The Vascular Plant Flora of the South Puget Sound Prairies, Washington, USA

Abstract

Vascular plant species lists were compiled for all the major prairies that remain in south Puget Sound, Washington State, USA. Overall, 278 species were recorded in 15 prairies that ranged in area from 12-3,000 ha. Fifty-nine percent of these were native taxa, with forbs the most frequently represented life form (74%). Seventy percent of the species were perennials. Annuals were most common in Ft. Lewis prairies, which may reflect higher levels of disturbance. On average, introduced annuals outnumbered the native annuals 2:1. Twenty-three native species were widespread, occurring in >80% of the prairies; all but one of these were perennial. In contrast, 5 of the 18 most widespread non-natives were annuals. Forty percent (64) of the native species were found in only 1 or 2 prairies, and another 61 prairie species were documented from a variety of sources as formerly or currently growing in the south Puget Sound region, but not currently known from the 15 prairies we studied. Our results provide a basis for identifying species potentially appropriate for including in prairie restoration efforts in this region. Our findings also suggest taxa that are uncommon, rare, or locally extirpated, and which may only persist in this region if active efforts are made to establish them in extant sites.

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Introduction

The prairies of the south Puget Sound region are part of an array of grassland, savanna, and woodland habitats that extend intermittently from Oregon's Willamette Valley, north through western Washington, to the Georgia Basin in southwest British Columbia. These habitats share numerous floristic and faunal affinities, and comprise a remarkable and somewhat unexpected collection of seasonally xeric communities within a larger, more mesic landscape dominated by coniferous forests. They owe their existence to a variety of edaphic, climatic, and historic factors that have helped to keep dense forest vegetation from overtaking these sites (Alverson 2005). These habitats in the south Puget Sound area occur on soils that tend to be shallower, coarser, and more xeric than elsewhere in the ecoregion.

The northernmost expression of these assemblages occurs in southwestern British Columbia, where they are best developed on Vancouver Island and the Gulf Islands. Here they are frequently dominated by *Quercus garryana* (Garry oak or Oregon white oak), and the associated communities are often collectively referred to as the Garry oak ecosystem (Plants at Risk Recovery Implementation Group 2005). In the northern Puget Trough, including the San Juan Islands, Olympic Peninsula, and Whidbey Island, xeric grass and oak-dominated communities frequently occur on coastal bluffs and rocky balds, although historically, some well-developed prairies occurred near Sequim and on central Whidbey Island (Chappell 2006). Prairies also occurred historically in Lewis, Cowlitz, and Clark Counties in southwest Washington, but little remains. Today, the largest and most intact prairies and oak woodlands in western Washington are centered around Olympia (Figure 1). Over 90% of the historic prairies and savannas in this region have been destroyed through a combination of agricultural conversion, urban development, and encroachment by coniferous forest (Crawford and Hall 1997). Most of the remaining sites are the focus of considerable protection and restoration efforts.

Restoration of degraded or destroyed habitats requires a clear understanding of the species, structure, and ecological processes that

