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: Columbia Plateau Low Sagebrush Steppe

Ecological Summary

The matrix or large patch Columbia Plateau Low Sagebrush Steppe ecological system occurs in a variety of shallow-soil habitats throughout eastern Oregon, northern Nevada, southern Idaho and eastern Washington. This system is dominated by *Artemisia arbuscula*. Of the four subspecies of *A.arbuscula* only subspecies *arbuscula* is in Washington. It appears on isolated ridges near or above lower treeline in Chelan, Kittitas and Yakima counties and not particularly commonly. In Washington, it forms stands on mountain ridges and flanks and broad terraces, ranging from 3280-4500 feet (1000 to 1400 m) elevation surrounded by *Pseudotsuga menziesii* and *Pinus ponderosa* forests. Substrates are shallow, fine-textured soils, poorly drained clays, and shallow soil areas, almost always very stony, characterized by recent rhyolite or basalt. It grows with *Artemisia rigida* and *Artemisia tridentata* ssp. *wyomingensis* or *vaseyana* with an understory of *Festuca idahoensis*, *Poa secunda*, *Pseudoroegneria spicata*, and *Koeleria macrantha*. Other shrubs and dwarf-shrubs present may include *Purshia tridentata* and *Eriogonum* spp. Many forbs also occur and may dominate the herbaceous vegetation, especially at the higher elevations. The space between vascular plants may support a biological crust that has low cover even without disturbance. Biological crust cover generally decreases with increasing disturbance of soil surface, vascular plant cover, elevation, loose surface rock, and coarseness of soil so that its presence and diversity indicate high integrity relative to anthropogenic disturbances. Johnson and Swanson (2005) indicate that bare ground even in least disturbed sites is 0-25% cover.

Fire influences the density and distribution of shrubs. In general, fire increases the abundance of herbaceous perennials and decreases the abundance of woody plants. The fire interval for this system is 110 years (Landfire 2007). Anecdotal observations indicate that these patches often are not burned during surrounding forest fires. However, recovery of this system after fire may take 325–450 years (Baker 2006). Low sagebrush steppe in Washington can be confused remotely the mountain sagebrush steppe and must be determine on-the-ground.

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 primary land uses that alter the natural processes of this system are associated with livestock practices, annual exotic species invasion, fire regime alteration, direct soil surface disturbance, and fragmentation. *Artemisia arbuscula* is considered a valuable browse plant during the spring, fall, and winter months and often grazed by native ungulates (elk and mule deer) and domestic livestock. Prolonged livestock use can cause a decrease in the abundance of native bunch grasses and increase in the cover of shrubs and non-native grass species, such as *Poa bulbosa* and *Bromus tectorum*.

Conceptual Ecological Model

The general relationships among the key ecological attributes associated with natural range of variability of the Columbia Plateau Low Sagebrush Steppe Ecological System are presented in Figure 1.

