*This document is part of a collection of Ecological Integrity Assessments addressing 67 of Washington's 99 Ecological Systems. These documents were prepared by the Washington Natural Heritage Program with funding provided by the Washington Department of Fish and Wildlife.*

# Ecological Integrity Assessment: North Pacific Herbaceous Bald and Bluff

## Ecological Summary

The North Pacific Herbaceous Bald and Bluff ecological system is a grassland / herbaceous-dominated, small patch system on steep, hilly terrain in the lowlands to mid-montane elevations extending from eastern Vancouver Island to the southern Willamette Valley. Due to shallow soils, steep slopes, sunny aspect, and/or upper slope position, these sites are dry and marginal for tree establishment and growth except in favorable microsites. The climate is relatively dry to wet (20 to 100 inches annual precipitation), always with a distinct dry summer season when these sites usually become droughty enough to limit tree growth and establishment. Most sites receive little snowfall, although sites in the *Abies amabilis* zone can have significant winter snowpack. Snowpacks would be expected to melt off sooner on these sunny aspect sites than surrounding areas. Seeps are frequent features that result in vernally moist to wet areas. Rock outcrops are a typical small-scale feature within balds and are considered part of this system (Chappell 2006). Landslides are a significant disturbance on coastal bluffs **without** persistent salt spray and high winds, especially on bluffs composed of glacial deposits. Landslides can both destroy these herbaceous communities and create new habitat for them by creating new barren surfaces that are colonized by herbaceous species.

Balds with many favorable microsites can have a "savanna" type structure with a sparse tree layer of *Pseudotsuga menziesii* or, less commonly at lower elevations, *Arbutus menziesii* or *Quercus garryana*. Vegetation varies among and within individual balds with relative differences in soil moisture. Grasslands are the most prevalent vegetation cover, though forblands are also common especially in the mountains. Dwarf-shrublands commonly occur, especially in mountains or foothills, as very small patches, usually in a matrix of herbaceous vegetation. Dominant or codominant native grasses include *Festuca roemeri, Danthonia californica, Achnatherum lemmonii, Festuca rubra* (near saltwater), and *Koeleria macrantha* (Chappell 2006). Forb diversity can be high and can include species such as *Camassia quamash, Camassia leichtlinii, Triteleia hyacinthina, Mimulus guttatus* (seeps), *Plectritis congesta, Lomatium martindalei, Allium cernuum,* and *Phlox diffusa* (can be considered a dwarf-shrub). Important dwarf-shrubs are *Arctostaphylos uva-ursi, Arctostaphylos nevadensis,* and *Juniperus communis*. Small patches and strips dominated by the shrub *Arctostaphylos columbiana* are a common feature associated with some herbaceous balds. Significant portions of balds, especially on rock outcrops, are dominated by bryophytes (mosses) and to a lesser degree lichens.

Fires, both lightning-ignited and those ignited by people, occasionally burn these sites. Lower elevation sites probably burned more frequently and in some cases intentionally. Due to shallow soils, steep slopes, sunny aspect, and/or upper slope position, these sites are dry and marginal for tree establishment and growth except in favorable microsites. Disturbance patches within that are part of the variation the matrix forest may appear similar to balds but have a preponderance of forest species, such as, *Gaultheria shallon* and *Mahonia nervosa*.

The North Pacific Hypermaritime Shrub and Herbaceous Headland system associated with persistent salt spray and high winds usually in a hypermaritime climate differs by having a distinct, often more shrubby flora (shrubs: *Gaultheria shallon, Vaccinium ovatum* grasses: *Calamagrostis nutkaensis, Festuca rubra*). Balds differ from the Willamette Valley Upland Prairie system in that balds: (1) occur on slopes, (2) are associated with relatively shallow soils and an underlying restrictive layer of bedrock, and (3) tend to be small patches in a forest matrix (Chappell 2006). High fidelity grassland plants differences among herbaceous systems are in Appendix A.

*Stressors*

The stressors described below are those primarily associated with the loss of extent and degradation of the ecological integrity of existing occurrences. The stressors are the cause of the system shifting away from its natural range of variability. In other words, type, intensity, and duration of these stressors is what moves a system's ecological integrity rank away from the expected, natural condition (e.g. A rank) toward degraded integrity ranks (i.e. B, C, or D).

The exclusion of fire from most of this system over the last 100+ years has resulted in profound changes. *Pseudotsuga menziesii* and other trees and shrub encroachment, in the absence of fire, is a "natural" process that occurs eventually on the vast majority of balds, except on the very driest sites. This encroachment leads to the conversion of herbaceous-dominance to shrublands or forests. Nonnative species such as *Cytisus scoparium, Hypericum perforatum, Hypochaeris radicata, Holcus lanatus, Chrysanthemum leucanthemum, Agrostis capillaris, Anthoxanthum odoratum, Poa pratensis, Arrhenatherum elatius, Taeniatherum caput-medusae, Festuca arundinacea, Hieracium pilosella, Potentilla recta, Centaurea* spp., and *Bromus mollis* are prominent in this habitat and generally increase after ground-disturbing activities like off-road vehicle use. Prescribed fire and other management tools have been used recently to control *Cytisus scoparium, Pseudotsuga menziesii* encroachment, and to attempt to mimic historical conditions in some areas. Recreation, as well as timber harvest activities and road-building, should avoid high-quality examples of this system due to the potential for spread of non-native species and relatively fragile soils.

*Conceptual Ecological Model*

The general relationships among the key ecological attributes associated with natural range of variability of the North Pacific Herbaceous Bald and Bluff system are presented in Figure 1.