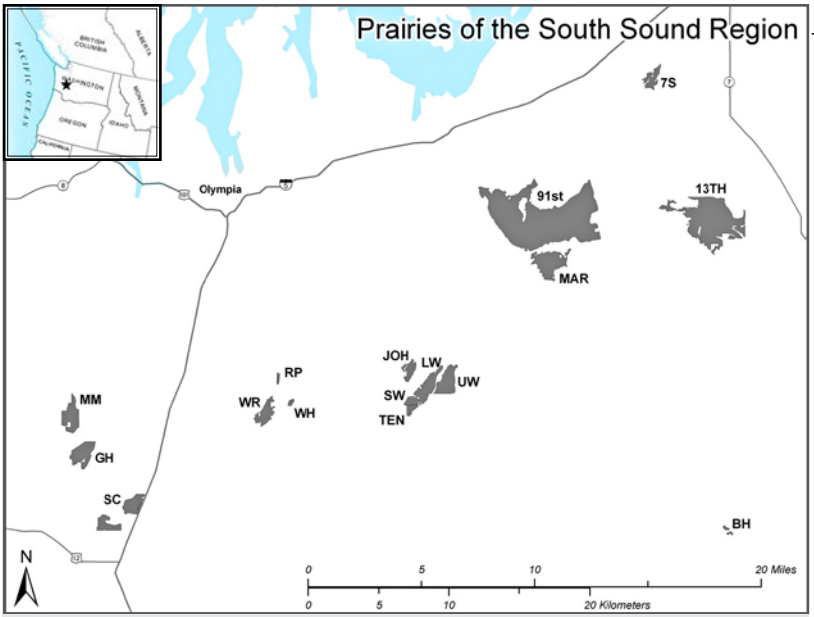

Figure 1. Locations of major prairies in the south Puget Sound region. Sites included in this study indicated as follows: GH=Glacial Heritage, Joh=Johnson, W=Lower Weir, Mar=Marion, MM=Mima Mounds, 91st=Ninety-first Division, RP=Rocky Prairie, SC=Scatter Creek, 7S= 7S Prairie, SW=South Weir, Ten=Tenalquot, 13th=Thirteenth Division, UW=Upper Weir, WR=West Rocky, WH=Wolf Haven. Bald Hill (BH) is a rocky bald community also noted in the text.

comprised and shaped the communities being restored. Unfortunately, all remaining fragments of these communities are significantly degraded. Most are a small fraction of their historic extent, with houses, cropland, tree farms, pastures, and surrounding forest now occupying the former prairies and oak woodlands. Numerous non-native species have invaded the remnants, in some cases entirely converting open grasslands into thickets of *Cytisus scoparius* (Scotch broom), *Rubus armeniacus* (blackberry), and other shrubs. Many native species have no doubt been lost from sites when the encroachment of exotic taxa is so extensive. But even where the historic grassland or woodland structure remains, past livestock grazing, fire suppression, and other land uses are likely to have resulted in the disappearance of many native species from these communities.

Understanding the current composition of native prairie remnants

provides a starting point for restoring these communities. With this information, a clearer picture can be developed of the nature and extent of degradation—what species are restricted to only a few sites? What sites appear to be particularly species depauperate? And what levels of native species diversity typify the most intact sites? We explore these questions for the prairies of south Puget Sound by compiling, in a single document, the most complete vascular plant species lists available for most of the major prairie fragments remaining in this region.

Study Area

The largest remnants of upland prairie in western Washington are found in the southern Puget Sound region, where conservation efforts have been underway for over 30 years. Most of these sites are now protected, and many are under active management to control invasive species and restore degraded areas. We identified 15 sites with reasonably complete lists of vascular plant species, such that meaningful comparisons could be made with one another (Figure 1). These included all of the major remaining prairies, as well as several smaller fragments that still retain many of their native species. All probably were regularly burned by Native Americans prior to the mid-1800s, and likely received some level of livestock grazing in the 19th and 20th centuries, although these histories are difficult to reconstruct in any detail.

Half of the study sites, including Johnson, Marion, 13th Division, 91st Division, 7S, Upper Weir, Lower Weir, and South Weir, are prairies on the Fort Lewis Military Reservation, established in 1917. Although neglected after World War I, Fort Lewis has been an active installation administered by the U.S. Department of Defense since the late 1930s. Military training occurs on most of the prairies, with the exception of South Weir. Fires are frequently ignited as a result of training exercises, particularly in the 91st Division prairie. The remaining study sites occur on non-military lands. Rocky Prairie and Mima Mounds are Natural Area Preserves managed by the Washington Department of Natural Resources. Rocky Prairie probably has been little disturbed in many decades; Mima Mounds was grazed by livestock until the 1960s, but has

been largely undisturbed since then except for restoration activities to control invasive grasses, shrubs, and trees. Scatter Creek and the recently acquired West Rocky Prairie are managed by the Washington Department of Fish and Wildlife for a variety of resource interests; neither has been grazed or burned in at least several decades. Glacial Heritage (officially the Black River-Mima Mounds Glacial Heritage Preserve) is owned by Thurston County, with restoration actions cooperatively managed with The Nature Conservancy. Fire management has been returned to portions of Glacial Heritage during the last 5 years, but this site has received little other use in several decades. Tenalquot Prairie is immediately adjacent to South Weir on Fort Lewis, but is private land outside the military reservation. It was very lightly grazed until 2005, when it was acquired by The Nature Conservancy. Finally, Wolf Haven is a privately owned wildlife rehabilitation centre that includes a small, lightly-used area of native prairie habitat.

