to separate from forest associations. The classification status of all associations currently placed in the *Pinus ponderosa* Forest Alliance (A.124) need to be reviewed and verified.

ALLIANCE DISTRIBUTION

Range: This alliance is not as widespread as the *Pinus ponderosa* Woodland Alliance (A.530). The forests occur in scattered locations from northern California, eastern Oregon and Washington, across the northern Rockies of Idaho, Wyoming and Montana, and into the Black Hills. They are also reported from central Utah and Colorado. East of the Rocky Mountains, they extend locally into western South Dakota, western Nebraska, and high elevations of west Texas. In the eastern part of its range, these forests contain a mixture of woodland and forest communities, with the former probably predominating at most low-elevation sites. The alliance may reach into southern British Columbia as well. *Pinus ponderosa* grows in Mexico, but the presence of the *Pinus ponderosa* Forest Alliance (A.124) has not been established.

Nations: CA MX? US

States/Provinces: AB? BC? CA CO ID MT NE OR SD TX UT WA WY

TNC Ecoregions: 10:C, 18:C, 19:C, 20:C, 21:C, 24:C, 25:C, 26:C, 27:C, 6:C, 8:C, 9:C

USFS Ecoregions: 321A:CC, 331A:CC, 331D:CC, 331F:C?, 331G:CC, 332C:CC, 342I:CC, M242C:CC, M261A:CC, M261D:CC, M261G:CC, M313B:CC, M331B:CC, M331I:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332G:CC, M333A:CC, M333B:CC, M333D:CC, M334A:CC

Federal Lands: NPS (Crater Lake?, Devils Tower, Guadalupe Mountains, Jewel Cave, Wind Cave, Zion); USFS (Black Hills, Boise, Nez Perce, Payette)

ALLIANCE SOURCES

Authors: D.J. ALLARD, MOD. M.S. RE, JT, West **Identifier:** A.124

References: Alexander 1986, Allard 1990, Atzet and Wheeler 1984, Atzet et al. 1996, Barrows et al. 1977, Burgess and Northington 1979, Burns and Honkala 1990a, Clausnitzer and Zamora 1987, Cooper and Pfister 1985, Cooper et al. 1987, Daubenmire 1952, Daubenmire and Daubenmire 1968, DeVelice et al. 1986, Diamond 1993, Eyre 1980, Faber-Langendoen et al. 1996, Fischer and Clayton 1983, Franklin and Dyrness 1973, Franklin et al. 1972, Hall 1973, Hansen and Hoffman 1988, Head 1959, Hess 1981, Hess and Alexander 1986, Hoffman and Alexander 1976, Hoffman and Alexander 1987, Holland 1986b, Johnson and Clausnitzer 1992, Johnson and Simon 1987, Johnston 1987, Lynn et al. n.d., Madany and West 1984, McLean 1970, Mehl 1992, Palmer 1929, Peet 1975, Peet 1981, Pfister et al. 1977, Progulskes and Shideler 1974, Roberts 1980, Rummell 1951, Sawyer and Keeler-Wolf 1995, Schuller and Evans 1986, Steele et al. 1981, Terwilliger et al. 1979a, Thilenius 1972, Tiedemann and Klock 1977,

Tisdale and McLean 1957, Volland 1976, WANHP n.d., WYNND unpubl. data, Wasser and Hess 1982, Williams and Lillybridge 1985, Williams and Smith 1990, Williams et al. 1990b, Youngblood and Mauk 1985, Zamora 1983

PINUS PONDEROSA / SYMPHORICARPOS OCCIDENTALIS FOREST

Ponderosa Pine / Western Snowberry Forest

Ponderosa Pine / Wolfberry Forest

ELEMENT CONCEPT

Summary: This forest type is an important association in the foothills and lower montane slopes of the Little Rocky Mountains of north-central Montana where it occurs on all aspects of the rounded foothills and on warm aspects of moderate mountain slopes. Elevations range from 1040-1585 m (3400-5200 feet). Soils are loams or sandy loams derived primarily from limestone. Stands have an open to closed canopy of *Pinus ponderosa*. *Symphoricarpos occidentalis*, *Amelanchier alnifolia*, and *Prunus virginiana* dominate the relatively dense shrub layer. The herbaceous layer is composed of the perennial bunchgrass *Pseudoroegneria spicata* with a sparse but diverse assemblage of forbs including *Anemone multifida* and *Balsamorhiza sagittata*. These warm dry pine forests benefit from periodic ground fire that reduces over-stocking by killing seedling- and sapling-sized trees and lessens the risk of stand replacing crown fires.

Environment: This community occurs on gentle to moderate slopes in foothills and warm aspects of lower mountain slopes at 3400 to 5200 feet (Roberts 1980). Mean annual precipitation is 35-40 cm (Soil Conservation Service 1981). Soils are loams or sandy loams derived from limestone (primarily) and non-calcareous parent materials. Soil reaction is near-neutral (mean pH=6.9), and average duff depth is 6.4 cm (Roberts 1980).

Vegetation: *Pinus ponderosa* is the only canopy tree (mean canopy cover of 61%); *Pseudotsuga menziesii* was present in 8% of stands (<1% cover). The understory is dominated by *Symphoricarpos occidentalis* (19%), but *Amelanchier alnifolia* (6%) *Juniperus communis* (7%), *Prunus virginiana* (6%), and *Shepherdia canadensis* (5%) are also common. *Pseudoroegneria spicata* (6%) is the only constant and common grass. Common forbs include *Anemone multifida* (2%), *Balsamorhiza sagittata* (3%), *Galium boreale* (1%), *Solidago missouriensis* (1%), and *Thermopsis rhombifolia* (1%) (Roberts 1980).

Dynamics: Presettlement stands in the warm, dry ponderosa pine habitat types were often open and park-like. Ground fires kept stands in open condition by thinning out seedling- and sapling-sized trees. However, many modern stands have become overstocked as a result of fire suppression. These overstocked stands are more prone to stand-replacing crown fires. Severe crown fires would cause stands to revert to grasslands and/or snowberry thickets (Fischer and Clayton 1983).

Similar Associations:

- *Pinus ponderosa* / *Prunus virginiana* Forest (CEGL000192)--Common in southeast Montana (Hansen and Hoffman 1988, Pfister et al. 1977) but, rosaceous shrubs dominate the understory in this type, while snowberry and bunch grasses are uncommon.
- *Pinus ponderosa* / *Symphoricarpos albus* Forest (CEGL000203)--Widespread in foothills of Montana east of the Continental Divide (Pfister et al. 1977). Understory species composition is quite similar to *Pinus ponderosa* / *Symphoricarpos occidentalis* Forest (CEGL000203); however, shrubs are more abundant and bunch grasses are less common in the latter. Furthermore, the dominant shrub is *Symphoricarpos albus* in the former and *Symphoricarpos occidentalis* in the latter.
- *Pseudotsuga menziesii* / *Symphoricarpos occidentalis* Forest (CEGL000461)

Synonymy:

- *Pinus ponderosa*/*Symphoricarpos occidentalis* (Bourgeron and Engelking 1994) =
- DRISCOLL FORMATION CODE:I.A.9.b. (Driscoll et al. 1984) B
- *Pinus ponderosa* / *Symphoricarpos occidentalis* Habitat Type (Roberts 1980) =

GRank & Reasons: G3 (00-01-03). This forested association has a very limited geographic distribution. This type is known only from the foothills and lower montane slopes on the Little Rocky Mountains in north central Montana where it is extensive as a matrix forest habitat type.

High-ranked species:

Comments: These forests are common in the Little Rocky Mountains (Roberts 1980) and appear to be a local variant of mesic ponderosa pine forest that is compositionally distinct from other described associations.

Compare this association to *Pseudotsuga menziesii* / *Symphoricarpos occidentalis* Forest (CEGL000461) that is derived from the *Pseudotsuga menziesii* / *Symphoricarpos occidentalis* Habitat Type and also occurs in the Little

Data current as of 17 Apr 2003.

Rocky Mountains (Roberts 1980). These two associations have nearly identical species composition. The only difference is that *Pseudotsuga menziesii* is more abundant in the latter with 6% mean canopy cover. This type is also similar to *Pinus ponderosa* / *Symphoricarpos albus* Forest (CEGL000203) which is common throughout Montana. However, in the Little Rocky Mountains, *Symphoricarpos occidentalis* replaces *Symphoricarpos albus*. Occurrences of *Pinus ponderosa* / *Symphoricarpos occidentalis* Forest (CEGL000204) from this area should be accepted with caution until voucher specimens of *Symphoricarpos occidentalis* from this mountain range and study area have been examined. If one follows the key of Hansen et al. (1995), most occurrences of *Pinus ponderosa* / *Symphoricarpos occidentalis* Forest (CEGL000204) would key to *Pinus ponderosa* / *Prunus virginiana* Forest (CEGL000192) by virtue of having greater than 5% cover of *Prunus virginiana* and *Amelanchier alnifolia*. However, their respective landscape settings are to a fair degree non-overlapping. *Pinus ponderosa* / *Symphoricarpos occidentalis* Forest (CEGL000204) occurs on upland slopes and well-drained sites, whereas CEGL000192 occurs on alluvial benches and toeslopes, where soil moisture is augmented. In mountain ranges of north-central Montana there are north- to northeast-facing slopes, possibly subirrigated, that key to CEGL000204, but that would best be considered CEGL000192 due to their augmented moisture supply.

ELEMENT DISTRIBUTION

Range: This type is known only from the foothills and lower montane slopes on the Little Rocky Mountains in north-central Montana.

Nations: US

States/Provinces: MT:S3

TNC Ecoregions: 26:C

USFS Ecoregions: 331D:CC, M332D:CC

Federal Lands:

ELEMENT SOURCES

Authors: P. Lesica and C. Jean, WCS **Confidence:** 2 **Identifier:** CEGL000204

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Fischer and Clayton 1983, Hansen and Hoffman 1988, Hansen et al. 1984, Hansen et al. 1995, Pfister et al. 1977, Roberts 1980, Soil Conservation Service 1981b

II. WOODLAND

II.A.4.N.a. Rounded-crowned temperate or subpolar needle-leaved evergreen woodland

II.A.4.N.a.32. PINUS PONDEROSA WOODLAND ALLIANCE

Ponderosa Pine Woodland Alliance

ALLIANCE CONCEPT

Summary: This alliance is one of the most widespread wooded alliances in the western United States; there are currently over 50 plant associations in this alliance. The alliance is found throughout the western half of the U.S. and southwestern Canada, as well as the Trans-Pecos of Texas and the western portions of the Great Plains, such as in western Oklahoma and the Dakotas. Sites are dry/dry-mesic to xeric, and soils are generally well-drained and coarse-textured. *Pinus ponderosa* often dominates these woodlands, but codominant species may include *Pseudotsuga menziesii*, other *Pinus* species, and species of *Juniperus*, *Abies*, or *Picea*. The understory ranges from dense shrub or graminoid layers to barren rock. The associated plant species vary with changes in geography and environmental conditions. Associated trees include species of *Pinus*, *Quercus*, *Juniperus*, *Abies*, *Pseudotsuga*, *Populus*, and *Picea*. Shrubs can include species of *Arctostaphylos*, *Artemisia*, *Cercocarpus*, *Ceanothus*, *Symphoricarpos*, *Physocarpus*, *Rosa*, *Purshia*, and others. Important graminoids include species of *Carex*, *Elymus*, *Poa*, *Festuca*, *Muhlenbergia*, *Piptochaetium*, and many others.

Environment: These woodlands typically occur at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forest. They occur across 20 degrees of latitude, from Canada well into northwestern Mexico. The quantity and timing of precipitation vary greatly across the range of the alliance, ranging from 25-60 cm annually, with at least some seasonal drought. East of the Continental Divide and in the Southwest, summer precipitation predominates, whereas western stands receive most of their precipitation from westerly winter storms. Monsoonal summer rains can contribute a substantial proportion to the annual precipitation totals in the Southwest. Elevations decrease with increasing latitude, from less than 1000 m in eastern Washington to over 2750 m in southern Arizona and New Mexico. Stands occur at low elevations (<1000 m) in the eastern Great Plains and west of the Cascade-Sierra axis.

Fire is a key factor in maintaining the open canopies characteristic of these woodlands, but soil drought or infertility may be equally important in some areas. Soils are derived from igneous, metamorphic, and sedimentary materials and are characterized by good aeration and drainage, coarse textures, circumneutral to slightly acid pH, an abundance of mineral material, and periods of drought during the growing season. Some stands may occur as edaphic climax communities on very skeletal, infertile, and/or excessively drained soils, such as pumice, cinder or lava fields, and scree slopes. All slopes and aspects are represented, but moderately steep to very steep slopes or ridgetops are the most common sites. Adjacent vegetation is highly varied, but most commonly these woodlands grade into semi-arid steppe grasslands or shrublands at the lower elevation margins and closed forests of *Abies grandis*, *Abies concolor*, *Pseudotsuga menziesii*, or *Populus tremuloides* at the upper elevation margins or adjacent more mesic sites. Adjacent drier sites can be dominated by *Juniperus scopulorum* or *Juniperus occidentalis* woodlands.

Vegetation: This alliance includes woodlands dominated by *Pinus ponderosa*. Structurally, these are open woodlands or savannas with large, open growth-form *Pinus ponderosa* trees (generally) as the only canopy dominant. Average tree canopy cover ranges from 20-70%. The understory may include dense stands of shrubs or be dominated by grasses, sedges, or herbaceous species, although many of the associations are named for shrub species. Existing stands usually have younger cohorts of *Pinus ponderosa* present and may be less open than in the past. Associated trees and understory species vary widely across the range of this alliance.

In the southern Rocky Mountains and the mountains of southern Arizona and New Mexico, associated trees include *Pseudotsuga menziesii*, *Abies concolor*, *Picea pungens*, *Pinus strobiformis*, *P. edulis*, *P. discolor*, *P. cembroides*, *P. flexilis*, *Juniperus scopulorum*, and *Populus tremuloides*. In far southern stands, *Juniperus deppeana* may also be common. In the interior Pacific Northwest as far east as northwestern Montana, associated tree species may include

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Pseudotsuga menziesii, *Abies grandis*, *Cercocarpus ledifolius*, *Pinus contorta*, *Larix occidentalis*, *Juniperus occidentalis*, or *Quercus garryana*. As in the southern Rockies, none of these trees are ever abundant in the canopy, but in some stands one or more may be successfully regenerating, particularly *Abies grandis* or *Pseudotsuga menziesii*.

A shrub layer may be prominent or nearly absent, depending on location and disturbance history. Common species include *Arctostaphylos uva-ursi*, *A. patula*, *A. pungens*, *A. nevadensis*, *Artemisia tridentata*, *A. arbuscula*, *A. nova*, *Amelanchier alnifolia*, *Cercocarpus montanus*, *C. ledifolius*, *Ceanothus greggii*, *C. fendleri*, *C. velutinus*, *Juniperus communis*, *Purshia mexicana*, *P. tridentata*, and species of *Quercus*, *Ribes*, and *Symphoricarpos*.

The herbaceous layer tends to vary inversely with shrub cover, but is composed primarily of graminoids. Important species include *Bouteloua gracilis*, *Carex geyeri*, *C. rossii*, *C. pennsylvanica*, *Koeleria macrantha*, *Leucopoa kingii* (= *Festuca kingii*), *Muhlenbergia virescens*, *M. montana*, *Achnatherum hymenoides* (= *Oryzopsis hymenoides*), *A. occidentale* (= *Stipa occidentalis*), *Pseudoroegneria spicata*, *Poa secunda*, *Elymus elymoides*, *Festuca idahoensis*, *F. arizonica*, and *Hesperostipa comata* (= *Stipa comata*). Important or diagnostic forb species include *Aspidotis densa*, *Wyethia mollis*, *Balsamorhiza sagittata*, *Achillea millefolium*, *Sedum stenopetalum*, *Maianthemum racemosum* (= *Smilacina racemosa*), *Vicia americana*, and species of many other genera, such as *Erigeron*, *Lupinus*, *Fragaria*, *Lathyrus*, *Heterotheca*, *Arenaria*, and *Antennaria*. In western Texas and Oklahoma other associated species include *Piptochaetium fimbriatum*, *P. pringlei*, *Achnatherum lobatum* (= *Stipa lobata*), *Bothriochloa barbinodis* (= var. *barbinodis*), *Schizachyrium scoparium* var. *scoparium* (= ssp. *neomexicanum*), *Muhlenbergia rigida*, and *Panicum bulbosum*.

Woodlands of the Black Hills and the surrounding region have somewhat unique species assemblages not found elsewhere. Tree associates include *Picea glauca*, *Quercus macrocarpa*, *Populus tremuloides*, *Betula papyrifera*, and *Juniperus scopulorum*. Characteristic shrubs in these eastern stands include *Rhus trilobata*, *Physocarpus monogynus*, *Symphoricarpos albus*, *S. occidentalis*, *Shepherdia canadensis*, *Arctostaphylos uva-ursi*, and *Rosa* spp. Many stands have an herbaceous understory composed of species from the adjacent mixed-grass prairie, including *Carex filifolia*, *Hesperostipa comata*, *Andropogon gerardii*, *Calamovilfa longifolia*, *Danthonia* spp., and *Schizachyrium scoparium*. In southwestern North Dakota, communities within this alliance do not cover large contiguous tracts. They are interrupted by other types of vegetation, usually grasslands (Potter and Green 1964).