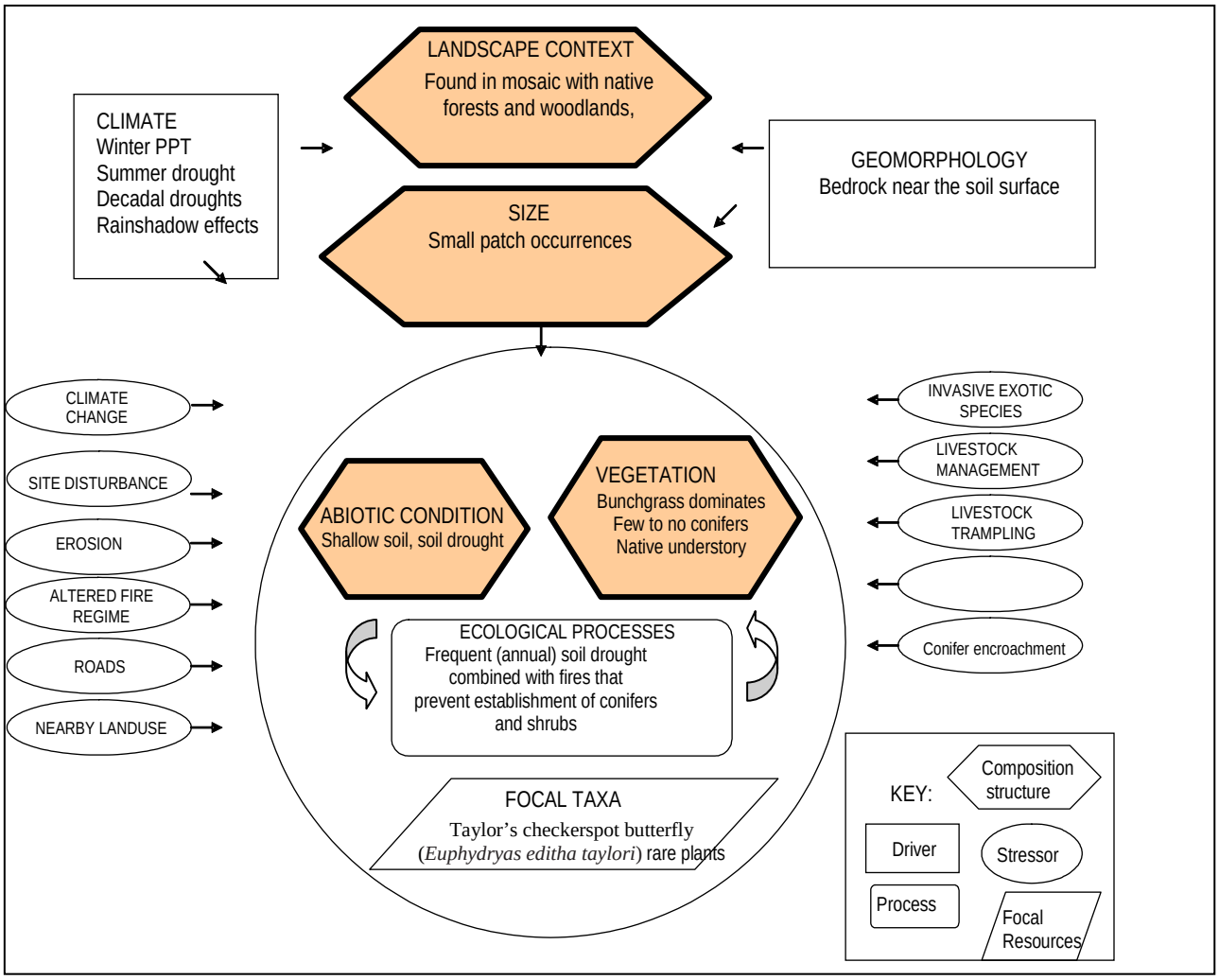

Figure 1. Generalized Conceptual Ecological Model for North Pacific Herbaceous Bald and Bluff Ecological System.

**Ecological Integrity Assessments**

The assessment of ecological integrity can be done at three levels of intensity depending on the purpose and design of the data collection effort. The three-level approach is intended to provide increasing accuracy of ecological integrity assessment, recognizing that not all conservation and management decisions need equal levels of accuracy. The three-level approach also allows users to choose their assessment based in part on the level of classification that is available or targeted. If classification is limited to the level of forests vs. wetlands vs. grasslands, the use of remote sensing metrics may be sufficient. If very specific, fine-scale forest, wetland, and grassland types are the classification target then one has the flexibility to decide to use any of the three levels, depending on the need of the assessment. In other words, there is no presumption that a fine-level of classification requires a fine-level of ecological integrity assessment.

Because the purpose is the same for all three levels of assessment (to measure the status of ecological integrity of a site) it is important that the Level 1 assessment use the same kinds of metrics and major attributes as used at Levels 2 and 3. Level 1 assessments rely

almost entirely on Geographic Information Systems (GIS) and remote sensing data to obtain information about landscape integrity and the distribution and abundance of ecological types in the landscape or watershed. Level 2 assessments use relatively rapid field-based metrics that are a combination of qualitative and narrative-based rating with quantitative or semi-quantitative ratings. Field observations are required for many metrics, and observations will typically require professional expertise and judgment. Level 3 assessments require more rigorous, intensive field-based methods and metrics that provide higher-resolution information on the integrity of occurrences. They often use quantitative, plot-based protocols coupled with a sampling design to provide data for detailed metrics.

