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 Oak Woodland

Ecological Summary

The North Pacific Oak Woodland ecological system is limited to the southern portions of the North Pacific region. It occurs primarily in the Puget Trough and Willamette Valley but trickles down into the Klamath ecoregion and into California. This system is associated with dry, predominantly low-elevation sites and/or sites that experienced frequent presettlement fires. Oak types associated with wetlands and riparian areas are not included here. They are associated with the North Pacific Lowland Riparian Forest and Shrubland ecological system.

In the Willamette Valley, soils are mesic yet well-drained, and the type is clearly large patch in nature. In the Puget Lowland and Georgia Basin, this system is primarily found on dry sites, typically either shallow bedrock soils or deep gravelly glacial outwash soils. In Washington, this oak woodland is most abundant on gravelly outwash plains in Thurston and Pierce counties but is found on dry sites that experienced frequent presettlement fires in other part of the Puget Trough. It occurs on various soils in the interior valleys of the Klamath Mountains, and on shallow soils of "bald hill" toward the coast. Even where more environmentally limited, the system is strongly associated with a pre-European settlement, low-severity fire regime. Succession in the absence of fire tends to favor increased shrub dominance in the understory, increased tree density, and increased importance of conifers, with the end result being conversion to a conifer forest. Dissemination of acorns by squirrels and chipmunks is thought to be the most important long-distance dispersal mechanism.

The vegetation ranges from savanna and woodland to forest dominated by deciduous broadleaf trees, mostly *Quercus garryana*. Codominance by the evergreen conifer *Pseudotsuga menziesii* is common, and *Pinus ponderosa* is important in some stands. In Washington, *Pinus ponderosa* is rare but important in some Pierce County stands. In the south, common associates also include *Quercus kelloggii* and *Arbutus menziesii*. *Acer macrophyllum*, *Cornus nuttallii*, and *Fraxinus latifolia* are common associates in moister sites while *Arbutus menziesii*, *Pinus ponderosa*, and occasionally *P. contorta* are common in more xeric sites. Understory species are diverse and today include many non-native and increaser species. Native shrubs such as *Symphoricarpos albus*, *Holodiscus discolor*, *Rosa* spp., *Mahonia aquifolium*, *Amelanchier alnifolia*, *Oemleria cerasiformis*, and the nonnative shrub *Cytisus scoparius* are common. Under natural fire regimes, some

sites (moist or otherwise protected sites) have naturally high relative cover of shrubs (up to 60%) while other sites typically have less than 10% cover of shrubs (fire regime I Landfire 2007). Native grass species such as *Festuca roemeri, Carex inops* ssp. *inops, Bromus carinatus, Danthonia californica*, and *Elymus glaucus* and nonnative species such as *Arrhenatherum elatius, Dactylis glomerata, Holcus lanata,* and *Poa pratensis,* are common components to oak woodlands. Native forbs such as *Camassia quamash, Vicia americana, Galium aparine, Fragaria vesca, Lomatium utriculatum* and nonnative forbs such as *Hypericum perforatum, Hypochaeris radicata,* and *Plantago lanceolata* are also conspicuous components to these oak woodlands. Oak woodlands also support distinctive epiphytic species as compared to other habitats throughout its range. In the Willamette Valley, over 100 species of epiphytic and terrestrial lichen and bryophytes have been documented in Oregon white oak forests (Pike 1973).

This system merges into Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland (CES206.923) on sites that support more conifer cover, and into Mediterranean California Mixed Oak Woodland (CES206.909) in the southern portion of its distribution. This system is borderline between small patch and large patch in its dynamics. *Quercus garryana* east of the Cascade Crest forms a different system (i.e., East Cascades Oak-Ponderosa Pine Forest and Woodland (CES204.085)). Oak types associated with wetlands or riparian areas are associated with the North Pacific Lowland Riparian Forest and Shrubland ecological system.

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).

These oak woodlands are relatively limited in area and are currently declining in extent and condition. With the cessation of regular burning 100-130 years ago, many oak woodlands have been invaded by a greater density and cover of oak and conifer trees. Fire suppression has also increased shrub cover in many oak woodlands. Some areas have been lost to urban or agriculture development. Ongoing threats include residential development, increase and spread of exotic species, and fire suppression effects. Removal of *Quercus garryana* trees for firewood, fence posts, and other lumber products has and continue to occur in some area. Selective logging of *Pseudotsuga menziesii* in oak stands can prevent long-term loss of *Quercus garryana* dominance. Oaks typically resprout after logging. Moderate to heavy grazing can lead to an increase in non-native species, many of which are now abundant. *Cytisus scoparius* is invasive and persistent in many oak woodlands. Sweet cherry *Prunus avium* and *Crataegus monogyna* have invaded and now dominate the subcanopy in Willamette Valley oak woodlands. *Poa pratensis* is a major nonnative dominant in the understory. Other herbaceous invasive species include *Agrostis capillaris, Holcus lanatus, Arrhenatherum elatius, Anthoxanthum odoratum, Phleum pratense, Bromus rigidus, Dactylis glomerata, Cirsium arvense, Plantago*

lanceolata, *Rumex acetosella*, *Cynosurus echinatus*, *Festuca arundinacea*, and *Hypericum perforatum*.

