

Ecological site F003XC305WA

Low Mountain Slopes Moist Forest western hemlock

Last updated: 9/09/2023
Accessed: 05/08/2024

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): 003X—Olympic and Cascade Mountains

This area includes the west slope and parts of the east slope of the Cascades Mountains in Washington and Oregon. The Olympic Mountains in Washington State are also included. These mountains are part of a volcanic arc located at a convergent plate boundary. Volcanic rocks predominate but metamorphic and sedimentary rocks occur in the North Cascades and Olympic Mountains. Topography is generally dissected and steep, but some areas consist of constructional volcanic platforms and isolated stratovolcanoes. Elevation is usually 500 to 6000 feet but reaches to 14,410 ft at the summit of Mount Rainier. Many areas hosted alpine glaciers or ice sheets during the Pleistocene, and a few remain today.

Climate becomes cooler and moister with increasing elevation and latitude. Low elevations experience a long growing season and mild temperatures. High elevations can accumulate snowpack lasting into summer and frost may occur in any month. Average annual precipitation ranges from 60 to 180 inches in most areas. Most precipitation falls during the fall, winter, and spring during low-intensity frontal storms. Summers are relatively dry. Average annual temperature is 27 to 50 degrees F. The frost-free period is 10 to 180 days.

LRU notes

The Glaciated Western Cascades land resource unit is located in southwestern Washington primarily along the western slope of the Cascade Range. It is bounded by the Snoqualmie Pass area to the north and the Columbia River to the south. To the west is the Puget Sound Trough (MLRA 2) and to the east is the drier eastern slope of the Cascade Range (MLRA 6).

The major rivers originating in the LRU are the Puyallup and Nisqually Rivers which drain to Puget Sound and the Cowlitz and Lewis Rivers which drain west to the Columbia.

Some of the lithology in the LRU is the result of numerous accretions from tectonic subduction of the Pacific plate along the margin of the North American plate creating combinations of metamorphized sedimentary or oceanic rock and intrusive volcanic plutons. The Cascades in this area have a long history of volcanic activity starting about 55 million years ago. Eruptions have created a complex sequence of low-silica and silica-rich depositions that have been eroded and buried repeatedly (Washington Geological Survey). Mount Rainier, Mount Adams, and Mount Saint Helens are volcanoes and the most notable peaks; Mount Saint Helens continues to vent after the 1980 eruption. Alpine glaciers still remain active at the highest elevations. The area was not influenced by continental glaciation, however Pleistocene alpine glaciation modified much of the dissected terrain and contributed glacial sediment to the complex combination of lithologies and volcanism.

Soils are mainly Spodosols and Andisols.

Vegetation is primarily dense forest with some parkland in subalpine and alpine areas. Douglas-fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*) are the dominate tree species found at lower elevations;

western redcedar (*Thuja plicata*) is quite common. Pacific silver fir (*Abies amabilis*) and mountain hemlock (*Tsuga mertensiana*) are the primary tree species in the higher elevations; subalpine fir (*Abies lasiocarpa*) and Alaska cedar (*Callitropsis nootkatensis*) can be widespread as well.

Classification relationships

western hemlock/Cascade Oregongrape
western hemlock/Pacific rhododendron-salal, Olympic

Ecological site concept

This ecological site resides on ridges and mountain slopes in the mountains at elevations ranging from 3,000 to 5,200 feet on slopes of 30 to more than 60 percent. The climate is warmer and moist (average frost-free days is 35-90 days, the mean annual precipitation is 40 to more than 90 inches, the mean annual air temperature is 37 to 43 degrees Fahrenheit. The soils are Inceptisols and Spodosols. Soils have have andic soil properties in the upper parts of the profile. Parent material is a mixture of colluvium and volcanic ash near the surface over colluvium or residuum. The soil temperature regime is cryic and the soil moisture regime straddles xeric and udic. The reference community has an overstory of western hemlock (*Tsuga heterophylla*) and western redcedar (*Thuja plicata*) with some Douglas fir (*Pseudotsuga menziesii*) in multiple canopy layers with an understory of mainly vine maple (*Acer circinatum*) in the early stages, and later: Cascade barberry (*Mahonia nervosa*) but also salal (*Gaultheria shallon*), pipsissewa (*Chimophila umbellatum*), dwarf bilberry (*Vaccinium caespitosum*). Other species that may be present include western teaberry (*Gaultheria ovalifolia*), western rattlesnake plantain (*Goodyear oblongifolia*), twinflower (*Linnea borealis*), rusty menziesia (*Menziesii ferruginea*), sidebells wintergreen (*Orthilia secunda*), Oregon boxleaf (*Pachistima myrsinites*), and thinleaf huckleberry (*Vaccinium membranaceum*). After ten years dominating the understory, vine maple (*Acer circinatum*) can be replaced with other longer living shrub species. Fire is the main disturbance factor and has a return interval of 100 to 200 years and is stand replacing in severity. For western hemlock (*Tsuga heterophylla*) in the Pacific Northwest, the fire return interval is 150 to 400 years. In the southern Washington Cascades, it is thought the fire return interval is 100 to 200 years based on stand ages. LANDFIRE models state that all types of fires for western hemlock (*Tsuga heterophylla*) stands have a return interval typically of 400 years but spans between 300 to 800 years for stand replacing fires. Other small patch disturbances such as diseases (Laminated (*Armillaria*, *Annosum*) root rots, brown cubical rot, dwarf mistletoe), and insect damage can occur.