Although the three levels can be integrated into a monitoring framework, each level is developed as a stand-alone method for assessing ecological integrity. **When conducting an ecological integrity assessment, one need only complete a single level that is appropriate to the study at hand.** Typically only one level may be needed, desirable, or cost effective. But for this reason it is very important that each level provide a comparable approach to assessing integrity, else the ratings and ranks will not achieve comparable information if multiple levels are used.

**Level 1 EIA**

A generalized Level 1 EIA is provided in Rocchio and Crawford (2009). Please refer to that document for the list of metrics applicable to this ecological system. For the Level 1 Fire Condition Class metric, please use the metric ratings for that same metric found below in the Level 2 EIA.

**Level 2 EIA**

The following table displays the metrics chosen to measure most of the key ecological attributes in the conceptual ecological model above. The EIA is used to assess the ecological condition of an assessment area, which may be the same as the element occurrence or a subset of that occurrence based on abrupt changes in condition or on artificial boundaries such as management areas. **Unless otherwise noted, metric ratings apply to both Level 2 and Level 3 EIAs. The difference between the two is that a Level 3 EIA will use more intensive and precise methods to determine metric ratings.** To calculate ranks, each metric is ranked in the field according the ranking categories listed below. Then, the rank and point total for each metric is entered into the EIA Scorecard (see Table 5 in Rocchio and Crawford (2009) for details) and multiplied by the weight factor associated with each metric resulting in a metric 'score'. Metric scores within a key ecological attribute are then summed to arrive at a score (or rank). These are then tallied in the same way to arrive at an overall ecological integrity score.

Table 1. North Pacific Herbaceous Bald and Bluff Ecological Integrity Assessment Scorecard

| Metric | Justification | Rank | | | |
|---|---|---|---|---|---|
| | | A (5 pts.) | B (4 pts.) | C (3 pts.) | D (1 pts.) |
| **Rank Factor: LANDSCAPE CONTEXT** | | | | | |
| **Key Ecological Attribute: *Edge Effects*** | | | | | |
| **Edge Length** | The intactness of the edge can be important to biotic and abiotic aspects of the site. | 75 – 100% of edge is bordered by natural communities | 50 – 74% of edge is bordered by natural communities | 25 – 49% of edge is bordered by natural communities | < 25% of edge is bordered by natural communities |
| **Edge Width** | | Average width of edge is at least 100 m. | Average width of edge is at least 75-100 m. | Average width of edge is at least 25-75 m. | Average width of edge is at least <25 m. |
| **Edge Condition** | | >95% cover native vegetation, <5% cover of non-native plants, intact soils | 75–95% cover of native vegetation, 5–25% cover of non-native plants, intact or moderately disrupted soils | 25–50% cover of non-native plants, moderate or extensive soil disruption | >50% cover of non-native plants, barren ground, highly compacted or otherwise disrupted soils |
| **Key Ecological Attribute: *Landscape Structure*** | | | | | |
| **Connectivity** | Intact areas have a continuous corridor of natural or semi-natural vegetation between areas | Intact: Embedded in 90-100% natural habitat; connectivity is expected to be high. | Variegated: Embedded in 60-90% natural or semi-habitat; habitat connectivity is generally high, but lower for species sensitive to habitat modification; | Fragmented: Embedded in 20-60% natural or semi-natural habitat; connectivity is generally low, but varies with mobility of species and arrangement on landscape. | Relictual: Embedded in < 20% natural or semi-natural habitat; connectivity is essentially absent |

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|---|---|---|---|---|---|
| **Landscape Condition Model Index** | The intensity and types of land uses in the surrounding landscape can affect ecological integrity. | Landscape Condition Model Index >0.8 | | Landscape Condition Model Index 0.79 – 0.65 | Landscape Condition Model Index < 0.65 |
| **Landscape Fire Condition** | Mixed to high severity fire is vital to maintaining ecological integrity (Fire Regime Condition Class) 2008). | FRCC 1 No departure from historic fire regime. | FRCC 2 Slight-moderate departure from historic fire regime. | | FRCC 3 Severe departure from historic fire regime. Fire suppression is evident; Fuel laddering is severe and throughout much of stand. |
| **Proximity to Nearby Prairies** | The occurrence of nearby prairies patches increases the likelihood that dispersal/pollinator processes are intact. (Alverson) | 3 balds (>10 acres) within1 km | 2 balds (>10 acres) within 1 km | 1 balds (>10 acres) within 1 km | No balds (>10 acres) within 1km |
| **Rank Factor: CONDITION** | | | | | |
| **Key Ecological Attribute: *Vegetation*** | | | | | |
| **Relative Cover of Native Plant Species** | Native species in shrub and herbaceous layers; non-natives increase with human impacts. | Native species cover >95% and dominate all physiognomic layers; | Native species cover 80-95% | Native species cover 40 to 80%. | Native species cover < 40%; nonnative species dominate. |
| **Douglas-fir encroachment** (Chappell 2006) | The amount of encroachment by *Pseudotsuga menziesii* is an indication of the integrity of the fire regime. | *Pseudotsuga menziesii*, if present, consists of widely scattered large, old trees. | *Pseudotsuga menziesii* at densities of <4 individuals/acre regardless of size. | *Pseudotsuga menziesii* numerous as seedlings/saplings/small trees. | *Pseudotsuga menziesi* numerous as seedlings/saplings/small trees and >25% cover. |
| **Relative Cover of Native Increasers** | Some stressors such as grazing can shift or homogenize native composition toward species tolerant of stress. (i.e., *Carex inops*, *Lupinus* spp. | <10% cover | 10-20% cover | 20-50% | >50% cover |
| **Relative Shrub Cover** | Shrub cover outside of NRV can indicate past disturbance such as grazing or fire suppression. *Arctostaphylos columbiana* thickets are within the NRV | None or minimal cover (<1%). | Present and <10% cover. | <10-25% | >25% |

