

## **Ecological site R003XA310WA High Glacial Valley Walls Alpine**

Last updated: 1/29/2025  
Accessed: 05/12/2025

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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): 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 North Cascades land resource unit is located in northwestern Washington primarily along the western slope of the Cascade Range. It bounded by the international boundary with Canada to the north and the Snoqualmie Pass area 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 Skagit River is the largest river to originate in the LRU and is governed by three hydroelectric dams. Other rivers that drain west include the Nooksack, Snohomish, and Skykomish. The Wenatchee River drains east toward the Columbia.

Lithology is the result of numerous accretions from tectonic subduction of the Pacific plate along the margin of the North American plate. The North Cascades are arranged in a west to east series of terranes which are combinations of metamorphized sedimentary or oceanic rock and intrusive volcanic plutons, punctuated by the minorly active Mount Baker and Glacier Peak volcanoes (Washington Geological Survey). Additionally, Pleistocene continental and alpine glaciation covered almost all of the area except the highest peaks in the range and deposited large amounts of glacial sediment. Alpine glaciers still remain active today in the highest elevations.

Soils are primarily Spodosols, Andisols, and Inceptisols.

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.

Ecological site concept

This ecological site resides at the highest elevation zone within this LRU, spanning from 5,500 ft to 7,150 ft on glacial valley walls in mountains on 30 to 60 percent slopes. This site is cold, with a persistent snowpack, high wind and a very short growing season. The frost-free days is 40-70 days, the mean annual precipitation is 40 to 80 inches, the mean annual air temperature is 35 to 40 degrees Fahrenheit. Soils are highly variable and are either Andisols (Humic Vitricryands) or Inceptisols (Humic Dystrocryepts, Lithic, or Vitrandic Dystrocryepts). The site occurs in the cryic soil temperature and udic soil moisture regimes. Parent material is primarily volcanic ash over colluvium or residuum. The reference vegetation community is a high alpine meadow that includes a diverse mix of sedges, rushes, grasses and herbaceous species with heath shrubs on slightly drier areas. Common disturbance is burrowing by rodents such as hoary marmots (*Marmota caligata*) or black bear (*Ursus americanus*) scavenging by digging. Rare fire occurs from lightning strikes that cause small patch size burns at 400-year rotational intervals. At the highest elevations, on concave positions which hold snow long into the summer, are sedge dominated snowbeds.

Associated sites

F003XA309WA	High Glacial Trough Valleys Parkland - mountain hemlock-subalpine larch-whitebark pine
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Similar sites

R003XN544WA	Southern Washington Cascades Wet Alpine Tundra
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Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Cassiope mertensiana</i> (2) <i>Luetkea pectinata</i>

Physiographic features

This ecological site resides at the highest elevation zone within this LRU, spanning from 5,500 to 7150 feet on glacial valley walls in mountains on 30 to 60 percent slopes. This site is cold, with a persistent snowpack, high wind and a very short growing season.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Glacial-valley wall (2) Mountains > Mountain slope
Elevation	1,554–2,195 m
Slope	30–60%
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Elevation	Not specified
Slope	15–75%

Climatic features

The frost-free days is 40 to 70 days, the mean annual precipitation is 40 to 80 inches, the mean annual air temperature is 35 to 40 degrees Fahrenheit.

**Table 4. Representative climatic features**

Frost-free period (characteristic range)	40-70 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	1,016-2,032 mm

## Influencing water features

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

## Soil features

Soils are highly variable and are either Andisols (Humic Vitricryands) or Inceptisols (Humic Dystrocryepts, Lithic, or Vitrandic Dystrocryepts). The site occurs in the cryic soil temperature and udic soil moisture regimes. Parent material is volcanic ash over colluvium or residuum from igneous, sedimentary, and metamorphic rock. Andic soil properties are present at depths ranging 0 to 30 inches.

**Table 5. Representative soil features**

Parent material	(1) Volcanic ash (2) Colluvium (3) Residuum
Surface texture	(1) Ashy silt loam (2) Ashy fine sandy loam (3) Ashy sandy loam
Family particle size	(1) Ashy over loamy-skeletal (2) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderately rapid to rapid
Depth to restrictive layer	20–152 cm
Soil depth	20–152 cm
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0–25%
Available water capacity (Depth not specified)	5.08–13.46 cm
Calcium carbonate equivalent (Depth not specified)	0%
Soil reaction (1:1 water) (Depth not specified)	5.1–7.3