Methods

Scientists have been documenting the flora of these prairies for over a century (Piper 1906, Rigg 1918, Lang 1961, Del Moral and Deardorff 1976). The famed west-coast botanist David Douglas may have botanized in the region in the mid 1800s but regrettably his journals and specimens were destroyed in a canoeing accident. Some early studies were documented with vouchered specimens, but often the labels do not clearly identify the prairie from which the specimens were collected. Over the last 25 years, researchers and site managers have begun compiling species lists for individual prairie sites, and it is this information, which exists primarily in unpublished reports and species lists, that we used as a starting point for this analysis (Evans et al. 1984, http://www.wnps.org/plant_lists/). We augmented these lists with additional species occurrence data from plot-based studies that are underway in several sites (Dunwiddie, Stanley, Delvin, Pearson, unpublished studies). Finally, we added species occurrences based on our personal records and from searches of the University of Washington and Washington State University herbarium collection databases. We did

not include species found in nearby forests, woodlands, and wet prairies, based on our knowledge of the particular sites and the occurrences of the taxa in question. In some sites, these distinctions were difficult to draw, and inconsistencies may exist among the lists from different prairies as a result.

We used the USDA PLANTS database (USDA 2006) as a basis for our nomenclature. Uncertainties inevitably arose regarding taxonomic identifications, particularly for taxa difficult to identify in the field, and for some identifications of species drawn from older lists. Given the general level at which the data are summarized in this paper, we feel that these issues would not significantly alter the main conclusions. However, we note in the Discussion where some questions remain to be resolved. In addition, some sites have been less well-studied than others. In particular, the lists from 7S, South Weir, Tenalquot, West Rocky, and Wolf Haven are probably missing some of the less-common taxa.

The area of the prairie and savanna habitat on each site was calculated by identifying these vegetation types on aerial imagery, delineating the perimeter in a GIS, and calculating the area of the polygons. Sites ranged from 12 to 3000 ha (Table 1).

Results and Discussion

A total of 278 taxa was recorded from the fifteen prairies, which individually contained from 40 to 195 taxa (Table 1). The total number of species was positively correlated with prairie area (R^2=0.34, P=0.02). This relationship was virtually unchanged when only native species were included. The most species rich prairies, both for native species richness and total species richness, were 13th Division Prairie with 199 species and 106 native prairie taxa; and 91st Division Prairie, with 170 species total and 105 native prairie taxa. Both prairies are located in Pierce County on Fort Lewis and are also the largest in extent.

When the species list for all prairies is considered collectively, 59% were native, and 40% were introduced, with 1% of uncertain origin, including *Aphanes arvensis*, *Draba verna*, *Festuca rubra*, and *Vulpia myuros*.

Most abundant were forbs, which comprise 74% of the taxa; graminoids (17%), shrubs (8%), and trees (2%) contribute relatively less. The majority of native forbs in these prairies were perennials (70%), but among the introduced forbs, annuals and biennials were more common, with perennials comprising only 39% of the exotic taxa. Among the graminoids, the majority of species were perennials, both among the natives (94%) and non-natives (67%).

These proportions did not vary greatly among the different prairies we examined, despite differences in historic and current land uses (Table 1). Although the abundance and dominance of introduced species probably would be found to vary considerably among the prairies, based on quantitative measures of cover or frequency, the percentage of introduced species as a proportion of the total flora for each site only varied from 33-48% among the 15 sites.

Perennial species dominated all the prairies, but the proportion of annuals varied among sites (Table 1). In general, annuals appeared to be more abundant in the prairies that receive regular disturbance, particularly the Ft. Lewis prairies, where they comprise up to 30% of the species. Tracked military vehicles created areas of bare soil and dispersed seeds, aiding in the spread and establishment of annuals. Frequent fires reduced thick mats of moss, lichens, and accumulated litter, and set back the growth of *Festuca roemeri*, a dominant native bunchgrass. Together, these processes would tend to encourage a greater diversity of annual species. Although introduced taxa now make up the majority of annual species, we surmise that historically, native annuals may have represented a significant portion of the floristic diversity of many of these prairies when they were being regularly burned by Native Americans. We recorded 32 native annuals in the 15 prairies. *Lotus micranthus* was particularly widespread, but several species of *Lupinus* and *Trifolium*, caryophs such as *Silene antirrhina* and *Microsteris gracilis*, and an assortment of taxa from other families, may once have been more abundant.

