WASHINGTON NATURAL HERITAGE PROGRAM

Plant Associations of Balds and Bluffs of Western Washington

Prepared by
Christopher B. Chappell

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Natural Heritage
Report 2006-02

WASHINGTON STATE DEPARTMENT OF
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Doug Sutherland - Commissioner of Public Lands

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Executive Summary

This report describes plant associations (plant community types) of existing vegetation found in specific habitats in lowland and mid-montane western Washington that have been little studied previously. The habitats covered by the report include dry-site balds (small openings on slopes within forested landscapes) dominated by herbaceous vegetation and/or dwarf-shrubs, as well as those portions of coastal bluffs dominated by herbaceous vegetation. These plant communities are significant for biodiversity conservation because within a very small relative area they host a diverse array of plant taxa that do not occur in most habitats of western Washington (a relatively high percentage of the total flora for the region in a very small area), and because some animal species, especially butterflies, of particular concern are confined to these or closely similar habitats.

The report defines these ecological systems in relation to vegetation, physical environment, and natural disturbance processes. They appear to be some of the driest habitats in western Washington that are dominated by vascular plants. Balds habitats are characterized by their low-growing vegetation, relatively shallow soils, relatively dry topographic positions, and relatively sunny aspects in comparison to the full range of physical environments in western Washington. These sites can be seasonally moist or wet early in the growing season, but if so, then they dry out to an extreme degree late in the growing season. Fire and other disturbances are important ecological processes in these habitats. Most balds appear to be environmentally marginal, at best, for the establishment of most trees due to extreme summer drought conditions. Extant balds appear to be much more resistant to invasion by trees and shrubs than western Washington prairies located on level terrain and deeper soils.

The bulk of the report is a description of each of 20 plant associations and 3 provisional associations. Of these 23 vegetation types, 19 are dominated by herbaceous vegetation, 3 are dominated by dwarf-shrubs, and 1 is shrub-dominated. The distribution, global and state status, environmental characteristics, context, vegetation, and relationships to other vegetation classifications are described for each association. A key to the plant associations in these habitats is included. A table with plant species composition of each association is included as an appendix.

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Table of Contents

Introduction

Herbaceous and dwarf-shrub vegetation associated with dry sites in lowland and mid-montane western Washington, as well as the remainder of the maritime Pacific Northwest, has been the subject of very little research and has not been described systematically. The formerly extensive prairies of the Puget Trough (Lang 1961, del Moral and Deardorff 1976, Chappell and Crawford 1997, Dunn and Ewing 1997, Dorner 1999) and vegetation of coastal dunes (Wiedeman 1984, Christy et al. 1998) are the two exceptions to this paucity of information. Coastal dunes have a unique physical environment and ecological setting that will not be further discussed herein. The Puget lowland prairies occur on relatively level terrain, primarily on soils without a restrictive layer (hereafter referred to as deep soils), and historically occurred as large patches (hundreds to thousands of acres) maintained by Native American burning practices (Norton 1979, Chappell and Crawford 1997, Crawford and Hall 1997, Chappell et al. 2001a). Chappell et al. (2001a, 2001b) note the existence of what they call "balds" that differ from prairies in the following respects: (1) they occur on slopes, (2) they are associated with relatively shallow soils and an underlying restrictive layer of bedrock, and (3) they tend to be small patches (less than one to at most hundreds of acres) in a forest matrix. Floberg et al. (2004) described a "Herbaceous Balds and Bluffs" ecological system in more detail than previous accounts.

Previous research on herbaceous and dwarf-shrub balds and bluffs includes the following. In Washington, Rapp (1981), Salstrom (1989), and Rust (1992) studied vegetation at sites in the San Juan Islands that included degraded examples of herbaceous balds and bluffs communities. Peterson and Hammer (2001) studied the historic decline of open conifer woodland and savanna found in association with balds (they called the remnant openings "glades", not balds) at another San Juan Island site. Davidson (1967) and Ripley (1984) examined communities on Oregon coastal headlands. Christy (2004) describes a couple of associations that occur as small patches in moist to wet microsites on basalt scablands in the Willamette Valley. Aldrich (1972) studied grass balds in the Oregon Coast Range.

We want to note that there are similarities between these communities and some Garry oak (*Quercus garryana*) woodland and savanna communities (e.g., Erickson 1996), and that in British Columbia the herbaceous communities we are concerned with are often considered part of a "Garry oak ecosystem". In the herbaceous and dwarf-shrub communities upon which we are focusing, oaks, as with conifers, may be present as occasional individuals. Patches of oak woodland sometimes occur in a mosaic with herbaceous vegetation on these shallow-soiled sites. We have chosen to focus herein only on the portions of such a site dominated by herbaceous or dwarf-shrub vegetation. See Chappell (2006) for descriptions of oak-dominated plant associations in the Puget Trough.

The objective of this work is to describe and characterize plant associations (plant community types) that are dominated by herbaceous or dwarf-shrub vegetation and that occur in low elevation and mid-montane western Washington on dry, relatively shallow-soiled slopes (balds) and on coastal headlands and bluffs.

Significance for Biodiversity Conservation

Balds and bluffs are inordinantly important for biodiversity conservation in relation to their small total extent due to a number of reasons. First of all, these small areas tend to have many more plant

species in them than surrounding forests. Secondly, those plant species that do occur in them typically do not occur in the matrix of western Washington forests, but only in balds or closely related habitats like prairies or oak woodlands. For example, of 572 plant species found regularly in prairies and balds in the Willamette Valley-Puget Trough-Georgia Basin ecoregion, 60% of them have high fidelity to these habitats, i.e., they rarely occur in other habitats (Chappell et al. 2004). Thirdly, balds and bluffs probably host a relatively high percentage of the total flora in western Washington, especially in relation to how small an area they cover. Fourthly, some rare or threatened animal species, most notably the Taylor's checkerspot butterfly (*Euphydryas editha taylori*), are limited to these habitats and closely similar ones.

Balds and Bluffs Defined

Balds are usually small, less than about 5 ha, though they can range in size up to about 100 ha, and are typically surrounded by forest. Balds are dominated by herbaceous vegetation, dwarf-shrubs, and/or mosses and lichens. They can be fringed by areas of oak woodland, and they can have patches of oak woodland within them. They can also have scattered trees, especially *Pseudotsuga menziesii, Arbutus menziesii,* and/or *Quercus garryana.* Mature trees, if present are generally rooted in localized microsites with greater late summer soil moisture, e.g., fissures in bedrock or deeper soil pockets.

Balds occur on sloping dry sites. They are typically the driest sites short of rock outcrops within the climate of lowland to mid-montane western Washington. Factors that contribute to creating such dry sites include depth to bedrock (shallower tends to be drier), slope position (upper slopes and ridgetops are drier), aspect (southern to western aspects are sunnier and therefore drier), slope steepness (steeper is drier), and soil texture and percentage of coarse fragments (coarse texture with more coarse fragments is drier). Rock outcrops are usually mixed in with balds vegetation, often at such a small scale that they are considered part of the same ecological system, and cliffs can also co-occur but are considered a different ecological system. Unlike cliffs or rock outcrops, balds have major portions with soil covering rock surfaces.

Portions of these dry sites can be seasonally moist to wet in winter and spring (where water is perched above an impervious rock layer on very shallow soils) and then become extremely dry later in the season. Such vernal seepage sites have some similarities to vernal pools, but are found on slopes rather than in contained depressions, do not show clear zonation of vegetation, and do not have vernal pool endemic plant species. Despite the seasonal wetness of these microsites, they do not favor tree invasion, probably because of the extreme dryness of late summer.

Openings created by fire alone (old burns), timber harvest, or roads may provide similar habitat in some respects, but they are not recognized herein as balds. Most plant species in balds and bluffs do not typically occur in forest understories or in clearcuts or old burns (formerly forested), and plant species diversity is usually much higher on balds than in these other habitats.

Balds occur at elevations below the subalpine forest zones (*Tsuga mertensiana, Abies lasiocarpa*) that are contiguous with subalpine parkland. They occur within a matrix of lowland or mid-montane forests. Mid-montane is herein considered the forest zone above the lowest elevation forest zones and below the subalpine forests. In the case of western Washington, the vast majority of mid-montane forests are part of the *Abies amabilis* zone (Franklin and Dyrness 1973). Herbaceous and dwarf-shrub

vegetation that appears in the subalpine forest zones typically has strong affinity to subalpine parkland communities (see Franklin and Dyrness 1973), and differs substantially from that of balds.

Balds appear to be absent from the very wet climates on the western Olympic Peninsula and at least the western part of the Willapa Hills in southwestern Washington. They are most abundant in western Washington in the northern Puget Trough (San Juan Islands and vicinity), the driest climatic area in western Washington, and in the Columbia River Gorge, where drying winds may be in important ecological factor.

For our purposes, herbaceous bluffs are those portions of steep slopes adjacent to saltwater that are dominated by herbaceous vegetation. Bluffs can consist of rocky headlands with shallow soils over bedrock or escarpments composed of glacial sediments. In the case of glacial bluffs, herbaceous vegetation usually occurs only on portions that have recently eroded, or on sunny aspect (southern to western), coarse-textured soils (very sandy or gravelly). Coastal bluffs are influenced by wind and salt spray, which probably exacerbate drought (Rust 1992, Chappell et al. 2001b). On the outer coast, herbaceous bluffs are usually small patches in a mosaic with more extensive shrublands, forests, or salt-spray-blasted woodlands. In the northern Puget Trough, herbaceous bluffs and herbaceous balds can merge together and be difficult to differentiate, both floristically and environmentally, on slopes near saltwater shorelines. Steep rocky slopes near saltwater in this area could be considered both balds and bluffs.

Disturbance and Succession

Most balds burn at least occasionally, as do the forests that surround them. In some cases, there is evidence to suggest that they burned more frequently than forests in pre-Western settlement times. For example, in the San Juan Islands where pre-settlement fires were much more frequent than currently, many dry-site open areas have shrunk considerably in size in the last 100 years (Agee and Dunwiddie 1984, Peterson and Hammer 2001, pers. obs.). We hypothesize that in the San Juan Islands, in particular, the distinction between prairies and balds was not so clear historically, when larger areas with deeper soils surrounding shallow-soiled areas were kept open by frequent fires (Peterson and Hammer 2001). What remains open are mostly the relatively shallow-soiled, driest sites (herein called balds), though animal browsing can also facilitate maintenance of open areas (Peterson and Hammer 2001). In montane areas, balds show less evidence of being maintained or enlarged by historic burning.

Fires can help maintain or expand the size of balds by killing small young trees. Trees show a tendency to invade some balds in the absence of fire. However, the potential for tree invasion leading to conversion to forest on what is left of herbaceous balds appears to be much less than on Puget Trough prairies, where the continued existence of the prairies is threatened by ongoing tree invasion (Giles 1970, Foster and Shaff 2003), among other factors. Most balds appear to be environmentally marginal, at best, for the establishment of *Pseudotsuga menziesii* due to extreme summer drought conditions. Many balds have *Pseudotsuga* saplings or small trees growing along shaded edges. In the short-term, such edge-mediated tree invasion threatens only very small balds (those narrower than a tree height in width). In the long-term, if the apparent trend continues in the face of climate change (a big question), larger balds could be threatened on a time scale of multiple hundreds of years. Balds with scattered mature trees in mesic microsites may be more susceptible to tree invasion because of the potential microclimatic amelioration adjacent to the mature trees.

Animals can be a significant source of disturbance in balds. For example, some balds show clear evidence of digging for bulbs by bears, deer, and/or elk (pers. obs.). In the most extreme case, a bear(s?) had overturned a large number of patches (each up to several square meters in area) of turf spread over many acres while apparently foraging on bulbs. All the balds where significant digging for bulbs was observed had one feature in common, an abundance of *Allium crenulatum*, which appeared to be the food item that was being sought. Such digging activities expose bare ground in a habitat where little bare ground is typically present due to dense growth of mosses and/or lichens, and provide more opportunities for establishment of ruderal and annual species.

On some San Juan Islands (e.g., Orcas and Cypress), native black-tailed deer (*Odocoileus hemonius*) are present in such densities (due to lack of predation and hunting pressure) that they have a notable influence on forest understory vegetation and appear to be feeding heavily on small *Pseudotsuga menziesii* that occur in balds (Peterson and Hammer 2001, pers. obs.). Saplings at such sites show clear evidence of extreme pruning by ungulates. Such browsing may help to maintain herbaceous dominance by significantly retarding and delaying the successional process of tree invasion and growth. Herbivory by small mammals may also be of significance in retarding tree establishment (Peterson and Hammer 2001).

Landslides are a significant disturbance on coastal bluffs, especially on those composed of glacial deposits. Landslides can both destroy these herbaceous communities and create new habitat for them by creating new barren surfaces that are colonized by herbaceous species.

Anthropogenic disturbances to balds include road-building, timber harvest activities, recreational vehicular use, equestrian use, and trampling and associated trail creation and proliferation. Road building, if it occurs within the area of a bald, is clearly the most destructive of these activities, resulting in the destruction of the habitat and the creation of surfaces very conducive to the spread of non-native plant species (roadsides). Road building close to a bald can indirectly impact the bald negatively by facilitating invasion of non-native species.

Timber harvest activities can have direct or indirect effects. Direct effects include soil compaction, soil disturbance and erosion associated with driving equipment on the bald or of yarding logs through the bald. Indirect effects of timber harvest activities include spread and increase of non-native species (both from yarding and driving on the balds themselves and via spread from adjacent roads or cutting units), and increased light (removal of shaded edges) resulting in potential cessation of edge-mediated tree invasion.

Recreational use varies in its impacts on balds, depending on the type of recreation and the severity. Vehicular use, especially motorized, within balds can have significant consequences in terms of soil compaction, erosion, and associated facilitation of non-native species invasion. Equestrian use may be preferable from the perspective of compaction and erosion, but adds the negative consequences of potential nutrient enrichment and the likely high potential for non-native species introductions through excrement and seeds carried on hair. Least severe in terms of the types of recreation is with people on foot. However, high numbers or frequency of visits (e.g., Washington Park, Skagit County) can have negative consequences in terms of reduction of vegetation cover, trail proliferation, increase of non-native species, and in extreme cases, creation of bare ground and surface erosion (pers. obs.).

Management Considerations

Because of their high biodiversity conservation significance and their susceptibility to non-native species invasions, balds should be managed with care to minimize the potential for spread of non-natives. This means avoiding, or minimizing to the extent possible, activities that expose bare soil or facilitate spread of weeds, including road-building, recreational trails, development, equestrian use, vehicular use, and log-yarding within or adjacent to balds. High levels of diffuse pedestrian traffic should also be avoided.

When possible, balds should be monitored occasionally for tree and shrub invasion. If tree establishment has occurred, removing tree saplings (except for *Quercus garryana*) manually is recommended because this effectively prevents future loss of balds habitat with minimal investment. Removing larger trees is much more difficult, leads to the problem of removing the debris (if left in place, debris will alter composition), and may leave unvegetated areas that are prime sites for non-native invasion. "Turning back the clock" to restore areas that have succeeded to forest (for example in the San Juan Islands) is not feasible without massive investment because just removing the trees is not likely to bring back an appropriate herbaceous component.

If prescribed fire is considered as a management tool, it should be done so judiciously because of the potential for increase of non-native species. Ideally, experiments would be performed on small areas at different seasons in different conditions prior to using prescribed fire as a management tool.

Methods

The plant associations are based on data collected from 258 plots. Most of the plots were collected by the author. Twenty-five of them were collected by Joe Arnett, a botanist trained to follow the same sampling protocol. The plots are not evenly distributed throughout the potential sampling area. We tend to have more plots on state land (where we surveyed relatively thoroughly) than on federal land (where surveys were targeted at major sites); this probably results in a bias toward somewhat lower elevations and areas nearer the edges of the mountain ranges. We have many plots from the San Juan Islands and vicinity in the northern Puget Trough, from the western Columbia River Gorge (east as far as Dog Mountain, Augsperger Mountain, and Grassy Knoll), from southeastern Thurston County foothills, and from the eastern and northern fringe of the Olympic Mountains (west as far as the Elwha River drainage). We have a number of plots also from the southern Cascades as far north as Lewis County, and we have very few in the northern Cascades. By design, our sampling universe did not extend east of the Cascade Crest.

Sampled stands of vegetation were dominated or co-dominated by native species. Most plots were placed subjectively to best represent the composition of relatively homogeneous stands of vegetation. Balds are often quite heterogeneous in terms of vegetation on a relatively small scale, i.e., they have many small patches in a mosaic. Sampling such a mosaic can be challenging. Our plots often included small inclusions of other "communities" within them, especially rock outcrops, which are nearly ubiquitous in many bald vegetation types.

Plots were circular or rectangular macroplots 25 to 400 m^2 in size (majority were 42 m^2). The location of each plot was determined using aerial photographs and/or topographic maps and entered as a point into a Geographic Information System. Most data were collected between mid-May and early July during the years 1992-2003.

On each plot, the crown cover (see Henderson et al. 1989 Appendix 1) of each vascular plant species was estimated in classes of percent on the following scale: <1, 1-5, 6-10, 11-15, 16-25, 26-35, 36-45, 46-55, 56-65, 66-75, 76-85, 86-95, 96-100. Environmental data collected on plots included aspect, percent slope, topographic position, microtopography or slope shape (convex, concave, straight, or undulating), percent bare ground, presence/absence of bedrock at the surface, and evidence of disturbance. Surficial geology and elevation data were derived using a Geographic Information System to intersect data layers of interest with plot locations. On about one half of our plots, surface soils were examined in the field for texture, color, coarse fragments, and depth. When referring to the relative moisture of the sites in the text, we are comparing only within the universe of balds habitats, all of which are relatively dry, at least seasonally so, in comparison to most sites in western Washington.

The terms “present,” “prominent,” “co-dominant,” and “dominant” are often used to describe the vegetation composition in the text. “Present” means present on the sample plot but less than about 5% crown cover. “Prominent” means about 5% to about 20% crown cover. “Co-dominant” means that species shares dominance in overstory or understory layer with other species and usually has about 10% to 50% crown cover. “Dominant” means that the species is the sole dominant in overstory or understory and usually has crown cover of greater than 25%.

Vegetation data were analyzed using ordinations, TWINSPAN, and clustering algorithms found in PC-ORD (McCune and Mefford 1997). Outliers were identified and removed from the analysis. Ecological interpretation of the results of these analyses resulted in the recognition of plant associations “with a characteristic range in species composition and diagnostic species, and a defined range in habitat conditions and physiognomy or structure” (Jennings et al. 2003). This is a classification of existing vegetation and as such each association can represent one or more successional stages. The plant associations are defined so as to be consistent with the methodology in the International Classification of Ecological Communities (Anderson et al. 1998, Grossman et al. 1998), and references to their placement within this broader classification are included with reference to NatureServe (2006). A few provisional types are described based on three or fewer plots. In addition, plant communities observed in the field or sampled, but for which associations have not been defined, are briefly mentioned using names of dominant and co-dominant species.

Nomenclature and Taxonomic Issues

Plant associations are named for dominant and/or diagnostic species. Species in parentheses are important because of frequent dominance or diagnostic value, but occurred in less than 80-90 percent of the plots of that type. Species not in parentheses occur in the vast majority (>80-90 percent), if not all plots of the type. Species are generally listed in decreasing order of abundance for the type. The name of a plant association is only a label, it does not indicate that a particular species is always present or always dominant. The key and descriptions must be consulted to identify the association.

Nomenclature for plant species follows Kartesz (2003). The following taxonomic and/or identification issues are relevant to our data. We used Hitchcock and Cronquist (1973) as our primary flora for identification, and consulted other floras when there was a significant identification problem or taxonomic uncertainty in connecting Kartesz to Hitchcock.

The two species of dwarf *Arctostaphylos* (*A. nevadensis* and *A. uva-ursi*) are not easily identified in bald habitats using Hitchcock and Cronquist (1973). By the time we had our identification of the taxa definitively figured out using Hickman (1993), we had already sampled some plots to which we did not return, so we are uncertain about the identity of these taxa in at least a few of our plots.

The native bromes (*Bromus carinatus, B. pacificus,* and *B. sitchensis*) were also difficult to distinguish with Hitchcock and Cronquist (1973), primarily due to the variability in *B. carinatus* that is not very well described as it locally manifests. So, there is some uncertainty about the identity of these taxa. After working with other floras and observing many local plants, we think that the vast majority of plants in balds are *Bromus carinatus*. If we were uncertain about the identity of plants on a particular plot, we called them *Bromus carinatus.*

Subspecific taxonomy of *Festuca rubra* has been dynamic historically and is very complex, with inadequate keys for identification to currently recognized (Kartesz 2003) taxa. For this reason, we did not attempt to identify *F. rubra* subspecies. Pavlick (1985), the source of the current taxonomy, is quite certain that most material near saltwater is native, and seems equally sure that material not near saltwater is non-native. We are confident that most of the material near saltwater is native. However, having seen this taxon in quite a few sites where it is the only significant potentially non-native species in communities otherwise dominated by native species, we question whether it is native or non-native in such circumstances, e.g., balds in the western Columbia River Gorge. This situation calls out for further research.

Identification of *Festuca roemeri* versus *Festuca rubra* can be challenging or impossible using solely the keys and descriptions in Hitchcock and Cronquist (1973). We consulted with B. Wilson (pers. comm.) to confirm our identifications. Generally speaking, multiple characters should be consulted, including awn length, lemma length (shorter in *F. rubra*), habit (rhizomatous or not), and color and degree of shredding/integrity of basal leaf sheaths.

The wood-rush (*Luzula*) species that occur in these habitats are confusing. We followed Hitchcock and Cronquist (1973) initially and called them all *Luzula campestris.* Recent taxonomic changes have resulted in that name being applied to an uncommon non-native rhizomatous species (not in our data set). The names now applied to our native (and possibly some non-native) caespitose material are *Luzula comosa* and *Luzula multiflora* spp. *multiflora* var. *multiflora.* Some authorities consider the latter to be non-native, others consider it native. In the last few years, we have identified both taxa in balds (with Douglas et al. 2001), but do not have enough information to infer the distribution or relative abundance of the two. For our purposes, we lumped them together as a single taxon for data analysis and summary.

The *Poa secunda* complex comprises several taxa formerly recognized as species, though in some cases difficult to distinguish. We have lumped them all as *Poa secunda*, though we recognize that there are probably some differences in habitat. For example, the most common of the former taxa in balds (*P. sandbergii*) often occurs in vernally moist to wet sites, whereas the larger stature taxa *(P. gracillima, P. scabrella, P. nevadensis*) appear to only occur on very dry sites.

The brodeaia (triteleia) species that occurs abundantly in vernally moist to wet sites within balds was initially difficult to identify due to the low frequency of flowering in this habitat. Often, the observer only sees a carpet of small liliaceous leaves. Eventually, we saw enough examples of a few plants blooming to deduce that the species is *Triteleia hyacinthina* (formerly *Brodeaia*).

We may have initially misidentified some *Lomatium nudicaule* in the western Columbia River Gorge as *Lomatium triternatum* because the leaves of *L. nudicaule* appear to be much narrower in that area than in the Puget Trough.

We lumped the entire *Polygonum douglasii* complex, including at least 3 subspecific taxa (*douglasii, nuttallii, spergulariforme),* at the species level due to the difficulty of identification without flowers and the late flowering habits of the taxa. We may have initially misidentified some *Polygonum minimum* as *Polygonum douglasii.*

Key to Plant Associations

Instructions:

1. Select a relatively uniform area of vegetation and topography to key out. A representative 1/100 acre plot (a square about 21 feet on a side) is a simple way to examine a stand, just be sure the plot does represent the stand of interest.
2. "Present" means the species is found on a representative plot, i.e. it regularly occurs in the stand.
3. If the stand or plot meets all the criteria in a line (couplet), then read to the right or (if blank) to the next indented line down. If the stand or plot does not meet the criteria, then go to the next line (couplet) down the page that is not indented from the current line.
4. Some associations key to multiple different lines.
5. Percentage values in the key (e.g., 25%) refer to % crown cover, that is the vertical projection below the entire crown of the plant, do not subtract for spaces between leaves and branches.
6. **The key is not the classification.** After you have keyed out a stand, always read the association description of vegetation composition, geographic distribution, and physical environment. If it sounds like it fits in most regards, you have made a correct identification. If there are multiple inconsistencies between the stand and the description, the key probably was incorrect. In this case, you probably need to try the key again and follow slightly different leads or identify the stand by reading the descriptions. If your stand falls in an ecotone, it may be impossible to assign to an association.
7. When using the key interactively from Adobe Acrobat Reader, you can click on the code for an association (underlined in blue) to go to the description of that association. Use the previous view (back) arrow from the navigation bar to return to the key. If the navigation bar is not displayed (white arrow on a green circle background), choose Toolbars from the View menu and click on Navigation.