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|---|---|---|---|---|---|
| **Absolute Cover of Scotch broom** (*Cytisus scoparius*) | This invasive shrub displaces native species and is very aggressive. Early detection is critical | None or minimal (<1%) present. | Present, but sporadic (<5% cover). | Prevalent (5–25% cover). | Abundant > 25% cover |
| **Absolute Cover of Invasive Herbaceous Species** | Invasive species can inflict a wide range of ecological impacts. Early detection is critical. Examples include *Arrhenatherum elatius, Holcus lanatus, Agrostis capillaris, Chrysanthemum leucanthemum.* | None or minimal (<1%) present. | Invasive species present, but sporadic (<5% cover). | Invasive species prevalent (5–30% absolute cover). | Invasive species abundant (>30% absolute cover). |
| **Richness of Prairie Associated Plant Species** (Alverson 2009a; Chappell 2000) | The overall composition of native species can shift when exposed to stressors. This metric measures the presence of those species with strong fidelity to prairies. Refer to fidelity list below. | >15 species with high fidelity to balds and bluffs | 10-15 species with high fidelity to balds and bluffs | 5-10 species with high fidelity to balds and bluffs | <5 species with high fidelity to balds and bluffs |
| **Key Ecological Attribute: *Physicochemical*** | | | | | |
| **Soil Surface Condition** | Soil disturbance can result in compaction, erosion thereby negatively affecting many ecological processes (Napper et al 2009) | **Soil-disturbance Class 0**<br>Undisturbed<br>• No evidence of past equipment.<br>• No depressions or wheel tracks.<br>• Forest-floor layers are present and intact.<br>• No soil displacement evident.<br>• No management-generated soil erosion.<br>• No management-created soil compaction.<br>• No management-created platy soils. | **Soil-Disturbance Class 1**<br>• Wheel tracks or depressions evident, but faint and shallow.<br>• Forest-floor layers are present and intact.<br>• Surface soil has not been displaced.<br>• Soil burn severity from prescribed fires is low (slight charring of vegetation, discontinuous)<br>• Soil compaction is shallow (0 to 4 inches).<br>• Soil structure is changed from undisturbed conditions to platy or massive albeit discontinuous | **Soil Disturbance Class 2**<br>• Wheel tracks or depressions are evident and moderately deep.<br>• Forest-floor layers are partially missing.<br>• Surface soil partially intact and maybe mixed with subsoil.<br>• Soil burn severity from prescribed fires is moderate (black ash evident and water repellency may be increased compared to preburn condition).<br>• Soil compaction is moderately deep (up to 12 inches).<br>• Soil structure is changed from undisturbed conditions and may be platy or massive. | **Soil Disturbance Class 3**<br>• Wheel tracks or depressions are evident and deep.<br>• Forest-floor layers are missing.<br>• Surface soil is removed through gouging or piling.<br>• Surface soil is displaced.<br>• Soil burn severity from prescribed fires is high (white orreddish ash, all litter completely consumed, and soil structureless).<br>• Soil compaction is persistent and deep (greater than 12inches).<br>• Soil structure is changed from undisturbed and is platy or massive throughout. |
| **Rank Factor: SIZE** | | | | | |

| **Key Ecological Attribute: *Size*** | | | | | |
|---|---|---|---|---|---|
| **Relative Size** | Indicates the proportion lost due to stressors such as complete fire suppression (conversion to a new system), development, roads, etc. | Site is at or minimally reduced from natural extent (>95% remains) | Occurrence is only modestly reduced from its original natural extent (80-95% remains) | Occurrence is substantially reduced from its original natural extent (50-80% remains) | Occurrence is severely reduced from its original natural extent (<50% remains) |
| **Absolute Size** | Absolute size may be important for buffering impacts originating in the surrounding landscape. Likely to be large enough to support multiple Vesper Sparrow territories (Altman 1999). | Very large (>50 ac/20 ha) | Large (10-50 ac/4-20 ha) | Moderate (1-10 ac/0.4-4 ha) | Small (<0.4 ac/1 ha) |

**Level 3 EIA**
Level 3 metrics would include more quantitative measures of the metrics listed above. In addition, further consideration might be given to:

- presence/absence of wildlife species of concern such Taylor's checkerspot butterfly (*Euphydryas editha taylori*)
- species composition of lichens and bryophytes.
- Alverson (2009a) has suggested metrics for 1 $m^2$ quadrats.

**Triggers or Management Assessment Points**
Ecological triggers or conditions under which management activities need to be reassessed are shown in the table below. Since the Ecological Integrity rankings are based on hypothesized thresholds, they are used to indicate where triggers might occur. Specific details about how these triggers translate for each metric can be found by referencing the values or descriptions for the appropriate rank provided in the Table above.