Nine native species were recorded in every prairie, and another nine occurred in all but one (Table 2). Widespread graminoids included *Festuca roemeri*, *Carex inops* ssp. *inops*, and *Danthonia californica*. Species of

Luzula also were common, but this genus includes both native and non-native species, which were not reliably distinguished in our data. *Koeleria macrantha* was also nearly as common, reported from 14 of the 15 sites. Native forbs that occurred in virtually every site included *Achillea millefolium*, *Apocynum androsaemifolium*, *Camassia quamash* ssp. *azurea* or ssp. *maxima*, *Eriophllum lanatum* var. *leucophyllum*, *Fragaria virginiana*, *Fritillaria affinis* var. *affinis*, *Lomatium utriculatum*, *Lotus micranthus*, *Microseris laciniata*, *Ranunculus occidentalis* var. *occidentalis*, *Sericocarpus rigidus*, *Viola adunca*, and *Zigadenus venenosus* var. *venenosus*. Other forbs that occurred on 12-13 of the 15 prairies included *Brodiaea coronaria* ssp. *coronaria*, *Campanula rotundifolia*, *Hieracium cynoglossoides*, and *Prunella vulgaris* ssp. *lanceolata*. This list of taxa largely coincides with those species included in the *Festuca roemeri–Sericocarpus rigidus* plant association described by the Washington Natural Heritage Program as characteristic of prairies in this region (http://www.dnr.wa.gov/nhp/refdesk/communities/pdf/fero-seri.pdf). Finally, the low shrub *Arctostaphylos uva-ursi* was found in most prairies.

While there was significant overlap between the species found in the south Puget prairies and those reported from similar habitats farther north, it is noteworthy that several of the widespread taxa appeared to be considerably less frequent in the San Juan Islands (Chappell 2006), and were entirely absent from species lists from Garry oak ecosystems in British Columbia (W. Erickson, personal communication). These include *Campanula rotundifolia*, *Delphinium nuttallii*, *Erigeron speciosus*, *Hieracium cynoglossoides*, *Lupinus albicaulis*, *Microseris laciniata*, and *Potentilla gracilis*. Most of these species occur in the Willamette Valley, however, suggesting that their absence in British Columbia is due either to limitations in species geographic range, or reduced species richness due to the smaller extent of prairies in British Columbia even in pre-EuroAmerican settlement times.

A suite of introduced species was also similarly widespread in the south Puget Sound area prairies (Table 3). Among the grasses, the most ubiquitous included *Aira caryophyllea*, *Aira praecox*, *Agrostis capillaris*, *Anthoxanthum odoratum*, and *Poa pratensis*. *Arrhenatherum elatius*, *Dactylis glomerata*, and *Holcus lanatus* were nearly as widespread. Introduced forbs that occurred in virtually all the prairies included *Hypericum perforatum*,

Hypochaeris radicata, *Leucanthemum vulgare*, *Plantago lanceolata*, *Rumex acetosella*, *Taraxacum officinale*, *Teesdalia nudicaulis*, *Trifolium dubium* and *Vicia sativa*. In addition, one shrub—*Cytisus scoparius*—also occurred in nearly every site. As with the widespread native species, most of these taxa were identified by the Washington Natural Heritage Program as frequent occurrences in the *Festuca roemeri–Sericocarpus rigidus* plant association.

In the absence of relatively pristine remnants of native prairie communities, it is difficult to determine which species are appropriate to include in restoration projects. It is likely that even sites that are still dominated by native species have lost some of their original flora. Developing comprehensive quantitative restoration goals thus can be problematic. For example, only occasionally do we have specific information that documents particular species as having been extirpated from a site (Table 4). The data compiled in this paper begin to provide a more complete picture of prairie floristic composition that will assist in developing restoration goals. The species documented here as being most frequent in the prairies of southern Puget Sound describe a basic suite of taxa that restorationists can be reasonably confident should be represented in significant numbers in a reconstructed prairie in this region. Furthermore, the list of common non-native taxa provide a warning of what species are almost certain to succeed in a site, and towards which appropriate control measures should be taken early on in the restoration process

Many species were documented from only a few of the prairies, for complete list see Appendix A. (http://www.davidsonia.org/appendix_a). Nearly 40% of the 163 native species occurred in only 1 or 2 prairies. We also compiled a list of species that, although they were not recorded in our dataset for the 15 focal prairies, warrant further efforts to determine their current distribution (Table 4). This list includes prairie species previously recorded in the sites we inventoried (based on herbarium records), species known from other south Puget Sound prairie sites not included in this study, and species which historically occurred in prairies in the south Puget Sound, but now are only found in the Bald Hill area. Bald Hill includes several rocky bald habitats which share many affinities with the south Puget

Sound prairies. However, these unique higher elevation habitats appear to have sustained remnant populations of several taxa that are no longer found in the nearby lowland prairies.