Conceptual Ecological Model

The general relationships among the key ecological attributes associated with natural range of variability of the North Pacific Oak Woodland system are presented in Figure 1. A model of oak dynamics in the Puget Sound is presented in Figure 2. Hanna and Dunn (1996) provide a conceptual model of the oak dynamics associated with human-induced stress (Figure 3).

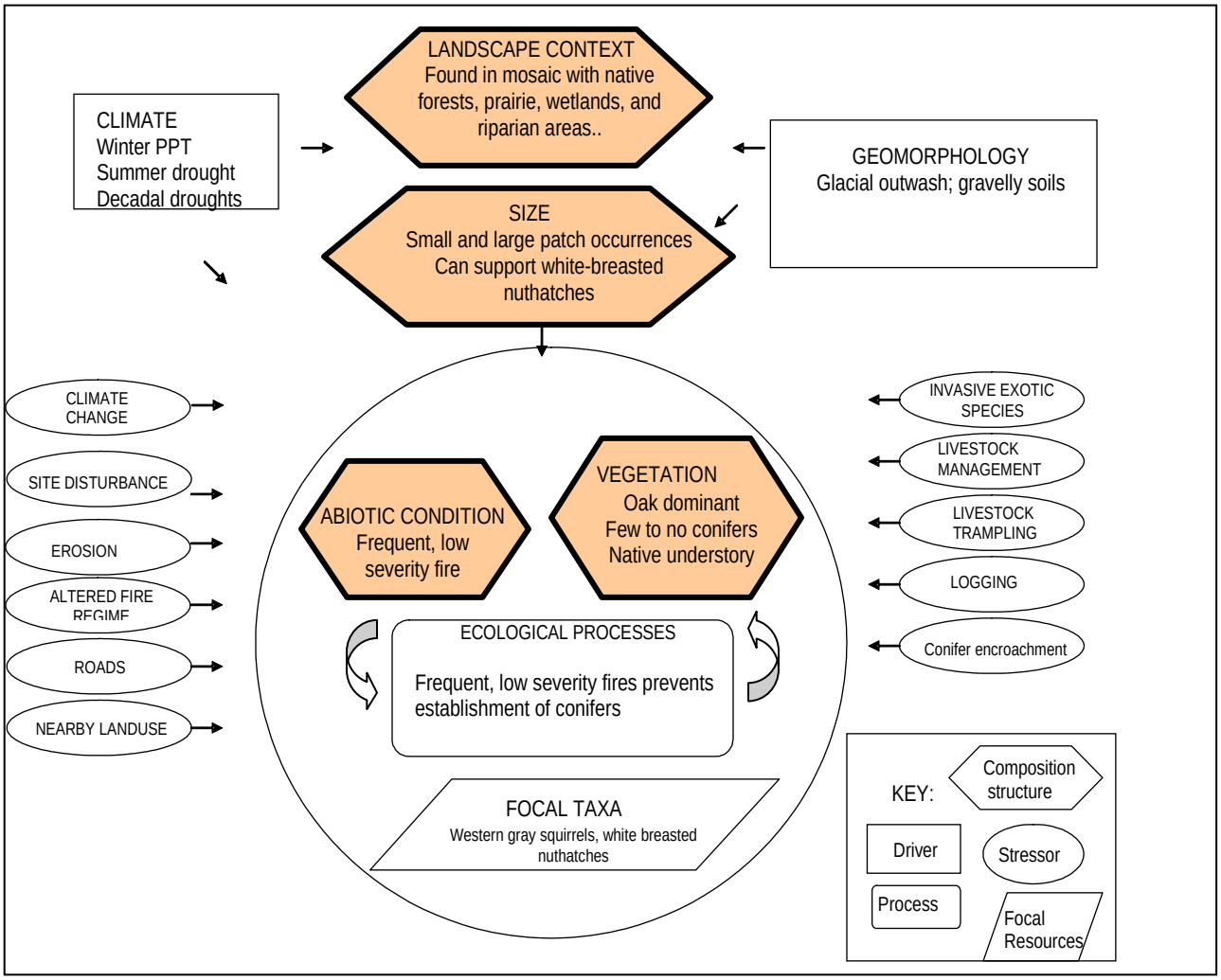


Figure 1. Generalized Conceptual Ecological Model for North Pacific Oak Woodland Ecological System.

