CLASSIFICATION OF OAK VEGETATION IN THE WILLAMETTE VALLEY

Oregon Natural Heritage Information Center,
Oregon State University

March 2008

CLASSIFICATION OF OAK VEGETATION IN THE WILLAMETTE VALLEY

AUTHORS

Arne Buechling[1], Ed Alverson[2], Jane Kertis[3], and Greg Fitzpatrick[2]

[1] Wyoming Geographic Information Center, University of Wyoming, 1000 E. University Ave., Laramie, WY 82071
[2] The Nature Conservancy of Oregon, 87200 Rathbone Rd., Eugene, OR 97402
[3] USDA Forest Service, Siuslaw National Forest, 4077 S.W. Research Way, P.O. Box 1148, Corvallis, Oregon 97339

ABSTRACT

A plant community classification was developed describing the comprehensive variation of oak vegetation currently occupying the Willamette Valley Ecoregion of western Oregon. Multivariate statistical analyses were used to classify field collected floristic and habitat data. Field sampling targeted minimally managed, homogenous vegetation stands with a significant oak component occupying at least 0.5 ha. Potential habitat locations were identified from local expert knowledge, data from The Nature Conservancy's previous conservation planning efforts, and an interpretation of high resolution NAIP imagery. Potential oak habitats were digitized in a GIS and a random selection of sites stratifying significant environmental gradients was generated in order capture the range of oak habitat variability. Precise sample plot locations were predetermined and established at digitized stand centroids. Field sampling was based on relevé plot data collection methods and included ocular estimates of species cover. A total of 350 stands of oak vegetation were sampled over two field seasons. Two-way indicator species analysis (TWINSPAN) was used as an exploratory tool to identify potential patterns in species cover data and Detrended Correspondence Analysis (DCA) was used to delimit final plant community types. Nine vegetation classes were described from ordinations including seven forest / woodland types and two savannas.

INTRODUCTION

The historical landscape of the Willamette Valley preceding settlement by Euro-Americans was characterized by a matrix of prairie and *Quercus garryana* (Oregon white oak) vegetation. Spatial analyses of historical survey records from ca. 1850 indicate that as much as 35 percent of the Willamette Valley Ecoregion was occupied by plant communities with significant components of *Quercus garryana* (Christy et al. 2008). In contrast, modern *Quercus garryana* communities are in decline throughout major portions of their range (Erickson 2003; Johnson and Rosenberg 2006) with estimates of habitat loss as high as 85 percent in some areas (Gucker 2007).

Historical vegetation is reconstructed from analyses of pollen, plant macrofossil, and charcoal records preserved in lake sediments and wetlands. Temporal fluctuations in patterns of vegetation were controlled historically by major changes in climate and disturbance processes. *Quercus garryana* vegetation may have achieved a maximum areal extent in the Pacific Northwest during a warmer and drier period (Erickson 2003; Barnosky 1985) between approximately 11,000 and 7,800 years ago (Whitlock 1992). Paleoecological records also indicate a relatively high frequency of fire occurrence during this period. Subsequent climatic cooling and increases in effective moisture over the past 7,800 years correlate with reduced fire frequencies and decreases in prairie and oak vegetation in the Willamette Valley (Whitlock and Knox 2002).

Significant modern losses in *Quercus garryana* vegetation are generally attributed to factors related to urban development, intensive land management, and the associated elimination of historical fires (MacDougall 2004). The expansion of housing tracts, conversion of prairie and woodland to agriculture, intensive livestock grazing, and extensive road building have reduced the areal extent, continuity, and quality of available oak habitat and caused the proliferation of non-native plant species. Modern fire management has accelerated the succession and replacement of residual oak woodland and savanna with closed canopy forests dominated by conifer species. In addition, predictions of future climatic warming associated with increases in tropospheric greenhouse gases (Woodhouse and Overpeck 1998) may, given the degree of habitat fragmentation and lack of connectivity between residual habitats, further affect the viability of *Quercus garryana* vegetation.

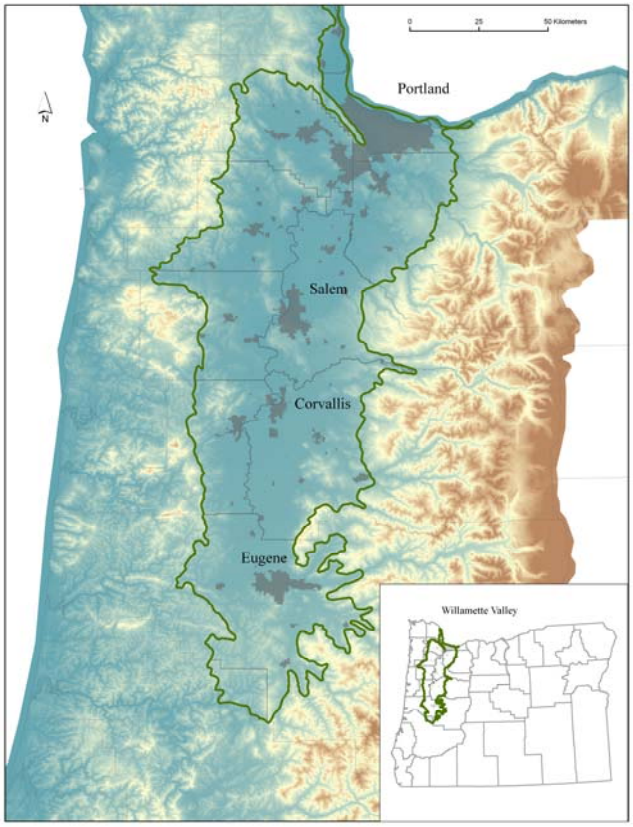
Current *Quercus garryana* ecosystems occupy fragmented landscapes that extend from northwestern California to southwestern British Columbia (Little 1971; Hitchcock and Cronquist 1973). The decline of *Quercus garryana* communities throughout their range has spurred research to evaluate and quantify the ecological variability and conservation status of remnant occurrences. Recent field inventories and quantitative analyses have been conducted in BC (Erickson and Meidinger 2007) and in the Puget Trough of Washington (Chappell 2006). Willamette Valley expressions of *Quercus garryana* vegetation were originally described by Thilenius (1968), who identified four distinct forested plant communities based on field data. This study expands Thilenius's classification, which was restricted to closed canopy forests, and quantifies the comprehensive range and variability of oak vegetation throughout the Willamette Valley including savanna and woodland types. Statistically rigorous field data were collected and used to describe floristic composition, stand structure, and physical habitats. Field data were analyzed using multivariate statistical analyses to categorize patterns in species composition and classify associated plant community types according to recognized national standards of plant community classification (Grossman et al. 1998).

METHODS

Study area

Data collection and classification analyses targeted Oregon white oak habitats throughout the geographical extent of the Willamette Valley (Figure 1). The Willamette Valley Ecoregion (Thorson et al. 2003) is characterized by a mild temperate climate with wet winters and summer drought. Average annual precipitation ranges from 1016 to 1168 mm (40-46 in), 80% of which occurs between October and March (Christy et al. 2007). Temperatures range from annual mean lows of 4 to 6°C (40-42°F) in winter to annual mean highs of 18°C (64-65°F) in summer.

Figure 1: Willamette Valley study area



Site Selection

Geographic Information System (GIS) layers were constructed delineating broad, general locations of oak habitat identified from previous information gathering efforts, known data associated with The Nature Conservancy's (TNC) ecoregional conservation planning program, and the export opinion of local biologists. Individual stands of homogenous oak vegetation potentially suitable for sampling were subsequently digitized within these broad target areas by overlaying high resolution aerial photography. USDA National Agriculture Imagery Program (NAIP) digital ortho photography with 1.0 meter ground resolution was used to digitize the oak habitats.

An environmental gradient analysis was used to stratify and generate a random selection of target sites for field sampling. Digitized oak polygons were correlated with environmental variables hypothesized to influence oak community distributions and floristic composition. Selected environmental parameters included soil texture, soil moisture indices, and previously described ecoregional subdivisions (http://www.epa.gov/wed/pages/ecoregions/level_iv.htm). A random selection

of sites within each unique combination of variables was then generated to provide field crews with target locations that span the range of oak habitat conditions present in the Willamette Valley.

A GIS overlay of taxlot data with the digitized oak polygons was used to identify land ownership and associated contact information. An introductory letter was mailed to landowners outlining project goals and requesting access to their land for field sampling. Private land owners were also subsequently contacted by phone. The positive response rate from land owners was less than 25%. Limited access to privately owned sites compromised the utility of the stratified random selection process and required additional opportunistic sampling based on access ability.

Field Methods

Specific sampling protocols and field data collection methods were adapted from the National Vegetation Classification System, a standardized protocol for sampling, classifying, and mapping vegetation across the United States that has been adopted by TNC, state heritage programs, and federal agencies (http://biology.usgs.gov/npsveg/classification/sect4.html). A minimum stand size for sampling was defined as 0.5 ha. Plots were located at the centroids of previously digitized oak polygons. Square, fixed-area plots of 400m^2 (20m x 20m) were used to sample target stands. Both floristic and environmental data were collected. Biological data included complete species inventories, estimated species abundances as quantified by foliar cover, and average plant height. Additional tree canopy data included tree height, diameters at breast height, and a subjective assessment of tree vigor or condition. Dead standing and down trees were also identified. Understory trees with diameters smaller than 8 cm were measured and tree regeneration was tallied in one predetermined 100 m^2 quadrant. In addition, relict trees present within 1.0 ha were measured.

Abiotic data quantified in plots included slope, elevation, aspect, slope position, landform type, and ground cover estimates of the relative proportions of rock, bare ground, litter, and wood present.

Classification Analysis

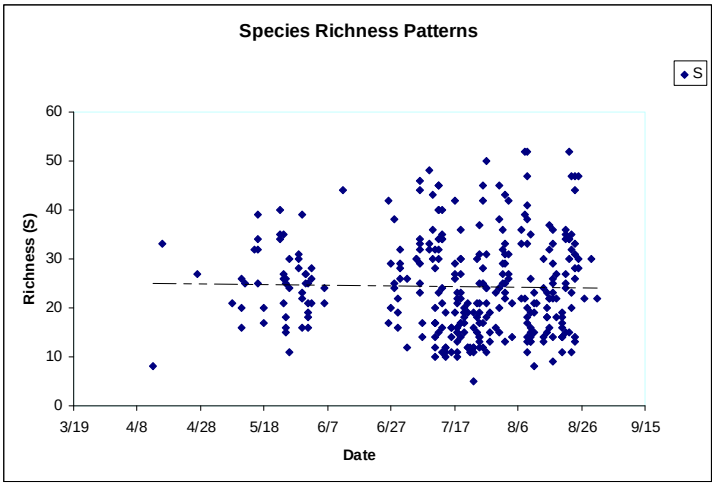
Field data was entered into an Access database for analysis. PC-ORD (McCune and Mefford 1999) was used for multivariate analyses. Two-way indicator species analysis (Twinspan; Hill 1979) was used to explore patterns in species composition between plots and identify potential plant associations. Plot data was first screened for potential outliers. PC-ORD default options were maintained during several iterations of Twinspan. Detrended correspondence analysis (DCA; Hill and Gauch 1980) was subsequently employed to further explore groups previously identified by Twinspan and analyze environmental controls on species distributions.

RESULTS

Field data and multivariate community analyses

A total of 350 discrete stands of vegetation were sampled during the 2006 and 2007 field seasons. Field sampling was conducted between the months of April and August in each year. Logistical constraints and a limited temporal window associated with flowering plants precluded identification of early season forbs in many plots. Potential relationships between species diversity and associated sampling dates were graphically analyzed, but no significant trends were observed (Figure 2).

Figure 2: Scatterplot of plot species richness and sampling dates. Regression line indicates no significant correlation (R^2 = 0.03).



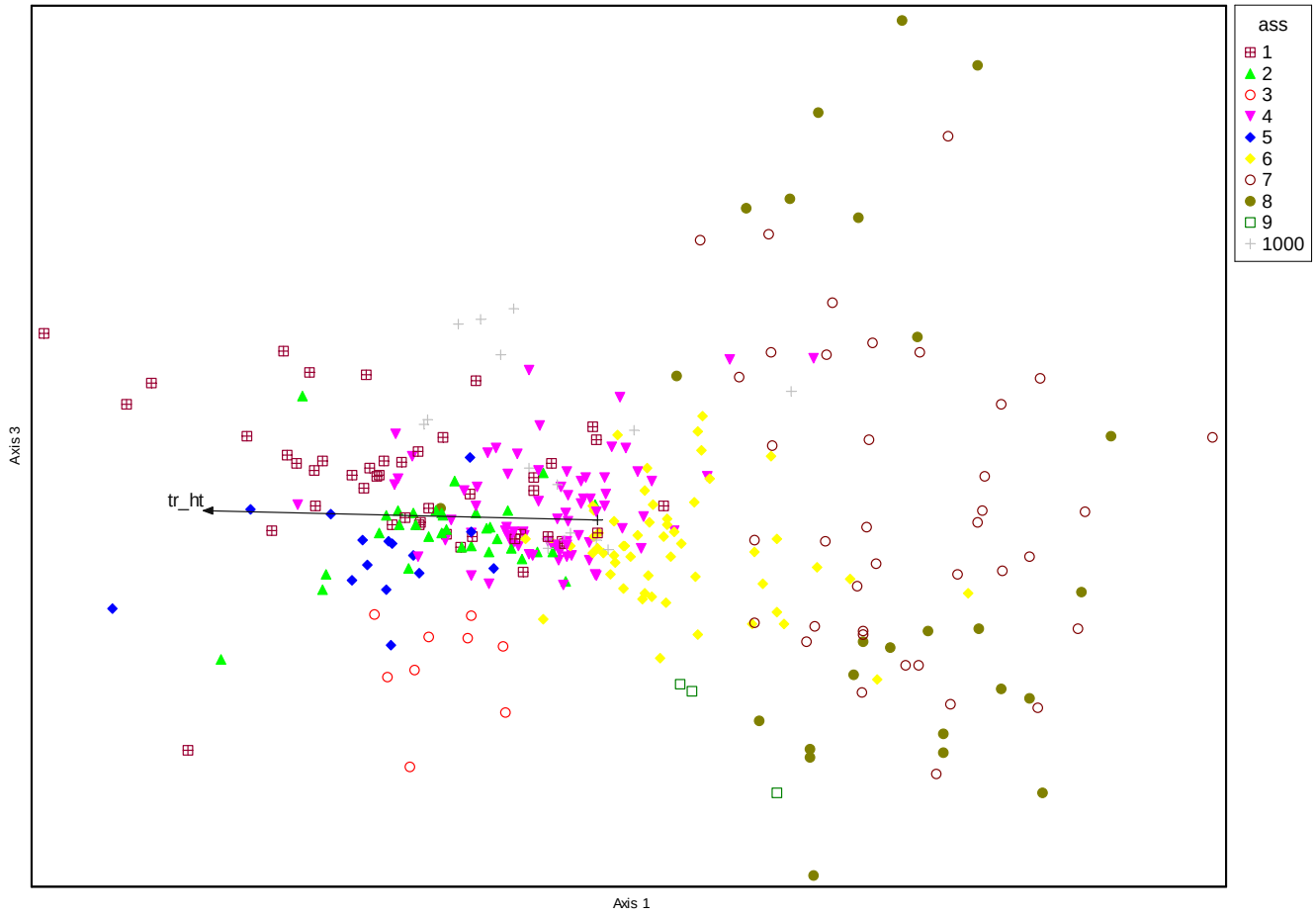
All plot data was transferred to an Access database specifically designed and constructed for this inventory. Data entry and associated quality control was time intensive and involved several volunteers and over 160 hours of staff time.

Plot data was subsequently screened for quality by subjectively identifying and excluding highly degraded or modified plots from classification analyses. A quantitative outlier analysis in PC-ORD (McCune and Mefford 1999) was also used to identify additional isolated plots for screening. Average distances between plots were calculated based on their floristic composition and plots greater than 2 standard deviations above the mean for average distance were excluded from ordination analyses (McCune and Grace 2002).

Species abundance data were transformed by weighting cover estimates according to a species' fidelity for oak woodland or savanna habitat. Fidelity is a qualitative measure determined from expert opinion (Alverson per com). The data weighting process involved proportionally rescaling cover values according to associated fidelity ratings of high, moderate, or low. Non-native species were similarly rescaled to reduce their relative importance by one half.

An initial twinspan analysis in PC-ORD delineated 9 distinct plot clusters or community types based on similarities in species composition. A subsequent DCA ordination spatially partitioned community types already identified in the Twinspan analysis (Figure 3). Distances between plots in the DCA ordination are proportional to their floristic similarity and seemingly correlate with an environmental gradient related to moisture availability. Mesic plots were clustered with low axis 1 ordination scores while increasingly xeric plots correlate with higher ordination values. Savanna plot types group together with maximum axis 1 ordination scores. Axis 3 does not correspond to an obvious environmental gradient.

Figure 3: DCA ordination of sample units (plots) in species space. Distances between plots are proportional to their floristic similarity. Horizontal vector represents the relative strength and direction of correlation between average plot height and Axis 1 ordination scores (R^2 = 0.33).



In order to quantify the hypothesized environmental relationship with the resulting community types, a matrix of environmental variables was constructed based on both the hypothesized significance of particular environmental gradients in limiting species distributions and associated data availability. Environmental variables selected included topographical data such as slope, aspect, and elevation, climatic data including temperature and precipitation, and several biological proxy variables such as tree height and basal area that may reflect or represent additional significant environmental controls not expressed by the selected topographical or climatic variables. The resulting environmental matrix was related to the DCA ordination in a joint plot (Figure 3) and identified a relatively weak correlation between maximum tree height and axis 1 ordination scores (R^2 = 0.33). This correlation does suggest that ordination scores and related community types are at least partially determined by moisture availability, which influences rates of tree growth.

Association names were subsequently assigned to the plot clusters based on associated species dominance and similarity with previously described associations in the literature (Table 1). Naming conventions are based on the National Vegetation Classification Standard (http://biology.usgs.gov/npsveg/standards.html). The community types are summarized in the following section based on environmental conditions associated with the constituent plots and their associated range in floristic composition.

Table 1: Community types derived from Twinspan and DCA ordination

Association	Ordination No	Sample size N	Total species richness	Species richness per plot	Shannon's Diversity Index	Non-native species %
Quercus garryana – (*Fraxinus latifolia*) / *Symphoricarpos albus* Forest	1	45	194	20.8	1.88	42
Quercus garryana – *Pseudotsuga menziesii* / *Corylus cornuta* – *Polystichum munitum* Forest	2	33	124	20	1.78	23
Quercus garryana – *Quercus kelloggii* / *Toxicodendron diversilobum* Forest	3	9	88	25	2.21	43
Quercus garryana – *Pseudotsuga menziesii* / *Amelanchier alnifolia* – *Symphoricarpos albus* Woodland	4	75	221	29.3	2.04	38
Quercus garryana – *Acer macrophyllum* – (*Pseudotsuga menziesii*) / *Toxicodendron diversilobum* Forest	5	15	79	19.2	1.81	22
Quercus garryana / *Toxicodendron diversilobum* / *Elymus glaucus* Woodland	6	55	193	23.5	1.95	41
Quercus garryana / *Toxicodendron diversilobum* / *Danthonia californica* - *Elymus glaucus* Savanna	7	38	191	32.7	2.44	40
Quercus garryana / *Toxicodendron diversilobum* / *Cynosurus echinatus* – *Arrhenatherum elatius* Savanna	8	25	148	23	2.00	48
Quercus garryana / *Toxicodendron diversilobum* / *Festuca californica* Woodland	9	3	42	20.7	1.94	15

Association 1: *Quercus garryana* – (*Fraxinus latifolia*) / *Symphoricarpos albus* Forest
(Oregon White Oak – (Oregon ash) / Common Snowberry)

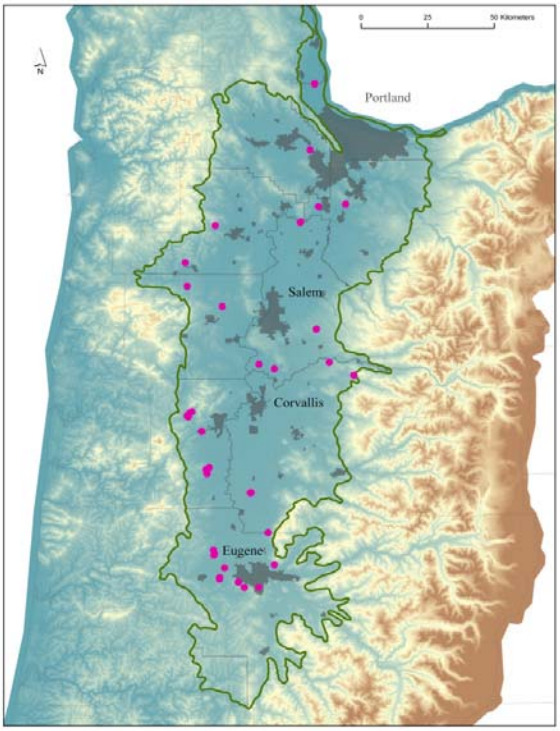
Distribution

The *Quercus garryana* – (*Fraxinus latifolia*) / *Symphoricarpos albus* community occurs throughout the Willamette Valley primarily in valley bottom habitats. Scattered occurrences are also associated with the lower slopes of adjacent mountain foothills. A majority of the sampled sites are located within Lane, Benton, and Marion counties.

