Ecological site AX001X01X407
Frigid Udic Moist Forest

Last updated: 5/15/2025
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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 area consists of a long and narrow range of mountains with associated foothills and valleys that parallels the Pacific Ocean. This area is entirely within the Pacific Border Province of the Pacific Mountain System in Oregon and Washington. MLRA 1 is bounded on the north by the highest elevations of the Olympic Mountains and the strait of Juan de Fuca, and by the Klamath Mountains on the south. The Washington portion of this MLRA is primarily composed of young Tertiary sedimentary rocks (siltstone and sandstone) mixed with some volcanic rocks of the same age. Glacial till and outwash deposits also found in the northern half of this area in Washington. Much of this area is accreted terrane formed by tectonic processes. The average annual precipitation ranges from 60 to 200 inches (1,525 to 5,580 millimeters), increasing with elevation. Most of the precipitation in this area occurs during low-intensity, Pacific frontal storms and is evenly distributed throughout fall, winter, and spring. The dominant soil orders in this MLRA are Andisols, Inceptisols, and Ultisols. Soil depths broadly range from shallow to very deep. Soils are primarily well drained, however poorly drained soils may be found in depressional areas and on alluvial floodplains. Surface textures are typically medial and loamy or clayey. Soils in this area dominantly have a mesic or frigid temperature regime and a udic moisture regime. Soils with aquic moisture regimes and cryic temperature regimes also occur.

Ecological site concept

Frigid Udic Moist Forest sites occur on stable landscape positions on glacial valley walls, ridges, and colluvial aprons in the frigid temperature zone. These sites are located on both the windward and leeward sides of the Olympic Mountains. Runoff generated from less stable Frigid Udic Forest and Frigid Udic Dry Forest sites accumulates on Frigid Udic Moist Forest sites, resulting in increased available water. As a result, Frigid Udic Forest sites characteristically favor the growth and production of moist mesophytic understory species, such as salmonberry (Rubus spectabilis), threeleaf foamflower (Tiarella trifoliata), and common ladyfern (Athyrium filix-femina). Frigid Udic Forest sites are characterized by a dense overstory of Pacific silver fir (Abies amabilis) and Western hemlock (Tsuga heterophylla), accompanied by an understory shrub community of oval-leaf blueberry (Vaccinium ovalifolium) and salmonberry. Western redcedar (Thuja plicata) may be present as a minor overstory component. The herbaceous layer is dominated by threeleaf foamflower, common ladyfern, strawberryleaf raspberry (Rubus pedatus), and bride’s bonnet (Clintonia uniflora). Deer fern (Blechnum spicant), twinflower (Linnaea borealis), rusty menziesii (Menziesia ferruginea), and deerfoot vanillaleaf (Achlys triphylla) are other common understory species on this site.

Associated sites

AX001X01X200	**Temperate Wet Meadow** Temperate Wet Meadow sites may be found adjacent to or surrounded by Frigid Udic Moist Forest sites. Temperate Wet Meadows occur on depressions and seeps. Temperate Wet Meadow sites lack tree cover.
AX001X01X108	**Frigid Aquic Forest** Frigid Aquic Forest sites may occur downslope or in mosaic with Frigid Udic Moist Forest sites. Frigid Aquic Forest sites occur on depressions and seeps and are subject to ponding.

AX001X01X406	**Frigid Udic Forest** Frigid Udic Forest sites may be found upslope of Frigid Udic Moist Forest sites and frequently generate run-off moisture that is captured by Frigid Udic Moist Forest sites.
AX001X01X408	**Frigid Udic Dry Forest** Frigid Udic Dry Forest sites may be found upslope of Frigid Udic Moist Forest sites and frequently generate run-off moisture that is captured by Frigid Udic Moist Forest sites.

Similar sites

AX001X01X401	**Mesic Udic Forest** Mesic Udic Moist Forest sites occur at lower elevations and lack Pacific Silver-fir (Abies amabilis).
AX001X01X411	**Low Cryic Udic Moist Forest** Low Cryic Udic Moist Forest sites are found at higher elevations and are indicated by the presence of mountain hemlock (Tsuga mertensiana).

Table 1. Dominant plant species

Tree	(1) *Abies amabilis* (2) *Tsuga heterophylla*
Shrub	(1) *Vaccinium ovalifolium* (2) *Rubus spectabilis*
Herbaceous	(1) *Tiarella trifoliata* (2) *Athyrium filix-femina*

Legacy ID

F001XA407WA

Physiographic features

This site primarily occurs on glacial valley walls, ridges, and colluvial aprons on mountains. These upland forest sites are strongly influenced by slope gradients. Frigid Udic Moist Forest sites are typically found on intermediate slopes between steeper Mesic Udic Forest or Mesic Udic Dry Forest sites and the more stable Temperate Wet Meadow or Mesic Aquic Forest sites. Mesic Udic Moist Forests receive a moderate amount of additional moisture via run-on.