Key to Plant Associations of Balds and Bluffs of Western Washington

Arctostaphylos columbiana >25% ..... ARCO

Dwarf-shrubs >25% (*Phlox diffusa* and *Penstemon subserratus* are not considered dwarf-shrubs)

- *Arctostaphylos nevadensis* dominant ..... AR(NE,UV)-JUCO
- *Arctostaphylos uva-ursi* dominant
  - *Juniperus communis* >5% ..... AR(NE,UV)-JUCO
  - *Fragaria virginiana* or *Festuca roemeri* >1% ..... ARUV-FRVI-(FERO)
- *Juniperus communis* dominant
  - *Arctostaphylos nevadensis* or *A. uva-ursi* >1% ..... AR(NE,UV)-JUCO
  - *Phlox diffusa* usually present ..... JUCO-(PHDI)
- *Juniperus communis* and either *A. nevadensis* or *A. uva-ursi* each >5% .... AR(NE,UV)-JUCO
- Not as above .... read dwarf-shrub association descriptions, if no match, then undescribed type

Mimulus guttatus >10% ..... MIGU-TRHY

Calamagrostis nutkaensis >25% ..... CANU-VIGI-(EQTE)

Festuca roemeri >10%
- *Plectritis congesta* >5% ..... FERO-PLCO
- *Festuca rubra* >5% and *Aspidotis densa* present ..... FERU-FERO-ASDE
- Not as above ..... FERO-(CEAR-KOMA)

Camassia quamash dominant, or co-dominant with *Triteleia hyacinthina* ..... CAQU-TRHY

Balsamorhiza deltoidea dominant ..... BADE

Plectritis congesta dominant ..... PLCO

Phlox diffusa >20%, and *Lomatium martindalei, Penstemon subserratus* or *Selaginella wallacei* present ..... PHDI-(LOMA-PESU)

Calamagrostis howelli >5%, mosses often dominant with sparse vascular plants ..... CAHO

Mimulus guttatus >5% ..... MIGU-TRHY

Senecio integerrimus var. *ochroleucus* dominant ..... SEIN

Triteleia hyacinthina >10% ..... TRHY

Allium cernuum dominant ..... ALCE

Danthonia californica >25% ..... DACA-ERLA

Achnatherum lemmonii >10%..... ACLE

Carex inops >25%..... CAIN-ERLA

Lomatium martindalei >10% ..... LOMA

Festuca rubra >10%

Festuca roemeri >1% and *Aspidotis densa* present..... FERU-FERO-ASDE
Located on bluff along outer Pacific coast ..... FERU Coastal Headland
Grindelia stricta or *Camassia leichtlinii* present ..... FERU-(GRST-CALE)
Not as above ..... go to next lead down in key

Triteleia hyacinthina >5% ..... TRHY

Koeleria macrantha and/or *Agrostis pallens* dominant ..... KOMA-(AGPA)

Lomatium martindalei >5% ..... LOMA

Saxifraga ferruginea >5% and *Lomatium martindalei* present ..... LOMA

Koeleria macrantha and/or *Agrostis pallens* >10%..... KOMA-(AGPA)

Not as above..... Go back to start of key and try with half the cover values, If, after that, you still can't find a description that matches the stand, you may have an undescribed type.

Herbaceous Vegetation

Achnatherum lemmonii Association

Common Name: Lemmon's needlegrass
Abbreviated Name: ACLE
Synonym: *Stipa lemmonii*

Sample size = 7 plots

DISTRIBUTION: In Washington, known from the central Columbia River Gorge (east of Wind River and West of Cascade Crest), Skamania County, and one site on Orcas Island, San Juan County (no plots from latter). A similar type occurs in the Willamette Valley, Oregon.

GLOBAL/STATE STATUS: G1S1. There are five known occurrences in Washington, some of which are very small. Potential threats include invasion and increase of non-native species, road-building, timber harvest, and recreational impacts.

ENVIRONMENT: These sites appear to be moderately dry to very dry portions of balds. Elevations range from about 220 m on Orcas Island to a maximum of 1100 m in the Columbia Gorge. Slopes face southeast to west and are gentle to steep. Topographic position of all plots was ridgetop or upper slope. Slope shape was most often convex, but also straight or undulating. Rock outcrops did not occur on most of our plots. Soil depths were mostly less than 15 cm. Soil texture was loam or sandy loam with major component of gravel and/or stones. Parent materials are basalt or volcaniclastic rocks on most plots; marine sedimentary on Orcas Island.

CONTEXT: This association occupies small- to occasionally large-sized patches within balds. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest, North Pacific Dry Douglas-fir Forest and Woodland, and North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest. In the case of the latter, *Abies procera* is typically the diagnostic species present adjacent to these balds, not *Abies amabilis.*

VEGETATION: Typically dominated by grasses; less frequently by a mix of grasses and forbs. Cover of mosses is typically very substantial (>50%). *Achnatherum lemmonii* is always dominant or co-dominant (>10% cover). *Lomatium triternatum* is present to prominent in all plots sampled. *Koeleria macrantha* and *Phlox diffusa* are usually present to prominent. *Eriophyllum lanatum, Bromus carinatus, Calochortus subalpinus, Selaginella wallacei* and *Lotus micranthus* are sometimes prominent. *Allium acuminatum, Eriogonum compositum, Penstemon subserratus, Sedum stenopetalum, Gilia capitata, Polygonum douglasii, Cerastium arvense* and *Microsteris gracilis* are usually present. *Vulpia myuros* and *Bromus hordaceus* are non-native annual grasses that are occasionally prominent to co-dominant.

CLASSIFICATION NOTES: NatureServe (2006) recognizes the ACLE/RACA association, which is described from the Willamette Valley in Oregon. These Washington plots are probably best considered part of the same association, even though they appear to be more diverse floristically, more varied structurally, and have many different associated species.

Allium cernuum Association

Common Name: Nodding onion
Abbreviated Name: ALCE

Sample size = 11 plots

DISTRIBUTION: Known to date only from the western Columbia River Gorge in Skamania County, Washington.

GLOBAL/STATE STATUS: GNRS1?. There are five known occurrences. Potential threats include invasion and increase of non-native species, tree and/or shrub invasion, road-building, timber harvest, and recreational impacts.

ENVIRONMENT: These sites appear to be mesic to moist portions of balds. They are at least somewhat moist in the spring. They occur on upper to middle slopes with straight to concave microtopography. Slopes are moderate to steep (35-70% slope) southerly to western aspects. Rock outcrops are not typically present at the surface within this association. Soils are relatively deep for balds habitat: at least 10 cm and can be over 25 cm deep. Recorded soil textures are mostly loams that are gravelly to very gravelly or stony to very stony (high coarse fragment content). Elevation ranges from 480 to 1025 m. Surficial geology is basalt flows or conglomerate.

CONTEXT: This association occupies small- to medium-sized patches within balds. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest, North Pacific Dry Douglas-fir Forest and Woodland, and North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest. In the case of the latter, *Abies procera* is typically the diagnostic species present adjacent to these balds, not *Abies amabilis.*

VEGETATION: Dominated by forbs or a mixture of graminoids and forbs. *Allium cernuum* is always dominant or co-dominant (>20% cover). *Carex inops* and *Festuca rubra* (latter may be non-native) are usually present and sometimes co-dominant. *Koeleria macrantha* and *Eriophyllum lanatum* are almost always present to prominent. *Phlox diffusa, Ligusticum apiifolium, Agrostis pallens, Delphinium nuttallii, Eurybia radulina, Collinsia grandiflora,* or *Triteleia hyacintha* are occasionally prominent, the latter with <10% cover if present. *Achillea millefolium, Penstemon subserratus, Rosa nutkana, Microseris laciniata, Cerastium arvense, Luzula (comosa, multiflora*), *Potentilla glandulosa, Microsteris gracilis*, *Vicia americana* and *Castilleja hispida* are usually present. *Aira caryophyllea* and *Hypericum performatum* are frequent non-natives.

CLASSIFICATION NOTES: This association has not been previously described in the literature.

Balsamorhiza deltoidea provisional association

Common Name: Puget balsamroot
Abbreviated Name: BADE

Sample size = 2 plots

DISTRIBUTION: Known to date only from the central Columbia River Gorge (east of Wind River, west of Cascade Crest) in Skamania County, Washington, as far north as Grassy Knoll.

GLOBAL/STATE STATUS: GNRS1Q. There are only three known occurrences. Potential threats include invasion and increase of non-native species, tree and/or shrub invasion, road-building, timber harvest, and recreational impacts.

ENVIRONMENT: Our plots are located on steep southwest aspect slopes at 840 to 1030 m elevation. Rock outcrops are not typically present within this association, indicating soils are not very shallow. Soil on one plot was gravelly loam. Surficial geology is basalt. These sites appear to be moderately dry to slightly dry portions of balds.

CONTEXT: This association occupies medium-sized to large patches within extensive areas of balds. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest and North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest. In the case of the latter, *Abies procera* is typically the diagnostic species present adjacent to these balds, not *Abies amabilis.*

VEGETATION: This relatively densely vegetated community type is dominated by the forb *Balsamorhiza deltoidea*. *Senecio integerrimus* can be co-dominant. Several other herbaceous species are often prominent including *Festuca rubra* (may be non-native), *Achillea millefolium, Cerastium arvense, Lupinus argenteus* ssp. *argenteus* var. *laxiflorus, Fragaria vesca, Artemisia douglasiana, Osmorhiza occidentalis,* and *Bromus carinatus*. Non-natives typically occupy low cover in this type, with the exception of *Festuca rubra.*

CLASSIFICATION NOTES: This association has not been previously described in the literature.

Calamagrostis howellii provisional association

Common Name: Howell's reedgrass
Abbreviated Name: CAHO

Sample size = 3 plots

DISTRIBUTION: Occurs only in the western Columbia River Gorge of Washington, Skamania County.

GLOBAL/STATE STATUS: GNRS1Q. This type is very localized in distribution and environment, with very few occurrences.

ENVIRONMENT: These sites are very dry portions of balds, being located on bedrock outcrops with very thin, intermittent veneers of soil. The plots are on steep to very steep upper slopes facing southeast to southwest. Surficial geology is basalt or andesite. Elevation range of recorded plots is 850 to 910 m.

CONTEXT: This association occupies small patches on rock outcrops within balds. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest, North Pacific Dry Douglas-fir Forest and Woodland, and North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest. In the case of the latter, *Abies procera* is typically the diagnostic species present adjacent to these balds, not *Abies amabilis.*

VEGETATION: This vegetation type has a sparse to open growth of grasses and forbs over bedrock and moss. The dominant vascular plant is *Calamagrostis howellii.* The moss-like *Selaginella wallacei* is always prominent as well. *Penstemon rupicola* and *Phlox diffusa* can also be prominent. *Silene douglasii, Polygonum douglasii, Lomatium martindalei, Hieracium longiberbe, Eriophyllum lanatum, Cryptogramma acrostichoides, Poa secunda,* and *Phlox diffusa* are usually present. Non-native species are found only in small amounts, if at all.

CLASSIFICATION NOTES: This association has not been previously described in the literature.

Calamagrostis nutkaensis – Vicia nigricans ssp. gigantea – (Equisetum telmateia) Association

Common Name: Nootka reedgrass – giant vetch – (giant horsetail)
Abbreviated Name: CANU-VIGI-(EQTE)
Synonym: *Calamagrostis nutkaensis – Vicia gigantea – (Equisetum telmateia)*

Sample size = 7 plots

DISTRIBUTION: In Washington, occurs along the outer Pacific coast in Pacific, Grays Harbor, Jefferson, and Clallam counties, and probably on off shore islands. Possibly occurs as well in Oregon and British Columbia.

GLOBAL/STATE STATUS: GNRS1. This type is very localized in distribution and environment, with few occurrences (probably less than 20 total in Washington). Occurs in a dynamic habitat susceptible to disturbances, both natural and human-caused.

ENVIRONMENT: These sites appear to be slightly dry to very moist portions of coastal bluffs located in a very wet, foggy climate (hypermaritime). Slopes are moderately to very steep and located on southwest to west aspects. Can occur anywhere along the face of a bluff, from toe slopes directly adjacent to sandy beach habitat up to the upper slope. Microtopography is often complex and variable. Seeps are often present within this association, though its occurrence is not dependent upon them. Recorded elevations range from just above sea level to about 60 m. Surficial geology is most often Fraser-age continental or alpine glacial deposits, and in one location, basalt.

CONTEXT: This association occupies small patches on coastal bluffs, intermixed with shrublands (*Gaultheria shallon* and *Rubus spectabilis* being most abundant), forests, and sparsely vegetated cliffs or banks. Surrounding forests fall within the North Pacific Hypermaritime Sitka Spruce Forest ecological system.

VEGETATION: Typically dominated by tall grasses; infrequently by a mix of tall grasses and forbs. *Calamagrostis nutkaensis* is typically dominant, and always at least co-dominant. *Vicia nigra* ssp. *gigantea* is present in all plots sampled to date and can be co-dominant. *Equisetum telmateia* is usually present to co-dominant, increasing in abundance with increasing soil water availability. Other frequent species include *Gaultheria shallon, Anaphalis margaritacea, Achillea millefolium, Fragaria chiloensis, Epilobium ciliatum, Polystichum munitum, Stellaria crispa, Rubus spectabilis,* and *Solidago canadensis. Carex obnupta* or *Scirpus microcarpus,* wetland indicators, are occasionally present. Non-native species are rather frequent, especially *Hypochaeris radicata* and *Cirsium vulgare*.

CLASSIFICATION NOTES: This association has not been previously described in the literature. *Calamagrostis nutkaensis - Elymus glaucus* Herbaceous Vegetation (NatureServe 2006) is similar in many respects. CANU-VIGI-(EQTE) differs from it in the following respects: (1) high constancy and cover of *Vicia nigra* ssp. *gigantea* and *Equisetum telmateia*; (2) frequent presence of seeps, wet soils, and wetland plant species; (3) has only been seen as small patches on steep slopes in largely forest and shrub dominated landscapes.

Camassia quamash – Triteleia hyacinthina Association

Common Name: Common camas – hyacinth triteleia
Abbreviated Name: CAQU-TRHY
Synonym: *Camassia quamash – Brodeaia hyacinthina*

Sample size = 11 plots

DISTRIBUTION: Occurs in the western Columbia River Gorge, Skamania County, in the southern Puget Trough of Clark County (Vancouver Lowlands), in foothills of southeastern Thurston County, and possibly elsewhere in the Puget Trough. It also occurs in the Willamette Valley of Oregon and possibly in the Georgia Basin of British Columbia.

GLOBAL/STATE STATUS: GNRS1S2. There are five known occurrences in Washington. Potential threats include invasion and increase of non-native species, road-building, timber harvest, and recreational impacts.

ENVIRONMENT: Sites appear to be very moist to wet portions of balds. They are very moist to wet in the spring, then become much drier later in the season. The seasonal water is perched on top of bedrock. Soils are consistently very shallow, with a maximum depth of about 15 cm. Outcrops are usually not present within the association, but often directly adjacent to it. Soil texture is loam, or rarely silt loam, with or without a gravelly or stony component. Aspect is southeast to west-southwest. Slopes are gentle to moderate in steepness in and around the Puget Trough, and steep (60-90%) in the Columbia Gorge. Slope position is mostly middle to upper slopes, with one plot on a broad ridgetop. Microtopography is most often concave (capturing water), though it can be straight, undulating, or convex. Recorded elevation ranges from 100 m to 560 m. Surficial geology includes basalt, andesite, and volcaniclastic rocks.

CONTEXT: This association occupies small patches within balds. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest and North Pacific Dry Douglas-fir Forest and Woodland. Locally, it can occur adjacent to or in a mosaic with North Pacific Oak Woodland

VEGETATION: This vegetation type is typically dominated by forbs. *Camassia quamash* is always dominant or co-dominant. All but one of our plots were co-dominated by *Triteleia hyacinthina*. *Prunus vulgaris* is usually prominent. *Leptosiphon biocolor, Festuca roemeri,* and *Mimulus guttatus* are occasionally prominent. *Zigadenus venenosus, Mimulus guttatus* and *Madia gracilis* are usually present. The non-native species *Aira caryophyllea, Bromus hordeaceus, Holcus lanatus, Hypochaeris radicata,* and *Sherardia arvensis* are frequent and often prominent.

CLASSIFICATION NOTES: Christy (2004) lists a CAQU association that he equates with CAQU wet prairie association (NatureServe 2006). Some of those plots come from basalt scablands with shallow soils that we recommend lumping with our CAQU-TRHY type as a new global association separate from CAQU wet prairie, which occurs in a different physical environment with different associated species. In summary, we recommend a new CAQU-TRHY association.

Carex inops – Eriophyllum lanatum Association

Common Name: Long-stolon sedge – woolly sunflower
Abbreviated Name: CAIN-ERLA
Synonym: *Carex pensylvanica – Eriophyllum lanatum*

Sample size = 6 plots

DISTRIBUTION: Occurs in the western Columbia River Gorge of Washington and in the northern Puget Trough. Known from Skamania, Whatcom, and San Juan counties. Small occurrences may be present elsewhere in the Puget Trough.

GLOBAL/STATE STATUS: GNRS2. There are only two occurrences of large size. There are probably quite a few very small ones. Potential threats include invasion and increase of non-native species, tree and/or shrub invasion, road-building, timber harvest, and recreational impacts.

ENVIRONMENT: These sites appear to be slightly dry to mesic portions of balds. They are often located near the edges of balds where shading from adjacent trees is substantial. Slopes are moderate to steep and face south to west. Upper slope positions appear most typical, with mid-slopes also represented. Slope shape is variable. Bare soil at the surface is often abundant. Surficial geology includes basalt and sedimentary rocks. Rock outcrops are typically not present at the surface and recorded soil depths are all greater than 10 cm. Both gravelly loam and sandy loam are reported.

CONTEXT: This association occupies small to large patches within balds. In the Puget Trough, it is found along the edges of balds, in the Columbia Gorge, it occurs as larger patches in the interior of balds as well. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest, North Pacific Dry Douglas-fir Forest and Woodland, and North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest. In the case of the latter, *Abies procera* is typically the diagnostic species present adjacent to these balds, not *Abies amabilis.*

VEGETATION: Dominated by graminoids or a mix of graminoids and forbs. *Carex inops* is always dominant or co-dominant. *Achillea millefolium* and *Eriophyllum lanatum* are always present and often prominent. Other species that can be prominent to co-dominant include *Mahonia aquifolium, Phlox diffusa, Bromus carinatus, Elymus glaucus, Allium cernuum, Festuca rubra, Koeleria macrantha, Cerastium arvense, Tripholium microcephalum, Lathyrus nevadensis, Senecio integerrimus, Microseris laciniata, Lupinus argenteus* ssp. *argenteus* var. *laxiflorus,* and *Fragaria virginiana*. Frequently occurring species are *Luzula (comosa, multiflora*), *Koeleria macrantha, Penstemon subserratus, Cerastium arvense,* and *Microseris laciniata.* Non-native *Poa pratensis* is co-dominant on one of our plots, *Rumex acetosella* is prominent on another.

CLASSIFICATION NOTES: This association has not been previously described in the literature. The large patches of this type in the Columbia Gorge may have been significantly different in composition prior to historic grazing by domestic ungulates.

Danthonia californica – Eriophyllum lanatum Association

Common Name: California danthonia – woolly sunflower
Abbreviated Name: DACA-ERLA

Sample size = 8 plots

DISTRIBUTION: Occurs in the Puget Trough in San Juan, western Skagit and western Whatcom counties, and rarely in foothills of southeastern Thurston County and the western Columbia River Gorge, Skamania County. It probably also occurs in the adjacent Georgia Basin of British Columbia, and may occur in the Willamette Valley of Oregon.

GLOBAL/STATE STATUS: GNRS1. There are very few known occurrences with fair or better integrity in Washington and they are highly threatened by invasion and increase of non-native species. Other threats include tree invasion with fire suppression, development, and recreational impacts.

ENVIRONMENT: These sites appear to be moderately dry to slightly dry portions of balds. Occurs primarily on moderate to steep mid- to upper slopes, with eastern to western aspects. Slope shape is variable. The two plots for which we have on-site soils data had sandy loam texture and depth to bedrock of 10 cm to greater than 20 cm. Surficial geology includes sedimentary, volcaniclastic, and ultramafic rocks (latter rare). One plot occurs on serpentine soils on Cypress Island. Rock outcrops are sometimes present within this association.

CONTEXT: This association occupies small to large patches within balds. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest and North Pacific Dry Douglas-fir Forest and Woodland.

VEGETATION: Dominated by grasses, of which *Danthonia californica* is always at least co-dominant. Other native graminoids that are occasionally co-dominant with *Danthonia* are *Carex inops, Koeleria macrantha, Bromus carinatus,* and *Festuca rubra* (latter may be non-native). Frequent native herbaceous species include *Elymus glaucus, Achillea millefolium, Eriophyllum lanatum* (almost always present), *Trifolium microcephalum, Koeleria macrantha, Luzula (comosa, multiflora), Aspidotis densa, Cerastium arvense, Zigadenus venenosus, Bromus carinatus,* and *Carex inops*. Common non-native species are *Aira caryophyllea, Aira praecox, Vulpia bromoides,* and *Vulpia myuros.* If *Festuca roemeri* is present, it is found only in small amounts.

CLASSIFICATION NOTES: This association is also described, albeit only in the Puget Trough, in Chappell (2006). It is considered a variant of FERO-CEAR-KOMA by NatureServe (2006). A similar dominance type has been noted in Oregon's Willamette Valley upland prairies and described as DACA Valley Grassland (NatureServe 2006). DACA-ERLA may be considered a variation of the latter, though the associated species appear to be different.

Festuca roemeri – (Cerastium arvense – Koeleria macrantha) Association

Common Name: Roemeri's fescue – (field chickweed – prairie Junegrass)
Abbreviated Name: FERO-(CEAR-KOMA)
Synonym: *Festuca idahoensis* var. *roemeri – (Cerastium arvense – Koeleria cristata)*

Sample size = 38 plots

DISTRIBUTION: This association is known to occur in the San Juan Islands, Fidalgo Island, northern Whidbey Island, foothills of the northern and eastern Olympic Mountains, southeastern Thurston Co. foothills, the western Columbia River Gorge, and near the western edge of the Cascades in Cowlitz Co. County distribution includes San Juan, Skagit, Island, Clallam, Mason, Skamania, Thurston, Jefferson, and Cowlitz. Also occurs in adjacent Georgia Basin of B.C.

GLOBAL/STATE STATUS: G2S2. There are 14 known occurrences with fair or better integrity in Washington and many of them are quite threatened by invasion and increase of non-native species. Other threats include development, road-building, fire suppression effects, and recreational impacts.

ENVIRONMENT: These sites appear to be slightly dry to moderately dry portions of balds. Occurs on eastern to western aspects, especially south to southwest. Slopes range from moderate to very steep (20-115%). Upper slope positions are most frequent, with mid-slopes also represented. Slope shape is usually convex or undulating, occasionally straight. Soils are loam or sandy loam in texture, often with a gravelly component. On any one plot, soil depth is often variable, with small rock outcrops often present within the association. Measured soil depths (between rock outcrops) ranged from 5 cm to over 20 cm (mean 13+). Elevation ranges from near sea level to about 930 m, with most plots occurring between 270 and 620 m. Rarely occurs directly adjacent to saltwater shorelines. More frequent in dry climatic areas (e.g., Olympic Mountains rainshadow). Surficial geology represents a wide variety of bedrock types including basalt, breccia, volcaniclastic rocks, sedimentary rocks, metasedimentary rocks, intrusive rocks, andesite, and ultramafic rocks.

CONTEXT: This association occupies small to large patches within balds. In the northern Puget Trough, on relatively good condition balds, it can be the dominant cover type. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest and North Pacific Dry Douglas-fir Forest and Woodland. In the Puget Trough and the Columbia Gorge, it can occur adjacent to or in a mosaic with North Pacific Oak Woodland.

VEGETATION: Dominated by grasses, of which *Festuca roemeri* is typically dominant or co-dominant (>10% cover). The evergreen dwarf-shrub *Mahonia aquifolium* (<0.5 m tall in this association) occurs in nearly half the plots with a maximum of 20 percent cover. The dwarf-shrub *Arctostaphylos uva-ursi* is occasionally prominent. The native graminoids *Danthonia californica, Bromus carinatus, Agrostis pallens,* or *Carex inops* are occasionally prominent to co-dominant. *Camassia quamash* is occasionally prominent. The most frequent native herbaceous species are *Koeleria macrantha, Luzula (comosa, multiflora), Achillea millefolium, Eriophyllum lanatum, Cerastium arvense, Zigadenus venenosus, Fritillaria affinis, Lotus micranthus,* and *Allium acuminatum*. *Selaginella wallacei* (habit similar to a moss) is usually present on small rock outcrops within the association. Common non-native species include *Aira caryophyllea, Aira praecox, Bromus hordeaceus, Hypochaeris radicata,* and *Rumex acetosella*.

CLASSIFICATION NOTES: This association is also described, albeit only in the Puget Trough, in Chappell (2006). The NatureServe (2006) description of FERO-CEAR-KOMA includes what are herein referred to as FERU-FERO-ASDE and DACA-ERLA.

Festuca roemeri – Plectritis congesta Association

Common Name: Roemeri's fescue – showy plectritis
Abbreviated Name: FERO-PLCO
Synonym: *Festuca idahoensis* var. *roemeri – Plectritis congesta*

Sample size = 9 plots

DISTRIBUTION: Occurs mostly around the periphery of the Puget Trough on foothills of the Olympic Mountains and southeastern Thurston County. It occurs occasionally in the San Juan Islands and vicinity and near Camas, Clark County. County distribution includes San Juan, Skagit, Clallam, Mason, Thurston, and Clark. It may also occur in the adjacent Georgia Basin of British Columbia.