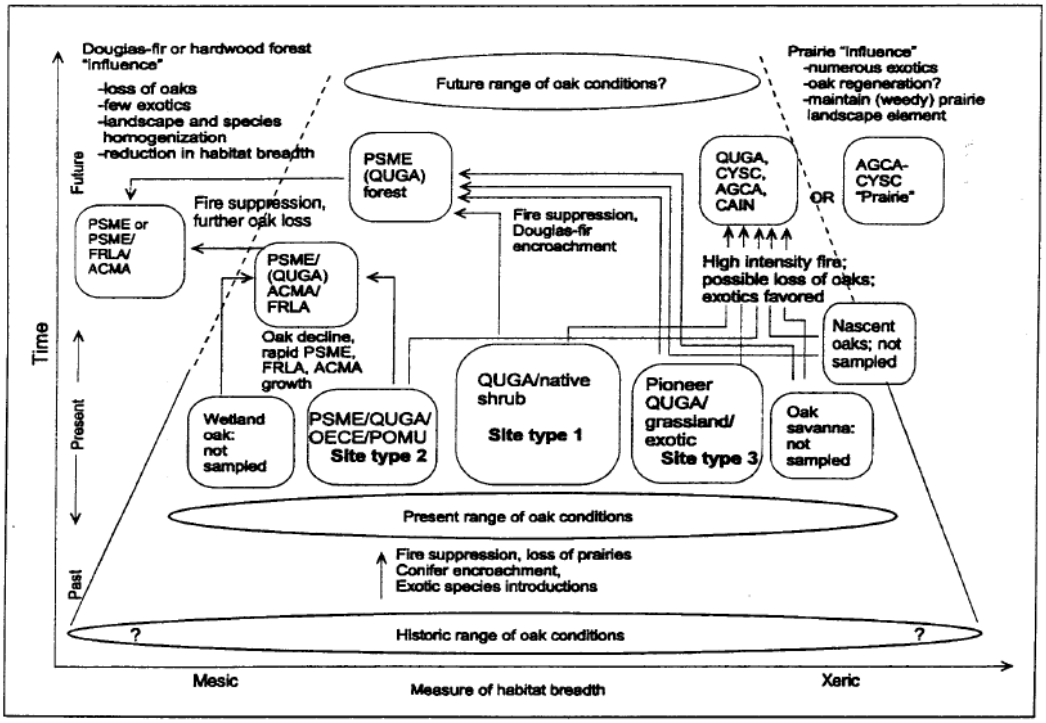


Figure 2. Conceptual Model of North Pacific Oak Woodlands in the Puget Sound, Washington (from Thysell and Carey 2001).

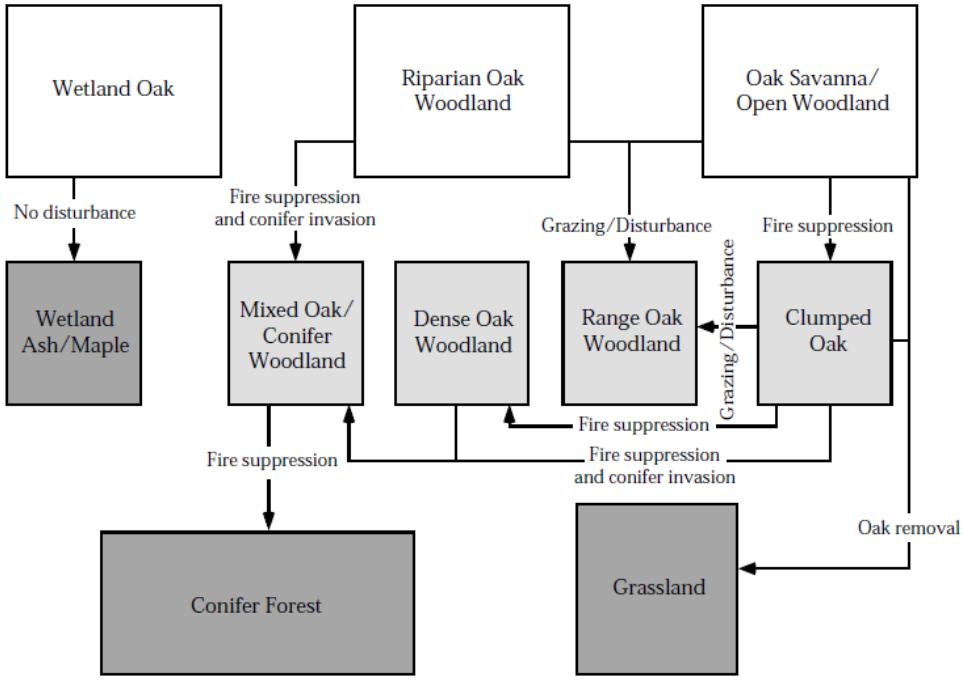


Figure 3. Conceptual Model Showing Response of Various Oak Ecological Types to Disturbance. White box represent oak woodland types functioning within their natural range of variation (A ranked sites); light gray boxes indicate altered states (B, C, or D ranked sites); dark gray boxes indicate non-oak habitats (sites which have crossed threshold to a new ecological type). From Hanna and Dunn (1996).