The species noted in Table 4, together with a longer list of species we recorded from only one or two prairies, present several issues worthy of consideration. First, greater efforts are warranted at most of the sites to thoroughly document their floras, and these less widespread species in particular ought to be the focus of directed searches in sites where they have not yet been recorded. Closer scrutiny of the distributions of these less-common species may reveal patterns that would be helpful in understanding where they might be expected to occur. Second, some of these taxa may be more limited in their distributions because they have more specialized habitat requirements or are at the edge of their range, and attempting to establish them at more sites may not be successful unless conditions are appropriate. More research is needed to clarify the ecological requirements of these taxa. For example, the documented northern-most limit of several native prairie species, including *Sidalcea malviflora* ssp. *virgata* and *Wyethia angustifolia*, is Scatter Creek, the southern-most prairie in this study. The other prairies may thus be outside of the potential geographic range of these species. Third, even though the prairies included in this study occur in a relatively small geographic region, differences in soils and precipitation may impose environmental patterns on the landscape that are important determinants in plant distributions. Fourth, of particular concern are species that are now limited to a handful of sites due to the extensive loss of their former habitat, like the federally threatened *Castilleja levisecta*.

The absence of these taxa from many sites may also help identify where conditions have been significantly altered by past land use, or where key ecological processes have been significantly altered. Conservation biologists have suggested that species losses may be greater in highly fragmented habitats. Species richness varies widely among the smallest prairies documented in this compilation—Wolf Haven, Tenalquot, South Weir, 7S, West Rocky, Rocky Prairie, and Marion. As noted previously, the first five need to be more thoroughly inventoried, but they also may have witnessed the disappearance of a part of their

floras due to a variety of factors. Stochastic events, loss or alteration of ecologically important processes (e.g., digging and harvesting by Native Americans, fire, fossorial animals, large grazing ungulates, pollinators, seed dispersers), introduction of novel processes (non-native plant and animal species, grazing livestock, fire at different times of the year, atmospheric nitrogen deposition), and interactions among these various factors, all may have particularly affected these smaller prairie remnants. These sites should be examined closely to determine whether their floras are, indeed, depauperate, and which species are likely to have been lost.

Site-specific data from a large number of prairies and savannas across the ecoregion would be helpful in understanding these distributional questions. While presence/absence data may clarify biogeographical questions, quantitative, plot-based abundance information (e.g., cover or frequency) would be especially helpful. An ecoregional conservation assessment has recently been completed by The Nature Conservancy and The Nature Conservancy of Canada, together with numerous experts from many agencies, which begins to gather some of this distributional data for many of the less common species (Floberg et al., 2004). Extensive site-specific work has been done in some regions for these habitats, including studies in Canada by Wayne Erickson (1996), in Oregon by Ed Alverson, and in Washington in this paper, and by Chris Chappell and others (Chappell 2006, Chappell et al. 2004, http://www.dnr.wa.gov/nhp/refdesk/communities/pdf/intro.pdf). Future work should be directed towards bringing this information into a comprehensive, regional synthesis.

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Table 1. Area of upland prairie at each site, total number of species, and frequency of species according to origin, life history, life form, and combinations of these categories at each prairie. Prairie name abbreviations as follows: GH=Glacial Heritage, Joh=Johnson, LW=Lower Weir, Mar=Marion, MM=