GLOBAL/STATE STATUS: GNRS1. There are very few known occurrences and they are highly threatened by invasion and increase of non-native species. Other threats include tree invasion, development, road-building, timber harvest, and recreational impacts.

ENVIRONMENT: These sites appear to be mesic to moist portions of balds. They appear to be moister in the spring than most balds habitats. They consist of the partially shaded portions or edges of balds or seasonally moist microsites within more extensive balds. Occurs primarily on mid- to upper slopes, with southern to western aspects. Slopes are gentle to steep. Slope shape is variable. Soils are loam or sandy loam in texture, sometimes with a gravelly component. Recorded soil depths (between rock outcrops) ranged from 8 cm to greater than 20 cm. Rock outcrops are sometimes present within the association. Surficial geology includes basalt, breccia, andesite, and volcaniclastic rocks. It occurs from near sea level up to about 600 m elevation.

CONTEXT: This association occupies small patches within balds. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest and North Pacific Dry Douglas-fir Forest and Woodland. Locally, it can occur adjacent to or in a mosaic with North Pacific Oak Woodland.

VEGETATION: Dominated by grasses or a mixture of grasses and forbs. *Festuca roemeri* is always co-dominant to dominant. *Plectritis congesta* is always prominent to co-dominant. *Collinisa grandiflora* is prominent to co-dominant in about half the plots, and *Prunella vulgaris* in one-third of them. Frequent native herbaceous species include *Clarkia amoena*, *Daucus pusillus*, *Galium aparine*, *Camassia quamash*, *Lotus micranthus*, *Danthonia californica*, *Bromus carinatus*, and *Luzula (comosa, multiflora)*. *Selaginella wallacei* (habit similar to a moss) is usually present on small rock outcrops within the association. Frequent non-native species are *Bromus hordeaceus*, *Holcus lanatus*, and *Aira caryophyllea*. *Hypochaeris radicata* and *Cynosurus echinatus* occasionally contribute substantial cover.

CLASSIFICATION NOTES: This association is also described in Chappell (2006).

Festuca rubra – Festuca roemeri – Aspidotis densa Association

Common Name: Red fescue – Roemer's fescue – Indian's dream
Abbreviated Name: FERU-FERO-ASDE
Synonym: *Festuca rubra - Festuca idahoensis* var. *roemeri – Aspidotis densa*

Sample size = 6 plots

DISTRIBUTION: Occurs only on islands in western Skagit County.

GLOBAL/STATE STATUS: GNRS1. There are only 5 known occurrences. Threats include invasion and increase of non-native species, recreational use, and perhaps tree invasion with fire suppression.

ENVIRONMENT: These sites appear to be moderately dry to very dry portions of balds. Occurs only on serpentine soils and usually near saltwater shorelines. Occurs on moderate to steep slopes, with southeast to west-southwest aspects. Slope shape is typically convex or undulating. Surficial geology is ultramafic rocks. Small rock outcrops are present within the association. Soils are loam in texture, often with abundant coarse fragments. Climate is dry for western Washington. Occurs from sea level up to about 180 m elevation: only one of six plots is higher than 45 m elevation.

CONTEXT: This association is often the major plant community on the balds where it occurs, though it can also occur as small patches within balds. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest and North Pacific Dry Douglas-fir Forest and Woodland, especially the latter.

VEGETATION: Dominated by grasses. Native *Festuca rubra* var. *littoralis* Vasey ex Beal and/or *Festuca roemeri* are dominant and both are always present. The serpentine indicator *Aspidotis densa* is always present. Frequent native herbaceous species include *Achillea millefolium, Koeleria macrantha, Luzula (comosa, multiflora), Cersastium arvense, Zigadenus venenosus, Elymus glaucus, Bromus carinatus, Grindelia stricta, Epilobium minutum,* and *Ranunculus occidentalis*. *Selaginella wallacei* (habit similar to a moss) is present and often prominent. *Pseudotsuga menziesii* and *Juniperus scopulorum* are usually present in small amounts. The dwarf-shrub *Mahonia aquifolium* occurs in half the plots. The most common non-native species are *Aira caryophyllea, Aira praecox, Vulpia bromoides,* and *Rumex acetosella*.

CLASSIFICATION NOTES: This association is also described in Chappell (2006). It is considered a variant of FERO-CEAR-KOMA by NatureServe (2006).

Festuca rubra – (Grindelia stricta – Camassia leichtlinii) Association

Common Name: Red fescue – (Oregon gumweed – great camas)
Abbreviated Name: FERU-(GRST-CALE)
Synonym: *Festuca rubra – (Grindelia integrifolia* var. *macrophylla – Camassia leichtlinii)*

Sample size = 18 plots

DISTRIBUTION: This association occurs in San Juan County, on western Whidbey Island (Island Co.), and islands of western Skagit and western Whatcom counties. It probably occurred historically, and could still occur rarely, in northeastern Clallam and northeastern Jefferson counties. It also occurs in the adjacent Georgia Basin of British Columbia.

GLOBAL/STATE STATUS: G1S1. There are nine known occurrences in Washington of fair to good integrity. It was probably more extensive historically. Threats include invasion and increase of non-native species, invasion of trees and shrubs with lack of fire, development, and recreational impacts.

ENVIRONMENT: These sites appear to be slightly dry to moderately dry portions of balds and moderately dry to very dry portions of coastal bluffs. Found only near saltwater shorelines, either on shallow soils over bedrock (balds) or on steep bluffs composed of glacial deposits. Slopes range from nearly flat to very steep. South to west aspects are most frequent, with occasional occurrence on other aspects. Topographic position is highly variable. Slope shape is most often convex or undulating. Soils on the glacial bluffs are very sandy and/or gravelly in texture. Small rock outcrops are often present within the association on the shallow-soiled sites. Surficial geology includes sedimentary, metasedimentary, and metavolcanic rocks, as well as glacial outwash and drift. Found only in dry climatic areas near sea level (maximum elevation of plots is 30 m).

CONTEXT: This association generally occurs as small- to medium-sized patches or linear strips adjacent to saltwater shorelines. Sometimes it occurs as small patches within larger degraded bald or bluff habitats dominated by non-native species. Adjacent forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest and North Pacific Dry Douglas-fir Forest and Woodland, especially the latter.

VEGETATION: Dominated by grasses or a mix of grasses and forbs. Native varieties of *Festuca rubra* are always dominant or co-dominant (formerly known as *Festuca rubra* var. *littoralis* Vasey ex Beal). *Camassia leichtlinii* is sometimes prominent to co-dominant. Other frequent herbaceous species include *Grindelia stricta, Cerastium arvense, Achillea millefolium, Allium acuminatum,* and *Luzula (comosa, multiflora). Lomatium nudicaule* is occasionally prominent. Frequent non-native species include *Hypochaeris radicata, Bromus hordaceus, Holcus lanatus, Aira caryophyllea, Aira praecox, Bromus rigidus, Rumex acetosella*, and *Plantago lanceolata*.

CLASSIFICATION NOTES: This association is also described in Chappell (2006). It is called FERU-(CALE-GRST) by NatureServe (2006).

Koeleria macrantha – (Agrostis pallens) Association

Common Name: Prairie Junegrass – (thin bentgrass)
Abbreviated Name: KOMA-(AGPA)
Synonym: *Koeleria cristata – (Agrostis diegoensis)*

Sample size = 15 plots

DISTRIBUTION: Known to occur only in the southern Cascades of Washington, especially in the western Columbia River Gorge, but also as far north as Lewis County.

GLOBAL/STATE STATUS: GNRS1. There are only six known occurrences with fair or better integrity in Washington, with a few more possibly in existence. They are threatened by invasion and increase of non-native species. Other possible threats include tree invasion with fire suppression and recreational impacts.

ENVIRONMENT: These sites appear to be slightly dry to moderately dry portions of balds. They occur on moderate to very steep slopes mostly facing east to west (rarely other aspects). Almost all sites are upper slopes, with an occasional mid-slope or ridgetop as well. Slope shape is variable. Bare soil or gravel is sometimes abundant on the soil surface, more often than in other grass-dominanted associations. Soil texture is loam, sandy loam, or loamy sand, typically with abundant coarse fragments (mostly gravel, occasionally stones). Small rock outcrops are sometimes present within or directly adjacent to the association. Surficial geology includes basalt, andesite, sedimentary, and volcaniclastic rocks, as well as mass-wasting deposits. This montane association occurs from 520 to 1250 m elevation.

CONTEXT: This association occupies small to large patches within balds. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest, North Pacific Dry Douglas-fir Forest and Woodland, and North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest. In the case of the latter, *Abies procera* is typically the diagnostic species present adjacent to these balds, not *Abies amabilis.* Locally, it can occur adjacent to or in a mosaic with North Pacific Oak Woodland.

VEGETATION: Dominated by grasses or a mixture of grasses and forbs. *Koeleria macrantha* and/or *Agrostis pallens* are usually co-dominant. The former is almost always present, the latter somewhat less frequently. Associated species are quite variable. Other species that were dominant or co-dominant in one or more of our plots are *Fetuca rubra* (may be non-native), *Eriophyllum lanatum, Microseris laciniata, Zigadenus venenosus, Gilia capitata,* and *Selaginella wallacei. Elymus glaucus, Bromus carinatus, Mahonia aquifolium, Allium cernuum, Lomatium dissectum,* and *Lomatium nudicaule* are occasionally prominent. Frequent native species include *Penstemon subserratus, Cerastium arvense, Elymus glaucus, Achillea millefolium, Castilleja hispida, Eriophyllum lanatum, Gilia capitata, Lomatium triternatum, Microsteris gracilis, Polygonum douglasii,* and *Vicia americana.* Common non-native species are *Aira caryophyllea* (can be co-dominant), *Bromus hordeaceus,* and *Hypericum perforatum.*

CLASSIFICATION NOTES: This association has not been previously described. Portions of it, those with abundant *Festuca rubra,* have been considered part of FERU Montane Herbaceous Vegetation by NatureServe (2006). We no longer recognize the latter association in Washington.

Lomatium martindalei Association

Common Name: Martindale's lomatium
Abbreviated Name: LOMA

Sample size = 12 plots

DISTRIBUTION: In Washington, known only from the southern Cascades in Skamania and Cowlitz counties. Also occurs in western Oregon and possibly further north in the Cascades or in the Olympics.

GLOBAL/STATE STATUS: G2S2. There are seven known occurrences in Washington, and there are likely to be at least several more. There is a low to moderate threat from invasion and increase of non-native species.

ENVIRONMENT: These sites appear to be very dry portions of balds. Soils are either very shallow, very stony, or very gravelly. These gentle to steep slopes are found on eastern to northwestern aspects. Upper slopes are most frequent, with mid-slopes and ridgetops also represented. Slope shape is usually convex, less often undulating. Typically there is substantial surface cover of bedrock (usually covered with mosses), stones, and/or gravel. Soil texture is mostly loam, less often sandy loam, with a major component of stones and/or gravel typical. Recorded soil depths range from 2 cm to over 15 cm. In the latter case, gravel was abundant on the surface. Surficial geology includes basalt, andesite, volcaniclastic, sedimentary, and plutonic igneous rocks. This montane association occurs at elevations of 520 to 1280 m.

CONTEXT: This association generally occupies small patches within balds. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest, North Pacific Dry Douglas-fir Forest and Woodland, and North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest.

VEGETATION: The most abundant plants in this association are sometimes mosses, which typically cover most of the space between the sparse to moderately open growth of forbs or mix of grasses and forbs. The dominant forb is typically *Lomatium martindalei*, and it is always present. The grass *Agrostis pallens* is almost always present and sometimes co-dominant. The moss-like *Selaginella wallacei* is usually prominent. *Phlox diffusa* is sometimes present to prominent, but never as much as co-dominant. *Allium crenulatum, Calochortus subalpinus, Saxifraga ferruginea, Eriophyllum lanatum,* and *Lupinus sellulus* ssp. *sellulus* var. *lobbii* are occasionally to sometimes prominent. Frequent native species include *Luzula (comosa, multiflora), Achillea millefolium, Eriophyllum lanatum, Polygonum douglasii, Calochortus subalpinus, Saxifraga ferruginea,* and *Vicia americana.* Non-native species are relatively infrequent. Occasionally, *Aira caryopyllea* or *Hieracium lachenalii* are abundant.

CLASSIFICATION NOTES: This association is described from western Oregon (Aldrich 1972, NatureServe 2006). Our plots tend to have higher percent cover of vascular plants and some different associated species than the Oregon sites.

Mimulus guttatus – Triteleia hyacinthina Association

Common Name: Yellow monkeyflower – hyacinth triteleia
Abbreviated Name: MIGU-TRHY
Synonym: *Mimulus guttatus – Brodeaia hyacinthina*

Sample size = 9 plots

DISTRIBUTION: Occurs in the western Columbia River Gorge, Skamania County, in foothills of southeastern Thurston County, and around the northern and eastern periphery of the Olympic Mountains (Clallam and Mason counties). May occur further north in the Cascades, in Oregon, in the northern Puget Trough of Washington, and in the Georgia Basin of British Columbia.

GLOBAL/STATE STATUS: GNRS2. There are eight known occurrences in Washington and there are likely to be additional occurrences located with more inventory. Potential threats include invasion and increase of non-native species, road-building, timber harvest, and recreational impacts.

ENVIRONMENT: These sites appear to be the wettest portions of balds. They are wet in the spring and typically become very dry by late summer (sometimes called vernal seeps). Slope steepness is moderate to very steep and aspect is east-southeastern to western. Topographic position is middle to upper slopes. Slope shape is most often concave, less frequently undulating, convex, or straight. Soil texture is loam, with or without coarse fragments (gravel). Soil depth ranges from less than 5 cm to 15 cm, with 5-10 cm apparently typical. Small bedrock exposures are sometimes found within this association. Surficial geology includes basalt, volcaniclastic rocks, andesite, and sedimentary rocks. Recorded elevation range is 250 to nearly 1000 m.

CONTEXT: This association typically occupies small patches within balds. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest, North Pacific Dry Douglas-fir Forest and Woodland, and North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest. Locally, it can occur adjacent to or in a mosaic with North Pacific Oak Woodland.

VEGETATION: This vegetation type is dominated by forbs or by a mixture of forbs and graminoids. *Mimulus guttatus* is always prominent to co-dominant, primarily as a low-growing annual. *Triteleia hyacinthina* was present in all but one of our plots, and is usually co-dominant. Other associated species are quite variable. *Montia parvifolia, Plectritis congesta, Leptosiphon bicolor, Lomatium nudicaule, Delphinium nuttallii, Poa secunda, Allium cernuum, Collinsia grandiflora, Prunella vulgaris, Saxifraga rufidula, Trifolium microcephalum, Trifolium cyathiferum* and *Danthonia californica* are occasionally to sometimes prominent to co-dominant. *Clarkia amoena, Trifolum wildenowii,* and *Eriophyllum lanatum* are usually present. The non-native species *Aira caryophyllea, Bromus hordaceus, Vulpia bromoides, Vulpia myuros, Hypochaeris glabra,* and *Hypochaeris radicata* can be prominent to co-dominant.

CLASSIFICATION NOTES: This association has not been previously described in the literature.

Phlox diffusa – (Lomatium martindalei – Penstemon subserratus) Association

Common Name: Spreading phlox – (Martindale's lomatium – fine-toothed penstemon)
Abbreviated Name: PHDI-(LOMA-PESU)

Sample size = 17 plots

DISTRIBUTION: Occurs in the southern Washington Cascades (Skamania, Cowlitz, and Lewis counties) and in the Olympic Mountains. Possibly occurs further north in the Cascades and in Oregon as well.

GLOBAL/STATE STATUS: GNRS2S3. There are at least ten known occurrences in Washington, with others likely. Threats include invasion and increase of non-native species, road-building, and recreational impacts.

ENVIRONMENT: These sites are appear to be moderately dry to very dry portions of balds. Topographic positions include moderately to very steep upper slopes (rarely mid-slope), as well as gently sloping ridgetops. Aspect is highly variable, tending more toward the south and west, but with better representation of northerly aspects than other balds associations. Slope shape is most often convex, with representation of concave, straight, and undulating sites as well. Soil texture is mostly loam, less often sandy loam, usually with abundant coarse fragments (mostly gravel). Soil depth is usually very shallow: 5-15 cm appears typical, occasionally deeper. Rock outcrops are usually present within this association. Surficial geology includes basalt, andesite, volcaniclastic rocks, conglomerate, and granodiorite (plutonic). This association appears to be strictly mid-montane, with plots ranging from 900 to 1300 m elevation.

CONTEXT: This association occupies small- to medium-sized patches within balds. Surrounding forests fall within the following ecological systems: North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest and North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest.

VEGETATION: This association is typically dominated by forbs, occasionally with grasses co-dominant. The dominant forb, *Phlox diffusa*, is intermediate in life-form between a forb and a dwarf-shrub because of its woody base. The dwarf-shrubs *Juniperus communis, Arctostaphylos nevadensis,* or *Symphoricarpos hesperius* are occasionally prominent. The graminoids *Agrostis pallens, Carex inops, Festuca rubra* (may be non-native), and *Koeleria macrantha* are occasionally to sometimes prominent. The moss-like *Selaginella wallacei* is usually prominent. *Penstemon subserratus, Lomatium martindalei, Luzula (comosa, multiflora), Achillea millefolium, Eriophyllum lanatum,* and *Calochortus subalpinus* are usually present. Non-native species are relatively infrequent, such as *Hieracium lachenalii*.

CLASSIFICATION NOTES: This association has not been previously described.

Plectritis congesta Association

Common Name: Showy plectritis
Abbreviated Name: PLCO

Sample size = 4 plots

DISTRIBUTION: Occurs in the western Columbia River Gorge, Skamania County, in foothills of southeastern Thurston County, in the San Juan Islands, on the northern Olympic Peninsula, Clallam County, and near the eastern edge of the Puget Trough ecoregion in King and Snohomish counties. It may also occur in the Georgia Basin of British Columbia.

GLOBAL/STATE STATUS: GNRS1Q. There are five known occurrences in Washington. Potential threats include invasion and increase of non-native species, road-building, timber harvest, and recreational impacts.

ENVIRONMENT: These sites appear to be moist portions of balds. Slopes are gentle to steep, facing southeast to west. Topographic position includes benches and upper slopes. Slope shape is undulating or convex. Soil texture is loam. Soil depth is shallow, less than 20 cm on all plots. Surficial geology includes intrusive rocks and volcaniclastic rocks. Recorded elevation ranges from near sea level to 525 m.

CONTEXT: This association typically occupies small patches within balds. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest and North Pacific Dry Douglas-fir Forest and Woodland. It also occurs on small non-forested islands surrounded by saltwater. Locally, it can occur adjacent to or in a mosaic with North Pacific Oak Woodland.

VEGETATION: This vegetation type is dominated by forbs, or less frequently by a mixture of forbs and grasses. *Plectritis congesta* is always dominant or co-dominant. *Triteleia hyacinthina* is prominent to co-dominant in all our plots. *Camassia leichtlinii* is co-dominant on one of our plots and at one additional site, both of which are in the San Juan Islands. *Carex inops, Festuca rubra, Elymus glaucus, Camassia quamash,* and *Collinsia grandiflora* are at least occasionally prominent. *Achillea millefolium, Lotus micranthus, Selaginella wallacei,* and *Trifolium wildenowii* are usually present. Non-native species are relatively abundant in this association and sometimes co-dominant. *Aira caryophyllea, Aira praecox, Bromus hordeaceus, Holcus lanatus, Hypericum perforatum,* and *Hypochaeris radicata* are the most common of them.

CLASSIFICATION NOTES: This association has not been previously described. More plot data might reveal more than one association and would certainly better describe the type.

Senecio integerrimus var. ochroleucus provisional association

Common Name: White western groundsel
Abbreviated Name: SEIN

Sample size = 3 plots

DISTRIBUTION: Known to date only from the western and central Columbia River Gorge in Skamania County, Washington.

GLOBAL/STATE STATUS: GNRS1Q. There are only two known occurrences, there may be a few more. Potential threats include invasion and increase of non-native species, tree and/or shrub invasion, road-building, timber harvest, and recreational impacts.

ENVIRONMENT: These sites appear to be mesic portions of balds. The three plots are all on west-facing moderately steep upper slopes. They often occur to be in areas that would be partially shaded by trees. The one field soil sample was a relatively deep (>25 cm) stony loam. Rock outcrops do not occur within this association. Surficial geology is basalt. Elevation of plots ranges from 1000 to 1120 m.

CONTEXT: This association occupies small patches within balds, often near edges. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest and North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest. In the case of the latter, *Abies procera* is typically the diagnostic species present adjacent to these balds, not *Abies amabilis.*

VEGETATION: This relatively densely vegetated community type is dominated by the forb *Senecio integerrimus* var. *ochroleucus*. One or more of several other herbaceous species are typically prominent to occasionally co-dominant, including *Penstemon subserratus* (woody base), *Festuca rubra* (may be non-native), *Achillea millefolium, Cerastium arvense, Lupinus argenteus* ssp. *argenteus* var. *laxiflorus, Delphinium nuttallii, Eriophyllum lanatum, Fragaria vesca, Lomatium triternatum,* and *Carex inops*. *Penstemon subserratus, Festuca rubra, Allium acuminatum, Achillea millefolium, Cerastium arvense, Collinsia parviflora, Delphinium nuttallii, Eriophyllum lanatum, Microsteris gracilis,* and *Vicia americana* were present in all 3 of our plots. Non-natives typically occupy low cover in this type, with the exception of *Festuca rubra.*

CLASSIFICATION NOTES: This provisional type has not been previously described in the literature.

Triteleia hyacinthina Association

Common Name: Hyacinth triteleia
Abbreviated Name: TRHY
Synonym: *Brodeaia hyacinthina*

Sample size = 8 plots

DISTRIBUTION: In Washington, this association has been noted in the western Columbia River Gorge, Skamania County, in foothills of southeastern Thurston County, in the San Juan Islands, on Chuckanut Mountain, Whatcom County, in the north Cascades, Skagit County, and on the eastern slopes of the Olympics, Jefferson and Mason counties. Given this widespread distribution, it is likely to occur more widely in the western Cascades and eastern and northern Olympics, and in adjacent British Columbia. It is known to occur as well in the Willamette Valley of Oregon.

GLOBAL/STATE STATUS: GNRS2. There are eight known occurrences in Washington, and likely to be others. Potential threats include invasion and increase of non-native species, road-building, timber harvest, and recreational impacts.

ENVIRONMENT: These sites appear to be moist to very moist portions of balds. They are relatively moist in the spring and then become very dry in late summer. Most sites are on moderate to steep south- to northwest-facing mid- to upper slopes. One plot is on a gentle northeast facing mid-slope bench. Slope shape is mostly concave, undulating, or straight. Soil texture is loam or sandy loam, with or without significant coarse fragment content (stones or gravel). Soil depth is always very shallow: typically 4-8 cm, maximum recorded 13 cm. Small rock outcrops sometimes occur within this association. Surficial geology includes basalt, andesite, quartz diorite (plutonic), sedimentary and volcaniclastic rocks. Recorded elevation ranges from 50 to 900 m.

CONTEXT: This association occupies small patches within balds. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest and North Pacific Dry Douglas-fir Forest and Woodland. Locally, it can occur adjacent to or in a mosaic with North Pacific Oak Woodland.

VEGETATION: This vegetation type is typically dominated by forbs. *Triteleia hyacinthina* is usually dominant and always at least co-dominant. *Allium cernuum, Leptosiphon bicolor, Leptosiphon minimus, Plectritis congesta,* or *Camassia leichtlinii* are occasionally prominent to co-dominant. *Aspidotis densa* and *Eriophyllum lanatum* are usually present to prominent. *Danthonia californica, Achillea millefolium,* and *Epilobium minutum* are usually present. *Agrostis pallens, Koeleria macrantha,* and *Prunella vulgaris* are occasionally prominent. Non-native species can be important, especially *Aira caryophyllea, Bromus hordeaceus, Holcus lanatus, Vulpia bromoides, Cynosurus echinatus, Hypochaeris glabra,* and *Hypochaeris radicata.*

CLASSIFICATION NOTES: This association has been described from Oregon (Christy 2004).

Dwarf-shrublands

Arctostaphylos (nevadensis, uva-ursi) – Juniperus communis Association

Common Name: (Pinemat manzanita, kinnikinnick) – common juniper
Abbreviated Name: AR(NE,UV)-JUCO

Sample size = 15 plots

DISTRIBUTION: To date, known only from the southwestern Cascade Range of Washington. Occurs in Skamania, Lewis, and Cowlitz counties, at least as far north as Mount Rainier. May occur further north or further south in the Cascades or in the Olympics.

GLOBAL/STATE STATUS: GNRS3S4. This association seems to be common within the limited habitat of balds and rock outcrops in the southern Cascades. May be some long-term threat from tree invasion. Non-native species could threaten to alter herbaceous component.