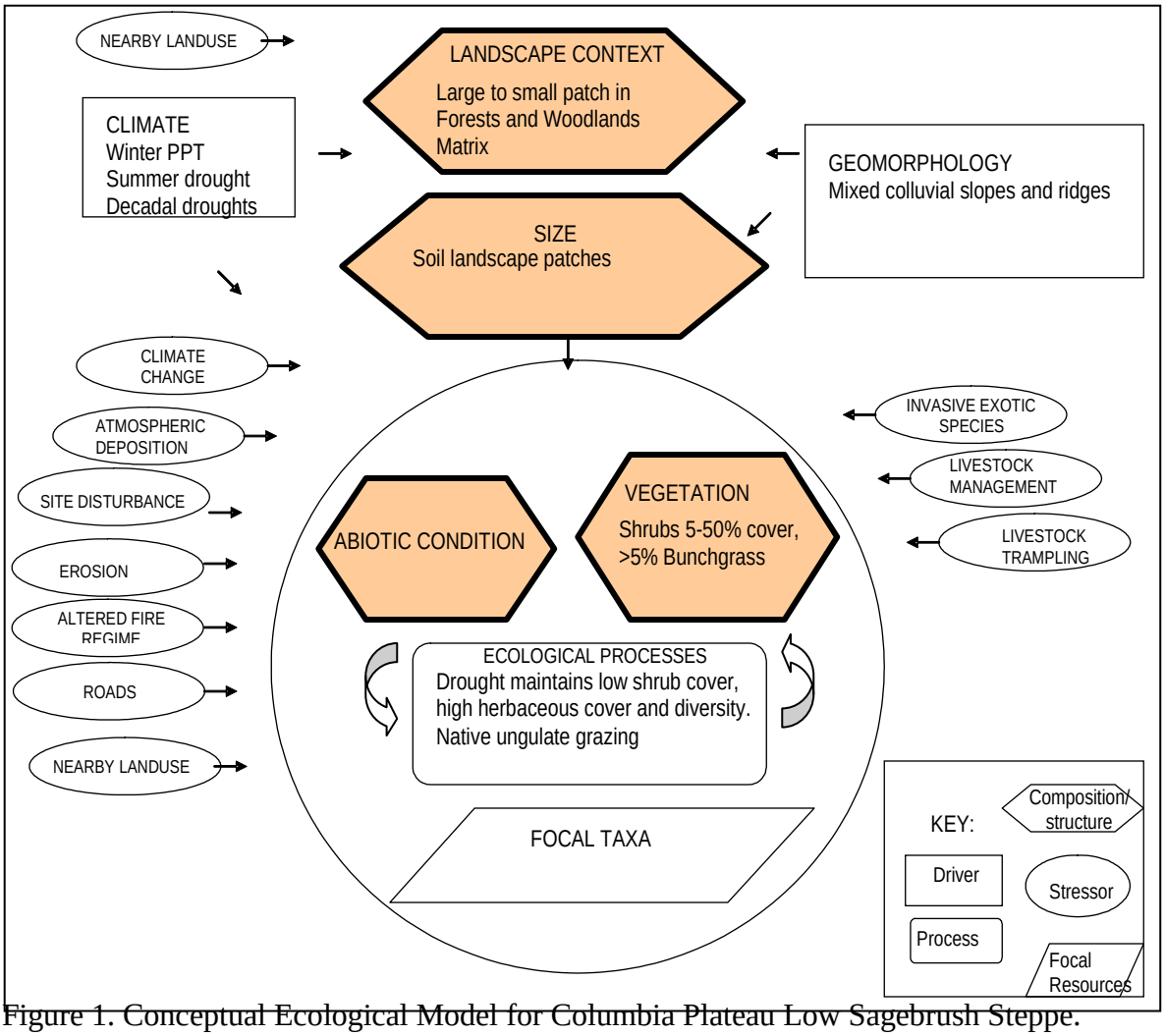

Figure 1. Conceptual Ecological Model for Columbia Plateau Low Sagebrush Steppe.

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.

Level 2 EIA

The following tables display 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 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. Columbia Plateau Low Sagebrush Steppe Ecological Integrity Assessment Scorecard Level 2 EIA

Metric	Justification	Rank			
		A (5 pts.)	B (4 pts.)	C (3 pts.)	D (1 pts.)
Rank Factor: LANDSCAPE CONTEXT					
Key Ecological Attribute: *Buffer*					
Buffer Length	The buffer can be important to biotic and abiotic aspects. of the site.	Buffer is > 75 – 100% of occurrence perimeter.	Buffer is > 50 – 74% of occurrence perimeter.	Buffer is 25 – 49% of occurrence perimeter	Buffer is < 25% of occurrence perimeter.
Buffer Width		Average buffer width of occurrence is > 200 m, adjusted for slope.	Average buffer width is 100 – 199 m, after adjusting for slope.	Average buffer width is 50 – 99 m, after adjusting for slope.	Average buffer width is < 49 m, after adjusting for slope.
Buffer Condition		Abundant (>95%) cover native vegetation, little or no (<5%) cover of non-native plants, intact soils, AND little or no trash or refuse.	Substantial (75–95%) cover of native vegetation, low (5–25%) cover of non-native plants, intact or moderately disrupted soils; minor intensity of human visitation or recreation.	Moderate (25–50%) cover of non-native plants, moderate or extensive soil disruption; moderate intensity of human visitation or recreation.	Dominant (>50%) cover of non-native plants, barren ground, highly compacted or otherwise disrupted soils, moderate or greater intensity of human visitation or recreation, no buffer at all.
Key Ecological Attribute: *Landscape Structure*					