Prairie Site	**GH**	**Joh**	**LW**	**Mar**	**MM**	**91st**	**RP**	**SC**
Area (ha)	235	94	200	62	150	3000	12	223
No. Species	94	136	111	140	100	168	115	119
Origin								
Intro. Species	0.36	0.40	0.41	0.45	0.40	0.39	0.36	0.34
Native Species	0.64	0.60	0.59	0.55	0.60	0.61	0.64	0.66
Life History								
Annual Species	0.15	0.24	0.24	0.28	0.14	0.30	0.17	0.20
Bien. & Peren. Spp.	0.86	0.77	0.77	0.74	0.87	0.71	0.86	0.82
Origin x Ann.								
Native Annuals	0.29	0.39	0.33	0.33	0.07	0.46	0.26	0.38
Intro. Annuals	0.71	0.58	0.63	0.64	0.93	0.52	0.63	0.58
Life Form								
Forbs	0.62	0.74	0.71	0.73	0.61	0.80	0.67	0.69
Graminoids	0.26	0.18	0.22	0.19	0.23	0.15	0.20	0.19
Shrubs	0.11	0.07	0.05	0.06	0.14	0.03	0.12	0.09
Trees	0.02	0.01	0.03	0.02	0.02	0.02	0.01	0.03
Orig. x Life Form								
Native Forbs	0.41	0.45	0.43	0.39	0.36	0.49	0.44	0.48
Nat. Gram.	0.13	0.08	0.09	0.10	0.10	0.07	0.10	0.08
Native Shrubs	0.07	0.06	0.04	0.04	0.12	0.02	0.10	0.08
Native Trees	0.02	0.01	0.03	0.02	0.02	0.02	0.01	0.03
Intro. Forbs	0.20	0.29	0.28	0.34	0.25	0.30	0.23	0.21
Intro. Gram.	0.13	0.10	0.13	0.09	0.13	0.08	0.10	0.12
Intro. Shrubs	0.03	0.01	0.01	0.01	0.02	0.01	0.03	0.02

Mima Mound, 91st=Ninety-first Division, RP=Rocky Prairie, SC=Scatter Creek, 7S= 7S Prairie,SW=South Weir, Ten=Tenalquot, 13th=Thirteenth Division, UW=Upper Weir, WR=West Rocky, WH=Wolf Haven.

Prairie Site	**7S**	**SW**	**Ten**	**13th**	**UW**	**WR**	**WH**	**Ave.**
Area (ha)	77	55	38	1114	219	70	13	
No. Species	53	60	40	195	116	57	40	
Origin								
Intro. Species	0.45	0.47	0.38	0.48	0.35	0.35	0.33	0.39
Native Species	0.55	0.53	0.63	0.52	0.65	0.65	0.68	0.61
Life History								
Annual Species	0.23	0.20	0.15	0.29	0.23	0.11	0.13	0.20
Bien. & Peren. Spp.	0.79	0.80	0.85	0.73	0.78	0.89	0.88	0.81
Origin x Ann.								
Native Annuals	0.25	0.17	0.17	0.38	0.44	0.67	0.40	0.33
Intro. Annuals	0.75	0.83	0.83	0.57	0.56	0.33	0.60	0.65
Life Form								
Forbs	0.68	0.68	0.65	0.70	0.71	0.67	0.70	0.69
Graminoids	0.25	0.23	0.30	0.20	0.22	0.18	0.18	0.21
Shrubs	0.06	0.08	0.00	0.09	0.05	0.12	0.10	0.08
Trees	0.02	0.00	0.03	0.02	0.02	0.04	0.03	0.02
Orig. x Life Form								
Native Forbs	0.42	0.40	0.40	0.38	0.48	0.47	0.48	0.43
Nat. Gram.	0.08	0.08	0.18	0.07	0.10	0.05	0.10	0.09
Native Shrubs	0.04	0.05	0.03	0.06	0.04	0.09	0.08	0.06
Native Trees	0.02	0.00	0.03	0.02	0.02	0.04	0.03	0.02
Intro. Forbs	0.26	0.28	0.25	0.32	0.22	0.19	0.23	0.26
Intro. Gram.	0.17	0.15	0.13	0.13	0.12	0.12	0.08	0.12
Intro. Shrubs	0.02	0.03	0.00	0.03	0.01	0.04	0.03	0.02

Table 2. Frequency of common native species in fifteen prairies in south Puget Sound. (Note: ***Luzula*** spp. may include both native and introduced species.)

