USDA Natural Resources
Conservation Service

Ecological site F003XN945WA
Southern Washington Cascades Wet Low Cryic Coniferous Forest

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

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, wet areas at middle to high elevations (1,800 to 5,700 feet) of Mount Rainier National Park. Climate is a key component in the succession of the forest dynamics. The site is in depressions and swales and on terraces and debris aprons that have a seasonal high water table.
The soils that support this ecological site are in the cryic soil temperature regime and the aquic soil moisture regime. They are poorly drained and very deep, and they have a seasonal high water table at the surface to a depth of 10 inches below the surface some time during the growing season. The soils are subject to frequent periods of ponding in April, May, and June. The most common natural disturbance is ponding. The volume and longevity of the ponding determine the effect on the dynamics of the forest.
Western redcedar (*Thuja plicata*) and red alder (*Alnus rubra*) are the most common overstory species, but western hemlock (*Tsuga heterophylla*), Douglas-fir (*Pseudotsuga menziesii*), and Pacific silver fir (Abies amabilis) are present. The root penetration of western redcedar makes it well adapted to forested swamps. An herb layer consisting of American skunkcabbage (*Lysichiton americanus*), western swordfern (*Polystichum munitum*), deer fern (*Blechnum spicant*), western oakfern (*Gymnocarpium dryopteris*), five-leaved bramble (*Rubus pedatus*), and twinflower (*Linnaea borealis*) is in scattered areas.

Associated sites

F003XN941WA	**Southern Washington Cascades Wet Frigid Coniferous Forest** The vegetation in ecological site F003XN945WA has commonalities to that of site F003XN941WA; however, site F003XN945WA receives more precipitation and is commonly located at higher elevations.

Similar sites

F003XN946WA	**Southern Washington Cascades Moist Low Cryic Coniferous Forest** Ecological F003XN945WA, Southern Washington Cascades Wet Low Cryic Coniferous Forest, has features similar to those of sitesF003XN946WA, Washington Cascades Moist Low Cryic Coniferous Forest. Ecological site F003XN945WA is wetter than site F003XN946WA. It is prone to frequent periods of ponding and it has a higher seasonal water table. As a result, site F003XN945WA supports species adapted to wetness, such as western redcedar, red alder, and American skunkcabbage. Ecological F003XN946WA is drier, and it supports species such as Pacific silver fir, western redcedar, and devilsclub.
F003XN947WA	**Southern Washington Cascades Low Cryic Coniferous Forest** Ecological F003XN945WA, Southern Washington Cascades Wet Low Cryic Coniferous Forest, has features similar to those of site F003XN947WA, Washington Cascades Low Cryic Coniferous Forest. The soils of site F003XN947WA are well drained. Species adapted to the drier conditions, such as Pacific silver fir, western hemlock, and black mountain huckleberry, are common.

Table 1. Dominant plant species

Tree	(1) *Thuja plicata* (2) *Alnus rubra*
Shrub	(1) *Oplopanax horridus*
Herbaceous	(1) *Lysichiton americanus*

Physiographic features

This ecological site is in depressions and swales and on terraces and debris aprons at middle to high elevations (1,800 to 5,700 feet) in Mount Rainier National Park. Slope commonly is 0 to 10 percent.

Table 2. Representative physiographic features

Landforms	(1) Depression (2) Swale (3) Terrace
Flooding frequency	None
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	1,800–5,700 ft
Slope	0–10%
Water table depth	0–80 in
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 50 to 113 inches, and the mean annual air temperature is 37 to 44 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)	50-113 in

