

## Ecological site AX001X03X413 Mesic Udic Warm Forest

Last updated: 9/09/2023  
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### General information

**Provisional.** A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

### MLRA notes

Major Land Resource Area (MLRA): 001X–Northern Pacific Coast Range, Foothills, and Valleys

This long and narrow resource area stretches along the Pacific Border Province of the Pacific Mountain System in Oregon and Washington. The area is bounded by the Olympic Mountains on the north and the Klamath Mountains on the south. Most of the area consists of hills and low mountains with gentle to steep slopes. The parent materials are composed primarily of young Tertiary sedimentary rocks with some minor volcanic rocks. Glacial till and outwash deposits are found in the northern half of the area within Washington. In the far southern portion of the area, near the Klamath Mountains, the sedimentary rocks are older and some have been metamorphosed. The average annual precipitation ranges from 60 to 200 inches, increasing with elevation.

The dominant soil orders in this MLRA are Andisols, Inceptisols, and Ultisols. Soil depth ranges from shallow to very deep. While most soils in the area are well drained and occur on foothills, mountain slopes and ridges, floodplain and depressional soils can range from well drained to very poorly drained. Soil textures are typically medial, loamy, or clayey. The dominant soils in the area have a mesic or frigid soil temperature regime and a udic soil moisture regime; however, soils with an aquic soil moisture regime or cryic soil temperature regime do occur.

### LRU notes

The Central Pacific Coast Range land resource unit (LRU 3) of MLRA 1 ranges from the Olympic Peninsula south into northern Oregon. LRU 3 is located south of the Olympic National Forest and extends to the Siletz River in Oregon. LRU 3 is bounded on the west by MLRA 4a Sitka Spruce Belt and MLRA 2 Willamette and Puget Sound Valleys to the east. Several major rivers have headwaters in this LRU or carved valleys through the landscape depositing more recent alluvium. These include the Chehalis, Columbia, Grays, Humptulips, Klaskanine, Nehalem, Satsop, Siletz, Willapa, Wilson, Wynoochee, and Yamhill Rivers.

### Ecological site concept

This ecological site is found on the western Coast Range in the Pacific Northwest from southern Washington to northern Oregon. It is located on the eastern extent of the LRU and has the warmest summer temperatures within this range. Elevations are typically between 300 and 2,500 feet.

The most common overstory species are western hemlock (*Tsuga heterophylla*) and Douglas-fir (*Pseudotsuga menziesii*). Bigleaf maple (*Acer macrophyllum*) and red alder (*Alnus rubra*) may be found in forest openings. Regeneration of bigleaf maple and red alder is limited by canopy cover and is commonly in gaps where sunlight is most available. Typical understory species include oceanspray (*Holodiscus discolor*), salal (*Gaultheria shallon*), vine maple (*Acer circinatum*), Cascade oregongrape (*Mahonia nervosa*), red huckleberry (*Vaccinium parvifolium*), dwarf rose (*Rosa gymnocarpa*), western swordfern (*Polystichum munitum*), and western brackenfern (*Pteridium aquilinum*). The presence of oceanspray is often the most indicative species of this site.

The most common disturbance on this site is from windthrow of overstory trees, which results in patchy, small pockets of open areas. These areas commonly occur in conjunction with either root-, butt- or stem-rot. Western hemlock is highly susceptible to rot diseases from fungi such as; *Armillaria ostoyae*, *Heterobasidion annosum*, *Phellinus weirii*, and *Echinodontium tinctorium* which may exacerbate the extent and area of disturbance. The

resulting openings in the canopy allow sunlight to reach the forest floor, benefiting the understory. Disturbance by fire is infrequent within the western hemlock zone; however, the site has a fire regime between 150-400 years and may experience stand replacing catastrophic wildfires (US Department of Agriculture, 2012).