This association has been previously quantified. Between 20 and 50 viable occurrences (NatureServe 2007) are recognized from the Puget Lowland of western Washington (Chappell 2006) and the Umpqua valley of southern Oregon (Smith 1985). In addition, 11 occurrences from the Willamette Valley have been previously described by McCain (2004).

Currently this association is classified as a globally rare plant community by NatureServe (2007) due to both a limited number of known viable occurrences and marginal habitat conditions affected by intensive land management activities and extensive non-native species establishment.

Figure 1a: Location of *Quercus garryana* – (*Fraxinus latifolia*) / *Symphoricarpos albus* Forest plots sampled during 2006 and 2007 field surveys (N=45)



Historical Condition

A spatial overlay of sampled stand locations and historical vegetation map layers reconstructed from General Land Office survey data from the middle of the 19th century (Christie et al. 2005) indicates that the current known extent of this community corresponds with historical savanna (33%), prairie (24%), and closed riparian forest (24%).

Environment

Suitable habitats for this community type occur in valley floor regions and at lower elevations between approximately 9 and 300 meters (Table 1a). Sites are characterized by gently sloping terrain and generally flat to concave topography adjacent to stream channels or wetlands. Upper soil horizons are comprised primarily of clayey alluvium deposits derived from basalt. High winter precipitation and relatively poor soil drainage result in conditions of seasonal soil saturation and periodic surface flooding. Soil moisture is significantly reduced during summer months when drought conditions affect and limit water availability and associated plant growth. Large fluctuations in soil moisture may be among the primary controls on species composition and abundance in these communities.

Table 1a: Abiotic environment

Variable	Mean	Median	Range	Min	Max
Elevation (m)	116	114	298	9.0	307
Slope (%)	6	2	55	0	55
Aspect (deg)	91	40	352	0	352
Total Precipitation (cm)	144	142	83	109	192
Temperature (^{o}C)	11.4	11.4	12.6	5.0	17.6
Soil depth to bedrock (cm)	73.5	70	67	40	107
Soil series	Hazelair; Jory; McAlpin; McBee; Natroy				

Vegetation

A total of 45 sites were sampled to quantify the *Quercus garryana* – (*Fraxinus latifolia*) / *Symphoricarpos* community. Measures of species diversity include a total species richness of 194, average species richness per plot of 20.8, and a Shannon – Wiener Index of 1.88. Diversity measures were calculated based on both native and non-native species components.

Tree canopy

The overstory tree canopy is co-dominated in almost all plots by *Quercus garryana* and *Fraxinus latifolia* (Table 1b). This consistent co-occurrence contrasts similar communities in the Puget Trough of Washington in which ash is less frequent (Chappell 2006). Species abundance was measured with ocular estimates of foliar cover and average 41% for *Quercus garryana* and 17% for *Fraxinus latifolia*. *Acer macrophyllum* occurs in one quarter of all plots, but is generally a minor species in terms of cover

or abundance in this association. Additional species attributes such as average tree height, basal area, and the density of understory regeneration suggest that successional processes leading to conifer dominance are not active in these stands.

Table 1b: Tree canopy and regeneration

Species	Freq (%)	Cover (%)		Basal area (m2/ha)	Ave tree ht (m)	Density (stems/ha)				
		Mean	Range			Relict trees (>75cm)	Poles (<8cm)	Sapling (ht <1.3m)	Seedling (<3yrs)	Down trees
Quercus garryana	100.0	41.0	0.5-80	4039	20	8	16	122	165	23
Fraxinus latifolia	82.6	17.1	0-60	304	14	0	195	351	613	24
Acer macrophyllum	26.1	1.9	0-20	8	16	0	3	4	18	0
Pseudotsuga menziesii	21.7	2.3	0-40	64	24	1	2	16	0	0
Quercus kelloggii	8.7	0.6	0-15	16	16	0	0	0	0	0
Pinus ponderosa	4.3	0.8	0-20	0.4	45	1	0	0	0	0

Shrub and herbaceous strata

Symphoricarpos albus is ubiquitous in the understory shrub layer and provides an average cover of 17% per plot (Appendix 1). Additional less frequent shrub species include *Oemleria cerasiformis*, *Toxicodendron diversilobum*, and *Amelanchier alnifolia*. *Rosa nutkana*, which is prominent in related communities in the Umpqua River Basin (Smith 1985), is present in approximately one quarter of all plots here. *Polystichum munitum* is also a frequent component occurring in approximately one half of all plots and *Osmorhiza berteroi* and *Galium aparine* are common forb species. *Carex deweyana* is a characteristic graminoid. Plants recognized as threatened or endangered include *Sidalcea nelsoniana*, an endemic forb that may occur on the forest edges and less commonly in the interior of these stands.

Non-native species are generally widespread and sometimes dominate shrub and herbaceous layers. Non-natives constitute 42% of the total species composition of this community. The most frequent and abundant invasive shrubs include *Rubus discolor*, *Crataegus monogyna*, and *Rosa eglanteria*. *Crataegus monogyna* forms virtual monocultures in some stands. Common non-native grasses include *Dactylis glomerata* and *Festuca arundinacea*. *Vicia sativa* and *Torilis arvensis* are pervasive non-native forb species.

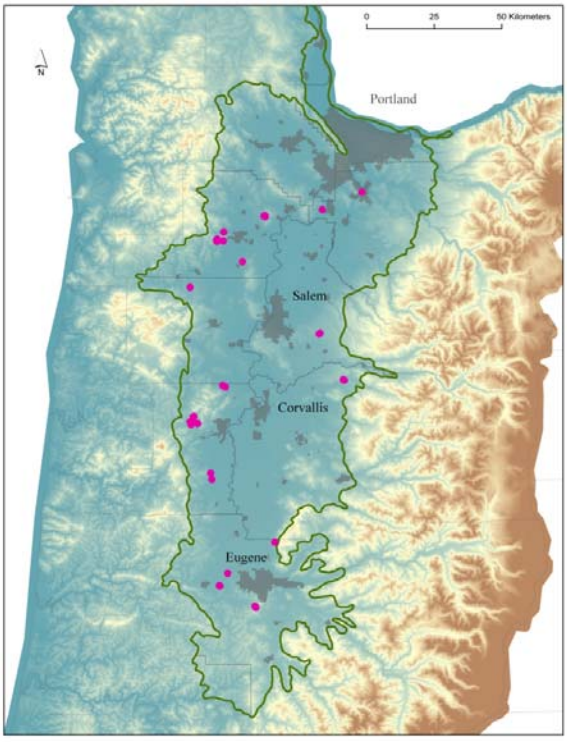
Association 2: ***Quercus garryana – Pseudotsuga menziesii / Corylus cornuta – Polystichum munitum*** **Forest**
Oregon White Oak – Douglas fir / beaked hazelnut – Sword fern

Distribution

Quercus garryana – Pseudotsuga menziesii / *Corylus cornuta – Polystichum munitum* communities occur in mesic and generally lower elevation habitats throughout the Willamette Valley. A majority of the 33 sampled stands are located in Lane, Benton, and Yamhill counties (Figure 2a).

This association has been previously described by Thilenius (1968). Known occurrences are restricted to the Willamette Valley. A limited known distribution, degraded habitat within its known range, intensive land management activity, a fire regime heavily modified by EuroAmerican settlement, and widespread conifer succession, suggest a condition of global rarity and limited persistence potential, but its conservation status has not been assessed by NatureServe (2007).

Figure 2a: Location of *Quercus garryana – Pseudotsuga menziesii* / *Corylus cornuta – Polystichum munitum* Forest plots sampled during 2006 and 2007 field surveys (N=33)



Historical Condition

Spatial vegetation reconstructions indicate that the current known extent of this community was historically characterized by savanna (45%), prairie (24%), and woodland (21%).

Environment

Communities occupy mesic environments (Thilenius 1968) associated with drainage areas, concave topography, shallow draws, and generally cool aspects on the lower slopes of hillsides or valley bottom areas. Maximum elevations reach 250 meters (Table 2a). Terrain is generally shallowly sloping although scattered stands occur on steep topography with slopes exceeding 40 percent. Dixonville, Price, Willakenzie, and Witzel are the most common soil series. The upper soil horizons are most commonly derived from colluvium of igneous origin.

Table 2a: Abiotic environment

Variable	Mean	Median	Range	Min	Max
Elevation (m)	159	162	185	66	251
Slope (%)	16.2	16	65	0	65
Aspect (deg)	203	240	368	0	368
Annual Precipitation (cm)	150.9	149.4	179.1	112.4	191.5
Temperature (^{o}C)	10.5	10.5	13.0	4.6	17.6
Soil depth to bedrock (cm)	55	61	130	0	130
Soil series	Dixonville; Price; Willakenzie; Witzel				

Vegetation

Measures of species diversity in this community include an average per plot species richness of 20.0 and a Shannon – Wiener Index of 1.78. A total of 124 species were identified across all plots.

Tree canopy

A dense mature tree canopy is characterized by the co-occurrence of *Quercus garryana* and *Pseudotsuga menziesii* in most stands (Table 2b). Cover and basal area estimates suggest that *Quercus garryana* is presently marginally dominant overall. However, tree height estimates and visual observations indicate that the future viability of *Quercus garryana* is threatened in approximately 36% of all sampled stands due to competition and shading from *Pseudotsuga menziesii*. Succession to conifer dominance appears to be correlated with and more advanced on cooler northern and eastern aspects.

Acer macrophyllum is present in 39% of plots, but is generally a minor species in terms of overall density or abundance. Its scattered presence may be correlated with seed source availability.

Table 2b: Tree canopy and regeneration

Species	Freq (%)	Cover (%)		Basal area (m2/ha)	Ave tree ht (m)	Density (stems/ha)				
		Mean	Range			Relict trees (>75cm)	Poles (<8cm)	Sapling (ht <1.3m)	Seedling (<3yrs)	Down trees
Quercus garryana	100	41.7	1-95	394	18	3	40	76	127	115
Pseudotsuga menziesii	82	20.8	0-70	112	21	2	20	15	3	45
Acer macrophyllum	39	3.1	0-30	2	16.8	0	34	36	276	0
Abies grandis	24	0.5	0-4	0	12	0	21	18	3	0
Pinus ponderosa	6	0.5	0-15	1	45	0	0	0	0	0
Arbutus menziesii	3	0.5	0-5	0	24	0	0	0	0	3
Quercus kelloggii	3	0.5	0-15	3	16	0	0	0	0	0
Fraxinus latifolia	12	0.5	0-2	4	9	0	12	0	0	0

Shrub and herbaceous strata

The consistent co-occurrence of the mesic species *Corylus cornuta* and *Polystichum munitum* characterizes this association (Thilenius 1968). *Corylus cornuta* generally occurs as scattered individuals or in small patches, but sometimes forms dense secondary canopies with foliar cover reaching 50% in some stands (Appendix 1). *Polystichum munitum* similarly forms dense populations at some sites reducing associated within-stand species diversity. *Symphoricarpos albus* and *Toxicodendron diversilobum* are also common shrub species, but their fidelity for more xeric site conditions is reflected in their limited abundance in this community.

Non-native species are less prolific then in other Willamette Valley oak communities constituting 23% of the total species composition in this association. *Prunus avium* is a significant non-native tall shrub, and sometimes tree species in scattered stands. Thilenius (1968) described the co-occurrence of *Quercus garryana* and *Prunus avium* as a distinct community type associated with intermediate soil moisture availability. However, ordination analyses based on data from this inventory did not delineate a distinct species assemblage characterized by *Prunus avium*.

Herbaceous species, including non-natives, are generally less diverse and abundant in these shaded forest floor environments, but *Brachypodium sylvaticum* is common and occasionally forms dense homogenous patches. *Dactylis glomerata* is also widespread.

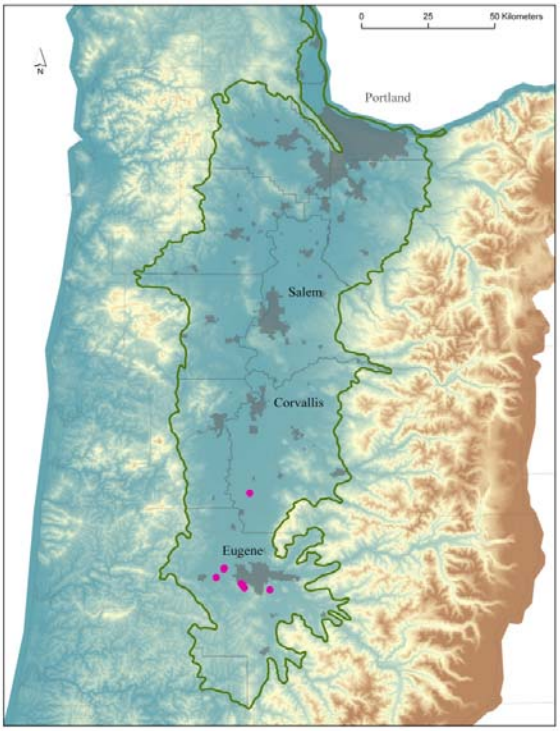
Association 3: *Quercus garryana – Quercus kelloggii* / *Toxicodendron diversil*obum Forest
Oregon White Oak – California Black Oak / Poison oak

Distribution

A total of 9 plots were classified as *Quercus garryana – Quercus kelloggii* / *Toxicodendron diversilobum* forest or woodland. All plots are located in southern portions of the Willamette Valley west of the Willamette River (Figure 3a).

A similar plant association was described by Smith (1985) based on quantitative data collected in the Umpqua River Basin of southwestern Oregon. The Willamette Valley expression of this rare community represents the northern limit of its range.

Figure 3a: Location of *Quercus garryana – Quercus kelloggii* / *Toxicodendron diversilobum* Forest plots sampled during 2006 and 2007 field surveys (N=9)



Historical Condition

Spatial vegetation reconstructions indicate that the current known extent of this community was historically primarily savanna (89%).

Environment

This community generally occupies upland non-riparian habitat at low elevations. *Quercus kelloggii* is characterized by relatively narrow ecological requirements defined by adequate soil moisture. Unlike *Quercus garryana*, *Quercus kelloggii* does not tolerate seasonal flooding in riparian areas or low moisture availability associated with south-facing slopes or upland ridges. Intermediate conditions in the southwestern portion of the Willamette Valley appear to allow both species to co-occur (Alverson per com). These intermediate habitats, favorable for both species, are characterized by shallow to moderately steep slopes and generally cool aspects (Table 3a). The most frequent soil series include Dixonville and Pengra.

Table 3a: Abiotic environment

Variable	Mean	Median	Range	Min	Max
Elevation (m)	169	158	228	52	280
Slope (%)	9	5	30	0	30
Aspect (deg)	114	78	322	0	322
Precipitation (cm)	140.2	140.5	11.0	134	145
Temperature (^{o}C)	11.5	11.6	12.6	5.0	17.6
Soil depth to bedrock (cm)	76	66	41	66	107
Soil series	Dixonville; Pengra				

Vegetation

Measures of species diversity in this community include an average per plot species richness of 25.0 and a Shannon – Wiener Index of 2.21. A total of 88 species were identified across all plots. Lower total species diversity may be attributed to the relatively small sample size (N=9).

Tree canopy

Generally dense forest canopies are dominated by *Quercus garryana* and *Quercus kelloggii* (Table 3b). Conifer composition and succession is currently minimal in the community as a whole as reflected by low mean cover and basal area estimates for *Pseudotsuga menziesii*. *Fraxinus latifolia* may be present on the wettest sites and scattered individuals of *Pinus ponderosa* may occur in the more xeric reaches of this community's range.

Table 3b: Tree canopy and regeneration

Species	Freq (%)	Cover (%)		Basal area (m2/ha)	Ave tree ht (m)	Density (stems/ha)				
		Mean	Range			Relict trees (>75cm)	Poles (<8cm)	Sapling (ht <1.3m)	Seedling (<3yrs)	Down trees
Quercus garryana	100	34	15-60	121	18	0.1	50	11	278	56
Quercus kelloggii	100	22	17-30	82	20	6	0	56	122	0
Acer macrophyllum	44	4	0-17	0	15	0	0	167	78	0
Arbutus menziesii	44	6	0-30	62	9	0	44	0	56	0
Pseudotsuga menziesii	33	3	0-10	3	23	0	44	78	0	11
Fraxinus latifolia	22	2	0-15	1	10	0	56	11	11	0
Pinus ponderosa	22	1	0-5	0	10	0	33	22	0	0

Shrub and herbaceous strata

Amelanchier alnifolia, *Toxicodendron diversilobum*, and *Symphoricarpos albus* are the most frequent native shrub species (Appendix 1) suggesting intermediate soil moisture conditions. More mesic species including *Corylus cornuta* and *Polystichum munitum* are less common. *Elymus glaucus* and *Bromus sitchensis* are the most common native grasses.

Non-native species form a significant component in this community constituting 43% of total species richness. *Rubus discolor* and *Crataegus monogyna* are common shrubs that sometimes form dense understory strata that tend to exclude native species and reduce species diversity. Rubus discolor is only marginally shade tolerant and generally establishes dense populations along forest edges or in the understories of open woodlands.

Dactylis glomerata, *Festuca arundinacea*, and *Cynosurus echinatus* are prevalent non-native grasses with variable densities. *Cynosurus echinatus* characterizes similar oak communities from the Umpqua River Basin (Smith 1985).

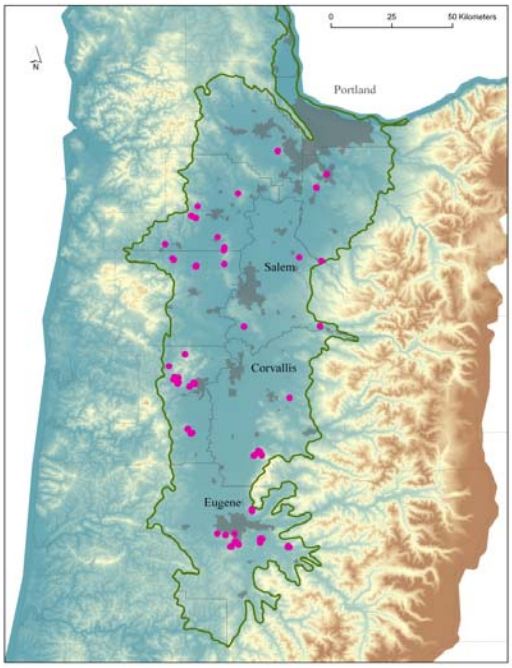
Association 4: *Quercus garryana – Pseudotsuga menziesii* / *Amelanchier alnifolia – Symphoricarpos albus* Woodland
Oregon White Oak – Douglas-fir / Saskatoon Serviceberry - Common Snowberry

Distribution

Quercus garryana – Pseudotsuga menziesii / *Amelanchier alnifolia – Symphoricarpos albus* woodland was the most intensively sampled community with a total of 75 stands surveyed. This may be the most common association with examples occurring throughout the valley on both public and private land (Figure 4a).

A similar community was quantified by Thilenius (1968), but no comparable types have been described elsewhere in the literature. Its global conservation status has not been assessed.

Figure 4a: Location of *Quercus garryana – Pseudotsuga menziesii* / *Amelanchier alnifolia – Symphoricarpos albus* Woodland plots sampled during 2006 and 2007 field surveys (N=75)



Historical Condition

Spatial vegetation reconstructions indicate that the current known extent of this community was historically comprised of savanna (63%) and prairie (19%).

Environment

Thilenius (1968) associated this community with intermediate environments on a moisture gradient from mesic water-receiving sites to xeric uplands and ridge tops. Most stands occur on moderately steep slopes at the middle to upper elevations for oak habitat in the Willamette Valley (Table 4a). Aspects are variable, but drier southern and western facing slopes are common. Stands are most frequently associated with Dixonville, Jory, Nekia, Philomath, and Witzel soil series.

Table 4a: Abiotic environment

Variable	Mean	Median	Range	Min	Max
Elevation (m)	217	220	399	39	438
Slope (%)	18	15	56	0	56
Aspect (deg)	173	167	342	0	342
Precipitation (cm)	153.3	151.8	97.4	120.9	218.4
Temperature (^{o}C)	10.9	11.0	12.9	4.4	17.3
Soil depth to bedrock (cm)	60.1	66	127	0	127
Soil series	Dixonville; Jory; Nekia; Philomath; Witzel				

Vegetation

Measures of species diversity in this community include an average per plot species richness of 29.3 and a Shannon – Wiener Index of 2.04. Total species richness is 221.

Tree canopy

Most stands are classified as woodlands based on canopy cover estimates and have lower tree densities than more mesic *Quercus* / *Corylus* – *Polystichum* forests. *Quercus garryana* dominates the tree canopy, but frequently co-occurs with *Pseudotsuga menziesii* in this community (Table 4b). Tree cover estimates and visual observations indicate that *Pseudotsuga menziesii* establishment and growth rates are threatening the future viability of *Quercus garryana* in at least 10% of sampled stands. Rates of tree regeneration, however, suggest that *Quercus garryana* dominated stands will persist at a landscape or valley-wide scale.

