USDA Natural Resources Conservation Service

Ecological site R003XA304WA
Avalanche Sitka alder (Alnus viridis)

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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 is defined by the process of the repeated effect of snow avalanches that create a chute in which rigid-stemmed trees cannot thrive, but flexible-stemmed shrub and herbaceous species persist. The reference community includes moisture-adapted shrubs and herbaceous species and deciduous tree species on the edges of the chutes including: gray alder (Alnus incana), Sitka alder (Alnus viridis), common ladyfern (Athyrium filix-femina), arrowleaf ragwort (Senecio triangularis), redosier dogwood (Cornus sericea), Pacific oakfern (Gymnocarpium disjunctum), rusty menziesia (Menziesi ferruginea), devilsclub (Ophopanax horridus), Oregon boxleaf (Pachistima myrsinites), black cottonwood (Populus balsamifera ssp. Trichocarpa) , prickly currant (Ribe lacustre), salmonberry (Rubus spectabilis), threeleaf foamflower (Tiarella trifoliata), Carolina bugbane (Trautvetteria caroliniensis). The site resides on mid to lower portions of avalanche chutes, in the mountains on slopes 35-90%, at elevations of 4,000 to 5,800 feet. The climatic characteristics are broad considering they cover the high elevation head of the avalanche chute down slope to the low elevation runout zone. The mean annual precipitation 40 to 80 inches, the mean annual air temperature is 35 to 40 degrees Fahrenheit, the frost-free days range 40 to 70 days. Soils in this site are in the cryic soil temperature regime and udic soil moisture regime. The soils are variable; taxonomic classification is to the great group level. Fulvicryands dominate with andic soil properties. Umbric epipedons develop due to the highly herbaceous plant community. The parent material is volcanic ash mixed with colluvium over fragmental material.

Associated sites

F003XA306WA	**East Mountain Slopes Forest subalpine fir**
F003XA307WA	**Mountain Slopes Forest Pacific silver fir**
F003XA308WA	**High Cirque Forest mountain hemlock**

Similar sites

F003XN926WA	**Cryic/Udic Active Natural Disturbance**

Table 1. Dominant plant species

Tree	(1) *Alnus viridis ssp. sinuata* (2) *Alnus incana*
Shrub	(1) *Alnus viridis ssp. sinuata* (2) *Alnus incana*
Herbaceous	(1) *Athyrium filix-femina* (2) *Senecio triangularis*

Physiographic features

It resides on mid to lower portions of avalanche chutes, in the mountains on slopes ranging from 35 to 90 percent at elevations of 4,000 to 5,800 feet.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Avalanche chute
Elevation	4,000–5,800 ft
Slope	35–90%
Aspect	W, NW, N, S, SW

Climatic features

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

Table 3. Representative climatic features

Frost-free period (characteristic range)	40-70 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	40-80 in

Influencing water features

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

Soil features

Soils in this site are in the cryic soil temperature regime and udic soil moisture regime. The soils are variable; taxonomic classification is to the great group level. Fulvicryands dominate with andic soil properties. Umbric epipedons develop due to the highly herbaceous plant community. The parent material is volcanic ash mixed with colluvium over fragmental material.

Table 4. Representative soil features

Parent material	(1) Volcanic ash (2) Colluvium
Surface texture	(1) Very stony, medial sandy loam
Family particle size	(1) Medial over 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"	20–25%
Surface fragment cover >3"	20–50%
Available water capacity (Depth not specified)	2.8–4.1 in
Calcium carbonate equivalent (Depth not specified)	0%
Soil reaction (1:1 water) (Depth not specified)	5.6–6.5

Ecological dynamics

The ecological dynamics of this site are defined by the power of avalanches down chutes which precludes the development of rigid-stemmed trees and allows only flexible-stemmed shrub and herbaceous species to thrive. At the end of the chute is the run-out zone in which moist adapted herbaceous species thrive. This area is in a run-in position for water and soils that are nutrient-rich and thus supports a diversity of herbaceous species. Avalanches repeat in the same locale.

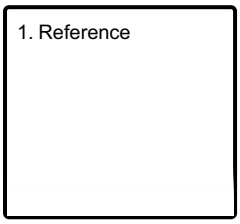
This ecological site is defined by the active movement of rock material and snow during avalanches through the chute and into the run-out area. The force of the avalanche precludes tree establishment in the chute and transports fine soil material into the run-out area, causing a nutrient-rich, lush vegetation community. Avalanches occur in the montane to lower subalpine on slopes beyond the angle of repose (generally 15 to 60 percent) and occur due to unstable snowpack. Avalanches can occur regularly in the same location, or there may be significant time between avalanche events. Large avalanche events can run thousands of feet from one mountain slope, across the adjacent valley, and up the opposing mountain slope (NPS Vegetation Mapping Report). Frequently, avalanches occur in areas with gullies and have moist site conditions due to adjacency with localized funneling of water drainage.

This ecological site is limited to avalanche chutes and debris cone landforms, found on backslope and footslope

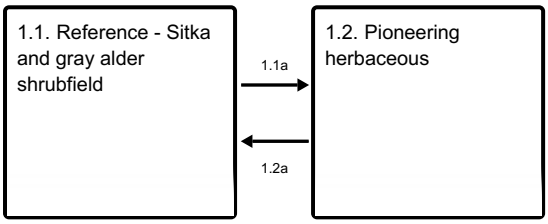
positions on mountains at higher elevations, on all aspects, and on moderate to steep slopes.
This ecological site is defined by its position on the landscape, the avalanche chute, an area of periodic active disturbance and its associated unique soil and vegetation characteristics. The avalanche chute spans numerous elevation zones, has active disturbance which periodically changes successional stages, and can be a vector for seeds and propagules from higher elevations to move to lower ones. As such, avalanche chutes tend to be very diverse in vegetation. The frequency and severity of disturbance can vary, but the impact on the vegetation community favors species that can withstand the force of the avalanche. Rigid-trunked conifer species rarely are able to withstand the force of the avalanche in the center of the chute and will either snap at the trunk or have broken tops, or be stunted. If trees are found in the chute, they generally are lower down in elevation in the flatter runout zone, the area with least force of the avalanche. They can be either deciduous resprouting species like quaking aspen or black cottonwood, or conifer species with a maximum 20 percent cover in the lower elevation, lower impact runout zone, and young (25 years old) growing between disturbance events. Shrub species that basally resprout after disturbance or are able to lie prostrate and sprout multiple stems are preferred.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1
Reference

Community 1.1
Reference - Sitka and gray alder shrubfield

Sitka alder and gray alder with an understory of moist adapted herbaceous species within the avalanche chute, and the run-out zone dominated by herbaceous species, deciduous tree clumps may be possible on edges of chute.

Community 1.2
Pioneering herbaceous

Pioneering herbaceous community that is comprised of on-site and windblown shrub seeds that establish, shrub and herbaceous plants may resprout and pioneering herbaceous plants establish on mineral soil.

Pathway 1.1a
Community 1.1 to 1.2

Avalanche force kills all ridge-stem trees, top-kills shrubs. Shrubs and herbaceous plants quickly regenerate by resprouting, pioneering herbaceous plants establish from resident seedbank and windblown seed. The avalanche run-out zone is in a run-in position for waterflow and thus is generally lush in herbaceous vegetation.

Pathway 1.2a
Community 1.2 to 1.1

Time allows the herbaceous plants and shrubs to dominate the site.

Additional community tables

Other references

Scientific Literature
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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	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:**