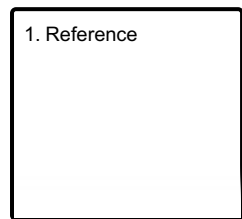
## Ecological dynamics

This ecological site is defined as a high alpine meadow that includes a diverse reference community of lush herbaceous species including sedges, rushes, grasses and forbs with heath species at drier convex positions and grass species on warmer, drier slopes. On wind blasted areas, species typical of tundra prevail. The diverse meadow includes sedges (mountain sedge (*Carex scopulorum*), showy sedge (*Carex spectabilis*)), rushes (Parry's rush (*Juncus parryi*), Piper's woodrush (*Luzula piperi*), curved woodrush (*Luzula arcuata*)) and forbs: Pacific lupine (*Lupinus Lepidus*), alpine mountainsorrel (*Oxyria digyna*), American bistort (*Polygonum bistotoides*), creeping sibbaldia (*Sibbaldia procumbens*), American globeflower (*Trollis laxus*), Cusick's speedwell (*Veronica cusickii*), American alpine speedwell (*Veronica wornskoldii*), white marsh marigold (*Caltha leptosepala*), Payson's draba (*Draba paysonii*)). Common shrubs are artic willow (*Salix arctica*), and dwarf bilberry (*Vaccinium ceasпитosum*). Heaths are pink mountainheath (*Phyllodoce empetriformis*), yellow mountainheath (*Phyllodoce glanduliflora*), western moss heather (*Cassiope mertensiana*), arctic white mountainheather (*Cassiope tetragona*), and

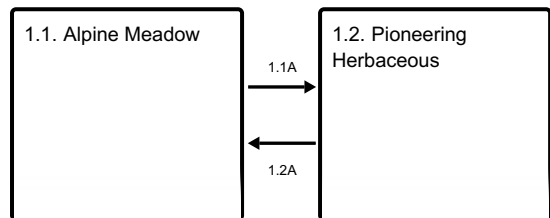
partridgefoot (*Luetika pectinate*). Tundra species include eightpetal mountain-avens (*Dryas octopetala*) and alpine flase candytuft (*Smelowskia ovalis*). On south aspects, Greenleaf fescue (*Festuca viridis*), alpine bluegrass (*Poa alpine*), alpine timothy (*Phleum alpine*) can dominate. Common natural disturbance is burrowing by rodents such as hoary marmots (*Marmota caligata*) or black bear (*Ursus americanus*) scavenging by digging that expose mineral soil allowing resident seedbank and windblown seeds to establish. Fire rarely occurs every 400 years. Fires can burn the site, though the fuel load is low. Erosional tears on slopes can occur and cause the vegetation community to return to the pioneering herbaceous phase. Trampling by humans, wildlife, or livestock can cause compaction of the soil and damage to vegetation and recovery is slow. At the highest elevations on concave positions, the sedge black alpine sedge (*Carex nigricans*) can dominate the snowbed.

## State and transition model

### Ecosystem states



### State 1 submodel, plant communities



## State 1 Reference

### Community 1.1 Alpine Meadow

A high alpine meadow of lush forb, sedge, rush, grass species with heath shrub communities included. Species can include: Valerian sitchensis, *Carex spectabilis*, *Luzula hitchcockii*, *Phyllodoce empetriformis*. This is a diverse forb, sedge community with heath shrubs on drier areas, low pioneering herbs in disturbed areas, grasses dominating in south aspects slopes, and *Carex nigricans* in concave snowbeds at highest elevations.

### Community 1.2 Pioneering Herbaceous

Pioneering herbaceous community of resident seedbank and windblown seeds establishing and with time being replaced by perennial species.

### Pathway 1.1A Community 1.1 to 1.2

Rodent / bear digging, erosional tear on slope, very infrequent fire due to low fuels, cold climate.

### Pathway 1.2A Community 1.2 to 1.1

Time since disturbance that allows pioneering herbaceous species to establish and then become replaced by perennial species.

## Additional community tables

## Other references

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Hartley, Ernest. Thirty-year monitoring of Subalpine Meadow vegetation following a 1967 trampling experiment at Logan Pass, Glacier National Park, Montana.

Landals, M. and Scotter, G. An ecological assessment of the Summit Area, Mount Revelstoke National Park. Edmonton, AB: Canadian Wildlife Service; 1974. 197 p.

U.S. Department of Agriculture, Forest Service, Missoula Fire Sciences Laboratory. 2012. Information from LANDFIRE on fire regimes of northwestern high-elevation grassland communities. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (Producer). Available:

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Tardiff, S. and J. Standford. 1998. Grizzly bear digging: effects on subalpine meadow plants in relation to mineral nitrogen availability. Ecology. 79 (7). pp. 2219-2228.

## Contributors

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## Approval

Kirt Walstad, 1/29/2025

## 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	01/29/2025
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:
- 
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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