Plant Name	**Growth Habit**	**Duration**	**% Freq.**
Achillea millefolium	Forb	Perennial	100
Camassia quamash	Forb	Perennial	100
Carex inops ssp. *inops*	Graminoid	Perennial	100
Eriophyllum lanatum var. *leucophyllum*	Forb	Perennial	100
Festuca roemeri	Graminoid	Perennial	100
Microseris laciniata	Forb	Perennial	100
Sericocarpus rigidus	Forb	Perennial	100
Arctostaphylos uva-ursi	Shrub	Perennial	93
Danthonia californica	Graminoid	Perennial	93
Fragaria virginiana ssp. *platypetala*	Forb	Perennial	93
Fritillaria affinis var. *affinis*	Forb	Perennial	93
Lomatium utriculatum	Forb	Perennial	93
Ranunculus occidentalis var. *occidentalis*	Forb	Perennial	93
Viola adunca	Forb	Perennial	93
Zigadenus venenosus var. *venenosus*	Forb	Perennial	93
Apocynum androsaemifolium	Forb	Perennial	87
Hieracium cynoglossoides	Forb	Perennial	87
Koeleria macrantha	Graminoid	Perennial	87
Lotus micranthus	Forb	Annual	87
Luzula spp.	Graminoid	Perennial	87
Prunella vulgaris ssp. *lanceolata*	Forb	Perennial	87
Brodiaea coronaria ssp. *coronaria*	Forb	Perennial	80
Campanula rotundifolia	Forb	Perennial	80

Table 3. Frequency of common introduced species in south Puget Sound prairies.

Plant Name	Growth Habit	Duration	% Freq.
Hypericum perforatum	Forb	Perennial	100
Hypochaeris radicata	Forb	Perennial	100
Leucanthemum vulgare	Forb	Perennial	100
Plantago lanceolata	Forb	Perennial	100
Rumex acetosella	Forb	Perennial	100
Teesdalia nudicaulis	Forb	Annual	100
Agrostis capillaris	Graminoid	Perennial	93
Anthoxanthum odoratum	Graminoid	Perennial	93
Cytisus scoparius	Shrub	Perennial	93
Poa pratensis	Graminoid	Perennial	93
Trifolium dubium	Forb	Annual	93
Aira caryophyllea	Graminoid	Annual	87
Aira praecox	Graminoid	Annual	87
Arrhenatherum elatius	Graminoid	Perennial	87
Holcus lanatus	Graminoid	Perennial	87
Vicia sativa	Forb	Annual	87
Dactylis glomerata	Graminoid	Perennial	80
Taraxacum officinale	Forb	Perennial	80

Table 4. Prairie species not recorded in the 15 prairies. X= prairie plants documented for south Puget Sound counties only from historic records, possibly extirpated, O= plants documented from other south Puget Sound prairies but not those in this study, BH= plants with historic records from south Puget Sound prairies but now only known from grassy balds in the Bald Hills area, Thurston County.

	Status
Agoseris elata	X
Agoseris heterophylla ssp. *heterophylla*	X
Amsinckia intermedia	X
Apocynum cannabinum var. *glaberrimum*	O
Athysanus pusillus	BH
Bromus marginatus	O
Carex tumulicola	O
Castilleja attenuata	BH
Chamaesyce serpyllifolia	X
Cirsium edule	X
Cirsium remotifolium	O
Clarkia gracilis	X
Clarkia purpurea ssp. *quadrivulnera*	BH
Claytonia exigua var. *exigua*	X
Claytonia perfoliata ssp. *perfoliata*	O
Claytonia rubra ssp. *depressa*	BH
Claytonia rubra ssp. *rubra*	X
Collomia linearis	O
Crataegus castlegarensis	O
Crocidium multicaule	BH
Cryptantha intermedia	O
Daucus pusillus	BH
Epilobium brachycarpum	O
Fragaria vesca ssp. *bracteata*	O
Galium boreale	O
Gilia capitata	O
Githopsis specularioides	BH

Table 4 continued.

Gnaphalium stramineum	O
Heterocodon rariflorum	BH
Hieracium scouleri var. *scouleri*	O
Iris tenax var. *tenax*	O
Lactuca biennis	O
Ligusticum apiifolium	O
Madia exigua	X
Madia glomerata	O
Madia gracilis	BH
Madia minima	X
Madia sativa	O
Meconella oregano	X
Minuartia rubella	X
Orobanche fasciculata	O
Plantago aristata	X
Plantago patigonica	X
Poa howellii	BH
Poa scabrella	O
Sagina decumbens ssp. *occidentalis*	X
Sambucus cerulea var. *cerulea*	O
Sanicula crassicaulis var. *tripartita*	O
Synthyris reniformis	O
Thysanocarpus curvipes	X
Tonella tenella	X
Toxicodendron diversilobum	O
Trifolium microdon	BH
Trifolium oliganthum	BH
Trifolium variegatum	X
Trifolium wormskioldii	X
Vaccinium caespitosum	O
Vicia gigantea	O
Viola howellii	O
Vulpia megalura	O
Vulpia microstachys	O