## Associated sites

AX001X03X410	<p><b>Mesic Udic Forest</b></p> <p>Mesic Udic Warm Forest is located in the eastern most extent of the Mesic Udic Forest sequence. Mesic Udic Warm Forest is less productive, is more prone to wildfire, and is often identified by the presence of oceanspray (<i>Holodiscus discolor</i>).</p>
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**Table 1. Dominant plant species**

Tree	(1) <i>Tsuga heterophylla</i> (2) <i>Pseudotsuga menziesii</i>
Shrub	(1) <i>Mahonia nervosa</i> (2) <i>Holodiscus discolor</i>
Herbaceous	(1) <i>Polystichum munitum</i>

## Legacy ID

F001XC413OR

## Physiographic features

This ecological site is located on the eastern extent of the LRU on mountain slopes. Elevations are typically between 300 and 2,500 feet.

**Table 2. Representative physiographic features**

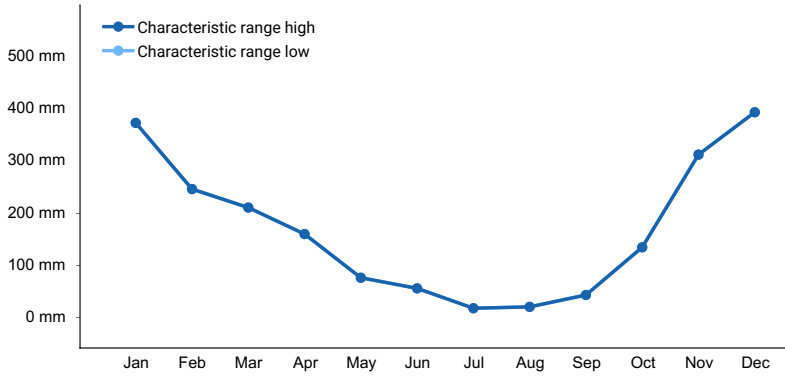
Landforms	(1) Mountains > Mountain slope (2) Mountains > Bench
Flooding frequency	None
Ponding frequency	None
Elevation	91–762 m
Slope	0–70%
Aspect	W, NW, N, NE, E, SE, S, SW

## Climatic features

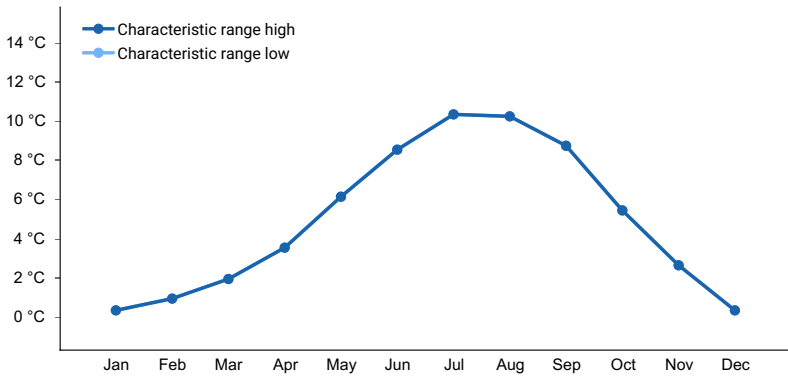
The climate has warm, moist summers and cool, wet winters. Mean annual precipitation ranges from 70 to 130 inches and occurs mostly as rain, when snow occurs it does not persist. Average annual temperatures range from 45 to 52 degrees F. The mild temperatures, abundant precipitation, and a long growing season result in highly productive forestlands.