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

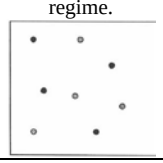
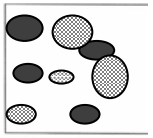
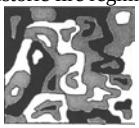
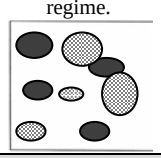
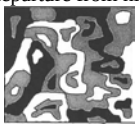
The following table displays the metrics chosen to measure most of the key ecological attributes in the conceptual ecological model above. The EIA is used to assess the ecological condition of an assessment area, which may be the same as the element occurrence or a subset of that occurrence based on 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 (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 Oak Woodland 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	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
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
Rank Factor: CONDITION					
Key Ecological Attribute: *Vegetation Composition*					
Relative Cover Native Plant Species	Native species in shrub and herbaceous layers; non-natives increase with human impacts.	Total cover of native species in shrub and herbaceous layers >95% and dominate all physiognomic layers;	Total cover of native species in shrub and herbaceous layers > 90%	Total cover of native species in shrub and herbaceous layers 50 to <90%. Nonnative may be codominant with native species	Total cover of native species in shrub and herbaceous layers <50%. Nonnative species dominate understory with minor native component.
Conifer Abundance	The amount and spatial distribution of conifer encroachment (<100 yrs. old) is an indication of the integrity of disturbance regimes (Chappell 2000; Chappell 2004)	Conifers are absent, scattered, or small OR if part of the canopy then they are part of an oak/conifer association representing an ecotone between oak woodland and conifer forest and NOT due to fire suppression of previous oak woodland sites	Conifers (<100 yrs. old) present but do not pose a near-term threat to the oak canopy	Conifers (<100 yrs. old) may be numerous in the canopy and/or understory but have not overtopped and shaded the majority of the oak canopy	Conifers (<100 yrs. old) have overtopped and shaded majority of oak canopy. Conifer cover may be close to 50% of total tree cover. If >50%, then the site has crossed threshold into a conifer ecological system.
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. See list of species below.	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 Oak Associated Plant Species (Alverson 2009a)	The overall composition of native species can shift when exposed to stressors. This metric measures the presence of those species with strong fidelity to oak woodlands. Refer to fidelity list below.	>10 native species (or >35% of native species) for oak-shrubland associations OR >15 species (or >70% of native species) for oak herbaceous associations with high and moderate fidelity to oak woodlands	7-10 native species (or 20-35% of native species) for oak-shrubland associations OR 9-15 species (or 45-70% of native species) for oak herbaceous associations with high and moderate fidelity to oak woodlands	4-7 native species (or 10-20% of native species) for oak-shrubland associations OR 4-9 species (or 20-45% of native species) for oak herbaceous associations with high and moderate fidelity to oak woodlands	<4 native species (or <10% of native species) for oak-shrubland associations OR <4 species (or <20% of native species) for oak herbaceous associations with high and moderate fidelity to oak woodlands
Key Ecological Attribute: *Vegetation Structure*					
Presence of Mature Oaks	The presence of mature oaks reflects intact ecological processes and provide unique habitat (Chappell 2000).	Large, mature (>150 yr. old or >24" dbh), widely spaced oaks with single trunks and broad spreading crowns present (savanna). Cohort of mature oaks is prominent but not necessarily dominant in the canopy (woodland); No logging of mature oak;	Logging has removed a few mature oak trees; overall logging impacts are minimal.	Moderate logging history. Many mature trees have been removed but some are still present. Minimally, there are numerous trees >15 cm dbh present	Substantial logging has occurred; All mature trees have been removed. No trees >15 cm dbh present
Oak Age Classes and Structure	The distribution of age classes and structure of oak canopies are indicative of intact ecological processes and provide important habitat (Chappell 2000; Alverson 2009a).	Multiple age or size classes of oak may be present but no single class dominates; Canopy architecture represents an appropriate mix of large open grown trees and younger tree recruitment that will replace older trees when they die.	Fire suppression is allowing dense, even-aged regeneration /sprouting to occur in some areas or in clumps (along with relict open grown trees).	Dense, even-aged young cohort present (along with relict open grown trees) across much of site. Most oak trees are <100 yrs. old.	Single age class of oaks present. All oak trees <100 yrs. old.
Total Tree Cover	Oak savanna	Total tree cover is acceptable (10%-25%) over at least 90% of the area	Tree cover is increasing but is acceptable (10%-25%) between 70-90% of the area	Tree cover is increasing but is acceptable (10%-25%) between 50-70% of the area	Tree cover is increasing and is acceptable (10-25%) over less than 50% of the area
	Oak woodland (Alverson 2009a)	Total tree cover is acceptable (25%-60%) over at least 90% of the area being managed for oak woodland.	Tree cover is increasing but total is acceptable (25%-60%) between 70-90% of the area being managed for oak woodland.	Tree cover is increasing but total is acceptable (25%-60%) between 50-70% of the area being managed for oak woodland.	Tree cover is increasing and is acceptable (25-60%) over less than 50% of the area being managed for oak woodland.
Shrub Cover	Shrub cover outside of NRV can indicate past disturbance such as grazing or fire suppression (DW-SPS CAP)	<=60% shrub cover (for oak-shrubland associations) or <=10% shrub cover (for oak herbaceous associations)		>=60-75% shrub cover (for oak-shrubland associations) or >=10-25% shrub cover (for oak herbaceous associations)	>=75% shrub cover (for oak-shrubland associations) or >=25% shrub cover (for oak herbaceous associations)
Key Ecological Attribute: *Natural Disturbance Regime*					