Table 4b: Tree canopy and regeneration

Species	Freq (%)	Cover (%)		Basal area (m2/ha)	Ave tree ht (m)	Density (stems/ha)				
		Mean	Range			Relict trees (>75cm)	Poles (<8cm)	Sapling (ht <1.3m)	Seedling (<3yrs)	Down trees
Quercus garryana	100	37.0	1-90	450	17	3	98	267	468	93
Pseudotsuga menziesii	73	11.6	0-75	70	18	1	23	24	13	39
Acer macrophyllum	39	0.5	0-10	3	14	0	1	11	1	0
Fraxinus latifolia	33	1.3	0-30	1	10	0	9	19	17	0
Pinus ponderosa	11	0.5	0-20	1	18	0	1	0	0	3
Abies grandis	7	0.5	0-2	0	5	0	1	4	7	0
Arbutus menziesii	7	0.5	0-20	0	8	0	2	0	0	0
Quercus kelloggii	7	0.5	0-5	0	13	0	1	0	0	0

Shrub and herbaceous strata

The prevalence and abundance of *Symphoricarpos albus* and *Amelanchier alnifolia* characterize the species composition of this community (Appendix 1). *Toxicodendron diversilobum* is the most frequent understory species, but is ubiquitous in all oak types. Species generally affiliated with more mesic forest conditions, such as *Corylus cornuta* and *Polystichum munitum*, are less abundant in this association.

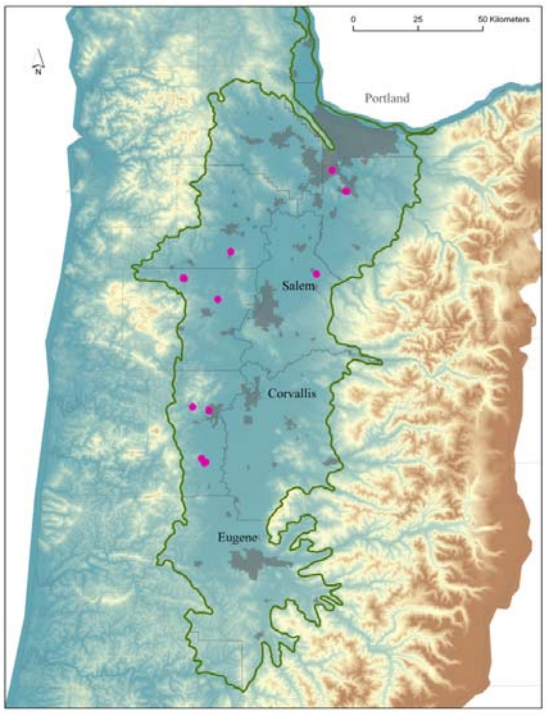
Non-native species comprise 38% of the total species composition in this community. *Rosa eglanteria*, *Crataegus monogyna*, and *Rubus discolor* are common introduced shrubs. Only *Rubus discolor*, however, forms dense patches in favorable light conditions that significantly reduce species diversity in woodland understories. *Brachypodium sylvaticum*, *Cynosurus echinatus*, and *Festuca arundinacea* are frequent introduced grasses that dominate herbaceous strata in some stands with maximum cover estimates of 90% for *Brachypodium*.

Association 5: Q*uercus garryana – Acer macrophyllum* – (*Pseudotsuga menziesii*) / *Toxicodendron diversilobum* Forest
(Oregon White Oak – Big Leaf Maple **–** (Douglas-fir) / Poison Oak)

Distribution

The *Quercus garryana – Acer macrophyllum* – (*Pseudotsuga menziesii*) / *Toxicodendron diversilobum* community is an uncommon type that has not been described in previous literature and may be restricted to habitats in the Willamette Valley. The associated sample size from 2006 and 2007 field surveys is relatively small with 15 stands sampled (Figure 5a).

Figure 5a: Location of *Quercus garryana – Acer macrophyllum* – (*Pseudotsuga menziesii*) / *Toxicodendron diversilobum* Forest plots sampled during 2006 and 2007 field surveys (N=15)



Historical Vegetation

Spatial vegetation reconstructions indicate that the current known extent of this community based on field sampling was historically comprised of a mix of savanna, woodland, prairie, and closed forest.

Environment

This community is frequently associated with steep south-facing slopes and rocky surface substrates. Rocky slopes and bedrock outcrops may have provided refuge from historical fire occurrence for populations of *Acer macrophyllum* (Alverson per com). Scattered stands also occur in mesic productive environments with component *Acer macrophyllum* trees present as a result the stand's proximity to available seed sources. Typical soil series include Dixonville, Willakenzie, and Xerochrepts.

Table 5a: Abiotic environment

Variable	Mean	Median	Range	Min	Max
Elevation (m)	140	104	374	20	394
Slope (%)	18	15	63	2	65
Aspect (deg)	183	210	310	0	310
Precipitation (cm)	143.1	148.0	58.1	117.7	175.8
Temperature (^{o}C)	11.4	11.4	12.3	5.1	17.4
Soil depth to bedrock (cm)	59	66	45	41	86
Soil series	Dixonville; Willakenzie; Xerochrepts				

Vegetation

A total of 15 stands were sampled to quantify this community. Measures of species diversity include a total species richness of 79, an average plot species richness of 19.2, and a Shannon – Wiener Index of 1.81. Diversity measures were calculated based on both native and non-native species components.

Tree canopy

This community is characterized by the co-occurrence of *Acer macrophyllum* and *Quercus garryana* in the tree canopy. Cover by *Acer macrophyllum* ranges from 20 to 80% and may be threatening the continued persistence of oak in some stands. *Pseudotsuga menziesii* is frequently present and sometimes co-dominant. *Fraxinus latifolia* is a minor component on more mesic sites.

Table 5b: Tree canopy and regeneration

Species	Freq (%)	Cover (%)		Basal area (m2/ha)	Ave tree ht (m)	Density (stems/ha)				
		Mean	Range			Relict trees (>75cm)	Poles (<8cm)	Sapling (ht <1.3m)	Seedling (<3yrs)	Down trees
Acer macrophyllum	100	34	20-80	44	15	0	180	0	2087	20
Quercus garryana	100	32	1-50	176	21	9	13	20	107	113

Species	Freq (%)	Cover (%)		Basal area (m2/ha)	Ave tree ht (m)	Density (stems/ha)				
		Mean	Range			Relict trees (>75cm)	Poles (<8cm)	Sapling (ht <1.3m)	Seedling (<3yrs)	Down trees
Pseudotsuga menziesii	47	12	0-50	101	26	2	0	7	0	20
Fraxinus latifolia	33	1.3	0-10	0	8	0	7	0	0	0
Arbutus menziesii	20	3	0-20	0	10	0	0	0	0	0

Shrub and herbaceous strata

Shrub strata are relatively sparse in relation to other community types although *Symphoricarpos albus* may form dense patches (Appendix 1). *Acer macrophyllum* is sometimes present as a dense tall shrub layer. *Oemleria cerasiformis*, *Corylus cornuta*, and *Polystichum munitum* are present on mesic sites. The most frequent native graminoids include *Bromus sitchensis, Carex deweyana*, and *Elymus glaucus*.

Non-native species establishment in this community is comparably minor constituting 22% of total species diversity in this type. Introduced grasses are not dominant components, but *Brachypodium sylvaticum* sometimes forms dense stands.

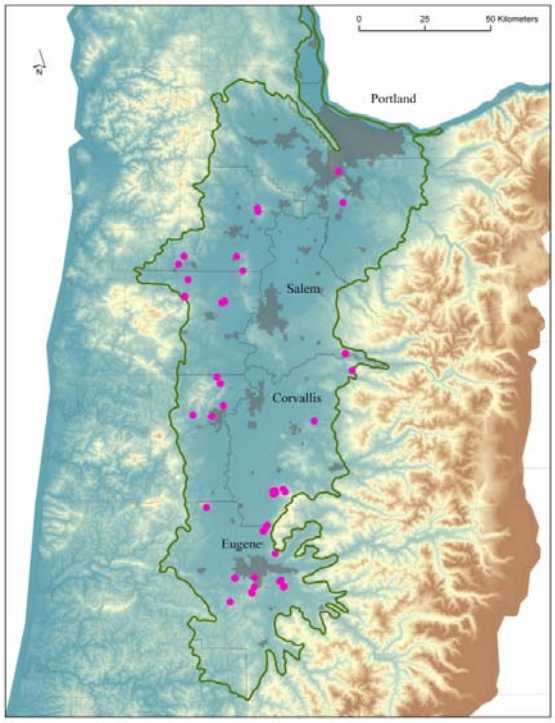
Association 6: *Quercus garryana* / *Toxicodendron diversilobum* / *Elymus glaucus* Woodland
(Oregon White Oak / Poison Oak / Blue Wildrye)

Distribution

The *Quercus garryana* / *Toxicodendron diversilobum* / *Elymus glaucus* community is predominantly comprised of open woodland stands associated with xeric environments on buttes and foothill slopes throughout the Willamette Valley (Figure 6a).

This association was originally quantified by Thilenius (1968) and subsequently described by Riegel et al. (1996) and Kagan et al. (2000). Remnant stands range from northern California to southern Washington and the Columbia Gorge and are classified as critically imperiled by NatureServe (2007) due to habitat loss and degradation associated with agriculture, extensive non-native species establishment, and altered fire regimes.

Figure 6a: Location of *Quercus garryana* / *Toxicodendron diversilobum* / *Elymus glaucus* Woodland plots sampled during 2006 and 2007 field surveys (N=55)



Historical Vegetation

Spatial vegetation reconstructions indicate that the current sampled extent of this community was historically characterized by savanna (56%) and prairie (33%).

Environment

The *Quercus garryana* / *Toxicodendron diversilobum* / *Elymus glaucus* association represents the extreme xeric limit of oak woodland community types in the Willamette Valley (Thilenius 1968). Stands tend to occur at middle and upper slope positions on relatively steep terrain with dry southern aspects (Table 6a). Rocky and shallow woodland soils are common and the most typical soil series include Chehulpum, Dixonville, Philomath, Rock outcrop, and Witzel.

Table 6a: Abiotic environment

Variable	Mean	Median	Range	Min	Max
Elevation (m)	225	206	581	65	646
Slope (%)	36	27	180	0	180
Aspect (deg)	183	180	360	0	360
Precipitation (cm)	152.3	146.7	112.5	119.8	232.3
Temperature (^{o}C)	11.0	11.2	13.1	4.1	17.2

Variable	Mean	Median	Range	Min	Max
Soil depth to bedrock (cm)	57	43	63	36	99
Soil series	Chehulpum; Dixonville; Philomath; Rock outcrop; Witzel				

Vegetation

A total of 55 stands were sampled to quantify this community. Measures of species diversity include a total species richness of 193, an average plot species richness of 23.5, and a Shannon – Wiener Index of 1.95. Diversity measures were calculated based on both native and non-native species components.

Tree canopy

These xeric woodland stands are characterized by lower tree densities and canopy cover, and reduced average tree height (Table 6b). Scattered stands on rocky substrates are characterized by stunted tree growth. Conifer establishment and succession is generally minimal in this community due to more extreme site conditions.

Table 6b: Tree canopy and regeneration

Species	Freq (%)	Cover (%)		Basal area (m2/ha)	Ave tree ht (m)	Density (stems/ha)				
		Mean	Range			Relict trees (>75cm)	Poles (<8cm)	Sapling (ht <1.3m)	Seedling (<3yrs)	Down trees
Quercus garryana	100	34	0-85	378	13	5	82	531	664	45
Pseudotsuga menziesii	33	2	0-20	10	16	0	15	5	27	7
Acer macrophyllum	24	0.5	0-10	1	10	0	0	4	35	0
Fraxinus latifolia	13	0.5	0-2	0	7	0	7	7	11	0
Arbutus menziesii	5	0.5	0-6	0	17	0	0	0	0	0
Pinus ponderosa	4	0.5	0-10	0	14	0	7	0	0	0
Quercus kelloggii	4	0.5	0-10	0	14	0	0	0	0	0

Shrub and herbaceous strata

Toxicodendron diversilobum dominates shrub strata and achieves maximum densities in this community (Appendix 1). More mesic shrub species such as *Symphoricarpos albus* and *Amelanchier*

alnifolia may be present, but provide minimal cover on average. Herbaceous strata are prominent and frequently include the native grasses *Elymus glaucus* and *Bromus carinatus*. Scattered remnant populations of *Achnatherum lemmonii* are associated with rocky substrates and are generally affiliated with adjacent grassland communities.

Non-native species are prolific in this community and account for 41% of total species richness. *Rosa eglanteria* and *Crataegus monogyna* are frequent non-native shrubs although they do not dominate understories as in more mesic habitats. Common and abundant graminoids include *Cynosurus echinatus*, *Dactylis glomerata*, *Festuca arundinacea*, *Lolium multiflorum*, and *Arrhenatherum elatius*. *Arrhenatherum elatius* sometimes forms dense monocultures with maximum cover estimates of 70%. *Torilis arvensis*, *Hypericum perforatum*, and *Geranium dissectum* are common non-native forbs. Related communities from the Umpqua River Basin are similarly dominated by *Dactylis glomerata* and *Cynosurus echinatus* (Smith 1985).

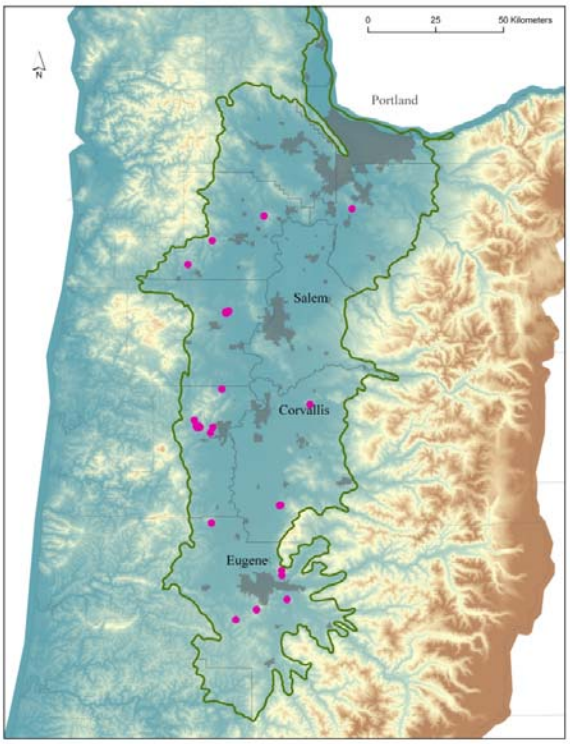
Association 7: *Quercus garryana* / *Toxicodendron diversilobum* / *Danthonia californica* - *Elymus glaucus* Savanna
(Oregon White Oak / Poison Oak / California oatgrass - Blue Wildrye)

Distribution

The *Quercus garryana* / *Toxicodendron diversilobum* / *Danthonia californica* - *Elymus glaucus* community represents a remnant savanna type heavily impacted and modified by livestock grazing and non-native species establishment. Similar communities in the literature are characterized by *Festuca roemeri* and occur in western Washington (Chappal 2006) and coastal British Columbia (Erickson and Meidinger 2007).

A total of 38 highly degraded stands were sampled during 2006 and 2007 field surveys (Figure 7a) with a significant proportion (37%) located at Baskette Slough National Wildlife Refuge west of Salem.

Figure 7a: Location of *Quercus garryana* / *Toxicodendron diversilobum* / *Danthonia californica* - *Elymus glaucus* Savanna plots sampled during 2006 and 2007 field surveys (N=38)



Historical Vegetation

Spatial vegetation reconstructions indicate that the current known extent of this community was historically predominantly prairie (63%) and savanna (26%).

Environment

Remnant examples of this community occupy valley bottom habitat, moderately to steeply sloping hillsides, and scattered rocky low elevation ridges partially insulated from intensive livestock grazing (Table 7a). Aspects are variable. Common soil series include Chehulpum, Dixonville, Jory, and Witzel.

Table 7a: Abiotic environment

Variable	Mean	Median	Range	Min	Max
Elevation (m)	104	100	175	40	215
Slope (%)	29	23	72	6	78
Aspect (deg)	212	247	347	3	350
Precipitation (cm)	147.7	124.0	70.6	121	191.5
Temperature (^{o}C)	11.2	11.2	12.5	4.8	17.3
Soil depth to bedrock (cm)	75	78	50	41	91
Soil series	Chehulpum; Dixonville; Jory; Witzel				

Vegetation

Plot data from 38 stands were used to quantify this association. Measures of species diversity include a total species richness of 191, an average plot species richness of 32.7, and a Shannon – Wiener Index of 2.44. Diversity measures were calculated based on both native and non-native species components.

Tree canopy

The sparse tree canopy that defines a savanna physiognomic structure was apparently maintained historically by relatively frequent surface fires caused by lightning or Native American burning that reduced tree establishment. Remnant stands have been intensively managed and few support historical stand structures or significant native species components. Many stands are characterized by relict tree occurrences on the savanna periphery with a few scattered trees distributed in the stand interior. Stands with trees completely restricted to the perimeter were either not sampled or excluded from the classification analyses. *Pseudotsuga menziesii* was not a significant component in sampled stands (Table 7b).

Table 7b: Tree canopy and regeneration

Species	Freq (%)	Cover (%)		Basal area (m2/ha)	Ave tree ht (m)	Density (stems/ha)				
		Mean	Range			Relict trees (>75cm)	Poles (<8cm)	Sapling (ht <1.3m)	Seedling (<3yrs)	Down trees
Quercus garryana	97	9	0-20	24	10	1	5	276	589	5
Pseudotsuga menziesii	32	0.5	0-15	1	14	0	24	24	0	3
Arbutus menziesii	8	0.5	0-1	0	4	0	0	13	0	0
Pinus ponderosa	5	0.5	0-5	0	11	0	0	0	0	3

Shrub and herbaceous strata

This community is characterized and dominated by herbaceous vegetation (Appendix 1). Shrub abundance is minimal, but *Toxicodendron diversilobum* is a common component usually associated with shaded microsites below tree canopies. *Lonicera hispidula* is relatively common woody vine and is also associated with microsites moderated by tree shading. *Elymus glaucus* and *Danthonia californica* are the most frequent native graminoids, but are usually present as minor components in terms of total cover. *Achillea millefolium, Triteleia hyacinthina, Fragaria virginiana*, and *Eriophyllum lanatum* are relatively common native forb species. *Sidalcea virgata* and *Potentilla gracilis* are also sometimes present below tree branches. The state endangered forb, *Lupinus sulphureus* var. *kincaidii* occurs in some stands and appears to persist despite high non-native species abundance. It is, however, excluded by the establishment and expansion of trees and shrubs and conversion of savanna to conifer or oak woodland.

Non-native species constitute 40% of the species richness of this community. Several non-native grasses have established large dense populations and include *Cynosurus echinatus*, *Taeniatherum*

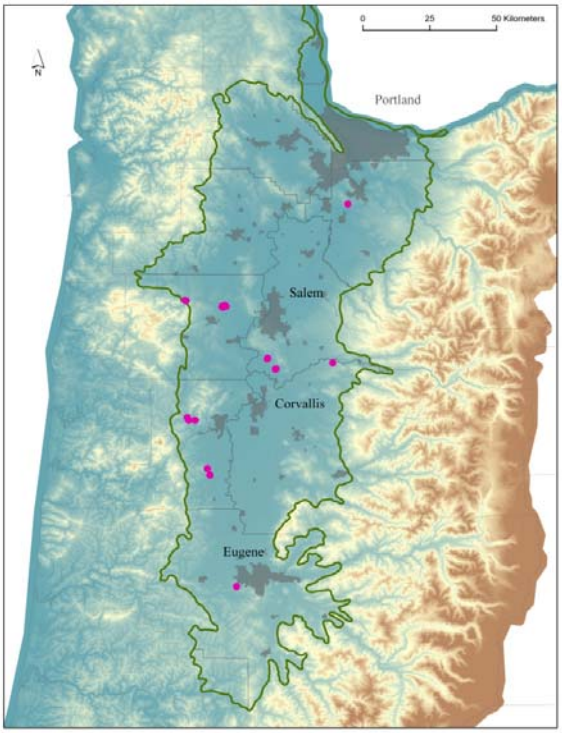
caput-medusae, *Bromus rigidus*, *Dactylis glomerata*, *Arrhenatherum elatius*, and *Brachypodium sylvaticum*. The most common non-native forbs include *Daucus carota*, *Linum bienne*, and *Vicia hirsuta*.

Association 8: *Quercus garryana* / *Toxicodendron diversilobum* / *Cynosurus echinatus* – *Arrhenatherum elatius* Savanna
(Oregon White Oak / Poison Oak / Bristly Dogstail - Tall Oatgrass)

Distribution

The *Quercus garryana* / *Toxicodendron diversilobum* / *Cynosurus echinatus* – *Arrhenatherum elatius* association is another rare and highly degraded savanna community. It ecologically and compositionally similar to the *Quercus garryana* / *Toxicodendron diversilobum* / *Danthonia californica* - *Elymus glaucus* savanna, but lacks a significant native species component. A total of 25 highly degraded stands were sampled (Figure 8a) and a significant proportion, approximately 30%, were again located at Baskette Slough National Wildlife Refuge west of Salem.

Figure 8a: Location of *Quercus garryana* / *Toxicodendron diversilobum* / *Cynosurus echinatus* – *Arrhenatherum elatius* Savanna plots sampled during 2006 and 2007 field surveys (N=25)



Historical Vegetation

Spatial vegetation reconstructions indicate that the current known extent of this community was historically characterized by prairie (52%) and closed conifer or mixed conifer and oak forest (26%).