Table 2. Triggers for Level 2 & 3 EIA

| Key Ecological Attribute or Metric | Trigger | Action |
|---|---|---|
| Any metric (except Connectivity or LCM) | ▪ C rank<br>▪ Shift from A to B rank<br>▪ negative trend within the B rating (Level 3) | Level 2 triggers: conduct Level 3 assessment; make appropriate short-term management changes to ensure no further degradation<br><br>Level 3 triggers: make appropriate management adjustments to ensure no additional degradation occurs. Continue monitoring using Level 3. |
| Any Key Ecological Attribute | ▪ any metric has a C rank<br>▪ > ½ of all metrics are ranked B<br>▪ negative trend within the B rating (Level 3) | Level 2 triggers: conduct Level 3 assessment; make appropriate short-term management changes to ensure no further degradation<br><br>Level 3 triggers: make appropriate management adjustments to ensure no additional degradation occurs. Continue monitoring using Level 3. |

**Protocol for Integrating Metric Ranks**
If desired, the user may wish to integrate the ratings of the individual metrics and produce an overall score for the three rank factor categories: (1) Landscape Context; (2) Condition; and (3) Size. These rank factor rankings can then be combined into an Overall Ecological Integrity Rank. This enables one to report scores or ranks from the various hierarchical scales of the assessment depending on which best meets the user's objectives. Please see Table 5 in Rocchio and Crawford (2009) for specifics about the protocol for integrating or 'rolling-up' metric ratings.

**List of Native Species with High Fidelity to North Pacific Balds and Bluffs** (from Chappell et al. 2004 and Alverson 2009b). Systems b=Balds and Bluffs, o=Oak Woodlands, p=Willamette Valley Prairie, w= Willamette Valley Wet Prairie, v=Vernal pools and seeps

| FAMILY | SPECIES | Systems |
|---|---|---|
| Apiaceae | Daucus pusillus Michaux | bp |
| Apiaceae | Lomatium dissectum (Nuttall) Mathias & Constance var. dissectum | bpow |
| Apiaceae | Lomatium grayii (Coult. & Rose) Coult. & Rose | b |
| Apiaceae | Lomatium hallii (S. Watson) J.M. Coult. & Rose | b |
| Apiaceae | Lomatium macrocarpum (Nuttall) J.M. Coult. & Rose | b |
| Apiaceae | Lomatium martindalei J.M. Coult. & Rose var. martindalei | b |
| Apiaceae | Lomatium nudicaule (Pursh) J.M. Coult. & Rose | bpw |
| Apiaceae | Lomatium triternatum (Pursh) J.M. Coult. & Rose var. triternatum | bp |
| Apiaceae | Lomatium utriculatum (Nuttall) J.M. Coult. & Rose | bp |
| Apiaceae | Perideridia montana (Blank.) Dorn | bpow |
| Apiaceae | Sanicula arctopoides Hook. & Arn. | b |
| Apiaceae | Sanicula bipinnatifida Douglas ex Hook. | bp |
| Apiaceae | Yabea microcarpa (Hook. & Arn.) Koso-Pol. | b |
| Aspleniaceae | Asplenium trichomanes L. ssp. quadrivalens D.E. Meyer | b |
| Aspleniaceae | Asplenium trichomanes L. ssp. trichomanes | b |
| Asteraceae | Agoseris grandiflora (Nuttall) Greene | bpow |
| Asteraceae | Agoseris heterophylla (Nuttall) Greene ssp. heterophylla | bp |
| Asteraceae | Antennaria rosea Greene | b |
| Asteraceae | Artemisia tilesii Ledeb. var. unalaschensis (Bess.) Hult. | b |
| Asteraceae | Balsamorhiza deltoidea Nuttall | bp |
| Asteraceae | Blepharipappus scaber Hook. | bp |
| Asteraceae | Calycadenia truncata DC | b |
| Asteraceae | Cirsium remotifolium (Hook.) DC. | bpo |
| Asteraceae | Crocidium multicaule Hook. | bv |

| | | |
|---|---|---|
| Asteraceae | Erigeron salishii G.W. Douglas & Packer | b |
| Asteraceae | Eriophyllum lanatum (Pursh) J. Forbes var. leucophyllum (DC) W.R. Carter) | bpow |
| Asteraceae | Eurybia merita (A. Nels.) Nesom | b |
| Asteraceae | Hieracium scouleri Hook. var. cynoglossoides | bp |
| Asteraceae | Hieracium scouleri Hook. var. scouleri | bp |
| Asteraceae | Lasthenia glaberrima DC. | bpwv |
| Asteraceae | Lasthenia minor (DC.) Ornduff var. maritima (Gray) Cronq. | b |
| Asteraceae | Luina hypoleuca Benth. | b |
| Asteraceae | Madia exigua (Sm.) A. Gray | bpo |
| Asteraceae | Madia gracilis (Sm.) D.D. Keck | bp |
| Asteraceae | Micropus californicus Fisch. & C.A. Mey. | b |
| Asteraceae | Microseris bigelovii (Gray) Schultz-Bip. | bv |
| Asteraceae | Microseris laciniata (Hook.) Sch. Bip. ssp. laciniata | bpw |
| Asteraceae | Senecio integerrimus Nuttall var. exaltatus (Nuttall) Cronquist | bpo |
| Asteraceae | Solidago spathulata D.C. var. neomexicana (Gray) Cronq. | bp |
| Asteraceae | Symphyotrichum ericoides (L.) Nesom var. pansum (Blake) Nesom | bp |
| Asteraceae | Uropappus lindleyi (DC) Nuttall | b |
| Boraginaceae | Cryptantha flaccida (Douglas ex Lehm.) Greene | bp |
| Boraginaceae | Cryptantha intermedia (A. Gray) Greene | bp |
| Brassicaceae | Athysanus pusillus (Hook.) Greene | bp |
| Brassicaceae | Draba stenoloba Ledeb. | b |
| Brassicaceae | Erysimum arenicola S. Watson | b |
| Brassicaceae | Erysimum asperum (Nuttall) DC | b |
| Brassicaceae | Idahoa scapigera (Hook.) A. Nels. & J.F. Macbr. | bp |
| Brassicaceae | Lepidium nitidum Nuttall var. nitidum | b |
| Brassicaceae | Thysanocarpus curvipes Hook. | bp |
| Cactaceae | Opuntia fragilis (Nuttall) Haw. | bp |