Associated sites

F003XC303WA	Flood Plain black cottonwood
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Similar sites

F003XA305WA	Low Glacial Trough Valleys Moist Forest western hemlock
F003XB305WA	Low Mountain Slopes Moist Forest western hemlock

Table 1. Dominant plant species

Tree	(1) <i>Tsuga heterophylla</i> (2) <i>Thuja plicata</i>
Shrub	(1) <i>Acer circinatum</i> (2) <i>Mahonia nervosa</i>
Herbaceous	(1) <i>Paxistima myrsinites</i> (2) <i>Clintonia uniflora</i>

Physiographic features

This ecological site resides on ridges and mountain slopes in the mountains at elevations ranging from 3,000 to 5,200 feet on slopes of 30 to more than 60 percent.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Mountains > Ridge
Elevation	3,000–5,200 ft
Slope	0–3%
Aspect	W, NW, N, S, SW

Climatic features

The climate is warmer and moist. The mean annual air temperature is 35 to 45 degrees Fahrenheit.

Table 3. Representative climatic features

Frost-free period (characteristic range)	35-90 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	40-90 in

Influencing water features

This site is not influenced by water from a wetland or stream.

Soil features

The soils are Inceptisols and Spodosols. Soils have have andic soil properties in the upper parts of the profile.

Parent material is volcanic ash over colluvium or residuum from igneous, sedimentary and metamorphic rock and marine deposits derived from basalt.

The soil temperature regime is cryic and the soil moisture regime straddles xeric and udic. Andic soil properties are found from 0 to 12 inches depth in the soil profile.

Table 4. Representative soil features

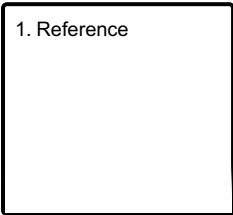
Parent material	(1) Volcanic ash (2) Colluvium (3) Residuum
Surface texture	(1) Ashy sandy loam (2) Ashy loamy sand (3) Medial sandy loam
Family particle size	(1) Sandy-skeletal (2) Loamy-skeletal
Drainage class	Well drained
Permeability class	Rapid
Depth to restrictive layer	20–60 in
Soil depth	20–60 in
Surface fragment cover <=3"	4–37%
Surface fragment cover >3"	10–19%
Available water capacity (Depth not specified)	0.7–3.7 in
Calcium carbonate equivalent (Depth not specified)	0%
Soil reaction (1:1 water) (Depth not specified)	4.5–6

Ecological dynamics

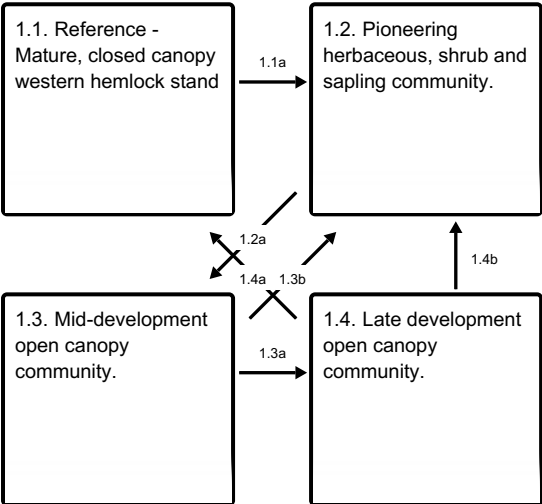
Ecological Dynamics Narrative: Fire is a rare, stand replacing event in this ecological site. Generally, the fire return interval is believed to be 100 to 200 years in the southern Washington Cascades, based on stand ages and 150 to 400 years for western hemlock in the Pacific Northwest as a whole. LANDFIRE BPS models state that stand replacement fires occur in 400-year intervals (300 to 800 year range) for western hemlock forests in Washington and Oregon. Fire is a large patch disturbance while diseases such as Laminated (Armillaria, Annosum) root rots, brown cubical rot, dwarf mistletoe are small patch disturbances that allow the closed, continuous canopy to open.