ENVIRONMENT: These sites appear to be moderately dry portions of balds. Aspect is mostly east to southwest, with one plot facing north-northeast. Topographic position includes gently sloping ridgetops and moderate to steep upper slopes. Slope shape is variable, with convex being most frequent. Recorded soil textures are loam and sandy loam, with or without significant coarse fragment content (gravel or stones). Small rock outcrops sometimes occur within this association. Soil depth appears somewhat variable: from about 10 cm or less to more than 20 cm. Surficial geology is mostly volcanic: basalt, andesite, and volcaniclastic rocks. One plot is on granodiorite, a plutonic rock. Elevation ranges from 750 to 1350 m.

CONTEXT: This association occupies small- to medium-sized patches within balds, often near edges. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest, North Pacific Dry Douglas-fir Forest and Woodland, and North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest.

VEGETATION: Dominated by dwarf-shrubs, or occasionally co-dominated by dwarf-shrubs and forbs. Either one of two *Arctostaphylos* species (*A. nevadensis* and *A. uva*-ursi) dominate or co-dominate. *Juniperus communis* is usually prominent to co-dominant. Where *Juniperus* is occasionally absent, *Arctostaphylos nevadensis* is dominant. *Phlox diffusa* is usually present to occasionally co-dominant. *Calochortus subalpinus, Lomatium martindalei, Achillea millefolium Eriophyllum lanatum, Xerophyllum tenax, Agrostis pallens,* and *Luzula (comosa, multiflora)* are usually present. These species as well as *Carex inops* can be occasionally prominent. Non-natives are relatively uncommon in this association.

CLASSIFICATION NOTES: This association has not been previously described. Identification of the two *Arctostaphylos* species can be difficult with the standard local flora: the Jepson manual (Hickman 1993) is helpful in this regard. We are not certain about the identification of these two taxa on a few of these plots.

Arctostaphylos uva-ursi – Fragaria virginiana – (Festuca roemeri) Association

Common Name: Kinnikinnick – broadpetal strawberry – (Roemer's fescue)
Abbreviated Name: ARUV-FRVI-(FERO)

Sample size = 9 plots

DISTRIBUTION: Occurs in the northern and eastern Olympic Mountains, the northern Cascades, and sporadically in the Puget Trough of Washington. It has been seen in Clallam, Jefferson, Mason, Skagit, Whatcom, Pierce, Thurston, and Kitsap (top of Green Mountain) counties. Possibly occurs also in British Columbia or Oregon. In Pierce and Thurston counties, it is known in the context of prairies, not balds.

GLOBAL/STATE STATUS: GNRS3S4. This association seems to be fairly common within the limited habitat of balds and rock outcrops in the Olympics and northern Cascades. May be some long-term threat from tree invasion. Non-native species could threaten to alter herbaceous component.

ENVIRONMENT: These sites appear to be moderately dry portions of balds. Occurs mostly on moderately steep slopes (up to 75% slope). Also occurs on gentle benches. Topographic position is mostly upper slopes, also ridgetops and mid-slopes. The most frequent slope shape is convex, with undulating and concave also represented by plots. Aspect of plots ranges from south-southeast to west. Soil texture is loam or sandy loam, usually with abundant coarse fragments (gravel). Soil depth is consistently shallow: maximum of 20 cm, 4-6 cm apparently typical. Small rock outcrops are usually present within this association. Surficial geology includes basalt, breccia, intrusive rocks, metasedimentary rocks, and quartz diorite (plutonic). Recorded elevation ranges from 320 to 920 m. On South Puget Sound prairies it occurs at lower elevations (50-125 m) on deep, coarse-textured glacial outwash deposits.

CONTEXT: This association occupies small- to medium-sized patches (occasionally large) within balds, often near edges. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest, North Pacific Dry Douglas-fir Forest and Woodland, and North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest. It also occurs as small patches within South Puget Sound prairies (FERO-SERI association, Willamette Valley Upland Prairie and Savanna ecological system), where it can occur adjacent to North Pacific Oak Woodland.

VEGETATION: Typically dominated by dwarf-shrubs, which always occupy at least 25% cover, or a mixture of dwarf-shrubs, graminoids, and forbs. *Arctostaphylos uva-ursi* is the dominant dwarf-shrub. *Juniperus communis* and *Arctostaphylos nevadensis* are absent. *Festuca roemeri* is usually present (Olympics and Puget Trough) up to sometimes co-dominant. *Fragaria virginiana* was present in all but one of our plots, and is usually prominent. *Eriophyllum lanatum, Luzula (comosa, multiflora),* and *Zigadenus venenosus* are usually present. Non-natives are relatively uncommon in this association.

CLASSIFICATION NOTES: This association has not been previously described. It differs significantly in associated species from the ARUV association in NatureServe (2006), which is an alpine type and should be renamed to better differentiate it from similar types like this one.

Juniperus communis – (Phlox diffusa) Association

Common Name: Common juniper – (spreading phlox)
Abbreviated Name: JUCO-(PHDI)

Sample size = 9 plots

DISTRIBUTION: Known to occur in the southern Cascades of Washington (Skamania, Lewis, and Cowlitz counties), and in the Olympics. It may also occur further north in the Cascades or in the Cascades of Oregon. All of our plots are from the Cascades.

GLOBAL/STATE STATUS: GNRS3S4. This association seems to be not infrequent within the limited habitat of balds and rock outcrops in the Olympics and southern Cascades. May be some long-term threat from tree invasion. Non-native species could threaten to alter herbaceous component.

ENVIRONMENT: These sites appear to be moderately dry portions of balds. Occupies gently sloping ridgetops and moderate to steep upper slopes. Aspect is east-southeast to west-northwest. Often occurs in partially shaded sites. Slope shape is most often convex, with undulating and concave also represented. Soil texture is loam or sandy loam, usually with a major coarse fragment content (gravel or stones). Recorded soil depths are less than 10 cm. Small rock outcrops sometimes occur within the association. Surficial geology is most often volcaniclastic rocks, with andesite, basalt, and granodiorite also represented. Elevation ranges from 900 m to 1350 m.

CONTEXT: This association occupies small patches within balds, often near edges. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest and North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest.

VEGETATION: Dominated by the dwarf-shrub *Juniperus communis*. *Arctostaphylos nevadensis* and *A. uva-ursi* are usually absent. *Phlox diffusa* is usually present to prominent and occasionally co-dominant. The moss-like *Selaginella wallacei* is usually present to prominent. *Eriophyllum lanatum, Achillea millefolium, Campanula rotundifolia, Calochortus subalpinus, Cerastium arvense, Castilleja hispida, Luzula (comosa, multiflora), Hieracium scouleri, Lomatium martindalei, Lomatium triternatum, Silene douglasii, Rosa nutkana,* and *Vaccinium membranaceum* are frequently present. Non-natives are relatively uncommon in this association: *Hieracium lachenalii* is the most frequent.

CLASSIFICATION NOTES: A similar association was noted from the Olympic Mountains by Henderson et al. (1979).

Shrublands

The following shrub-dominated association is included in this report because it was always found as small patches within the matrix of herbaceous and dwarf-shrub balds vegetation in the same general physical environment.

Arctostaphylos columbiana Association

Common Name: Hairy manzanita
Abbreviated Name: ARCO
Sample size = 7 plots

DISTRIBUTION: Found in the northern and eastern Olympic Mountains, in the southwestern Washington Cascades, and rarely in the northern Puget Trough (western Whatcom County). Counties include Clallam, Jefferson, Mason, Whatcom, Skamania, and Lewis. Possibly occurs elsewhere in the western Cascades, in the Georgia Basin of British Columbia, and in northwestern Oregon.

GLOBAL/STATE STATUS: GNRS3. This is a small-scale association that occurs in a limited environment. There are estimated to be fewer than 50 occurrences in Washington. No major threats apparent, though tree invasion could be an issue in the long-term picture.

ENVIRONMENT: These sites appear to be slightly dry to moderately dry portions of balds. Occurs on moderate to steep slopes, with south-southeast to west-southwest aspects. Topographic position is usually upper slope, with mid-slope and ridgetop also represented. Slope shape is mostly convex, occasionally straight. Soil texture is mostly sandy loam (one plot loam) with a major component of coarse fragments (usually gravel) in all but one plot. Soil depth appears to be somewhat, but not extremely, shallow (in one plot maximum recorded depth was 20 cm). Small rock outcrops are present on about half the plots. Surficial geology is usually basalt, also represented are volcaniclastic and sedimentary rocks. Recorded elevation ranges from 370 to 810 m.

CONTEXT: This association occupies small-sized patches within balds, often near edges where it can be a linear ecotone. Surrounding forests fall within the following ecological systems: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest and North Pacific Dry Douglas-fir Forest and Woodland. *Arbutus menziesii,* or less frequently, *Quercus garryana*, often occurs at the ecotone between this association and adjacent forests.

VEGETATION: This is the only "balds" association that is dominated by shrubs taller than 0.5 m. *Arctostaphylos columbiana* is always the dominant shrub. The dwarf-shrub *Symphoricarpos hesperius* is usually prominent, and the grass *Elymus glaucus* is usually present to prominent. *Carex inops* is occasionally prominent. *Arctostaphylos uva-ursi* or *Arctostaphylos nevadensis* (latter only in southern Cascades) are sometimes prominent. Small *Pseudotsuga menziesii* are usually present. Frequently occurring shrubs and dwarf-shrubs are *Amelanchier alnifolia, Mahonia aquifolium, Holodiscus discolor, Lonicera ciliosa, Paxistima myrsinites,* and *Rosa gymnocarpa*. *Festuca occidentalis, Castilleja hispida, Collomia heterophylla, Epilobium minutum, Fragaria virginiana, Achillea millefolium,* and *Eriophyllum lanatum* are the herbaceous species usually present. Non-natives are relatively uncommon in this association. One stand of this type had scattered small *Quercus garryana* trees within it.

CLASSIFICATION NOTES: This association has not been previously described.

Other Native Vegetation Dominance Types Observed

Festuca rubra Coastal Headland Herbaceous Vegetation (NatureServe 2006): No plots collected. Occurs on headlands at Fort Canby State Park, Pacific County. Possibly on outer coastal headlands or islands further north on the outer coast.

Moss-dominated: 3 plots collected on rock outcrops or very shallow soils with sparse perennial vegetation and/or ephemeral annual vegetation. We did not collect data on non-vascular species. These plots did not cluster floristically based on their vascular plant vegetation.

Poa secunda: 4 plots from Columbia Gorge, Skamania Co., and northeastern Olympics, Clallam Co. These plots cluster floristically if the *Poa* is lumped to species, but not all plots had the same form of this taxon (using Hitchcock and Cronquist 1973). Associated species were somewhat variable. Occurs as very small patches on shallow soils.

Polygonum douglasii – Eriogonum compositum: One plot, Columbia Gorge, Skamania Co.

Eriogonum compositum – Penstemon subserratus: One plot, Skamania Co.

Bromus sitchensis: One plot, adjacent to saltwater on small island, San Juan Co.

Carex hoodii: One plot, Mount Constitution, San Juan Co.

Ligusticum grayi – Lupinus latifolius: One plot, Silver Star Mountain, Skamania Co.

Rubus parviflorus: One plot, Table Mountain, Skamania Co. Different composition than *Rubus parviflorus/Chamerion angustifolium-Heracleum maximum* (NatureServe 2006).

Mahonia aquifolium – Spiraea x pyramidata – Rosa gymnocarpa: One plot, Columbia Gorge, Skamania Co.

Delphinium nuttallii: One plot, Table Mountain, Skamania Co. Open vegetation, on dry site.

Lomatium nudicaule – Danthonia spicata: One plot, Vedder Mountain, Whatcom Co.

Elymus glaucus: No plots, occasionally seen in northern Puget Trough near edges or on degraded sites.

References

Agee, J.K., and P. Dunwiddie. 1984. Recent forest development on Yellow Island, Washington. Canadian Journal of Botany 62:2074-2080.

Anderson, M., P. Bougeron, M.T. Bryer, R. Crawford, L. Engelking, D. Faber-Langendoen, M. Gallyoun, K. Goodin, D.H. Grossman, S. Landaal, K. Metzler, K.D. Patterson, M. Pyne, M. Reid, L. Sneddon, and A.S. Weakley. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume II. The National Vegetation Classification System: list of types. The Nature Conservancy, Arlington, Virginia.

Chappell, C.B. 2006. Upland plant associations of the Puget Trough ecoregion, Washington. Natural Heritage Rep. 2006-01. Washington Department of Natural Resources, Natural Heritage Program, Olympia, Wash. [http://www.dnr.wa.gov/nhp/refdesk/communities/pdf/intro.pdf].

Chappell, C.B., and R.C. Crawford. 1997. Native vegetation of the south Puget Sound prairie landscape. Pages 107-122 *in* P. Dunn and K. Ewing, editors. Ecology and conservation of the South Puget Sound prairie landscape. The Nature Conservancy of Washington, Seattle, Wash.

Chappell, C.B., M.S. Mohn Gee, B. Stephens, R. Crawford, and S. Farone. 2001a. Distribution and decline of native grasslands and oak woodlands in the Puget Lowland and Willamette Valley ecoregions, Washington. Pages 124-139 *in* Reichard, S. H., P.W. Dunwiddie, J. G. Gamon, A.R. Kruckeberg, and D.L. Salstrom, eds. Conservation of Washington's rare plants and ecosystems. Washington Native Plant Society, Seattle, Wash.

Chappell, C.B., R.C. Crawford, C. Barrett, J. Kagan, D.H. Johnson, M. O'Mealy, G.A. Green, H.L. Ferguson, W.D. Edge, E.L. Greda, and T.A. O'Neil. 2001b. Wildlife habitats: descriptions, status, trends, and system dynamics. Pages 22-114 in Johnson, D.H., and T.A. O'Neil, dirs. Wildlife-Habitat Relationships in Oregon and Washington. Oregon State Univ. Press, Corvallis, OR.

Chappell, C., E. Alverson, and W. Erickson. 2004. Ecologic and geographic variation in species composition of prairies, herbaceous balds, and oak woodlands of the Willamette Valley – Puget Trough – Georgia Basin Ecoregion. Presentation at Ecological Society of America, 2004 Annual Meeting, Portland, OR, Aug 2-6, 2004.

Christy, J.A. 2004. Native freshwater wetland plant associations of northwestern Oregon. Oregon Natural Heritage Information System, Oregon State Univ.

Christy, J.A., J.S. Kagan & A.M. Wiedemann. 1998. Plant Associations of the Oregon Dunes National Recreation Area, Siuslaw National Forest, Oregon. Technical Paper R6-NR-ECOL-TP-09-98. USDA Forest Service, Pacific Northwest Region, Portland, Oregon.

Davidson, E.D. 1967. Synecological features of a natural headland prairie on the Oregon coast. M.S. thesis, Oregon State University, Corvallis, OR.

del Moral, R., and D.C. Deardorff. 1976. Vegetation of the Mima Mounds, Washington State. Ecology 57:520-530.

Dorner, J.M.W. 1999. The South Puget Sound prairie plant community: A multivariate analysis of plant species distribution and the relationship of environmental variables. M.S. thesis, Univ. of Wash., Seattle, Wash.

Dunn, P., and K. Ewing, eds. 1997. Ecology and conservation of the South Puget Sound prairie landscape. The Nature Conservancy of Washington, Seattle, Wash.

Douglas, G.W., D. Meidinger, and J. Pojar, eds. 2001. Illustrated Flora of British Columbia, Volume 6. Monocotyledons (Acoraceae through Najadaceae). British Columbia Ministry Environment, Lands and Parks.

Erickson, W.R. 1996. Classification and interpretation of Garry oak(Quercus garryana) plant communities and ecosystems in southwestern British Columbia. M.S. thesis, Univ. of Victoria, Victoria, B.C.

Floberg, J., M. Goering, G. Wilhere, C. MacDonald, C. Chappell, C. Rumsey, Z. Ferdana, A. Holt, P. Skidmore, T. Horsman, E. Alverson, C. Tanner, M. Bryer, P. Iachetti, A. Harcombe, B. McDonald, T. Cook, M. Summers, and D. Rolph. 2004. Willamette Valley-Puget Trough-Georgia Basin Ecoregional Assessment, Volume One: Report. Prepared by The Nature Conservancy with support from the Nature Conservancy of Canada, Washington Department of Fish and Wildlife, Washington Department of Natural Resources (Natural Heritage and Nearshore Habitat programs), Oregon State Natural Heritage Information Center and the British Columbia Conservation Data Centre.

Foster, J.R., and S.E. Shaff. 2003. Forest colonization of Puget lowland grasslands at Fort Lewis, Washington. Northwest Science 77:283-296.

Franklin, J.F. and C.T. Dyrness. 1973. Natural vegetation of Oregon and Washington. PNW Forest & Range Experiment Station, General Technical Report. PNW 8, Portland, OR.

Giles, L.J. 1970. The ecology of the mounds on Mima Prairie with special reference to Douglas-fir invasion. M.S. thesis, Univ. of Washington, Seattle, Wash.

Grossman, D.H., D. Faber-Langendoen, A.S. Weakley, M. Anderson, P. Bougeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K. D. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International Classification of ecological communities: terrestrial vegetation of the United States. Volume 1. The National Vegetation Classification System: development, status, and applications. The Nature Conservancy, Arlington, Virginia.

Henderson, J.A., B.G. Smith, and R.L. Mauk. 1979. Plant communities of the Hoh and Dosewallips drainages, Olympic National Park, Washington. Unpubl. progress rep., Dept. of Forestry and Outdoor Rec., Utah St. Univ., Logan, UT.

Henderson, J.A., D.A. Peter, R. Lesher, and D.C. Shaw. 1989. Forested Plant Associations of the Olympic National Forest U.S.D.A. For. Serv. PNW Region. R6-ECOL-TP 001-88.

Hickman, J.C., ed. 1993. The Jepson manual: higher plants of California. Univ. of California Press.

Hitchcock, C. L., and A. Cronquist. 1973. Flora of the Pacific Northwest: an illustrated manual. Univ. of Wash. Press, Seattle, Wash. 730 pp.

Jennings, M., O. Loucks, R. Peet, D. Faber-Langendoen, D. Glenn-Lewin, D. Grossman, A. Damman, M. Barbour, R. Pfister, M. Walker, S. Talbot, J. Walker, G. Hartshorn, G. Waggoner, M. Abrams, A. Hill, D. Roberts, D. Tart, M. Rejmanek. 2003. Standards for associations and alliances for the U.S. National Vegetation Classification. Version 3.0. Ecological Society of America, Vegetation Classification Panel. [http://www.esa.org/vegweb/NVC_guidelines_v3.pdf].

Kartesz, J.T. 2003. A Synonymized Checklist and Atlas with Biological Attributes for the Vascular Flora of the United States, Canada, and Greenland. Second Edition. In: Kartesz, J.T., and C.A. Meacham. Synthesis of the North American Flora, Version 2.0.

Lang, F. A. 1961. A study of vegetation change on the gravelly prairies of Pierce and Thurston Counties, western Washington. M.S. thesis, University of Washington, Seattle, Wash.

McCune, B., and M. J. Mefford. 1997. PC-ORD. Multivariate analyis of ecological data, version 3.0. MjM Software Design, Gleneden Beach, Oregon.

NatureServe. 2006. NatureServe explorer. [http://www.natureserve.org/explorer/servlet/NatureServe?init=Ecol].

Norton, H.H. 1979. The association between anthropogenic prairies and important food plants in western Washington. Northwest Anthropological Research Notes 13:199-219.

Pavlick, L.E. 1985. A new taxonomic survey of the *Festuca rubra* complex in northwestern North America, with emphasis on British Columbia. Phytologia 57:1-17.

Peterson, D.L., and R.D. Hammer. 2001. From open to closed canopy: a century of change in a Douglas-fir forest, Orcas Island, Washington. Northwest Science 75:262-269.

Rapp, P.E. 1981. Sentinel Island, San Juan County: a survey of the vegetation. The Nature Conservancy, Seattle, Wash.

Ripley, J.D. 1983. Description of the plant communities and succession of the Oregon coast grasslands. M.S. thesis, Oregon State University, Corvallis.

Rust, S.K. 1992. Plant ecology of a coastal headland, Iceberg Point, Lopez Island, Washington. M. S. thesis, University of Washington, Seattle, Wash.

Salstrom, D. 1989. Plant community dynamics asociated with *Quercus garryana* on Pt. Disney, Waldron Island, Washington. M.S. thesis, Western Wash. Univ., Bellingham, Wash.

Wiedemann, A.M. 1984. The ecology of Pacific Northwest coastal sand dunes: a community profile. U.S. Fish & Wildlife Service. FWS/OBS-84/04.

APPENDIX A. Complete species list of vascular plants recorded on plots, with common names and Hitchcock and Cronquist (1973) names.

Kartesz 2005 Name	Hitchcock & Cronquist Name	Common Name
Trees		
Abies procera	Abies procera	noble fir
Acer macrophyllum	Acer macrophyllum	bigleaf maple
Alnus rubra	Alnus rubra	red alder
Arbutus menziesii	Arbutus menziesii	Pacific madrone
Frangula purshiana	Rhamnus purshiana	cascara
Juniperus scopulorum	Juniperus scopulorum	Rocky Mountain juniper
Picea sitchensis	Picea sitchensis	Sitka spruce
Pinus contorta var. contorta	Pinus contorta var. contorta	shore pine
Prunus emarginata var. mollis	Prunus emarginata	bitter cherry
Pseudotsuga menziesii var. menziesii	Pseudotsuga menziesii	Douglas-fir
Quercus garryana var. garryana	Quercus garryana	Oregon white oak
Shrubs		
Amelanchier alnifolia	Amelanchier alnifolia	serviceberry
Arctostaphylos columbiana	Arctostaphylos columbiana	hairy manzanita
Ceanothus sanguineus	Ceanothus sanguineus	redstem ceanothus
Corylus cornuta var. californica	Corylus cornuta	beaked hazelnut
Cytisus scoparius	Cytisus scoparius	Scot's broom
Gaultheria shallon	Gaultheria shallon	salal
Holodiscus discolor	Holodiscus discolor	oceanspray
Lonicera involucrata var. involucrata	Lonicera involucrata	black twinberry
Morella californica	Myrica californica	Pacific wax-myrtle
Philadelphus lewisii	Philadelphus lewisii	mockorange
Ribes cereum var. cereum	Ribes cereum	squaw currant
Ribes sanguineum var. sanguineum	Ribes sanguineum	red-flowering currant
Rosa gymnocarpa	Rosa gymnocarpa	baldhip rose
Rosa nutkana	Rosa nutkana	nootka rose
Rubus leucodermis	Rubus leucodermis	blackcap
Rubus parviflorus var. parviflorus	Rubus parviflorus	thimbleberry
Rubus spectabilis var. spectabilis	Rubus spectabilis	salmonberry
Sorbus scopulina var. cascadensis	Sorbus scopulina	Cascade mountain-ash
Spiraea splendens var. splendens	Spiraea densiflora	subalpine spirea
Spiraea x pyramidata	Spiraea pyramidata	pyramid spirea
Symphoricarpos albus var. laevigatus	Symphoricarpos albus	common snowberry
Vaccinium membranaceum	Vaccinium membranaceum	big huckleberry
Vaccinium ovatum	Vaccinium ovatum	evergreen huckleberry
Viburnum ellipticum	Viburnum ellipticum	oval-leaved viburnum
Dwarf-shrubs		
Arctostaphylos nevadensis	Arctostaphylos nevadensis	pinemat manzanita
Arctostaphylos uva-ursi	Arctostaphylos uva-ursi	kinnikinnick
Eriogonum compositum var. compositum	Eriogonum compositum	arrow-leaf buckwheat
Eriogonum umbellatum var. majus	Eriogonum umbellatum	sulfur buckwheat