Fire Regime Condition (Agee 1998) 	Frequent, low severity fire (~3-10 yrs.) is vital to maintaining diversity of patch types. (Kertis 1986) Oak Savanna	No departure from historic fire regime. 	Slight departure from historic fire regime. 	Moderate departure from historic fire regime. 	Severe departure from historic fire regime.
	Oak woodland	No departure from historic fire regime. 	Slight/Moderate departure from historic fire regime. 		Severe departure from historic fire regime.
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** Undisturbed • No evidence of past equipment. • No depressions or wheel tracks. • Forest-floor layers are present and intact. • No soil displacement evident. • No management-generated soil erosion. • No management-created soil compaction. • No management-created platy soils.	**Soil-Disturbance Class 1** • Wheel tracks or depressions evident, but faint and shallow. • Forest-floor layers are present and intact. • Surface soil has not been displaced. • Soil burn severity from prescribed fires is low (slight charring of vegetation discontinuous). • Soil compaction is shallow (0 to 4 inches). • Soil structure is changed from undisturbed conditions to platy or massive albeit discontinuous.	**Soil Disturbance Class 2** • Wheel tracks or depressions are evident and moderately deep. • Forest-floor layers are partially missing. • Surface soil partially intact and maybe mixed with subsoil. • Soil burn severity from prescribed fires is moderate (black ash evident and water repellency may be increased compared to preburn condition). • Soil compaction is moderately deep (up to 12 inches). • Soil structure is changed from undisturbed conditions and may be platy or massive.	**Soil Disturbance Class 3** • Wheel tracks or depressions are evident and deep. • Forest-floor layers are missing. • Surface soil is removed through gouging or piling. • Surface soil is displaced. • Soil burn severity from prescribed fires is high (white orreddish ash, all litter completely consumed, and soil structureless). • Soil compaction is persistent and deep (greater than 12 inches). • 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	Very large (>100 ac/40 ha)	Large (40-100 ac/16-40 ha)	Moderate (5-40 ac/2-16 ha)	Small (<5 ac/2 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 as White-breasted Nuthatch, western gray squirrel, Western pond turtle, Lewis's Woodpecker, Western Bluebird, Propertius' Duskywing, pocket gohper and/or oak-associated invertebrates (e.g., butterflies, moths, gall wasps, moths, and spiders)
- presence/absence of woodpeckers, and neotropical migrant birds. (Hanna and Dunn 1996).
- species composition of lichens and bryophytes on oak trees.

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 ▪ Shift from A to B rank ▪ 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 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 ▪ > ½ of all metrics are ranked B ▪ 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 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 Species with High or Moderate Fidelity to Oak Woodlands (subset from Chappell et al. 2004 and Alverson 2009b)