In the far west, these woodlands occur in summer dry valleys and foothills from southern Oregon to central California. Typical tree associates include *Calocedrus decurrens*, *Pinus sabiniana*, *P. lambertiana*, *P. attenuata*, *Pseudotsuga menziesii*, *Quercus* spp., and *Aesculus californica*. The understory typically contains shrub species from adjacent chaparral communities, including *Arctostaphylos patula*, *A. viscida*, *Ceanothus cuneatus*, *Toxicodendron diversilobum*, *Frangula californica* (= *Rhamnus californica*), and *Symphoricarpos* spp. The herbaceous layer is typically sparse due to litter accumulation and is dominated by xerophytic forbs and grasses.

Dynamics: *Pinus ponderosa* is a drought-resistant, shade-intolerant conifer which usually occurs at lower treeline in the major ranges of the western United States. Historically, ground fires and drought were influential in maintaining open-canopy conditions in these woodlands. With settlement and subsequent fire suppression, stands have become more dense. Presently, many stands contain understories of more shade-tolerant species, such as *Pseudotsuga menziesii* and/or *Abies* spp., as well as younger cohorts of *Pinus ponderosa*. These altered stand structures have affected fuel loads and altered fire regimes. Presettlement fire regimes were primarily frequent (5- to 15-year return intervals), low-intensity ground fires triggered by lightning strikes or deliberately set fires by Native Americans. With fire suppression and increased fuel loads, fires are now less frequent and often become intense crown fires which can kill mature *Pinus ponderosa*. Establishment is erratic and believed to be linked to periods of adequate soil moisture and good seed crops, as well as fire frequencies which allow seedlings to reach sapling size. Longer fire intervals have resulted in many stands having dense subcanopies of overstocked and unhealthy young *Pinus ponderosa*.

Similar Alliances:

- PINUS PONDEROSA FOREST ALLIANCE (A.124)
- PINUS PONDEROSA - PSEUDOTSUGA MENZIESII FOREST ALLIANCE (A.134)
- PINUS PONDEROSA WOODED TALL HERBACEOUS ALLIANCE (A.1488)
- PINUS PONDEROSA SPARSELY VEGETATED ALLIANCE (A.1859)
- PINUS PONDEROSA - POPULUS TREMULOIDES FOREST ALLIANCE (A.399)
- PINUS PONDEROSA - PSEUDOTSUGA MENZIESII WOODLAND ALLIANCE (A.533)

Data current as of 17 Apr 2003.

- PINUS PONDEROSA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.565)
- PINUS PONDEROSA - QUERCUS GARRYANA WOODLAND ALLIANCE (A.689)

Similar Alliance Comments: The *Pinus ponderosa* Woodland Alliance (A.530) is distinguished by the singular dominance of *Pinus ponderosa* in open stands (25-60% cover) occurring in non-wetland habitats and exhibiting an obvious woodland physiognomy. Closed forests dominated by *Pinus ponderosa* are found in the I.A.8.N.b *Pinus ponderosa* Forest Alliance (A.124). The presence of significant amounts of *Pseudotsuga menziesii* may make it difficult to separate some stands from communities in the II.A.4.N.a *Pinus ponderosa* - *Pseudotsuga menziesii* Woodland Alliance (A.533). The abundance of graminoids typically found in dry and dry-mesic prairies is one diagnostic feature to separate many elements within this woodland alliance from those within *Pinus ponderosa* Forest Alliance (A.124). However, some woodland elements are relatively mesic and contain mesophytic shrubs. The classification status and diagnostic characteristics for these elements need to be further elucidated.

Synonymy:

- Interior Ponderosa Pine: 237, in part (Eyre 1980)
- Pacific Ponderosa Pine: 245, in part (Eyre 1980)
- Upland Coast Range Ponderosa Pine Forest, in part (Holland 1986b)
- Westside Ponderosa Pine Forest, in part (Holland 1986b)
- *Pinus ponderosa* woodland alliance (Hoagland 1998a)
- Ponderosa Pine Series, in part (Diamond 1993)

Comments: Taxonomists (Kartesz 1999) recognize two varieties of *Pinus ponderosa*, a Pacific form, *Pinus ponderosa* var. *ponderosa*, and an interior form, *Pinus ponderosa* var. *scopulorum*. Associations dominated by either variety are included in this alliance. The classification status of all associations currently placed in the *Pinus ponderosa* Forest Alliance (A.124) should be reviewed and verified.

ALLIANCE DISTRIBUTION

Range: These woodlands occur in every state west of the Great Plains, as well as in British Columbia, Canada. East of the Rocky Mountains, they extend locally into North and South Dakota, Nebraska, Oklahoma, and Texas. The alliance is also found in northern Mexico.

Nations: CA MX US

States/Provinces: AZ BC CA CO ID MT MXCH MXCO MXSO ND NE NM NV OK OR SD TX UT WA WY

TNC Ecoregions: 10:C, 11:C, 12:C, 18:C, 19:C, 1:C, 20:C, 21:C, 22:C, 24:C, 25:C, 26:C, 27:C, 3:C, 4:C, 5:C, 6:C, 7:C, 8:C, 9:C

USFS Ecoregions: 313A:CC, 313B:CC, 313C:CC, 313D:CC, 313E:CC, 315A:CC, 321A:CC, 331A:CC, 331D:CC, 331E:C?, 331F:CC, 331G:CC, 331I:CC, 331J:CC, 332C:CP, 341B:CC, 341F:CC, 341G:CC, 342B:CC, 342C:CC, 342H:CC, 342I:CC, M242C:CC, M261A:CC, M261E:CC, M261G:CC, M313A:CC, M313B:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CP, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:CC, M341A:C?, M341C:CC

Federal Lands: NPS (Badlands, Crater Lake, Devils Tower, Florissant Fossil Beds, Fort Laramie, Grand Canyon, Guadalupe Mountains, Jewel Cave, Mount Rushmore, Scotts Bluff, Sunset Crater, Theodore Roosevelt, Walnut Canyon, Wind Cave, Yosemite, Zion); USFS (Apache-Sitgreaves, Black Hills, Deschutes, Fremont, Modoc, Ochoco, Wallowa-Whitman, Winema)

ALLIANCE SOURCES

Authors: M.S. REID, D. SARR, JT, West **Identifier:** A.530

References: Alexander 1985, Alexander 1986, Alexander et al. 1984a, Alexander et al. 1984b, Alexander et al. 1987, Bader 1932, Barrows et al. 1977, Bassett et al. 1987, Blackburn et al. 1969e, Boyce 1977, Brayshaw 1965, Brown 1971, Bunin 1975c, Clary 1978, Clary and Pearson 1969, Clausnitzer and Zamora 1987, Cooper and Pfister 1985, Cooper et al. 1987, Costello 1954, Costello and Schwan 1946, Currie 1975, Daubenmire 1952, Daubenmire 1970, Daubenmire and Daubenmire 1968, DeVelice and Ludwig 1983b, DeVelice et al. 1986, Dealy 1971, Dealy 1975, Diamond 1993, Dixon 1935, Dyrness 1960, Eyre 1980, Faber-Langendoen et al. 1996, Fischer and Clayton 1983, Fitzhugh et al. 1987, Francis 1986, Franklin and Dyrness 1973, Ganskopp 1979, Graybosch and Buchanan 1983, Hall 1967, Hall 1973, Hanks et al. 1983, Hansen and Hoffman 1988, Hanson and Ball 1928, Harmon 1980, Hess 1981, Hess and Alexander 1986, Hess and Wasser 1982, Hoagland 1998a, Hoffman and Alexander 1976, Hoffman and Alexander 1987, Holland 1986b, Hopkins 1979a, Hopkins 1979b, Johannessen et al. 1971, Johnson 1945, Johnson 1953, Johnson 1956a, Johnson 1985a, Johnson and Clausnitzer 1992, Johnson and Niederhof 1941, Johnson and Reid 1958, Johnson and Reid 1964, Johnson and Simon 1985, Johnson and Simon 1987, Johnston 1987, Johnston and Hendzel 1985, Kahler 1973, Kartesz 1999, Komarkova et al. 1988a, Komarkova et al. 1988b, Kooiman and Linhart 1986, Larson 1974, Larson and Moir 1986, Larson and Moir 1987, Lindsey 1951, Livingston

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1949, Luti 1953, Lynn et al. n.d., MTNHP n.d., MacCracken et al. 1983a, MacCracken et al. 1983b, Marr et al. 1973a, Mauk and Henderson 1984, Mayo 1971, McLean 1970, Mehl 1992, Merkle 1962, Moir and Ludwig 1979, Moir et al. 1973b, Muldavin et al. 1996, Nichol 1937, Peet 1975, Peet 1981, Pfister 1977, Pfister et al. 1977, Potter and Green 1964, Progulske and Shideler 1974, Roberts 1980, Roberts et al. 1992, Rogers 1953, Rowdabaugh 1978, Sawyer and Keeler-Wolf 1995, Schmoll 1935, Shepherd 1975, Sherman 1969, Smith 1967, Somers et al. 1980, Steele et al. 1981, Steinhoff 1978, Strong et al. 1978, Swift 1974, Thilenius 1971, Thilenius 1972, Tisdale and McLean 1957, Volland 1976, WANHP n.d., Warren and Treadwell 1980, Watson 1912, Williams and Lillybridge 1983, Williams and Smith 1990, Williams et al. 1990b, Wirsing and Alexander 1975, Wright et al. 1973, Youngblood and Mauk 1985, Zamora 1983

PINUS PONDEROSA / FESTUCA CAMPESTRIS WOODLAND

Ponderosa Pine / Prairie Fescue Woodland

Ponderosa Pine / Rough Fescue Forest

ELEMENT CONCEPT

Summary:

Environment:

Vegetation:

Dynamics:

Similar Associations:

Synonymy:

- DRISCOLL FORMATION CODE:I.A.9.b. (Driscoll et al. 1984) B
- *Pinus ponderosa/Festuca scabrella* (Bourgeron and Engelking 1994) =

GRank & Reasons: G3G4 (96-02-01).

High-ranked species:

Comments:

ELEMENT DISTRIBUTION

Range:

Nations: CA US

States/Provinces: BC:S?, ID:S1, MT:S3, WA:S1

TNC Ecoregions: 6:C

USFS Ecoregions: 331A:CC, 342I:CC, M333A:CC

Federal Lands:

ELEMENT SOURCES

Authors: WCS **Confidence:** 2 **Identifier:** CEG000185

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, MTNHP n.d., McLean 1970, Pfister et al. 1977, WANHP n.d.

PINUS PONDEROSA / PSEUDOROEGNERIA SPICATA WOODLAND

Ponderosa Pine / Bluebunch Wheatgrass Woodland

*Ponderosa Pine / Bluebunch Wheatgrass Woodland***Ecological Group (SCS;MCS):** Rocky Mountains Dry Ponderosa Pine Forests and Woodlands (760-20; 2.5.6.1)**ELEMENT CONCEPT**

Summary: This ponderosa pine woodland is one of the drier ponderosa pine woodlands found in the northern Rocky Mountains, Inter-Mountains, and extreme northwestern Great Plains of the United States and Canada. It is found on slopes with coarse soils, often with a high gravel or rock content. *Pinus ponderosa* is typically the only tree in the overstory, although *Juniperus scopulorum* may be present in the subcanopy. It forms open to moderately closed canopies. There are very few shrubs. The herbaceous layer is dominated by *Pseudoroegneria spicata*. Other species found in this layer are *Carex filifolia*, *Carex inops ssp. heliophila*, *Koeleria macrantha*, *Achillea millefolium*, *Balsamorhiza sagittata* and *Hesperostipa comata* (= *Stipa comata*). Bare mineral soil and exposed rock are common.

Environment: This community occurs mostly on steep southerly aspects. It is found on coarse soils derived from sandstone, porcellanate, or limestone (Thilenius et al. 1995). These include sandy alluvium, gravelly or sandy till, and loams with high stone content. Rock and mineral soil are commonly exposed.

Vegetation: This community is dominated by the tree and herbaceous strata. On three stands in the eastern portion of its range, Hansen and Hoffman (1988) found that total cover by understory strata was 55%. Shrubs made up only 1.3% of this total. *Pinus ponderosa* is often the only tree in the overstory. The tree coverage can vary from open to moderately closed. In northeastern Wyoming, most of the trees were less than 15 m tall and 60 cm dbh (Thilenius et al. 1995). The herbaceous stratum is also open to moderately dense. *Pseudoroegneria spicata* is the dominant species. Other species that are often found in the central and eastern portions of its range are *Achillea millefolium* var. *occidentalis*, *Carex filifolia*, *Carex inops ssp. heliophila*, *Koeleria macrantha*, and *Hesperostipa comata* (= *Stipa comata*). In the western portion of the range of this community *Festuca idahoensis* may be present (Daubenmire 1952). When shrubs are present they typically include *Rhus aromatica* and, especially on sandy soils, *Ericameria nauseosa* (= *Chrysothamnus nauseosus*).

Dynamics: Fire likely occurred at regular intervals in this type; documentation on fire frequency is not available.

Similar Associations:

- *Pinus ponderosa* / *Festuca idahoensis* Woodland (CEGL000857)--is similar in structure and composition (Daubenmire and Daubenmire 1968).

Synonymy:

- DRISCOLL FORMATION CODE:II.A.2.a. (Driscoll et al. 1984) B
- *Pinus ponderosa*/*Pseudoroegneria spicata* (Bourgeron and Engelking 1994) =
- *Pinus ponderosa* / *Agropyron spicatum* Association (Daubenmire 1952) =
- *Pinus ponderosa* / *Agropyron spicatum* Habitat Type (Cooper and Pfister 1985) =
- *Pinus ponderosa* / *Roegneria spicata* Plant Association (Daubenmire and Daubenmire 1968) =
- *Pinus ponderosa* / *Roegneria spicata* Plant Association (Hansen et al. 1984) =
- *Pinus ponderosa* / *Roegneria spicata* Plant Association (Hoffman and Alexander 1976) =
- *Pinus ponderosa* / *Roegneria spicata* Plant Association (Pfister et al. 1977)
- *Pinus ponderosa* / *Roegneria spicata* Plant Association (Johnston 1987)
- *Pinus ponderosa* / *Agropyron spicata* Community (Jones 1992b)
- *Pinus ponderosa* / *Agropyron spicatum* Coniferous Forest (Thilenius et al. 1995)
- *Pinus ponderosa* / *Festuca idahoensis* (Daubenmire and Daubenmire 1968). similar in structure and composition
- *Pseudoroegneria spicata* / *Bouteloua gracilis* (Hansen et al. 1984). similar to this type, but without the pine canopy
- *Rhus aromatica* / *Pseudoroegneria spicata* (Hansen et al. 1984). similar to this type, but without the pine canopy
- *Pinus ponderosa* / *Pseudoroegneria spicata* Woodland Habitat Type (Hansen and Hoffman 1988)
- *Pinus ponderosa* / *Pseudoroegneria spicata* Woodland Habitat Type (Hoffman and Alexander 1976)

GRank & Reasons: G4 (96-02-01).

High-ranked species:

Comments: The stands used to document the *Pinus ponderosa* / *Pseudoroegneria spicata* Woodland Habitat Type described by Hansen and Hoffman (1988) and Hoffman and Alexander (1976) had very high basal area and densities for a woodland, possibly due to their sampling procedure. The dense structure may have affected the floristic makeup of the stands and made the list of dominant species a poor reflection of the community as a whole.

Data current as of 17 Apr 2003.

ELEMENT DISTRIBUTION

Range: This ponderosa pine woodland is one of the drier ponderosa pine woodlands found in the northern Rocky Mountains, Intermountains, and extreme northwestern Great Plains of the United States and Canada, extending from the Black Hills of South Dakota and Wyoming west to Oregon, Washington, and British Columbia.

Nations: CA US

States/Provinces: BC:S2S3, ID:S3, MT:S4, ND:S2S3?, OR:S2, SD:S4, WA:S1, WY:S3?

