Ecological site F003XN949WA
Southern Washington Cascades High Cryic Riparian Forest

Last updated: 5/10/2024
Accessed: 05/20/2024

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

Steep mountains and narrow to broad, gently sloping valleys characterize this MLRA. A triple junction of two oceanic plates and one continental plate is directly offshore from Puget Sound. Subduction of the oceanic plates under the westerly and northwesterly moving continental plate contributes to volcanic activity in the Cascade Mountains. Movement among these plates has resulted in major earthquakes and the formation of large stratovolcanoes. The Cascade Mountains consist primarily of volcanic crystalline rock and some associated metasedimentary rock. The mean annual precipitation is dominantly 60 to 100 inches, but it is 30 to 60 inches on the east side of the Cascade Mountains.
The soil orders in this MLRA are dominantly Andisols, Spodosols, and Inceptisols and minor areas of Entisols and Histosols. The soils are dominantly in the frigid or cryic temperature regime and the udic moisture regime. The soils generally are shallow to very deep, well drained, ashy to medial, and loamy or sandy. They are on mountain slopes and ridges.

Ecological site concept

This ecological site is in cold, moist areas at low to high elevations (1,700 to 6,900 feet) in Mount Rainier National Park. The site is on flood plains and terraces of river valleys. The most common natural disturbance is flooding. The volume and longevity of the flooding determine the effect on the dynamics of the forest. Elevation and climate are key components in the succession of the forest. The cold, wet winters and cool, dry summers impact the rate of growth and time to maturity.
The soils that support this site are in the cryic soil temperature regime and the udic soil moisture regime. They are somewhat excessively drained and very deep. Soil moisture is not a limiting factor to forest growth because of the abundance of precipitation and the inherent water-holding properties of soils influenced by volcanic ash. A thin organic horizon consisting of decomposing twigs, needles, and litter is on the soil surface. This horizon helps to protect the soils from wind and water erosion.
Alaska cedar (*Callitropsis nootkatensis*) and Sitka alder (*Alnus viridis* ssp. sinuata) are the most common overstory species. Some Pacific silver fir (*Abies amabilis*), Engelmann spruce (*Picea engelmannii*), black cottonwood (*Populus balsamifera* ssp. trichocarpa), and Douglas-fir (*Pseudotsuga menziesii*) are present.

Associated sites

F003XN950WA	**Southern Washington Cascades Moist High Cryic Coniferous Forest** Ecological Site F003XN950WA is located within the cryic temperature regime and is upslope from riparian corridors. This conifer forest is not influenced by flooding disturbance, but may have a seasonal high water table at a depth of 10 to 20 inches during the growing season. Primary vegetation indicators include mountain hemlock and Cascade azalea.

Similar sites

F003XN944WA	**Southern Washington Cascades Low Cryic Riparian Forest** Ecological site F003XN949WA is located at high elevations compared to site F003XN944WA, Southern Washington Cascades Low Cryic Riparian Forest. Both sites are associated with the Flett soils and are subject to intense flooding. Site F003XN949WA is in colder, wetter areas at high elevations; thus, the growing conditions are harsher. Ecological site F003XN944WA supports black cottonwood and Pacific silver fir in the reference community, and site F003XN949WA supports Alaska cedar and Sitka alder. The rates of maturity and growth of species are lower on site F003XN949WA than they are on site F003XN944WA.

Table 1. Dominant plant species

Tree	(1) *Callitropsis nootkatensis* (2) *Alnus viridis var. sinuata*
Shrub	(1) *Salix barclayi* (2) *Rubus pedatus*
Herbaceous	Not specified

Physiographic features

This ecological site is on flood plains and terraces of river valley bottoms at an elevation of 1,700 to 6,900 feet in Mount Rainier National Park. Slope commonly is 0 to 15 percent.

Table 2. Representative physiographic features

Landforms	(1) River valley > Flood plain
Flooding frequency	None to rare
Ponding frequency	None
Elevation	518–2,103 m
Slope	0–15%
Water table depth	152 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

Most of the annual precipitation is received in October through March. The mean annual precipitation is 63 to 100 inches, and the mean annual air temperature is 36 to 45 degrees F. Generally, the summers are cool and dry and the winters are cold and wet.