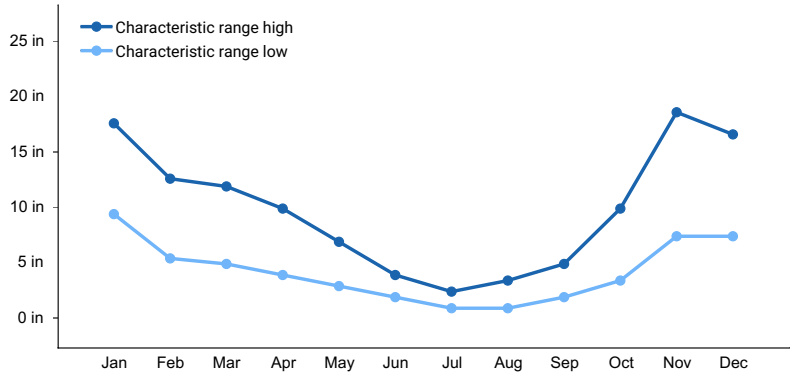


Figure 1. Monthly precipitation range

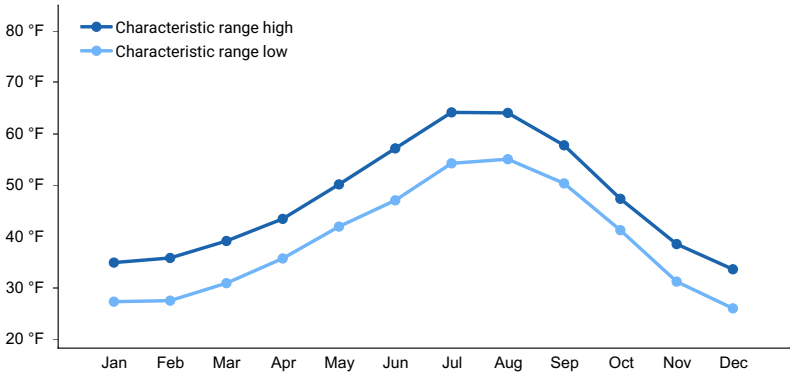


Figure 2. Monthly minimum temperature range

Influencing water features

This site is at middle to high elevations along depressions, swales, terraces, and debris aprons in Mount Rainier National Park. It is subject to frequent, long periods of ponding.

Soil features

Applicable soils: Frogheaven

Applicable soil map units: 8101, 8110, 8120, 8125, 8130, 8150, 9110, 9120, 9125

The Frogheaven soils are in depressions and swales and on terraces, and debris aprons. They have a seasonal high water table at the surface to a depth of 10 inches below the surface some time during the growing season. They are subject to frequent periods of ponding in April, May, and June. The soils formed in volcanic ash, and they have less than 35 percent rock fragments in the particle-size control section. They are coarse textured and primarily ashy loamy sand and ashy sandy loam. The upper mineral horizon is mucky. The soils have an ochric epipedon and a cambic horizon. Podsolization is not evident in the soils.

Table 4. Representative soil features

Parent material	(1) Volcanic ash
Surface texture	(1) Mucky, ashy fine sandy loam (2) Mucky, ashy sandy loam
Drainage class	Poorly drained
Soil depth	60 in
Surface fragment cover <=3"	0–25%
Surface fragment cover >3"	0–25%

Available water capacity (Depth not specified)	4.9–12 in
Soil reaction (1:1 water) (Depth not specified)	3.5–5.5
Subsurface fragment volume <=3" (Depth not specified)	0–35%
Subsurface fragment volume >3" (Depth not specified)	0–15%