TNC Ecoregions: 10:C, 20:C, 25:C, 26:C, 6:C, 9:C

USFS Ecoregions: 331A:CC, 331F:C?, 331G:CC, 342C:CC, 342I:CC, M242C:??, M331B:CC, M331I:C?, M332A:CC, M332G:CC, M333A:CC, M334A:CC

Federal Lands: NPS (Devils Tower)

ELEMENT SOURCES

Authors: J. Drake, WCS **Confidence:** 1 **Identifier:** CEGLO00865

References: Bourgeron and Engelking 1994, Clausnitzer and Zamora 1987, Cooper and Pfister 1985, Cooper et al. 1987, Daubenmire 1952, Daubenmire 1970, Daubenmire and Daubenmire 1968, Driscoll et al. 1984, Hall 1973, Hansen and Hoffman 1988, Hansen et al. 1984, Hoffman and Alexander 1976, Johnson and Clausnitzer 1992, Johnson and Simon 1985, Johnson and Simon 1987, Johnston 1987, Jones 1992b, McAdams et al. 1998, McLean 1970, Pfister et al. 1977, Steele et al. 1981, Terwilliger et al. 1979a, Thilenius et al. 1995, Williams and Lillybridge 1983, Williams and Lillybridge 1985, Zamora 1983

II.A.4.N.b. Conical-crowned temperate or subpolar needle-leaved evergreen woodland

II.A.4.N.b.9. PSEUDOTSUGA MENZIESII WOODLAND ALLIANCE

Douglas-fir Woodland Alliance

ALLIANCE CONCEPT

Summary: This widespread coniferous woodland alliance occurs across the western U.S., typically on relatively poor sites for tree growth. Environmental factors, such as harsh substrate, desiccating winds or frequent disturbances that limit the tree canopy density, vary geographically. Stands are typically restricted to hot, dry slopes with southern and western exposures at higher elevations and latitudes. At lower elevations and latitudes stands are found on relatively mesic northern aspects. Where there is adequate moisture to develop a closed tree canopy, shallow rocky soils, talus and scree have so little moisture-holding capacity that these sites are effectively very dry for plant growth. Other harsh substrates, such as serpentine, or frequent disturbance from fire may also limit tree canopy development. Substrates are typically shallow, lithic, coarse-textured and well-drained. Woodlands included in this alliance have a sparse to moderately dense canopy, or may occur as patchy stands that are dominated by *Pseudotsuga menziesii*. Other trees in the canopy and subcanopy may include *Pinus ponderosa*, *Tsuga mertensiana* or *Quercus chrysolepis* in Oregon, and *Pinus flexilis* or *Juniperus scopulorum*. Typically sparse tall-shrub/small-tree layer may include *Acer circinatum* or any of the above trees depending on the species range. Shrub cover is scattered to patchy. Common shrubs include *Cercocarpus ledifolius*, *Cercocarpus montanus*, *Holodiscus dumosus*, *Purshia tridentata*, or *Toxicodendron diversilobum*. The herbaceous layer is often dominated by perennial graminoids such as *Festuca campestris*, *Festuca idahoensis*, *Leucopoa kingii* (= *Festuca kingii*), *Piptatherum micranthum* (= *Oryzopsis micrantha*), *Pseudoroegneria spicata*, or *Schizachyrium scoparium*. Forbs important in this layer include *Aspidotis densa* and *Penstemon fruticosus*. Annual grasses and forbs may be present, especially on disturbed sites. Diagnostic of this alliance is the *Pseudotsuga menziesii*-dominated tree canopy with less than 60% cover on average.

Environment: Associations included in this woodland alliance occur on dry sites in Washington and Oregon in the Cascade, Okanogan, Blue and Klamath mountains, and in the Rocky Mountains. Elevations vary with latitude from 300 m in the Northern Cascades to 3000 m in New Mexico and Arizona. The climate regime is strongly influenced by the rainshadow effect of the Cascade Range or Coastal Ranges of southern Oregon. Climate is mostly temperate, continental with maritime influences in the Cascades and northwestern Rocky Mountains. Annual precipitation ranges from approximately 40 cm in drier habitats in the Blue Mountains and southern Rocky Mountains to 150-230 cm in the Cascades. There are usually environmental factors, such as harsh substrate or frequent disturbance, that limit these open (25-60% canopy cover) stands from developing closed canopies. Stands are typically restricted to hot, dry slopes with southern and western exposures and shallow soils. This is true of many stands in the Cascades and Northern Rocky Mountains. However, in some stands, serpentine soils limit tree density. In more xeric habitats and the southern Rocky Mountains, stands occur on relatively mesic sites and have been described from scree slopes at high elevations or north slopes.

Stands occur on moderate to steep slopes. Substrates are typically shallow, lithic, coarse-textured soils derived from colluvium and residuum. Soil texture ranges from gravelly sand to loam. There is typically high surface cover of rock, as well as coarse fragments within the soil. Soil pH varies from acidic to alkaline depending on parent material. Parent materials are extremely varied in these widespread associations and may include volcanic, sedimentary, metamorphic and igneous rocks such as lava, basalt, tuff, granite, gneiss, rhyolite, andesite, dolomite, limestone, mudstone and sandstone. These rocky, shallow soils have so little moisture-holding capacity that these sites are effectively very dry for plant growth even where there is substantial precipitation. In some cases, these sites are exposed to high winds. Wind detracts from soil moisture status by blowing off snow, directly desiccating plants, and eroding soil.

Adjacent stands at higher elevations include mixed-conifer subalpine forests. At lower elevations these stands often grade into woodlands and savannas dominated by *Pinus ponderosa*, *Pinus edulis*, or *Juniperus* spp., or montane grassland parks dominated by *Pseudoroegneria spicata* or *Festuca idahoensis* with scattered shrubs such as *Purshia tridentata* or *Cercocarpus* spp.

Vegetation: These coniferous woodlands occur in the mountains of the western U.S. They have a sparse to moderately dense, open canopy, or may occur as patchy stands, dominated by *Pseudotsuga menziesii*. Other trees in

Data current as of 17 Apr 2003.

the canopy and subcanopy may include *Pinus ponderosa*, *Tsuga mertensiana* or *Quercus chrysolepis* in Oregon, and *Pinus flexilis* or *Juniperus scopulorum* in the Rocky Mountains. A typically sparse tall-shrub/small-tree layer may include *Acer circinatum* or any of the above trees depending on the species range. The short-shrub layer is scattered to patchy, and may be dominated by *Cercocarpus ledifolius*, *Cercocarpus montanus*, *Holodiscus dumosus*, *Purshia tridentata* or *Toxicodendron diversilobum*, but can include numerous other species. The herbaceous layer is sparse to moderately dense in more open stands. It is often dominated by perennial graminoids such as *Festuca campestris*, *Festuca idahoensis*, *Leucopoa kingii* (= *Festuca kingii*), *Piptatherum micranthum* (= *Oryzopsis micrantha*), *Pseudoroegneria spicata* or *Schizachyrium scoparium*. Forbs important in this layer include *Aspidotis densa* and *Penstemon fruticosus*. Numerous other graminoid and forb species may be present, but cover is generally sparse. Annual grasses and forbs may be present, especially on disturbed sites.

Dynamics: *Pseudotsuga menziesii* is tolerant of ground fires. Many mature trees have fire scars. The fire frequency is 5-30 years in many montane stands, but may be much longer in stands on talus slopes in the subalpine (Williams and Smith 1990). The exotic grass *Bromus tectorum* often invades the herbaceous layer of disturbed stands in the interior northwestern U.S.

Similar Alliances:

- PINUS PONDEROSA - PSEUDOTSUGA MENZIESII WOODLAND ALLIANCE (A.533)

Similar Alliance Comments: There are 16 alliances that share *Pseudotsuga menziesii* as a diagnostic species, five are woodlands and 11 are forests. *Pseudotsuga menziesii* is widespread in mountainous areas in the western U.S., and is frequently an important to codominant species in stands of many forest and woodland vegetation types that may be classified in other alliances.

Synonymy:

- Douglas-fir Series, in part (Sawyer and Keeler-Wolf 1995)
- *Pinus ponderosa* - *Pseudotsuga menziesii* Woodlands, in part (Chappell et al. 1997)

Comments: There are two scree associations in this alliance that appear very similar and possibly could be combined. Information from California needs to be incorporated into this alliance. Both this alliance and the *Pinus ponderosa* - *Pseudotsuga menziesii* Woodland Alliance (A.533) have an association with both conifers and *Penstemon fruticosus* in the herbaceous layer.

ALLIANCE DISTRIBUTION

Range: Woodlands included this alliance are found on the dry sites in mountains of the northwestern U.S. from California to Washington, east to the Rocky Mountains in Montana, Wyoming and Utah. The alliance also occurs in New Mexico and Arizona, and probably is found in Colorado and southern British Columbia, Canada.

Nations: CA US

States/Provinces: AZ BC? CA CO? ID MT NM OR UT WA WY

TNC Ecoregions: 10:C, 20:C, 26:C, 6:C, 8:C

USFS Ecoregions: 313E:CC, 331D:CC, 331J:CC, 342A:C?, 342B:CC, 342C:CC, M242B:CC, M242C:CC, M261A:CC, M261B:C?, M261D:C?, M261G:C?, M313A:CC, M313B:CC, M331A:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332C:CC, M332D:CP, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M341C:CC

Federal Lands:

ALLIANCE SOURCES

Authors: K. SCHULZ, West **Identifier:** A.552

References: Atzet and Wheeler 1984, Atzet et al. 1996, Chappell et al. 1997, Cole 1982, Cooper 1975, Cooper et al. 1995, DeVelice 1992, DeVelice et al. 1986, DeVelice et al. 1991, DeVelice et al. 1995, Fitzhugh et al. 1987, Johnson and Clausnitzer 1992, Johnston 1987, Larson and Moir 1986, Larson and Moir 1987, MTNHP n.d., Mauk and Henderson 1984, Pfister et al. 1977, Roberts et al. 1979, Sawyer and Keeler-Wolf 1995, Steele et al. 1981, Steele et al. 1983, Williams and Smith 1990, Williams et al. 1990b, Youngblood and Mauk 1985

PSEUDOTSUGA MENZIESII / FESTUCA CAMPESTRIS WOODLAND

Douglas-fir / Prairie Fescue Woodland

Douglas-fir / Rough Fescue Woodland

ELEMENT CONCEPT**Summary:****Environment:****Vegetation:****Dynamics:****Similar Associations:****Synonymy:**

- DRISCOLL FORMATION CODE:II.A.2.b. (Driscoll et al. 1984) B
- *Pseudotsuga menziesii/Festuca scabrella* (Bourgeron and Engelking 1994) =

GRank & Reasons: G4 (94-02-23).**High-ranked species:****Comments:****ELEMENT DISTRIBUTION****Range:****Nations:** US**States/Provinces:** MT:S4, UT?**TNC Ecoregions:** 26:C**USFS Ecoregions:** 331D:CC, M332B:CC, M332C:CC, M333B:CC, M333C:CC, M333D:CC**Federal Lands:****ELEMENT SOURCES****Authors:** WCS **Confidence:** 2 **Identifier:** CEG000901**References:** Bourgeron and Engelking 1994, Driscoll et al. 1984, Pfister et al. 1977

V. HERBACEOUS VEGETATION

V.A.5.N.d. Medium-tall bunch temperate or subpolar grassland

V.A.5.N.d.28. ACHNATHERUM NELSONII HERBACEOUS ALLIANCE

Nelson's Needlegrass Herbaceous Alliance

ALLIANCE CONCEPT

Summary: Grasslands included in this alliance have been described only in the Uinta Basin of Utah. Stands occur above the Pinyon-Juniper Community in the Mid-Altitude *Artemisia* and in the Upper Altitude Communities. Elevations range from approximately 1800-2600 m. These grasslands form in openings on the slopes and benches in the shrublands and lower elevation forests. Climate is semi-arid with mean annual precipitation ranging from 22-35 cm. Summers are hot and winter are cold with below freezing temperature common. These grasslands are in a matrix of *Artemisia tridentata*-dominated shrublands, *Pinus edulis* and *Juniperus osteosperma* woodland at lower elevations, and *Populus tremuloides* forests at higher elevations. Grasslands in this alliance occur in a mosaic with shrublands on submontane slopes and benches in the Uinta Basin of Utah. Stands have a moderately dense cover of graminoids codominated by the cool-season, perennial bunch grasses *Achnatherum nelsonii* (= *Stipa nelsonii*) and *Koeleria macrantha*. Other graminoids may include *Aristida purpurea*, *Juncus* spp., *Poa* spp., *Achnatherum hymenoides* (= *Oryzopsis hymenoides*), *Pascopyrum smithii*, and *Hesperostipa comata* (= *Stipa comata*). Scattered shrubs and dwarf-shrubs are typically present, such as *Artemisia tridentata*, *Ericameria nauseosa* (= *Chrysothamnus nauseosus*), *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*), and *Purshia tridentata*. The sparse forb layer may include species of Asteraceae, *Astragalus*, *Delphinium*, *Polygonum*, and the exotic *Taraxacum officinale*.

Environment: Grasslands included in this alliance have been described only by Dastrup (1963) in the Uinta Basin of Utah. Stands occur above the Pinyon-Juniper Community in the Mid-Altitude *Artemisia* and in the Upper Altitude Communities. Elevations range from approximately 1800-2600 m. These grasslands form in openings on the slopes and benches in the shrublands and lower elevation forests. Climate is semi-arid with mean annual precipitation ranging from 22-35 cm. Summers are hot and winter are cold with below freezing temperature common. These grasslands are in a matrix of *Artemisia tridentata*-dominated shrublands, *Pinus edulis* and *Juniperus osteosperma* woodland at lower elevations, and *Populus tremuloides* forests at higher elevations.

Vegetation: Grasslands in this alliance occur in a mosaic with shrublands on submontane slopes and benches in the Uinta Basin of Utah. Stands have a moderately dense cover of graminoids codominated by the cool-season, perennial bunch grasses *Achnatherum nelsonii* (= *Stipa nelsonii*) and *Koeleria macrantha*. Other graminoids may include *Aristida purpurea*, *Juncus* spp., *Poa* spp., *Achnatherum hymenoides* (= *Oryzopsis hymenoides*), *Pascopyrum smithii*, and *Hesperostipa comata* (= *Stipa comata*). Scattered shrubs and dwarf-shrubs are typically present, such as *Artemisia tridentata*, *Ericameria nauseosa* (= *Chrysothamnus nauseosus*), *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*), and *Purshia tridentata*. The sparse forb layer may include species of Asteraceae, *Astragalus*, *Delphinium*, *Polygonum*, and the exotic *Taraxacum officinale*.

Dynamics: In the Uinta Basin, mid-altitude *Artemisia* communities have been sprayed with herbicide to encourage the growth of grass (forage) species (Dastrup 1963). This basin has a long history of livestock grazing, and there has been significant deterioration to the vegetation especially in the low-altitude and mid-altitude *Artemisia* communities (Dastrup 1963). The relative grass cover has been reduced from 28% to 17%, and the relative shrub cover has increased from 65% to 78% (Dastrup 1963). Current information on condition was not available.

Similar Alliances:

Similar Alliance Comments:

Synonymy:

- Mid-Altitude *Artemisia* Community. These grasslands occur in openings within this type. (Dastrup 1963)

Comments: Vegetation in this alliance is poorly understood and needs additional description and classification work. Shrubs are common enough in the Uinta Basin stands to consider re-classifying as a shrub herbaceous alliance.

ALLIANCE DISTRIBUTION

Range: These grasslands have been described from openings in shrublands and woodlands in Uinta Basin in northeastern Utah, but is likely more widespread because *Achnatherum nelsonii* occurs throughout much of western North America at elevations of 1500-3350 m.

Nations: US
States/Provinces: UT
TNC Ecoregions: 10:C, 19:C
USFS Ecoregions: M331E:CC
Federal Lands:

ALLIANCE SOURCES

Authors: K. SCHULZ, West **Identifier:** A.1271
References: Dastrup 1963, Graham 1937, Welsh et al. 1987

ACHNATHERUM NELSONII - KOELERIA MACRANTHA HERBACEOUS VEGETATION
Nelson's Needlegrass - Prairie Junegrass Herbaceous Vegetation

ELEMENT CONCEPT

Summary:

Environment:

Vegetation:

Dynamics:

Similar Associations:

Synonymy:

- DRISCOLL FORMATION CODE:V.B.4.b. (Driscoll et al. 1984) B
- *Stipa nelsonii-Koeleria macrantha* (Bourgeron and Engelking 1994) =

GRank & Reasons: G? (94-02-23).

High-ranked species:

Comments:

ELEMENT DISTRIBUTION

Range:

Nations: US

States/Provinces: UT:S?

TNC Ecoregions: 10:C, 19:C

USFS Ecoregions: M331E:CC

Federal Lands:

ELEMENT SOURCES

Authors: WCS **Confidence:** 3 **Identifier:** CEG001707

References: Bourgeron and Engelking 1994, Dastrup 1963, Driscoll et al. 1984

V.A.5.N.d.12. FESTUCA CAMPESTRIS HERBACEOUS ALLIANCE

Prairie Fescue Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This grassland alliance is found in the northwestern Great Plains, in the Northern Rockies on both sides of the Continental Divide, and west into eastern Washington and Oregon. Elevations range from 500-2100 m, but are found only below 1500 m in Canada. Stands occur in glaciated landscapes, on prairies, foothills and mountain slopes. Sites are nearly level to steep slopes on all aspects. Sites range from mesic to relatively xeric. In the northern extent it is restricted to warmer west- and southwest-facing slopes. Soils are derived from a variety of parent materials and are loamy and moderately deep, with neutral pH. These grasslands typically occur in a mosaic with montane forests dominated by *Pinus contorta*. Vegetation included in this alliance is characterized by the dominance of *Festuca campestris*. Codominants may include *Pseudoroegneria spicata* or *Festuca idahoensis*. The forb layer is sparse to moderately dense, often with relatively high species diversity. Scattered woody species may also be present. Annuals are typically sparse. Overall species composition varies geographically with stands east of the Continental Divide resembling Northern Mixed Prairie and stands west of the Divide floristically related to the Intermountain Basin. The east side stands may lack *Festuca idahoensis*, but often include *Bouteloua gracilis*, *Muhlenbergia cuspidata*, *Hesperostipa comata* (= *Stipa comata*), *Artemisia ludoviciana*, *Heterotheca villosa*, *Liatris punctata*, *Lupinus sericeus*, and the dwarf-shrubs *Artemisia frigida* and *Gutierrezia sarothrae*. West of the Divide *Balsamorhiza sagittata*, *Besseyia wyomingensis*, *Castilleja lutescens*, and *Lomatium triternatum* are more common. Other common species include *Antennaria rosea*, *Carex filifolia*, *Carex obtusata*, *Geranium viscosissimum*, *Koeleria macrantha*, *Poa secunda*, *Potentilla gracilis*, *Achnatherum occidentale* (= *Stipa occidentalis*), *Achnatherum richardsonii* (= *Stipa richardsonii*), and the shrub *Rosa arkansana*. Diagnostic of this grassland alliance is the dominance of *Festuca campestris*.