Table 3. Representative climatic features

Frost-free period (characteristic range)	60-90 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	1,600-2,540 mm

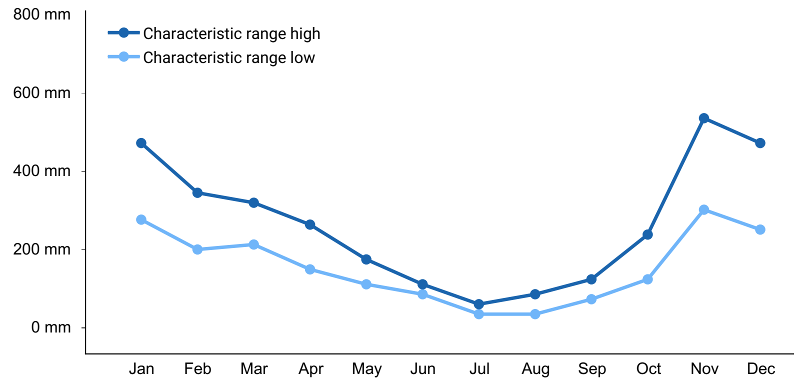


Figure 1. Monthly precipitation range

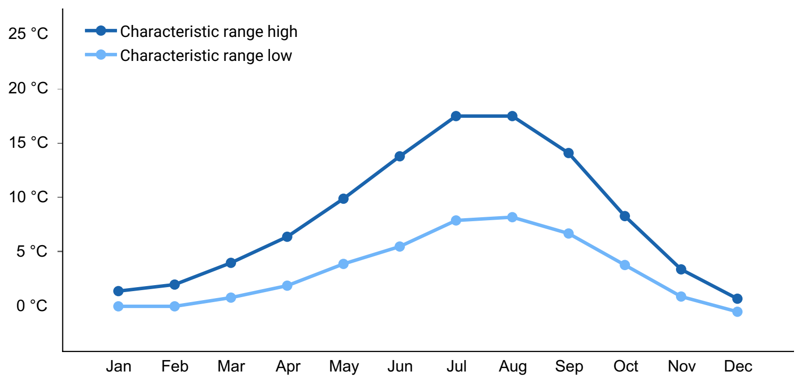


Figure 2. Monthly minimum temperature range

Influencing water features

This site is at low to high elevations on terraces and flood plains in Mount Rainier National Park. The frequency of flooding is rare; however, 100- or 500-year floods may dramatically alter the landscape. The water table typically rises in spring and recedes in fall.

Soil features

Applicable soils: Flett, cold

Applicable soil map units: 8200

The Flett soils are on flood plains and terraces of river valleys. The soils formed in alluvium derived from andesite mixed with volcanic ash. They are subject to rare periods of flooding in April, May, October, and November. The soils have more than 35 percent rock fragments in the particle-size control section. They are coarse textured and primarily ashy loamy sand and ashy sandy loam. Podsolization is not evident in the profile because the soils are relatively young in terms of soil formation. The soils have an ochric epipedon and a cambic horizon.

