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 Hypermaritime Shrub and Herbaceous Headland

Ecological Summary

The North Pacific Hypermaritime Shrub and Herbaceous Headland system consists of herbaceous- and shrub-dominated areas directly adjacent to the outer Pacific Coast typically with persistent salt spray and high winds. It is a small patch system associated with coastal temperate rain forests (CWHvh) along the outer Pacific Coast from central Oregon north to Vancouver Island. The system typically occurs on steep slopes on coastal bluffs, headlands, or small islands, though sometimes this system occurs on relatively level tops of headlands or islands. Soils can be shallow to bedrock or of glacial or marine sediment origin. Climate is under the dominant influence of the Pacific Ocean (hypermaritime continentality sensu Klinka et al. 1989), is very wet, relatively warm in winter where snow is rare, and cool and foggy. There are no prolonged dry periods although summers are drier than winter and seasonal conditions are milder and less extreme than continental climates at similar latitudes.

Vegetation is dominated by perennial bunch grasses and/or shrubs. Shrubland areas are dominated by evergreen shrubs *Gaultheria shallon* and *Vaccinium ovatum*, and deciduous shrubs *Lonicera involucrata*, *Rubus spectabilis*, *Rubus parviflorus*, *Vaccinium alaskaense*, *Vaccinium ovalifolium* or the dwarf shrub, *Empetrum nigrum*. Scattered stunted trees, especially *Picea sitchensis* but occasionally *Tsuga heterophylla*, *Pseudotsuga menziesii*, or *Alnus rubra* are often present. Native dominant grasses are *Festuca rubra* or *Calamagrostis nutkaensis*. *Elymus glaucus*, *Danthonia californica*, and *Bromus sitchensis* can also be important. A diversity of forbs occurs, with some of the most prominent being *Solidago canadensis*, *Lomatium martindalei*, *Vicia gigantea*, *Equisetum telmateia*, and *Artemisia suksdorfii*. Ferna *Pteridium aquilinum* or *Blechnum spicant* can be common. Relative prevalence of grasslands versus shrublands increases to the south into Oregon. Wind and salt spray combine to limit tree growth and are dominant ecological processes on these sites along with slope failures.

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).

Road construction or timber harvesting can accelerate slope movements. Building and associated development can introduce exotic species and alter drainage and slope stability. Large patch grasslands within this system can be grazed by livestock that can result in decreasing importance of native grasses, especially bunchgrasses, and increasing importance of exotic species. Sweet vernalgrass (*Anthoxanthum odoratum*), common velvetgrass (*Holcus lanatus*), and orchardgrass (*Dactylis glomerata*) are major exotic grass species that dominate significant areas. Gorse (*Ulex europaeus*) is also found in this system.