SPECIES	FAMILY	COMMON NAME	Degree of fidelity to prairie habitats	Nativity	Present in Georgia Basin	Present in Puget Trough	Present in Lower Columbia River	Present in Willamette Valley
Achillea millefolium L.	Asteraceae	yarrow	M	Native	Y	Y	Y	Y
Agoseris grandiflora (Nuttall) Greene	Asteraceae	large flowered agoseris	H	Native	Y	Y	Y	Y
Allium amplectens Torr.	Liliaceae	narrowleaf wild onion	H	Native	Y	Y	Y	Y
Amelanchier alnifolia (Nuttall) Nuttall ex M. Roem. var. semiintegrifolia (Hook.) C.L. Hitchc.	Rosaceae	Pacific serviceberry	M	Native	Y	Y	Y	Y
Anemone lyallii Britton	Ranunculaceae	Lyall's anemone	M	Native	Y	Y	Y	Y
Apocynum androsaemifolium L. var. androsaemifolium	Apocynaceae	spreading dogbane	M	Native	Y	Y	Y	Y
Aquilegia formosa Fisch. ex DC.	Ranunculaceae	red columbine	M	Native	Y	Y	Y	Y
Balsamorhiza deltoidea Nuttall	Asteraceae	deltoid balsamroot	H	Native	Y	Y	Y	Y
Berberis aquifolium Pursh	Berberidaceae	tall Oregon grape	M	Native	Y	Y	Y	Y
Brodiaea coronaria (Salisb.) Engl. ssp. coronaria	Liliaceae	harvest brodiaea	H	Native	Y	Y	Y	Y
Bromus sitchensis Trin.	Poaceae	Sitka brome	M	Native	Y	Y	Y	Y
Calochortus tolmiei Hook. & Arn.	Liliaceae	Tolmie's cat's ear	H	Native	?	Y	Y	Y
Camassia leichtlinii (Baker) S. Watson ssp. suksdorfii (Greenm.) Gould	Liliaceae	large camas	H	Native	Y	Y	Y	Y
Camassia quamash (Pursh) Greene ssp. maxima Gould	Liliaceae	small camas	H	Native	Y	Y	Y	Y
Cardamine nuttallii Greene var. nuttallii	Brassicaceae	spring beauty	M	Native	Y	Y	Y	Y
Carex inops L.H. Bailey ssp. inops	Cyperaceae	long stolon sedge	H	Native	Y	Y	Y	Y
Carex pachystachya Cham. ex Steud.	Cyperaceae	thick headed sedge	M	Native	Y	Y	Y	Y
Carex rossii W. Boott	Cyperaceae	Ross' sedge	H	Native	Y	Y	Y	Y
Carex tumulicola Mack.	Cyperaceae	foothill sedge	H	Native	Y	Y	Y	Y
Castilleja hispida Benth. ssp. hispida	Scrophulariaceae	harsh paintbrush	H	Native	Y	Y	Y	Y
Cirsium edule Nuttall	Asteraceae	edible thistle	M	Native	Y	Y	Y	Y
Cirsium remotifolium (Hook.) DC.	Asteraceae		H	Native	?	Y	Y	Y
Clarkia gracilis (Piper) A. Nelson & J.F. Macbr. ssp. gracilis	Onagraceae	slender godetia	H	Native	?	Y	Y	Y

Claytonia parviflora Douglas ex Hook. ssp. parviflora	Portulacaceae	small flowered miner's lettuce	M	Native	Y	Y	Y	Y
Claytonia perfoliata Donn ex Willd. ssp. perfoliata	Portulacaceae	miner's lettuce	M	Native	Y	Y	Y	Y
Collinsia grandiflora Lindl.	Scrophulariaceae	large flowered blue-eyed Mary	H	Native	Y	Y	Y	Y
Collinsia parviflora Lindl.	Scrophulariaceae	small flowered blue-eyed Mary	H	Native	Y	Y	Y	Y
Collomia grandiflora Douglas ex Lindl.	Polemoniaceae	large flowered collomia	M	Native	Y	Y	Y	Y
Comandra umbellata (L.) Nuttall var. californica (Eastw.) C.L. Hitchc.	Santalaceae	bastard toadflax	H	Native	Y	?	Y	Y
Crataegus suksdorfii (Sarg.) Kruschke	Rosaceae	Suksdorf's hawthorn	M	Native	Y	Y	Y	Y
Cystopteris fragilis (L.) Bernh.	Woodsiaceae	fragile fern	M	Native	Y	Y	Y	Y
Danthonia californica Bolander var. americana (Scribner) A.S. Hitchc.	Poaceae	Umbrella Plant	H	Native	Y	Y	Y	Y
Delphinium menziesii DC.	Ranunculaceae	Menzies' larkspur	H	Native	Y	Y	Y	Y
Dichelostemma congestum (Sm.) Kunth	Liliaceae	ookow	H	Native	Y	Y	Y	Y
Dodecatheon hendersonii A. Gray ssp. hendersonii	Primulaceae	Henderson's shooting star	H	Native	Y	Y	Y	Y
Dryopteris arguta (Kaulf.) Maxon	Dryopteridaceae	coastal shield fern	H	Native	Y	Y	Y	Y
Elymus glaucus Buckley	Poaceae	western ryegrass	M	Native	Y	Y	Y	Y
Epilobium brachycarpum C. Presl	Onagraceae	tall annual willowherb	M	Native	Y	Y	Y	Y
Erigeron speciosus (Lindl.) DC. var. speciosus	Asteraceae	showy daisy	H	Native	Y	Y	Y	Y
Eriophyllum lanatum (Pursh) J. Forbes var. leucophyllum (DC) W.R. Carter)	Asteraceae	Oregon sunshine	H	Native	Y	Y	Y	Y
Erythronium oregonum Applegate ssp. oregonum	Liliaceae	Oregon fawnlily	M	Native	Y	Y	Y	Y
Eurybia radulina (A. Gray) G.L Nesom	Asteraceae	rough leaved aster	M	Native	Y	N	Y	Y
Festuca roemeri Y.V. Alexeev	Poaceae	Roemer's fescue	H	Native	Y	Y	Y	Y
Fragaria vesca L. ssp. bracteata (Heller) Staudt	Rosaceae	woods strawberry	M	Native	Y	Y	Y	Y
Fragaria virginiana Duchesne var. platypetala (Rydb.) H.M. Hall	Rosaceae	prairie strawberry	H	Native	Y	Y	Y	Y
Fraxinus latifolia Benth.	Oleaceae	Oregon ash	M	Native	Y	Y	Y	Y
Fritillaria affinis (Schult.) Sealy var. affinis	Liliaceae	chocolate lily	H	Native	Y	Y	Y	Y
Galium boreale L.	Rubiaceae		H	Native	Y	Y	Y	Y