Environment: These grasslands are found in the northwestern Great Plains, in the Northern Rockies on both sides of the Continental Divide, and west into eastern Washington and Oregon. Elevations range from 500-2100 m, but are found only below 1500 m in Canada. Climate is temperate, and mean annual precipitation ranges from 40-60 cm. Stands occur in glaciated landscapes, on prairies, foothills and mountain slopes. Sites are nearly level to steep slopes of all aspects. In the northern extent it is restricted to warmer west- and southwest-facing slopes. Sites range from mesic to relatively xeric. Soils are derived from a variety of parent materials and are loamy and moderately deep, with neutral pH. These grasslands typically occur in a mosaic with montane forests dominated by *Pinus contorta*.

Vegetation: Vegetation included in this alliance occurs in the northwestern Great Plains, northern Rocky Mountains and into the Blue Mountains of eastern Oregon and Washington. Stands have a moderately dense graminoid layer of cool-season, medium-tall bunch grasses that is dominated by *Festuca campestris*. Codominants may include *Pseudoroegneria spicata* or *Festuca idahoensis*. The forb layer is sparse to moderately dense, often with relatively high species diversity. Scattered woody species may also be present. Annuals are typically sparse. Overall species composition varies with geography with stands east of the Continental Divide resembling Northern Mixed Prairie and stands west of the Divide floristically related to the Intermountain Basin. The east side stands may lack *Festuca idahoensis*, but often include *Bouteloua gracilis*, *Muhlenbergia cuspidata*, *Hesperostipa comata* (= *Stipa comata*), *Artemisia ludoviciana*, *Heterotheca villosa*, *Liatris punctata*, *Lupinus sericeus*, and the dwarf-shrubs *Artemisia frigida* and *Gutierrezia sarothrae*. West of the Divide *Balsamorhiza sagittata*, *Besseyia wyomingensis*, *Castilleja lutescens*, and *Lomatium triternatum* are more common. Other common species include *Antennaria rosea*, *Carex filifolia*, *Carex obtusata*, *Geranium viscosissimum*, *Koeleria macrantha*, *Poa secunda*, *Potentilla gracilis*, *Achnatherum occidentale* (= *Stipa occidentalis*), *Achnatherum richardsonii* (= *Stipa richardsonii*), and the shrub *Rosa arkansana*.

Dynamics: *Festuca campestris* is highly palatable throughout the grazing season. Summer overgrazing for 2-3 years can result in the loss of *Festuca campestris* in the stand (Hodgkinson and Young 1973). Although a light stocking rate for 32 years did not affect range condition, a modest increase in stocking rate led to a marked decline in range condition. The major change was a measurable reduction in basal area of *Festuca campestris* (Willms et al. 1985). Long-term heavy grazing on moister sites can result in a shift to a Kentucky bluegrass - timothy type (Willoughby 1997). Willms and Fraser (1992) found *Festuca campestris* to be highly susceptible to grazing during the growing season, and conclude that optimum management would include dormant-season grazing. Mueggler and Stewart (1980) also suggest that *Festuca campestris* is least susceptible to grazing damage in fall and winter.

Festuca campestris is well-adapted to periodic burning. Burn intervals of 5-10 years have been recommended for *Festuca* maintenance. Two to 3 years are needed to recover from a burn, so short fire-return intervals impede *Festuca* re-establishment. Longer intervals result in excessive litter build-up that causes high tussock mortality.

Data current as of 17 Apr 2003.

Growing-season burns reduce plant vigor and recovery takes longer. Floral development is initiated in the fall, so spring burning can result in a reduction in seed production (FEIS 1998). *Festuca idahoensis* is also highly palatable in most seasons, but can withstand occasional heavy grazing. It is "a fire-sensitive species that can be severely damaged by summer and fall fires," and may take many years to recover its pre-fire cover. The size of clumps affects fire sensitivity, with smaller ones being less sensitive due to lower fuel build-up. Late summer (August) burns cause more damage than fall (September) burns (FEIS 1998). *Pseudoroegneria spicata* shows an inconsistent reaction to grazing, increasing on some grazed sites while decreasing on others. It seems to recover more quickly from overgrazing than *Festuca campestris* (Mueggler and Stewart 1980). It tolerates dormant-period grazing well, but is sensitive to defoliation during the growing season. Light spring use or fall grazing can help retain plant vigor. Plants usually survive fire, but regrowth may be variable. It is particularly sensitive to defoliation in late spring (FEIS 1998).

Similar Alliances:

- FESTUCA ALTAICA HERBACEOUS ALLIANCE (A.1250)
- PSEUDOROEGNERIA SPICATA HERBACEOUS ALLIANCE (A.1265)
- FESTUCA IDAHOENSIS HERBACEOUS ALLIANCE (A.1251)

Similar Alliance Comments: Stands in the *Festuca altaica* Herbaceous Alliance (A.1250) are dominated by the closely related species *Festuca altaica* and *Festuca hallii*. Stands in this alliance are often codominated by *Pseudoroegneria spicata* and *Festuca idahoensis* and share similar habitats.

Synonymy:

- Fescue Grassland, in part (Coupland 1952)
- Fescue Prairie, in part (Coupland 1992b)
- Upper Grassland (Tisdale 1947)

Comments: *Festuca campestris* is generally recognized as part of the *Festuca scabrella* complex which includes two other species, *Festuca altaica* and *Festuca hallii* (Aiken and Darbyshire 1996, Aiken et al. 1996). *Festuca campestris* is thought to occur as far east as the western edge of the Great Plains. The other two species occur in the northern Great Plains of Saskatchewan and Manitoba, Canada, and likely North Dakota. The range of *Festuca altaica* extends north to Alaska. Stands dominated by these other two species are currently classified in the *Festuca altaica* Herbaceous Alliance (A.1250). Further investigation is needed to confirm the distribution of the species in the *Festuca altaica* complex.

Tisdale (1947) described an 'Upper Grassland' from British Columbia, Canada, that closely resembles *Festuca altaica* - *Pseudoroegneria spicata* Herbaceous Vegetation (CEGL001629). Looman (1969) reported *Festuca altaica* grasslands occurring across southwestern Canada from British Columbia to western Manitoba. Although it is likely stands in eastern Saskatchewan and Manitoba are dominated by *Festuca hallii*, the stands in British Columbia, Alberta and western Saskatchewan may be dominated by *Festuca campestris*.

ALLIANCE DISTRIBUTION

Range: These grasslands occur on the northwestern edge of the Great Plains in northwestern Montana, and west into Idaho, eastern Washington, northeastern Oregon, and western Saskatchewan and Alberta, Canada. The alliance likely occurs in the Canadian province of British Columbia, but has not yet been described from there.

Nations: CA US

States/Provinces: AB ID MT ND? OR WA

TNC Ecoregions: 26:C, 34:C, 6:C

USFS Ecoregions: 331A:CC, 331D:CC, M331A:??, M332B:CC, M332C:CC, M332D:CC, M332E:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC

Federal Lands: NPS (Glacier?)

ALLIANCE SOURCES

Authors: K. SCHULZ, West **Identifier:** A.1255

References: Aiken and Darbyshire 1990, Aiken et al. 1996, Comer et al. 1999, Coupland 1952, Coupland 1992b, Daubenmire 1970, FEIS 1998, Hodgkinson and Young 1973, Looman 1969, McLean 1970, Mueggler and Stewart 1980, Pfister et al. 1977, Tisdale 1947, Tisdale 1982, Tisdale and Bramble-Brodahl 1983, Tisdale and McLean 1957, Willms and Fraser 1992, Willms et al. 1985, Willoughby 1997

FESTUCA ALTAICA - PSEUDOROEGNERIA SPICATA HERBACEOUS VEGETATION

Rough Fescue - Bluebunch Wheatgrass Herbaceous Vegetation

*Rough Fescue - Bluebunch Wheatgrass Mixedgrass Prairie***Ecological Group (SCS;MCS):** Great Plains Mixedgrass Prairies (521-10; 2.9.3.2)**ELEMENT CONCEPT**

Summary: *Festuca altaica* - *Pseudoroegneria spicata* Herbaceous Vegetation is found in the northwestern Great Plains on both level topography and steep slopes of all aspects. Soils are loamy and moderately deep. This midgrass community is fairly arid and heavily dominated by *Festuca altaica* (= *Festuca scabrella*). *Pseudoroegneria spicata* is abundant while *Festuca idahoensis* is common. Other graminoids that may be found are *Bouteloua gracilis*, *Muhlenbergia cuspidata*, and *Hesperostipa comata* (= *Stipa comata*). Forbs may include *Heterotheca villosa*, *Liatris punctata*, and *Lupinus sericeus*. The short shrubs *Artemisia frigida* and *Gutierrezia sarothrae* are also common.

Environment: This community has been described in Montana between 900-1800 m (3000-4000) on both level topography and steep slopes of all aspects (Mueggler and Stewart 1980). Soils were loamy and moderately deep.

Vegetation: This midgrass community is heavily dominated by *Festuca altaica* (= *Festuca scabrella*). *Pseudoroegneria spicata* is abundant while *Festuca idahoensis* is common. Other graminoids that may be found are *Bouteloua gracilis*, *Muhlenbergia cuspidata*, and *Hesperostipa comata* (= *Stipa comata*). Forbs may include *Heterotheca villosa*, *Liatris punctata*, and *Lupinus sericeus*. The short shrubs *Artemisia frigida* and *Gutierrezia sarothrae* are also common.

Dynamics:**Similar Associations:****Synonymy:**

- DRISCOLL FORMATION CODE: V.B.4.b. (Driscoll et al. 1984) B
- *Festuca scabrella*-*Pseudoroegneria spicata* (Bourgeron and Engelking 1994) =
- *Festuca scabrella* / *Agropyron spicatum* Habitat Type (Mueggler and Stewart 1980) =

GRank & Reasons: G4 (96-02-01).**High-ranked species:****Comments:****ELEMENT DISTRIBUTION****Range:** This community is found in Montana.**Nations:** CA? US**States/Provinces:** AB?, MT:S4, ND?**TNC Ecoregions:** 34:C**USFS Ecoregions:** 331D:CC, M331A:??, M332B:CC, M332C:CC, M332D:CC, M332E:C?, M333B:CC, M333C:CC**Federal Lands:****ELEMENT SOURCES****Authors:** J. Drake, WCS **Confidence:** 1 **Identifier:** CEGL001629**References:** Bourgeron and Engelking 1994, Driscoll et al. 1984, Mueggler and Stewart 1980

FESTUCA CAMPESTRIS - FESTUCA IDAHOENSIS HERBACEOUS VEGETATION

Prairie Fescue - Idaho Fescue Herbaceous Vegetation

*Rough Fescue - Idaho Fescue Mixedgrass Prairie***ELEMENT CONCEPT**

Summary: *Festuca campestris* - *Festuca idahoensis* Herbaceous Vegetation is found in the northwestern Great Plains on moderate to steep mountain and foothill slopes. It is found on both sides of the Continental Divide on mesic sites from 900-2100 m elevation on any aspect, becoming restricted to west- and southwest-facing slopes farther north. Soils are loamy and moderately deep on a variety of soil parent materials. This midgrass community is dominated by *Festuca campestris*. *Festuca idahoensis* is also abundant, but *Festuca campestris* generally has the greater canopy cover and is clearly dominant on undisturbed sites. *Carex obtusata* may be common, especially on more mesic sites. Other graminoids may also be found, including *Danthonia intermedia*, *Koeleria macrantha*, *Achnatherum richardsonii* (= *Stipa richardsonii*) and *Achnatherum occidentale* (= *Stipa occidentalis*). *Lupinus sericeus* and *Geranium viscosissimum* are not found in all stands but may be dominant in some. Additional forbs may include *Achillea millefolium*, *Galium boreale*, *Geum triflorum* and *Potentilla gracilis*.

Environment: This community is found on moderate to steep mountain and foothill slopes on both sides of the Continental Divide. It occurs on mesic sites from 900 to 2100 m elevation on any aspect, becoming restricted to west- and southwest-facing slopes farther north. Soils are loamy and moderately deep on a variety of soil parent materials.

Vegetation: Although rich in forbs, this is a grassland community clearly dominated by *Festuca campestris* and *Festuca idahoensis*. Tussocks of the bunchgrass *Festuca campestris* are a prominent component with culms that may be taller than 75 cm. *Lupinus sericeus* and *Geranium viscosissimum* are not found in all stands but may be dominant in some. *Symphoricarpos occidentalis* and *Rosa arkansana* may occur in shallow depressions within the Fescue matrix.

Dynamics: Periodic fire may have been an important factor in the maintenance of these grasslands.

Similar Associations:

- *Festuca altaica* - *Pseudoroegneria spicata* Herbaceous Vegetation (CEGL001629)

Synonymy:

- DRISCOLL FORMATION CODE:V.B.4.b. (Driscoll et al. 1984) B
- *Festuca scabrella*-*Festuca idahoensis* (Bourgeron and Engelking 1994) =
- *Festuca campestris* - *Festuca idahoensis* type, *Geranium viscosissimum* phase (Mueggler and Stewart 1980)
- *Festuca campestris* - *Festuca idahoensis* type, *Stipa richardsonii* phase (Mueggler and Stewart 1980)
- *Festuca campestris* - *Festuca idahoensis* - *Danthonia parryi*. (Jaques 1979)
- *Festuca campestris* - *Festuca idahoensis* - *Danthonia parryi* (Willoughby et al. 1998)
- *Festucetum scabrella* association (Lynch 1955)

GRank & Reasons: G3 (96-02-01).

High-ranked species:

Comments: *Festuca scabrella* (rough fescue) is now generally recognized as a complex, consisting of three separate species (*Festuca campestris*, *Festuca altaica* and *Festuca hallii*) (Aiken and Darbyshire 1990). Kartesz (1999) treats *Festuca scabrella* as *Festuca altaica*. Of the species within the former *Festuca scabrella* complex, *Festuca campestris* is the one most likely to be found with *Festuca idahoensis* at the western edge of the Great Plains (ibid., Aiken et al. 1996). Confirmation is required that *Festuca campestris* is the species of fescue that occurs in this vegetation type.

The dominance of *Festuca campestris* with a significant cover of *Festuca idahoensis* defines this type. The absence or low cover of *Danthonia parryi* is also significant. *Danthonia parryi* is commonly a third codominant in the Alberta foothills, forming a *Festuca campestris* - *Festuca idahoensis* - *Danthonia parryi* type, usually associated with deeper soils. *Danthonia parryi* has been noted as occasionally codominant with *Festuca scabrella* in northern Montana, east of the Continental Divide, but Mueggler and Stewart (1980) did not note enough other differences to define a separate type. Additional work is needed, but these likely should be considered two separate communities, given the extensive occurrence of the *Festuca campestris* - *Festuca idahoensis* - *Danthonia parryi* type in Alberta.

Mueggler and Stewart (1980) recognize two phases of the *Festuca campestris* - *Festuca idahoensis* type. The *Geranium viscosissimum* phase is characterized by the presence of *Geranium viscosissimum* and *Potentilla gracilis*, with a greater abundance of *Achnatherum occidentale* (= *Stipa occidentalis*) and *Pseudoroegneria spicata* than

generally present in the rest of the type. The *Achnatherum richardsonii* (= *Stipa richardsonii*) phase is found on moist sites. It is similar to the *Geranium viscosissimum* phase, but with conspicuous cover of *Achnatherum richardsonii* and substantial *Carex filifolia* and *Danthonia intermedia*.

Festuca campestris - *Festuca idahoensis* - *Danthonia parryi* has been described by a number of authors (e.g., Jaques 1979, Willoughby et al. 1998). It is considered the "modal grassland community type in Black Chernozemic soils in the foothills of southern Alberta" (Willoughby et al. 1998). Although *Festuca campestris* remains clearly dominant, it is separated from the *Festuca campestris* - *Festuca idahoensis* type by the prominence of *Danthonia parryi*. Koterba and Habeck (1971) looked at grasslands along the North Fork Valley, Glacier National Park, Montana. They found stands in which *Festuca scabrella* was a common associate with *Festuca idahoensis*, but concluded that these grasslands in general represent a mixture of Great Plains and Intermountain elements, making them floristically unusual. The *Festucetum scabrella* association of Lynch (1955) in Glacier County, Montana, is dominated by *Festuca scabrella* with *Festuca ovina* and *Achnatherum nelsonii* ssp. *dorei* (= *Stipa columbiana*) also significant. As Lynch considers *Festuca idahoensis* to be an intergrading variety of *Festuca ovina*, this association appears to be similar to *Festuca campestris* - *Festuca idahoensis* Herbaceous Vegetation (CEGL001628). Lynch notes similarities with other *Festuca scabrella* types in Alberta, Washington and Idaho.