**Table 3. Representative climatic features**

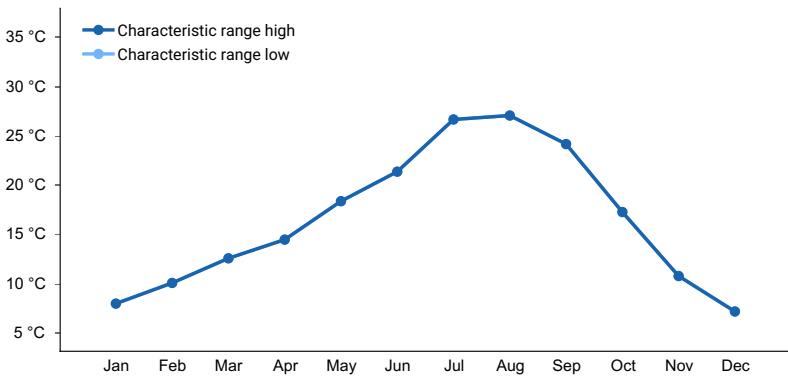
Frost-free period (characteristic range)	110-220 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	1,778-3,302 mm



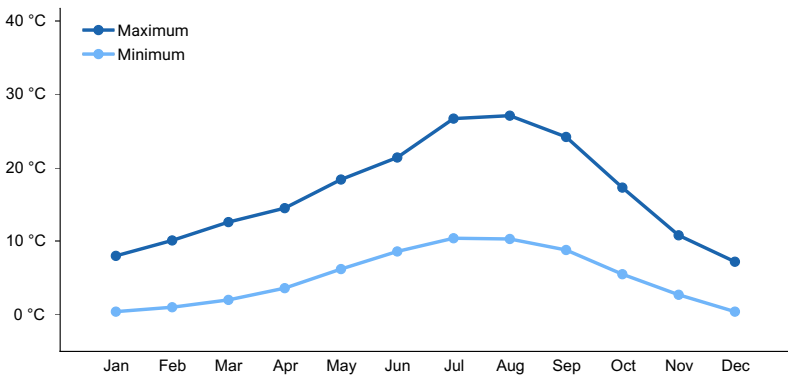
**Figure 1. Monthly precipitation range**



**Figure 2. Monthly minimum temperature range**



**Figure 3. Monthly maximum temperature range**



**Figure 4. Monthly average minimum and maximum temperature**

### **Climate stations used**

- (1) FALLS CITY 2 SSW [USC00352800], Dallas, OR

### **Influencing water features**

In general, this ecological site is not influenced by wetland or riparian water features but may be found on stream terraces or adjacent to wetland and riparian areas. This site does not experience flooding or ponding.

## Soil features

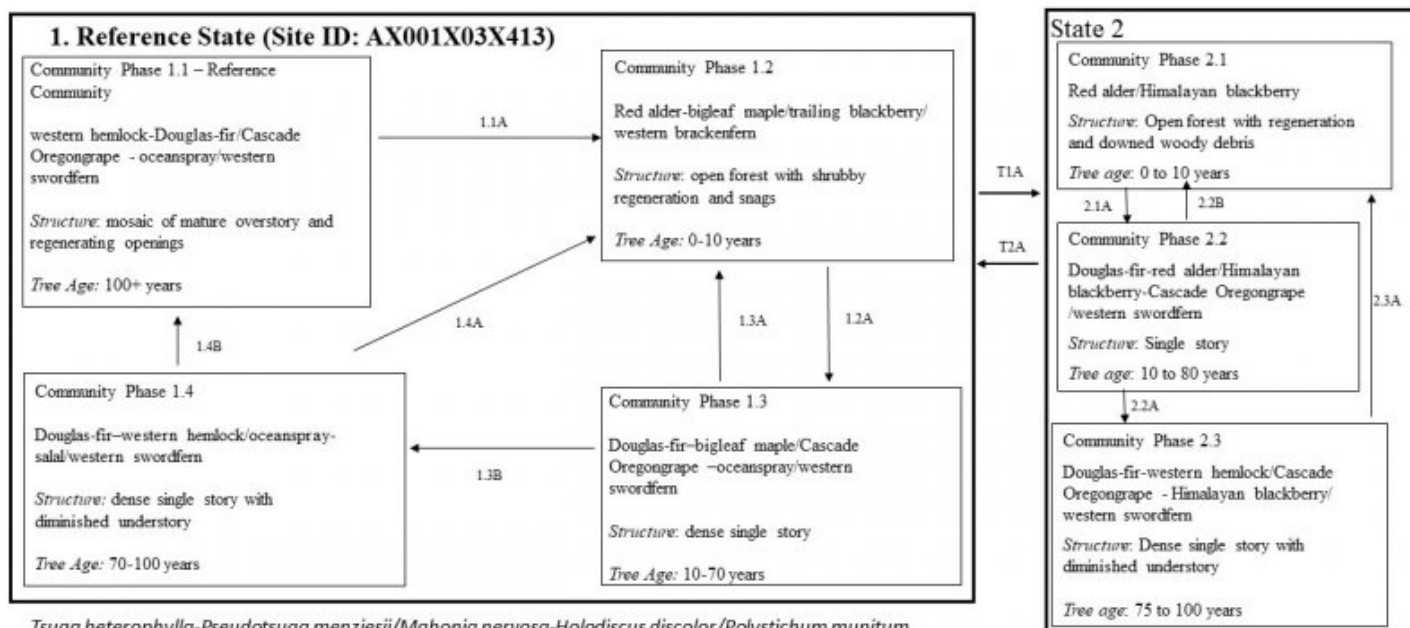
Soils that support this ecological site are well drained. They have a mesic soil temperature regime and a udic soil moisture regime. It often occurs on warmer, dry aspects of steep slopes.