Environment

Remnant examples of this community occupy valley bottom habitat, moderately to steeply sloping hillsides, and scattered rocky low elevation ridges (Table 8a). Aspects are variable. Common soil series include Chehulpum and Steiwer.

Table 8a: Abiotic environment

Variable	Mean	Median	Range	Min	Max
Elevation (m)	150	118	407	59	466
Slope (%)	22	20	52	3	55
Aspect (deg)	181	184	272	86	358
Precipitation (cm)	146.7	140.2	67.1	120.3	187.3
Temperature (^{o}C)	11.2	11.3	12.2	5.2	17.4
Soil depth to bedrock (cm)	58	43	89	41	130
Soil series	Chehulpum; Steiwer				

Vegetation

Plot data from 21 stands were used to quantify this association. Measures of species diversity include a total species richness of 148, an average plot species richness of 23.0, and a Shannon – Wiener Index of 2.0. Diversity measures were calculated based on both native and non-native species components.

Tree canopy

The sparse tree canopy includes scattered occurrences of mature *Arbutus menziesii* and *Pseudotsuga menziesii*. Significant sapling densities suggest that component stands are transitioning to *Quercus garryana* woodland (Table 8b). Scattered large relict oak trees persist in some stands.

Table 8b: Tree canopy and regeneration

Species	Freq (%)	Cover (%)		Basal area (m2/ha)	Ave tree ht (m)	Density (stems/ha)				
		Mean	Range			Relict trees (>75cm)	Poles (<8cm)	Sapling (ht <1.3m)	Seedling (<3yrs)	Down trees
Quercus garryana	100	9	1-25	33	13	9	48	410	48	5
Arbutus menziesii	10	0.5	0-5	0	10	1	0	0	0	0
Pseudotsuga menziesii	10	0.5	0-2	0	13	0	0	14	5	0

Shrub and herbaceous strata

Species composition is similar to the *Quercus garryana* / *Toxicodendron diversilobum* / *Danthonia californica* - *Elymus glaucus* community and is dominated by herbaceous vegetation (Appendix 1). Shrub abundance is minimal, but *Toxicodendron diversilobum* is a common component usually associated with shaded microsites below tree canopies. *Rubus ursinus* is abundant in some stands.

Native herbaceous species have been severely reduced in this community due to intensive livestock grazing and management. *Elymus glaucus* is a minor component in some stands, but provides an average cover of only 1%. *Eriophyllum lanatum* is the most frequent native forb species, but provides less than 1% cover on average. *Madia gracilis* and *Triteleia hyacinthina* are minor components in some stands.

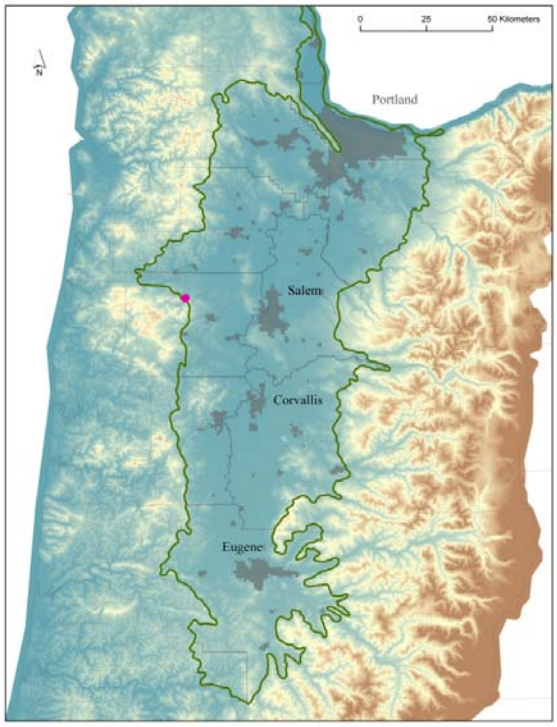
Non-native species constitute 48% of the species richness of this community. *Cynosurus echinatus* dominates a majority of stands. Additional frequent and abundant non-native grasses include *Arrhenatherum elatius*, *Bromus rigidus*, *Dactylis glomerata*, *Taeniatherum caput-medusae*, *Bromus mollis*, and *Holcus lanatus*. *Vicia hirsuta*, *Vicia sativa*, and *Geranium dissectum* are common and abundant non-native forbs.

Association 9: *Quercus garryana* / *Toxicodendron diversilobum* / *Festuca californica* Woodland
(Oregon White Oak / Poison Oak / California fescue)

Distribution

The *Quercus garryana* / *Toxicodendron diversilobum* / *Festuca californica* community was sampled at a single location at a high elevation site on the western fringe of the Willamette Valley (Figure 9a). This site is managed by the BLM with the apparent objective of preserving oak woodland. A total of 3 plots were established. Limited data precludes accurate descriptions of the ecological range of this rare community and additional future sampling is recommended.

Figure 9a: Location of *Quercus garryana* / *Toxicodendron diversilobum* / *Festuca californica* plots sampled during 2006 and 2007 field surveys (N=3)



Environment

This community occupies a xeric, high elevation, south-facing ridge with thin rocky soils and areas of exposed bedrock (Table 9a).

Table 9a: Abiotic environment

Variable	Mean	Median	Range	Min	Max
Elevation (m)	351	340	65	324	389
Slope (%)	46	46	12	40	52
Aspect (deg)	187	180	30	176	206
Precipitation (cm)	187.3	187.3	-	-	-
Temperature (^{o}C)	10.3	10.3	10.5	5.0	15.5
Soil depth to bedrock (cm)	38	38	0	38	38
Soil series	Kilchis; Rock outcrop				

Vegetation

Measures of species diversity include a total species richness of 42, an average plot species richness of 20.7, and a Shannon – Wiener Index of 1.94. Diversity measures were calculated based on both native and non-native species components.

Tree canopy

Quercus garryana is dominant, but *Pseudotsuga menziesii* trees have been removed at this site.

Table 9b: Tree canopy and regeneration

Species	Freq (%)	Cover (%)		Basal area (m2/ha)	Ave tree ht (m)	Density (stems/ha)				
		Mean	Range			Relict trees (>75cm)	Poles (<8cm)	Sapling (ht <1.3m)	Seedling (<3yrs)	Down trees
Quercus garryana	100	27	1-40	98	7	0	133	0	0	167
Arbutus menziesii	67	1	0-3	9	12	0	0	0	0	0
Pseudotsuga menziesii	33	2	0-5	56	8	18	0	0	0	200

Shrub and herbaceous strata

Shrub cover is relatively low, but *Toxicodendron diversilobum* is dominant (Appendix 1). *Holodiscus discolor* and *Amelanchier alnifolia* are also minor components.

The presence and significant abundance of *Festuca californica* characterizes this association. The average cover of *Festuca californica* plants ranges from 15 to 30% and average heights range from 1.0 to 2.0 meters. *Bromus vulgaris* and *Elymus glaucus* are also present. Small populations of *Achnatherum lemmonii* occur in adjacent prairies associated with rock outcrop.

Non-native species are relatively minor constituting 15% of total species richness at this site. *Cynosurus echinatus* is an abundant non-native grass with from 5 to 20% cover in the 3 stands. *Torilis arvensis* occurs in every stand, but is a minor element in terms of total foliar cover.

DISCUSSION

Multivariate analyses of the 2006 and 2007 field data using Twinspan and DCA ordination partitioned plots based on compositional similarities and enabled the classification and description of 9 associations for the Willamette Valley. A total of 4 associations have not been previously described. The *Quercus garryana* / *Toxicodendron diversilobum* / *Festuca californica* community is poorly quantified with only 3 plots, but represents an unusual and rare association for which additional future sampling is recommended.

The described associations closely approximate community types identified by Thilenius (1968), but apparently encompass a wider ecological range and broader, valley-wide geographic region. Significant compositional similarities and environmental overlap characterize these communities, but consistent patterns in both species co-occurrence and fluctuations in abundance of dominant species suggest a significant environmental control. Patterns in the structure of the ordinations imply a causal relationship between soil moisture availability and community composition. Gradients of soil moisture range from valley bottom riparian habitat to xeric rocky upland ridges and correlate with specific aggregations of species or associations. Mesic habitats are occupied by *Quercus garryana – Pseudotsuga menziesii* / *Corylus cornuta – Polystichum munitum* and *Quercus garryana – Fraxinus latifolia* / *Symphoricarpos*

albus forests. The xeric limit of oak habitat is occupied by *Quercus garryana* / *Toxicodendron diversilobum* / *Elymus glaucus* woodlands.

Savanna communities may be anomalous types representing stages of recovery or succession from more recent past disturbance. Open canopy physiognomic structures characterizing savanna types are therefore not necessarily associated with moisture limiting conditions. Scattered savanna stands do, however, occupy xeric rocky habitat. Dense and ubiquitous populations of non-native grasses and forbs inhibit accurate classification and delineation of savanna vegetation. Additional sampling may be required to further elucidate distinctions and ecological relationships among savanna associations.

Accurate community classification and field identification is constrained by the degree of modification of pre European settlement vegetation in the Willamette Valley. Intensive land use including agriculture, livestock grazing, logging, fire suppression, and urban development have fragmented habitat, modified natural ecological processes of disturbance and succession, and altered species composition and structure. Non-native species are consequently prevalent in all associations and early successional communities, which are intrinsic components of landscapes affected by natural disturbance processes including fire, are increasingly rare.

Fire dependent savannas are the most severely affected and support the highest densities of non-native species. Non-native species composition ranges from 15 to 48% among the community types. No apparent correlation between ownership and ecological integrity was observed. Oak vegetation associated with public conservation areas, such as Baskette Butte and Finley Wildlife Refuges, were equally affected and dominated by non-native species. Remnant oak stands with high native species composition are rare and may be non-existent in the Willamette Valley.

Succession to conifer dominance is an ongoing process in woodland and forest associations and is accelerated by the exclusion of historical fire occurrence. Mesic associations such as *Quercus garryana – Pseudotsuga menziesii* / *Corylus cornuta – Polystichum munitum* forests occupy habitats conducive to conifer establishment and support the highest densities of *Pseudotsuga menziesii*. Associations least affected and threatened by conifer replacement include the xeric woodland type *Quercus garryana* / *Toxicodendron diversilobum* / *Elymus glaucus*, the riparian association, *Quercus garryana – Fraxinus latifolia* / *Symphoricarpos albus*, and remnant savanna types.

ACKNOWLEDGEMENTS

Funding for this project was provided by The National Fish and Wildlife Foundation and the Nature Conservancy. Substantial in-kind and project support was provided by the Oregon Natural Heritage Information Center, part of Oregon State University's Institute for Natural Resources, Jane Kertis of the United States Forest Service, and Nancy Sawtelle of the Bureau of Land Management, Eugene, Oregon District Office. Many regional partners offered advice on sampling sites or provided introductions to private landowners. Thank you.

The field work, analysis and reporting were organized, supervised or conducted by Mr. Arne Buechling, ecologist for the Oregon Natural Heritage Information Center under contract to The Nature Conservancy. Field surveys were assisted by Henry Burton, Rachel Chambers, Sonja Ralph, Erin Riggs, and David Schuhwerk. Extensive data entry was performed by Charles Carter and Annie Weiland. Ed Alverson (The Nature Conservancy), Greg Fitzpatrick (The Nature Conservancy), Jane Kertis (United States Forest Service), John Christy (Oregon Natural Heritage Information Center), and Jimmy Kagan (Oregon Natural Heritage Information Center) helped with project design or data analysis.

LITERATURE CITED

Barnosky, C. W. 1985. Late Quaternary vegetation near Battle Ground Lake, southern Puget Trough, Washington. Geological Society of America Bulletin 96:263-271.

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].

Christy, J.A., E.R. Alverson, M.P. Dougherty, S.C. Kolar, C.W. Alton, S.M. Hawes, L. Ashkenas & P. Minear. 2005. Historical vegetation of the Willamette Valley, Oregon, 1851-1910. ArcMap shapefile, Version 7.0. Oregon Natural Heritage Information Center, Oregon State University.

Christy, J.A., E.R. Alverson, M.P. Dougherty, S.C. Kolar, & C.W. Alton. 2008. Vegetation of the Willamette Valley, Oregon, in 1850. Manuscript in preparation.

Erickson, W. 1993. Garry Oak Ecosystems. B.C. Ministry of Environment, Lands and Parks, Wildlife Branch. Victoria, B.C. 6pp. Ecosystems at Risk in British Columbia brochure.

Erickson, W.R. and D. Meidinger. 2007. Garry oak (Quercus garryana) plant communities in British Columbia: A guide to identification. B.C. Ministry of Forests and Range Forest Science Program. Res. Br. Victoria, B.C. Tech Rep. 040. [http://www.for.gov.bc.ca/hfd/pubs/Docs/Tr/Tr040.htm].

Grossman, D. H., D. Faber-Langendoen, A. S. Weakley, M. Anderson, P. Bourgeron, 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 I. The National Vegetation Classification System: development, status, and applications. The Nature Conservancy, Arlington, Virginia, USA.

Gucker, C. L. 2007. Quercus garryana. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. (Available: http://www.fs.fed.us/database/feis/).

Hill, M.O. 1979. TWINSPAN—a FORTRAN program for detrended correspondence analysis and reciprocal averaging. Ecology and Systematics, Cornell University. Ithaca, New York. 52pp.

Hill, M.O. and J.G. Gauch. 1980. Detrended correspondence analysis: an improved ordination technique. Vegetatio 42: 47-58.

Hitchcock, C. L. and A. Cronquist. 1973. Flora of the Pacific Northwest. University of Washington Press, Seattle, WA: 730 p.

Johnson, E. M. and K. D. Rosenberg. 2006. Granary-site selection by acorn woodpeckers in the Willamette Valley, Oregon. Northwest Science 80(3): 177-183.

Kagan, J. S., J. A. Christy, M. P. Murray, and J. A. Titus. 2000. Classification of native vegetation of Oregon. Oregon Natural Heritage Program, Portland. 63 pp.

Little, E. L. 1971. Atlas of United States trees. U.S. Department of Agriculture, Forest Service. Miscellaneous Publication No 1146. Washington, DC.

MacDougall, A. S., Beckwith, B. R., and C. Y Maslovat. 2004. Defining conservation strategies with historical perspectives: a case study from a degraded oak grassland ecosystem. Conservation Biology 18(2): 455-465

McCain, C. 2004. Riparian plant communities of Northwest Oregon: Streamside plant communities. United States Department of Agriculture, Forest Service, Pacific Northwest Region. Technical Paper R6-NR-ECOL-TP-10-04.

McCune, B. and J.B. Grace. 2002. Analysis of ecological communities. MjM Software Design, Gleneden Beach, Oregon, USA.

McCune, B. and M.J. Mefford 1999. PC-ORD. Multivariate analysis of ecological data, Version 4. MjM Software Design, Gleneden Beach, Oregon, USA.

NatureServe. 2007. NatureServe Explorer. http://www.natureserve.org/explorer/.

Riegel, G .M., B. G. Smith, and J. F. Franklin. 1991. Foothill oak woodlands of the interior valleys of southwestern Oregon. Northwest Science 66: 66-76.

Smith, P.S. 1985. Plant associations within the interior valleys of the Umpqua River Basin, Oregon. Journal of Range Management 38(6): 526-530.

Thilenius, J.F. 1968. The Quercus garryana forests of the Willamette Valley, Oregon. Ecology 49 (6): 1124-1133.

Whitlock, C. and M. A. Knox. 2002. Prehistoric burning in the Pacific Northwest: human versus climatic influences. In Fire, Native Peoples, and the Natural Landscape, ed. Thomas R. Vale, 222–23. Washington, DC: Island Press.

Woodhouse, C.A., and J.T. Overpeck. 1998. 2000 years of drought variability in the central United States. Bull. Am. Meteorol. Soc. 79: 2693–2714.

Appendix 1: Complete Species Lists by Association

Association 1: *Quercus garryana* – (*Fraxinus latifolia*) / *Symphoricarpos albus* Forest
(Oregon White Oak – (Oregon ash) / Common Snowberry)

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
*** non-native species**						
Shrub						
Symphoricarpos albus (L.) Blake var. laevigatus (Fern.) Blake	89	19	24.0	0	90	L
Rubus ursinus Cham. & Schltdl. var. macropetalus (Douglas ex Hook.) Britton	63	3	6.0	0	35	L
Oemleria cerasiformis	61	2	3.4	0	20	L
Toxicodendron diversilobum	61	3	6.0	0	30	M
Amelanchier alnifolia (Nuttall) Nuttall ex M. Roem. var. semiintegrifolia (Hook.) C.L. Hitchc.	57	4	7.2	0	40	M
Corylus cornuta	33	4	9.0	0	40	L
Rubus discolor*	33	4	13.8	0	90	
Crataegus monogyna*	28	2	5.1	0	30	
Rosa nutkana C. Presl var. nutkana	26	0.5	2.2	0	15	L
Frangula purshiana	22	0.5	2.4	0	13	L
Rosa eglanteria*	20	0.5	0.7	0	4	
Berberis aquifolium	17	0.5	0.4	0	2	M
Viburnum ellipticum	15	0.5	1.7	0	8	H
Holodiscus discolor	13	1.1	4.2	0	20	L
Prunus avium*	13	0.5	1.5	0	10	
Rubus laciniatus*	13	0.5	0.2	0	1	
Crataegus suksdorfii (Sarg.) Kruschke	11	0.5	1.0	0	5	M
Physocarpus capitatus	11	0.5	0.9	0	5	
Spiraea douglasii	11	0.5	0.5	0	3	L
Acer circinatum	9	1.4	5.4	0	25	
Rosa gymnocarpa	9	0.5	0.8	0	5	L
Rubus parviflorus	9	0.5	0.3	0	2	
Cornus sericea	7	0.5	3.1	0	20	
Philadelphus lewisii Pursh var. gordonianus (Lindl.) Jeps.	4	0.5	0.3	0	2	L
Pyrus communis*	4	0.5	0.1	0	1	
Malus sylvestris*	2	0.5	0.1	0	1	
Rubus spectabilis	2	0.5	2.9	0	20	
Sambucus racemosa	2	0.5	0.1	0	1	
Graminoid						
Carex deweyana Schwein. ssp. leptopoda (Mack.) Calder & Roy	37	0.5	1.0	0	6	L
Dactylis glomerata*	28	1	3.0	0	17	
Festuca arundinacea*	24	3	12.7	0	81	
Elymus glaucus	20	0.5	2.3	0	15	M

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Bromus carinatus	15	0.5	2.4	0	15	H
Poa spp	13	0.5	2.3	0	15	
Poa trivialis*	13	0.5	3.0	0	20	
Carex obnupta	11	2	7.9	0	50	L
Holcus lanatus*	11	0.5	2.9	0	20	
Poa pratensis*	11	0.5	2.3	0	15	
Bromus rigidus*	9	0.5	1.2	0	8	
Bromus sitchensis	9	0.5	0.2	0	1	M
Carex spp	9	0.5	0.1	0	1	
Anthoxanthum odoratum*	7	0.5	0.5	0	3	
Brachypodium sylvaticum*	7	0.5	0.2	0	1	
Cynosurus echinatus*	7	0.5	0.3	0	2	
Melica subulata (Griesb.) Scrib. var. subulata	7	0.5	0.3	0	2	L
Alopecurus pratensis*	4	0.5	0.7	0	5	
Arrhenatherum elatius*	4	0.5	0.1	0	1	
Bromus vulgaris	4	0.5	0.1	0	1	L
Lolium multiflorum*	4	0.5	2.2	0	15	
Poa compressa*	4	0.5	0.1	0	1	
Agrostis capillaris*	2	0.5	0.1	0	1	
Bromus mollis*	2	0.5	0.1	0	1	
Cynosurus cristatus*	2	0.5	0.1	0	1	
Deschampsia cespitosa (L.) P. Beauv. var. cespitosa	2	0.5	2.2	0	15	M
Festuca spp	2	0.5	0.1	0	1	
Juncus effusus L. ssp. pacificus (Fernald & Wiegand) Lint ex Zika	2	0.5	0.1	0	1	L
Lolium perenne*	2	0.5	0.1	0	1	
Phalaris arundinacea*	2	0.5	0.3	0	2	
Taeniatherum caput-medusae*	2	0.5	2.9	0	20	
Forb						
Galium aparine L. var. echinospermum (Wallr.) Farw.	57	0.5	3.1	0	20	L
Osmorhiza berteroi	43	0.5	0.4	0	2	L
Sanicula crassicaulis Poepp. ex DC. var. crassicaulis	41	0.5	0.4	0	2	L
Tellima grandiflora	41	0.5	0.5	0	2	L
Claytonia sibirica	30	1	6.7	0	45	L
Frangula purshiana	22	0.5	2.4	0	13	
Ranunculus occidentalis Nuttall var. occidentalis	22	0.5	0.3	0	1	H
Vicia sativa*	20	0.5	3.0	0	20	
Fragaria vesca L. ssp. bracteata (Heller) Staudt	17	0.5	0.5	0	3	M
Torilis arvensis*	17	0.5	0.4	0	2	
Camassia quamash (Pursh) Greene ssp. maxima Gould	15	0.5	2.3	0	15	H
Galium triflorum	15	0.5	0.4	0	2	
Hypericum perforatum*	15	0.5	0.2	0	1	
Nemophila parviflora Douglas ex Benth. var. parviflora	15	0.5	2.2	0	15	L
Perideridia spp	15	0.5	0.3	0	2	H
Geranium dissectum*	13	0.5	0.9	0	5	
Viola glabella	13	0.5	0.5	0	3	
Adenocaulon bicolor	11	0.5	0.2	0	1	L
Geranium lucidum*	11	4	13.6	0	55	
Geranium robertianum*	11	0.5	0.8	0	5	
Heracleum lanatum	11	0.5	0.2	0	1	L