Heuchera chlorantha Piper	Saxifragaceae	green flowered alumroot	M	Native	Y	Y	Y	Y
Hypericum scouleri Hook. var. scouleri	Clusiaceae	western St. John's wort	M	Native	Y	Y	Y	Y
Iris tenax Douglas ex Lindl. var. tenax	Iridaceae	Oregon iris	M	Native	?	Y	Y	Y
Juncus tenuis Willd.	Juncaceae	poverty rush	M	Native	Y	Y	Y	Y
Koeleria macrantha (Ledeb.) Schult.	Poaceae	junegrass	H	Native	Y	Y	Y	Y
Lactuca biennis (Moench) Fernald	Asteraceae	tall blue lettuce	M	Native	Y	Y	Y	Y
Lathyrus nevadensis S. Watson ssp. lanceolatus (Howell) C.L. Hitchc. var. pilosellus (Peck) C.L. Hitchc.	Fabaceae		M	Native	Y	Y	Y	Y
Ligusticum apiifolium (Nuttall) A. Gray	Apiaceae	celery leaved lovage	H	Native	?	Y	Y	Y
Lithophragma parviflorum (Hook.) Nuttall var. parviflorum	Saxifragaceae	small flowered woodland star	H	Native	Y	Y	Y	Y
Lomatium dissectum (Nuttall) Mathias & Constance var. dissectum	Apiaceae	fern leaved lomatium	H	Native	Y	Y	Y	Y
Lomatium utriculatum (Nuttall) J.M. Coult. & Rose	Apiaceae	spring gold	H	Native	Y	Y	Y	Y
Lonicera hispidula (Lindl.) Douglas ex Torr. & A. Gray var. hispidula	Caprifoliaceae	hairy honeysuckle	M	Native	Y	Y	Y	Y
Lotus micranthus Benth.	Fabaceae	small flowered deervetch	M	Native	Y	Y	Y	Y
Lupinus bicolor Lindl. ssp. bicolor	Fabaceae		M	Native	Y	Y	Y	Y
Lupinus polycarpus Greene	Fabaceae	miniature lupine	M	Native	Y	Y	Y	Y
Lupinus sulphureus Douglas ex Hook. ssp. kincaidii (C.P. Sm.) C.L. Hitchc.	Fabaceae	Kincaid's lupine	H	Native	Y	N	Y	Y
Luzula comosa E. Mey.	Juncaceae	Pacific woodrush	M	Native	Y	Y	Y	Y
Madia exigua (Sm.) A. Gray	Asteraceae	threadstem tarweed	H	Native	Y	Y	Y	Y
Marah oreganus (Torr. & A. Gray) Howell	Cucurbitaceae	Oregon bigroot	M	Native	Y	Y	Y	Y
Nemophila pedunculata Douglas ex Benth.	Hydrophyllaceae	spreading nemophila	M	Native	Y	N	Y	Y
Panicum acuminatum Sw. ssp. fasciculatum (Torr.) Freckman & Lelong	Poaceae	western witchgrass	H	Native	?	Y	Y	Y
Pentagramma triangularis (Kaulf.) Yatsk., Windham, E. Wollenw. ssp. triangularis	Pteridaceae	gold back fern	H	Native	Y	Y	Y	Y
Perideridia montana (Blank.) Dorn	Apiaceae	mountain yampah	H	Native	Y	Y	Y	Y
Phacelia linearis (Pursh) Holz.	Hydrophyllaceae	narrow leaved phacelia	H	Native	Y	Y	Y	Y
Pinus ponderosa Douglas ex C. Lawson var. ponderosa	Pinaceae	ponderosa pine	H	Native	?	Y	Y	Y