Table 4. Representative soil features

Parent material	(1) Colluvium–basalt (2) Colluvium–sedimentary rock
Surface texture	(1) Very gravelly loam (2) Silty clay loam (3) Silt loam
Drainage class	Moderately well drained to well drained
Soil depth	51–152 cm
Surface fragment cover <=3"	0–2%
Surface fragment cover >3"	0%
Clay content (0-17.8cm)	18–34%
Subsurface fragment volume <=3" (2.5-152.4cm)	2–39%
Subsurface fragment volume >3" (2.5-152.4cm)	0–9%

## Ecological dynamics

### State and transition model



Community Phase Pathway 1.X = Community Phase X#Y = Transition Pathway  
1.XY = Pathway (ecological response to natural processes)  
T.XY = Pathway (ecological response to forest management influenced by invasive species)

## State 1 Reference State

### Community 1.1

Western hemlock–Douglas-fir/Cascade Oregongrape- oceanspray/western swordfern Structure: mosaic of mature overstory and regenerating openings Western hemlock and Douglas-fir are the most common overstory species in the Reference Community which lacks major disturbance for cycles of at least 100 years. Western hemlock is the most shade tolerant species in this forest and regenerates successfully in the understory. Douglas-fir is often dominant in the overstory, but regeneration is limited to gaps in the canopy. Gaps in the mid-canopy and overstory allow sunlight to reach the ground and are where the majority of the understory plants establish. In addition, these gaps provide opportunities for deciduous tree species such as red alder to regenerate throughout this reference community. Common understory shrub species include oceanspray, salal, red huckleberry, vine maple, Cascade Oregongrape, western swordfern, and western brackenfern. Because this site is within the eastern and warmest extent of the LRU, it has the lowest productivity of the forested sites within this area.

#### Dominant plant species

- western hemlock (*Tsuga heterophylla*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree
- bigleaf maple (*Acer macrophyllum*), tree
- red alder (*Alnus rubra*), tree
- Cascade barberry (*Mahonia nervosa*), shrub
- oceanspray (*Holodiscus discolor*), shrub
- salal (*Gaultheria shallon*), shrub
- vine maple (*Acer circinatum*), shrub
- red huckleberry (*Vaccinium parvifolium*), shrub
- dwarf rose (*Rosa gymnocarpa*), shrub
- western swordfern (*Polystichum munitum*), other herbaceous
- western brackenfern (*Pteridium aquilinum*), other herbaceous