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Rumex conglomeratus*	11	0.5	0.2	0	1	
Stellaria media*	11	0.5	0.3	0	2	
Thalictrum occidentale A. Gray var. occidentale	11	0.5	0.4	0	2	L
Vicia spp	11	0.5	0.5	0	3	
Anthriscus caucalis*	9	0.5	0.8	0	5	
Cirsium vulgare*	9	0.5	0.1	0	1	
Clinopodium douglasii	9	0.5	0.2	0	1	L
Lapsana communis*	9	0.5	0.2	0	1	
Mentha puleguim*	9	0.5	0.2	0	1	
Rumex crispus*	9	0.5	0.1	0	1	
Circaea alpina L. ssp. pacifica (Asch. & Magnus) P.H. Raven	7	0.5	0.1	0	1	L
Epilobium ciliatum Raf. ssp. watsonii (Barbey) Hoch & P.H. Raven	7	0.5	0.2	0	1	L
Geranium molle*	7	0.5	0.5	0	3	
Ligusticum apiifolium	7	0.5	2.2	0	15	H
Lithophragma parviflorum (Hook.) Nuttall var. parviflorum	7	0.5	0.1	0	1	H
Maianthemum racemosum (L.) Link ssp. amplexicaule (Nuttall) LaFrankie	7	0.5	3.0	0	20	
Mycelis muralis*	7	0.5	0.3	0	2	
Senecio jacobaea*	7	0.5	0.0	0	0	
Trifolium repens*	7	0.5	1.5	0	10	
Veratrum californicum	7	0.5	0.1	0	1	
Vicia americana	7	0.5	0.2	0	1	M
Vicia hirsuta*	7	0.5	0.3	0	2	
Arctium minus*	4	0.5	0.2	0	1	
Brodiaea spp	4	0.5	0.1	0	1	
Cirsium arvense*	4	0.5	0.1	0	1	
Claytonia perfoliata Donn ex Willd. ssp. perfoliata	4	0.5	0.3	0	2	M
Daucus carota*	4	0.5	0.1	0	1	
Dipsacus fullonum*	4	0.5	0.2	0	1	
Equisetum hyemale	4	0.5	0.1	0	1	
Geranium oreganum	4	0.5	0.1	0	1	H
Iris tenax Douglas ex Lindl. var. tenax	4	0.5	0.1	0	1	M
Lathyrus aphaca*	4	0.5	0.2	0	1	
Lathyrus sphaericus*	4	0.5	0.1	0	1	
Leucanthemum vulgare*	4	0.5	0.1	0	1	
Lilium columbianum	4	0.5	0.1	0	1	L
Moehringia macrophylla	4	0.5	0.3	0	2	L
Potentilla gracilis Douglas ex Hook. var. gracilis	4	0.5	0.1	0	1	H
Potentilla spp	4	0.5	0.1	0	1	
Ranunculus orthorhynchus Hook. var. orthorhynchus	4	0.5	0.1	0	1	H
Scutellaria lateriflora L. var. lateriflora	4	0.5	0.2	0	1	L
Vicia tetrasperma*	4	0.5	0.2	0	1	
Achillea millefolium	2	0.5	0.1	0	1	M
Cardamine nuttallii	2	0.5	0.1	0	1	
Cardamine penduliflora	2	0.5	0.1	0	1	M
Cerastium glomeratum*	2	0.5	0.1	0	1	
Conium maculatum*	2	0.5	0.4	0	3	
Cynoglossum grande	2	0.5	0.1	0	1	H
Cytisus scoparius*	2	0.5	0.0	0	0	
Delphinium menziesii	2	0.5	0.1	0	1	H
Dodecatheon hendersonii A. Gray ssp. hendersonii	2	0.5	0.1	0	1	H

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Equisetum telmateia	2	0.5	0.1	0	1	
Erythronium oregonum Applegate ssp. leucandrum (Applegate) Applegate	2	0.5	0.1	0	1	M
Fragaria virginiana Duchesne var. platypetala (Rydb.) H.M. Hall	2	0.5	0.1	0	1	H
Galium oreganum	2	0.5	0.1	0	1	
Geum macrophyllum Willd. var. macrophyllum	2	0.5	0.0	0	0	L
Lactuca serriola*	2	0.5	0.1	0	1	
Lamium purpureum*	2	0.5	0.1	0	1	
Lycopus uniflorus	2	0.5	0.1	0	1	
Madia sativa	2	0.5	0.1	0	1	M
Maianthemum stellatum	2	0.5	0.1	0	1	L
Melissa officinalis*	2	0.5	0.1	0	1	
Myosotis discolor*	2	0.5	0.0	0	0	
Oxalis spp	2	0.5	0.0	0	0	
Plantago lanceolata*	2	0.5	0.1	0	1	
Plantago major*	2	0.5	0.1	0	1	
Prosartes hookeri	2	0.5	0.1	0	1	
Prunella vulgaris	2	0.5	0.1	0	1	H
Prunella vulgaris ssp. vulgaris*	2	0.5	0.1	0	1	
Saxifraga integrifolia Hook. var. integrifolia	2	0.5	0.1	0	1	H
Senecio sylvaticus*	2	0.5	0.1	0	1	
Sidalcea nelsoniana	2	0.5	0.1	0	1	H
Sidalcea spp	2	0.5	0.1	0	1	H
Sidalcea virgata	2	0.5	0.1	0	1	H
Stachys rigida Nuttall ex Benth. var. rigida	2	0.5	0.1	0	1	L
Stellaria crispa	2	0.5	0.1	0	1	
Taraxacum officinale*	2	0.5	0.1	0	1	
Tolmiea menziesii	2	0.5	0.1	0	1	
Trientalis latifolia	2	0.5	0.1	0	1	L
Triteleia hyacinthina	2	0.5	0.0	0	0	H
Urtica dioica	2	0.5	0.1	0	1	
Vancouveria hexandra	2	0.5	0.1	0	1	L
Verbascum blattaria*	2	0.5	0.0	0	0	
Verbascum thapsus*	2	0.5	0.0	0	0	
Veronica scutellata	2	0.5	1.2	0	8	M
Vicia cracca*	2	0.5	0.1	0	1	
Vicia pannonica*	2	0.5	0.0	0	0	
Viola spp	2	0.5	0.0	0	0	
Fern						
Polystichum munitum	54	1.5	3.4	0	17	L
Polypodium glycyrrhiza	22	0.5	0.2	0	1	L
Pteridium aquilinum (L.) Kuhn var. pubescens Underw.	17	0.5	0.7	0	3	L
Athyrium filix-femina	2	0.5	0.0	0	0	
Dryopteris arguta	2	0.5	0.7	0	5	H
Vine						
Hedera helix*	11	1.7	6.8	0	40	

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Marah oreganus	7	0.5	0.1	0	1	M
Lonicera hispidula (Lindl.) Douglas ex Torr. & A. Gray var. hispidula	4	0.5	0.2	0	1	M

Association 2: ***Quercus garryana – Pseudotsuga menziesii / Corylus cornuta – Polystichum munitum*** **Forest**

Oregon White Oak – Douglas fir / beaked hazelnut – Sword fern

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
*** non-native species**						
Shrub						
Corylus cornuta	94	8.8	12.3	0	50	L
Rubus ursinus Cham. & Schltdl. var. macropetalus (Douglas ex Hook.) Britton	85	8.9	21.5	0	95	L
Symphoricarpos albus (L.) Blake var. laevigatus (Fern.) Blake	73	9.4	15.1	0	45	L
Toxicodendron diversilobum	70	4.0	7.6	0	40	M
Amelanchier alnifolia (Nuttall) Nuttall ex M. Roem. var. semiintegrifolia (Hook.) C.L. Hitchc.	36	2.3	6.9	0	35	M
Frangula purshiana	36	1.3	3.6	0	20	L
Oemleria cerasiformis	33	0.5	0.9	0	4	L
Rubus discolor*	30	4.7	12.2	0	45	
Rosa gymnocarpa	27	0.5	0.6	0	3	L
Holodiscus discolor	21	0.5	1.7	0	8	L
Prunus avium*	21	3.4	10.8	0	55	
Rosa eglanteria*	21	0.5	0.4	0	2	
Rubus laciniatus*	21	0.5	3.8	0	20	
Berberis aquifolium	18	0.5	0.6	0	3	M
Crataegus monogyna*	18	0.5	0.4	0	2	
Crataegus suksdorfii (Sarg.) Kruschke	12	0.5	2.6	0	15	M
Ilex aquifolium*	12	0.5	0.6	0	3	
Rosa nutkana C. Presl var. nutkana	12	0.5	0.8	0	4	L
Acer circinatum	6	0.5	0.9	0	5	
Physocarpus capitatus	6	0.5	0.1	0	1	
Sambucus racemosa	6	0.5	0.9	0	5	
Cornus nuttallii	3	0.5	0.3	0	2	
Gaultheria shallon	3	0.5	1.7	0	10	
Malus sylvestris*	3	0.5	0.9	0	5	
Prunus virginiana L. var. demissa (Nuttall) Torr.	3	0.5	0.2	0	1	L
Viburnum ellipticum	3	0.5	0.2	0	1	H
Graminoid						
Brachypodium sylvaticum*	30	1.9	7.8	0	45	
Elymus glaucus	24	0.5	1.5	0	8	M
Bromus sitchensis	21	0.5	0.8	0	4	M
Carex deweyana Schwein. ssp. leptopoda (Mack.) Calder & Roy	21	0.5	0.3	0	1	L
Dactylis glomerata*	21	0.5	0.9	0	5	
Carex spp	18	0.5	1.1	0	5	
Festuca arundinacea*	15	0.5	0.5	0	3	
Holcus lanatus*	15	0.5	1.7	0	9	
Bromus vulgaris	12	0.5	0.6	0	3	L
Cynosurus echinatus*	9	0.5	0.1	0	1	
Melica subulata (Griesb.) Scrib. var. subulata	9	0.5	0.2	0	1	L

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Poa pratensis*	9	0.5	0.1	0	1	
Juncus effusus L. ssp. pacificus (Fernald & Wiegand) Lint ex Zika	6	0.5	0.4	0	2	L
Luzula comosa	6	0.5	0.1	0	1	M
Agrostis capillaris*	3	0.5	0.5	0	3	
Arrhenatherum elatius*	3	0.5	0.3	0	2	
Bromus rigidus*	3	0.5	0.0	0	0	
Carex obnupta	3	0.5	2.6	0	15	L
Danthonia californica Bolander var. americana (Scribner) A.S. Hitchc.	3	0.5	0.0	0	0	H
Festuca spp	3	0.5	0.1	0	1	
Poa compressa*	3	0.5	0.1	0	1	
Poa trivialis*	3	0.5	0.1	0	1	
Forb						
Osmorhiza berteroi	67	0.5	0.9	0	4	L
Claytonia sibirica	39	0.5	1.2	0	5	L
Frangula purshiana	36	1.3	3.6	0	20	
Galium aparine L. var. echinospermum (Wallr.) Farw.	36	0.5	0.4	0	2	L
Galium triflorum	33	0.5	0.5	0	2	
Adenocaulon bicolor	27	0.5	0.7	0	3	L
Fragaria vesca L. ssp. bracteata (Heller) Staudt	21	0.5	0.2	0	1	M
Geranium lucidum*	21	1.3	4.4	0	25	
Lapsana communis*	21	0.5	0.3	0	1	
Sanicula crassicaulis Poepp. ex DC. var. crassicaulis	21	0.5	0.3	0	1	L
Clinopodium douglasii	18	0.5	0.6	0	3	L
Hypericum perforatum*	18	0.5	0.2	0	1	
Nemophila parviflora Douglas ex Benth. var. parviflora	18	0.5	0.2	0	1	L
Lactuca serriola*	15	0.5	0.4	0	2	
Torilis arvensis*	15	0.5	0.2	0	1	
Circaea alpina L. ssp. pacifica (Asch. & Magnus) P.H. Raven	12	0.5	0.2	0	1	L
Cirsium vulgare*	12	0.5	0.2	0	1	
Fragaria virginiana Duchesne var. platypetala (Rydb.) H.M. Hall	12	0.5	0.2	0	1	H
Leucanthemum vulgare*	12	0.5	0.1	0	1	
Tellima grandiflora	12	0.5	0.5	0	2	L
Trientalis latifolia	12	0.5	0.2	0	1	L
Vancouveria hexandra	12	0.5	0.1	0	1	L
Geum macrophyllum Willd. var. macrophyllum	9	0.5	0.1	0	1	L
Ligusticum apiifolium	9	0.5	0.4	0	2	H
Lonicera ciliosa	9	0.5	0.5	0	3	L
Perideridia spp	9	0.5	0.1	0	1	H
Ranunculus occidentalis Nuttall var. occidentalis	9	0.5	0.2	0	1	H
Trillium albidum	9	0.5	0.1	0	1	M
Vicia spp	9	0.5	0.1	0	1	
Aquilegia formosa	6	0.5	0.1	0	1	M
Cirsium arvense*	6	0.5	0.1	0	1	
Daucus carota*	6	0.5	0.1	0	1	
Mimulus dentatus	6	0.5	0.1	0	1	

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Mycelis muralis*	6	0.5	0.1	0	1	
Prunella vulgaris	6	0.5	0.1	0	1	H
Senecio jacobaea*	6	0.5	0.1	0	1	
Stellaria media*	6	0.5	0.1	0	1	
Achillea millefolium	3	0.5	0.0	0	0	M
Achlys triphylla	3	0.5	0.1	0	1	
Arctium minus*	3	0.5	0.2	0	1	
Asplenium trichomanes L. ssp. trichomanes	3	0.5	0.1	0	1	H
Brodiaea coronaria (Salisb.) Engl. ssp. coronaria	3	0.5	0.0	0	0	H
Calocedrus decurrens	3	0.5	0.7	0	4	M
Camassia quamash (Pursh) Greene ssp. maxima Gould	3	0.5	0.0	0	0	H
Cardamine nuttallii var. nuttallii	3	0.5	0.1	0	1	M
Cardamine oligosperma Nuttall var. oligosperma	3	0.5	0.1	0	1	L
Cynoglossum grande	3	0.5	0.1	0	1	H
Cytisus scoparius*	3	0.5	0.1	0	1	
Erythronium oregonum Applegate ssp. leucandrum (Applegate) Applegate	3	0.5	0.0	0	0	M
Galium oreganum	3	0.5	0.1	0	1	
Geranium dissectum*	3	0.5	0.1	0	1	
Geranium robertianum*	3	0.5	0.3	0	2	
Iris tenax Douglas ex Lindl. var. tenax	3	0.5	0.1	0	1	M
Madia gracilis	3	0.5	0.1	0	1	H
Maianthemum racemosum (L.) Link ssp. amplexicaule (Nuttall) LaFrankie	3	0.5	0.2	0	1	
Montia fontana L. var. tenerrima (Gray) Fern. & Wieg.	3	0.5	0.0	0	0	M
Montia parvifolia (Mot. ex DC.) Greene var. parvifolia	3	0.5	0.1	0	1	M
Rumex crispus*	3	0.5	0.1	0	1	
Stachys cooleyae	3	0.5	0.3	0	2	
Tonella tenella	3	0.5	0.1	0	1	H
Vicia sativa*	3	0.5	0.1	0	1	
Viola glabella	3	0.5	0.0	0	0	
Viola spp	3	0.5	0.1	0	1	
Fern						
Polystichum munitum	97	8.3	14.4	0	65	L
Polypodium glycyrrhiza	21	2.0	11.3	0	65	L
Pteridium aquilinum (L.) Kuhn var. pubescens Underw.	15	0.5	0.5	0	3	L
Vine						
Lonicera hispidula (Lindl.) Douglas ex Torr. & A. Gray var. hispidula	15	0.5	0.2	0	1	M
Marah oreganus	9	0.5	0.4	0	2	M
Hedera helix*	3	0.5	0.1	0	1	

Association 3: *Quercus garryana – Quercus kelloggii / Toxicodendron diversilobum* Forest

Oregon White Oak – California Black Oak / Poison oak

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
*** non-native species**						
Shrub						
Amelanchier alnifolia (Nuttall) Nuttall ex M. Roem. var. semiintegrifolia (Hook.) C.L. Hitchc.	89	3	2.4	0	6	M
Rubus discolor*	78	16	23.9	0	75	
Symphoricarpos albus (L.) Blake var. laevigatus (Fern.) Blake	78	4	6.3	0	15	L
Toxicodendron diversilobum	78	9	10.1	0	25	M
Crataegus monogyna*	56	9	24.9	0	75	
Rubus laciniatus*	56	0.5	0.4	0	1	
Prunus avium*	44	2	3.7	0	10	
Rosa eglanteria*	44	1	1.7	0	5	
Corylus cornuta	33	3	5.3	0	15	L
Frangula purshiana	33	2	5.1	0	15	L
Rosa nutkana C. Presl var. nutkana	33	0.5	0.4	0	1	L
Rubus ursinus Cham. & Schltdl. var. macropetalus (Douglas ex Hook.) Britton	33	0.5	1.6	0	5	L
Ilex aquifolium*	22	0.5	0.2	0	1	
Oemleria cerasiformis	22	0.5	0.7	0	2	L
Berberis aquifolium	11	0.5	0.7	0	2	M
Cotoneaster horizontalis*	11	0.5	0.2	0	1	
Prunus lusitanica*	11	0.5	0.0	0	0	
Prunus mahaleb*	11	1	3.3	0	10	
Pyracantha coccinea*	11	0.5	0.2	0	1	
Ribes lacustre	11	0.5	0.2	0	1	
Rosa gymnocarpa	11	0.5	0.2	0	1	L
Graminoid						
Dactylis glomerata*	56	5	11.5	0	35	
Elymus glaucus	56	2	4.8	0	15	M
Festuca arundinacea*	44	7	14.0	0	40	
Bromus sitchensis	33	0.5	1.3	0	4	M
Cynosurus echinatus*	22	3	8.3	0	25	
Holcus lanatus*	22	0.5	0.4	0	1	
Poa spp	22	0.5	1.0	0	3	
Anthoxanthum odoratum*	11	0.5	0.7	0	2	
Avena fatua*	11	0.5	0.2	0	1	
Bromus carinatus	11	0.5	0.2	0	1	H
Carex spp	11	0.5	0.2	0	1	
Deschampsia cespitosa (L.) P. Beauv. var. cespitosa	11	0.5	0.2	0	1	M
Festuca californica Vasey var. californica	11	1	3.3	0	10	M
Juncus effusus L. ssp. pacificus (Fernald & Wiegand) Lint ex Zika	11	0.5	0.3	0	1	L

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Melica subulata (Griesb.) Scrib. var. subulata	11	0.5	0.7	0	2	L
Phalaris arundinacea*	11	0.5	0.7	0	2	
Poa trivialis*	11	0.5	0.2	0	1	
Forb						
Osmorhiza berteroi	78	0.5	0.8	0	2	L
Galium aparine L. var. echinospermum (Wallr.) Farw.	67	0.5	0.3	0	1	L
Hypericum perforatum*	67	0.5	0.3	0	1	
Sanicula crassicaulis Poepp. ex DC. var. crassicaulis	56	0.5	0.4	0	1	L
Frangula purshiana	33	2	5.1	0	15	
Lathyrus aphaca*	33	0.5	0.7	0	2	
Leucanthemum vulgare*	33	0.5	0.3	0	1	
Torilis arvensis*	33	0.5	1.1	0	3	
Vicia sativa*	33	0.5	0.4	0	1	
Cirsium vulgare*	22	0.5	0.4	0	1	
Cytisus scoparius*	22	1	3.3	0	10	
Fragaria virginiana Duchesne var. platypetala (Rydb.) H.M. Hall	22	0.5	0.2	0	1	H
Geranium dissectum*	22	0.5	0.4	0	1	
Nemophila parviflora Douglas ex Benth. var. parviflora	22	0.5	0.2	0	1	L
Sidalcea spp	22	0.5	0.2	0	1	H
Sidalcea virgata	22	0.5	0.2	0	1	H
Stellaria media*	22	0.5	0.2	0	1	
Tellima grandiflora	22	0.5	0.2	0	1	L
Achillea millefolium	11	0.5	0.2	0	1	M
Adenocaulon bicolor	11	0.5	0.3	0	1	L
Apocynum spp	11	0.5	0.2	0	1	M
Aquilegia formosa	11	0.5	0.7	0	2	M
Claytonia sibirica	11	0.5	0.3	0	1	L
Clinopodium douglasii	11	0.5	0.7	0	2	L
Galium oreganum	11	0.5	0.2	0	1	
Geum macrophyllum Willd. var. macrophyllum	11	0.5	0.2	0	1	L
Goodyera oblongifolia	11	0.5	0.2	0	1	
Hypericum anagalloides	11	0.5	0.2	0	1	M
Hypochaeris radicata*	11	0.5	0.2	0	1	
Lathyrus sphaericus*	11	0.5	0.2	0	1	
Mentha puleguim*	11	0.5	0.2	0	1	
Perideridia spp	11	0.5	0.0	0	0	H
Ranunculus occidentalis Nuttall var. occidentalis	11	0.5	0.2	0	1	H
Rumex acetosella*	11	0.5	0.0	0	0	
Senecio jacobaea*	11	0.5	0.2	0	1	
Trifolium dubium*	11	0.5	0.2	0	1	
Vicia cracca*	11	0.5	0.2	0	1	
Vicia hirsuta*	11	0.5	0.7	0	2	
Vicia tetrasperma*	11	0.5	0.2	0	1	
Fern						