Ecological dynamics

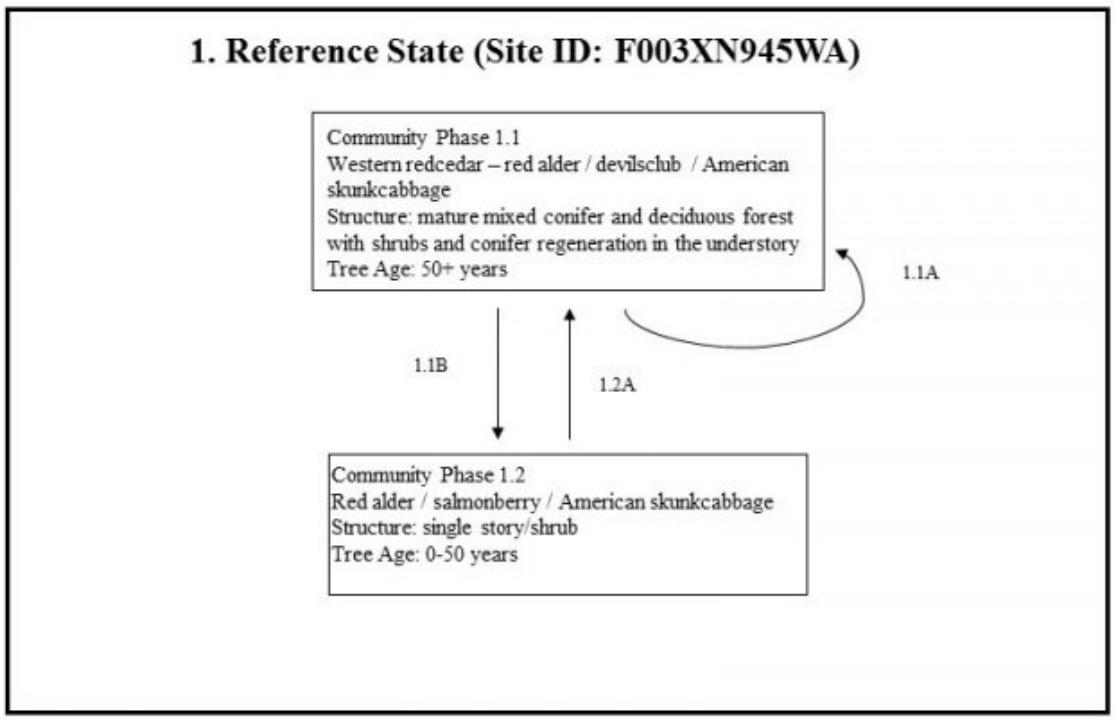
This ecological site is in depressions and swales and on terraces and debris aprons that have a seasonal high water table. Western redcedar (*Thuja plicata*) and red alder (*Alnus rubra*) are the most common overstory species. These are early seral tree species that regenerate successfully following disturbances. They are well adapted to excessive soil moisture and ponding. Over time, shade-tolerant trees such as Douglas-fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*) will establish in areas that are less susceptible to frequent periods of ponding, such as on hummocks, terraces, and debris aprons.

The most common natural disturbance is ponding. The volume and longevity of the ponding determine the effect on the dynamics of the forest. This site is susceptible to windthrow because of the seasonal high water table. The shallow rooting zone in saturated areas causes roots to grow laterally, resulting in frequent tip-ups. This results in openings in the canopy that allow sunlight to reach the forest floor, leading to a shrubby understory.

Because of the frequent tip-ups, this site has a hummocky surface and an abundance of downed woody debris. Western redcedar reproduces on fallen branches and trees and can regenerate successfully in disturbed areas (Minore, 1990). Many species grow only on the hummocks, and some herb species grow only in the depressions created by the downed woody debris and fallen trees.

Devilsclub (*Oplopanax horridus*), vine maple (*Acer circinatum*), salmonberry (*Rubus spectabilis*), and thimbleberry (*Rubus parviflorus*) make up the dense understory. An herb layer consisting of American skunkcabbage (*Lysichiton americanus*), western swordfern (*Polystichum munitum*), deer fern (*Blechnum spicant*), western oakfern (*Gymnocarpium dryopteris*), five-leaved bramble (*Rubus pedatus*), and twinflower (*Linnaea borealis*) is in scattered areas.