Piperia elegans (Lindl.) Rydb. ssp. elegans	Orchidaceae	elegant rein orchid	M	Native	Y	Y	Y	Y
Piperia transversa Suksdorf	Orchidaceae	Suksdorf's rein orchid	H	Native	Y	Y	N	Y
Plectritis congesta (Lindl.) DC. var. congesta	Valerianaceae	rosy plectritis	H	Native	Y	Y	Y	Y
Potentilla glandulosa Lindl. var. glandulosa	Rosaceae	sticky cinquefoil	H	Native	Y	Y	Y	Y
Potentilla gracilis Douglas ex Hook. var. gracilis	Rosaceae	graceful cinquefoil	H	Native	Y	Y	Y	Y
Prunella vulgaris L. var. lanceolata (W.P.C. Barton) Fernald	Lamiaceae	native self heal	M	Native	Y	Y	Y	Y
Quercus garryana Douglas ex Hook. var. garryana	Fagaceae	Oregon white oak	H	Native	Y	Y	Y	Y
Ranunculus occidentalis Nuttall var. occidentalis	Ranunculaceae	western buttercup	H	Native	Y	Y	Y	Y
Ribes lobbii Gray	Grossulariaceae	gummy gooseberry	M	Native	Y	Y	Y	Y
Rupertia physodes (Douglas ex Hook.) J. Grimes	Fabaceae	California tea	M	Native	Y	Y	Y	Y
Sambucus cerulea Raf. var. cerulea	Caprifoliaceae	blue elderberry	M	Native	Y	Y	Y	Y
Sanicula bipinnatifida Douglas ex Hook.	Apiaceae	purple sanicle	H	Native	Y	Y	Y	Y
Sanicula crassicaulis Poepp. ex DC. var. tripartita (Suksdorf) H. Wolff	Apiaceae	Pacific Black Snakeroot	M	Native	Y	Y	N	Y
Sanicula graveolens Poepp. ex DC.	Apiaceae	Sierra sanicle	M	Native	Y	Y	Y	Y
Saxifraga integrifolia Hook. var. integrifolia	Saxifragaceae	common western saxifrage	H	Native	Y	Y	Y	Y
Senecio macounii Greene	Asteraceae	Puget groundsel	M	Native	Y	Y	Y	Y
Sericocarpus rigidus Lindl.	Asteraceae	rigid white topped aster	H	Native	Y	Y	Y	Y
Silene scouleri Hook.	Caryophyllaceae	Scouler's catchfly	H	Native	Y	Y	Y	Y
Sisyrinchium idahoense E.P. Bicknell var. idahoense	Iridaceae	Idaho blue-eyed-grass	H	Native	Y	Y	Y	Y
Spiraea betulifolia Pall. var. lucida (Douglas ex Greene) C.L. Hitchc.	Rosaceae		H	Native	?	Y	Y	Y
Symphoricarpos hesperius G.N. Jones	Caprifoliaceae	creeping snowberry	M	Native	Y	Y	Y	Y
Symphyotrichum hallii (A. Gray) G.L. Nesom	Asteraceae	Hall's aster	H	Native	?	Y	Y	Y
Synthyris reniformis (Douglas ex Benth.) Benth. var. reniformis	Scrophulariaceae	snow queen	M	Native	?	Y	Y	Y
Tonella tenella (Benth.) A. Heller	Scrophulariaceae	baby innocence	H	Native	Y	Y	Y	Y
Toxicodendron diversilobum (Torr. & A. Gray) Greene	Anacardiaceae	poison oak	M	Native	Y	Y	Y	Y
Triodanis biflora (Ruíz & Pav.) Greene	Campanulaceae	small Venus' lookingglass	H	Native	Y	Y	Y	Y

Triteleia hyacinthina (Lindl.) Greene	Liliaceae	hyacinth triteleia	H	Native	Y	Y	Y	Y
Vaccinium caespitosum Michaux	Ericaceae	dwarf huckleberry	M	Native	Y	Y	Y	Y
Viburnum ellipticum Hook.	Caprifoliaceae	Oregon viburnum	H	Native	?	Y	Y	Y
Vicia americana Muhl. ex Willd. var. americana	Fabaceae	American vetch	M	Native	Y	Y	Y	Y
Vicia americana Muhl. ex Willd. var. truncata (Nutt.) Brew.	Fabaceae		M	Native	Y	Y	Y	N
Viola adunca Sm. var. adunca	Violaceae	western blue violet	H	Native	Y	Y	Y	Y
Viola howellii A. Gray	Violaceae	Howell's violet	M	Native	Y	Y	Y	Y
Viola praemorsa Douglas ex Lindl. ssp. praemorsa	Violaceae	upland yellow violet	H	Native	Y	Y	Y	Y
Vulpia microstachys Nuttall	Poaceae	small fescue	H	Native	Y	Y	Y	Y
Vulpia octoflora (Walter) Rydb. var. octoflora	Poaceae	eight flowered fescue	M	Native	Y	Y	Y	Y
Wyethia angustifolia (DC.) Nuttall	Asteraceae	narrowleaf mule's ears	H	Native	?	Y	Y	Y
Zigadenus venenosus S. Watson var. venenosus	Liliaceae	meadow deathcamas	H	Native	Y	Y	Y	Y

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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