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Polystichum munitum	44	0.5	1.1	0	3	L
Polypodium glycyrrhiza	22	0.5	0.2	0	1	L
Pteridium aquilinum (L.) Kuhn var. pubescens Underw.	11	1	3.3	0	10	L
Vine						
Lonicera hispidula (Lindl.) Douglas ex Torr. & A. Gray var. hispidula	56	2	2.0	0	5	M
Hedera helix*	22	0.5	0.7	0	2	
Marah oreganus	22	0.5	0.4	0	1	M

Association 4: *Quercus garryana – Pseudotsuga menziesii / Amelanchier alnifolia – Symphoricarpos albus* Woodland

Oregon White Oak – Douglas-fir / Saskatoon Serviceberry - Common Snowberry

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
*** non-native species**						
Shrub						
Toxicodendron diversilobum	89	10.2	13.8	0	55	M
Symphoricarpos albus (L.) Blake var. laevigatus (Fern.) Blake	85	5.7	11.6	0	80	L
Amelanchier alnifolia (Nuttall) Nuttall ex M. Roem. var. semiintegrifolia (Hook.) C.L. Hitchc.	83	5.1	12.9	0	85	M
Rubus ursinus Cham. & Schltdl. var. macropetalus (Douglas ex Hook.) Britton	68	2.2	5.6	0	35	L
Rosa eglanteria*	52	0.5	1.9	0	15	
Rosa gymnocarpa	44	0.5	0.4	0	2	L
Crataegus monogyna*	41	0.5	0.6	0	4	
Oemleria cerasiformis	32	0.5	1.4	0	10	L
Rubus discolor*	32	3.8	15.3	0	81	
Berberis aquifolium	28	0.5	0.7	0	5	M
Holodiscus discolor	24	0.5	2.4	0	15	L
Corylus cornuta	21	0.5	1.0	0	5	L
Frangula purshiana	16	0.5	1.2	0	10	L
Rosa nutkana C. Presl var. nutkana	15	0.5	0.4	0	3	L
Prunus avium*	13	0.5	3.4	0	20	
Rubus laciniatus*	13	0.5	0.2	0	1	
Crataegus suksdorfii (Sarg.) Kruschke	8	0.5	0.8	0	5	M
Berberis nervosa	4	0.5	0.1	0	1	
Ilex aquifolium*	3	0.5	0.1	0	1	
Pyrus communis*	3	0.5	0.1	0	1	
Pyrus spp*	3	0.5	0.0	0	0	
Rubus parviflorus	3	0.5	0.1	0	1	
Viburnum ellipticum	3	0.5	0.1	0	1	H
Cornus nuttallii	1	0.5	0.3	0	3	
Genista monspessulana*	1	0.5	0.0	0	0	
Philadelphus lewisii Pursh var. gordonianus (Lindl.) Jeps.	1	0.5	0.1	0	1	L
Physocarpus capitatus	1	0.5	0.2	0	2	
Prunus mahaleb*	1	0.5	0.1	0	1	
Prunus virginiana L. var. demissa (Nuttall) Torr.	1	0.5	1.2	0	10	L
Rosa pisocarpa	1	0.5	0.1	0	1	M
Taxus brevifolia	1	0.5	0.5	0	4	
Graminoid						
Dactylis glomerata*	73	1.9	3.3	0	15	
Elymus glaucus	57	1.8	3.2	0	15	M
Cynosurus echinatus*	51	2.8	6.7	0	35	
Festuca arundinacea*	47	3.2	10.8	0	65	
Bromus carinatus	33	0.5	1.6	0	13	H

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Holcus lanatus*	29	1.2	5.9	0	50	
Brachypodium sylvaticum*	28	5.3	18.8	0	90	
Bromus sitchensis	28	0.5	0.4	0	2	M
Poa pratensis*	24	0.5	0.4	0	2	
Poa spp	15	0.5	0.5	0	3	
Bromus rigidus*	13	0.5	6.4	0	55	
Bromus vulgaris	13	0.5	4.0	0	35	L
Poa trivialis*	13	0.5	2.3	0	20	
Arrhenatherum elatius*	12	0.5	3.6	0	30	
Carex spp	12	0.5	0.1	0	1	
Phleum pratense*	12	0.5	0.5	0	4	
Cynosurus cristatus*	11	0.5	0.4	0	2	
Juncus effusus L. ssp. pacificus (Fernald & Wiegand) Lint ex Zika	11	0.5	0.2	0	1	L
Poa compressa*	11	0.5	0.1	0	1	
Melica subulata (Griesb.) Scrib. var. subulata	8	0.5	0.2	0	1	L
Aira caryophyllea*	7	0.5	0.3	0	2	
Bromus commutatus*	7	0.5	0.6	0	5	
Lolium multiflorum*	7	0.5	0.6	0	5	
Luzula comosa	7	0.5	0.1	0	1	M
Agrostis hallii Vasey var. hallii	5	0.5	0.2	0	2	H
Agrostis stolonifera*	5	0.5	1.8	0	15	
Bromus mollis*	5	0.5	0.5	0	4	
Carex deweyana Schwein. ssp. leptopoda (Mack.) Calder & Roy	5	0.5	0.1	0	1	L
Danthonia californica Bolander var. americana (Scribner) A.S. Hitchc.	5	0.5	0.2	0	2	H
Festuca spp	5	0.5	1.3	0	10	
Agrostis capillaris*	4	0.5	3.6	0	30	
Anthoxanthum odoratum*	4	0.5	3.6	0	30	
Festuca californica Vasey var. californica	3	0.5	0.4	0	3	M
Bromus sterilis*	1	0.5	0.1	0	1	
Festuca roemeri	1	0.5	0.1	0	1	H
Hordeum brachyantherum Nevski ssp. brachyantherum	1	0.5	0.1	0	1	M
Melica smithii	1	0.5	0.5	0	4	
Vulpia bromoides*	1	0.5	0.1	0	1	
Forb						
Sanicula crassicaulis Poepp. ex DC. var. crassicaulis	79	0.5	0.4	0	2	L
Osmorhiza berteroi	75	0.5	0.9	0	5	L
Hypericum perforatum*	64	0.5	0.3	0	2	
Galium aparine L. var. echinospermum (Wallr.) Farw.	49	0.5	0.4	0	2	L
Torilis arvensis*	48	0.5	1.1	0	8	
Vicia sativa*	47	0.5	1.4	0	10	
Clinopodium douglasii	41	0.5	1.0	0	8	L
Fragaria virginiana Duchesne var. platypetala (Rydb.) H.M. Hall	39	0.5	0.4	0	3	H
Geranium lucidum*	39	2.8	7.5	0	40	
Adenocaulon bicolor	36	0.5	1.2	0	10	L
Claytonia sibirica	36	0.5	0.7	0	5	L

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Ligusticum apiifolium	27	0.5	2.4	0	20	H
Fragaria vesca L. ssp. bracteata (Heller) Staudt	25	0.5	0.4	0	3	M
Geranium dissectum*	25	0.5	2.6	0	20	
Cynoglossum grande	19	0.5	0.2	0	1	H
Leucanthemum vulgare*	19	0.5	0.5	0	3	
Sidalcea spp	17	0.5	0.2	0	1	H
Sidalcea virgata	17	0.5	0.2	0	1	H
Cirsium vulgare*	16	0.5	0.2	0	1	
Frangula purshiana	16	0.5	1.2	0	10	
Senecio jacobaea*	16	0.5	0.1	0	1	
Vicia spp	16	0.5	0.2	0	1	
Iris tenax Douglas ex Lindl. var. tenax	15	0.5	0.2	0	1	M
Nemophila parviflora Douglas ex Benth. var. parviflora	15	0.5	0.2	0	1	L
Prunella vulgaris	13	0.5	0.3	0	2	H
Stellaria media*	13	0.5	0.2	0	1	
Goodyera oblongifolia	12	0.5	0.1	0	1	
Perideridia spp	12	0.5	0.8	0	7	H
Tellima grandiflora	12	0.5	0.3	0	2	L
Vicia hirsuta*	12	0.5	1.7	0	15	
Circaea alpina L. ssp. pacifica (Asch. & Magnus) P.H. Raven	11	0.5	0.1	0	1	L
Cytisus scoparius*	11	0.5	0.5	0	4	
Galium triflorum	11	0.5	0.2	0	1	
Lapsana communis*	11	0.5	0.3	0	2	
Vicia americana	11	0.5	0.3	0	2	M
Achillea millefolium	9	0.5	0.2	0	1	M
Lathyrus aphaca*	9	0.5	1.7	0	15	
Camassia quamash (Pursh) Greene ssp. maxima Gould	8	0.5	2.9	0	25	H
Cirsium arvense*	8	0.5	0.2	0	1	
Daucus carota*	8	0.5	0.4	0	3	
Moehringia macrophylla	8	0.5	0.1	0	1	L
Cardamine oligosperma Nuttall var. oligosperma	7	0.5	0.1	0	1	L
Prunella vulgaris ssp. lanceolata	7	0.5	0.1	0	1	M
Trientalis latifolia	7	0.5	0.1	0	1	L
Vancouveria hexandra	7	0.5	0.1	0	1	L
Calocedrus decurrens	5	0.5	1.2	0	10	M
Centaurium erythraea*	5	0.5	0.1	0	1	
Collomia heterophylla	5	0.5	0.1	0	1	L
Lactuca serriola*	5	0.5	0.1	0	1	
Madia sativa	5	0.5	0.1	0	1	M
Melissa officinalis*	5	0.5	0.2	0	1	
Mycelis muralis*	5	0.5	0.1	0	1	
Plantago lanceolata*	5	0.5	0.5	0	4	
Rumex crispus*	5	0.5	0.1	0	1	
Sonchus asper*	5	0.5	0.1	0	1	
Synthyris reniformis (Douglas ex Benth.) Benth. var. reniformis	5	0.5	0.1	0	1	M
Aquilegia formosa	4	0.5	0.2	0	2	M
Delphinium menziesii	4	0.5	0.1	0	1	H
Digitalis purpurea*	4	0.5	0.1	0	1	
Eriophyllum lanatum (Pursh) J. Forbes var. leucophyllum (DC) W.R. Carter)	4	0.5	0.1	0	1	H

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Erythronium oregonum Applegate ssp. leucandrum (Applegate) Applegate	4	0.5	0.1	0	1	M
Geranium robertianum*	4	0.5	1.8	0	15	
Heracleum lanatum	4	0.5	0.1	0	1	L
Hypochaeris radicata*	4	0.5	0.1	0	1	
Iris spp	4	0.5	0.1	0	1	M
Plectritis congesta (Lindl.) DC. var. congesta	4	0.5	0.1	0	1	H
Prunella vulgaris ssp. vulgaris*	4	0.5	0.2	0	2	
Rumex acetosella*	4	0.5	0.1	0	1	
Senecio vulgaris*	4	0.5	0.1	0	1	
Allium acuminatum	3	0.5	0.1	0	1	H
Allium spp	3	0.5	0.1	0	1	H
Anthriscus caucalis*	3	0.5	0.1	0	1	
Arctium minus*	3	0.5	0.4	0	3	
Balsamorhiza deltoidea	3	0.5	0.1	0	1	H
Cerastium glomeratum*	3	0.5	0.1	0	1	
Claytonia parviflora Douglas ex Hook. ssp. parviflora	3	0.5	0.1	0	1	M
Claytonia perfoliata Donn ex Willd. ssp. perfoliata	3	0.5	0.1	0	1	M
Delphinium leucophaeum	3	0.5	0.1	0	1	H
Galium oreganum	3	0.5	0.1	0	1	
Galium parisiense*	3	0.5	0.1	0	1	
Geranium molle*	3	0.5	0.1	0	1	
Geum macrophyllum Willd. var. macrophyllum	3	0.5	0.1	0	1	L
Lonicera ciliosa	3	0.5	0.1	0	1	L
Mentha puleguim*	3	0.5	0.1	0	1	
Piperia elegans ssp. elegans	3	0.5	0.1	0	1	M
Plantago major*	3	0.5	0.1	0	1	
Ranunculus occidentalis Nuttall var. occidentalis	3	0.5	0.1	0	1	H
Taraxacum officinale*	3	0.5	0.1	0	1	
Thalictrum occidentale A. Gray var. occidentale	3	0.5	0.1	0	1	L
Vicia cracca*	3	0.5	0.2	0	2	
Vicia disperma*	3	0.5	0.1	0	1	
Viola glabella	3	0.5	0.1	0	1	
Apocynum spp	1	0.5	0.0	0	0	M
Arctium lappa*	1	0.5	0.2	0	2	
Brassica rapa*	1	0.5	0.1	0	1	
Brodiaea coronaria (Salisb.) Engl. ssp. coronaria	1	0.5	0.0	0	0	H
Brodiaea elegans Hoover ssp. hooveri Niehaus	1	0.5	0.1	0	1	H
Brodiaea spp	1	0.5	0.1	0	1	
Calochortus tolmiei	1	0.5	0.1	0	1	H
Centaurea cyanus*	1	0.5	0.1	0	1	
Centaurium muehlenbergii	1	0.5	0.1	0	1	H
Collinsia parviflora	1	0.5	0.1	0	1	H
Comandra umbellata (L.) Nuttall var. californica (Eastw.) C.L. Hitchc.	1	0.5	0.0	0	0	H
Corallorhiza maculata	1	0.5	0.0	0	0	
Crepis capillaris*	1	0.5	0.1	0	1	
Crepis setosa*	1	0.5	0.1	0	1	
Delphinium spp	1	0.5	0.0	0	0	
Dianthus armeria*	1	0.5	0.1	0	1	
Epilobium ciliatum Raf. ssp. watsonii (Barbey) Hoch & P.H. Raven	1	0.5	0.1	0	1	L
Heuchera micrantha Douglas ex Lindl. var.	1	0.5	0.3	0	3	M

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
micrantha						
Hypopitys monotropa	1	0.5	0.1	0	1	
Lamium purpureum*	1	0.5	0.1	0	1	
Lathyrus sphaericus*	1	0.5	0.1	0	1	
Linum bienne*	1	0.5	0.1	0	1	
Lotus corniculatus*	1	0.5	0.1	0	1	
Lysimachia nummularia*	1	0.5	0.1	0	1	
Madia gracilis	1	0.5	0.1	0	1	H
Madia madioides	1	0.5	0.1	0	1	
Madia spp	1	0.5	0.1	0	1	
Maianthemum racemosum (L.) Link ssp. amplexicaule (Nuttall) LaFrankie	1	0.5	0.1	0	1	
Mimulus spp	1	0.5	0.1	0	1	
Navarretia spp	1	0.5	0.0	0	0	
Oxalis spp	1	0.5	0.1	0	1	
Oxalis suksdorfii	1	0.5	0.1	0	1	M
Parentucellia viscosa*	1	0.5	0.2	0	2	
Potentilla gracilis Douglas ex Hook. var. gracilis	1	0.5	0.3	0	3	H
Potentilla spp	1	0.5	0.3	0	3	
Ranunculus orthorhynchus Hook. var. orthorhynchus	1	0.5	0.0	0	0	H
Sherardia arvensis*	1	0.5	0.1	0	1	
Silene noctiflora*	1	0.5	0.1	0	1	
Tolmiea menziesii	1	0.5	0.0	0	0	
Tonella tenella	1	0.5	0.1	0	1	H
Trifolium pratense*	1	0.5	0.0	0	0	
Trifolium repens*	1	0.5	0.1	0	1	
Trillium albidum	1	0.5	0.1	0	1	M
Trillium ovatum	1	0.5	0.0	0	0	
Triteleia hyacinthina	1	0.5	0.0	0	0	H
Vicia tetrasperma*	1	0.5	1.2	0	10	
Yabea microcarpa (Hook. & Arn.) Koso-Pol.	1	0.5	0.2	0	2	H
Fern						
Polystichum munitum	67	1.0	1.7	0	8	L
Polypodium glycyrrhiza	29	0.5	1.1	0	8	L
Pteridium aquilinum (L.) Kuhn var. pubescens Underw.	15	0.5	0.4	0	3	L
Dryopteris arguta	11	0.5	1.4	0	10	H
Athyrium filix-femina	1	0.5	0.1	0	1	
Vine						
Lonicera hispidula (Lindl.) Douglas ex Torr. & A. Gray var. hispidula	47	0.5	1.0	0	5	M
Marah oreganus	9	0.5	0.1	0	1	M
Hedera helix*	3	1.1	9.2	0	80	

Association 5: *Quercus garryana – Acer macrophyllum –* (*Pseudotsuga menziesii*) / *Toxicodendron diversilobum* Forest

Oregon White Oak – Big Leaf Maple – (Douglas-fir) / Poison Oak

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
*** non-native species**						
Shrub						
Symphoricarpos albus (L.) Blake var. laevigatus (Fern.) Blake	80	20	27.7	0	85	L
Toxicodendron diversilobum	73	5	7.2	0	20	M
Rubus ursinus Cham. & Schltdl. var. macropetalus (Douglas ex Hook.) Britton	67	4	8.0	0	27	L
Oemleria cerasiformis	60	2	2.7	0	10	L
Corylus cornuta	53	2	2.3	0	7	L
Rosa gymnocarpa	47	1	3.8	0	15	L
Amelanchier alnifolia (Nuttall) Nuttall ex M. Roem. var. semiintegrifolia (Hook.) C.L. Hitchc.	40	1.2	1.9	0	5	M
Holodiscus discolor	40	4	11.5	0	45	L
Crataegus monogyna*	27	0.5	0.8	0	3	
Berberis aquifolium	20	0.5	0.3	0	1	M
Crataegus suksdorfii (Sarg.) Kruschke	20	0.5	0.3	0	1	M
Frangula purshiana	20	0.5	0.3	0	1	L
Philadelphus lewisii Pursh var. gordonianus (Lindl.) Jeps.	20	0.5	0.3	0	1	L
Prunus avium*	20	0.5	1.0	0	4	
Rubus discolor*	20	0.5	0.6	0	2	
Rubus parviflorus	20	0.5	1.6	0	6	
Gaultheria shallon	13	2	7.7	0	30	
Ilex aquifolium*	13	0.5	0.5	0	2	
Prunus virginiana L. var. demissa (Nuttall) Torr.	13	0.5	0.8	0	3	L
Rosa eglanteria*	13	0.5	0.2	0	1	
Berberis nervosa	7	0.5	0.5	0	2	
Ribes sanguineum Pursh var. sanguineum	7	0.5	0.1	0	1	L
Vaccinium parvifolium	7	0.5	0.5	0	2	
Graminoid						
Bromus sitchensis	33	0.5	0.8	0	3	M
Carex deweyana Schwein. ssp. leptopoda (Mack.) Calder & Roy	20	0.5	0.2	0	1	L
Brachypodium sylvaticum*	13	6	23.2	0	90	
Elymus glaucus	13	0.5	0.2	0	1	M
Bromus vulgaris	7	0.5	0.1	0	1	L
Festuca arundinacea*	7	0.5	0.0	0	0	
Melica subulata (Griesb.) Scrib. var. subulata	7	0.5	0.0	0	0	L
Forb						
Galium aparine L. var. echinospermum (Wallr.) Farw.	73	0.5	1.2	0	4	L
Osmorhiza berteroi	60	0.5	0.7	0	2	L