Kartesz 2005 Name	Hitchcock & Cronquist Name	Common Name
Juniperus communis var. montana	Juniperus communis	common juniper
Lonicera ciliosa	Lonicera ciliosa	orange honeysuckle
Lonicera hispidula	Lonicera hispidula	hairy honeysuckle
Mahonia aquifolium	Berberis aquifolium	tall Oregongrape
Mahonia nervosa	Berberis nervosa	dwarf Oregongrape
Opuntia fragilis	Opuntia fragilis	brittle prickly-pear
Paxistima myrsinites	Pachistima myrsinites	Oregon boxwood
Penstemon cardwellii	Penstemon cardwellii	Cardwell's penstemon
Penstemon fruticosus var. fruticosus	Penstemon fruticosus	shrubby penstemon
Rubus ursinus ssp. macropetalus	Rubus ursinus	trailing blackberry
Spiraea betulifolia var. lucida	Spiraea betulifolia	birch-leaf spirea
Symphoricarpos hesperius	Symphoricarpos mollis	spreading snowberry
Toxicodendron diversilobum	Rhus diversiloba	poison-oak
Graminoids		
Achnatherum lemmonii var. lemmonii	Stipa lemmonii	Lemmon's needlegrass
Agrostis capillaris	Agrostis tenuis	colonial bentgrass
Agrostis exarata	Agrostis exarata	spike bentgrass
Agrostis microphylla	Agrostis microphylla	small-leaf bentgrass
Agrostis pallens	Agrostis diegoensis	thin bentgrass
Agrostis spp.	Agrostis spp	bentgrass
Aira caryophyllea	Aira caryophyllea	silver hairgrass
Aira praecox	Aira praecox	early hairgrass
Anthoxanthum odoratum	Anthoxanthum odoratum	sweet vernalgrass
Arrhenatherum elatius	Arrhenatherum elatius	tall oatgrass
Bromus carinatus	Bromus carinatus	California brome
Bromus commutatus	Bromus commutatus	meadow brome
Bromus hordeaceus	Bromus mollis	soft brome
Bromus pacificus	Bromus pacificus	Pacific brome
Bromus rigidus	Bromus rigidus	rip-gut brome
Bromus sitchensis	Bromus sitchensis	Sitka brome
Bromus sterilis	Bromus sterilis	poverty brome
Bromus tectorum	Bromus tectorum	cheatgrass
Bromus vulgaris	Bromus vulgaris	Columbia brome
Calamagrostis howellii	Calamagrostis howellii	Howell's reedgrass
Calamagrostis nutkaensis	Calamagrostis nutkaensis	Nootka reedgrass
Calamagrostis sesquiflora	Calamagrostis sesquiflora	one-and-a-half-flowered reedgrass
Carex geyeri	Carex geyeri	Geyer's sedge
Carex inops ssp. inops	Carex pensylvanica	long-stolon sedge
Carex obnupta	Carex obnupta	slough sedge
Carex raynoldsii	Carex raynoldsii	Raynolds' sedge
Carex rossii	Carex rossii	Ross's sedge
Carex spp.	Carex spp.	sedge
Cynosurus echinatus	Cynosurus echinatus	hedgehog dogtail
Dactylis glomerata	Dactylis glomerata	orchard grass
Danthonia californica	Danthonia californica	California danthonia
Danthonia intermedia	Danthonia intermedia	timber danthonia

Kartesz 2005 Name	Hitchcock & Cronquist Name	Common Name
Danthonia spicata	Danthonia spicata	poverty danthonia
Dichanthelium acuminatum var. fasciculatum	Panicum occidentale	acuminate panic grass
Distichlis spicata	Distichlis spicata	saltgrass
Elymus elymoides	Sitanion hystrix	squirreltail
Elymus glaucus ssp. glaucus	Elymus glaucus	blue wildrye
Elymus repens	Agropyron repens	quackgrass
Elymus trachycaulus ssp. trachycaulus	Agropyron caninum	slender wheatgrass
Festuca occidentalis	Festuca occidentalis	western fescue
Festuca roemeri	Festuca idahoensis	Roemer's fescue
Festuca rubra	Festuca rubra	red fescue
Holcus lanatus	Holcus lanatus	common velvet grass
Juncus bufonius	Juncus bufonius	toad rush
Juncus effusus	Juncus effusus	soft rush
Juncus spp.	Juncus spp.	rush
Juncus tenuis	Juncus tenuis	slender rush
Koeleria macrantha	Koeleria cristata	prairie junegrass
Lolium perenne ssp. perenne	Lolium perenne	perennial ryegrass
Luzula (comosa, multiflora ssp. multiflora var. multiflora)	Luzula campestris	wood-rush
Melica harfordii	Melica harfordii	Harford's oniongrass
Melica subulata	Melica subulata	Alaska oniongrass
Phleum pratense	Phleum pratense	common timothy
Poa compressa	Poa compressa	Canadian bluegrass
Poa fendleriana	Poa fendleriana	mutton grass
Poa pratensis	Poa pratensis	Kentucky bluegrass
Poa secunda	Poa (sandbergii, scabrella, nevadensis)	one-sided bluegrass
Poa spp.	Poa spp.	bluegrass
Pseudoroegneria spicata	Agropyron spicatum	bluebunch wheatgrass
Scirpus microcarpus	Scirpus microcarpus	small-fruited bulrush
Trisetum canescens	Trisetum canescens	tall trisetum
Vulpia bromoides	Festuca bromoides	barren fescue
Vulpia microstachys	Festuca microstachys	Nuttall's fescue
Vulpia myuros	Festuca megalura, myuros	rat-tail fescue
Forbs and Ferns		
Achillea millefolium var. occidentalis	Achillea millefolium	yarrow
Agoseris grandiflora	Agoseris grandiflora	large-flowered agoseris
Agroseris heterophylla var. heterophylla	Agroseris heterophylla	annual agoseris
Allium acuminatum	Allium acuminatum	Hooker's onion
Allium amplectens	Allium amplectens	narrowleaf onion
Allium cernuum var. obtusum	Allium cernuum	nodding onion
Allium crenulatum	Allium crenulatum	Olympic onion
Anaphalis margaritacea	Anaphalis margaritacea	pearly-everlasting
Anemone oregana	Anemone oregana	Oregon anemone
Angelica arguta	Angelica arguta	Lyall's angelica
Angelica lucida	Angelica lucida	seawatch
Antennaria racemosa	Antennaria racemosa	slender pussy-toes

Kartesz 2005 Name	Hitchcock & Cronquist Name	Common Name
Antennaria rosea	Antennaria microphylla	rosy pussytoes
Aphanes arvensis	Alchemilla occidentalis	western lady's-mantle
Apocynum androsaemifolium	Apocynum androsaemifolium	spreading dogbane
Aquilegia formosa	Aquilegia formosa	red columbine
Arabis hirsuta	Arabis hirsuta	hairy rockcress
Arabis holboellii	Arabis holboellii	Holboell's rockcress
Arenaria capillaris ssp. americana	Arenaria capillaris	slender mountain sandwort
Arenaria serpyllifolia	Arenaria serpyllifolia	thyme-leaf sandwort
Armeria maritima vars. (californica, purpurea)	Armeria maritima	thrift
Artemisia campestris ssp. borealis var. scouleriana	Artemisia campestris	northern wormwood
Artemisia douglasiana	Artemisia douglasiana	Douglas' wormwood
Artemisia tilesii ssp. elatior	Artemisia tilesii	mountain wormwood
Aspidotis densa	Aspidotis densa	Indian's dream
Asplenium trichomanes	Asplenium trichomanes	maindenhair spleenwort
Athyrium filix-femina ssp. cyclosorum	Athyrium filix-femina	lady-fern
Atriplex subspicata	Atriplex patula	triangle orache
Balsamorhiza deltoidea	Balsamorhiza deltoidea	Puget balsamroot
Blechnum spicant	Blechnum spicant	deerfern
Brodiaea coronaria ssp. coronaria	Brodiaea coronaria	harvest brodiaea
Calochortus subalpinus	Calochortus subalpinus	subalpine mariposa
Camassia leichtlinii ssp. suksdorfii	Camassia leichtlinii	great camas
Camassia quamash vars. (azurea, maxima)	Camassia quamash	common camas
Campanula rotundifolia	Campanula rotundifolia	bluebells-of-Scotland
Cardamine oligosperma var. oligosperma	Cardamine oligosperma	little western bittercress
Cardamine pensylvanica	Cardamine pensylvanica	Pennsylvania bittercress
Castilleja attenuata	Orthocarpus attenuatus	narrow-leaved owl-clover
Castilleja hispida ssp. hispida	Castilleja hispida	harsh paintbrush
Castilleja levisecta	Castilleja levisecta	golden paintbrush
Castilleja miniata ssp. dixonii	Castilleja miniata	scarlet paintbrush
Castilleja miniata ssp. miniata	Castilleja miniata	scarlet paintbrush
Cerastium arvense ssp. strictum	Cerastium arvense	field chickweed
Cerastium glomeratum	Cerastium viscosum	sticky chickweed
Chamerion angustifolium	Epilobium angustifolium	fireweed
Cheilanthes gracillima	Cheilanthes gracillima	lace lip-fern
Cirsium arvense	Cirsium arvense	Canada thistle
Cirsium brevistylum	Cirsium brevistylum	short-styled thistle
Cirsium remotifolium	Cirsium remotifolium	weak thistle
Cirsium vulgare	Cirsium vulgare	bull thistle
Clarkia amoena ssp. (caurina, lindleyi)	Clarkia amoena	farewell-to-spring
Clarkia purpurea ssp. quadrivulnera	Clarkia quadrivulnera	small-flowered clarkia
Claytonia perfoliata ssp. perfoliata	Montia perfoliata	miner's lettuce
Claytonia siberica var. sibirica	Montia sibirica	Siberian springbeauty
Clinopodium douglasii	Satureja douglasii	yerba buena
Collinsia grandiflora	Collinsia grandiflora	large-flowered blue-eyed mary
Collinsia parviflora	Collinsia parviflora	small-flowered blue-eyed mary

Kartesz 2005 Name	Hitchcock & Cronquist Name	Common Name
Collomia heterophylla	Collomia heterophylla	varied-leaf collomia
Columbiadoria hallii	Haplopappus hallii	Hall's goldenweed
Comandra umbellata ssp. californica	Comandra umbellata	bastard toad-flax
Crepis capillaris	Crepis capillaris	smooth hawksbeard
Cryptantha intermedia	Cryptantha intermedia	common cryptantha
Cryptogramma acrostichoides	Cryptogramma crispa	American rockbrake
Cystopteris fragilis	Cystopteris fragilis	fragile fern
Daucus pusillus	Daucus pusillus	rattlesnake weed
Delphinium menziesii ssp. menziesii	Delphinium menziesii	Menzies' larkspur
Delphinium nuttallii	Delphinium nuttallii	Nuttall's larkspur
Dianthus armeria	Dianthus armeria	Deptford pink
Dichelostemma congestum	Brodiaea congesta	congested snakelily
Dodecatheon pulchellum	Dodecatheon pulchellum	handsome shooting star
Epilobium brachycarpum	Epilobium paniculatum	tall annual willow-herb
Epilobium ciliatum	Epilobium (watsonii, glandulosum)	common willow-herb
Epilobium minutum	Epilobium minutum	small-flowered willow-herb
Equisetum hyemale var. affine	Equisetum hyemale	scouring-rush
Equisetum telmateia var. braunii	Equisetum telmateia	giant horsetail
Erigeron speciosus var. speciosus	Erigeron speciosus	showy fleabane
Erigeron subtrinervis var. conspicuus	Erigeron subtrinervis	three-veined fleabane
Eriophyllum lanatum var. lanatum	Eriophyllum lanatum	woolly sunflower
Erodium cicutarium	Erodium cicutarium	redstem stork's bill
Erysimum capitatum var. capitatum	Erysimum asperum	western wallflower
Erythronium grandiflorum ssp. grandiflorum	Erythronium grandiflorum	glacier lily
Erythronium montanum	Erythronium montanum	avalanche lily
Erythronium oreganum var. oreganum	Erythronium oreganum	Oregon fawnlily
Eurybia radulina	Aster radulinus	rough-leaf aster
Fragaria chiloensis ssp. pacifica	Fragaria chiloensis	beach strawberry
Fragaria vesca ssp. bracteata	Fragaria vesca	woods strawberry
Fragaria virginiana ssp. platypetala	Fragaria virginiana	common strawberry
Fritillaria affinis var. affinis	Fritillaria lanceolata	chocolate lily
Galium aparine	Galium aparine	cleavers
Gamochaeta purpurea	Gnaphalium purpureum	purple cudweed
Gentiana calycosa	Gentiana calycosa	explorer's gentian
Geranium bicknellii	Geranium bicknellii	Bicknell's geranium
Geranium carolinianum var. carolinianum	Geranium carolinianum	Carolina geranium
Geranium columbinum	Geranium columbinum	long-stalked geranium
Geranium molle	Geranium molle	dovefoot geranium
Geranium robertianum	Geranium robertianum	herb robert
Gilia capitata ssp. capitata	Gilia capitata	bluehead gilia
Githopsis specularioides	Githopsis specularioides	common bluecup
Grindelia integrifolia	Grindelia integrifolia var. integrifolia	Puget gumweed
Grindelia stricta var. stricta	Grindelia integrifolia var. macrophylla	Oregon gumweed
Hedysarum occidentale var. occidentale	Hedysarum occidentale	western sweet-vetch
Hemizonella minima	Madia minima	small-head tarweed
Heracleum maximum	Heracleum lanatum	cow-parsnip

Kartesz 2005 Name	Hitchcock & Cronquist Name	Common Name
Heterocodon rariflorum	Heterocodon rariflorum	western pearlflower
Heterotheca villosa	Chrysopsis villosa	hairy goldenaster
Heuchera glabra	Heuchera glabra	smooth alumroot
Heuchera micrantha	Heuchera micrantha	small-flowered alumroot
Hieracium albiflorum	Hieracium albiflorum	white-flowered hawkweed
Hieracium lachenalii	Hieracium vulgatum	common hawkweed
Hieracium longiberbe	Hieracium longiberbe	long-beaked hawkweed
Hieracium scouleri var. scouleri	Hieracium scouleri	woolly-weed
Hydrophyllum capitatum var. thompsonii	Hydrophyllum capitatum	ballhead waterleaf
Hypericum perforatum	Hypericum perforatum	common St. John's-wort
Hypochaeris glabra	Hypochaeris glabra	smooth cats-ear
Hypochaeris radicata	Hypochaeris radicata	hairy cat's-ear
Lathyrus nevadensis ssp. lanceolatus var. pilosellus	Lathyrus nevadensis	Nuttall's peavine
Leptosiphon bicolor	Linanthus bicolor var. bicolor	bicolored linanthus
Leptosiphon minimus	Linanthus bicolor var. minimus	dwarf linanthus
Leucanthemum vulgare	Chrysanthemum leucanthemum	oxeye daisy
Lewisia columbiana var. rupicola	Lewisia columbiana	Columbia lewisia
Ligusticum apiifolium	Ligusticum apiifolium	celery-leaf licorice-root
Lilium columbianum	Lilium columbianum	Columbia lily
Lithophragma parviflorum var. parviflorum	Lithophragma parviflorum	small-flowered prairiestar
Lomatium dissectum var. dissectum	Lomatium dissectum	fern-leaved lomatium
Lomatium martindalei	Lomatium martindalei	Martindale's lomatium
Lomatium nudicaule	Lomatium nudicaule	bare-stem lomatium
Lomatium triternatum var. triternatum	Lomatium triternatum	nine-leaf lomatium
Lomatium utriculatum	Lomatium utriculatum	spring-gold
Lotus corniculatus	Lotus corniculatus	garden birdsfoot trefoil
Lotus micranthus	Lotus micranthus	small-flowered deervetch
Lotus nevadensis var. douglasii	Lotus nevadensis	Nevada deervetch
Lotus unifoliolatus var. unifoliolatus	Lotus purshiana	Spanish-clover
Lupinus argenteus ssp. argenteus var. laxiflorus	Lupinus laxiflorus	spurred lupine
Lupinus bicolor ssp. bicolor	Lupinus bicolor	two-colored lupine
Lupinus densiflorus var. densiflorus	Lupinus microcarpus var. scopulorum	dense-flowered lupine
Lupinus latifolius ssp. latifolius	Lupinus latifolius var. latifolius	broadleaf lupine
Lupinus sellulus ssp. sellulus var. lobbii	Lupinus lepidus var. lobbii	Lobb's lupine
Madia exigua	Madia exigua	little tarweed
Madia gracilis	Madia gracilis	slender tarweed
Madia madioides	Madia madioides	woodland tarweed
Maianthemum dilatatum	Maianthemum dilatatum	false lily-of-the-valley
Maianthemum stellatum	Smilacina stellata	starry false Solomon's-seal
Marah oreganus	Marah oreganus	Oregon manroot
Microseris laciniata ssp. laciniata	Microseris laciniata	cut-leaf microseris
Microseris nutans	Microseris nutans	nodding microseris
Microsteris gracilis var. humilior	Microsteris gracilis	pink microsteris
Mimulus alsinoides	Mimulus alsinoides	chickweed monkey-flower
Mimulus guttatus	Mimulus guttatus	yellow monkey-flower

Kartesz 2005 Name	Hitchcock & Cronquist Name	Common Name
Mimulus pulsiferae	Mimulus pulsiferae	Pulsifer's monkeyflower
Minuartia michauxii var. michauxii	Arenaria stricta	Michaux's stitchwort
Moehringia macrophylla	Arenaria macrophylla	big-leaved sandwort
Montia parvifolia ssp. parvifolia	Montia parvifolia	little-leaf montia
Myosotis discolor	Myosotis discolor	yellow-and-blue forget-me-not
Olsynium douglasii var. douglasii	Sisyrinchium douglasii	grass-widows
Orobanche uniflora	Orobanche uniflora	naked broomrape
Osmorhiza occidentalis	Osmorhiza occidentalis	western sweet-cicely
Packera macounii	Senecio macounii	Puget groundsel
Parentucellia viscosa	Parentucellia viscosa	yellow parentucellia
Pedicularis contorta var. contorta	Pedicularis contorta	white coiled-beak lousewort
Pedicularis racemosa	Pedicularis racemosa	leafy lousewort
Penstemon ovatus	Penstemon ovatus	broad-leaved penstemon
Penstemon rupicola	Penstemon rupicola	cliff penstemon
Penstemon serrulatus	Penstemon serrulatus	coast penstemon
Penstemon subserratus	Penstemon subserratus	fine-toothed penstemon
Pentagrama triangularis ssp. triangularis	Pityrogramma triangularis	gold-back fern
Perideridia (gairdneri, oregana)	Perideridia (gairdneri, oregana)	yampah
Petasites frigidus var. palmatus	Petasites frigidus	colts foot
Phacelia leptosepala	Phacelia hastata var. leptosepala	narrow-sepal phacelia
Phacelia linearis	Phacelia linearis	threadleaf phacelia
Phacelia mutabilis	Phacelia heterophylla var. pseudohispida	varied-leaf phacelia
Phlox diffusa ssp. longistylis	Phlox diffusa	spreading phlox
Piperia elegans ssp. elegans	Habenaria (elegans, greenei)	elegant rein-orchid
Piperia unalascensis	Habenaria unalaschensis	Alaska rein-orchid
Plantago lanceolata	Plantago lanceolata	English plantain
Plantago maritima var. juncoides	Plantago maritima	seaside plantain
Plectritis congesta ssp. congesta	Plectritis congesta	rosy plectritis
Polygonum bistortoides	Polygonum bistortoides	American bistort
Polygonum douglasii ssp. (douglasii, nuttallii, spergulariiforme)	Polygonum (douglasii, nuttallii, spergulariaeforme)	Douglas' knotweed
Polygonum minimum	Polygonum minimum	broadleaf knotweed
Polypodium (amorphum, hesperium)	Polypodium hesperium	polypody
Polypodium glycyrrhiza	Polypodium glycyrrhiza	licorice fern
Polystichum imbricans ssp. imbricans	Polystichum munitum ssp. imbricans	imbricate sword fern
Polystichum munitum	Polystichum munitum	sword fern
Potentilla glandulosa	Potentilla glandulosa	sticky cinquefoil
Potentilla gracilis var. gracilis	Potentilla gracilis	graceful cinquefoil
Prunella vulgaris ssp. lanceolata	Prunella vulgaris	self-heal
Pteridium aquilinum var. pubescens	Pteridium aquilinum	bracken fern
Ranunculus californicus	Ranunculus californicus	California buttercup
Ranunculus occidentalis var. occidentalis	Ranunculus occidentalis	western buttercup
Rumex acetosella	Rumex acetosella	sheep sorrel
Rupertia physodes	Psoralea physodes	forest scurfpea
Sagina procumbens	Sagina procumbens	procumbent pearlwort
Sanicula bipinnatifida	Sanicula bipinnatifida	purple sanicle

Kartesz 2005 Name	Hitchcock & Cronquist Name	Common Name
Sanicula crassicaulis vars. (crassicaulis, tripartita)	Sanicula crassicaulis	Pacific sanicle
Sanicula graveolens	Sanicula graveolens	Sierra sanicle
Saxifraga caespitosa	Saxifraga caespitosa	tufted saxifrage
Saxifraga ferruginea var. vreelandii	Saxifraga ferruginea	rusty saxifrage
Saxifraga integrifolia	Saxifraga integrifolia	early saxifrage
Saxifraga rufidula	Saxifraga occidentalis var. rufidula	rustyhair saxifrage
Scrophularia oregana	Scrophularia californica	Oregon figwort
Scutellaria angustifolia	Scutellaria angustifolia	narrow-leaved skullcap
Sedum divergens	Sedum divergens	spreading stonecrop
Sedum lanceolatum ssp. nesioticum	Sedum lanceolatum	lance-leaved stonecrop
Sedum oreganum	Sedum oreganum	Oregon stonecrop
Sedum spathulifolium ssp. spathulifolium	Sedum spathulifolium	broad-leaved stonecrop
Sedum stenopetalum	Sedum stenopetalum	wormleaf stonecrop
Selaginella wallacei	Selaginella wallacei	Wallace's selaginella
Senecio integerrimus var. ochroleucus	Senecio integerrimus var. ochroleucus	white western groundsel
Senecio sylvaticus	Senecio sylvaticus	woodland ragwort
Sherardia arvensis	Sherardia arvensis	blue field-madder
Silene antirrhina	Silene antirrhina	sleepy catchfly
Silene douglasii vars. (douglasii, monantha)	Silene douglasii	Douglas' catchfly
Silene gallica	Silene gallica	common catchfly
Silene menziesii ssp. menziesii	Silene menziesii	white catchfly
Silene oregana	Silene oregana	Oregon catchfly
Sisyrinchium idahoense	Sisyrinchium angustifolium	Idaho blue-eyed grass
Solidago canadensis var. salebrosa	Solidago canadensis	Canadian goldenrod
Sonchus spp.	Sonchus spp.	sow-thistle
Spiranthes romanzoffiana	Spiranthes romanzoffiana	hooded ladies'-tresses
Stellaria (calycantha, borealis ssp. sitchana)	Stellaria calycantha	northern, boreal starwort
Stellaria crispa	Stellaria crispa	crisped starwort
Stenanthium occidentale	Stenanthium occidentale	western bronze bells
Synthyris missurica ssp. stellata	Synthyris missurica	Columbia kittentails
Taraxacum officinale	Taraxacum officinale	common dandelion
Teesdalia nudicaulis	Teesdalia nudicaulis	common shepherd's-cress
Tellima grandiflora	Tellima grandiflora	fringecup
Thalictrum occidentale	Thalictrum occidentale	western meadowrue
Thermopsis gracilis var. ovata	Thermopsis montana var. ovata	golden-pea
Thlaspi montanum var. montanum	Thlaspi fendleri	Fendler's pennycress
Thysanocarpus curvipes	Thysanocarpus curvipes	sand fringepod
Tragopogon dubius	Tragopogon dubius	yellow salsify
Trientalis borealis ssp. latifolia	Trientalis latifolia	western starflower
Trifolium bifidum	Trifolium bifidum	pinole clover
Trifolium cyathiferum	Trifolium cyathiferum	cup clover
Trifolium dichotomum	Trifolium macraei var. dichotomum	branched Indian clover
Trifolium dubium	Trifolium dubium	suckling clover
Trifolium macrocephalum	Trifolium macrocephalum	big-head clover
Trifolium microcephalum	Trifolium microcephalum	small-headed clover

Kartesz 2005 Name	Hitchcock & Cronquist Name	Common Name
Trifolium microdon	Trifolium microdon	thimble clover
Trifolium oliganthum	Trifolium oliganthum	few-flowered clover
Trifolium spp.	Trifolium spp.	clover
Trifolium variegatum	Trifolium variegatum	white-tip clover
Trifolium willdenowii	Trifolium tridentatum	tomcat clover
Triphysaria pusilla	Orthocarpus pusillus	dwarf false owl-clover
Triteleia hyacinthina	Brodiaea hyacinthina	hyacinth triteleia
Veronica arvensis	Veronica arvensis	wall speedwell
Veronica officinalis	Veronica officinalis	Paul's betony
Vicia americana ssp. americana	Vicia americana	American vetch
Vicia hirsuta	Vicia hirsuta	hairy vetch
Vicia nigricans ssp. gigantea	Vicia gigantea	giant vetch
Vicia sativa	Vicia sativa	common vetch
Vicia spp.	Vicia spp.	vetch
Viola adunca var. adunca	Viola adunca	early blue violet
Viola howellii	Viola howellii	Howell's violet
Viola praemorsa ssp. praemorsa	Viola nuttallii	prairie violet
Woodsia oregana ssp. oregana	Woodsia oregana	Oregon woodsia
Woodsia scopulina ssp. scopulina	Woodsia scopulina	Rocky Mountain woodsia
Xerophyllum tenax	Xerophyllum tenax	beargrass
Zigadenus venenosus var. venenosus	Zigadenus venenosus	meadow death camas

APPENDIX B. Constancy (frequency) and average relative cover of vascular plant species in plant associations of balds and bluffs in western Washington.

Note: The first number in each cell is constancy, the second is cover, and a hyphen separates the two. Constancy is the fraction (multiply by 100 for percent) of plots within which the species was found (range 0 to 1.00). Average relative cover is the mean crown cover of the species within the plots where it did occur (range 0.01-100.00).