### Community 1.2

Red alder-bigleaf maple/trailing blackberry/western brackenfern Structure: open forest with abundant regeneration and snags Community phase 1.2 is an early seral plant community that has been impacted by a stand-replacing disturbance such as a wildfire, large scale wind event, mass movement, or major insect pest or disease. Nearly all trees are absent, but some fire-resistant trees may survive in the overstory. Snags are prevalent and remain standing and decaying. Large woody debris may be present on the surface and serve as nurse sites. The understory is predominately early seral tree, shrub, and forb species such as red alder, bigleaf maple, red huckleberry, and western brackenfern. Red alder has several competitive advantages and can establish quickly, relative to conifers. Red alder can sprout and establish in full sunlight and as a nitrogen fixer, it can thrive in areas deficient in nitrogen (Villarin, 2009). In addition, the seeds of deciduous species are light and can be transported long distances by wind and water, allowing for rapid recolonization. Red alder seedlings and saplings will typically establish 3 to 10 years following disturbance, depending on severity. Douglas-fir is relatively fire resistant and can survive moderately intense fires, due to its thick corky bark. Depending on fire severity and cambium damage, a mature Douglas-fir component may remain as a dominant overstory species, while western redcedar and western hemlock may be at full stand replacement post fire. When resulting from a moderate to severe fire event, there is a good probability for shrubs to out-compete tree seedlings. Vine maple, oceanspray, red huckleberry, salal, and Cascade Oregongrape (which may have been only moderately abundant previously) all have the capacity to rapidly recover and spread when top-killed, slowing successful overstory regeneration. Seed sources for tree species would be from the surrounding, undisturbed forest and any of the survivors of the disturbance and would result in a mixed stand which could include Douglas-fir, western hemlock, red alder, and bigleaf maple.

#### Dominant plant species

- red alder (*Alnus rubra*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree
- bigleaf maple (*Acer macrophyllum*), tree
- California blackberry (*Rubus ursinus*), shrub

- vine maple (*Acer circinatum*), shrub
- red huckleberry (*Vaccinium parvifolium*), shrub
- Cascade barberry (*Mahonia nervosa*), shrub
- salal (*Gaultheria shallon*), shrub
- western brackenfern (*Pteridium aquilinum*), other herbaceous

### Community 1.3

Douglas-fir–bigleaf maple/Cascade Oregongrape–oceanspray/western swordfern Structure: dense single story Community phase 1.3 is an early seral forest in regeneration, possibly with scattered remnant mature trees. Species composition depends on the natural seed sources present and the intensity of disturbance. When resulting from a moderate to severe fire event, it is probable that shrubs will out-compete tree seedlings. Red alder, bigleaf maple, red huckleberry, Cascade Oregongrape, western swordfern, and oceanspray may be abundant in the understory depending on sunlight availability (Bailey, 1968). Red alder will begin to die between 40 to 70 years following disturbance and allow more light to penetrate the newly nitrogen rich soil (Naiman, 2009). As a result, conifer regeneration becomes more prevalent in this community phase. Douglas-fir will begin to regenerate and increase in dominance, creating thick patches of regenerating saplings. Species composition depends on the natural seed sources present and the intensity of disturbance.

#### Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- bigleaf maple (*Acer macrophyllum*), tree
- red alder (*Alnus rubra*), tree
- Cascade barberry (*Mahonia nervosa*), shrub
- oceanspray (*Holodiscus discolor*), shrub
- red huckleberry (*Vaccinium parvifolium*), shrub
- western swordfern (*Polystichum munitum*), other herbaceous
- western brackenfern (*Pteridium aquilinum*), other herbaceous

### Community 1.4

Douglas-fir–western hemlock/oceanspray–salal/western swordfern Structure: dense single story with diminished understory Community phase 1.4 is a forest in the competitive exclusion stage, possibly with scattered remnant mature trees. There is increasing competition among individual trees for available water and nutrients. Douglas-fir will dominate the overstory canopy, however red alder and bigleaf maple may be present in pockets of canopy openings. In addition, western hemlock is very shade tolerant and will begin to establish in the shade of mature Douglas-fir. Canopy closure is almost 100 percent leading to diminished shrub and forb layers. Some understory species better adapted to at least partial shade will begin to increase. Over time, the forest will begin to self-thin due to the elevated competition.

#### Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- western hemlock (*Tsuga heterophylla*), tree
- bigleaf maple (*Acer macrophyllum*), tree
- red alder (*Alnus rubra*), tree
- oceanspray (*Holodiscus discolor*), shrub
- salal (*Gaultheria shallon*), shrub
- Cascade barberry (*Mahonia nervosa*), shrub
- red huckleberry (*Vaccinium parvifolium*), shrub
- western swordfern (*Polystichum munitum*), grass
- western brackenfern (*Pteridium aquilinum*), grass

### Pathway 1.1A

#### Community 1.1 to 1.2

This pathway represents a major stand-replacing disturbance such as a high-intensity fire, large scale wind event, major insect pest infestation, timber management, or large mass movement event leading to the stand initiation

phase of forest development.

### **Pathway 1.2A** **Community 1.2 to 1.3**

This pathway represents growth over time with no further significant disturbance.

### **Pathway 1.3A** **Community 1.3 to 1.2**

This pathway represents a major stand-replacing disturbance such as a high-intensity fire, large scale wind event, major insect pest infestation, timber management, or large mass movement event leading to the stand initiation phase of forest development.

### **Pathway 1.3B** **Community 1.3 to 1.4**

This pathway represents growth over time with no further significant disturbance.

### **Pathway 1.4B** **Community 1.4 to 1.1**

This pathway represents growth over time with no further significant disturbance.

### **Pathway 1.4A** **Community 1.4 to 1.2**

This pathway represents a major stand-replacing disturbance such as a high-intensity fire, large scale wind event, major insect pest infestation, timber management, or large mass movement event leading to the stand initiation phase of forest development.

## **State 2**

### **Community 2.1**

Red alder/Himalayan blackberry Structure: Open forest with regeneration and downed woody debris Community Phase 2.1 represents a recently disturbed forest that is naturally regenerating. Large woody debris is often prolific following large-scale disturbances which inhibits vegetation to establish under natural conditions. Areas that are not replanted immediately (1 to 3 years) following a timber harvest or large-scale disturbance may become vulnerable to invasive species infestation. Typically, commercially managed forests will be replanted following disturbance and species preference depends on site conditions and long-term economic market decisions. Overall, species biodiversity in forests managed for short rotation timber is diminished. Natural reforestation depends on available seed sources following disturbance. Early seral species such as red alder and bigleaf maple tend to regenerate quickly with abundant sunlight. Plant community composition is typically homogenous and even-aged. Following disturbance, these sites are often dominated by Himalayan blackberry (*Rubus armeniacus*), and Scotch broom (*Cytisus scoparius*) which tend to outcompete native species establishment. Invasive species management is most critical during this phase.

#### **Dominant plant species**

- red alder (*Alnus rubra*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree
- Himalayan blackberry (*Rubus armeniacus*), shrub
- Scotch broom (*Cytisus scoparius*), shrub
- fireweed (*Chamerion angustifolium*), other herbaceous

### **Community 2.2**

Douglas-fir-red alder/Himalayan blackberry-Cascade Oregongrape/western swordfern Structure: Single story Community phase 2.2 represents an even-aged, regenerating forest. Douglas-fir can regenerate quickly on nurse logs or in recently disturbed soils. Shade-intolerant red alder remains a large component in the overstory until it reaches maturity (Fonda, 1974). The vegetation in areas that have been replanted commonly is dense and even aged, and the understory species are sparse in areas that have a high percentage of canopy cover. Cascade Oregongrape and salal are common understory species, but invasive species increase in prominence. Scotch broom and Himalayan blackberry can greatly impact the shrubby understory and outcompete native species. Scotch broom is shade-intolerant and will diminish as the canopy cover increases. Management techniques such as pre-commercial thinning and mitigation of invasive species will accelerate the maturation and improve the health of the forest.