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|---|---|---|
| Campanulaceae | Campanula rotundifolia L. | bp |
| Campanulaceae | Githopsis specularioides Nuttall | bp |
| Campanulaceae | Triodanis perfoliata (L.) Nieuwl. | bpow |
| Caryophyllaceae | Arenaria capillaris Poir. ssp. americana Maguire | b |
| Caryophyllaceae | Cerastium arvense L. | bp |
| Caryophyllaceae | Minuartia cismontana R.J. Meinke & P.F. Zika | b |
| Caryophyllaceae | Minuartia pusilla (S. Watson) Mattf. var. pusilla | b |
| Caryophyllaceae | Minuartia rubella (Wahlenb.) Hiern. | bp |
| Caryophyllaceae | Minuartia tenella (Nuttall) Mattf. | bp |
| Caryophyllaceae | Sagina maxima Gray ssp. crassicaulis (S. Watson) Crow | bv |
| Caryophyllaceae | Silene antirrhina L. | bp |
| Caryophyllaceae | Silene campanulata S. Watson ssp. glandulosa C.L. Hitchc. & Maguire | bpo |
| Caryophyllaceae | Silene douglasii Hook. | bp |
| Caryophyllaceae | Silene menziesii Hook. | bp |
| Caryophyllaceae | Silene scouleri Hook. | bpo |
| Convolvulaceae | Calystegia atriplicifolia Hallier f. ssp. atriplicifolia | bp |
| Crassulaceae | Sedum divergens S. Watson | b |
| Crassulaceae | Sedum lanceolatum Torr. | b |
| Crassulaceae | Sedum oreganum Nuttall | b |
| Crassulaceae | Sedum spathulifolium Hook. | b |
| Crassulaceae | Sedum stenopetalum Pursh | b |
| Cupressaceae | Juniperus communis L. var. montana Ait. | b |
| Cupressaceae | Juniperus scopulorum Sarg | b |
| Cyperaceae | Carex inops L.H. Bailey ssp. inops | bpo |
| Cyperaceae | Carex rossii W. Boott | bpo |
| Cyperaceae | Carex tumulicola Mack. | bpow |
| Dryopteridaceae | Dryopteris arguta (Kaulf.) Maxon | bpo |

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|---|---|---|
| Dryopteridaceae | Polystichum californicum (D.C. Eat.) Diels | b |
| Dryopteridaceae | Polystichum imbricans (D.C. Eaton) D.H. Wagner | b |
| Dryopteridaceae | Woodsia scopulina D.C. Eaton | b |
| Euphorbiaceae | Chamaesyce serpyllifolia (Pers.) Small | bv |
| Euphorbiaceae | Eremocarpus setigerus (Hook.) Benth. | bp |
| Fabaceae | Lupinus densiflorus Benth. var. densiflorus | bp |
| Fabaceae | Oxytropis monticola A. Gray ssp. monticola | b |
| Fabaceae | Trifolium bifidum A. Gray var. decipiens Greene | bp |
| Fabaceae | Trifolium ciliolatum Benth. | bp |
| Fabaceae | Trifolium depauperatum Desv. var. depauperatum | b |
| Fabaceae | Trifolium dichotomum Hook. & Arn. | bp |
| Fabaceae | Trifolium gracilientum Torr. & A. Gray var. gracilientum | bp |
| Fabaceae | Trifolium microcephalum Pursh | bp |
| Fabaceae | Trifolium microdon Hook. & Arn. | bp |
| Fabaceae | Trifolium oliganthum Steud. | bp |
| Fabaceae | Trifolium variegatum Nuttall | bp |
| Fabaceae | Trifolium willdenowii Spreng. | bp |
| Fagaceae | Quercus garryana Douglas ex Hook. var. garryana | bpo |
| Gentianaceae | Centaurium muehlenbergii (Griseb.) W. Wight ex Piper | bpwv |
| Geraniaceae | Geranium oreganum Howell | bpow |
| Hydrophyllaceae | Phacelia heterophylla Pursh | b |
| Hydrophyllaceae | Phacelia linearis (Pursh) Holz. | bpo |
| Hydrophyllaceae | Romanzoffia sitchensis Bong. | b |
| Hydrophyllaceae | Romanzoffia thompsonii Martalla | b |
| Iridaceae | Olsynium douglasii (A. Dietr.) E.P. Bicknell | b |
| Iridaceae | Sisyrinchium idahoense E.P. Bicknell var. idahoense | bpow |
| Iridaceae | Sisyrinchium idahoense E.P. Bicknell var. macounii (E.P. Bicknell) D. Henderson | bp |