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Tellima grandiflora	47	0.5	2.5	0	10	L
Clinopodium douglasii	27	0.5	0.6	0	2	L
Geranium lucidum*	27	0.5	1.6	0	5	
Hypericum perforatum*	27	0.5	0.2	0	1	
Nemophila parviflora Douglas ex Benth. var. parviflora	27	0.5	0.3	0	1	L
Sanicula crassicaulis Poepp. ex DC. var. crassicaulis	27	0.5	0.8	0	3	L
Trientalis latifolia	27	0.5	0.5	0	2	L
Adenocaulon bicolor	20	0.5	3.1	0	12	L
Cardamine oligosperma Nuttall var. oligosperma	20	0.5	0.2	0	1	L
Claytonia sibirica	20	3	10.3	0	40	L
Frangula purshiana	20	0.5	0.3	0	1	
Moehringia macrophylla	20	0.5	0.5	0	2	L
Torilis arvensis*	20	0.5	0.2	0	1	
Fragaria virginiana Duchesne var. platypetala (Rydb.) H.M. Hall	13	0.5	0.0	0	0	H
Lapsana communis*	13	0.5	0.8	0	3	
Ligusticum apiifolium	13	0.5	0.2	0	1	H
Lonicera ciliosa	13	0.5	0.3	0	1	L
Trillium ovatum	13	0.5	0.0	0	0	
Cardamine nuttallii	7	0.5	0.0	0	0	
Cytisus scoparius*	7	0.5	0.5	0	2	
Dipsacus fullonum*	7	0.5	0.0	0	0	
Erythronium oregonum Applegate ssp. leucandrum (Applegate) Applegate	7	0.5	0.0	0	0	M
Fragaria vesca L. ssp. bracteata (Heller) Staudt	7	0.5	0.0	0	0	M
Galium triflorum	7	0.5	0.1	0	1	
Geranium robertianum*	7	0.5	0.8	0	3	
Heracleum lanatum	7	0.5	0.1	0	1	L
Hydrophyllum occidentale	7	0.5	1.0	0	4	
Hypopitys monotropa	7	0.5	0.1	0	1	
Lunaria annua*	7	0.5	0.1	0	1	
Maianthemum stellatum	7	0.5	0.3	0	1	L
Mentha puleguim*	7	0.5	0.1	0	1	
Ranunculus occidentalis Nuttall var. occidentalis	7	0.5	0.1	0	1	H
Streptopus amplexifolius var. americanus	7	0.5	0.1	0	1	
Tonella tenella	7	0.5	0.0	0	0	H
Vicia americana	7	0.5	0.1	0	1	M
Vicia sativa*	7	0.5	0.1	0	1	
Fern						
Polystichum munitum	87	7	10.8	0	40	L
Polypodium glycyrrhiza	53	0.5	1.1	0	4	L
Dryopteris arguta	7	0.5	0.5	0	2	H
Pteridium aquilinum (L.) Kuhn var. pubescens Underw.	7	0.5	0.5	0	2	L
Vine						
Hedera helix*	20	1	5.2	0	20	

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Lonicera hispidula (Lindl.) Douglas ex Torr. & A. Gray var. hispidula	13	0.5	1.0	0	4	M

Association 6: *Quercus garryana* / *Toxicodendron diversilobum* / *Elymus glaucus* Woodland

Oregon White Oak / Poison Oak / Blue Wildrye

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
*** non-native species**						
Shrub						
Toxicodendron diversilobum	96	14	20.5	0	85	M
Rosa eglanteria*	53	0.5	1.1	0	5	
Symphoricarpos albus (L.) Blake var. laevigatus (Fern.) Blake	44	0.5	1.7	0	10	L
Amelanchier alnifolia (Nuttall) Nuttall ex M. Roem. var. semiintegrifolia (Hook.) C.L. Hitchc.	31	0.5	1.4	0	10	M
Crataegus monogyna*	29	0.5	0.7	0	4	
Rubus discolor*	25	0.5	1.1	0	5	
Oemleria cerasiformis	16	0.5	0.7	0	4	L
Berberis aquifolium	15	0.5	0.5	0	2	M
Holodiscus discolor	15	0.5	1.1	0	7	L
Frangula purshiana	7	0.5	0.1	0	1	L
Prunus avium*	7	0.5	0.8	0	5	
Prunus virginiana L. var. demissa (Nuttall) Torr.	7	0.5	0.7	0	4	L
Rosa gymnocarpa	7	0.5	0.1	0	1	L
Corylus cornuta	5	0.5	0.7	0	5	L
Rubus laciniatus*	5	0.5	0.1	0	1	
Rubus ursinus Cham. & Schltdl. var. macropetalus (Douglas ex Hook.) Britton	4	0.5	0.3	0	2	L
Berberis nervosa	2	0.5	0.1	0	1	
Crataegus suksdorfii (Sarg.) Kruschke	2	0.5	0.1	0	1	M
Malus sylvestris*	2	0.5	0.1	0	1	
Philadelphus lewisii Pursh var. gordonianus (Lindl.) Jeps.	2	0.5	0.1	0	1	L
Pyrus communis*	2	0.5	0.1	0	1	
Pyrus spp*	2	0.5	0.1	0	1	
Graminoid						
Cynosurus echinatus*	84	13	12.2	0	45	
Dactylis glomerata*	80	4	6.8	0	30	
Elymus glaucus	73	6	8.3	0	40	M
Festuca arundinacea*	45	6	10.5	0	40	
Bromus carinatus	42	1	2.9	0	20	H
Lolium multiflorum*	31	2	8.6	0	60	
Bromus rigidus*	29	0.5	1.2	0	5	
Arrhenatherum elatius*	24	4	11.4	0	70	
Bromus sitchensis	22	0.5	1.5	0	10	M
Poa spp	18	0.5	0.9	0	5	
Poa pratensis*	15	0.5	1.0	0	5	
Bromus commutatus*	13	0.5	0.3	0	2	
Bromus mollis*	13	0.5	1.2	0	5	
Holcus lanatus*	13	0.5	0.3	0	2	

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Phleum pratense*	13	0.5	0.4	0	3	
Aira caryophyllea*	11	0.5	0.3	0	2	
Carex spp	11	0.5	0.2	0	1	
Poa compressa*	11	0.5	0.2	0	1	
Poa trivialis*	11	0.5	2.1	0	15	
Danthonia californica Bolander var. americana (Scribner) A.S. Hitchc.	9	0.5	0.3	0	2	H
Taeniatherum caput-medusae*	9	0.5	1.5	0	10	
Achnatherum lemmonii	7	0.5	0.1	0	1	H
Agrostis capillaris*	7	1	6.1	0	40	
Festuca roemeri	7	0.5	1.0	0	5	H
Avena fatua*	5	0.5	0.2	0	1	
Brachypodium sylvaticum*	5	0.5	0.8	0	5	
Bromus vulgaris	5	1	8.8	0	65	L
Melica subulata (Griesb.) Scrib. var. subulata	5	0.5	0.3	0	2	L
Vulpia bromoides*	5	0.5	0.2	0	2	
Anthoxanthum odoratum*	4	0.5	0.1	0	1	
Carex deweyana Schwein. ssp. leptopoda (Mack.) Calder & Roy	4	0.5	0.3	0	2	L
Festuca occidentalis	4	0.5	0.2	0	1	L
Juncus effusus L. ssp. pacificus (Fernald & Wiegand) Lint ex Zika	4	0.5	0.1	0	1	L
Koeleria macrantha	4	0.5	0.3	0	2	H
Poa secunda	4	0.5	0.1	0	1	H
Agrostis stolonifera*	2	0.5	3.4	0	25	
Bromus sterilis*	2	0.5	2.0	0	15	
Cynosurus cristatus*	2	0.5	0.4	0	3	
Deschampsia cespitosa (L.) P. Beauv. var. cespitosa	2	0.5	0.1	0	1	M
Festuca spp	2	0.5	0.4	0	3	
Hordeum murinum*	2	0.5	0.1	0	1	
Juncus patens	2	0.5	0.3	0	2	M
Lolium perenne*	2	0.5	0.1	0	1	
Luzula comosa	2	0.5	0.1	0	1	M
Vulpia myuros*	2	0.5	0.4	0	3	
Forb						
Torilis arvensis*	64	1	2.3	0	10	
Hypericum perforatum*	62	0.5	0.3	0	1	
Sanicula crassicaulis Poepp. ex DC. var. crassicaulis	62	0.5	3.4	0	25	L
Galium aparine L. var. echinospermum (Wallr.) Farw.	51	0.5	0.7	0	4	L
Geranium dissectum*	47	1	3.0	0	20	
Vicia sativa*	45	0.5	0.7	0	3	
Osmorhiza berteroi	35	0.5	0.3	0	1	L
Vicia hirsuta*	33	0.5	0.8	0	5	
Geranium lucidum*	31	1	3.0	0	20	
Achillea millefolium	29	0.5	0.2	0	1	M
Cirsium vulgare*	22	0.5	0.2	0	1	
Fragaria virginiana Duchesne var. platypetala (Rydb.) H.M. Hall	20	0.5	0.2	0	1	H
Daucus carota*	18	0.5	0.5	0	3	
Anthriscus caucalis*	16	0.5	0.7	0	5	

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Linum bienne*	15	0.5	2.4	0	15	
Madia gracilis	15	0.5	0.4	0	2	H
Senecio jacobaea*	15	0.5	0.2	0	1	
Brodiaea coronaria (Salisb.) Engl. ssp. coronaria	13	0.5	0.2	0	1	H
Eriophyllum lanatum (Pursh) J. Forbes var. leucophyllum (DC) W.R. Carter)	13	0.5	0.2	0	1	H
Fragaria vesca L. ssp. bracteata (Heller) Staudt	13	0.5	0.2	0	1	M
Lapsana communis*	13	0.5	0.7	0	5	
Plantago lanceolata*	13	0.5	0.2	0	1	
Sonchus asper*	13	0.5	0.2	0	1	
Vicia spp	13	0.5	0.3	0	2	
Clinopodium douglasii	11	0.5	0.2	0	1	L
Cynoglossum grande	11	0.5	0.1	0	1	H
Cytisus scoparius*	11	0.5	0.5	0	3	
Brodiaea congestum	9	0.5	0.1	0	1	H
Cerastium glomeratum*	9	0.5	0.1	0	1	
Dichelostemma congestum	9	0.5	0.1	0	1	H
Leucanthemum vulgare*	9	0.5	0.1	0	1	
Ligusticum apiifolium	9	0.5	0.1	0	1	H
Sidalcea spp	9	0.5	0.2	0	1	H
Sidalcea virgata	9	0.5	0.2	0	1	H
Allium acuminatum	7	0.5	0.2	0	1	H
Allium spp	7	0.5	0.2	0	1	H
Arctium minus*	7	0.5	0.2	0	1	
Calocedrus decurrens	7	0.5	0.7	0	5	M
Clarkia spp	7	0.5	0.1	0	1	H
Frangula purshiana	7	0.5	0.1	0	1	
Galium parisiense*	7	0.5	0.3	0	2	
Lathyrus aphaca*	7	0.5	0.1	0	1	
Madia spp	7	0.5	0.1	0	1	
Nemophila parviflora Douglas ex Benth. var. parviflora	7	0.5	0.1	0	1	L
Ranunculus occidentalis Nuttall var. occidentalis	7	0.5	0.1	0	1	H
Triteleia hyacinthina	7	0.5	0.1	0	1	H
Vicia americana	7	0.5	0.3	0	2	M
Vicia tetrasperma*	7	0.5	0.1	0	1	
Brodiaea elegans Hoover ssp. hooveri Niehaus	5	0.5	0.1	0	1	H
Claytonia sibirica	5	0.5	0.1	0	1	L
Dianthus armeria*	5	0.5	0.1	0	1	
Lathyrus sphaericus*	5	0.5	0.1	0	1	
Potentilla gracilis Douglas ex Hook. var. gracilis	5	0.5	0.1	0	1	H
Potentilla spp	5	0.5	0.1	0	1	
Rumex acetosella*	5	0.5	0.1	0	1	
Stellaria media*	5	0.5	0.2	0	1	
Taraxacum officinale*	5	0.5	0.1	0	1	
Tellima grandiflora	5	0.5	0.1	0	1	L
Tonella tenella	5	0.5	0.1	0	1	H
Adenocaulon bicolor	4	0.5	0.3	0	2	L
Calochortus tolmiei	4	0.5	0.1	0	1	H
Camassia quamash (Pursh) Greene ssp. maxima Gould	4	0.5	0.2	0	1	H
Cardamine oligosperma Nuttall var. oligosperma	4	0.5	0.1	0	1	L
Centaurium erythraea*	4	0.5	0.5	0	4	
Collinsia parviflora	4	0.5	0.1	0	1	H

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Geranium molle*	4	0.5	0.1	0	1	
Hypochaeris radicata*	4	0.5	0.1	0	1	
Iris tenax Douglas ex Lindl. var. tenax	4	0.5	0.1	0	1	M
Lactuca serriola*	4	0.5	0.3	0	2	
Madia sativa	4	0.5	0.1	0	1	M
Mimulus spp	4	0.5	0.1	0	1	
Rumex conglomeratus*	4	0.5	0.1	0	1	
Rumex crispus*	4	0.5	0.1	0	1	
Sherardia arvensis*	4	0.5	0.1	0	1	
Synthyris reniformis (Douglas ex Benth.) Benth. var. reniformis	4	0.5	0.1	0	1	M
Trifolium repens*	4	0.5	1.3	0	10	
Vicia cracca*	4	0.5	0.2	0	1	
Anthemis cotula*	2	0.5	0.1	0	1	
Carduus pycnocephalus*	2	0.5	0.1	0	1	
Centaurea cyanus*	2	0.5	0.7	0	5	
Circaea alpina L. ssp. pacifica (Asch. & Magnus) P.H. Raven	2	0.5	0.1	0	1	L
Cirsium arvense*	2	0.5	0.1	0	1	
Claytonia perfoliata Donn ex Willd. ssp. perfoliata	2	0.5	0.1	0	1	M
Collomia heterophylla	2	0.5	0.1	0	1	L
Comandra umbellata (L.) Nuttall var. californica (Eastw.) C.L. Hitchc.	2	0.5	0.1	0	1	H
Crepis setosa*	2	0.5	0.1	0	1	
Daucus pusillus	2	0.5	0.2	0	2	H
Delphinium leucophaeum	2	0.5	0.1	0	1	H
Delphinium menziesii	2	0.5	0.1	0	1	H
Delphinium spp	2	0.5	0.1	0	1	
Eriogonum spp	2	0.5	0.1	0	1	
Erythronium oregonum Applegate ssp. leucandrum (Applegate) Applegate	2	0.5	0.1	0	1	M
Geum macrophyllum Willd. var. macrophyllum	2	0.5	0.1	0	1	L
Heracleum lanatum	2	0.5	0.1	0	1	L
Iris chrysophylla	2	0.5	0.1	0	1	M
Kickxia elatine*	2	0.5	0.1	0	1	
Lathyrus latifolius*	2	0.5	0.1	0	1	
Lunaria annua*	2	0.5	0.3	0	2	
Madia madioides	2	0.5	0.1	0	1	
Medicago lupulina*	2	0.5	0.1	0	1	
Mentha puleguim*	2	0.5	0.1	0	1	
Moehringia macrophylla	2	0.5	0.1	0	1	L
Piperia elegans ssp. elegans	2	0.5	0.1	0	0	M
Plectritis congesta (Lindl.) DC. var. congesta	2	0.5	0.1	0	1	H
Sidalcea campestris	2	0.5	0.1	0	0	H
Sisymbrium officinale*	2	0.5	0.1	0	1	
Tragopogon dubius*	2	0.5	0.1	0	1	
Tragopogon porrifolius*	2	0.5	0.1	0	1	
Trifolium dubium*	2	0.5	0.1	0	1	
Trillium ovatum	2	0.5	0.1	0	1	
Triteleia grandiflora ssp. howellii	2	0.5	0.1	0	1	H
Vancouveria hexandra	2	0.5	0.1	0	1	L
Verbascum thapsus*	2	0.5	0.1	0	1	
Vinca major*	2	0.5	0.1	0	1	

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Fern						
Polystichum munitum	18	0.5	0.9	0	6	L
Polypodium glycyrrhiza	16	0.5	0.2	0	1	L
Dryopteris arguta	11	0.5	0.5	0	2	H
Pentagramma triangularis (Kaulf.) Yatsk., Windham, E. Wollenw. ssp. triangularis	4	0.5	0.1	0	1	H
Polystichum imbricans imbricans	2	0.5	0.1	0	0	H
Vine						
Lonicera hispidula (Lindl.) Douglas ex Torr. & A. Gray var. hispidula	40	0.5	0.9	0	4	M
Marah oreganus	7	0.5	0.2	0	1	M

Association 7: *Quercus garryana* / *Toxicodendron diversilobum* / *Danthonia californica* - *Elymus glaucus* Savanna

Oregon White Oak / Poison Oak / California oatgrass - Blue Wildrye

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
*** non-native species**						
Shrub						
Toxicodendron diversilobum	92	2	1.7	0	6	M
Rosa eglanteria*	66	0.5	0.3	0	1	
Amelanchier alnifolia (Nuttall) Nuttall ex M. Roem. var. semiintegrifolia (Hook.) C.L. Hitchc.	45	0.5	0.5	0	2	M
Rubus discolor*	39	0.5	1.9	0	10	
Crataegus monogyna*	37	0.5	1.1	0	5	
Rubus ursinus Cham. & Schltdl. var. macropetalus (Douglas ex Hook.) Britton	11	0.5	0.2	0	1	L
Symphoricarpos albus (L.) Blake var. laevigatus (Fern.) Blake	11	0.5	0.5	0	3	L
Oemleria cerasiformis	8	0.5	0.3	0	2	L
Berberis aquifolium	5	0.5	0.2	0	1	M
Corylus cornuta	5	0.5	0.2	0	1	L
Rosa gymnocarpa	5	0.5	0.1	0	1	L
Arctostaphylos uva-ursi	3	0.5	0.3	0	2	M
Crataegus suksdorfii (Sarg.) Kruschke	3	0.5	0.5	0	3	M
Holodiscus discolor	3	0.5	0.3	0	2	L
Pyrus communis*	3	0.5	0.1	0	1	
Pyrus spp*	3	0.5	0.1	0	1	
Rubus laciniatus*	3	0.5	0.1	0	1	
Viburnum ellipticum	3	0.5	0.1	0	1	H
Graminoid						
Cynosurus echinatus*	95	15	12.2	0	40	
Danthonia californica Bolander var. americana (Scribner) A.S. Hitchc.	84	2	2.8	0	13	H
Elymus glaucus	74	2	4.2	0	25	M
Aira caryophyllea*	68	3	4.5	0	20	
Bromus rigidus*	68	4	8.8	0	40	
Taeniatherum caput-medusae*	66	6	9.9	0	35	
Bromus mollis*	55	5	7.1	0	20	
Dactylis glomerata*	55	2	5.8	0	35	
Festuca arundinacea*	55	5	9.5	0	30	
Arrhenatherum elatius*	47	9	16.2	0	75	
Poa pratensis*	45	0.5	0.8	0	3	
Bromus carinatus	39	1	3.8	0	20	H
Bromus commutatus*	34	0.5	1.8	0	10	
Holcus lanatus*	34	3	11.8	0	60	
Avena fatua*	32	0.5	0.8	0	4	
Carex spp	29	0.5	1.0	0	5	
Luzula comosa	29	0.5	0.3	0	1	M
Lolium multiflorum*	26	0.5	1.0	0	5	
Vulpia bromoides*	26	0.5	0.8	0	4	

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Poa trivialis*	21	0.5	2.5	0	15	
Achnatherum lemmonii	16	0.5	3.3	0	20	H
Anthoxanthum odoratum*	16	0.5	3.2	0	20	
Brachypodium sylvaticum*	16	2	10.9	0	65	
Briza media*	13	0.5	0.5	0	3	
Festuca occidentalis	13	0.5	0.9	0	5	L
Festuca roemeri	13	0.5	0.9	0	4	H
Festuca spp	13	0.5	5.7	0	35	
Phleum pratense*	13	0.5	3.2	0	20	
Poa spp	8	0.5	0.1	0	1	
Agrostis capillaris*	5	2	9.7	0	60	
Bromus sitchensis	5	0.5	0.1	0	1	M
Lolium perenne*	5	0.5	0.9	0	5	
Poa compressa*	5	0.5	0.1	0	1	
Agrostis hallii Vasey var. hallii	3	0.5	0.1	0	1	H
Aira elegans*	3	0.5	0.1	0	1	
Briza minor*	3	0.5	0.3	0	2	
Bromus racemosus*	3	0.5	0.5	0	3	
Carex deweyana Schwein. ssp. leptopoda (Mack.) Calder & Roy	3	0.5	0.1	0	1	L
Cynosurus cristatus*	3	0.5	0.1	0	1	
Elymus trachycaulus (Link) Gould ex Shinners	3	0.5	0.5	0	3	
Koeleria macrantha	3	0.5	1.6	0	10	H
Vulpia microstachys	3	0.5	0.1	0	1	H
Vulpia myuros*	3	0.5	0.2	0	1	
Forb						
Plantago lanceolata*	82	1	2.5	0	15	
Daucus carota*	79	7	11.7	0	45	
Geranium dissectum*	79	2	1.5	0	5	
Linum bienne*	55	2	2.3	0	10	
Hypericum perforatum*	50	0.5	0.3	0	1	
Torilis arvensis*	50	0.5	0.9	0	5	
Achillea millefolium	45	0.5	0.4	0	2	M
Triteleia hyacinthina	45	0.5	0.5	0	3	H
Vicia hirsuta*	42	0.5	2.4	0	15	
Vicia sativa*	42	0.5	0.4	0	2	
Fragaria virginiana Duchesne var. platypetala (Rydb.) H.M. Hall	34	0.5	0.5	0	2	H
Vicia cracca*	34	1	6.5	0	40	
Eriophyllum lanatum (Pursh) J. Forbes var. leucophyllum (DC) W.R. Carter)	32	0.5	0.4	0	2	H
Galium aparine L. var. echinospermum (Wallr.) Farw.	32	0.5	0.3	0	1	L
Hypochaeris radicata*	32	0.5	0.8	0	4	
Sanicula crassicaulis Poepp. ex DC. var. crassicaulis	32	0.5	0.2	0	1	L
Cerastium glomeratum*	29	0.5	0.4	0	2	
Cirsium vulgare*	29	0.5	0.2	0	1	
Sherardia arvensis*	29	0.5	1.6	0	7	
Trifolium dubium*	29	0.5	1.8	0	10	
Galium parisiense*	26	0.5	0.4	0	2	