Tisdale (1982) compared the plant communities documented in the Pacific Northwest Bunchgrass region. He found the *Festuca scabrella* / *Festuca idahoensis* types reported in Montana (Mueggler and Stewart 1980) and in Idaho (Tisdale 1979) to be similar; however, a subsequent study (Tisdale and Bramble-Brodahl 1983) did not note a *Festuca scabrella* - *Festuca idahoensis* type. Tisdale (1982) suggests that the relationship is unclear between similar types reported for British Columbia, Oregon and Washington.

Some stands of *Festuca altaica* - *Pseudoroegneria spicata* Herbaceous Vegetation (CEGL001629) may have a significant amount of *Festuca idahoensis*, making separation with the *Festuca campestris* - *Festuca idahoensis* vegetation type problematic. However, the presence of a number of Great Plains species in combination with *Festuca campestris* and *Pseudoroegneria spicata* seems to separate the two types. Species reported as occurring regularly (>50% constancy) in the *Festuca campestris* - *Pseudoroegneria spicata* - *Stipa comata* type but not reported for the *Festuca campestris* - *Festuca idahoensis* type include *Gaura coccinea*, *Gutierrezia sarothrae*, *Liatris punctata*, and *Hesperostipa comata* (= *Stipa comata*) (Mueggler and Stewart 1980). Shrubs and *Pseudoroegneria spicata* tend to be less prominent in the *Festuca campestris* - *Festuca idahoensis* type while *Danthonia intermedia*, *Achnatherum occidentale* (= *Stipa occidentalis*), and *Carex* spp. are more p

ELEMENT DISTRIBUTION

Range: This community is found in Montana, north of 46 degrees latitude, into southwestern Alberta, Canada.

Nations: CA US

States/Provinces: AB:S?, ID:S1, MT:S3, OR:S1, WA:S1

TNC Ecoregions: 26:C, 6:C

USFS Ecoregions: 331A:CC, 331D:CC, M331A:??, M332B:CC, M332C:CC, M332D:CC, M332E:CC, M332G:CC, M333A:CC, M333B:CC, M333D:CC

Federal Lands: NPS (Glacier?)

ELEMENT SOURCES

Authors: WCS **Confidence:** 2 **Identifier:** CEGL001628

References: Aiken and Darbyshire 1990, Aiken et al. 1996, Bourgeron and Engelking 1994, Daubenmire 1970, Driscoll et al. 1984, FEIS 1998, Hodgkinson and Young 1973, Kartesz 1999, Lynch 1955, McLean 1970, Mueggler and Stewart 1980, Tisdale 1947, Tisdale 1979, Tisdale 1982, Tisdale and Bramble-Brodahl 1983, Tisdale and McLean 1957, Willms and Fraser 1992, Willms et al. 1985, Willoughby 1997, Willoughby et al. 1998

V.A.5.N.d.8. FESTUCA IDAHOENSIS HERBACEOUS ALLIANCE

Idaho Fescue Herbaceous Alliance

ALLIANCE CONCEPT

Summary: These grasslands are characteristic of the Palouse Prairie on the Columbia Plateau, but extend east into the Rocky Mountains and south into the Great Basin. Stands are found on undulating prairie, valley bottoms, canyon benches, and expansive park meadow openings in montane and subalpine forests, on ridges above subalpine forests in the Rocky Mountains, on coastal terraces and inland bald hills, and glacial outwash plains. Stands also occur in coastal and inland prairies on the western side of the Cascades Mountains. Soils are moderately to well-drained, loams or silt loams or silty clays, that are generally deep, and derived from alluvium, colluvium, or loess. Vegetation included in this alliance is characterized by the dominance or codominance of *Festuca idahoensis*. Other important species may include *Sericocarpus rigidus* (= *Aster curtus*), *Carex filifolia*, *Carex inops* ssp. *heliophila*, *Carex obtusata*, *Danthonia intermedia*, *Elymus caninus*, *Elymus trachycaulus*, *Eriogonum caespitosum*, *Eriogonum heracleoides*, *Festuca thurberi*, *Geranium caespitosum*, *Koeleria macrantha*, *Pascopyrum smithii*, *Poa secunda*, *Pseudoroegneria spicata*, or *Achnatherum richardsonii* (= *Stipa richardsonii*). Scattered shrubs and dwarf-shrubs, such as species of *Symphoricarpos* and *Rosa*, are present in some stands. Diagnostic of this widespread grassland alliance is the dominance or codominance of *Festuca idahoensis*.

Environment: These grasslands are characteristic of the Palouse Prairie on the Columbia Plateau, but extend east into the Rocky Mountains and south into the Great Basin. Stands also occur in coastal and inland prairies on the western side of the Cascades Mountains. Elevations range from 20-3500 m. Climate varies geographically. East of the Cascades Mountains, climate is temperate and mostly continental. Mean annual precipitation ranges from 33-60 cm. Precipitation primarily occurs in the winter as snow or rain. This moisture is stored in the soil profile and utilized throughout the typically dry summers. West of the Cascade Mountains, the maritime climate is much wetter, with mean annual precipitation over 100 cm. Stands are found on undulating prairie, valley bottoms, canyon benches, expansive park meadow openings in montane and subalpine forests, on ridges above subalpine forests in the Rocky Mountains, on coastal terraces and inland bald hills, and glacial outwash plains. Sites are nearly level to steep slopes. Aspect varies depending on elevation, latitude and soil moisture. Soils are generally deep, but may be shallow and rocky. They are moderately to well-drained, loams or silt loams or silty clays, with pH of 5.8-7.2 and derived from alluvium, colluvium, or loess. Parent material may include igneous, sedimentary and metamorphic rocks such as basalt, tuff, granite, lava, breccia, calcareous conglomerate, volcanic andesite, quartzite, sandstone, shale, limestone and rhyolite.

Adjacent stands vary with geography. In the Palouse Prairie and Rocky Mountains, adjacent stands often include other grasslands dominated by *Pseudoroegneria spicata*, *Poa secunda* or other perennial grasses, shrublands dominated by *Artemisia tridentata*, and montane and subalpine forests dominated by *Pinus ponderosa*, *Picea engelmannii*, *Pseudotsuga menziesii*, *Abies lasiocarpa* or one of a number of other species. West of the Cascades, adjacent stands are wet meadows dominated by *Festuca rubra* and *Deschampsia caespitosa*, and forests or woodlands dominated by *Pseudotsuga menziesii* or *Quercus garryana*.

Vegetation: These grasslands occur east of the Cascade Mountains in the Palouse Prairie and intermountain steppe, west of the Cascade Mountains in grasslands of the Willamette Valley, Puget Sound basin and along the coast in the northwestern U.S. They also occur in parks and on ridges in the montane and subalpine zones in the Rocky Mountains. Stands have a moderate to dense cover of graminoids (<1 m tall) that is dominated or codominated by the cool-season, perennial bunchgrass *Festuca idahoensis*. The associated species in these grasslands vary geographically.

In the Palouse region codominant and characteristic species may include *Pseudoroegneria spicata*, *Poa secunda*, *Koeleria macrantha*, *Eriogonum caespitosum*, *Eriogonum heracleoides* and on drier sites *Hieracium cynoglossoides*. Scattered shrubs and dwarf-shrubs such as *Symphoricarpos albus*, *Rosa nutkana*, and *Rosa woodsii* are present in some stands. Disturbed stands may be codominated by *Ericameria nauseosa* (= *Chrysothamnus nauseosus*) and the exotics *Poa pratensis* or *Bromus tectorum* (on dry sites). In the Rocky Mountains codominants can include *Carex filifolia*, *Carex inops* ssp. *heliophila*, *Carex obtusata*, *Danthonia intermedia*, *Elymus trachycaulus*, *Festuca thurberi*, *Geranium caespitosum*, *Koeleria macrantha*, *Pascopyrum smithii*, *Pseudoroegneria spicata* or *Achnatherum richardsonii* (= *Stipa richardsonii*). Other characteristic species include *Artemisia ludoviciana*, *Antennaria rosea*, *Gaura coccinea*, *Bouteloua gracilis* or *Hesperostipa comata* (= *Stipa comata*).

West of the Cascades, codominants include *Elymus caninus*, *Koeleria macrantha*, and *Sericocarpus rigidus* (= *Aster curtus*) for inland stands. These fire-dependent stands often are invaded by woody species such as *Pseudotsuga menziesii* and *Cytisus scoparius* (an exotic), exotic forage species like *Agrostis capillaris* (= *Agrostis tenuis*), *Agrostis gigantea* (= *Agrostis alba*), *Dactylis glomerata* or *Poa pratensis*, and many exotic weeds. *Festuca idahoensis* stands on the coast may include species such as *Danthonia californica*, *Festuca rubra*, *Melica californica*, *Nassella pulchra* (= *Stipa pulchra*), and often many exotic species.

Dynamics: Most associations included in this alliance are rare or threatened and ranked as a G3 to G1. Most of these grasslands in the Palouse Region have been converted to agriculture. Without fire, tall shrubs or trees invade and displace grassland species on the remnant other sites. This has led to conversion of isolated grassland fragments to shrublands and forests. Lower treeline occurrences also tend to invasion by shrubs or trees with fire suppression. Past grazing has resulted in altered composition and structure of many stands. Exotic species such as *Poa pratensis* and *Bromus tectorum* have invaded many mesic and xeric stands, respectively (Daubenmire 1970, 1992).

Similar Alliances:

- FESTUCA IDAHOENSIS ALPINE HERBACEOUS ALLIANCE (A.1313)
- CAREX HOODII HERBACEOUS ALLIANCE (A.1253)
- FESTUCA CAMPESTRIS HERBACEOUS ALLIANCE (A.1255)
- PSEUDOROEGNERIA SPICATA HERBACEOUS ALLIANCE (A.1265)
- LEYMUS CINEREUS HERBACEOUS ALLIANCE (A.1204)
- ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE (A.1192)
- DANTHONIA CALIFORNICA HERBACEOUS ALLIANCE (A.1254)
- FESTUCA VIRIDULA HERBACEOUS ALLIANCE (A.1257)

Similar Alliance Comments: Two of the similar alliances have *Festuca idahoensis* as a dominant or codominant in the alliance. The other similar alliances include grasslands that have at least one association where *Festuca idahoensis* is a codominant species. *Festuca idahoensis* is a widespread grassland species in the northern half of the western U.S. and is also a dominant understory species in many forests, woodlands and shrublands.

Synonymy:

- *Festuca idahoensis* Series. includes thirteen *Festuca idahoensis* dominated plant associations. (Johnston 1987)
- Idaho Fescue Series, in part (Sawyer and Keeler-Wolf 1995)
- *Festuca idahoensis* Series, in part (Tisdale 1986)

Comments: Stands in California need further investigation and association-level description, especially the northern and central coastal types, montane types in the Klamath, Cascade and Sierra Nevada mountains, and types on the Modoc Plateau (Holland 1986, Sawyer and Keeler-Wolf 1995). *Festuca idahoensis* - *Carex hoodii* Herbaceous Vegetation (CEGL001609) in this alliance may be very similar to *Carex hoodii* - *Festuca idahoensis* Herbaceous Vegetation (CEGL001595) in the *Carex hoodii* Herbaceous Alliance (A.1253). The reference cited, Lewis (1971), does not describe the *Festuca idahoensis* - *Carex hoodii* herbaceous association. More study is needed to resolve if both associations are needed.

ALLIANCE DISTRIBUTION

Range: Grasslands included in this alliance are most characteristic of the Palouse Prairie of eastern Washington and eastern Oregon and Idaho, but also extend east into the northwestern Great Plains of eastern Montana, and south into the southern Rocky Mountains, Colorado Plateau and Modoc Plateau. The alliance also occurs west of the Cascades in the Willamette Valley, Puget Sound basin, and along the coast south into northern California. It may also occur in Alberta and other adjacent Canadian provinces.

Nations: CA US

States/Provinces: AB BC CA CO ID MT NV OR UT? WA WY

TNC Ecoregions: 10:C, 11:C, 19:C, 20:C, 26:C, 2:C, 6:C, 9:C

USFS Ecoregions: 242A:CC, 331A:CC, 331D:CC, 331F:C?, 331G:CC, 342B:CC, 342C:CC, 342I:CC, M331A:CC, M331B:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332C:C?, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333D:CC

Federal Lands: DOD (Fort Lewis); NPS (Yellowstone); USFS (Nez Perce, White River NF)

ALLIANCE SOURCES

Authors: K. SCHULZ, West **Identifier:** A.1251

References: Bond 1959, Brown and Thompson 1965, Caicco 1983, Chappell et al. 1997, Cooper and Lesica 1992, Cooper et al. 1995, Cooper et al. 1997, Crawford et al. 1994, Daubenmire 1970, Daubenmire 1992, DeVilice and Lesica 1993, Evans et al. 1984, Hansen 1985, Hansen and Hoffman 1988, Harrington 1978, Hess 1981, Hess and Data current as of 17 Apr 2003.

Wasser 1982, Holland 1986b, Hurd 1961, Johnson and Clausnitzer 1992, Johnson and Simon 1985, Johnson and Simon 1987, Johnston 1987, Klish 1977, Komarkova 1986, Lang 1961, Lewis 1971, Macdonald 1989, Magee 1985, Mattson 1984, McLean 1970, Mueggler and Stewart 1980, Paulsen 1969, Poulton 1955, Reid et al. 1994, Sawyer and Keeler-Wolf 1995, Terwilliger et al. 1979a, Tisdale 1947, Tisdale 1986, Tisdale and Bramble-Brodahl 1983, Turner and Dortignac 1954, WANHP n.d., Ward and Keith 1962, Wasser and Hess 1982

FESTUCA IDAHOENSIS - PSEUDOROEGNERIA SPICATA HERBACEOUS VEGETATION

Idaho Fescue - Bluebunch Wheatgrass Herbaceous Vegetation

Idaho Fescue - Bluebunch Wheatgrass Mixedgrass

ELEMENT CONCEPT

Summary:

Environment:

Vegetation:

Dynamics:

Similar Associations:

Synonymy:

- DRISCOLL FORMATION CODE:V.B.4.b. (Driscoll et al. 1984) B
- *Festuca idahoensis-Pseudoroegneria spicata* (Bourgeron and Engelking 1994) =

GRank & Reasons: G4 (96-02-01).

High-ranked species:

Comments:

ELEMENT DISTRIBUTION

Range:

Nations: US

States/Provinces: CA:S?, ID:S3, MT:S4, WA:S2, WY:S3

TNC Ecoregions: 10:C, 20:C

USFS Ecoregions: M331A:CC, M331J:CC, M332A:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333D:CC

Federal Lands:

ELEMENT SOURCES

Authors: WCS **Confidence:** 1 **Identifier:** CEG001624

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Mueggler and Stewart 1980, Tisdale 1986

V.A.5.N.d.27. HESPEROSTIPA COMATA BUNCH HERBACEOUS ALLIANCE

Needle-and-Thread Bunch Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This grassland alliance is found on sandy soils in the intermountain steppe, Wyoming Basin, Colorado Plateau, Great Basin and Columbia Plateau. Stands typically occur on upland sites with coarse-textured soils such as sandstone outcrop ridges in the plains, dry-sandy sites in the Columbia Basin, and parks on dissected alluvial fans below sandstone plateaus, but not dunes. Sites are on flat to moderately steep, often south-facing slopes, but can occur on any aspect. Soils are shallow to moderately deep, well-drained, coarse-textured, and non-saline. Grasslands included in this alliance are characterized by a moderately dense herbaceous layer dominated by *Hesperostipa comata* (= *Stipa comata*), but cover ranges from sparse to dense. *Achnatherum hymenoides* (= *Oryzopsis hymenoides*) or *Poa secunda* codominate some stands. Other graminoids may include *Aristida purpurea*, *Bouteloua gracilis*, *Carex filifolia*, *Koeleria macrantha*, *Pleuraphis jamesii* (= *Hilaria jamesii*), or *Sporobolus cryptandrus*. Shrubs and dwarf-shrubs are sparse (<10%) and may include scattered *Artemisia cana*, *Artemisia frigida*, *Artemisia tridentata*, or *Ericameria nauseosa* (= *Chrysothamnus nauseosus*). Forb cover is also sparse, but can be relatively diverse. Common forbs are *Gaura coccinea*, *Lappula occidentalis* (= *Lappula redowskii*), *Lithophragma glabrum*, *Lupinus pusillus*, *Opuntia aurea* (= *Opuntia basilaris* var. *aurea*), *Opuntia polyacantha*, *Plantago patagonica*, or *Pediomelum argophyllum* (= *Psoralea argophylla*). Cryptogams are important in some stands with up to 40% ground cover on sites in the Colorado Plateau. Diagnostic of this grassland alliance is the dominance of *Hesperostipa comata* in the herbaceous layer and the lack of significant cover of *Bouteloua gracilis* or *Nassella viridula*.

Environment: Grasslands included in this alliance are found on sandy soils in the intermountain steppe, Wyoming Basin and Colorado Plateau. Elevations range from 350-425 m in the Columbia Basin to 1100-1850 m elsewhere. Climate is temperate, mostly continental and semi-arid to arid. Mean annual precipitation ranges from 25-35 cm. The year-to-year variation of annual precipitation is great. Precipitation occurs mostly in during the winter in the intermountain steppe. In the Great Plains, precipitation occurs mostly in the spring. Summers are hot and dry, except for locally occurring, high-intensity convective storms. Stands typically occur on upland sites with coarse-textured soils such as sandstone outcrop ridges in the plains, dry-sandy sites in the Columbia Basin, parks on dissected alluvial fans below sandstone plateaus, but not dunes. Sites are on flat to moderately steep, often south-facing slopes, but can occur any aspect. Soils are well-drained, shallow to moderately deep, and non-saline with loamy sand to sandy loam texture. Parent materials often include gravel and sand from sandstone, or weathered volcanic ash.