| | | |
|---|---|---|
| Isoetaceae | Isoetes nuttallii A. Br. | bpwv |
| Juncaceae | Juncus kelloggii Engelm. | bv |
| Lamiaceae | Scutellaria antirrhinoides Benth. | b |
| Lamiaceae | Trichostema lanceolatum Benth. | bpwv |
| Liliaceae | Allium acuminatum Hook. | bpo |
| Liliaceae | Allium amplectens Torr. | bpow |
| Liliaceae | Allium cernuum Roth | bp |
| Liliaceae | Allium geyeri S. Watson var. geyeri | bp |
| Liliaceae | Allium geyeri S.Watson var. tenerum M.E. Jones | bp |
| Liliaceae | Brodiaea coronaria (Salisb.) Engl. ssp. coronaria | bpow |
| Liliaceae | Brodiaea elegans Hoover ssp. hooveri Niehaus | bpow |
| Liliaceae | Calochortus tolmiei Hook. & Arn. | bpo |
| Liliaceae | Camassia leichtlinii (Baker) S. Watson var. suksdorfii (Greenm.) Gould | bpow |
| Liliaceae | Camassia quamash (Pursh) Greene ssp. azurea (Heller) Gould | bpo |
| Liliaceae | Camassia quamash (Pursh) Greene ssp. maxima Gould | bpow |
| Liliaceae | Dichelostemma capitatum (Benth.) A.W. Wood ssp. capitatum | bp |
| Liliaceae | Dichelostemma congestum (Sm.) Kunth | bpo |
| Liliaceae | Fritillaria affinis (Schult.) Sealy var. affinis | bpow |
| Liliaceae | Stenanthium occidentale Gray | b |
| Liliaceae | Triteleia hyacinthina (Lindl.) Greene | bpowv |
| Liliaceae | Zigadenus venenosus S. Watson var. venenosus | bpow |
| Onagraceae | Clarkia amoena (Lehm.) A. Nelson & J.F. Macbr. | bp |
| Onagraceae | Clarkia purpurea (Curtis) A. Nelson & J.F. Macbr. ssp. quadrivulnera (Douglas ex Hook.) F.H. Lewis & M.R. Lewis | bp |
| Onagraceae | Clarkia purpurea (Curtis) A. Nelson & J.F. Macbr. var. purpurea | bpo |
| Onagraceae | Clarkia rhomboidea Douglas ex Hook. | bpo |
| Onagraceae | Epilobium minutum Lindl. | b |
| Onagraceae | Epilobium torreyi (S. Watson) P.C. Hoch & P.H. Raven | bpwv |

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| Orchidaceae | Piperia maritima Rydb. | b |
| Orchidaceae | Piperia transversa Suksdorf | bpo |
| Orchidaceae | Spiranthes porrifolia Lindl. | b |
| Orchidaceae | Spiranthes romanzoffiana Cham. | bpw |
| Orobanchaceae | Orobanche californica Cham. & Schlect. | bp |
| Orobanchaceae | Orobanche fasciculata Nuttall | bp |
| Orobanchaceae | Orobanche uniflora L. var. occidentalis (Greene) Taylor & MacBryde | bp |
| Papaveraceae | Meconella oregana Nuttall | bp |
| Plantaginaceae | Plantago elongata Pursh var. elongata | bv |
| Poaceae | Achnatherum lemmonii (Vasey) Barkworth ssp. lemmonii | bp |
| Poaceae | Achnatherum nelsonii (Scribn.) Barkworth ssp. dorei (Barkworth & J.R. Maze) Barkworth | b |
| Poaceae | Agrostis diegoensis Vasey | bp |
| Poaceae | Agrostis microphylla Steud. | bpwv |
| Poaceae | Bromus carinatus Hook. & Arn. | bp |
| Poaceae | Danthonia californica Bolander var. americana (Scribner) A.S. Hitchc. | bpw |
| Poaceae | Danthonia intermedia Vasey | bpw |
| Poaceae | Danthonia spicata (L.) Beauv. | bp |
| Poaceae | Elymus trachycaulus (Link) Gould ex Shinners ssp. trachycaulus | bp |
| Poaceae | Festuca roemeri Y.V. Alexeev | bpo |
| Poaceae | Festuca rubra L. ssp. pruinosa (Hack.) Piper | bp |
| Poaceae | Koeleria macrantha (Ledeb.) Schult. | bpw |
| Poaceae | Melica harfordii Bolander | b |
| Poaceae | Panicum oligosanthes Schult. var. scribnerianum (Nash) Fern. | bp |
| Poaceae | Poa gracillima Vasey | b |
| Poaceae | Poa scabrella (Thurb.) Benth | bpwv |
| Polemoniaceae | Gilia sinistra M.E. Jones ssp. sinistra | b |
| Polemoniaceae | Linanthus bicolor (Nuttall) Greene ssp. bicolor | bpwv |