Table 2. Representative physiographic features

Landforms	(1) Mountains (2) Glacial-valley wall (3) Colluvial apron (4) Ridge

Flooding frequency	None
Ponding frequency	None
Elevation	450 – 1,150 m
Slope	0 – 70 %
Water table depth	150 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

This site occurs in a frigid temperature and udic moisture regime. Precipitation arrives mostly via low-intensity, Pacific frontal storms. Precipitation is unevenly distributed, with the lowest amounts on the leeward side of the Coast Range mountains. Precipitation falls largely as snow in higher elevations. Precipitation is evenly distributed throughout the fall, winter, and spring, while summers are dry. Air temperatures vary significantly along the elevation gradient.

Table 3 Representative climatic features

Frost-free period (characteristic range)	90-150 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	2,010-3,000 mm

Influencing water features

There are no dominant water features influencing plant community dynamics on site.

Soil features

The soils are very deep, have very high or high Ksat throughout, and are well drained. The soils are formed colluvium derived from metasedimentary rock. The soil surface texture is gravelly loam. Clay content is eight to 17 percent throughout. The soil series for this ecological site is Bonjonpass. Although representative of this site, these soils may exist across multiple ecological sites because of naturally variable slope, texture, rock fragments, and pH. An on-site soil pit and the most current ecological site key are necessary to classify a site.

Table 4. Representative soil features

Parent material	(1) Colluvium – metasedimentary rock
Surface texture	(1) Gravelly loam

Drainage class	Well drained
Soil depth	150 cm
Surface fragment cover <=3"	0 – 10 %
Surface fragment cover >3"	0 – 10 %
Available water capacity (0-101.6cm)	5.08 – 10.16 cm
Soil reaction (1:1 water) (0-25.4cm)	4.5 – 5.5
Subsurface fragment volume <=3" (0-50.8cm)	20 – 60 %
Subsurface fragment volume >3" (0-50.8cm)	0 – 20 %

Ecological dynamics

Frequent, small-scale disturbances from windthrow events create a mosaic fabric of early-seral patches within late-seral communities. Canopy gaps are created by windthrow events. These small-scale disturbances create a mosaic of dense canopy and small regenerating forest openings. Dominant conifers on this site are susceptible to a variety of root and butt rot fungi. Wood decay fungi exacerbate mature trees' vulnerability to windthrow events.

Infrequent, large-scale disturbances may occur in the form of stand-replacing wildfires, cataclysmic wind events, or large mass movement events. High-force windstorms are a major source of large-scale disturbance in these forests. These blowdown events may be stand-replacing and conditions tend to favor shade-intolerant species in their aftermath (Van Pelt, 2007). The fire regime of the western half of the Olympic Peninsula is characterized by high-intensity, stand-replacing fires with a long return interval of greater than 100 years (Agee, 1987). Though infrequent, wildfires have a profound influence on the composition of these forests. Douglas-fir is a shade-intolerant species and generally requires a stand-replacing wildfire to clear canopy for successful recruitment and regeneration. In the absence of large-scale disturbance, more shade-tolerant western hemlock and pacific silver fir regenerate successfully and gradually succeed Douglas-fir. The longevity of Douglas-fir preserves evidence of historical high-intensity fire events. Large mass-movement events also provide conditions for the initiation of primary succession. Landslides are a significant source of disturbance, owing to the steep terrain and sedimentary geology of the park. (Gavin, 2014). As with stand-replacing wildfires, bare patches created by landslides favor establishment of non-shade tolerant Douglas-fir (Geertsema & Pojar, 2007).

Red alder and Douglas-fir recruits regenerate in the aftermath of stand-replacing disturbance, accompanied by salmonberry (Rubus spectabilis) and western swordfern (Polystichum munitum). Western hemlock gradually establishes post-disturbance, and along with Douglas-fir, begins to form a discrete canopy. As this happens, the understory community diversifies. Shrub and forb layers develop, dominated by red huckleberry, sweet after death (Achlys triphylla), locally known as deerfoot vanilla leaf, and bunchberry dogwood (Cornus canadensis). As the canopy begins to mature, western hemlock begins to replace Douglas-fir as the dominant tree species. Given enough time, extremely shade-tolerant Pacific silver fir will establish on the site. At this point, the canopy is composed of a single, dense stratum. Canopy stratification will be encouraged by tree maturation, as well as by mortality induced by small-scale disturbances. Increased vertical stratification promotes diversity and abundance of shrubs and forbs, allowing a return to reference community conditions.

Changes in disturbance frequency or intensity through human alteration of the natural fire regime and a changing climate may promote shifts in community structure and function. For example, fire suppression efforts will likely shift communities further towards shade-tolerant Pacific silver fir and western hemlock-dominated seral stage. (Reed, 2010) Alternatively, increased fire frequency in some areas due to human activity will encourage Douglas-fir recruitment and establishment. (Gavin, 2015)

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 1.4 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 1.5 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 10. Community 1.6 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

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Approval

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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	09/24/2026
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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

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

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

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

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

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:**