Kartesz 2005 Name	ACLE	ALCE	ARCO	AR(NE,UV)-JUCO	ARUV-FRVI-(FERO)	BADE	CAHO
Trees	7 plots	11 plots	7 plots	15 plots	9 plots	2 plots	3 plots
Abies procera				0.07 - 0.50			
Arbutus menziesii			0.14 - 0.50				
Pseudotsuga menziesii var. menziesii		0.18 - 0.50	0.57 - 0.50	0.27 - 0.50	0.22 - 0.50		
Quercus garryana var. garryana			0.14 - 20.00				
Shrubs							
Amelanchier alnifolia		0.27 - 1.33	0.86 - 2.58	0.47 - 1.57	0.67 - 1.33		0.33 - 3.00
Arctostaphylos columbiana			1.00 - 70.00		0.11 - 3.00		
Ceanothus sanguineus			0.29 - 0.50				
Cytisus scoparius			0.14 - 0.50		0.11 - 3.00		
Holodiscus discolor		0.09 - 0.50	0.57 - 3.00	0.07 - 0.50	0.33 - 1.33		
Ribes cereum var. cereum		0.09 - 0.50					
Ribes sanguineum var. sanguineum			0.14 - 0.50				
Rosa gymnocarpa		0.18 - 1.75	0.57 - 2.38	0.20 - 5.50	0.22 - 0.50		
Rosa nutkana	0.14 - 0.50	0.55 - 0.92			0.11 - 8.00		
Rubus leucodermis		0.09 - 0.50					
Rubus parviflorus var. parviflorus		0.18 - 1.75					
Sorbus scopulina var. cascadensis		0.09 - 0.50					
Spiraea x pyramidata				0.07 - 0.50			
Symphoricarpos albus var. laevigatus		0.27 - 3.83					
Vaccinium membranaceum		0.18 - 1.75		0.27 - 0.50			
Viburnum ellipticum			0.14 - 0.50				
Dwarf-shrubs							
Arctostaphylos nevadensis			0.14 - 20.00	0.60 - 58.89			
Arctostaphylos uva-ursi		0.09 - 20.00	0.43 - 14.50	0.40 - 55.00	1.00 - 62.22		0.33 - 0.50
Eriogonum compositum var. compositum	0.71 - 5.90			0.13 - 3.00		0.50 - 0.50	
Eriogonum umbellatum var. majus	0.29 - 1.75						
Juniperus communis var. montana		0.18 - 0.50		0.80 - 26.38			
Lonicera ciliosa			0.57 - 1.13	0.07 - 0.50			
Mahonia aquifolium		0.27 - 3.00	0.71 - 4.50		0.44 - 3.63		
Mahonia nervosa		0.18 - 0.50	0.29 - 3.00	0.07 - 0.50			
Paxistima myrsinites		0.18 - 0.50	0.71 - 4.50	0.20 - 0.50	0.22 - 0.50		0.33 - 3.00

Kartesz 2005 Name	ACLE	ALCE	ARCO	AR(NE,UV)-JUCO	ARUV-FRVI-(FERO)	BADE	CAHO
Penstemon cardwellii				0.33 - 1.50			0.33 - 0.50
Penstemon fruticosus var. fruticosus			0.14 - 3.00				
Rubus ursinus ssp. macropetalus		0.18 - 1.75			0.11 - 0.50		
Spiraea betulifolia var. lucida		0.27 - 3.00	0.29 - 1.75	0.20 - 3.00	0.33 - 3.83		
Symphoricarpos hesperius		0.18 - 1.75	0.71 - 17.60	0.07 - 3.00	0.11 - 0.50	0.50 - 3.00	
Toxicodendron diversilobum		0.09 - 3.00					
Graminoids							
Achnatherum lemmonii var. lemmonii	1.00 - 29.43			0.07 - 0.50			
Agrostis pallens		0.45 - 12.40	0.14 - 0.50	0.53 - 2.69	0.22 - 0.50		0.33 - 3.00
Aira caryophyllea	0.14 - 3.00	0.64 - 6.86	0.29 - 3.00		0.33 - 1.33		
Aira praecox			0.29 - 0.50		0.44 - 1.13		
Bromus carinatus	0.43 - 9.50	0.18 - 1.75				1.00 - 10.50	
Bromus commutatus							
Bromus hordeaceus	0.29 - 15.25					0.50 - 0.50	
Bromus tectorum	0.29 - 4.25					0.50 - 3.00	
Bromus vulgaris			0.14 - 0.50				
Calamagrostis howellii							1.00 - 23.33
Calamagrostis sesquiflora	0.29 - 1.75			0.13 - 1.75			
Carex geyeri	0.14 - 3.00					0.50 - 3.00	
Carex inops ssp. inops	0.14 - 3.00	0.73 - 25.50	0.29 - 6.75	0.47 - 6.50	0.22 - 5.50		
Carex rossii	0.14 - 3.00	0.09 - 0.50		0.20 - 1.33			
Cynosurus echinatus		0.09 - 0.50				0.50 - 0.50	
Danthonia californica		0.09 - 13.00		0.07 - 0.50	0.33 - 14.50		
Danthonia intermedia				0.07 - 13.00			
Danthonia spicata			0.43 - 3.00		0.44 - 17.88		
Elymus elymoides	0.14 - 0.50						
Elymus glaucus ssp. glaucus	0.57 - 3.63	0.45 - 2.50	0.57 - 7.38	0.20 - 4.67	0.44 - 2.38	0.50 - 0.50	
Festuca occidentalis			0.57 - 2.38	0.40 - 3.83			
Festuca roemeri			0.43 - 3.00		0.78 - 19.14		
Festuca rubra		0.82 - 13.33		0.33 - 5.90		1.00 - 16.50	0.33 - 3.00
Holcus lanatus		0.09 - 8.00					
Koeleria macrantha	0.71 - 11.80	0.82 - 6.89	0.14 - 0.50	0.13 - 4.25	0.44 - 0.50	1.00 - 0.50	
Luzula (comosa, multiflora ssp. multiflora var. multiflora)	0.14 - 0.50	0.73 - 6.06	0.29 - 1.75	0.80 - 5.25	0.67 - 1.33		0.33 - 0.50
Melica harfordii			0.14 - 0.50				
Melica subulata			0.14 - 0.50				
Poa compressa	0.29 - 16.50	0.09 - 3.00	0.14 - 0.50			0.50 - 0.50	
Poa pratensis	0.14 - 13.00						
Poa secunda	0.14 - 3.00	0.09 - 3.00					0.67 - 1.75

Kartesz 2005 Name	ACLE	ALCE	ARCO	AR(NE,UV)-JUCO	ARUV-FRVI-(FERO)	BADE	CAHO
Pseudoroegneria spicata						0.50 - 0.50	
Trisetum canescens			0.14 - 0.50				
Vulpia bromoides			0.43 - 1.33				
Vulpia myuros	0.14 - 30.00	0.18 - 4.25	0.43 - 1.33		0.22 - 1.75		
Forbs and Ferns							
Achillea millefolium var. occidentalis	1.00 - 4.07	0.91 - 3.25	0.86 - 3.00	0.67 - 1.75	1.00 - 2.44	1.00 - 10.50	0.33 - 0.50
Allium acuminatum	0.86 - 0.92			0.27 - 1.13		1.00 - 1.75	
Allium cernuum var. obtusum		1.00 - 43.64	0.14 - 0.50	0.20 - 3.00			0.33 - 0.50
Allium crenulatum	0.29 - 4.25		0.14 - 0.50	0.07 - 13.00	0.33 - 10.33		
Anemone oregana				0.27 - 1.13			
Angelica arguta						0.50 - 0.50	
Antennaria racemosa				0.27 - 1.75			
Antennaria rosea	0.14 - 3.00		0.14 - 0.50	0.07 - 0.50			
Apocynum androsaemifolium		0.36 - 1.13	0.14 - 0.50				
Aquilegia formosa		0.18 - 3.00					
Arabis hirsuta		0.09 - 0.50					
Arabis holboellii		0.09 - 0.50					
Arenaria capillaris ssp. americana	0.14 - 0.50			0.07 - 3.00			
Arenaria serpyllifolia	0.29 - 0.50						
Artemisia douglasiana						0.50 - 8.00	
Aspidotis densa		0.09 - 3.00	0.43 - 0.50		0.33 - 2.17		
Asplenium trichomanes					0.22 - 0.50		
Balsamorhiza deltoidea	0.14 - 20.00					1.00 - 50.00	
Calochortus subalpinus	0.43 - 8.67	0.36 - 1.13		0.67 - 2.00			0.33 - 0.50
Camassia quamash vars. (azurea, maxima)		0.18 - 8.00			0.11 - 0.50		
Campanula rotundifolia		0.18 - 0.50		0.13 - 1.75		0.50 - 0.50	0.33 - 0.50
Cardamine oligosperma var. oligosperma	0.14 - 0.50						
Castilleja hispida ssp. hispida	0.14 - 0.50	0.55 - 1.33	0.57 - 0.50	0.27 - 0.50	0.44 - 0.50	1.00 - 1.75	0.33 - 0.50
Cerastium arvense ssp. strictum	0.57 - 5.50	0.73 - 4.56	0.14 - 0.50	0.20 - 1.33	0.44 - 1.75	1.00 - 16.50	
Cerastium glomeratum	0.14 - 3.00						
Chamerion angustifolium		0.09 - 0.50					
Cirsium remotifolium						1.00 - 0.50	
Cirsium vulgare							
Clarkia amoena ssp. (caurina, lindleyi)	0.43 - 2.17	0.36 - 4.88	0.14 - 3.00	0.07 - 0.50	0.44 - 3.00	0.50 - 0.50	0.33 - 0.50
Claytonia perfoliata ssp. perfoliata			0.14 - 0.50				
Collinsia grandiflora	0.14 - 0.50	0.45 - 6.00					
Collinsia parviflora	0.57 - 1.13	0.09 - 0.50		0.07 - 0.50	0.33 - 0.50	0.50 - 0.50	
Collomia heterophylla			0.71 - 1.50	0.07 - 0.50	0.33 - 0.50		
Columbiadoria hallii	0.43 - 2.17	0.09 - 0.50		0.07 - 3.00		1.00 - 3.00	

Kartesz 2005 Name	ACLE	ALCE	ARCO	AR(NE,UV)-JUCO	ARUV-FRVI-(FERO)	BADE	CAHO
Comandra umbellata ssp. californica	0.14 - 0.50		0.14 - 3.00	0.40 - 1.33			
Cryptantha intermedia	0.14 - 0.50						
Cryptogramma acrostichoides		0.09 - 0.50		0.27 - 1.13	0.44 - 0.50		1.00 - 0.50
Daucus pusillus			0.14 - 3.00		0.22 - 0.50		
Delphinium menziesii ssp. menziesii	0.14 - 0.50					0.50 - 3.00	
Delphinium nuttallii		0.55 - 6.25					
Epilobium brachycarpum	0.57 - 0.50	0.18 - 0.50					
Epilobium minutum	0.43 - 0.50	0.27 - 0.50	0.57 - 1.13	0.13 - 0.50	0.44 - 0.50		
Eriophyllum lanatum var. lanatum	0.29 - 14.00	1.00 - 6.91	0.57 - 0.50	0.53 - 2.38	0.89 - 1.44	1.00 - 5.50	1.00 - 2.17
Erysimum capitatum var. capitatum		0.09 - 0.50					
Erythronium grandiflorum ssp. grandiflorum	0.14 - 0.50	0.09 - 0.50					
Eurybia radulina		0.45 - 11.30		0.07 - 0.50			
Fragaria vesca ssp. bracteata	0.14 - 3.00	0.45 - 3.50				0.50 - 8.00	
Fragaria virginiana ssp. platypetala	0.14 - 8.00	0.18 - 16.50	0.86 - 4.67	0.20 - 2.17	0.89 - 9.13	0.50 - 0.50	
Fritillaria affinis var. affinis	0.14 - 0.50	0.27 - 1.33	0.14 - 0.50	0.13 - 0.50	0.44 - 0.50	0.50 - 0.50	
Galium aparine		0.27 - 0.50	0.14 - 0.50		0.11 - 0.50	1.00 - 3.00	
Gentiana calycosa		0.27 - 0.50		0.53 - 1.44			
Gilia capitata ssp. capitata	0.57 - 1.13	0.36 - 1.75	0.14 - 0.50	0.07 - 0.50		1.00 - 4.25	
Hedysarum occidentale var. occidentale				0.13 - 1.75			
Heuchera glabra		0.09 - 0.50					
Heuchera micrantha				0.07 - 3.00			0.33 - 3.00
Hieracium albiflorum			0.29 - 1.75	0.13 - 0.50			
Hieracium lachenalii		0.09 - 0.50		0.20 - 1.33			
Hieracium longiberbe	0.14 - 0.50	0.36 - 1.13		0.27 - 1.75		1.00 - 1.75	0.67 - 0.50
Hieracium scouleri var. scouleri	0.14 - 0.50			0.47 - 3.36			
Hydrophyllum capitatum var. thompsonii						0.50 - 0.50	
Hypericum perforatum	0.14 - 0.50	0.64 - 1.93	0.14 - 8.00		0.11 - 0.50		
Hypochaeris glabra							
Hypochaeris radicata		0.18 - 0.50	0.29 - 0.50		0.11 - 0.50		
Lathyrus nevadensis ssp. lanceolatus var. pilosellus		0.36 - 1.13		0.13 - 0.50		1.00 - 5.50	
Lewisia columbiana var. rupicola				0.07 - 0.50			0.33 - 8.00
Ligusticum apiifolium		0.55 - 11.17		0.13 - 0.50			
Lilium columbianum		0.36 - 0.50	0.43 - 0.50	0.13 - 1.75	0.11 - 0.50		0.33 - 0.50
Lomatium dissectum var. dissectum		0.18 - 4.25				0.50 - 3.00	
Lomatium martindalei		0.18 - 3.00	0.43 - 3.00	0.87 - 4.92	0.44 - 2.38		1.00 - 3.00
Lomatium nudicaule		0.18 - 0.50			0.11 - 0.50		
Lomatium triternatum var. triternatum	1.00 - 5.43	0.45 - 0.50	0.14 - 0.50	0.27 - 0.50			0.33 - 0.50
Lomatium utriculatum			0.14 - 0.50		0.33 - 3.83		

Kartesz 2005 Name	ACLE	ALCE	ARCO	AR(NE,UV)-JUCO	ARUV-FRVI-(FERO)	BADE	CAHO
Lotus corniculatus							
Lotus micranthus	0.29 - 11.50	0.36 - 5.50	0.29 - 1.75		0.44 - 0.50		
Lotus nevadensis var. douglasii		0.09 - 0.50					
Lotus unifoliolatus var. unifoliolatus							
Lupinus argenteus ssp. argenteus var. laxiflorus	0.29 - 3.00	0.36 - 2.38		0.20 - 4.67		1.00 - 14.00	
Lupinus latifolius ssp. latifolius	0.14 - 0.50	0.09 - 0.50		0.33 - 4.00			
Lupinus sellulus ssp. sellulus var. lobbii				0.07 - 3.00			
Madia gracilis	0.29 - 4.25		0.14 - 0.50			0.50 - 0.50	
Madia madioides			0.14 - 0.50				
Maianthemum stellatum		0.27 - 3.00					
Microseris laciniata ssp. laciniata	0.14 - 8.00	0.55 - 6.33		0.13 - 5.50			
Microseris nutans	0.43 - 1.33		0.14 - 0.50				
Microsteris gracilis var. humilior	0.71 - 2.50	0.64 - 0.50	0.29 - 0.50	0.33 - 1.00	0.11 - 0.50		0.33 - 3.00
Mimulus alsinoides					0.11 - 0.50		
Mimulus guttatus		0.18 - 0.50					
Mimulus pulsiferae			0.14 - 0.50				
Minuartia michauxii var. michauxii					0.22 - 0.50		
Moehringia macrophylla		0.18 - 0.50	0.14 - 0.50	0.20 - 0.50			
Montia parvifolia ssp. parvifolia			0.14 - 0.50	0.07 - 3.00			
Myosotis discolor		0.09 - 0.50					
Orobanche uniflora				0.07 - 0.50	0.11 - 0.50		
Osmorhiza occidentalis						0.50 - 8.00	
Pedicularis contorta var. contorta				0.07 - 0.50			
Pedicularis racemosa				0.07 - 0.50			
Penstemon rupicola							0.33 - 8.00
Penstemon serrulatus	0.14 - 3.00						
Penstemon subserratus	0.57 - 3.63	0.64 - 4.07	0.14 - 13.00	0.47 - 2.29		0.50 - 3.00	0.33 - 0.50
Pentagrama triangularis ssp. triangularis					0.22 - 0.50		
Phacelia leptosepala						0.50 - 3.00	
Phacelia linearis	0.14 - 0.50					0.50 - 0.50	
Phacelia mutabilis							0.33 - 0.50
Phlox diffusa ssp. longistylis	0.71 - 8.00	0.36 - 12.25	0.14 - 0.50	0.80 - 17.79	0.33 - 0.50		0.67 - 5.50
Piperia elegans ssp. elegans			0.29 - 0.50		0.11 - 0.50		
Piperia unalascensis			0.43 - 0.50	0.20 - 0.50	0.22 - 0.50		
Plectritis congesta ssp. congesta					0.11 - 3.00		
Polygonum douglasii ssp. (douglasii, nuttallii, spergulariiforme)	0.57 - 3.00	0.18 - 0.50	0.14 - 0.50	0.33 - 0.50	0.11 - 0.50	0.50 - 0.50	
Polygonum minimum				0.07 - 0.50	0.22 - 0.50		
Polystichum imbricans ssp. imbricans					0.33 - 0.50		
Polystichum munitum				0.07 - 0.50			

Kartesz 2005 Name	ACLE	ALCE	ARCO	AR(NE,UV)-JUCO	ARUV-FRVI-(FERO)	BADE	CAHO
Potentilla glandulosa	0.29 - 0.50	0.64 - 2.29	0.14 - 3.00	0.07 - 3.00		0.50 - 0.50	
Prunella vulgaris ssp. lanceolata		0.27 - 0.50	0.29 - 0.50		0.33 - 5.50		
Pteridium aquilinum var. pubescens				0.07 - 0.50			
Ranunculus occidentalis var. occidentalis						0.50 - 0.50	
Rumex acetosella	0.14 - 8.00			0.07 - 0.50	0.11 - 0.50	0.50 - 3.00	
Rupertia physodes			0.14 - 0.50				
Sanicula graveolens	0.14 - 3.00	0.09 - 0.50					
Saxifraga ferruginea var. vreelandii				0.20 - 0.50			
Saxifraga integrifolia		0.09 - 0.50					
Saxifraga rufidula		0.09 - 0.50					
Sedum divergens				0.07 - 0.50			
Sedum oreganum				0.13 - 0.50			
Sedum spathulifolium ssp. spathulifolium					0.11 - 0.50		0.33 - 3.00
Sedum stenopetalum	0.71 - 1.50					1.00 - 0.50	
Selaginella wallacei	0.43 - 12.00	0.36 - 0.50	0.29 - 0.50	0.33 - 1.50	0.44 - 1.13		1.00 - 13.67
Senecio integerrimus var. ochroleucus	0.29 - 0.50	0.09 - 0.50		0.13 - 0.50		1.00 - 14.00	
Senecio sylvaticus			0.14 - 0.50				
Silene antirrhina			0.43 - 0.50		0.33 - 0.50		
Silene douglasii vars. (douglasii, monantha)				0.20 - 0.50			0.67 - 0.50
Silene oregana	0.14 - 3.00	0.27 - 1.33		0.40 - 1.33			
Stellaria (calycantha, borealis ssp. sitchana)						0.50 - 3.00	
Taraxacum officinale	0.14 - 0.50	0.09 - 3.00				0.50 - 0.50	
Thermopsis gracilis var. ovata				0.07 - 3.00			
Thlaspi montanum var. montanum	0.14 - 3.00	0.18 - 0.50		0.07 - 0.50		1.00 - 1.75	
Tragopogon dubius	0.14 - 0.50						
Trientalis borealis ssp. latifolia			0.14 - 3.00				
Trifolium macrocephalum				0.07 - 0.50			
Trifolium microcephalum		0.09 - 20.00	0.14 - 0.50		0.11 - 0.50		
Trifolium oliganthum			0.14 - 0.50		0.11 - 0.50		
Trifolium willdenowii		0.18 - 4.25			0.11 - 0.50		
Triteleia hyacinthina		0.27 - 8.00	0.14 - 0.50		0.11 - 0.50		
Veronica arvensis	0.14 - 0.50						
Vicia americana ssp. americana	0.14 - 3.00	0.64 - 2.29	0.29 - 0.50	0.20 - 1.33	0.11 - 0.50	1.00 - 1.75	0.33 - 0.50
Viola adunca var. adunca			0.14 - 0.50	0.07 - 0.50	0.44 - 1.13		
Viola howellii		0.18 - 0.50				0.50 - 3.00	
Xerophyllum tenax				0.53 - 4.25			
Zigadenus venenosus var. venenosus		0.18 - 1.75	0.14 - 3.00		0.67 - 1.75		

Kartesz 2005 Name	CANU-VIGI-(EQTE)	CAQU-TRHY	CAIN-ERLA	DACA-ERLA	FERO-(CEAR-KOMA)	FERO-PLCO	FERU-(GRST-CALE)	FERU-FERO-ASDE
Trees	7 plots	11 plots	6 plots	8 plots	38 plots	9 plots	18 plots	6 plots
Acer macrophyllum					0.03 - 0.50			
Alnus rubra	0.29 - 1.75							
Arbutus menziesii					0.05 - 0.50	0.22 - 0.50		0.17 - 3.00
Juniperus scopulorum					0.03 - 0.50		0.06 - 3.00	0.67 - 4.25
Picea sitchensis	0.57 - 2.38				0.03 - 3.00			
Pinus contorta var. contorta					0.13 - 1.50			
Prunus emarginata var. mollis			0.17 - 0.50					
Pseudotsuga menziesii var. menziesii		0.09 - 0.50	0.33 - 4.25	0.25 - 1.75	0.34 - 1.08		0.33 - 1.33	0.83 - 6.00
Shrubs								
Amelanchier alnifolia			0.33 - 1.75		0.13 - 0.50	0.11 - 3.00	0.06 - 3.00	
Gaultheria shallon	0.86 - 10.83				0.03 - 0.50			
Holodiscus discolor				0.25 - 0.50	0.24 - 2.44	0.11 - 8.00	0.06 - 0.50	
Lonicera involucrata var. involucrata	0.43 - 3.83							
Morella californica	0.43 - 0.50							
Rosa gymnocarpa			0.50 - 1.33	0.38 - 0.50	0.11 - 1.13		0.06 - 0.50	
Rosa nutkana	0.14 - 0.50			0.13 - 3.00	0.16 - 4.67	0.11 - 8.00	0.56 - 2.00	
Rubus parviflorus var. parviflorus			0.33 - 1.75					
Rubus spectabilis var. spectabilis	0.71 - 3.50							
Sorbus scopulina var. cascadensis			0.17 - 0.50					
Symphoricarpos albus var. laevigatus			0.50 - 3.00	0.38 - 0.50	0.05 - 0.50	0.11 - 3.00	0.11 - 4.25	
Vaccinium ovatum	0.29 - 0.50							
Dwarf-shrubs								
Arctostaphylos uva-ursi			0.17 - 8.00		0.18 - 9.00	0.11 - 0.50		
Eriogonum compositum var. compositum					0.05 - 4.25			
Juniperus communis var. montana			0.17 - 13.00					
Lonicera ciliosa			0.17 - 0.50					
Lonicera hispidula							0.06 - 3.00	0.17 - 0.50
Mahonia aquifolium			0.17 - 13.00	0.25 - 1.75	0.42 - 4.53	0.22 - 4.25	0.11 - 2.75	0.50 - 0.50
Opuntia fragilis							0.17 - 0.50	
Paxistima myrsinites					0.03 - 8.00			
Penstemon fruticosus var. fruticosus			0.17 - 0.50					
Rubus ursinus ssp. macropetalus	0.14 - 3.00			0.38 - 0.50	0.16 - 0.50	0.11 - 0.50	0.28 - 3.00	
Spiraea betulifolia var. lucida			0.33 - 0.50		0.08 - 2.17			
Symphoricarpos hesperius					0.03 - 0.50			
Graminoids								
Achnatherum lemmonii var. lemmonii				0.38 - 8.83	0.11 - 3.63			
Agrostis capillaris	0.14 - 8.00							