Table 4. Representative soil features

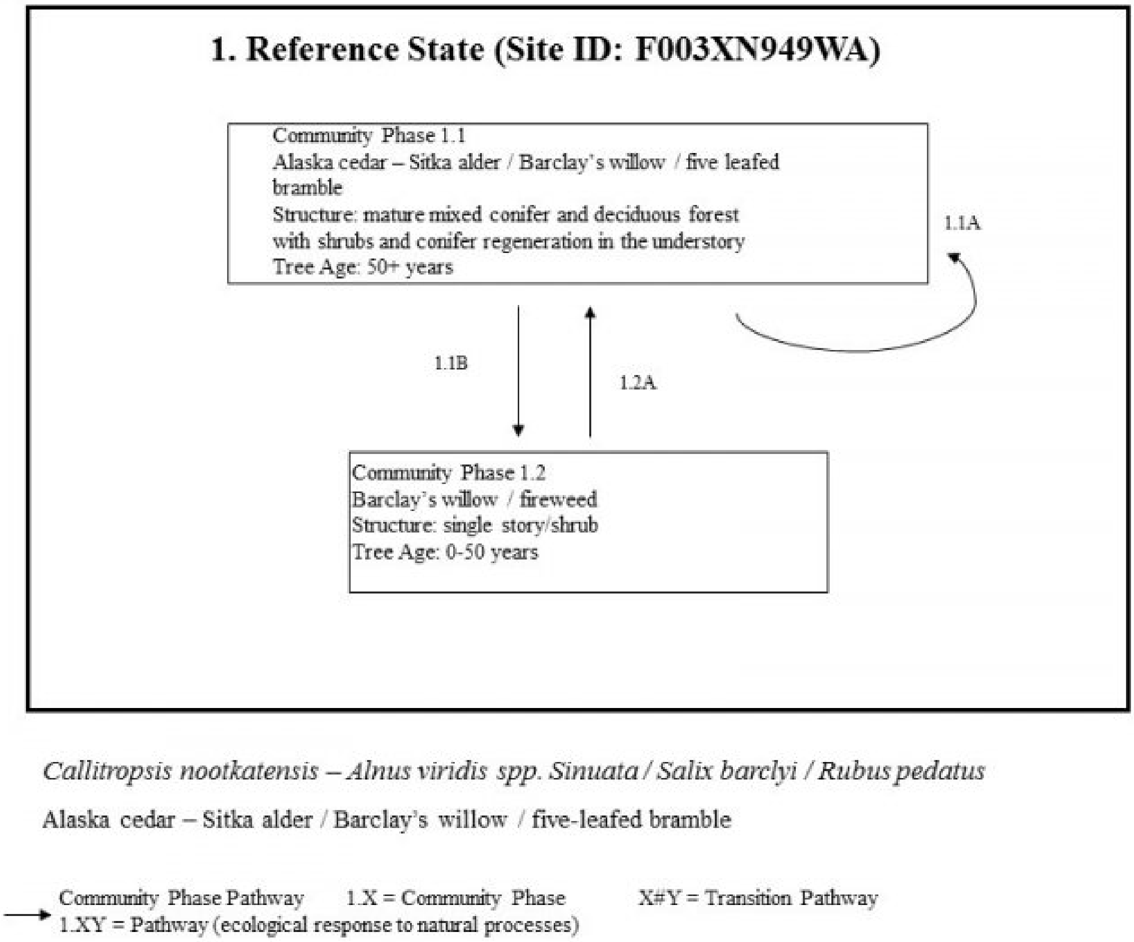
Parent material	(1) Alluvium–andesite (2) Volcanic ash
Surface texture	(1) Very stony, ashy sandy loam (2) Gravelly, ashy coarse sandy loam (3) Very gravelly, ashy loamy sand
Drainage class	Excessively drained
Soil depth	152 cm
Surface fragment cover <=3"	15–60%
Surface fragment cover >3"	0–30%

Available water capacity (Depth not specified)	3.3–16 cm
Soil reaction (1:1 water) (Depth not specified)	3.5–6
Subsurface fragment volume <=3" (Depth not specified)	0–55%
Subsurface fragment volume >3" (Depth not specified)	0–60%

Ecological dynamics

This ecological site is along rivers on flat, historic flood plains and terraces. Alaska cedar (*Callitropsis nootkatensis*) and Sitka alder (*Alnus viridis* ssp. sinuata) are the most common overstory species. Some Pacific silver fir (*Abies amabilis*), Engelmann spruce (*Picea engelmannii*), black cottonwood (*Populus balsamifera* ssp. trichocarpa), and Douglas-fir (*Pseudotsuga menziesii*) are present. The understory commonly is shrubby. Barclay's willow (*Salix barclayi*) and vine maple (*Acer circinatum*) make up the dense subcanopy.
The most common natural disturbance is flooding. The volume and longevity of the flooding determine the effect on the dynamics of the forest. Frequent periods of peak flow generally do not impact the channel flow, but they transport a considerable amount of sediment. Extreme rain-on-snow flood events and debris flows can alter the stream channel by incision or aggradation. These events remove the existing vegetation along the flood plain and are stand replacing (Czuba, 2012).
The landscape position is perhaps the most important factor that determines the species composition. Conifers are more prevalent on the terraces, and deciduous species are more prevalent on the active flood plains, where more frequent fluvial disturbances occur (Villarian, 2009). Black cottonwood and red alder germinate successfully on the bare mineral soil present after the site is scoured by flooding. In the more flood-prone areas, shrubs may be less dense and more light may reach the forest floor. An herb layer that includes five-leaved bramble (*Rubus pedatus*), fireweed (*Chamerion angustifolium*), and pearly everlasting (*Anaphalis margaritacea*) is in scattered areas. During a long the period between major floods, conifers establish and the overstory becomes more diverse. With the absence of disturbance, it is expected that the maturation and succession of the forest will result in an old growth conifer community.