State and transition model



Tjuja plicata – Alnus rubra / Oplopanax horridus / Lysichiton americanus

Western redcedar – red alder / devilsclub / American skunkcabbage

→ Community Phase Pathway 1.X = Community Phase X#Y = Transition Pathway
1.XY = Pathway (ecological response to natural processes)

State 1

Community 1.1
Western redcedar-red alder/devilsclub/American skunkcabbage

Structure: Mature mixed conifer and deciduous forest with shrubs and conifer regeneration in the understory The reference community represents a lack of major disturbance for at least 50 years. Western redcedar and red alder are the dominant overstory species. Western redcedar is shade tolerant and can survive up to 1,000 years of age (Minore, 1990). In contrast, red alder is short lived. It matures at about 65 years of age and rarely lives more than 100 years (Harrington, 1990). Without disturbance and openings in the canopy, red alder will be replaced by shade-tolerant species. Pacific silver fir, Douglas-fir, and western hemlock are subcomponents of the forest; however, they

are poorly suited to areas where the water table is less than 6 inches below the soil surface. These species can become established in areas that tend toward an ustic or xeric soil moisture regime. They rarely are more prolific or dominant in the overstory than is western redcedar (Packee, 1990). If the soil moisture conditions change over time to more well drained, western hemlock and western redcedar may become dominant. Devilsclub (*Oplopanax horridus*), vine maple (*Acer circinatum*), salmonberry (*Rubus spectabilis*), and thimbleberry (*Rubus parviflorus*) make up the dense understory. An herb layer consisting of American skunkcabbage (*Lysichiton americanus*), western swordfern (*Polystichum munitum*), deer fern (*Blechnum spicant*), western oakfern (*Gymnocarpium dryopteris*), five-leaved bramble (*Rubus pedatus*), and twinflower (*Linnaea borealis*) is in scattered areas. Common disturbances include small gap dynamics (openings of 1/2 acre or smaller) following the decline of shade-intolerant species and minor sediment deposition or mortality of vegetation as a result of ponding. Community phase pathway 1.1A This pathway represents minor disturbances that maintain the overall structure of the reference community. The mortality of one or two trees creates gaps that allow sunlight to reach the forest floor, promoting growth of forbs and shrubs and regeneration of overstory species. Deposition of soil material after minor scouring from ponding temporarily affects the understory community, but it does not alter the composition of the overstory.

Forest overstory. Pacific silver fir, western redcedar, Douglas-fir, western hemlock, and red alder make up the forest canopy. The forest has multiple layers. The upper canopy is 130 to 220 feet in height, and it averages 110 feet. The diameter of the trees varies depending on the species.

Forest understory. The composition of the understory varies depending on the overstory cover and competition for moisture and light. Overall cover of shrubs such as devilsclub is 0 to 50 percent, and they can be prolific in the reference community. Overall cover of western swordfern is as much as 50 percent.

Dominant plant species

- western redcedar (*Thuja plicata*), tree
- Pacific silver fir (*Abies amabilis*), tree
- western hemlock (*Tsuga heterophylla*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree
- devilsclub (*Oplopanax horridus*), shrub
- salmonberry (*Rubus spectabilis*), shrub
- vine maple (*Acer circinatum*), shrub
- thimbleberry (*Rubus parviflorus*), shrub
- American skunkcabbage (*Lysichiton americanus*), other herbaceous
- western swordfern (*Polystichum munitum*), other herbaceous
- western oakfern (*Gymnocarpium dryopteris*), other herbaceous
- deer fern (*Blechnum spicant*), other herbaceous
- twinflower (*Linnaea borealis*), other herbaceous
- strawberryleaf raspberry (*Rubus pedatus*), other herbaceous

Community 1.2
Red alder/salmonberry/American skunkcabbage

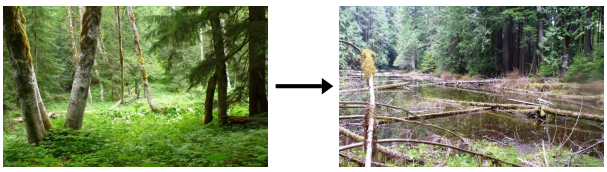
Structure: Single story/shrub Community phase 1.2 represents a forest that is undergoing regeneration or stand

initiation. Scattered remnant mature trees are in some areas. Red alder, salmonberry, and vine maple are the pioneering early seral species that become established first after a major disturbance. The seeds are light and can be transported long distances by wind and water, allowing for rapid recolonization. Most of the common shrubs, such as vine maple, can readily regenerate by sprouting from the root crown that has been buried by excessive ponding. The shrubs compete with the seedlings and saplings until the tree species overtop them. A major disturbance allows seral forb species to become established.