Adjacent stands include shrublands dominated by *Artemisia tridentata* or more often grasslands dominated by *Pascopyrum smithii* in mesic bottomlands in the plains, *Bouteloua gracilis* in xeric plains, or *Pseudoroegneria spicata* or *Festuca idahoensis* in the Columbia Basin.

Vegetation: These grasslands occur on sandy upland sites in the northern Great Plains, Wyoming and Columbia Basins, and the Colorado Plateau. Stands typically have a moderately dense herbaceous layer, but range from sparse cover on the arid Colorado Plateau to dense cover in the relatively mesic Columbia Basin. This herbaceous layer is dominated the medium-tall, cool-season bunchgrass *Hesperostipa comata* (= *Stipa comata*). *Achnatherum hymenoides* (= *Oryzopsis hymenoides*) or *Poa secunda* codominate some stands. Other graminoids may include *Aristida purpurea*, *Bouteloua gracilis*, *Carex filifolia*, *Koeleria macrantha*, *Pleuraphis jamesii* (= *Hilaria jamesii*), or *Sporobolus cryptandrus*. Shrubs and dwarf-shrubs are sparse and may include scattered *Artemisia cana*, *Artemisia frigida*, *Artemisia tridentata*, or *Ericameria nauseosa* (= *Chrysothamnus nauseosus*). Forb cover is also sparse, but can be relatively diverse with species such as *Gaura coccinea*, *Lappula occidentalis* (= *Lappula redowskii*), *Lithophragma glabrum*, *Lupinus pusillus*, *Opuntia aurea* (= *Opuntia basilaris* var. *aurea*), *Opuntia polyacantha*, *Plantago patagonica* or *Pediomelum argophyllum* (= *Psoralea argophylla*). Cryptogams are important in some stands with up to 40% ground cover on sites the Colorado Plateau.

Dynamics: These grasslands are dominated by relatively deep-rooted grasses that use soil moisture below 0.5 m during the typically dry summers. The coarse-textured soils allow for rapid infiltration and storage of winter and summer precipitation (Daubenmire 1970, Kleiner 1968, Kleiner and Harper 1977, Thilenius et al. 1995). Burning generally kills or severely damages *Hesperostipa comata* plants. After fire, regeneration of this non-rhizomatous bunchgrass is through seed and may take many years to reach prefire densities (FEIS 1998).

Exotic species such as *Bromus tectorum*, *Draba verna*, *Lactuca serriola*, *Tragopogon dubius* are present in some these stands (Daubenmire 1970). The cool-season annual grass *Bromus tectorum* can be an effective competitor for

Data current as of 17 Apr 2003.

winter soil moisture because it can germinate in the fall, over-winter, then begin re-growing in the early spring before it is warm enough for many perennial grasses, completing its lifecycle and depleting soil moisture before the dry summer weather begins. This annual species also produces abundant fine fuels that carry fire well, and increase the frequency of fires (FEIS 1998).

Similar Alliances:

- HESPEROSTIPA COMATA - BOUTELOUA GRACILIS HERBACEOUS ALLIANCE (A.1234)
- NASSELLA VIRIDULA - HESPEROSTIPA COMATA HERBACEOUS ALLIANCE (A.3521)

Similar Alliance Comments: Stands in the similar alliances are codominated by *Bouteloua gracilis* or *Nassella viridula* whereas these stands are not.

Synonymy:

Comments: More investigation is needed to clarify the concept of this alliance. Some stands described by Kleiner (1968) have less than 25% herbaceous cover and are better classified in a sparsely vegetated alliance. Little information was available for *Hesperostipa comata* - *Achnatherum hymenoides* Herbaceous Vegetation (CEGL001703).

ALLIANCE DISTRIBUTION

Range: Vegetation included in this grassland alliance is found in the central Wyoming Basins, on the Colorado Plateau of Utah and Colorado, in the Great Basin and on the dry interior steppe of eastern Oregon, Washington and possibly British Columbia, Canada.

Nations: CA? US

States/Provinces: AZ BC? CO OR UT WA WY

TNC Ecoregions: 10:C, 18:C, 19:C, 20:C, 26:C, 6:C

USFS Ecoregions: 313A:CC, 313D:CC, 331F:CC, 331G:CC, 341B:CC, 341C:CC, 342G:CC, 342I:CC, M341C:CC

Federal Lands: DOE (Hanford); NPS (Boardman RNA, Canyonlands, Wupatki, Zion); USFWS (Ouray)

ALLIANCE SOURCES

Authors: K. SCHULZ, West **Identifier:** A.1270

References: Daubenmire 1970, FEIS 1998, Kleiner 1968, Kleiner 1983, Kleiner and Harper 1977, Poulton 1955, Rzedowski 1981, Sweetwater Uranium Project 1978, Thilenius et al. 1995, Youtie 1990

HESPEROSTIPA COMATA - POA SECUNDA HERBACEOUS VEGETATION
Needle-and-Thread - Curly Bluegrass Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This association is endemic to the Palouse Prairie region of Oregon and Washington. Similar sandy soil sites support sparse shrub cover of *Purshia tridentata*, *Artemisia tridentata*, or *Artemisia tripartita* in the Columbia Basin. Sandy to gravelly soils or certain low fertility soils (old weathered volcanic ash) are associated with this type. This community occurs in more climatically moist areas than sites of *Artemisia tridentata* ssp. *wyomingensis* / *Hesperostipa comata* Shrubland (CEGL001051). This is an open to closed vegetation type with most of its total cover found in only the mid-tall bunchgrass lifeform. *Ericameria* spp. (= *Chrysothamnus* spp.) can be present or codominant especially on disturbed sites. The general aspect is of a bunchgrass community with *Hesperostipa comata* (= *Stipa comata*) dominating the midgrass layer. Some stands have a short bunchgrass layer of *Poa secunda*. Broad-leaved herbs typically contribute little to composition of individual sites. Annual grasses and forbs are common and can be diverse. In disturbed sites *Bromus tectorum* and *Plantago patagonica* are common. A diverse ground moss and lichen layer can cover much of the space between vascular plants, although it can be displaced with ground disturbance.

Environment: This association is found in the Columbia Basin of southeastern Washington, primarily in the *Pseudoroegneria - Poa* and *Pseudoroegneria - Festuca* zones of Daubenmire (1970). The region is shrub-steppe, in the rainshadow of the Cascade Ranges, and too dry to support forest vegetation. The climate is characterized by moderately cold winters and warm to hot summers. Precipitation occurs primarily in the winter as rains and occasional snows. Elevations where found range from roughly 1100-2950 feet, and the slopes range from gentle to moderate.

This association occurs on sandy, or gravelly soils, in some cases derived from strongly weathered volcanic ash. They are deep, coarse-textured and have low fertility. Additionally, sands and gravels have low moisture-holding capacity.

Vegetation: This grassland association is characterized by the codominance of the perennial bunch grasses *Hesperostipa comata* (= *Stipa comata*) and *Poa secunda* (= var. *secunda*). Together they average nearly 100% cover in most stands. A very few scattered evergreen needle-leaved shrubs may occur, including *Ericameria nauseosa* (= *Chrysothamnus nauseosus*) and *Chrysothamnus viscidiflorus*. Only a few perennial forbs occur, most with less than 1% cover. *Lithophragma glabrum* (= *Lithophragma bulbiferum*) is the most abundant with 2-5% cover. Species richness is low, with only 5-12 species occurring. A well-developed, but sensitive, cryptogam layer can cover the soil surface on undisturbed sites.

Dynamics:**Similar Associations:****Synonymy:**

- DRISCOLL FORMATION CODE:V.B.4.b. (Driscoll et al. 1984) B
- *Stipa comata*-*Poa secunda* (Bourgeron and Engelking 1994) =
- *Hesperostipa comata* community type (Daubenmire 1970). on sandy to infertile soils outside the range of sagebrush and bitterbrush in the Palouse of Oregon and Washington.

GRank & Reasons: G1 (00-12-17). Historically, this association was endemic to the Palouse Prairie region of Oregon and Washington. The best condition Palouse versions are too small to be occurrences in Washington or in Oregon. Representatives on the Hanford Monument in Washington are in fair to poor condition. Boardman RNA in Oregon has similar stands as currently at Hanford Monument. Agricultural conversion and composition changes following livestock grazing have apparently retrogressed most of the remaining sites to new exotic-dominated community types. Number of sites is based on mapping and inventory projects. Global rank change from G3 to G1 reflects the understanding of how truly rare and threatened this vegetation type is.

High-ranked species:

Comments: As originally conceptualized, this type was the *Hesperostipa comata* community type on sandy to infertile soils outside the range of sagebrush and bitterbrush in the Palouse of Oregon and Washington following Daubenmire 1970. It was unclear where the *Eriogonum niveum* phase fit. Accepting the classification as one of existing vegetation places this phase within this syntaxon or within the variation of *Purshia tridentata* / *Achnatherum hymenoides* Shrubland (CEGL001058). Compositionally, the *Eriogonum niveum* phase is more like this *Hesperostipa comata* community type with some dwarf-shrub cover, and sites are more gravelly sands than the

later. This type includes this phase. Stands burned will have no sagebrush or bitterbrush. Occurrences that have no *Artemisia* or *Purshia* in the immediate landscape are included here.

ELEMENT DISTRIBUTION

Range: This association is known from 2-3 counties in Washington and 1-2 counties in Oregon.

Nations: CA? US

States/Provinces: BC?, OR:S3, WA:S1

TNC Ecoregions: 6:C

USFS Ecoregions: 342I:CC

Federal Lands: DOE (Hanford); NPS (Boardman RNA)

ELEMENT SOURCES

Authors: M.S. Reid, WCS **Confidence:** 1 **Identifier:** CEG001704

References: Bourgeron and Engelking 1994, Daubenmire 1970, Driscoll et al. 1984, Easterly and Salstrom 1997, Kagan 1989b, Poulton 1955, WANHP n.d., Wildermann 1994, Youtie 1990

V.A.5.N.d.22. PSEUDOROEGNERIA SPICATA HERBACEOUS ALLIANCE

Bluebunch Wheatgrass Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This widespread grassland alliance occurs across the western U.S. from the slopes of the Cascades, extending east to the Rocky Mountains and the northwestern Great Plains, and south to the Great Basin, Uinta Basin and the Colorado Rocky Mountains. Stands are found on valley bottoms, stream terraces, rolling uplands, canyons, hills, plateaus and badlands, expansive park meadow openings in montane forests, and glacial outwash plains. Sites may be xeric or mesic, on nearly level to steep slopes. Stands occur on all aspects, but often on the drier southern and western slopes. Substrates are also variable and range from shallow, lithic soils with a rocky surface to moderately deep soils with little rock. Grasslands included in this alliance are dominated or codominated by *Pseudoroegneria spicata*. There is typically sparse to moderate cover of perennial forbs and widely scattered shrubs and dwarf-shrubs. Annual grasses and forbs are seasonally present. Litter, moss and lichen are important ground cover in some stands. Species composition is variable over the range of this alliance and may include many other important species such as *Bouteloua curtipendula*, *Bouteloua gracilis*, *Carex* spp., *Danthonia intermedia*, *Eriogonum heracleoides*, *Festuca idahoensis*, *Festuca thurberi*, *Koeleria macrantha*, *Achnatherum hymenoides* (= *Oryzopsis hymenoides*), *Pascopyrum smithii*, *Poa fendleriana*, *Poa secunda*, and *Hesperostipa comata* (= *Stipa comata*). Scattered shrubs and dwarf-shrubs, including *Ericameria nauseosa* (= *Chrysothamnus nauseosus*), *Symphoricarpos albus*, *Rosa* spp., *Artemisia frigida*, may be present in some stands. Disturbed stands may be codominated by the exotics *Poa pratensis* and *Bromus tectorum*. Diagnostic of this grassland alliance is the dominance of *Pseudoroegneria spicata*.

Environment: These widespread grasslands are characteristic of the Palouse Prairie but occur across the Columbia Basin from the slopes of the Cascades, extending east to the Rocky Mountains and the northwestern Great Plains, and south to the Great Basin, Uinta Basin and the Colorado Rocky Mountains. Elevations range from 200 m in eastern Washington to 3050 m in Colorado. Climate is temperate and mostly continental. Mean annual precipitation ranges from 33-60 cm. Season of precipitation varies geographically. In the Columbia Basin precipitation comes mainly in the winter as snow or rain. This moisture is stored in the soil profile and utilized throughout the typically dry summers. Stands in the Rocky Mountains and Great Plains may receive up to 75% of the annual precipitation during the growing season. Stands are found on valley bottoms, stream terraces, rolling uplands, canyon benches and slopes, hills, ridges, plateaus and buttes, badlands, foothills, expansive park meadow openings in montane forests, and glacial outwash plains. Sites may be xeric or mesic, on nearly level to steep slopes. The alliance occurs on all aspects, but often on the drier southern and western slopes. Substrates are also variable and range from shallow and lithic soils with a rocky surface of gravel, cobbles or scoria, to moderately deep soils with little rock. Soils are moderately to well-drained, sometimes calcareous, with pH of 6.8-7.7. Soil texture ranges from gravelly, sandy loams to clay. Parent material may include alluvium, colluvium, residuum, glacial deposits or loess derived from lava, basalt, granite, quartz diorite, calcareous sandstone, limestone, acid shale, bentonite, marlstone and other volcanic materials. Litter, moss and lichen are important groundcover in some stands.

Adjacent stands often include other grasslands dominated by *Festuca idahoensis*, *Poa secunda* or other perennial grasses, and shrublands dominated by *Artemisia tridentata* or *Purshia tridentata*. Other adjacent vegetation may include woodlands dominated by *Juniperus occidentalis*, *Pinus edulis*, *Pinus flexilis*, *Pinus ponderosa*, *Pseudotsuga menziesii*, or *Quercus gambelii*.

Vegetation: These grasslands occur east of the Cascade Mountains in the Palouse Prairie, the more arid intermountain steppe, in parks, on ridges in the montane zones in the Rocky Mountains, and into the western Great Plains. Stands have a sparse to dense cover of graminoids (<1 m tall) that is dominated or codominated by the cool-season, perennial bunchgrass *Pseudoroegneria spicata*. There is typically sparse to moderate cover of perennial forbs and widely scattered shrubs and dwarf-shrubs. Annual grasses and forbs are seasonally present. Litter, moss and lichen are important groundcover in some stands.

Species composition and structure varies somewhat with habitat, climate and geography. In the Intermountain Region codominant and associated species may include *Festuca idahoensis*, *Poa secunda*, *Koeleria macrantha*, *Eriogonum heracleoides* and on drier sites *Hesperostipa comata* (= *Stipa comata*). Scattered shrubs and dwarf-shrubs such as *Symphoricarpos albus*, *Rosa nutkana*, and *Rosa woodsii* are present in some stands. In the Rocky Mountains and northern Great Plains, species such as *Arenaria hookeri*, *Artemisia frigida*, *Artemisia ludoviciana*, *Bouteloua curtipendula*, *Bouteloua gracilis*, *Carex filifolia*, *Carex inops* ssp. *heliophila*, *Carex obtusata*, *Danthonia intermedia*, *Festuca thurberi*, *Gaura coccinea*, *Geranium caespitosum*, *Koeleria macrantha*, *Achnatherum*

Data current as of 17 Apr 2003.

hymenoides (= *Oryzopsis hymenoides*), *Pascopyrum smithii*, *Poa fendleriana* or *Achnatherum richardsonii* (= *Stipa richardsonii*) are characteristic and may codominate. Disturbed stands may be codominated by *Ericameria nauseosa* (= *Chrysothamnus nauseosus*) and the exotics *Poa pratensis* and *Bromus tectorum* (on dry sites).

Dynamics: Fire has variable effects on *Pseudoroegneria spicata* bunchgrasses. Plants usually survive burning, and growth is often stimulated, except when fire occurs in the driest month when the crowns will burn because of low moisture in the vegetation, and the meristems are damaged (Johnson and Simon 1987). Grazing impacts are concentrated on the gentler slopes accessible to livestock. *Pseudoroegneria spicata* shows an inconsistent reaction to grazing, increasing on some grazed sites while decreasing on others. It seems to recover more quickly from overgrazing than *Festuca campestris* (Mueggler and Stewart 1980). It tolerates dormant-period grazing well, but is sensitive to defoliation during the growing season. Light spring use or fall grazing can help retain plant vigor. It is particularly sensitive to defoliation in late spring (Comer et al. 1999). The exotic species *Bromus tectorum* occurs in many stands of the alliance and contributes significant cover on sites disturbed by livestock.

Similar Alliances:

- PSEUDOROEGNERIA SPICATA - BOUTELOUA GRACILIS HERBACEOUS ALLIANCE (A.1239)
- PSEUDOROEGNERIA SPICATA SPARSELY VEGETATED ALLIANCE (A.1876)
- FESTUCA IDAHOENSIS HERBACEOUS ALLIANCE (A.1251)
- FESTUCA CAMPESTRIS HERBACEOUS ALLIANCE (A.1255)
- RHUS TRILOBATA SHRUB HERBACEOUS ALLIANCE (A.1537)

Similar Alliance Comments: Two of the similar alliances have *Pseudoroegneria spicata* as a dominant or codominant in the alliance. The other similar alliances include grasslands that have associations where *Pseudoroegneria spicata* is a codominant species. *Pseudoroegneria spicata* is a widespread grassland species in the northern half of the western U.S. and is also a dominant understory species in many forests, woodlands and shrublands.