State and transition model



State 1
Reference State

Community 1.1
Alaska cedar-Sitka alder/Barclay's willow/five-leaved bramble

Structure: Mature mixed conifer and deciduous forest with shrubs and conifer regeneration in the understory The reference community represents a lack of major flooding for at least 80 years. Conifers are more prevalent on the terraces, and deciduous species are on the active flood plains, where more frequent fluvial disturbances occur. Over time, shade-tolerant conifers such as Alaska cedar, Pacific silver fir, and Engelmann spruce regenerate in the understory. The lack of flooding allows for growth of a vigorous understory of shrubs, including Barclay's willow and vine maple. Other common disturbances include small gap dynamics (openings of 1/2 acre or smaller) following the decline of shade-intolerant species and minor scouring from flooding. Community phase pathway 1.1A This pathway represents minor disturbances that maintain the overall structure of the reference community. The death of one or two trees creates gaps that allow sunlight to reach the understory, promoting the growth of forbs and shrubs and the regeneration of overstory species. Deposition following minor scouring from flooding temporarily affects the understory community, but it does not alter the composition of the overstory.

Dominant plant species

- Alaska cedar (*Callitropsis nootkatensis*), tree
- Pacific silver fir (*Abies amabilis*), tree
- Engelmann spruce (*Picea engelmannii*), tree
- Sitka alder (*Alnus viridis ssp. sinuata*), shrub
- Barclay's willow (*Salix barclayi*), shrub
- strawberryleaf raspberry (*Rubus pedatus*), shrub
- fireweed (*Chamerion angustifolium*), other herbaceous
- western pearly everlasting (*Anaphalis margaritacea*), other herbaceous

Community 1.2
Barclay's willow/fireweed

Structure: Single story/shrub Community phase 1.2 represents a forest that is undergoing regeneration or stand initiation. Scattered remnant mature trees are in some areas. Successful regeneration is dependent on the local seed source, an adequate seedbed, and sufficient light and water (Nierenberg, 2000). Sitka alder, Barclay’s willow, and vine maple are the pioneering early seral species that become established first after a major disturbance. Seeds of deciduous species are light and can be transported long distances by wind and water, which allows for rapid recolonization. The shrubs compete with seedlings and saplings until the tree species overtop them. A major disturbance allows for establishment of seral forb species such as five-leaved bramble and fireweed.

Dominant plant species

- Barclay's willow (*Salix barclayi*), shrub
- Sitka alder (*Alnus viridis ssp. sinuata*), shrub
- vine maple (*Acer circinatum*), shrub
- strawberryleaf raspberry (*Rubus pedatus*), shrub
- fireweed (*Chamerion angustifolium*), other herbaceous

Pathway 1.1B
Community 1.1 to 1.2

Alaska cedar-Sitka alder/Barclay's willow/five-leaved bramble

Barclay's willow/fireweed

This pathway represents a major 100- or 500-year flood that results in complete or nearly complete loss of the overstory.

Pathway 1.2A
Community 1.2 to 1.1

Barclay's willow/fireweed

Alaska cedar-Sitka alder/Barclay's willow/five-leaved bramble

This pathway represents growth over time with no further significant disturbance. The areas of regeneration go through the typical phases of stands, including competitive exclusion, maturation, and understory reinitiation, until they resemble the old-growth structure of the reference community.

Additional community tables

Type locality

Location 1: Pierce County, WA	
Township/Range/Section	T1N R07E S25
Latitude	46° 50′ 46″
Longitude	121° 52′ 7″

Other references

Barnes, George H. 1962. Yield of even-aged stands of western hemlock. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station Technical Bulletin 1273.
Crawford, R.C., C.B. Chappell, C.C. Thompson, and F.J. Rocchio. 2009. Vegetation classification of Mount Rainier, North Cascades, and Olympic National Parks. Natural Resource Technical Report NPS/NCCN/NRTR-2009/211. National Park Service, Fort Collins, Colorado.
Czuba, J., C. Magirl, C. Czuba, C. Curran, K. Johnson, T. Olsen, H. Kimball, and C. Gish. 2012. Geomorphic analysis of the river response to sedimentation downstream of Mount Rainier, Washington. U.S. Geological Survey Open-file Report 2012-1242. Reston, Virginia.
Dwire, K., and J. Kauffman. 2003. Fire and riparian ecosystems in landscapes in the western United States. Forest Ecology and Management. Volume 178, pages 61-74.
Goheen, E.M., and E.A. Willhite. 2006. Field guide to common diseases and insect pests of Oregon and Washington conifers. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region R6-NR-FID-PR-01-06.
Hanley, D.P., and D.M. Baumgartner. 2002. Forest ecology in Washington. Washington State University Cooperative Extension Technical Report EB 1943.
Hanson, E.J., D.L. Azuma, and B.A. Hiserote. 2002. Site index equations and mean annual increment equations for Pacific Northwest Research Station forest inventory and analysis inventories, 1985-2001. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station Research Note PNW-RN-533.
Hemstrom, M., and J. Franklin. 1982. Fire and other disturbances of the forests in Mount Rainier National Park. Quaternary Research. Volume 18, pages 32-61.
Henderson, J.A., R.D. Lesher, D.H. Peter, and D.C. Shaw. 1992. Field guide to the forested plant associations of