#### **Dominant plant species**

- Douglas-fir (*Pseudotsuga menziesii*), tree
- red alder (*Alnus rubra*), tree
- Himalayan blackberry (*Rubus armeniacus*), shrub
- Cascade barberry (*Mahonia nervosa*), shrub
- salal (*Gaultheria shallon*), shrub
- western swordfern (*Polystichum munitum*), other herbaceous

### **Community 2.3**

Douglas-fir-western hemlock/Cascade Oregongrape-Himalayan blackberry/western swordfern Structure: Dense single story with diminished understory Community phase 2.3 represents a maturing forest that has increased plant diversity. Western hemlock can regenerate under dense, shrubby canopies. It will begin to establish in the overstory canopy along with Douglas-fir. Native shrub species such as Cascade Oregongrape, salal, oceanspray, and red huckleberry may increase in prominence as the forest matures. However, invasive species may inhibit the overall health and structure of the forest, creating an ecosystem which is susceptible to devastation from insects and disease. Commercial logging operations commonly take place during this phase as trees reach economical maturity in size and volume. It is presumed that without timber management during this phase, an old-growth western hemlock stand will develop.

#### **Dominant plant species**

- Douglas-fir (*Pseudotsuga menziesii*), tree
- western hemlock (*Tsuga heterophylla*), tree
- Cascade barberry (*Mahonia nervosa*), shrub
- Himalayan blackberry (*Rubus armeniacus*), shrub
- western swordfern (*Polystichum munitum*), other herbaceous

### **Pathway 2.1A**

#### **Community 2.1 to 2.2**

This pathway represents growth over time with no further major disturbance or active forest management.

### **Pathway 2.2B**

#### **Community 2.2 to 2.1**

This pathway represents a major stand-replacing disturbance such as a high-intensity fire, a large-scale wind event, a major insect or disease infestation, large mass movement, or timber harvest activities that lead to the stand initiation phase of forest development.

### **Pathway 2.2A**

#### **Community 2.2 to 2.3**

This pathway represents growth over time with no further major disturbance or active forest management.

### **Pathway 2.3A**



## **Community 2.3 to 2.1**

This pathway represents a major stand-replacing disturbance such as a high-intensity fire, a large-scale wind event, a major insect or disease infestation, large mass movement, or timber harvest activities that lead to the stand initiation phase of forest development.

### **Transition T1A**

#### **State 1 to 2**

This pathway represents an area of major disturbance that removes most of the overstory. Large-scale disturbances such as this, have the potential to increase the vulnerability of invasive species infestation when the seed source is either nearby or introduced to the site. This type of disturbance will impact the ecological site and the natural feedbacks that maintained the reference state.

### **Transition T2A**

#### **State 2 to 1**

This pathway represents intensive management to restore the historic plant community.

## **Additional community tables**

### **Inventory data references**

Other Established Classifications for Ecological Site

National Vegetation Classification: A3379 *Tsuga heterophylla* – *Pseudotsuga menziesii* / *Holodiscus discolor* Dry Forest Alliance

USDA Forest Service Plant Association and Management Guide of the Northern Oregon Coast Range: Western hemlock/dwarf Oregon grape-salal Dry Northwest Oregon Coast

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## Contributors

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## Approval

Kirt Walstad, 9/09/2023

## Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	12/16/2021
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

Dominant:

Sub-dominant:

Other:

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth ( in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state**

for the ecological site:

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17. **Perennial plant reproductive capability:**

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