Synonymy:

- *Roegneria spicata* Series. includes eleven *Festuca idahoensis* dominated plant associations. (Johnston 1987)
- Bluebunch Wheatgrass Series, in part (Sawyer and Keeler-Wolf 1995)
- *Agropyron spicatum* Series, in part (Tisdale 1986)
- *Agropyron spicatum* Series, in part (Johnson and Simon 1987)
- *Agropyron spicatum* Series, in part (Tweit and Houston 1980)
- Great Basin Grasslands (#43000), in part (Holland 1986b)
- *Pseudoroegneria spicata* Grasslands, in part (Chappell et al. 1997)

Comments: Stands in California need further investigation and association-level description, especially the Great Basin (Holland 1986). Wyoming stands in *Pseudoroegneria spicata* - *Hesperostipa comata* Herbaceous Vegetation (CEGL001679) and *Pseudoroegneria spicata* - *Carex filifolia* Herbaceous Vegetation (CEGL001665) in this alliance may be very similar to stands in *Pseudoroegneria spicata* - *Bouteloua gracilis* Herbaceous Vegetation (CEGL001664) found in Montana (Comer et al. 1999). The later association is in the *Pseudoroegneria spicata* - *Bouteloua gracilis* Herbaceous Alliance (A.1239). More study is needed to decide if both alliances are needed. Stands in *Pseudoroegneria spicata* ssp. *inermis* Herbaceous Vegetation (CEGL001661) may be too sparse to be included in this alliance and could be moved to the sparsely vegetated alliance (Baker 1983b).

ALLIANCE DISTRIBUTION

Range: Grasslands included in this alliance are most characteristic of the Columbia Basin of eastern Washington and eastern Oregon and Idaho, but also extend east into the Rocky Mountains and northwestern Great Plains of Montana and Wyoming, and south into the Colorado Rocky Mountains and Colorado Plateau. The alliance likely occurs on the Modoc Plateau of California and may also extend into the Canadian provinces of British Columbia, Alberta and Saskatchewan.

Nations: CA US

States/Provinces: BC CO ID MT ND OR UT WA WY

TNC Ecoregions: 10:C, 11:C, 20:C, 26:C, 6:C, 9:C

USFS Ecoregions: 331A:CC, 331D:CC, 331F:CC, 331G:CC, 342A:CC, 342B:CC, 342C:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, M242C:??, M331A:CC, M331B:CC, M331D:CC, M331G:CP, M331H:CP, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M341C:CC

Federal Lands: USFS (Clearwater, Custer, Little Missouri?, Thunder Basin, Wallowa-Whitman)

ALLIANCE SOURCES

Authors: K. SCHULZ, West **Identifier:** A.1265

References: Anderson 1956, Baker 1982b, Baker 1983b, Baker 1984a, Baker and Kennedy 1985, Bighorn Coal Mine n.d., Chappell et al. 1997, Christensen 1963, Christensen and Welsh 1963, Comer et al. 1999, Cooper et al. 1995, Cotter-Ferguson Project n.d., Daubenmire 1970, Daubenmire 1992, DeVelice 1992, DeVelice and Lesica 1993, DeVelice et al. 1995, Despain 1973a, Fisser et al. 1965, Francis 1983, Ganskopp 1979, Hall 1973, Hansen 1985, Hansen and Hoffman 1988, Hansen et al. 1988a, Holland 1986b, Hyde 1964, Johnson and Clausnitzer 1992, Johnson and Simon 1985, Johnson and Simon 1987, Johnston 1987, Kleiner 1968, Lesica and DeVelice 1992, MTNHP n.d., Mueggler and Stewart 1980, Poulton 1955, Price and Brotherson 1987, Prodgers 1978, Reid et al. 1994, Ross et al. 1973, Sawyer and Keeler-Wolf 1995, Seminoe II Mine Application n.d., Terwilliger and Tiedemann 1978, Terwilliger et al. 1979a, Tiedemann et al. 1987, Tisdale 1979, Tisdale 1986, Tweit and Houston 1980, Williams 1961

PSEUDOROEGNERIA SPICATA - POA SECUNDA HERBACEOUS VEGETATION

Bluebunch Wheatgrass - Curly Bluegrass Herbaceous Vegetation

*Bluebunch Wheatgrass - Sandberg's Bluegrass Mixedgrass***ELEMENT CONCEPT**

Summary: Throughout its geographic range this is a bunch grassland with minor cover of forbs and, often, sparse shrubs. *Pseudoroegneria spicata* dominates or codominates the vegetation, *Poa secunda* and *Koeleria macrantha* usually are present in substantial amounts, and *Festuca idahoensis* is absent or present in very small amounts. The common shrubs are *Ericameria nauseosa* (= *Chrysothamnus nauseosus*), *Chrysothamnus viscidiflorus*, and *Artemisia tridentata* (subspecies unknown). Stands of this association occupy loamy, rocky, often shallow soils on slopes and ridges, generally around the edges of basins and in the foothills of the mountains. This association was at one time common throughout its wide geographic range, but much of it in Washington and Oregon has been converted to agricultural fields. In many of the remaining stands, the cover of *Pseudoroegneria spicata* has decreased and the cover of *Hesperostipa comata* (= *Stipa comata*) and shrubs have increased, and exotics (especially *Bromus tectorum*, *Tragopogon* spp., and *Alyssum* spp.) have become common members of the vegetation; these changes are attributed in large part to livestock grazing.

Environment: Stands of this association grow on well-drained, often shallow, and frequently gravelly or rocky soils generally of loam, silt loam, or sandy loam textural classes. Sites usually are ridges and slopes (and sometimes alluvial fans) of any aspect, although southerly and westerly aspects are most common in the northwestern (British Columbia, Washington, Idaho) and northern (Montana) parts of the geographic range. In Wyoming and Colorado, many of the sites supporting this association are windswept slopes and ridges. This association grows over a very broad elevational range, from 700-2800 feet in the northwestern part of the range, 3000-7500 feet in the north-central part, and 9400-10,000 feet in central Colorado.

Vegetation: As would be expected for an association whose geographic range includes such a broad range of climates and of prehistoric grazing regimes, the composition of the vegetation varies, but a number of traits are constant. Throughout, this is a bunch grassland with minor cover of forbs and, often, sparse shrubs. *Pseudoroegneria spicata* dominates or codominates the vegetation; *Poa secunda* and *Koeleria macrantha* usually are present in substantial amounts, and *Festuca idahoensis* is absent or present in very small amounts. *Hesperostipa comata* (= *Stipa comata*) often is present in substantial amounts and may codominate, due (at least in part of the range) to prolonged grazing. *Bromus tectorum*, *Tragopogon* spp., and *Alyssum* spp. also are common members of the vegetation, due at least in part to disturbance. The common shrubs are *Ericameria nauseosa* (= *Chrysothamnus nauseosus*), *Chrysothamnus viscidiflorus*, and *Artemisia tridentata* (subspecies unknown). In southern British Columbia (Tisdale 1947), eastern Washington (Daubenmire 1988), and northeastern Oregon (Poulton 1955, Anderson 1956), the undisturbed vegetation of this type consists of *Pseudoroegneria spicata* and *Poa secunda*, with few other vascular plants (*Lomatium macrocarpum*, *Draba verna*, *Artemisia frigida*, *Gutierrezia sarothrae*, and a number of annuals), and substantial cover of epigeous cryptogams. *Hesperostipa comata* is present in most stands and may codominate with *Pseudoroegneria spicata*, as a result of heavy grazing. In western Idaho (Tisdale 1986), xeric sites support open vegetation with little *Poa secunda* and with *Opuntia polyacantha*, *Phacelia heterophylla*, and *Scutellaria angustifolia*. Stands on mesic sites are denser and usually contain *Balsamorhiza sagittata*, *Lomatium triternatum*, and *Lupinus sericeus*. In Utah (Christensen 1963, Christensen and Welsh 1963), *Gutierrezia sarothrae* is a common but minor species; *Hesperostipa comata* and *Achnatherum hymenoides* (= *Oryzopsis hymenoides*) are now common and often contribute substantial cover, apparently in stands disturbed by prolonged grazing. Montana stands (Mueggler and Stewart 1980, Cooper et al. 1995) often contain *Artemisia frigida*, *Gutierrezia sarothrae*, *Achillea millefolium*, *Phlox hoodii*, *Stenotus acaulis* (= *Haplopappus acaulis*), and a number of other forbs; *Hesperostipa comata* or *Hesperostipa spartea* (= *Stipa spartea*) often codominate with *Pseudoroegneria spicata*, apparently even in stands that have not been markedly disturbed. In northwestern Wyoming (Tweit and Houston 1980), the vegetation is much like that in Montana (but without *Hesperostipa spartea*), while in central Wyoming (Williams 1961, Fisser 1964) and northeastern Wyoming (Terwilliger et al. 1979a), nearer to the eastern edge of the geographic range, *Bouteloua gracilis*, *Rhus trilobata*, *Pascopyrum smithii*, and *Carex filifolia* may be present as minor species. In Colorado (Hess and Wasser 1987), species present in greater than trace amounts are *Achillea millefolium*, *Arenaria fendleri*, *Oxytropis lambertii*, *Potentilla gracilis*, and *Taraxacum officinale*.

Dynamics:**Similar Associations:**

- *Pseudoroegneria spicata* - *Balsamorhiza sagittata* - *Poa secunda* Herbaceous Vegetation (CEGL001662)
- *Pseudoroegneria spicata* - *Poa secunda* Lithosolic Herbaceous Vegetation (CEGL001678)

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- *Pseudoroegneria spicata* - *Pascopyrum smithii* Herbaceous Vegetation (CEGL001675)--rhizomatous wheatgrasses (*Pascopyrum smithii* or *Elymus lanceolatus*) are subdominant or codominant and clearly contribute more cover than does *Poa secunda*.
- *Pseudoroegneria spicata* - Cushion Plants Herbaceous Vegetation (CEGL001666)--contains a substantial amount of *Pseudoroegneria spicata* and often contains *Poa secunda*, but forbs generally provide more cover than do the grasses.
- *Pseudoroegneria spicata* - *Poa fendleriana* Herbaceous Vegetation (CEGL001676)--relationship is unclear.

Synonymy:

- DRISCOLL FORMATION CODE: V.B.4.b. (Driscoll et al. 1984) B
- *Pseudoroegneria spicata*-*Poa secunda* (Bourgeron and Engelking 1994) =
- *Agropyron* - *Poa* grassland zone, climax vegetation (Tisdale 1947) F
- *Agropyron* - *Poa* zone, climatic climax (Poulton 1955) F
- *Agropyron spicatum* - *Poa secunda* habitat type (Daubenmire 1970) F. Daubenmire's (1970) *Pseudoroegneria spicata* - *Poa secunda* association constitutes relatively undisturbed vegetation on his habitat type. Comments by other authors (Mueggler and Stewart 1980, Tisdale 1986) suggest that it represents relatively xeric and species-poor vegetation of this association.
- *Agropyron spicatum* / *Poa sandbergii* / *Balsamorhiza sagittata* habitat type (Tisdale 1986) F. Tisdale's (1986) *Agropyron spicatum* / *Poa sandbergii* / *Balsamorhiza sagittata* habitat type represents a mesic part of this association, with substantial cover of *Poa secunda* (= *Poa sandbergii*) and of perennial forbs.
- *Agropyron spicatum* / *Opuntia polyacantha* habitat type (Tisdale 1986) F. Tisdale's (1986) *Agropyron spicatum* / *Opuntia polyacantha* habitat type represents a xeric part of this association, with relatively sparse vegetation in which *Poa secunda* (= *Poa sandbergii*) contributes little cover and perennial forbs are minor.
- *Agropyron spicatum* / *Poa sandbergii* (MONT) habitat type (Mueggler and Stewart 1980) F
- Upland prairie (Christensen and Welsh 1963) B
- Central Utah foothill bunchgrass vegetation (Christensen 1963) F
- *Agropyron spicatum* / *Poa secunda* habitat type (Terwilliger et al. 1979a) F
- *Agropyron spicatum* / *Poa sandbergii* habitat type (Tweit and Houston 1980) F
- *Agropyron spicatum* / *Poa sandbergii* habitat type (Hess and Wasser 1982) F
- Northern Utah Palouse grassland association (Stoddart 1941) F
- *Roegneria spicata* / *Poa secunda* plant association (Johnston 1987) F

GRank & Reasons: G4? (96-02-01).

High-ranked species:

Comments: Relationships between this association and several others are unclear. *Pseudoroegneria spicata* - *Balsamorhiza sagittata* - *Poa secunda* Herbaceous Vegetation (CEGL001662) from Idaho and Oregon, apparently taken from Tisdale's (1986) *Agropyron spicatum* / *Poa secunda* / *Balsamorhiza sagittata* habitat type of western Idaho, is included here. *Pseudoroegneria spicata* - *Poa secunda* Lithosolic Herbaceous Vegetation (CEGL001678) of Idaho, Oregon, and Washington may be based on the lithosolic phase of Daubenmire's (1988) habitat type; this association presently includes that vegetation. If these types are to be considered separate associations, clear distinctions must be made between them.

In *Pseudoroegneria spicata* - *Pascopyrum smithii* Herbaceous Vegetation (CEGL001675), rhizomatous wheatgrasses (*Pascopyrum smithii* or *Elymus lanceolatus*) are subdominant or codominant and clearly contribute more cover than does *Poa secunda*. Similarly, in *Pseudoroegneria spicata* - *Hesperostipa comata* Herbaceous Vegetation (CEGL001679), *Hesperostipa comata* is subdominant or codominant and clearly contributes more cover than does *Poa secunda*. *Pseudoroegneria spicata* - Cushion Plant Herbaceous Vegetation (CEGL001666) contains a substantial amount of *Pseudoroegneria spicata* and often contains *Poa secunda*, but forbs generally provide more cover than do the grasses. The relationship between this association and the *Pseudoroegneria spicata* - *Poa fendleriana* Herbaceous Vegetation (CEGL001676) is unclear.

ELEMENT DISTRIBUTION

Range: This association has been described from British Columbia, Washington, Oregon, Idaho, Utah, Colorado, Wyoming, and Montana.

Nations: CA US

States/Provinces: BC:S?, CO:S1S2, ID:S?, MT:S4?, OR:S1, UT:S2S4, WA:S2, WY:S2

TNC Ecoregions: 10:C, 6:?, 9:C

USFS Ecoregions: 331A:CC, 331F:CC, 331G:CP, 342A:CC, 342C:CC, 342F:CC, 342I:CC, M331A:CC, M331D:CC, M331G:CP, M331H:CP, M332A:CC, M332B:CP, M332D:CP, M332E:CC, M332G:CC, M341C:CC
Federal Lands: USFS (Custer?, Thunder Basin)

ELEMENT SOURCES

Authors: WCS **Confidence:** 1 **Identifier:** CEG001677

References: Anderson 1956, Bourgeron and Engelking 1994, Christensen 1963, Christensen and Welsh 1963, Cooper et al. 1995, Daubenmire 1970, Daubenmire 1988, Driscoll et al. 1984, Fisser 1964, Fisser et al. 1965, Hall 1973, Hess and Wasser 1982, Johnson and Simon 1985, Johnson and Simon 1987, Johnston 1987, Kleiner 1968, Mueggler and Stewart 1980, Poulton 1955, Price and Brotherson 1987, Stoddart 1941, Terwilliger et al. 1979a, Tisdale 1947, Tisdale 1986, Tweit and Houston 1980, Williams 1961

V.A.7.N.e. Medium-tall temperate or subpolar grassland with a sparse needle-leaved or microphyllous evergreen shrub layer

V.A.7.N.e.3. PURSHIA TRIDENTATA SHRUB HERBACEOUS ALLIANCE

Bitterbrush Shrub Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This shrub steppe alliance occurs throughout the Intermountain West and forms a landscape matrix which occurs over a broad range of landforms and microhabitats. Stands are often found on the margins of *Pinus ponderosa* woodlands or forests, forming the transition into sagebrush vegetation. They also occur on flats to moderate slopes in foothills, on slopes of lakebeds with ash or pumice soils, stabilized dunes and on dry sites within lower forest zones as shrub-steppe inclusions in forest. Soils are generally well-drained, coarse-textured without high salinity or pH. Vegetation included in this alliance is characterized by a sparse shrub canopy of *Purshia tridentata*, often with *Artemisia tridentata* ssp. *vaseyana* or *Artemisia tridentata* ssp. *wyomingensis* as codominants. Other important or occasional shrubs include *Ericameria nauseosa* (= *Chrysothamnus nauseosus*), *Chrysothamnus viscidiflorus*, *Ribes cereum*, and *Ceanothus velutinus*. Scattered trees may form an emergent layer of individual trees; species include *Pinus ponderosa*, *Juniperus occidentalis*, *Juniperus osteosperma*, *Juniperus scopulorum*, or *Cercocarpus ledifolius*. The herbaceous layer is usually strongly dominated by perennial bunch grasses, including *Pseudoroegneria spicata*, *Festuca idahoensis*, *Festuca campestris*, *Carex pensylvanica*, and *Carex geyeri*, *Achnatherum hymenoides* (= *Oryzopsis hymenoides*), *Hesperostipa comata* (= *Stipa comata*), and *Achnatherum occidentale* (= *Stipa occidentalis*). *Balsamorhiza sagittata* is an important forb associate. Other forbs include several species of *Penstemon*, *Erigeron*, *Eriogonum*, *Castilleja*, *Astragalus*, and *Lupinus*. Diagnostic of this shrub steppe alliance is a typically sparse shrub layer (10-25% cover) dominated by *Purshia tridentata* over an herbaceous layer that is typically dominated by perennial bunch grasses.