Kartesz 2005 Name	CANU-VIGI-(EQTE)	CAQU-TRHY	CAIN-ERLA	DACA-ERLA	FERO-(CEAR-KOMA)	FERO-PLCO	FERU-(GRST-CALE)	FERU-FERO-ASDE
Agrostis exarata	0.29 - 0.50							
Agrostis microphylla		0.09 - 8.00						
Agrostis pallens		0.18 - 11.50	0.50 - 0.50		0.21 - 9.81			
Agrostis spp.					0.03 - 8.00			
Aira caryophyllea		0.91 - 6.95		0.75 - 7.17	0.76 - 3.74	0.56 - 3.50	0.67 - 1.96	1.00 - 2.58
Aira praecox	0.29 - 1.75	0.36 - 1.13	0.17 - 0.50	0.63 - 1.00	0.42 - 6.44	0.22 - 0.50	0.61 - 3.23	1.00 - 1.33
Anthoxanthum odoratum	0.14 - 3.00	0.09 - 3.00			0.03 - 0.50	0.11 - 8.00	0.06 - 3.00	
Bromus carinatus			0.50 - 9.50	0.50 - 15.38	0.26 - 10.65	0.56 - 4.00	0.17 - 1.50	0.67 - 4.25
Bromus commutatus		0.09 - 0.50				0.22 - 3.00		
Bromus hordeaceus		0.91 - 13.55		0.63 - 16.00	0.50 - 3.66	0.67 - 4.67	0.78 - 4.93	0.33 - 0.50
Bromus pacificus	0.14 - 0.50						0.11 - 5.50	
Bromus rigidus							0.50 - 8.39	
Bromus sitchensis				0.13 - 3.00			0.06 - 3.00	
Bromus sterilis				0.13 - 0.50	0.08 - 3.83			
Bromus tectorum				0.25 - 9.25	0.11 - 2.38		0.17 - 0.50	0.33 - 6.75
Calamagrostis howellii								
Calamagrostis nutkaensis	1.00 - 70.00							
Carex inops ssp. inops			1.00 - 43.33	0.63 - 13.40	0.24 - 7.89	0.11 - 3.00	0.06 - 0.50	0.17 - 0.50
Carex obnupta	0.29 - 5.50						0.06 - 0.50	
Carex rossii					0.11 - 0.50		0.17 - 1.33	
Cynosurus echinatus		0.45 - 2.00		0.13 - 0.50	0.05 - 1.75	0.22 - 11.50		
Dactylis glomerata		0.09 - 0.50			0.08 - 3.00		0.11 - 2.00	
Danthonia californica		0.45 - 4.00		1.00 - 49.63	0.37 - 8.96	0.67 - 4.25	0.28 - 3.50	0.17 - 0.50
Danthonia spicata					0.03 - 3.00			
Distichlis spicata							0.06 - 3.00	
Elymus glaucus ssp. glaucus			0.33 - 14.00	0.88 - 3.00	0.47 - 3.69	0.44 - 3.00	0.33 - 7.08	0.67 - 4.88
Elymus repens							0.11 - 5.50	
Elymus trachycaulus ssp. trachycaulus				0.13 - 18.00	0.03 - 0.50			0.50 - 3.83
Festuca roemeri		0.27 - 7.83		0.13 - 3.00	1.00 - 46.68	1.00 - 45.33	0.06 - 8.00	1.00 - 19.50
Festuca rubra		0.27 - 3.00	0.50 - 8.67	0.25 - 13.00	0.11 - 4.25		1.00 - 37.39	1.00 - 30.67
Holcus lanatus	0.29 - 3.00	0.73 - 6.06		0.25 - 0.50	0.11 - 3.63	0.56 - 6.40	0.61 - 5.91	
Juncus effusus	0.29 - 0.50						0.06 - 3.00	
Juncus spp.		0.09 - 0.50						
Juncus tenuis					0.03 - 0.50			
Koeleria macrantha			0.67 - 12.88	0.75 - 9.58	0.68 - 4.33	0.22 - 1.75	0.17 - 1.33	1.00 - 5.92
Lolium perenne ssp. perenne								
Luzula (comosa, multiflora ssp. multiflora var. multiflora)			0.83 - 2.50	0.63 - 7.50	0.55 - 1.69	0.56 - 1.50	0.56 - 1.05	1.00 - 1.75
Phleum pratense					0.03 - 0.50			

Kartesz 2005 Name	CANU-VIGI-(EQTE)	CAQU-TRHY	CAIN-ERLA	DACA-ERLA	FERO-(CEAR-KOMA)	FERO-PLCO	FERU-(GRST-CALE)	FERU-FERO-ASDE
Poa compressa	0.14 - 3.00				0.05 - 1.75			
Poa pratensis			0.17 - 30.00	0.25 - 18.00	0.05 - 4.25	0.11 - 13.00	0.44 - 6.25	0.17 - 3.00
Poa secunda		0.27 - 3.00		0.13 - 0.50	0.08 - 7.83	0.11 - 0.50		
Poa spp.			0.17 - 0.50					
Scirpus microcarpus	0.29 - 1.75							
Trisetum canescens					0.03 - 3.00			
Vulpia bromoides		0.18 - 15.25	0.17 - 8.00	0.75 - 6.33	0.24 - 4.39	0.33 - 6.33	0.39 - 6.21	0.67 - 4.25
Vulpia microstachys					0.03 - 0.50	0.11 - 8.00		0.17 - 0.50
Vulpia myuros		0.45 - 2.50	0.17 - 0.50	0.50 - 3.63	0.26 - 3.75	0.33 - 5.50	0.39 - 1.93	0.33 - 1.75
Forbs and Ferns								
Achillea millefolium var. occidentalis	0.57 - 3.00	0.27 - 0.50	1.00 - 7.17	0.88 - 5.86	0.79 - 5.82	0.44 - 2.38	0.83 - 4.10	1.00 - 11.75
Agoseris grandiflora	0.14 - 0.50			0.13 - 0.50	0.11 - 1.75	0.11 - 0.50		
Allium acuminatum			0.17 - 0.50	0.38 - 0.50	0.45 - 2.12	0.22 - 4.25	0.56 - 2.00	0.67 - 3.00
Allium amplectens		0.18 - 1.75						
Allium cernuum var. obtusum		0.18 - 5.50	0.50 - 7.17		0.16 - 4.67		0.22 - 6.63	0.17 - 0.50
Allium crenulatum					0.08 - 3.83			
Anaphalis margaritacea	0.86 - 3.00						0.06 - 0.50	
Angelica arguta			0.17 - 3.00					
Angelica lucida	0.29 - 0.50							
Aphanes arvensis							0.11 - 0.50	
Arabis hirsuta					0.03 - 0.50	0.11 - 0.50		
Arenaria capillaris ssp. americana			0.17 - 0.50					
Arenaria serpyllifolia				0.13 - 0.50				
Armeria maritima vars. (californica, purpurea)							0.17 - 6.33	0.17 - 0.50
Artemisia campestris ssp. borealis var. scouleriana							0.11 - 9.50	
Aspidotis densa			0.17 - 8.00	0.50 - 5.50	0.18 - 5.14	0.22 - 1.75		1.00 - 4.67
Asplenium trichomanes					0.03 - 0.50			
Athyrium filix-femina ssp. cyclosorum	0.14 - 3.00							
Atriplex subspicata							0.06 - 3.00	
Balsamorhiza deltoidea				0.13 - 3.00				
Blechnum spicant	0.29 - 1.75							
Brodiaea coronaria ssp. coronaria				0.38 - 0.50	0.11 - 0.50		0.17 - 3.00	0.33 - 0.50
Calochortus subalpinus			0.33 - 1.75					
Camassia leichtlinii ssp. suksdorfii				0.13 - 0.50			0.56 - 11.10	
Camassia quamash vars. (azurea, maxima)		1.00 - 35.73		0.13 - 0.50	0.34 - 6.04	0.67 - 4.67		
Campanula rotundifolia					0.05 - 0.50			
Cardamine pensylvanica						0.11 - 0.50		
Castilleja attenuata		0.18 - 0.50		0.13 - 0.50				
Castilleja hispida ssp. hispida			0.50 - 1.33	0.25 - 1.75	0.34 - 0.88		0.06 - 3.00	

Kartesz 2005 Name	CANU-VIGI-(EQTE)	CAQU-TRHY	CAIN-ERLA	DACA-ERLA	FERO-(CEAR-KOMA)	FERO-PLCO	FERU-(GRST-CALE)	FERU-FERO-ASDE
Castilleja levisecta							0.11 - 1.75	
Castilleja miniata ssp. dixonii							0.06 - 0.50	
Cerastium arvense ssp. strictum			0.67 - 6.00	0.63 - 3.00	0.58 - 3.11	0.33 - 3.83	0.89 - 3.78	1.00 - 4.25
Cerastium glomeratum		0.27 - 0.50		0.38 - 1.33	0.11 - 0.50	0.33 - 1.33	0.11 - 0.50	
Cirsium arvense							0.17 - 2.17	
Cirsium brevistylum		0.09 - 0.50					0.22 - 0.50	
Cirsium remotifolium			0.17 - 3.00					
Cirsium vulgare	0.43 - 0.50			0.25 - 0.50	0.03 - 3.00		0.17 - 0.50	0.33 - 1.75
Clarkia amoena ssp. (caurina, lindleyi)		0.36 - 3.00	0.17 - 3.00	0.38 - 5.50	0.34 - 2.23	0.89 - 2.69		
Clarkia purpurea ssp. quadrivulnera					0.03 - 0.50			
Claytonia perfoliata ssp. perfoliata							0.06 - 0.50	
Claytonia siberica var. sibirica	0.14 - 0.50							
Clinopodium douglasii			0.17 - 0.50					
Collinsia grandiflora		0.36 - 3.00			0.08 - 3.83	0.44 - 17.25		
Collinsia parviflora		0.09 - 0.50			0.05 - 1.75	0.22 - 1.75	0.06 - 0.50	
Collomia heterophylla					0.03 - 0.50			
Columbiadoria hallii		0.09 - 0.50			0.03 - 0.50			
Comandra umbellata ssp. californica					0.05 - 1.75			
Cryptantha intermedia				0.13 - 3.00	0.03 - 0.50	0.11 - 3.00		
Cryptogramma acrostichoides		0.09 - 0.50			0.05 - 0.50			
Cystopteris fragilis						0.11 - 0.50		
Daucus pusillus		0.18 - 0.50	0.17 - 8.00	0.25 - 1.75	0.29 - 2.73	0.89 - 2.38	0.06 - 3.00	0.17 - 3.00
Delphinium menziesii ssp. menziesii				0.13 - 3.00	0.08 - 2.17	0.11 - 0.50	0.06 - 8.00	
Delphinium nuttallii		0.27 - 1.33	0.33 - 1.75		0.13 - 2.50	0.11 - 0.50		
Dichelostemma congestum					0.03 - 8.00	0.22 - 0.50		
Dodecatheon pulchellum		0.09 - 30.00			0.05 - 0.50	0.11 - 3.00	0.11 - 5.50	
Epilobium brachycarpum		0.09 - 0.50		0.25 - 0.50	0.08 - 0.50	0.44 - 0.50		
Epilobium ciliatum	0.71 - 2.00							
Epilobium minutum		0.36 - 0.50		0.38 - 0.50	0.37 - 0.50	0.11 - 0.50	0.06 - 0.50	0.67 - 0.50
Equisetum hyemale var. affine							0.11 - 3.00	
Equisetum telmateia var. braunii	0.86 - 17.00							
Erigeron speciosus var. speciosus							0.06 - 2.00	
Eriophyllum lanatum var. lanatum		0.45 - 1.00	1.00 - 8.42	0.75 - 8.00	0.87 - 5.80	0.22 - 0.50	0.28 - 6.10	0.33 - 1.75
Erodium cicutarium				0.13 - 0.50		0.11 - 0.50	0.11 - 0.50	
Erythronium oreganum var. oreganum					0.08 - 0.50		0.06 - 0.50	
Fragaria chiloensis ssp. pacifica	0.57 - 4.88							
Fragaria vesca ssp. bracteata			0.33 - 4.25		0.18 - 3.71			
Fragaria virginiana ssp. platypetala		0.09 - 0.50	0.33 - 20.00	0.13 - 3.00	0.39 - 2.83	0.22 - 5.50	0.11 - 1.75	0.17 - 0.50

Kartesz 2005 Name	CANU-VIGI-(EQTE)	CAQU-TRHY	CAIN-ERLA	DACA-ERLA	FERO-(CEAR-KOMA)	FERO-PLCO	FERU-(GRST-CALE)	FERU-FERO-ASDE
Fritillaria affinis var. affinis		0.09 - 0.50	0.17 - 0.50	0.25 - 0.50	0.53 - 0.75	0.22 - 0.50	0.11 - 0.50	0.33 - 0.50
Galium aparine	0.71 - 6.90	0.36 - 0.50	0.17 - 0.50	0.50 - 1.13	0.29 - 1.86	0.89 - 3.31	0.11 - 1.75	0.17 - 0.50
Gamochaeta purpurea	0.14 - 0.50				0.05 - 0.50		0.11 - 0.50	
Gentiana calycosa			0.17 - 0.50					
Geranium bicknellii		0.09 - 0.50						
Geranium carolinianum var. carolinianum		0.36 - 1.13			0.08 - 0.50	0.22 - 4.25		
Geranium columbinum		0.09 - 0.50			0.03 - 0.50			
Geranium molle				0.13 - 3.00		0.22 - 0.50	0.11 - 1.75	
Gilia capitata ssp. capitata		0.18 - 3.00	0.17 - 0.50		0.13 - 2.50			
Grindelia integrifolia				0.13 - 0.50	0.11 - 3.00			
Grindelia stricta var. stricta					0.08 - 1.33		0.83 - 3.87	0.67 - 2.38
Hemizonella minima								
Heracleum maximum	0.29 - 6.50							
Heterotheca villosa							0.11 - 10.50	
Heuchera micrantha					0.05 - 1.75		0.17 - 1.33	
Hieracium longiberbe			0.33 - 0.50					
Hypericum perforatum		0.18 - 0.50	0.33 - 1.75	0.13 - 3.00	0.21 - 1.13		0.06 - 0.50	
Hypochaeris glabra		0.18 - 1.75						
Hypochaeris radicata	0.43 - 7.17	0.55 - 4.17		0.13 - 8.00	0.24 - 8.00	0.22 - 10.50	0.89 - 3.34	
Lathyrus nevadensis ssp. lanceolatus var. pilosellus			0.33 - 10.25		0.05 - 1.75			
Leptosiphon bicolor		0.36 - 14.75		0.13 - 0.50	0.03 - 3.00	0.11 - 0.50		
Leucanthemum vulgare	0.14 - 3.00	0.09 - 0.50		0.13 - 0.50	0.03 - 0.50			
Ligusticum apiifolium			0.33 - 0.50					
Lomatium dissectum var. dissectum					0.05 - 0.50			
Lomatium martindalei		0.09 - 3.00	0.17 - 20.00		0.05 - 11.50			
Lomatium nudicaule		0.27 - 3.83			0.11 - 2.38		0.33 - 8.67	0.17 - 8.00
Lomatium triternatum var. triternatum		0.09 - 3.00	0.17 - 0.50		0.11 - 1.13			
Lomatium utriculatum		0.09 - 0.50		0.38 - 5.50	0.39 - 4.50	0.11 - 8.00	0.17 - 3.00	0.17 - 0.50
Lotus corniculatus	0.14 - 0.50				0.05 - 15.25			
Lotus micranthus		0.45 - 1.50	0.17 - 3.00	0.38 - 1.33	0.63 - 2.25	0.67 - 2.58	0.11 - 1.75	0.33 - 1.75
Lotus unifoliolatus var. unifoliolatus		0.09 - 3.00						
Lupinus argenteus ssp. argenteus var. laxiflorus			0.50 - 12.00					
Lupinus bicolor ssp. bicolor					0.03 - 0.50			
Lupinus densiflorus var. densiflorus	0.14 - 0.50						0.17 - 6.33	
Madia gracilis		0.55 - 4.25		0.25 - 3.00	0.13 - 1.00	0.44 - 2.38		
Maianthemum dilatatum	0.43 - 5.50							
Maianthemum stellatum			0.17 - 0.50					
Marah oreganus	0.14 - 3.00			0.13 - 8.00				

Kartesz 2005 Name	CANU-VIGI-(EQTE)	CAQU-TRHY	CAIN-ERLA	DACA-ERLA	FERO-(CEAR-KOMA)	FERO-PLCO	FERU-(GRST-CALE)	FERU-FERO-ASDE
Microseris laciniata ssp. laciniata			0.67 - 11.75		0.16 - 0.92			
Microsteris gracilis var. humilior		0.27 - 2.17	0.50 - 2.17		0.11 - 0.50	0.22 - 1.75		
Mimulus alsinoides					0.03 - 0.50			
Mimulus guttatus		0.55 - 8.00				0.22 - 4.25		
Minuartia michauxii var. michauxii					0.18 - 0.86			0.33 - 1.75
Montia parvifolia ssp. parvifolia		0.36 - 1.75				0.22 - 0.50		
Myosotis discolor		0.09 - 0.50		0.13 - 0.50	0.05 - 0.50	0.22 - 0.50	0.06 - 0.50	
Olsynium douglasii var. douglasii					0.05 - 4.25			
Orobanche uniflora		0.09 - 0.50		0.13 - 0.50	0.08 - 0.50			
Packera macounii					0.03 - 3.00			
Parentucellia viscosa		0.09 - 0.50				0.11 - 0.50		
Penstemon ovatus					0.03 - 0.50			
Penstemon subserratus			0.67 - 2.38	0.13 - 0.50	0.05 - 0.50			
Pentagrama triangularis ssp. triangularis					0.16 - 0.50	0.33 - 1.33		
Perideridia (gairdneri, oregana)		0.73 - 2.06			0.05 - 0.50	0.11 - 0.50		
Petasites frigidus var. palmatus	0.43 - 2.17							
Phlox diffusa ssp. longistylis			0.50 - 8.00		0.03 - 0.50			
Piperia elegans ssp. elegans					0.16 - 0.50	0.11 - 0.50	0.06 - 3.00	0.33 - 0.50
Piperia unalascensis					0.05 - 0.50	0.11 - 0.50		
Plantago lanceolata	0.14 - 3.00	0.27 - 2.17			0.08 - 0.50		0.61 - 5.05	
Plantago maritima var. juncoides							0.22 - 4.88	
Plectritis congesta ssp. congesta		0.45 - 1.50		0.13 - 0.50	0.16 - 1.33	1.00 - 20.00		0.33 - 1.75
Polygonum douglasii ssp. (douglasii, nuttallii, spergulariiforme)			0.50 - 0.50		0.18 - 0.86	0.11 - 0.50	0.06 - 3.00	
Polypodium glycyrrhiza					0.05 - 0.50	0.33 - 3.00	0.06 - 0.50	
Polystichum imbricans ssp. imbricans					0.08 - 0.50	0.22 - 1.75		
Polystichum munitum	0.86 - 5.00						0.11 - 0.50	
Potentilla glandulosa				0.13 - 3.00	0.11 - 1.75			
Potentilla gracilis var. gracilis					0.08 - 3.00			
Prunella vulgaris ssp. lanceolata		0.73 - 15.63	0.17 - 3.00		0.32 - 2.38	0.33 - 11.17	0.06 - 0.50	
Pteridium aquilinum var. pubescens	0.14 - 10.00				0.03 - 18.00		0.22 - 5.63	
Ranunculus californicus							0.11 - 0.50	
Ranunculus occidentalis var. occidentalis		0.09 - 0.50		0.13 - 0.50	0.18 - 3.71	0.22 - 3.00	0.11 - 4.25	0.50 - 0.50
Rumex acetosella			0.17 - 8.00	0.25 - 1.75	0.32 - 2.38	0.11 - 0.50	0.67 - 2.83	0.50 - 0.50
Sagina procumbens	0.43 - 1.33							
Sanicula bipinnatifida					0.03 - 0.50			
Sanicula crassicaulis vars. (crassicaulis, tripartita)				0.13 - 0.50	0.03 - 0.50		0.22 - 2.25	0.17 - 3.00
Sanicula graveolens			0.17 - 3.00		0.03 - 0.50	0.11 - 0.50		
Saxifraga integrifolia		0.27 - 3.83		0.13 - 0.50	0.03 - 0.50	0.33 - 2.17	0.06 - 0.50	

Kartesz 2005 Name	CANU-VIGI-(EQTE)	CAQU-TRHY	CAIN-ERLA	DACA-ERLA	FERO-(CEAR-KOMA)	FERO-PLCO	FERU-(GRST-CALE)	FERU-FERO-ASDE
Saxifraga rufidula		0.18 - 5.50						
Scrophularia oregana	0.14 - 3.00							
Sedum lanceolatum ssp. nesioticum							0.22 - 1.13	0.33 - 0.50
Sedum oreganum		0.18 - 1.75						
Sedum spathulifolium ssp. spathulifolium					0.11 - 0.50	0.11 - 8.00	0.11 - 6.75	
Selaginella wallacei		0.18 - 4.25	0.33 - 0.50	0.38 - 1.33	0.58 - 6.86	0.56 - 2.50	0.33 - 3.42	1.00 - 14.00
Senecio integerrimus var. ochroleucus			0.33 - 31.50		0.03 - 3.00			
Senecio sylvaticus					0.03 - 0.50			
Sherardia arvensis		0.55 - 8.75			0.08 - 6.33	0.22 - 0.50		
Silene antirrhina				0.13 - 0.50	0.08 - 1.33			
Silene douglasii vars. (douglasii, monantha)					0.05 - 0.50			
Silene menziesii ssp. menziesii							0.06 - 0.50	
Silene oregana			0.33 - 0.50					
Sisyrinchium idahoense					0.03 - 0.50			
Solidago canadensis var. salebrosa	0.57 - 4.88						0.06 - 2.00	
Sonchus spp.							0.28 - 1.10	0.17 - 0.50
Spiranthes romanzoffiana					0.03 - 0.50		0.06 - 0.50	
Stellaria (calycantha, borealis ssp. sitchana)	0.43 - 1.33							
Stellaria crispa	0.57 - 1.13							
Stenanthium occidentale			0.17 - 3.00					
Taraxacum officinale			0.17 - 0.50		0.08 - 0.50		0.28 - 1.00	
Thalictrum occidentale			0.17 - 13.00					
Thlaspi montanum var. montanum			0.33 - 6.75					
Thysanocarpus curvipes					0.03 - 0.50			
Tragopogon dubius				0.25 - 1.75	0.05 - 0.50			
Trifolium bifidum				0.13 - 0.50	0.03 - 0.50			
Trifolium dichotomum					0.03 - 3.00			
Trifolium dubium		0.09 - 3.00		0.13 - 3.00	0.05 - 3.00	0.11 - 3.00	0.11 - 0.50	
Trifolium microcephalum		0.18 - 0.50	0.17 - 20.00	0.75 - 5.08	0.18 - 1.21	0.11 - 3.00	0.06 - 0.50	0.17 - 8.00
Trifolium microdon		0.18 - 0.50		0.13 - 8.00	0.03 - 0.50		0.11 - 0.50	
Trifolium oliganthum		0.09 - 0.50		0.38 - 0.50	0.18 - 2.29	0.11 - 0.50	0.11 - 1.75	
Trifolium spp.					0.05 - 0.50	0.11 - 0.50	0.17 - 1.33	0.33 - 1.75
Trifolium willdenowii		0.45 - 1.00	0.17 - 0.50	0.25 - 5.50	0.18 - 0.86	0.22 - 0.50	0.39 - 1.21	0.33 - 0.50
Triphysaria pusilla		0.36 - 1.75						
Triteleia hyacinthina		0.91 - 40.40		0.13 - 3.00	0.13 - 1.00	0.44 - 4.25		
Veronica arvensis		0.18 - 0.50		0.38 - 0.50	0.03 - 0.50	0.11 - 0.50	0.06 - 0.50	
Veronica officinalis			0.17 - 0.50					
Vicia americana ssp. americana			0.50 - 5.50	0.25 - 1.75	0.05 - 1.75		0.39 - 5.86	

Kartesz 2005 Name	CANU-VIGI-(EQTE)	CAQU-TRHY	CAIN-ERLA	DACA-ERLA	FERO-(CEAR-KOMA)	FERO-PLCO	FERU-(GRST-CALE)	FERU-FERO-ASDE
Vicia hirsuta					0.11 - 2.38	0.22 - 0.50	0.22 - 1.13	
Vicia nigricans ssp. gigantea	1.00 - 23.14							
Vicia sativa				0.13 - 0.50	0.08 - 1.33	0.33 - 2.17	0.28 - 0.50	
Vicia spp.	0.14 - 0.50				0.03 - 3.00	0.11 - 0.50	0.11 - 0.50	
Viola adunca var. adunca					0.11 - 0.50			
Viola howellii			0.17 - 0.50		0.03 - 0.50			
Viola praemorsa ssp. praemorsa					0.05 - 0.50	0.11 - 0.50		
Woodsia scopulina ssp. scopulina					0.03 - 0.50			
Zigadenus venenosus var. venenosus		0.55 - 4.25	0.33 - 1.75	0.50 - 1.75	0.53 - 6.18	0.56 - 3.50	0.33 - 0.92	0.83 - 5.00