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Leucanthemum vulgare*	26	0.5	0.7	0	3	
Cytisus scoparius*	21	0.5	1.1	0	5	
Lupinus sulphureus var. kincaidii	21	0.5	0.7	0	3	H
Centaurium erythraea*	18	0.5	0.2	0	1	
Potentilla gracilis Douglas ex Hook. var. gracilis	18	0.5	0.4	0	2	H
Potentilla spp	18	0.5	0.4	0	2	
Rumex acetosella*	18	0.5	0.5	0	2	
Valerianella locusta*	18	0.5	0.8	0	3	
Lathyrus sphaericus*	16	0.5	0.4	0	2	
Madia gracilis	16	0.5	0.5	0	3	H
Prunella vulgaris	16	0.5	0.2	0	1	H
Zigadenus venenosus S. Watson var. venenosus	16	0.5	0.3	0	1	H
Brodiaea coronaria (Salisb.) Engl. ssp. coronaria	13	0.5	0.2	0	1	H
Calochortus tolmiei	13	0.5	0.4	0	2	H
Clarkia spp	13	0.5	0.2	0	1	H
Myosotis discolor*	13	0.5	0.2	0	1	
Ranunculus occidentalis Nuttall var. occidentalis	13	0.5	0.2	0	1	H
Senecio jacobaea*	13	0.5	0.2	0	1	
Tragopogon dubius*	13	0.5	0.2	0	1	
Vicia tetrasperma*	13	0.5	0.4	0	2	
Apocynum spp	11	0.5	0.2	0	1	M
Clinopodium douglasii	11	0.5	0.2	0	1	L
Iris tenax Douglas ex Lindl. var. tenax	11	0.5	0.7	0	4	M
Nemophila parviflora Douglas ex Benth. var. parviflora	11	0.5	0.1	0	1	L
Parentucellia viscosa*	11	0.5	0.2	0	1	
Prunella vulgaris ssp. lanceolata	11	0.5	0.2	0	1	M
Sonchus asper*	11	0.5	0.1	0	1	
Vicia spp	11	0.5	0.2	0	1	
Brodiaea congestum	8	0.5	0.1	0	1	H
Cardamine oligosperma Nuttall var. oligosperma	8	0.5	0.1	0	1	L
Cirsium arvense*	8	0.5	0.1	0	1	
Delphinium menziesii	8	0.5	0.1	0	1	H
Dianthus armeria*	8	0.5	0.1	0	1	
Dichelostemma congestum	8	0.5	0.1	0	1	H
Fragaria vesca L. ssp. bracteata (Heller) Staudt	8	0.5	0.2	0	1	M
Osmorhiza berteroi	8	0.5	0.1	0	1	L
Allium acuminatum	5	0.5	0.1	0	1	H
Allium spp	5	0.5	0.1	0	1	H
Cerastium arvense L. ssp. strictum (L.) Ugborogho	5	0.5	0.1	0	1	H
Collomia heterophylla	5	0.5	0.1	0	1	L
Comandra umbellata (L.) Nuttall var. californica (Eastw.) C.L. Hitchc.	5	0.5	0.3	0	2	H
Convolvulus arvensis*	5	0.5	0.1	0	1	
Epilobium brachycarpum C. Presl	5	0.5	0.1	0	1	M
Galium triflorum	5	0.5	0.1	0	1	
Geranium lucidum*	5	0.5	0.8	0	4	
Iris spp	5	0.5	0.2	0	1	M
Lathyrus sylvestris*	5	0.5	0.1	0	1	
Lithophragma parviflorum (Hook.) Nuttall var. parviflorum	5	0.5	0.1	0	1	H
Lomatium utriculatum	5	0.5	0.1	0	1	H
Lonicera ciliosa	5	0.5	0.1	0	1	L
Madia sativa	5	0.5	0.2	0	1	M

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Madia spp	5	0.5	0.1	0	1	
Medicago lupulina*	5	0.5	0.2	0	1	
Piperia elegans ssp. elegans	5	0.5	0.1	0	1	M
Sanicula bipinnatifida	5	0.5	0.1	0	1	H
Senecio vulgaris*	5	0.5	0.1	0	1	
Sidalcea spp	5	0.5	0.1	0	1	H
Sidalcea virgata	5	0.5	0.1	0	1	H
Stellaria media*	5	0.5	0.1	0	1	
Trifolium microcephalum	5	0.5	0.3	0	2	H
Amsinckia retrorsa	3	0.5	0.1	0	1	M
Aquilegia formosa	3	0.5	0.1	0	1	M
Brodiaea elegans Hoover ssp. hooveri Niehaus	3	0.5	0.1	0	1	H
Brodiaea hyacinthina	3	0.5	0.1	0	1	H
Brodiaea spp	3	0.5	0.0	0	0	
Calocedrus decurrens	3	0.5	0.2	0	1	M
Camassia quamash (Pursh) Greene ssp. maxima Gould	3	0.5	0.2	0	1	H
Carduus pycnocephalus*	3	0.5	0.2	0	1	
Centaurea pratensis*	3	0.5	1.0	0	6	
Cerastium spp*	3	0.5	0.1	0	1	
Claytonia parviflora Douglas ex Hook. ssp. parviflora	3	0.5	0.1	0	1	M
Claytonia perfoliata Donn ex Willd. ssp. perfoliata	3	0.5	0.1	0	1	M
Collinsia parviflora	3	0.5	0.1	0	1	H
Crepis setosa*	3	0.5	0.1	0	1	
Cryptantha leucophaea	3	0.5	0.1	0	1	
Cryptogramma acrostichoides	3	0.5	0.1	0	1	H
Daucus pusillus	3	0.5	0.1	0	1	H
Delphinium leucophaeum	3	0.5	0.2	0	1	H
Dipsacus fullonum*	3	0.5	0.1	0	1	
Eriogonum compositum Douglas Ex Benth. var. compositum	3	0.5	0.1	0	1	H
Erodium cicutarium*	3	0.5	0.1	0	1	
Erythronium oregonum Applegate ssp. leucandrum (Applegate) Applegate	3	0.5	0.0	0	0	M
Geranium molle*	3	0.5	0.1	0	1	
Geranium robertianum*	3	0.5	0.1	0	1	
Lathyrus aphaca*	3	0.5	0.1	0	1	
Ligusticum apiifolium	3	0.5	0.0	0	0	H
Lomatium triternatum (Pursh) J.M. Coult. & Rose var. triternatum	3	0.5	0.1	0	1	H
Madia elegans D. Don ex Lindl. ssp. elegans	3	0.5	0.1	0	1	H
Madia madioides	3	0.5	0.1	0	1	
Perideridia spp	3	0.5	0.1	0	1	H
Plectritis congesta (Lindl.) DC. var. congesta	3	0.5	0.1	0	1	H
Polygonum californicum	3	0.5	0.1	0	1	
Rumex crispus*	3	0.5	0.1	0	1	
Sedum spathulifolium Hook. ssp. spathulifolium	3	0.5	0.2	0	1	H
Sidalcea campestris	3	0.5	0.2	0	1	H
Tanacetum vulgare*	3	0.5	0.5	0	3	
Taraxacum officinale*	3	0.5	0.1	0	1	
Trichostema lanceolatum	3	0.5	0.1	0	1	H
Ventenata dubia*	3	0.5	0.1	0	1	
Verbascum blattaria*	3	0.5	0.0	0	0	

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Vicia americana	3	0.5	0.1	0	1	M
Fern						
Polypodium glycyrrhiza	5	0.5	0.5	0	3	L
Pteridium aquilinum (L.) Kuhn var. pubescens Underw.	5	0.5	0.4	0	2	L
Polystichum munitum	3	0.5	0.0	0	0	L
Vine						
Lonicera hispidula (Lindl.) Douglas ex Torr. & A. Gray var. hispidula	21	0.5	0.2	0	1	M
Marah oreganus	5	0.5	0.2	0	1	M

Association 8: *Quercus garryana / Toxicodendron diversilobum / Cynosurus echinatus – Arrhenatherum elatius* Savanna

Oregon White Oak / Poison Oak / Bristly Dogstail - Tall Oatgrass

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
*** non-native species**						
Shrub						
Toxicodendron diversilobum	52	0.5	1.1	0	3	M
Crataegus monogyna*	29	0.5	1.1	0	5	
Rosa eglanteria*	24	0.5	0.3	0	1	
Rubus ursinus Cham. & Schltdl. var. macropetalus (Douglas ex Hook.) Britton	19	3	13.1	0	60	L
Amelanchier alnifolia (Nuttall) Nuttall ex M. Roem. var. semiintegrifolia (Hook.) C.L. Hitchc.	14	0.5	0.2	0	1	M
Rubus discolor*	14	0.5	0.5	0	2	
Symphoricarpos albus (L.) Blake var. laevigatus (Fern.) Blake	14	0.5	0.5	0	2	L
Frangula purshiana	10	0.5	0.2	0	1	L
Prunus avium*	10	0.5	3.3	0	15	
Crataegus suksdorfii (Sarg.) Kruschke	5	0.5	0.1	0	1	M
Holodiscus discolor	5	0.5	0.1	0	1	L
Oemleria cerasiformis	5	0.5	0.4	0	2	L
Physocarpus capitatus	5	0.5	0.2	0	1	
Rosa spp	5	0.5	0.1	0	1	
Rubus laciniatus*	5	0.5	0.1	0	1	
Graminoid						
Cynosurus echinatus*	81	7	8.5	0	30	
Aira caryophyllea*	52	2	4.7	0	20	
Bromus rigidus*	48	5	10.1	0	35	
Dactylis glomerata*	48	2	5.7	0	25	
Taeniatherum caput-medusae*	48	4	8.2	0	30	
Arrhenatherum elatius*	43	14	24.0	0	85	
Bromus mollis*	43	4	9.4	0	40	
Holcus lanatus*	38	4	10.5	0	45	
Bromus commutatus*	33	2	6.7	0	30	
Elymus glaucus	33	1	2.4	0	10	M
Festuca arundinacea*	33	4	10.6	0	40	
Lolium multiflorum*	33	11	22.7	0	75	
Poa trivialis*	29	3	8.8	0	40	
Bromus carinatus	24	0.5	1.2	0	5	H
Carex spp	24	0.5	0.5	0	2	
Luzula comosa	19	0.5	0.5	0	2	M
Vulpia bromoides*	19	0.5	3.3	0	15	
Agrostis capillaris*	14	6	16.8	0	60	
Poa pratensis*	14	0.5	1.3	0	5	
Achnatherum lemmonii	10	0.5	0.2	0	1	H
Alopecurus pratensis*	10	0.5	0.2	0	1	
Anthoxanthum odoratum*	10	0.5	2.2	0	10	
Briza media*	10	0.5	0.2	0	1	
Koeleria macrantha	10	0.5	0.2	0	1	H

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Phleum pratense*	10	0.5	1.2	0	5	
Aira elegans*	5	0.5	0.4	0	2	
Avena fatua*	5	0.5	0.4	0	2	
Brachypodium sylvaticum*	5	0.5	0.1	0	1	
Briza minor*	5	0.5	0.1	0	1	
Bromus vulgaris	5	0.5	0.2	0	1	L
Cynosurus cristatus*	5	0.5	0.4	0	2	
Elymus trachycaulus (Link) Gould ex Shinners	5	0.5	1.7	0	8	
Festuca californica Vasey var. californica	5	0.5	0.2	0	1	M
Festuca occidentalis	5	0.5	0.1	0	1	L
Melica subulata (Griesb.) Scrib. var. subulata	5	0.5	0.1	0	1	L
Poa compressa*	5	0.5	0.1	0	1	
Poa spp	5	0.5	0.4	0	2	
Forb						
Daucus carota*	62	2	3.5	0	10	
Achillea millefolium	43	0.5	0.4	0	1	M
Torilis arvensis*	43	0.5	0.7	0	2	
Vicia sativa*	43	0.5	0.9	0	4	
Vicia hirsuta*	38	1	4.3	0	20	
Geranium dissectum*	33	0.5	2.0	0	8	
Trifolium dubium*	33	0.5	0.7	0	3	
Eriophyllum lanatum (Pursh) J. Forbes var. leucophyllum (DC) W.R. Carter)	29	0.5	0.3	0	1	H
Galium aparine L. var. echinospermum (Wallr.) Farw.	29	0.5	0.4	0	1	L
Galium parisiense*	29	0.5	0.8	0	3	
Hypericum perforatum*	29	0.5	1.7	0	7	
Linum bienne*	29	0.5	0.8	0	3	
Plantago lanceolata*	29	0.5	0.5	0	2	
Vicia cracca*	29	0.5	0.7	0	2	
Cirsium vulgare*	24	0.5	0.3	0	1	
Leucanthemum vulgare*	24	0.5	3.3	0	15	
Myosotis discolor*	24	0.5	0.3	0	1	
Centaurium erythraea*	19	0.5	0.2	0	1	
Cerastium glomeratum*	19	0.5	0.3	0	1	
Parentucellia viscosa*	19	0.5	0.3	0	1	
Rumex acetosella*	19	0.5	0.4	0	2	
Clarkia spp	14	0.5	0.2	0	1	H
Cytisus scoparius*	14	0.5	0.6	0	3	
Fragaria virginiana Duchesne var. platypetala (Rydb.) H.M. Hall	14	0.5	2.2	0	10	H
Geranium lucidum*	14	0.5	0.8	0	3	
Madia gracilis	14	0.5	0.6	0	2	H
Prunella vulgaris	14	0.5	0.2	0	1	H
Rumex crispus*	14	0.5	0.3	0	1	
Senecio jacobaea*	14	0.5	0.3	0	1	
Sonchus asper*	14	0.5	0.3	0	1	
Valerianella locusta*	14	0.5	0.3	0	1	
Vicia tetrasperma*	14	1	4.4	0	20	
Wyethia angustifolia	14	0.5	0.5	0	2	H
Allium acuminatum	10	0.5	0.2	0	1	H

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Allium spp	10	0.5	0.2	0	1	H
Capsella bursa-pastoris*	10	0.5	0.4	0	2	
Collinsia parviflora	10	0.5	0.3	0	2	H
Frangula purshiana	10	0.5	0.2	0	1	
Iris tenax Douglas ex Lindl. var. tenax	10	0.5	1.3	0	6	M
Madia elegans D. Don ex Lindl. ssp. elegans	10	0.5	0.5	0	2	H
Madia sativa	10	0.5	0.4	0	2	M
Madia spp	10	0.5	0.4	0	2	
Mycelis muralis*	10	0.5	0.2	0	1	
Myosotis laxa	10	0.5	0.2	0	1	L
Nemophila parviflora Douglas ex Benth. var. parviflora	10	0.5	0.2	0	1	L
Sanicula crassicaulis Poepp. ex DC. var. crassicaulis	10	0.5	0.2	0	1	L
Sherardia arvensis*	10	0.5	0.2	0	1	
Taraxacum officinale*	10	0.5	0.2	0	1	
Triteleia hyacinthina	10	0.5	0.2	0	1	H
Verbascum thapsus*	10	0.5	0.2	0	1	
Apocynum spp	5	0.5	0.1	0	1	M
Arctium minus*	5	0.5	0.1	0	1	
Brodiaea spp	5	0.5	0.1	0	1	
Camassia quamash (Pursh) Greene ssp. maxima Gould	5	0.5	0.2	0	1	H
Castilleja levisecta	5	0.5	0.1	0	1	H
Centaurea cyanus*	5	0.5	0.0	0	0	
Cerastium spp*	5	0.5	0.1	0	1	
Claytonia perfoliata Donn ex Willd. ssp. perfoliata	5	0.5	0.1	0	1	M
Crepis setosa*	5	0.5	0.1	0	1	
Delphinium spp	5	0.5	0.1	0	1	
Digitalis purpurea*	5	0.5	0.1	0	1	
Epilobium brachycarpum C. Presl	5	0.5	0.1	0	1	M
Fragaria vesca L. ssp. bracteata (Heller) Staudt	5	0.5	0.1	0	1	M
Galium triflorum	5	0.5	0.1	0	1	
Geranium robertianum*	5	0.5	0.2	0	1	
Hypochaeris radicata*	5	0.5	1.1	0	5	
Lapsana communis*	5	0.5	0.1	0	1	
Lathyrus aphaca*	5	0.5	0.1	0	1	
Lathyrus sphaericus*	5	0.5	0.1	0	1	
Lithophragma parviflorum (Hook.) Nuttall var. parviflorum	5	0.5	0.1	0	1	H
Lomatium macrocarpum	5	0.5	0.1	0	1	H
Lotus corniculatus*	5	0.5	0.1	0	1	
Lupinus sulphureus var. kincaidii	5	0.5	0.2	0	1	H
Matricaria discoidea	5	0.5	0.2	0	1	
Mimulus guttatus	5	0.5	0.1	0	1	M
Navarretia intertexta (Benth.) Hook. ssp. intertexta	5	0.5	0.1	0	1	H
Osmorhiza berteroi	5	0.5	0.1	0	1	L
Prunella vulgaris ssp. lanceolata	5	0.5	0.1	0	1	M
Rumex conglomeratus*	5	0.5	0.1	0	1	
Sidalcea spp	5	0.5	0.1	0	1	H
Sidalcea virgata	5	0.5	0.1	0	1	H
Stellaria media*	5	0.5	0.2	0	1	
Tellima grandiflora	5	0.5	0.1	0	1	L
Tonella tenella	5	0.5	0.1	0	1	H

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Trifolium repens*	5	0.5	1.5	0	7	
Vicia spp	5	0.5	0.1	0	1	
Viola arvensis*	5	0.5	0.1	0	1	
Fern						
Polystichum munitum	10	0.5	0.2	0	1	L
Pteridium aquilinum (L.) Kuhn var. pubescens Underw.	10	0.5	0.4	0	2	L
Athyrium filix-femina	5	0.5	0.1	0	1	
Polypodium glycyrrhiza	5	0.5	0.1	0	1	L
Vine						
Lonicera hispidula (Lindl.) Douglas ex Torr. & A. Gray var. hispidula	5	0.5	0.1	0	1	M
Marah oreganus	5	0.5	0.2	0	1	M

Association 9: *Quercus garryana* / *Toxicodendron diversilobum* / *Festuca californica* Woodland
Oregon White Oak / Poison Oak / California fescue

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
*** non-native species**						
Shrub						
Toxicodendron diversilobum	100	5	3.6	1	8	M
Holodiscus discolor	67	0.5	0.5	0	1	L
Amelanchier alnifolia (Nuttall) Nuttall ex M. Roem. var. semiintegrifolia (Hook.) C.L. Hitchc.	33	0.5	0.3	0	1	M
Berberis aquifolium	33	0.5	0.3	0	1	M
Corylus cornuta	33	0.5	0.6	0	1	L
Rosa gymnocarpa	33	0.5	0.3	0	1	L
Rosa spp	33	0.5	1.2	0	2	
Symphoricarpos albus (L.) Blake var. laevigatus (Fern.) Blake	33	0.5	0.3	0	1	L
Graminoid						
Cynosurus echinatus*	100	15	8.7	5	20	
Festuca californica Vasey var. californica	100	23	7.6	15	30	M
Bromus vulgaris	67	1	1.5	0	3	L
Elymus glaucus	67	1	1.2	0	2	M
Aira caryophyllea*	33	0.5	0.3	0	1	
Bromus mollis*	33	0.5	1.2	0	2	
Koeleria macrantha	33	0.5	0.6	0	1	H
Luzula comosa	33	0.5	0.3	0	1	M
Melica subulata (Griesb.) Scrib. var. subulata	33	0.5	0.3	0	1	L
Forb						
Torilis arvensis*	100	1	0.8	1	2	
Achillea millefolium	67	0.5	0.3	0	1	M
Brodiaea congestum	67	0.5	0.3	0	1	H
Delphinium spp	67	0.5	0.3	0	1	
Dichelostemma congestum	67	0.5	0.3	0	1	H
Eriophyllum lanatum (Pursh) J. Forbes var. leucophyllum (DC) W.R. Carter)	67	0.5	0.3	0	1	H
Madia gracilis	67	0.5	0.6	0	1	H
Allium acuminatum	33	0.5	0.3	0	1	H
Allium spp	33	0.5	0.3	0	1	H
Brodiaea hyacinthina	33	0.5	0.3	0	1	H
Brodiaea spp	33	0.5	0.3	0	1	
Calochortus tolmiei	33	0.5	0.3	0	1	H
Clarkia spp	33	0.5	0.3	0	1	H
Collinsia parviflora	33	0.5	0.3	0	1	H
Collomia heterophylla	33	0.5	0.3	0	1	L
Daucus carota*	33	0.5	0.1	0	0	
Epilobium brachycarpum C. Presl	33	0.5	0.3	0	1	M
Fragaria vesca L. ssp. bracteata (Heller) Staudt	33	0.5	0.3	0	1	M

Species name	Freq (%)	Cover %				Fidelity
		Mean	SD	Min	Max	
Hypericum perforatum*	33	0.5	0.3	0	1	
Iris spp	33	0.5	0.3	0	1	M
Iris tenax Douglas ex Lindl. var. tenax	33	0.5	0.2	0	0	M
Vicia americana	33	0.5	0.3	0	1	M
Vicia sativa*	33	0.5	0.3	0	1	
Vine						
Lonicera hispidula (Lindl.) Douglas ex Torr. & A. Gray var. hispidula	67	0.5	0.3	0	1	M