Environment: Plant associations in this alliance occur throughout the Intermountain West at elevations from 500-3000 m. Most of the region is arid to semi-arid with annual precipitation ranging from 15-75 cm. The entire range is under a continental temperature regime of cold winters, cool to warm summers and large diurnal variation. In the western portions of the alliance's range, summers are dry. Growing-season precipitation increases eastward and is the greatest in the Rocky Mountains. These communities form a landscape matrix which occurs over a broad range of landforms and microhabitats. They are often found on the margins of *Pinus ponderosa* woodlands or forests, forming the transition into sagebrush vegetation. They also occur on flats to moderate slopes in foothills, on slopes of lakebeds with ash or pumice soils, and on dry sites within lower forest zones as shrub-steppe inclusions in forest. In Idaho, the alliance is reported from stabilized dunes. In general, it is an upland type associated with coarse, well-drained soils without high salinity or pH. Adjacent communities are typically *Artemisia tridentata* or *Purshia tridentata* shrublands, *Pinus* spp. or *Juniperus* spp. woodlands, and steppe grasslands.

Vegetation: Plant associations in this alliance are characterized by a sparse shrub canopy of *Purshia tridentata*, often with *Artemisia tridentata* ssp. *vaseyana* or *Artemisia tridentata* ssp. *wyomingensis* as codominants. Other important or occasional shrubs include *Ericameria nauseosa* (= *Chrysothamnus nauseosus*), *Chrysothamnus viscidiflorus*, *Ribes cereum*, and *Ceanothus velutinus*. Scattered trees may form an emergent layer of individual trees; species include *Pinus ponderosa*, *Juniperus occidentalis*, *Juniperus osteosperma*, *Juniperus scopulorum*, or *Cercocarpus ledifolius*. The herbaceous layer is usually strongly dominated by perennial bunch grasses, including *Pseudoroegneria spicata* (at lower elevations), *Festuca idahoensis*, *Festuca campestris*, *Carex pensylvanica*, and *Carex geyeri* (at higher elevations), *Achnatherum hymenoides* (= *Oryzopsis hymenoides*), *Hesperostipa comata* (= *Stipa comata*), and *Achnatherum occidentale* (= *Stipa occidentalis*). *Balsamorhiza sagittata* is an important forb associate, and *Penstemon*, *Erigeron*, *Eriogonum*, *Castilleja*, *Astragalus*, and *Lupinus* species can be important.

Dynamics: Sawyer and Keeler-Wolf (1995) report that stands of *Purshia tridentata* can reach 125 years of age on deep, well-drained sites, but more commonly become decadent at 30 years, and die at 40-50 years of age. Stands appear to result from either a disturbance event (such as fire), or from rare years when many seedlings survive. This results in even-aged stands (Sawyer and Keeler-Wolf 1995). *Purshia tridentata* displays considerable plasticity in growth across its range. The broad range in height and form of different populations appears to be related to ecotypic variation (Mozingo 1987). Although mycorrhizae are considered important in establishment and growth of individual plants, *Purshia tridentata* is one of the first species to colonize barren volcanic substrates following eruption. The species is valuable as winter browse for native ungulates and livestock and is used extensively. Moderate livestock utilization (<60% of the year's current growth) has been reported to stimulate twig growth the following spring (Mueggler and Stewart 1980).

Data current as of 17 Apr 2003.

Similar Alliances:

- PURSHIA TRIDENTATA SHRUBLAND ALLIANCE (A.825)
- PURSHIA TRIDENTATA SHRUB TALL HERBACEOUS ALLIANCE (A.1517)

Similar Alliance Comments: The *Purshia tridentata* Shrub Herbaceous Alliance (A.1523) is distinguished from the *Purshia tridentata* Shrub Tall Herbaceous Alliance (A.1517) by having a graminoid layer dominated by a perennial bunchgrasses less than 1 m in height. The *Purshia tridentata* Shrubland Alliance (A.825) has a shrub canopy that is usually over 25% in cover.

Synonymy:

- Bitterbrush Series, in part (Sawyer and Keeler-Wolf 1995)

Comments:**ALLIANCE DISTRIBUTION**

Range: This alliance is found in most western United States, from Nevada north and east into Oregon, Washington, Idaho, Montana, and Wyoming. It also occurs in British Columbia, Canada. The core of its range is the northern Great Basin, Columbia Plateau, Owyhee Uplands, and Snake River Plains. *Purshia tridentata* is one of the most widespread shrubs in the western United States. Stands cover millions of acres from the Rocky Mountains to the Pacific ranges and south to the high-elevation ranges of the Mojave Desert. The alliance may have a wider distribution than currently documented.

Nations: CA US

States/Provinces: BC CA ID MT NV OR WA WY

TNC Ecoregions: 10:C, 6:C

USFS Ecoregions: 342B:CC, 342C:CC, 342H:CC, 342I:CC, M242C:CC, M261G:??, M331D:CC, M331I:C?, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:C?, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC

Federal Lands: NPS (Crater Lake); USFS (Winema)

ALLIANCE SOURCES

Authors: D. SARR, West **Identifier:** A.1523

References: Chappell et al. 1997, Copeland 1978, Daubenmire 1970, Franklin and Dyrness 1973, Hall 1973, Hironaka et al. 1983, Johnson and Clausnitzer 1992, Johnson and Simon 1987, Lewis 1975, Mozingo 1987, Mueggler and Stewart 1980, Poulton 1955, Sawyer and Keeler-Wolf 1995, Tisdale 1947, Tweit and Houston 1980, Volland 1976

PURSHIA TRIDENTATA / FESTUCA CAMPESTRIS SHRUB HERBACEOUS VEGETATION
 Bitterbrush / Prairie Fescue Shrub Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This association has been documented from Montana west of the Continental Divide and north of 47 degrees latitude; it has not been described from adjacent states or Canadian provinces. Stands occur in the 30-50 cm precipitation zone at elevations ranging 915-1525 m (3000-5000 feet), on confined granitic substrates with steep (>35%), south- through east-facing slopes. This type occurs primarily as small patches to approaching large patch status, the dominant aspect of which is robust bunch grasses. Shrub cover, contributed almost wholly by *Purshia tridentata*, generally does not exceed 20% and may be considerably less (approaching 5%) where browsing pressure from both domestic stock and wild ungulates has been intensive. *Pseudoroegneria spicata* and *Festuca idahoensis* are the dominant graminoids. *Festuca campestris* is also well represented and diagnostic for the type, indicative of the favorable moisture conditions which set this type apart from *Purshia tridentata* / *Pseudoroegneria spicata* Shrub Herbaceous Vegetation (CEGL001495) and *Purshia tridentata* / *Festuca idahoensis* Shrub Herbaceous Vegetation (CEGL002674), which typically occur on drier sites (or outside the geographic range of *Festuca campestris*). The forb component is dominated by *Balsamorhiza sagittata*. *Achillea millefolium*, *Collinsia parviflora*, *Lithospermum ruderale* and *Lomatium triternatum* are regularly present with lesser canopy cover.

Environment:**Vegetation:****Dynamics:****Similar Associations:**

- *Purshia tridentata* / *Pseudoroegneria spicata* Shrub Herbaceous Vegetation (CEGL001495)
- *Purshia tridentata* / *Festuca idahoensis* Shrub Herbaceous Vegetation (CEGL002674)

Synonymy:

- DRISCOLL FORMATION CODE:V.B.2.a. (Driscoll et al. 1984) B
- *Purshia tridentata*/*Festuca scabrella* (Bourgeron and Engelking 1994) =

GRank & Reasons: G2? (00-01-09). Since its identification in 1980 based on four plots, this plant association has not been further sampled or inventoried in Montana or in adjacent states or Provinces (to the best of knowledge of Montana Natural Heritage Program). Thus there is a poor appreciation of its extent, though it has long been recognized as occurring predominantly in small patches. This type is under threats from both wildlife and domestic stock grazing pressure and from development. The lower elevation western Montana landscapes in which it is found are awash in a sea of exotics and highly aggressive noxious weeds. The four most potentially abundant species of this association are highly selected for by livestock and/or wild ungulates; in fact both *Purshia tridentata* and *Festuca campestris* are capable of being selectively eliminated from communities by intensive browsing/grazing pressure. Any grazing pressure that reduces the integrity of the community will open these sites to weed infestations. Development is a threat in that weed populations follow using these inroads to establish founder populations and spread over the landscape.

High-ranked species:

Comments: Since its identification in 1980 based on four plots, this plant association has not been sampled or inventoried in adjacent states or Canadian provinces. In the intervening time it has become clear that *Festuca campestris* is not only a highly palatable species to cattle and wildlife, but it is very sensitive to grazing pressure and can be easily eliminated from communities. Always sparingly represented in the landscape, undoubtedly some of this type has been lost to overgrazing and development and is under continuing threats from these sources so that the G2 rank is merited.

ELEMENT DISTRIBUTION

Range: This association has been documented from Montana west of the Continental Divide and north of 47 degrees latitude; it has not been described from adjacent states or Canadian provinces.

Nations: US

States/Provinces: MT:S2?

TNC Ecoregions:

USFS Ecoregions: M332B:??, M333B:CC, M333C:CC

Federal Lands:

ELEMENT SOURCES

Authors: S.V. Cooper, WCS **Confidence:** 2 **Identifier:** CEGl001494

Data current as of 17 Apr 2003.

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Mueggler and Stewart 1980

PURSHIA TRIDENTATA / HESPEROSTIPA COMATA SHRUB HERBACEOUS VEGETATION

Bitterbrush / Needle-and-Thread Shrub Herbaceous Vegetation

*Antelope Bitterbrush / Needle-and-Thread***ELEMENT CONCEPT**

Summary: This plant association is described for the Columbia Basin and Owyhee Uplands ecoregional sections of western Idaho, and eastern Washington and Oregon. The association is restricted to gently sloped sand deposits located at 500-1300 feet elevation. Dispersed *Purshia tridentata* forms an open shrub canopy (with an average 20% canopy cover) over an herbaceous layer dominated by *Hesperostipa comata* (= *Stipa comata*) (averaging >50% cover). *Ericameria nauseosa* (= *Chrysothamnus nauseosus*) and *Chrysothamnus viscidiflorus* are occasionally present, and increase in cover with disturbance. *Poa secunda* is usually also present in the understory and occurs with 20-50% cover. Other locally abundant perennial grasses include *Achnatherum hymenoides* (= *Oryzopsis hymenoides*) and *Koeleria macrantha* (= *Koeleria cristata*). Common forbs include *Lithophragma glabrum* (= *Lithophragma bulbiferum*), *Achillea millefolium*, *Antennaria dimorpha* and *Astragalus purshii*. A cryptogamic layer is well-developed in the most undisturbed stands.

Environment: This association occurs in the Columbia Basin, a downwarped, basalt-floored region. Loess is thick in some portions of the region, and alluvial deposits of variable parent materials are patchy along streams and rivers. Thick mantles of sands from periodically glacially dammed lakes cover some portions of the region. In other areas, valleys and canyons (coulees) have been deeply scoured into the basalt by glacial flooding.

The climate of the region is characterized by a mix of continental and maritime influences. It is in the rainshadow of the Cascades, with annual precipitation between 9 and 20 inches. Between 55% and 75% of the precipitation falls during October through March as snow, and summers are typically dry. Summer temperatures can be hot, and winters are typically cold.

This association occurs on flats to gentle slopes of old sand dunes, from 500 to 1300 feet elevation. It often occurs in a patchwork with sand dunes and sandy Palouse grasslands. The soils are deep, infertile sands.

Vegetation: The broad-leaved semi-evergreen shrub *Purshia tridentata* is scattered (averaging 20% cover) over an herbaceous layer dominated by the 0.5-m tall perennial bunchgrass *Hesperostipa comata* (= *Stipa comata*) (averaging greater than 50% cover). The evergreen microphyllous shrubs *Ericameria nauseosa* (= *Chrysothamnus nauseosus*) and *Chrysothamnus viscidiflorus* are occasionally present, and increase in cover with disturbance. Another bunchgrass, *Poa secunda*, forms a lower graminoid layer, with 20-50% cover. Other locally abundant perennial grasses include *Achnatherum hymenoides* (= *Oryzopsis hymenoides*), *Koeleria macrantha*, and *Elymus lanceolatus*. The most constant perennial forb is *Lithophragma glabrum*. A cryptogamic layer is well-developed in the most undisturbed stands.

Dynamics:**Similar Associations:****Synonymy:**

- DRISCOLL FORMATION CODE: V.B.2.a. (Driscoll et al. 1984) B
- *Purshia tridentata/Stipa comata* (Bourgeron and Engelking 1994) =
- UNESCO FORMATION CODE: V.B.3b (UNESCO 1973) B

GRank & Reasons: G2 (98-11-30). This Columbia Basin association occurs with discrete habitat conditions in well dispersed stands, and is restricted to sandy, weakly developed soils. The number, condition, and size of stands has declined significantly due to land conversion to cultivation, intensive range management, introduction of exotic species, and alteration of fire disturbance regimes. Few high-quality occurrences are known. Protected occurrences are typically not of high-quality condition and/or are small in size.

High-ranked species:**Comments:****ELEMENT DISTRIBUTION**

Range: The association occurs in the Columbia Basin, Owyhee Uplands and Snake River Basalts ecoregional sections. Occurrences are known from Douglas, Franklin and Grant counties, Washington; Morrow County, Oregon; and Ada and Payette counties, Idaho.

Nations: US**States/Provinces:** ID:S1, OR:S1, WA:S2**TNC Ecoregions:** 6:C

Data current as of 17 Apr 2003.

USFS Ecoregions: 342C:CC, M331D:CC, M331I:C?

Federal Lands:

ELEMENT SOURCES

Authors: M.S. Reid, mod. S.K. Rust, WCS **Confidence:** 1 **Identifier:** CEGLO01498

References: Bourgeron and Engelking 1994, Daubenmire 1970, Driscoll et al. 1984, Hironaka et al. 1983, Poulton 1955, Tisdale 1947, UNESCO 1973

PURSHIA TRIDENTATA / PSEUDOROEGNERIA SPICATA SHRUB HERBACEOUS VEGETATION
 Bitterbrush / Bluebunch Wheatgrass Shrub Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This plant association is described from sites in the Eastern Cascades, Blue Mountains, and Bitterroot Valley ecoregional sections. Stands are also reported from the southwestern portion of the Idaho Batholith section. The association occurs on steep, south-facing, mid to upper slopes at 1900-5500 feet elevation (typically at higher elevation in the eastern portion of the range). Soils are typically dry, shallow, and rocky. A high exposure of rock and surface soil is common. Relatively open stands of *Purshia tridentata* occur with *Pseudoroegneria spicata* and *Balsamorhiza sagittata*. *Poa secunda* and *Lomatium dissectum* are often also present.

Environment:**Vegetation:****Dynamics:****Similar Associations:****Synonymy:**

- DRISCOLL FORMATION CODE:V.B.2.a. (Driscoll et al. 1984) B
- *Purshia tridentata/Pseudoroegneria spicata* (Bourgeron and Engelking 1994) =

GRank & Reasons: G3 (99-04-28). This relatively wide spread plant association is known from the Eastern Cascades, Blue Mountains, and Bitterroot Valley ecoregional sections, and extends north into British Columbia. Stands are clustered in discrete centers of occurrence. Very few, high-quality, representative stands are known. Nearly all of the known stands are reported to be in poor condition. The condition of occurrences is declining due to the cumulative effects of the establishment and increased abundance of exotic annual grass species, the decline in perennial bunch grass abundance, and the subsequent loss of resilience of stands to fire disturbance events.

High-ranked species:

Comments: The association is described as a classification of natural potential vegetation by Daubenmire (1970), Johnson and Simon (1987), and Mueggler and Stewart (1980). Hall (1973) did not differentiate sites with the potential for *Festuca idahoensis*.

ELEMENT DISTRIBUTION

Range: The association is reported for sites in the Eastern Cascades, Blue Mountains, and Bitterroot Valley ecoregional sections.

Nations: CA US

States/Provinces: BC:S3?, CA?, ID:S1S2, MT:S2, OR:S1, WA:S2

TNC Ecoregions: 10:C, 6:C

USFS Ecoregions: 342B:C?, 342C:CC, 342H:C?, 342I:CC, M242C:CC, M261G:??, M331D:CC, M332A:CC, M332B:CC, M332D:CC, M332E:C?, M332F:CC, M332G:CC, M333A:CC

Federal Lands:

ELEMENT SOURCES

Authors: S.K. Rust, WCS **Confidence:** 1 **Identifier:** CEGl001495

References: Bourgeron and Engelking 1994, Daubenmire 1970, Driscoll et al. 1984, Hall 1973, Hironaka et al. 1983, Johnson and Simon 1987, Mueggler and Stewart 1980