Connectivity	The percentage of anthropogenic (altered) patches provides an estimate of connectivity among natural ecological systems.	Intact: Embedded in 90-100% natural habitat; connectivity is expected to be high. (Remaining natural habitat is in good condition (low modification); and a mosaic with gradients).	Variegated: Embedded in 60-90% natural habitat; habitat connectivity is generally high, but lower for species sensitive to habitat modification; (Remaining natural habitat with low to high modification and a mosaic that may have both gradients and abrupt boundaries).	Fragmented: Embedded in 10-60% natural habitat; connectivity is generally low, but varies with mobility of species and arrangement on landscape. (Remaining natural habitat with low to high modifications and gradients shortened).	Relictual: Embedded in < 10% natural habitat; connectivity is essentially absent. Remaining natural habitat generally highly modified and generally uniform).
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 0.65 – 0.79	Landscape Condition Model Index < 0.65
Rank Factor: CONDITION					
Key Ecological Attribute: *Vegetation Composition*					
Relative Cover Native Plant Species	Native species dominate this system; non-natives increase with human impacts.	Cover of native plants 95-100%.	Cover of native plants 80-95%.	Cover of native plants 50 to 79%.	Cover of native plants <50%.
Relative Cover of Invasive Species	Invasive species can inflict a wide range of ecological impacts. Early detection is critical. *Bromus tectorum* spp. and *Ventenata dubia*, are examples.	None present.	Invasive species present, but sporadic (<3% cover).	Invasive species prevalent (3–10% absolute cover).	Invasive species abundant (>10% absolute cover).
Relative Cover of Native Increasers	Some stressors such as grazing can shift or homogenize native composition toward species tolerant of stressors.	Absent or incidental	<10% cover	10-20% cover	>20% cover
Species Composition Note: Once developed, the Floristic Quality Assessment index could be used here instead.	The overall composition of native species can shift when exposed to stressors.	Species diversity/abundance at or near reference standard conditions. Native species sensitive to anthropogenic degradation are present, functional groups indicative of anthropogenic disturbance (ruderal or "weedy" species) are absent to minor, and full range of diagnostic / indicator species are present.	Species diversity/abundance close to reference standard condition. Some native species reflective of past anthropogenic degradation present. Some indicator/ diagnostic species may be absent.	Species diversity/abundance is different from reference standard condition in, but still largely composed of native species characteristic of the type. This may include ruderal ("weedy") species. Many indicator/diagnostic species may be absent.	Vegetation severely altered from reference standard. Expected strata are absent or dominated by ruderal ("weedy") species, or comprised of planted stands of non-characteristic species, or unnaturally dominated by a single species. Most or all indicator/diagnostic species are absent.

Relative Native Bunchgrass Cover	Native bunchgrass dominate; high cover is related to community resistance to invasion	Perennial bunchgrasses 80% or more relative cover or near site potential.	Perennial bunchgrasses 50-80% relative cover or reduced from site potential.	Perennial bunchgrasses 30-50% relative cover or reduced from site potential.	Perennial bunchgrass <30% relative cover and much reduced from site potential.
Key Ecological Attribute: *Vegetation Structure*					
Fire-sensitive Shrubs	Shrubs are part of the historic range of variation	Fire-sensitive shrubs mature and recovered from past fires; shrubs generally <25% cover	Fire-sensitive shrubs common not fully recovered from past fires;	Fire-sensitive shrubs present recovering from past fires;	Fire-sensitive shrubs absent to rare due to past fires;
Key Ecological Attribute: *Physicochemical*					
Soil Surface Condition	Soil disturbance can result in erosion thereby negatively affecting many ecological processes; the amount of bare ground varies naturally with site type.	Bare soil areas are limited to naturally caused disturbances such as burrowing or game trails	Some bare soil due to human causes but the extent and impact is minimal. The depth of disturbance is limited to only a few inches	Bare soil areas due to human causes are common. There may be disturbance/compaction to several inches. ORVs or other machinery may have left some shallow ruts.	Bare soil areas substantially & contribute to long-lasting impacts. Deep ruts from ORVs or machinery may be present, or livestock and/or trails are widespread. Water will be channeled or ponded.
Rank Factor: SIZE					
Key Ecological Attribute: *Size*					
Relative Size	Indicates the proportion lost due to stressors.	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	Shallow patches are determined by soil depth naturally small.	Very Large (>1000 ac; 250 ha)	Large (100-1000 ac; 25-250 ha)	(1-10 ac; 2.5-25 ha).	Small (< 1 ac; 2.5 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:

- Quantitative measurements of range health indicators (Pellant and others 2005)
- Biological Soil Crust species composition and abundance (Eldridge and Rosentreter 1999).

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 Tables above.

Table 2. Triggers for Level 2 & 3 EIA

Key Ecological Attribute or Metric	Trigger	Action
Any metric (except Connectivity)	▪ 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.

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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February 28, 2011