Dominant plant species

- red alder (*Alnus rubra*), tree
- salmonberry (*Rubus spectabilis*), shrub
- vine maple (*Acer circinatum*), shrub

Pathway 1.1B
Community 1.1 to 1.2

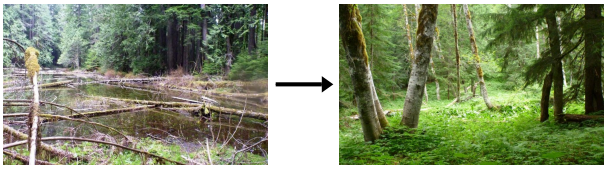


Western redcedar-red alder/devilsclub/American skunkcabbage

Red alder/salmonberry/American skunkcabbage

This pathway represents excessive ponding, which results in areas of windthrown trees more than 1 acre in size.

Pathway 1.2A
Community 1.2 to 1.1



Red alder/salmonberry/American skunkcabbage

Western redcedar-red alder/devilsclub/American skunkcabbage

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

Table 5. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
Pacific silver fir	ABAM	*Abies amabilis*	Native	–	–	–	–
western redcedar	THPL	*Thuja plicata*	Native	–	–	–	–
Douglas-fir	PSME	*Pseudotsuga menziesii*	Native	–	–	–	–
western hemlock	TSHE	*Tsuga heterophylla*	Native	–	–	–	–
red alder	ALRU2	*Alnus rubra*	Native	–	–	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Forb/Herb					
sweet after death	ACTR	*Achlys triphylla*	Native	1–18	0–30
western rattlesnake plantain	GOOB2	*Goodyera oblongifolia*	Native	1–6	0–5
twinflower	LIBO3	*Linnaea borealis*	Native	1–6	0–5
American skunkcabbage	LYAM3	*Lysichiton americanus*	Native	12–36	0–5
Fern/fern ally					
western swordfern	POMU	*Polystichum munitum*	Native	12–36	0–50
common ladyfern	ATFI	*Athyrium filix-femina*	Native	1–36	0–5
Shrub/Subshrub					
devilsclub	OPHO	*Oplopanax horridus*	Native	12–120	0–50
roughfruit berry	RULA2	*Rubus lasiococcus*	Native	1–8	0–5
salmonberry	RUSP	*Rubus spectabilis*	Native	1–6	0–3
thimbleberry	RUPA	*Rubus parviflorus*	Native	1–3	0–1

Table 7. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
western hemlock	*TSHE*	104	–	149	–	60	–	–	

Inventory data references

Other Established Classifications

National vegetation classification: Vancouverian Flooded and Swamp Forest Macrogroup-North Pacific Hardwood-Conifer Swamp Group

U.S. Department of Agriculture, Forest Service, plant association: TSHE/OPHO-ATFI

U.S. Department of the Interior, National Park Service, plant association:
• TSUHET-(THUPLI-ALNRUB)/LYSAME-ATHFIL
• TSUHET-ABIAMA/VACALA/LYSAME
• ALNRUB/ATHFIL-LYSAME

Type locality

Location 1: Lewis County, WA	
Township/Range/Section	T15N R09E S26
Latitude	46° 45′ 48″
Longitude	121° 38′ 12″

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.
Harrington, C. 1990. *Alnus rubra*. In Silvics of North America: Volume 2. Hardwoods. U.S. Department of Agriculture, Forest Service, Agriculture Handbook 654. Pages 116-123.
https://www.srs.fs.usda.gov/pubs/misc/ag_654_vol2.pdf
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
Minore, D. 1990. *Thuja plicata*. In Silvics of North America: Volume 1. Conifers. U.S. Department of Agriculture, Forest Service, Agriculture Handbook 654. Pages 590-600. https://www.srs.fs.usda.gov/pubs/misc/ag_654_vol1.pdf
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.

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	05/09/2024
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:**