State and transition model

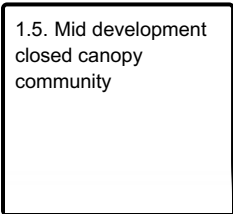
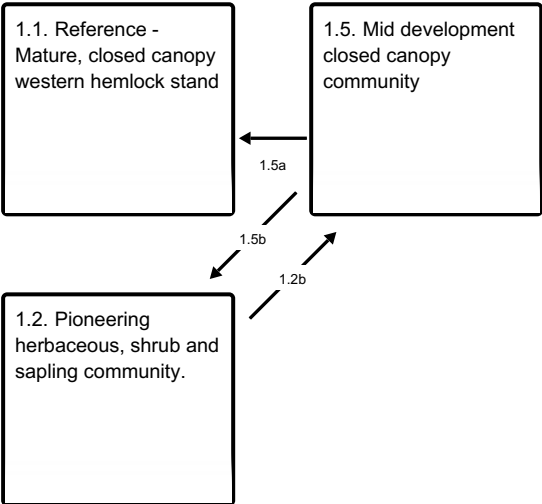
Ecosystem states



State 1 submodel, plant communities



Communities 1, 5 and 2 (additional pathways)



State 1
Reference

Community 1.1
Reference - Mature, closed canopy western hemlock stand

This phase has an overstory dominated Western hemlock, with Western cedar and Douglas fir, with a lower tree canopy of these species; an understory of tall shrubs, and cool, moist adapted herbaceous species. understory of mainly vine maple in the early stages, and later: Cascade barberry but also salal , pipsissewa, dwarf bilberry. Other species that may be present include western teaberry, western rattlesnake plantain, twinflower, rusty menziesia, sidebells wintergreen, Oregon boxleaf, and thinleaf huckleberry. Trees are large, with an average diameter at breast

height of 20 to 30 inches and older, at least 150 to 200 years old.

Community 1.2

Pioneering herbaceous, shrub and sapling community.

Immediately post-fire, western brackenfern and fireweed dominate, and on-site and windblown tree seeds establish including Douglas fir, western hemlock, western redcedar, trembling aspen, paper birch and black cottonwood in wetter areas. Shrub and herbaceous plants resprout and pioneering herbaceous plants establish on mineral soil interspaces. This is a short duration community phase. This initial phase is followed by the shrub community. This plant community contains a high diversity of shrubs including Cascade barberry but also salal, pipsissewa, dwarf bilberry. Other species that may be present include western teaberry, western rattlesnake plantain, twinflower, rusty menziesia, sidebells wintergreen, Oregon boxleaf, and thinleaf huckleberry. In time, seedlings grow into sapling sized trees. This phase lasts for approximately twenty years.

Community 1.3

Mid-development open canopy community.

This phase is dominated by a mix of Douglas fir, western redcedar, and western hemlock and some deciduous trees that are pole sized (less than 20 inches diameter at breast height), and are 20-100 years old, and are in an open canopy due to windthrow, insects and disease.

Community 1.4

Late development open canopy community.

This phase is dominated by a mix of large Douglas fir, western hemlock, and western redcedar and some deciduous trees that are pole sized and are in an open canopy due to windthrow, insects and disease. Trees are large greater than 20 inches diameter at breast height, and older 100-150 years old.

Community 1.5

Mid development closed canopy community

This phase is dominated by a mix of Douglas fir, western hemlock, western redcedar and some deciduous trees that are pole sized and are in a closed canopy configuration. Trees are less than 20 inches diameter at breast height and 20 to 100 years old.

Pathway 1.1a

Community 1.1 to 1.2

Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants. This disturbance causes a return to the pioneering, herbaceous community with resprouting shrubs.

Pathway 1.2a

Community 1.2 to 1.3

With time, the tree seedlings and small saplings go to the mid development community and due to the occurrence of mixed severity fire the canopy is in an open configuration.

Pathway 1.2b

Community 1.2 to 1.5

With time, the tree seedlings and small saplings go to the mid development community grow into the closed canopy configuration.

Pathway 1.3b

Community 1.3 to 1.2

Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous

plants. This disturbance causes a return to the pioneering, herbaceous community with resprouting shrubs.

Pathway 1.3a **Community 1.3 to 1.4**

With time, the pole sized trees develop to large mature trees in the late development phase.

Pathway 1.4a **Community 1.4 to 1.1**

With time, the large mature trees develop into the closed configuration of the reference phase without the occurrence of mixed severity fire.

Pathway 1.4b **Community 1.4 to 1.2**

Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants. This disturbance causes a return to the pioneering, herbaceous community with resprouting shrubs.

Pathway 1.5a **Community 1.5 to 1.1**

With time, the large mature trees develop into the closed configuration of the reference phase without the occurrence of mixed severity fire.

Pathway 1.5b **Community 1.5 to 1.2**

Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants. This disturbance causes a return to the pioneering, herbaceous community with resprouting shrubs.

Additional community tables

Other references

Scientific Literature:

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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	05/08/2024
Approved by	Kirt Walstad
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):**
-
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:
-
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**
-
14. **Average percent litter cover (%) and depth (in):**
-
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**
-
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:

17. **Perennial plant reproductive capability:**