the Mt. Baker-Snoqualmie National Forest. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region Technical Paper R6-ECOL-TP-028-91.
King, James E. 1966. Site index curves for Douglas-fir in the Pacific Northwest. Weyerhaeuser Company, Forestry Research Center Forestry Paper 8.
Kittel, G., D. Meidinger, and D. Faber-Langendoen. 2015. G240 *Pseudotsuga menziesii*-Tsuga heterophylla/Gaultheria shallon forest group. United States National Vegetation Classification. Federal Geographic Data Committee, Vegetation Subcommittee, Washington, D.C.
Means, J.E. 1990. Tsuga mertensiana. In Silvics of North America: Volume 1. Conifers. U.S. Department of Agriculture, Forest Service, Agriculture Handbook 654. Pages 623-634. https://www.srs.fs.usda.gov/pubs/misc/ag_654_vol1.pdf
Naiman, R., S. Bechtold, T. Beechie, J. Latterell, and R. Van Pelt. 2009. A process-based view of floodplain forest patterns in coastal river valleys of the Pacific Northwest. Ecosystems. Volume 13, pages 1-31.
Nierenberg, T., and D. Hibbs. 2000. A characterization of unmanaged riparian areas in the central Coast Range of western Oregon. Forest Ecology and Management. Volume 129, pages 195-206.
Packee, E.C. 1990. Tsuga heterophylla. In Silvics of North America: Volume 1. Conifers. U.S. Department of Agriculture, Forest Service, Agriculture Handbook 654. Pages 613-622. https://www.srs.fs.usda.gov/pubs/misc/ag_654_vol1.pdf
Pojar, J., and A. MacKinnon. 1994. Plants of the Pacific Northwest Coast. Lone Pine, Vancouver, British Columbia.
PRISM Climate Group. Oregon State University. Accessed February 2015. http://prism.oregonstate.edu
Rochefort, R.M., and D.L. Peterson. 1996. Temporal and spatial distribution of trees in subalpine meadows of Mount Rainier National Park. Arctic and Alpine Research. Volume 28, number 1, pages 52-59.
Seastedt, T.R., and G.A. Adams. 2001. Effects of mobile tree islands on alpine tundra soils. Ecology. Volume 82, pages 8-17. Scientia Silvica. 1997. Regeneration patterns in the mountain hemlock zone. Extension Series, Number 6.
Smith, K., G. Kuhn, and L. Townsend. 2008. Culmination of mean annual increment for indicator tree species in the State of Washington. U.S. Department of Agriculture, Natural Resources Conservation Service, Technical Note Forestry-9.
Tesky, J.L. 1992. Tsuga mertensiana. In Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/tsumer/all.html
Topik, C., N.M. Halverson, and D.G. Brockway. 1986. Plant associations and management guide for the western hemlock zone, Gifford Pinchot National Forest. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region Technical Paper R6-ECOL-230A-1986.
United States Department of Agriculture, Forest Service. 1990. Silvics of North America. Agriculture Handbook 654. https://www.fs.usda.gov/naspf/
United States Department of Agriculture, Natural Resources Conservation Service, and United States Department of the Interior, National Park Service. 2014. Ecological site descriptions for North Cascades National Park Complex, Washington.
Villarin, L., D. Chapin, and J. Jones. 2009. Riparian forest structure and succession in second-growth stands of the central Cascade Mountains, Washington, USA. Forest Ecology and Management. Volume 257, pages 1375-1385.

Contributors

Erin Kreutz
Erik Dahlke
Philip Roberts

Approval

Kirt Walstad, 5/10/2024

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	05/10/2024
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:**