Conceptual Ecological Model

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

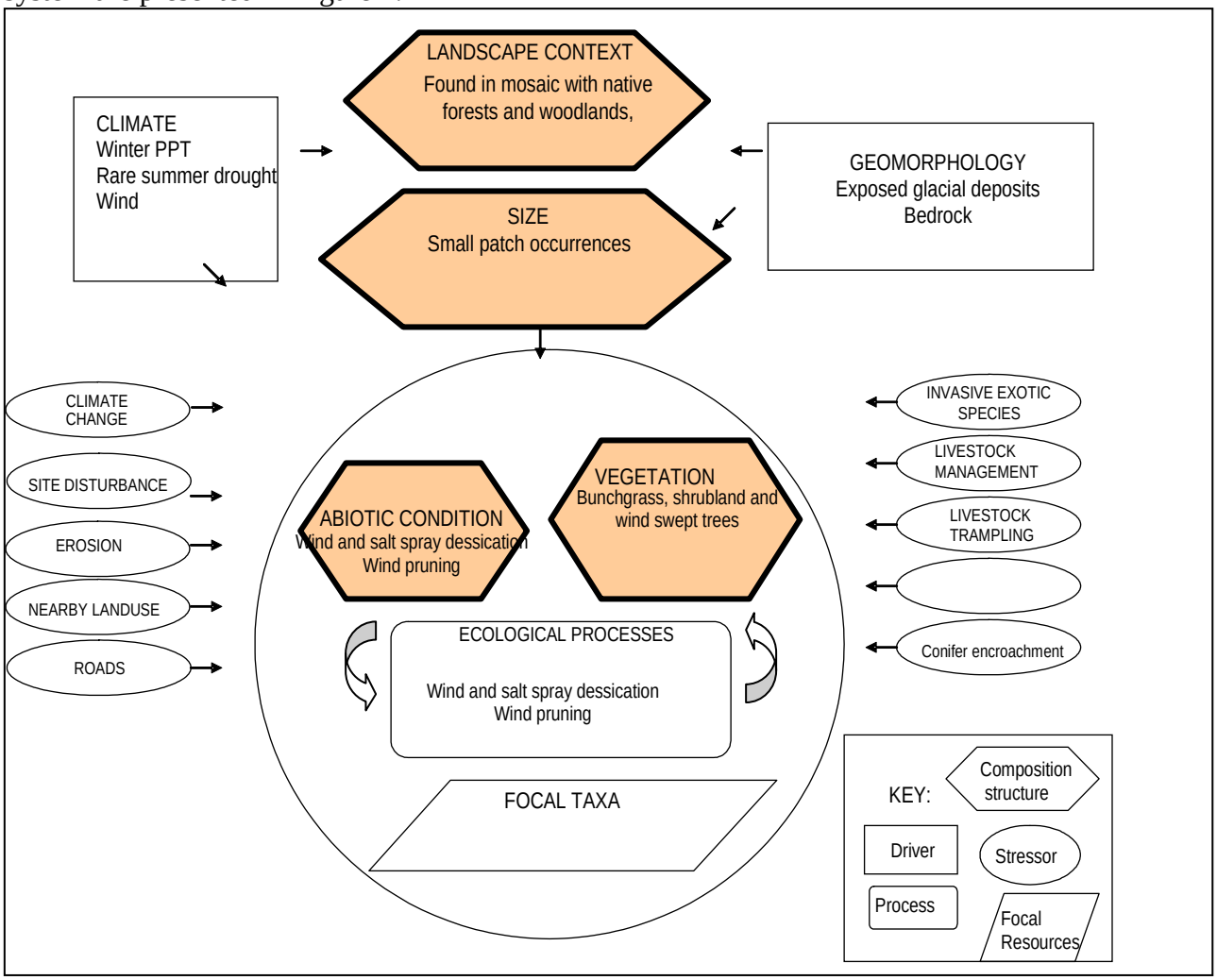

Figure 1. Generalized Conceptual Ecological Model for North Pacific Hypermaritime Shrub and Herbaceous Headland Ecological System.

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 Hypermaritime Shrub and Herbaceous Headland 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

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
Proximity to Nearby Headlands	The occurrence of nearby headland patches increases the likelihood that dispersal/pollinator processes are intact. (Alverson)	3 headlands (>10 acres) within 1 km	2 headlands (>10 acres) within 1 km	1 headlands (>10 acres) within 1 km	No headlands (>10 acres) within 1 km
Rank Factor: CONDITION					
Key Ecological Attribute: *Vegetation*					
Relative Cover Native Plant Species	Native species in shrub and herbaceous layers; non-natives increase with human impacts.	Native species total cover >95% and dominate all physiognomic layers;	Native species total cover 80-95%	Native species total cover 40 to 80%.	Native species total cover < 40%; nonnative species dominate.
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
Cover of Exotic Shrubs	Invasive shrubs (*Cytisus scoparius* or *Ulex europaeus*) displace native species and can be very aggressive. Early detection is critical	None or minimal (<1%) present.	Present, but sporadic (<5% cover).	Prevalent (5–25% cover).	Abundant > 25% cover
Relative 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*,	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).
Key Ecological Attribute: *Physicochemical*					

Soil Surface Condition	Soil disturbance can result in erosion thereby negatively affecting many ecological processes (Chappell 2006).	Bare soil areas are limited to naturally caused disturbances such as bulb digging 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 and does not show evidence of ponding or channeling water.	Bare soil areas due to human causes are common. There may be pugging due to livestock resulting in several inches of soil disturbance. ORVs or other machinery may have left some shallow ruts.	Bare soil areas substantially & contribute to altered hydrology or other long-lasting impacts. Deep ruts from ORVs or machinery may be present, or livestock pugging 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 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 (>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:

- 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 ▪ 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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