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| Polemoniaceae | Linanthus bicolor (Nuttall) Greene ssp. minimus Mason | bp |
| Polemoniaceae | Phlox gracilis (Hook.) Greene | bpwv |
| Polemoniaceae | Polemonium pulcherrimum Hook. var. pulcherrimum | b |
| Polygonaceae | Eriogonum compositum Douglas Ex Benth. var. compositum | b |
| Polygonaceae | Eriogonum nudum Douglas ex Benth. var. nudum | bp |
| Polygonaceae | Polygonum douglasii Greene | bp |
| Polygonaceae | Polygonum nuttallii Small | b |
| Polypodiaceae | Polypodium amorphum Suksdorf | b |
| Portulacaceae | Claytonia exigua Torr. & Gray var. exigua | b |
| Portulacaceae | Claytonia exigua Torr. & Gray var. glauca J.M. Miller & K.L. Chambers | bp |
| Portulacaceae | Claytonia rubra (Howell) Tidestr. ssp. rubra | bp |
| Portulacaceae | Montia dichotoma (Nuttall) Howell | bp |
| Primulaceae | Dodecatheon hendersonii A. Gray | bpo |
| Primulaceae | Dodecatheon pulchellum (Raf.) Merr. ssp. macrocarpum (A. Gray) Roy Taylor & MacBryde | bpw |
| Pteridaceae | Aspidotis densa (Brack.) Lellinger | b |
| Pteridaceae | Cheilanthes gracillima D.C. Eaton | b |
| Pteridaceae | Cryptogramma acrostichoides R. Br. | b |
| Pteridaceae | Pellaea andromedifolia (Kaulf.) Fee | b |
| Pteridaceae | Pentagramma triangularis (Kaulf.) Yatsk., Windham, E. Wollenw. ssp. triangularis | b |
| Ranunculaceae | Delphinium leucophaeum Greene | bpo |
| Ranunculaceae | Delphinium menziesii DC. | bpow |
| Ranunculaceae | Delphinium nuttallii A. Gray | bp |
| Ranunculaceae | Ranunculus californicus Benth. | bp |
| Ranunculaceae | Ranunculus occidentalis Nuttall var. occidentalis | bpow |
| Rhamnaceae | Ceanothus cuneatus (Hook.) Nuttall ex Torr. & A. Gray | b |
| Rosaceae | Fragaria chiloensis (L.) Duchesne | bp |
| Rosaceae | Fragaria virginiana Duchesne var. platypetala (Rydb.) H.M. Hall | bpow |

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| Rosaceae | Geum triflorum Pursh var. campanulatum (Greene) C.L. Hitchc. | bp |
| Rosaceae | Potentilla glandulosa Lindl. var. glandulosa | bpo |
| Rosaceae | Spiraea betulifolia Pall. var. lucida (Douglas ex Greene) C.L. Hitchc. | bpo |
| Santalaceae | Comandra umbellata (L.) Nuttall var. californica (Eastw.) C.L. Hitchc. | bpo |
| Saxifragaceae | Bolandra oregana S. Watson | b |
| Saxifragaceae | Lithophragma glabrum Nuttall | bp |
| Saxifragaceae | Lithophragma parviflorum (Hook.) Nuttall | bpo |
| Saxifragaceae | Saxifraga aequidentata (Small) Rosendahl | b |
| Saxifragaceae | Saxifraga bronchialis L. ssp. austromontana (Wieg.) Piper | b |
| Saxifragaceae | Saxifraga cespitosa L. | b |
| Saxifragaceae | Saxifraga ferruginea R.C. Grah. | b |
| Saxifragaceae | Saxifraga gormanii Suksdorf | b |
| Saxifragaceae | Saxifraga integrifolia Hook. var. integrifolia | bpo |
| Saxifragaceae | Saxifraga marshallii Greene | b |
| Saxifragaceae | Saxifraga mertensiana Bong. | b |
| Saxifragaceae | Saxifraga nidifica Greene var. nidifica | b |
| Saxifragaceae | Saxifraga nidifica Greene var. claytoniaefolia (Canby) Elvander | b |
| Saxifragaceae | Saxifraga nuttallii Small | b |
| Saxifragaceae | Sullivantia oregana S. Watson | b |
| Scrophulariaceae | Castilleja attenuata (A. Gray) T.I. Chuang & Heckard | bp |
| Scrophulariaceae | Castilleja hispida Benth. | bpo |
| Scrophulariaceae | Castilleja miniata Douglas ex. Hook. var. dixonii (Fern.) A. Nels. & J.F. Macbr. | bp |
| Scrophulariaceae | Castilleja pruinosa Fernald | b |
| Scrophulariaceae | Collinsia grandiflora Lindl. | bpo |
| Scrophulariaceae | Collinsia parviflora Lindl. | bpo |
| Scrophulariaceae | Collinsia rattanii A. Gray ssp. glandulosa (Howell) Pennell | b |
| Scrophulariaceae | Collinsia sparsiflora Fisch. & Mey. Var. bruciae (M.E. Jones) Newsom | b |

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| Scrophulariaceae | Mimulus alsinoides Douglas ex Benth. | b |
| Scrophulariaceae | Mimulus nasutus Greene | b |
| Scrophulariaceae | Penstemon ovatus Douglas | b |
| Scrophulariaceae | Penstemon richardsonii Douglas var. richardsonii | b |
| Scrophulariaceae | Penstemon serrulatus Menzies ex Sm. | b |
| Scrophulariaceae | Tonella floribunda A. Gray | b |
| Scrophulariaceae | Tonella tenella (Benth.) A. Heller | bpo |
| Scrophulariaceae | Triphysaria versicolor Fisch & Mey. ssp. versicolor | bp |
| Selaginellaceae | Selaginella douglasii (Hook. & Grev.) Spring | b |
| Selaginellaceae | Selaginella wallacei Hieron. | b |
| Valerianaceae | Plectritis ciliosa (Greene) Jeps. | b |
| Valerianaceae | Plectritis congesta (Lindl.) DC. var. congesta | bpow |
| Valerianaceae | Plectritis congesta (Lindl.) DC. var. major (Fisch. & Mey.) Dyal | b |
| Valerianaceae | Plectritis macrocera Torr. & A. Gray | b |
| Violaceae | Viola adunca Sm. | bpo |
| Violaceae | Viola praemorsa Douglas ex Lindl. ssp. praemorsa | bpo |

*Supporting documents for the EIAs can be found at:*
*http://www1.dnr.wa.gov/nhp/refdesk/communities/eia.html*

*Documentation about Ecological Systems can be found at:*
*http://www1.dnr.wa.gov/nhp/refdesk/communities/ecol_systems.html*

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