Kartesz 2005 Name	JUCO-(PHDI)	KOMA-(AGPA)	LOMA	MIGU-TRHY	PHDI-(LOMA-PESU)	PLCO	SEIN	TRHY
Trees	9 plots	15 plots	12 plots	9 plots	17 plots	4 plots	3 plots	8 plots
Acer macrophyllum		0.07 - 0.50						
Frangula purshiana		0.07 - 0.50						
Pseudotsuga menziesii var. menziesii	0.11 - 0.50	0.07 - 0.50	0.08 - 0.50		0.12 - 0.50	0.25 - 0.50		
Quercus garryana var. garryana		0.07 - 0.50						
Shrubs								
Amelanchier alnifolia	0.44 - 1.75	0.20 - 0.50	0.17 - 0.50	0.11 - 0.50	0.29 - 1.50			
Corylus cornuta var. californica		0.07 - 0.50						
Holodiscus discolor		0.40 - 1.75		0.33 - 1.33	0.18 - 0.50	0.25 - 0.50		
Rosa gymnocarpa		0.13 - 1.75	0.08 - 0.50		0.12 - 5.50		0.33 - 8.00	0.13 - 0.50
Rosa nutkana	0.56 - 1.00	0.20 - 2.17		0.11 - 0.50	0.24 - 1.13	0.25 - 0.50	0.67 - 3.00	0.13 - 0.50
Rubus parviflorus var. parviflorus							0.67 - 0.50	
Spiraea splendens var. splendens	0.22 - 3.00							
Symphoricarpos albus var. laevigatus		0.13 - 1.75		0.11 - 0.50				0.25 - 0.50
Vaccinium membranaceum	0.56 - 4.00		0.08 - 0.50		0.06 - 0.50		0.33 - 0.50	
Dwarf-shrubs								
Arctostaphylos nevadensis		0.07 - 3.00			0.06 - 13.00			
Arctostaphylos uva-ursi	0.11 - 0.50		0.08 - 0.50					
Eriogonum compositum var. compositum	0.33 - 3.00	0.20 - 3.00			0.35 - 1.75			
Eriogonum umbellatum var. majus		0.07 - 0.50						
Juniperus communis var. montana	1.00 - 74.44		0.08 - 0.50		0.24 - 6.63			
Lonicera ciliosa	0.11 - 3.00							
Mahonia aquifolium		0.33 - 7.40		0.11 - 0.50	0.06 - 3.00	0.50 - 0.50		0.25 - 3.00
Mahonia nervosa	0.11 - 0.50	0.07 - 0.50						
Paxistima myrsinites	0.44 - 2.38				0.24 - 1.75		0.33 - 0.50	
Penstemon cardwellii	0.44 - 3.63		0.42 - 1.50		0.29 - 4.90			
Rubus ursinus ssp. macropetalus						0.25 - 3.00		
Spiraea betulifolia var. lucida	0.11 - 8.00	0.13 - 4.25		0.11 - 3.00	0.47 - 2.38	0.25 - 0.50		
Symphoricarpos hesperius	0.11 - 0.50	0.13 - 1.75		0.11 - 0.50	0.12 - 25.25			
Graminoids								
Achnatherum lemmonii var. lemmonii		0.07 - 0.50		0.11 - 0.50			0.33 - 0.50	0.13 - 0.50
Agrostis pallens	0.44 - 11.00	0.60 - 28.11	0.92 - 12.14	0.11 - 8.00	0.41 - 9.93	0.25 - 0.50		0.25 - 11.50
Aira caryophyllea		0.33 - 19.60	0.17 - 16.50	0.44 - 7.38		0.50 - 3.00		0.63 - 15.30
Aira praecox				0.11 - 0.50		0.25 - 20.00		0.38 - 1.33
Anthoxanthum odoratum			0.08 - 3.00					
Arrhenatherum elatius					0.12 - 0.50			
Bromus carinatus	0.22 - 1.75	0.33 - 7.50		0.33 - 5.50				
Bromus commutatus				0.11 - 3.00		0.25 - 0.50		0.13 - 0.50

Kartesz 2005 Name	JUCO-(PHDI)	KOMA-(AGPA)	LOMA	MIGU-TRHY	PHDI-(LOMA-PESU)	PLCO	SEIN	TRHY
Bromus hordeaceus	0.11 - 0.50	0.20 - 8.00		0.56 - 24.00		1.00 - 15.88		0.50 - 8.50
Bromus rigidus						0.25 - 3.00		
Bromus sterilis			0.08 - 0.50					
Bromus tectorum		0.07 - 3.00		0.11 - 3.00		0.25 - 3.00		
Calamagrostis howellii	0.22 - 1.75		0.17 - 3.00	0.11 - 8.00	0.06 - 13.00			
Calamagrostis sesquiflora	0.33 - 1.33		0.17 - 4.25		0.24 - 4.25			
Carex geyeri	0.22 - 21.50				0.06 - 3.00			
Carex inops ssp. inops	0.33 - 20.33	0.27 - 3.00	0.17 - 4.25		0.47 - 10.06	0.50 - 10.25	0.33 - 13.00	
Carex raynoldsii	0.11 - 8.00		0.08 - 0.50					
Carex rossii		0.07 - 3.00	0.25 - 1.33		0.18 - 5.50		0.33 - 3.00	
Cynosurus echinatus	0.11 - 0.50			0.11 - 8.00				0.13 - 8.00
Dactylis glomerata				0.11 - 3.00				
Danthonia californica		0.07 - 20.00		0.33 - 11.17				0.63 - 3.00
Danthonia spicata								0.13 - 8.00
Dichanthelium acuminatum var. fasciculatum								0.13 - 3.00
Elymus elymoides		0.07 - 0.50						
Elymus glaucus ssp. glaucus	0.22 - 1.75	0.53 - 6.94	0.08 - 3.00	0.44 - 8.00	0.12 - 1.75	0.25 - 8.00	0.67 - 4.25	0.50 - 1.13
Festuca occidentalis					0.12 - 0.50			
Festuca roemeri				0.44 - 3.00		0.25 - 3.00		0.25 - 4.25
Festuca rubra	0.44 - 10.50	0.53 - 22.06	0.25 - 1.33	0.11 - 8.00	0.59 - 12.30	0.50 - 8.00	1.00 - 10.33	0.13 - 0.50
Holcus lanatus				0.11 - 0.50		0.50 - 3.00		0.38 - 2.17
Juncus bufonius				0.11 - 0.50				
Juncus tenuis				0.11 - 0.50				
Koeleria macrantha	0.33 - 1.33	0.93 - 19.86	0.08 - 0.50	0.22 - 1.75	0.29 - 10.80	0.25 - 3.00	0.33 - 8.00	0.50 - 5.38
Lolium perenne ssp. perenne								0.13 - 0.50
Luzula (comosa, multiflora ssp. multiflora var. multiflora)	0.78 - 1.57	0.60 - 2.44	0.83 - 1.00	0.11 - 0.50	0.76 - 3.00	0.25 - 3.00	0.33 - 8.00	0.38 - 1.33
Poa compressa	0.22 - 1.75	0.07 - 3.00			0.06 - 20.00		0.33 - 0.50	
Poa fendleriana		0.07 - 0.50						
Poa secunda	0.11 - 0.50	0.40 - 1.75	0.08 - 0.50	0.44 - 20.75	0.35 - 3.00	0.50 - 4.25		0.25 - 1.75
Pseudoroegneria spicata	0.11 - 3.00							
Vulpia bromoides				0.22 - 20.25				0.38 - 6.33
Vulpia microstachys		0.07 - 0.50		0.11 - 3.00				0.13 - 0.50
Vulpia myuros		0.13 - 0.50		0.44 - 6.00		0.50 - 4.25		0.63 - 3.00
Forbs and Ferns								
Achillea millefolium var. occidentalis	0.89 - 2.38	0.87 - 4.35	0.42 - 2.50	0.67 - 3.00	0.82 - 2.11	0.75 - 2.17	1.00 - 5.50	0.63 - 3.50
Agoseris grandiflora		0.07 - 0.50						0.13 - 0.50
Agroseris heterophylla var. heterophylla				0.11 - 3.00				
Allium acuminatum	0.11 - 0.50	0.47 - 4.43		0.11 - 0.50	0.29 - 2.00	0.25 - 0.50	1.00 - 1.33	0.13 - 0.50

Kartesz 2005 Name	JUCO-(PHDI)	KOMA-(AGPA)	LOMA	MIGU-TRHY	PHDI-(LOMA-PESU)	PLCO	SEIN	TRHY
Allium cernuum var. obtusum		0.27 - 8.63	0.17 - 4.25	0.22 - 50.00	0.12 - 1.75			0.25 - 39.00
Allium crenulatum			0.25 - 5.50		0.29 - 3.00			0.13 - 3.00
Anaphalis margaritacea	0.11 - 0.50	0.07 - 8.00	0.17 - 0.50					
Anemone oregana	0.44 - 2.38			0.11 - 0.50	0.06 - 3.00			
Angelica arguta				0.11 - 0.50			0.33 - 0.50	
Antennaria racemosa	0.11 - 3.00							
Antennaria rosea	0.11 - 0.50							
Aphanes arvensis						0.25 - 3.00		
Apocynum androsaemifolium		0.07 - 0.50			0.12 - 5.50			
Arabis hirsuta								0.13 - 0.50
Arabis holboellii								
Arenaria capillaris ssp. americana	0.11 - 0.50				0.18 - 3.83			
Arenaria serpyllifolia		0.07 - 8.00						
Artemisia douglasiana							0.33 - 0.50	
Artemisia tilesii ssp. elatior		0.07 - 0.50						
Aspidotis densa		0.07 - 0.50		0.22 - 4.25				0.63 - 11.40
Asplenium trichomanes								0.13 - 0.50
Balsamorhiza deltoidea	0.22 - 1.75				0.06 - 0.50			
Brodiaea coronaria ssp. coronaria								0.13 - 0.50
Calochortus subalpinus	0.56 - 3.00	0.33 - 2.00	0.67 - 5.13	0.22 - 0.50	0.71 - 4.25		0.33 - 0.50	
Camassia leichtlinii ssp. suksdorfii						0.25 - 50.00		0.13 - 20.00
Camassia quamash vars. (azurea, maxima)				0.22 - 8.00		0.25 - 8.00		0.13 - 0.50
Campanula rotundifolia	0.78 - 1.21	0.07 - 0.50	0.17 - 0.50		0.24 - 2.38			
Castilleja attenuata				0.22 - 5.50		0.25 - 0.50		0.13 - 0.50
Castilleja hispida ssp. hispida	0.56 - 1.50	0.73 - 0.50	0.33 - 3.63	0.11 - 0.50	0.47 - 0.81			0.50 - 0.50
Castilleja miniata ssp. miniata							0.33 - 3.00	
Cerastium arvense ssp. strictum	0.67 - 3.83	0.67 - 3.00		0.44 - 1.13	0.47 - 4.56		1.00 - 8.00	0.25 - 1.75
Cerastium glomeratum		0.07 - 0.50		0.33 - 0.50		0.75 - 0.50		0.25 - 0.50
Cheilanthes gracillima	0.11 - 0.50		0.08 - 0.50					
Clarkia amoena ssp. (caurina, lindleyi)	0.11 - 0.50	0.27 - 4.88	0.08 - 3.00	0.78 - 1.21		0.50 - 4.25		0.38 - 1.33
Collinsia grandiflora		0.27 - 4.88		0.11 - 50.00	0.06 - 0.50	0.25 - 8.00		0.25 - 10.50
Collinsia parviflora		0.27 - 1.13	0.17 - 1.75	0.22 - 0.50			1.00 - 0.50	
Collomia heterophylla				0.11 - 0.50				
Columbiadoria hallii	0.22 - 5.50	0.40 - 3.83		0.11 - 0.50	0.12 - 5.50			
Comandra umbellata ssp. californica	0.44 - 1.13				0.35 - 2.58			
Crepis capillaris						0.25 - 0.50		
Cryptantha intermedia		0.07 - 3.00		0.11 - 0.50				
Cryptogramma acrostichoides	0.44 - 0.50	0.20 - 0.50	0.42 - 1.00		0.35 - 0.50	0.25 - 0.50		0.13 - 0.50

Kartesz 2005 Name	JUCO-(PHDI)	KOMA-(AGPA)	LOMA	MIGU-TRHY	PHDI-(LOMA-PESU)	PLCO	SEIN	TRHY
Cystopteris fragilis	0.11 - 0.50	0.20 - 0.50		0.33 - 0.50		0.25 - 0.50		0.13 - 0.50
Daucus pusillus				0.44 - 2.38		0.25 - 3.00		0.38 - 2.17
Delphinium menziesii ssp. menziesii					0.18 - 1.33			
Delphinium nuttallii		0.20 - 1.33	0.08 - 0.50	0.22 - 10.25			1.00 - 7.17	0.13 - 8.00
Dianthus armeria				0.11 - 0.50				
Dichelostemma congestum				0.11 - 0.50				
Epilobium brachycarpum		0.13 - 0.50		0.11 - 0.50				
Epilobium minutum		0.47 - 0.86	0.17 - 0.50	0.22 - 0.50	0.12 - 0.50			0.63 - 1.00
Eriophyllum lanatum var. lanatum	0.67 - 2.58	0.80 - 12.50	0.75 - 5.17	0.78 - 2.29	0.53 - 4.11	0.25 - 3.00	1.00 - 8.00	0.63 - 10.40
Erodium cicutarium								0.13 - 0.50
Erysimum capitatum var. capitatum	0.33 - 0.50				0.12 - 0.50			
Erythronium grandiflorum ssp. grandiflorum	0.11 - 0.50		0.25 - 1.33		0.41 - 0.86	0.25 - 0.50	0.67 - 0.50	
Erythronium montanum	0.11 - 0.50							
Eurybia radulina	0.11 - 0.50							
Fragaria vesca ssp. bracteata		0.27 - 0.50	0.08 - 0.50			0.25 - 8.00	0.33 - 0.50	
Fragaria virginiana ssp. platypetala		0.27 - 4.88	0.08 - 0.50	0.11 - 0.50	0.24 - 1.75	0.25 - 3.00	0.67 - 20.00	0.25 - 0.50
Fritillaria affinis var. affinis		0.33 - 1.00		0.22 - 1.75		0.25 - 0.50		0.50 - 1.13
Galium aparine		0.13 - 8.00	0.08 - 0.50	0.33 - 1.33		0.25 - 0.50		0.50 - 1.75
Gentiana calycosa	0.44 - 3.63				0.24 - 1.13			
Geranium carolinianum var. carolinianum				0.11 - 3.00		0.25 - 0.50		
Geranium columbinum								0.13 - 0.50
Geranium molle				0.11 - 8.00				0.13 - 0.50
Geranium robertianum						0.25 - 0.50		
Gilia capitata ssp. capitata	0.11 - 3.00	0.67 - 7.40	0.17 - 1.75	0.33 - 1.33	0.06 - 3.00	0.25 - 0.50		0.25 - 10.25
Githopsis specularioides				0.11 - 0.50				
Hedysarum occidentale var. occidentale	0.11 - 3.00							
Hemizonella minima		0.07 - 8.00						
Heterocodon rariflorum				0.11 - 0.50				
Heuchera micrantha		0.07 - 30.00	0.08 - 3.00	0.22 - 1.75	0.06 - 0.50			
Hieracium lachenalii	0.44 - 1.13	0.20 - 0.50	0.17 - 4.25		0.12 - 1.75			
Hieracium longiberbe	0.22 - 3.00	0.33 - 1.50	0.08 - 0.50		0.35 - 3.83			
Hieracium scouleri var. scouleri	0.56 - 2.00	0.07 - 0.50	0.08 - 3.00		0.29 - 4.00			
Hydrophyllum capitatum var. thompsonii	0.11 - 0.50							
Hypericum perforatum		0.67 - 4.00	0.08 - 0.50	0.22 - 1.75	0.06 - 8.00	0.75 - 3.83		0.25 - 0.50
Hypochaeris glabra				0.22 - 8.00		0.25 - 0.50		0.13 - 13.00
Hypochaeris radicata			0.17 - 0.50	0.22 - 6.75		1.00 - 4.88	0.33 - 0.50	0.13 - 13.00
Lathyrus nevadensis ssp. lanceolatus var. pilosellus	0.22 - 0.50	0.20 - 0.50					0.67 - 1.75	
Leptosiphon bicolor				0.22 - 21.50		0.25 - 8.00		0.13 - 50.00

Kartesz 2005 Name	JUCO-(PHDI)	KOMA-(AGPA)	LOMA	MIGU-TRHY	PHDI-(LOMA-PESU)	PLCO	SEIN	TRHY
Leptosiphon minimus								0.13 - 30.00
Leucanthemum vulgare	0.11 - 0.50							
Lewisia columbiana var. rupicola			0.33 - 1.13					
Ligusticum apiifolium		0.13 - 3.00					0.33 - 0.50	
Lilium columbianum	0.22 - 0.50	0.07 - 0.50			0.06 - 0.50		0.33 - 0.50	
Lithophragma parviflorum var. parviflorum		0.07 - 0.50					0.33 - 0.50	
Lomatium dissectum var. dissectum		0.20 - 5.50		0.11 - 0.50		0.25 - 0.50		
Lomatium martindalei	0.56 - 4.50	0.07 - 3.00	1.00 - 21.42	0.11 - 3.00	0.76 - 5.50			
Lomatium nudicaule		0.13 - 8.00		0.22 - 10.25		0.25 - 3.00		0.13 - 0.50
Lomatium triternatum var. triternatum	0.56 - 2.50	0.67 - 4.25	0.08 - 0.50	0.33 - 0.50	0.35 - 3.42		0.67 - 10.50	0.25 - 3.00
Lomatium utriculatum				0.22 - 0.50				0.38 - 1.33
Lotus micranthus		0.47 - 3.29	0.08 - 0.50	0.22 - 0.50		0.75 - 6.33		0.38 - 3.00
Lotus nevadensis var. douglasii		0.07 - 8.00						
Lupinus argenteus ssp. argenteus var. laxiflorus	0.33 - 1.33	0.27 - 3.00			0.29 - 5.50		1.00 - 8.00	
Lupinus latifolius ssp. latifolius	0.44 - 1.75		0.17 - 0.50		0.24 - 0.50			
Lupinus sellulus ssp. sellulus var. lobbii			0.17 - 11.50		0.12 - 8.00			
Madia exigua		0.07 - 3.00						
Madia gracilis		0.07 - 0.50		0.33 - 3.83		0.25 - 3.00		0.38 - 3.83
Maianthemum stellatum					0.06 - 0.50			
Marah oreganus								
Microseris laciniata ssp. laciniata		0.27 - 8.50	0.08 - 8.00				0.67 - 0.50	0.13 - 3.00
Microseris nutans	0.11 - 0.50				0.06 - 3.00			
Microsteris gracilis var. humilior	0.22 - 0.50	0.67 - 1.50	0.25 - 3.00	0.33 - 4.67	0.29 - 1.00	0.25 - 0.50	1.00 - 0.50	0.38 - 1.33
Mimulus alsinoides				0.44 - 1.75		0.25 - 0.50		0.13 - 0.50
Mimulus guttatus				1.00 - 16.89				0.50 - 2.38
Minuartia michauxii var. michauxii								0.13 - 0.50
Moehringia macrophylla			0.08 - 0.50		0.06 - 0.50			
Montia parvifolia ssp. parvifolia	0.22 - 0.50	0.20 - 3.00	0.50 - 3.00	0.56 - 19.30	0.12 - 0.50	0.25 - 3.00		0.25 - 4.25
Orobanche uniflora			0.17 - 0.50	0.11 - 0.50	0.06 - 0.50			
Pedicularis contorta var. contorta	0.11 - 0.50		0.08 - 0.50					
Penstemon rupicola			0.08 - 0.50		0.06 - 0.50			
Penstemon serrulatus		0.07 - 0.50			0.18 - 1.33			
Penstemon subserratus	0.78 - 1.93	0.87 - 1.46	0.33 - 1.75		0.88 - 6.10	0.25 - 0.50	1.00 - 13.67	0.13 - 0.50
Pentagrama triangularis ssp. triangularis				0.33 - 0.50		0.25 - 0.50		
Perideridia (gairdneri, oregana)				0.11 - 0.50				0.25 - 0.50
Phacelia mutabilis		0.07 - 0.50						
Phlox diffusa ssp. longistylis	0.78 - 6.86	0.40 - 7.08	0.58 - 6.21		0.94 - 34.44		0.33 - 8.00	
Piperia unalascensis					0.12 - 0.50			

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Plantago lanceolata				0.11 - 0.50				0.13 - 8.00
Plectritis congesta ssp. congesta				0.56 - 12.40		1.00 - 30.00		0.13 - 30.00
Polygonum bistortoides	0.33 - 1.33				0.06 - 0.50			
Polygonum douglasii ssp. (douglasii, nuttallii, spergulariiforme)	0.11 - 0.50	0.67 - 6.20	0.75 - 3.28	0.44 - 1.13	0.35 - 1.75	0.25 - 0.50	0.67 - 1.75	0.25 - 10.50
Polygonum minimum		0.07 - 3.00	0.08 - 0.50		0.06 - 0.50			
Polypodium (amorphum, hesperium)		0.07 - 0.50			0.12 - 3.00			
Polypodium glycyrrhiza		0.07 - 0.50						
Polystichum imbricans ssp. imbricans		0.13 - 1.75						
Polystichum munitum		0.07 - 0.50				0.25 - 0.50		
Potentilla glandulosa	0.33 - 1.33	0.53 - 2.06	0.08 - 0.50	0.44 - 1.13	0.06 - 0.50		0.33 - 0.50	0.38 - 1.33
Prunella vulgaris ssp. lanceolata		0.07 - 0.50		0.33 - 9.50		0.50 - 1.75		0.50 - 6.13
Pteridium aquilinum var. pubescens					0.06 - 0.50			
Rumex acetosella		0.07 - 0.50	0.08 - 3.00		0.24 - 1.13	0.50 - 0.50	0.33 - 0.50	0.13 - 0.50
Sanicula graveolens		0.13 - 0.50					0.67 - 0.50	
Saxifraga caespitosa					0.06 - 20.00			
Saxifraga ferruginea var. vreelandii			0.58 - 6.21		0.06 - 0.50			
Saxifraga integrifolia		0.07 - 0.50		0.44 - 4.88		0.25 - 0.50		0.38 - 1.33
Saxifraga rufidula				0.56 - 6.40				0.13 - 0.50
Scutellaria angustifolia		0.07 - 0.50						
Sedum divergens		0.07 - 3.00	0.17 - 1.75					
Sedum oreganum	0.11 - 0.50	0.13 - 0.50	0.17 - 0.50	0.11 - 8.00				0.13 - 0.50
Sedum spathulifolium ssp. spathulifolium					0.12 - 1.75			
Sedum stenopetalum	0.22 - 3.00	0.20 - 1.33			0.18 - 3.83			
Selaginella wallacei	0.78 - 6.14	0.53 - 19.94	0.83 - 12.65	0.33 - 1.33	0.71 - 20.54	0.75 - 2.17		0.38 - 2.17
Senecio integerrimus var. ochroleucus	0.22 - 1.75	0.33 - 2.50		0.33 - 1.33	0.24 - 2.38	0.25 - 0.50	1.00 - 33.33	0.25 - 0.50
Sherardia arvensis				0.11 - 0.50				0.13 - 8.00
Silene antirrhina		0.13 - 0.50						0.38 - 2.17
Silene douglasii vars. (douglasii, monantha)	0.56 - 1.00	0.20 - 1.33	0.17 - 1.75		0.35 - 1.33			
Silene gallica								0.13 - 0.50
Silene oregana	0.22 - 0.50				0.35 - 2.58		0.33 - 0.50	
Sonchus spp.				0.11 - 0.50				0.13 - 0.50
Stellaria (calycantha, borealis ssp. sitchana)	0.11 - 0.50							
Stenanthium occidentale				0.11 - 0.50				
Synthyris missurica ssp. stellata	0.11 - 3.00				0.12 - 1.75			
Taraxacum officinale				0.11 - 0.50	0.06 - 0.50			
Teesdalia nudicaulis						0.25 - 0.50		
Tellima grandiflora				0.11 - 0.50				
Thlaspi montanum var. montanum	0.33 - 2.17	0.07 - 0.50			0.35 - 0.92		0.67 - 3.00	

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Tragopogon dubius		0.07 - 0.50				0.25 - 0.50		0.13 - 0.50
Trifolium cyathiferum				0.22 - 29.00				0.13 - 0.50
Trifolium dubium						0.25 - 0.50		0.13 - 0.50
Trifolium macrocephalum		0.20 - 3.00						
Trifolium microcephalum		0.07 - 0.50		0.44 - 13.38		0.25 - 0.50		0.38 - 3.00
Trifolium microdon				0.22 - 3.00		0.25 - 13.00		
Trifolium oliganthum				0.11 - 3.00		0.50 - 4.25		0.13 - 0.50
Trifolium spp.						0.25 - 8.00		
Trifolium variegatum				0.22 - 1.75				0.13 - 3.00
Trifolium willdenowii		0.07 - 0.50		0.56 - 2.00		0.75 - 6.33		0.38 - 0.50
Triphysaria pusilla				0.11 - 0.50				
Triteleia hyacinthina		0.07 - 3.00		0.89 - 19.38		1.00 - 23.25		1.00 - 41.25
Veronica arvensis				0.22 - 0.50				0.13 - 0.50
Veronica officinalis			0.08 - 0.50					
Vicia americana ssp. americana	0.22 - 1.75	0.60 - 2.44		0.33 - 1.33	0.29 - 1.00		1.00 - 1.33	0.13 - 0.50
Vicia sativa				0.11 - 3.00		0.25 - 0.50		
Viola adunca var. adunca			0.08 - 0.50		0.06 - 3.00			
Woodsia oregana ssp. oregana				0.11 - 0.50				
Woodsia scopulina ssp. scopulina		0.20 - 0.50						
Xerophyllum tenax	0.33 - 2.17		0.08 - 3.00		0.06 - 3.00			
Zigadenus venenosus var. venenosus		0.40 - 11.58		0.22 - 1.75				0.38 - 4.67